GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE

2022-2026 Management Plan

Grand Bay
National Estuarine
Research Reserve

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Executive Summary

Plan Purpose and Scope

The Grand Bay National Estuarine Research Reserve (GNDNERR) is operated by the Mississippi Department of Marine Resources (MDMR) in partnership with NOAA's Office for Coastal Management as part of the National Estuarine Research Reserve System (NERRS). The NERRS are authorized under Section 315 of the Coastal Zone Management Act of 1972 (CZMA), which recognizes the significance of coastal resources and established the Coastal Zone Management Program and the NERRS to manage these resources for long-term conservation in partnership with the states. The GNDNERR was designated in 1999 as the 24th reserve in the NERRS. In 1973 the Mississippi Legislature also recognized the importance of Mississippi's coastal resources and passed the Coastal Wetlands Protection Act. Subsequently, the Mississippi Coastal Program (MCP) was established in 1980. The purpose of this management plan is to provide a guiding document for the GNDNERR for the next five years (2021-2025). The scope of this plan is the programmatic actions that the GNDNERR will pursue to address our vision and mission. The program at the GNDNERR includes five sectors: Administration, Research and Monitoring, Stewardship, Education, and Training.

Reserve Context

The reserve is the largest estuarine and coastal wetland system in the state of Mississippi. Located in Jackson County, immediately adjacent to the Mississippi-Alabama state line, the reserve includes a variety of wetland types, including tidal estuary and non-tidal wetlands. The emergent tidal marshes are dominated by black needlerush with a narrow fringe of cordgrass along the lower elevation edges. The landward wetlands are mostly wet pine savanna. The reserve size is 18,049 acres and is a mix of public and private lands. In 2018, a 320-acre parcel was transferred from private ownership to MDMR ownership. The reserve supports a highly diverse community of plants and animals. Estuarine ecosystems serve as vital nursery areas for a large portion of our commercial and recreational species of fish and shellfish, serve as filters to enhance coastal water quality and serve to provide a degree of resilience to buffer human built and natural communities from severe storm events. The GNDNERR is a retrograding delta with no direct freshwater input from a mainstem river and thus a unique ecosystem among the NERRS and in our region. The state lead for the reserve is the MDMR, which was created in 1994 by the Mississippi Legislature, with the mission to enhance, protect and conserve the state's marine interests. The agency manages all marine life, public trust wetlands, adjacent uplands, and waterfront areas for Mississippi to provide optimal commercial, recreational, educational, and economical uses of these resources in accordance with the agency mission to enhance, protect, and conserve.

Coastal Management Issues and Reserve Goals

The mission of the GNDNERR is to be a leader in science and outreach, in service to our community. This mission reflects our vision of inspiring our community to value, support, and practice ecosystem conservation. Staff and partners will work collaboratively to address focus areas relating to habitat protection, environmental change and water quality established in the NERRS Strategic Plan. Our specific goals to support this work include 1) Systematically collect quality data and answer relevant questions that inform management; 2) Conserve and manage natural resources to improve ecosystem function; 3) Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them; 4) Communicate efficiently and effectively; and 5) Streamline administrative functions. These goals and strategies meet our vision of serving the community through science and outreach that informs and inspires communities to support ecosystem conservation. Priority coastal management issues will be addressed including wet pine savanna

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restoration, marsh conservation and protection, habitat improvements, hydrological and sediment flow improvements, improved understanding of ecosystem function, including water quality, fisheries and human values, contamination and remediation (e.g., MS Phosphates, non-point source, external), and outreach in the form of translating science and research for coastal managers and education for the community and students of all ages.

Reserve Programs Overview

The GNDNERR has a wide array of programs within each sector to address our local coastal management priorities and serve our community. These include collaborative research projects to better understand ecosystem function; large-scale wet pine savanna restoration and management through the actions of invasive species control, mechanical clearing, and prescribed burning; water quality, weather monitoring, marsh elevation, vegetation, shoreline erosion as part of the System-wide Monitoring Program with the NERRS; research information transfer and technical trainings in statistics, natural history, geographic information systems (GIS), and other subjects; and, a variety of community education programs for all ages from classroom and field experiences, art workshops, kayaking for veterans, and large-scale community events like the Star Party Open House, Celebrate the Gulf Marine Education Festival, and National Estuaries Day celebrations.

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Introduction to National Estuarine Research Reserve System

The National Estuarine Research Reserve System (NERRS) is a network of 29 protected estuarine areas that represent different biogeographic regions and estuarine types within the United States. Reserves are protected for long-term research, monitoring, education, and coastal stewardship. The Reserve System, created by the Coastal Zone Management Act of 1972 (CZMA), currently protects over one million acres of estuarine lands and waters. The system is managed in accordance with code of federal regulations (CFR) at 15 CFR Part 921 (Appendix 1).

Each reserve has a unique boundary based on the nature of its ecosystem. The boundaries include the land and water areas needed to protect an intact ecological unit. Reserves classify their land and water areas as either "core" or "buffer," which determines the level of protection and the types of activities allowed within each area. Each reserve develops the programming most appropriate for its location while also delivering required system-wide programs focused on research and monitoring, education, training, and stewardship.

The Reserve System is a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states. NOAA provides funding, national guidance, and technical assistance for reserve operations and system-wide programs, facilities construction and land acquisition, graduate fellowships, and collaborative science projects. The state partner manages the reserve on a daily basis and works collaboratively with local and regional partners. NOAA also leads projects that integrate data or support decision-making at the national level.

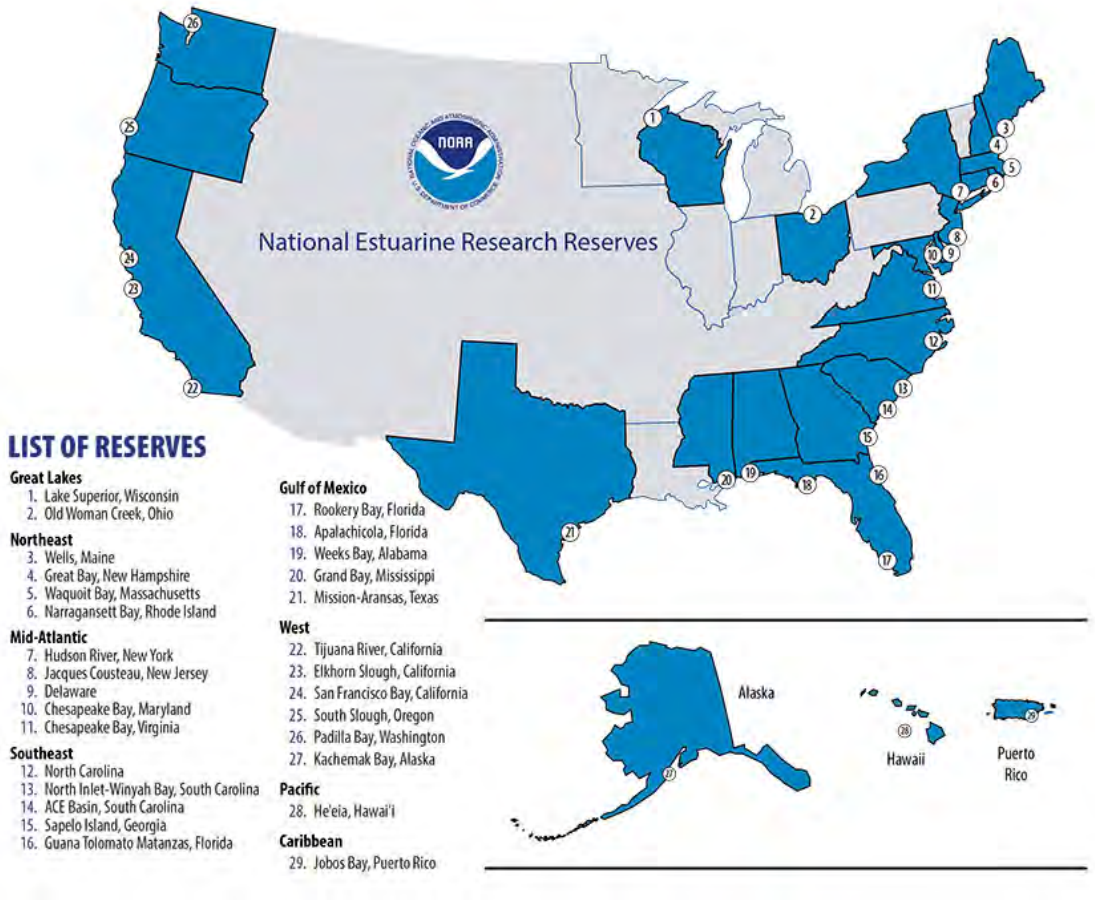

Figure 1. National Estuarine Research Reserve System (NERRS) Map.

Each reserve is required to develop a management plan that contains the goals, objectives, and strategies for that reserve. Management plans are updated every five years and must be approved by NOAA. These plans enable the reserves and NOAA to track progress and realize opportunities for growth. Each plan describes how the reserve will carry out its foundational research, education, and training programs. Each plan also outlines administration, resource protection, public access, land acquisition, and facility plans, as well as restoration and resource manipulation plans, if applicable. The plans also incorporate strategies designed to help the reserve contribute to the system's national goals. NOAA periodically evaluates reserves for compliance with federal requirements and their approved management plan.

The most recent strategic plan for the NERRS can be found at *coast.noaa.gov/data/docs/nerrs/StrategicPlan.pdf*. It describes the following goals for the system.

> **Protecting Places:** Enhance and inspire stewardship, protection, and management of estuaries and their watersheds in coastal communities through place-based approaches.
>
> **Applying Science:** Improve the scientific understanding of estuaries and their watersheds through the development and application of reserve research, data, and tools.
>
> **Educating Communities:** Advance environmental appreciation and scientific literacy, allowing for science-based decisions that positively affect estuaries, watersheds, and coastal communities.

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Introduction to the Grand Bay National Estuarine Research Reserve

Overview

The Grand Bay National Estuarine Research Reserve (GNDNERR) is operated by the Mississippi Department of Marine Resources (MDMR) in partnership with NOAA's Office for Coastal Management (OCM) as part of the NERRS. The NERRS are authorized under Section 315 of the CZMA, which recognizes the significance of coastal resources and established the Coastal Zone Management Program and the NERRS to manage these resources for long-term conservation in partnership with the states. The GNDNERR was designated in 1999 as the 24th reserve in the NERRS. In 1973 the Mississippi Legislature also recognized the importance of Mississippi's coastal resources and passed the Coastal Wetlands Protection Act. Subsequently, the Mississippi Coastal Program (MCP) was established in 1980.

The GNDNERR is located on the Mississippi-Alabama state line in Jackson County, MS, about 30 miles east of Biloxi, MS and 30 miles southwest of Mobile, AL, and is part of the Grand Bay Savanna Complex, which is the largest area of intact coastal habitats in the state of Mississippi. The GNDNERR is co-located with the United States Fish and Wildlife Service's (USFWS) Grand Bay National Wildlife Refuge (GNDNWR) and the Grand Bay Coastal Preserve. The GNDNWR, as well as its acquisition boundary, extends into Alabama. There are lands in conservation acquired by The Nature Conservancy and Forever Wild lands within and adjacent to the acquisition boundary (Figure 2).

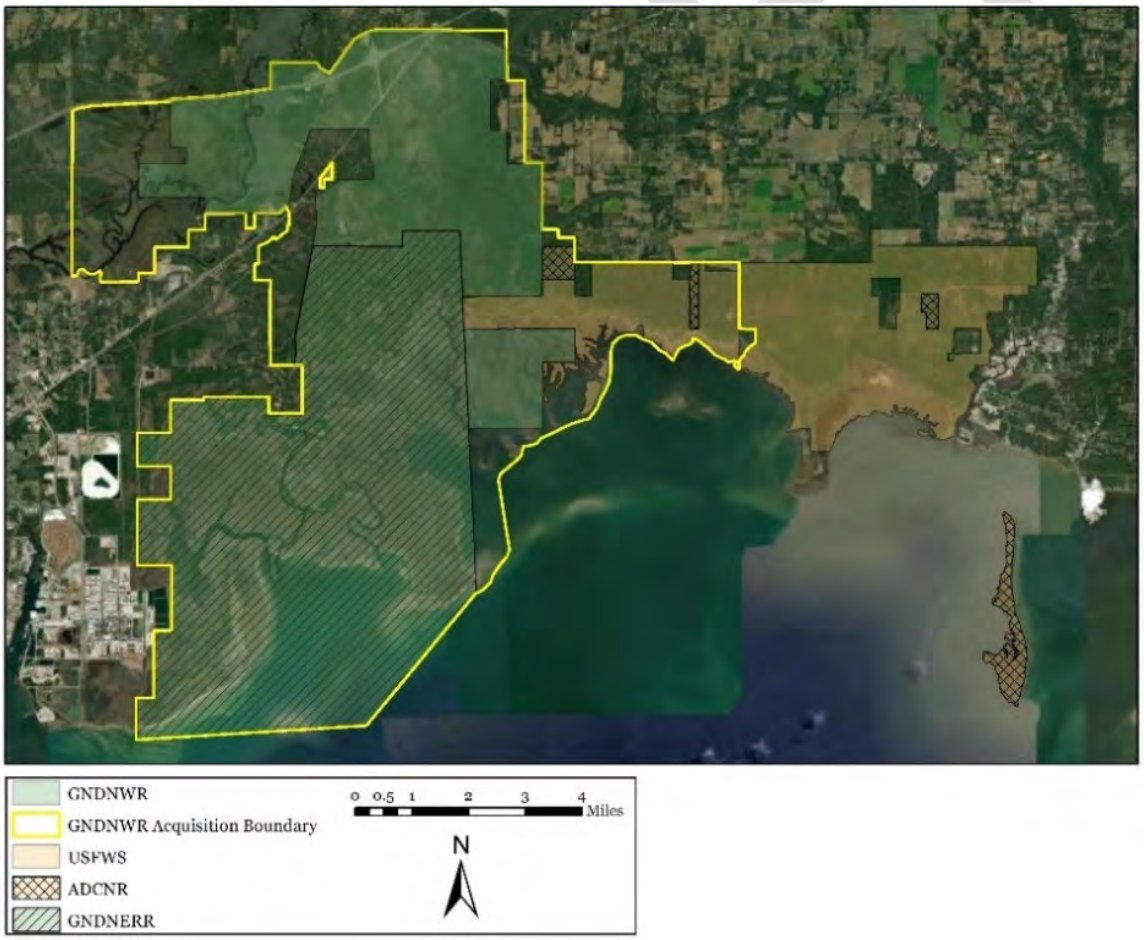

Figure 2. The GNDNERR vicinity map.

This large area is under conservation to protect the function of the Grand Bay estuary across both states. The main functions of the GNDNERR include habitat and nursery areas for fish and shellfish, areas for recreational and commercial fishing and hunting, protection of water quality, and flood protection. The following provides a basic description of aspects of the site, and additional details can be found in the Grand Bay Site Profile (Peterson et al. 2007). Primary reserve facilities, referred to as the Grand Bay Coastal Resources Center (CRC), are located on Bayou Heron Road, Moss Point, MS (Figure 3). The Grand Bay CRC houses staff for the GNDNERR, GNDNWR, USFWS' Coastal Program and Ecological Services, and Wildlife Mississippi.

Figure 3. The Grand Bay Coastal Resources Center.

The GNDNERR is representative of the Louisianan biogeographic region, within the NERRS biogeographical regions structure, and is in the Mississippi Deltaic subregion. No other reserve currently exists within the Louisianan region, which comprises portions of Texas, Louisiana, Mississippi, and Alabama west of Mobile Bay, although Louisiana has begun a designation process. Designation of the GNDNERR did not establish new state or federal regulations or alter the traditional uses of the area. Current uses include boating, fishing, hunting, photography, bird watching, and other recreational activities. Waters are closed to oyster harvest due to water quality (bacteria levels), but other uses continue, with limited restrictions that may apply to significant habitats or other areas of special interests (e.g., facilities, trails) and in accordance with Mississippi and USFWS regulations.

History and Local Management

The area around the GNDNERR has been of conservation interest since the early 1990s when the GNDNWR was established. The impetus for establishing the GNDNERR was local interest in the

conservation of rare wet pine savanna, wet pine flatwoods, and emergent marsh habitats, which have been dramatically impacted across the Mississippi coast. The parties involved in the designation included local landowners, conservation groups, federal, state agency and university personnel. These stakeholders followed the usual process to designate the reserve including a request from the Governor to NOAA and used vital habitat connectivity and synergy created by co-locating the reserve with the GNDNWR as rationale. The designation created a permanent partnership between the GNDNERR and the GNDNWR. The MDMR is the state partner and controls the management of the GNDNERR. The MDMR works in coordination with the GNDNWR.

Additional restoration efforts have occurred north of the GNDNERR boundary, which have included land acquisition and structure removal, but none have occurred within the boundary. Just north of the GNDNERR boundary was a community along Pecan Road. After Hurricane Katrina in 2005, the houses in this community were bought out by the Army Corp of Engineers (ACOE) as part of the Mississippi Coastal Improvements Program (MsCIP) that aimed to stop recurrent losses from flooding in this area and return these homesites to a natural landscape. Some of the residents in this area were those who were instrumental in the establishment of the GNDNERR. Bought out land was returned to the State of Mississippi and this area is currently part of an ongoing restoration project.

In April 2010, an explosion on the *Deepwater Horizon* led to the largest oil spill in the history of the Gulf Coast. Impacts to the GNDNERR were minimal in terms of direct oiling, however marsh scarring from response efforts including the use of booms, remain visible today. Funds from the *Deepwater Horizon* incident associated with the Natural Resources Damages Assessment (NRDA) are currently being used for the restoration and acquisition of additional habitat through the Grand Bay Land Acquisition and Land Management Project. The state's trustee, Mississippi Department of Environmental Quality (MDEQ), the Mississippi Trustee Implementation Group (MS TIG), USFWS GNDNWR, and the federal trustee, the Department of Interior, are all partners in this project. Restoration activities associated with this project occur in the GNDNERR, the GNDNWR, and on state lands acquired through MsCIP and returned to state ownership. Recently, as part of this project, another small structure was removed in the Pecan area and several Jackson County parcels within this area were also transferred from county to state ownership and titled to the MDMR.

Ecological Characteristics

Geography and Geology

The GNDNERR lies within the gently sloping, lower Gulf coastal plain and was part of the previous deltas of the Escatawpa and Pascagoula rivers. The geomorphic evolution of this area is characterized by a long, complex sequence of events and processes evidenced by extensive marsh headlands and riverine scarring across the landscape. The Escatawpa River became a large tributary of the Pascagoula River through a process of stream piracy after the formation of the delta. As a result, the Grand Bay area is characterized as a retrograding delta with limited freshwater inflow and sediment load. Headland erosion of the delta front caused the development of flanking barriers referred to as the Grand Batture Islands and two open embayment areas, Grand Bay to the east and Point Aux Chenes to the west. The Grand Batture Islands are now eroded and mostly submerged. Sediment in the area consist of sands, silts, and clays of coastal and riverine origin. Sediment substrate of the marshes is rich in organic material and clays but also has a sizeable sand/silt component. Bayous Cumbest and Heron are the primary watercourses discharging into Point Aux Chenes Bay and the Grand Bay/Middle Bay complex, respectively. Both bayous are relatively small with slow flowing waters rich in tannic acid from their forested watersheds. Freshwater flow originates in large part from localized rainfall. Much of the reserve would be connected to the Escatawpa River watershed during moderate rainfall events by

overland flows; however, this connection is interrupted by Highway 90 and the CSX Railway, which prevent sediment and flooding exchange between the river and the bay.

Hydrology

The Grand Bay area is a shallow, estuarine area with an average water depth of approximately 0.9 m (3 ft). Water depths can range from zero at some low tides to 3.1 m (10 ft) in the channel connecting Point Aux Chenes Bay with the Mississippi Sound. Average water depth in Bangs Lake and Middle Bay is less than 0.9 m (3 ft). Dominant water movement results from the flood and ebb of the tide except during heavy rain events when freshwater discharge from the bayous is significant. Both astronomical and meteorological tides influence the Grand Bay area. Astronomical tides are diurnal, i.e., usually one high and one low water per day with an average tidal range of approximately 0.6 m (2 ft). Tidal range fluctuates seasonally with a minimal range of 0-0.5 m (0-1.5 ft) during the winter months and a maximum range of 0.6-0.9 m (2-3 ft) during the summer months (Peterson et al. 2007). Because of the minimal tide range of the area, meteorological conditions often exert a strong influence on local tide levels, making this a wind dominated tidal system. Strong southerly winds push water into the area, exaggerating and often maintaining high water conditions. Strong northerly winds push water out of the area, exaggerating and maintaining low water conditions and often resulting in the exposure of large mudflats and sandy shoals.

Water Quality

Reserve water temperatures recorded at the four current System-wide Monitoring Program (SWMP) stations ranged between a low of 1.8°C (35.2°F) in the winter to a high of 36.7°C (98.0°F) in the summer from 2005-2020. Average water temperatures at these sites ranged from 22.5°C (72.5°F) to 23.2°C (73.8°F). Salinity values vary along a gradient from bayou to bay and decrease with rainfall events. Salinity values have been recorded from fresh or oligohaline conditions (0.0-5.0 ppt) to polyhaline conditions (18-30+ ppt). Salinity is generally highest during the late fall to winter (November – December) and lowest during the early spring wet season (March – April). Median salinity across all SWMP stations from 2005-2020 was 20 ppt. Nitrogen, phosphorous and chlorophyll measurements from reserve water quality stations are generally low (Figure 4).

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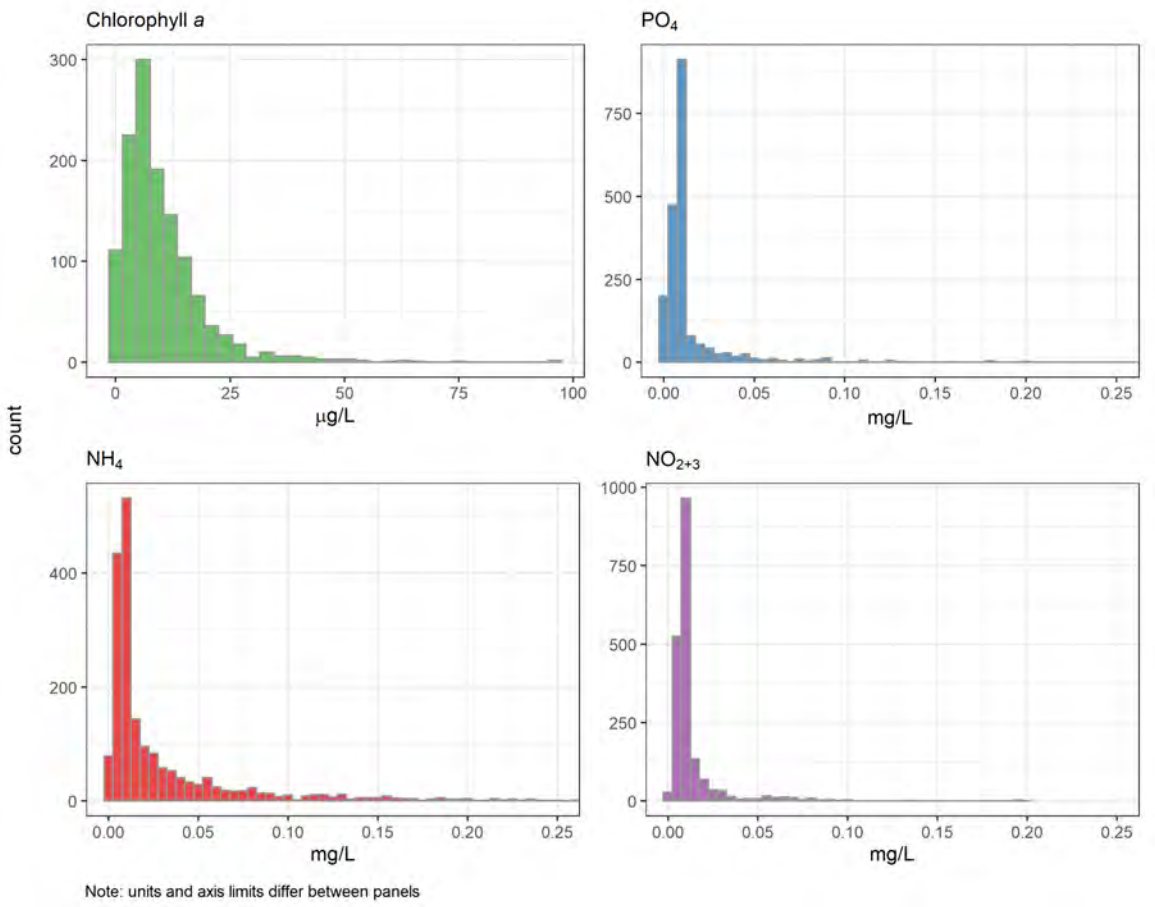

Figure 4. Distribution of measured chlorophyll *a* from 2011-2020, and other SWMP nutrients from 2004-2020. Nutrient values above 0.25 mg/L are rare and have been excluded from this plot.

Climate and Weather

The Grand Bay area has a subtropical climate. The Bermuda High exerts the greatest influence on the climate of this area. During spring and summer when the Bermuda High intensifies, warm, humid, south, and southeast winds dominate. Wind speeds of spring and summer are generally less than those of fall and winter. Storms are common and result in heavy rainfall and violent storm conditions locally. During fall and winter, the Bermuda High diminishes in strength, allowing continental pressure systems and associated cold fronts to move south. During this time, the dominant winds are frequently from the north. Summer is hot and humid, characterized by afternoon thunderstorms. Average annual maximum temperature as reported from nearby Pascagoula, MS is 24.7°C (76.5°F) with July averages reaching 32.0°C (89.7°F). Winters are mild, with annual minimum temperatures averaging 14.7°C (58.5°F) and January averages at 5.8°C (42.4°F). Light freezes are common and hard freezes occur occasionally. Average annual rainfall is approximately 1.6 m (63 in). Extreme rainfall events may result in 0.25-0.76 m (10-30 in) of rainfall over a short period of time. Such events have caused major flooding on the nearby Escatawpa River. This flooding causes issues at the reserve, impeding vehicular access to the facilities and boat ramp.

Grand Bay is situated within an active hurricane zone. Hurricane season is from June through November with most hurricanes occurring during August and September. Eleven hurricanes have made landfall in

Mississippi since 1960 (Ethel – 1960, Camille – 1969, Bob – 1979, Frederic – 1979, Elena – 1985, Georges – 1998, Katrina – 2005, Nate – 2017, Gordon – 2018). The Grand Bay area is also frequently affected by tropical systems in the Northern Gulf of Mexico; most notably Rita in 2005 and Isaac in 2012. All these tropical events dramatically impacted the human and natural communities on the Mississippi Coast. The GNDNERR was most dramatically affected in August 2005 by Hurricane Katrina. Depth recorders measured a maximum water depth of 5.5 m (18 ft) at the reserve in Bayou Heron, a station where water depth is typically < 2 m (6 ft). The entire reserve and most of the surrounding landscape was flooded under several feet of water. Approximately 2.4 m (8 ft) of water destroyed the GNDNERR temporary offices during the storm. The planning for the permanent facility was underway at the time, and architectural plans were revised due to the storm. The building was elevated and redesigned to be more resilient to future storms. Impacts from hurricanes will provide continued disturbance to the landscape through flooding, erosion, storm surge, sediment deposition, direct and indirect species mortality, and debris. As the climate changes, it is expected that the emergent marshes will move landward with sea level rise (SLR), which is an impetus for wet pine savanna restoration in Grand Bay. Research from Grand Bay has suggested that landward movement of marsh may depend on the existence of grasslands versus an overgrown woody understory associated with unmanaged habitat (Hacker 2018). Other changes expected are increasing road flooding, which will impact access to the building and boat launch area. Some models describe the conversion of all emergent marsh to open water by 2100 (Alizad et al. 2018) and other models identify barriers to upslope marsh migration (Borchert et al. 2018).

Biological Resources

Habitat Types

The GNDNERR is composed of wet pine savanna, emergent marshes, maritime forests, salt pannes, and open water environments. These habitats are known for their diverse plant communities and the existence of rare bird species. Wet pine savanna is an ecosystem that has mostly been lost across the southeast United States, and few intact examples exist along the Gulf Coast. The emergent marshes are known to be important nurseries for juvenile fish among other important functions. Interconnected habitats are thought to enhance coastal water quality and support these critical ecosystem functions. The classification of habitat types within the reserve is reflected in our current habitat map that follows the NERRS habitat classification scheme (Figure 5).

The most common species in the emergent marsh is black needlerush. Wet pine savannas and flatwoods are composed of many species of herbaceous vegetation, several species of shrubs, and are interspersed with mostly slash pine trees. The most common animal species are fox squirrels, white-tailed deer, ospreys, bald eagles, black racer, green tree frogs, oak toads, cottonmouths, feral hogs, raccoons, Gulf Coast box turtles, alligators, etc. Henslow's sparrows occur in the reserve along with many other rare birds. The listed species within the GNDNERR includes West Indian Manatee, Piping Plover, Red Knot, Wood Stork, Alabama Red-bellied Turtle, Gopher Tortoise, Hawksbill Sea Turtle, Kemp's Ridley Sea Turtle, Leatherback Sea Turtle, Loggerhead Sea Turtle, and Atlantic Sturgeon. The species we have some likelihood to encounter are Alabama Red-bellied Turtle and Gopher Tortoise.

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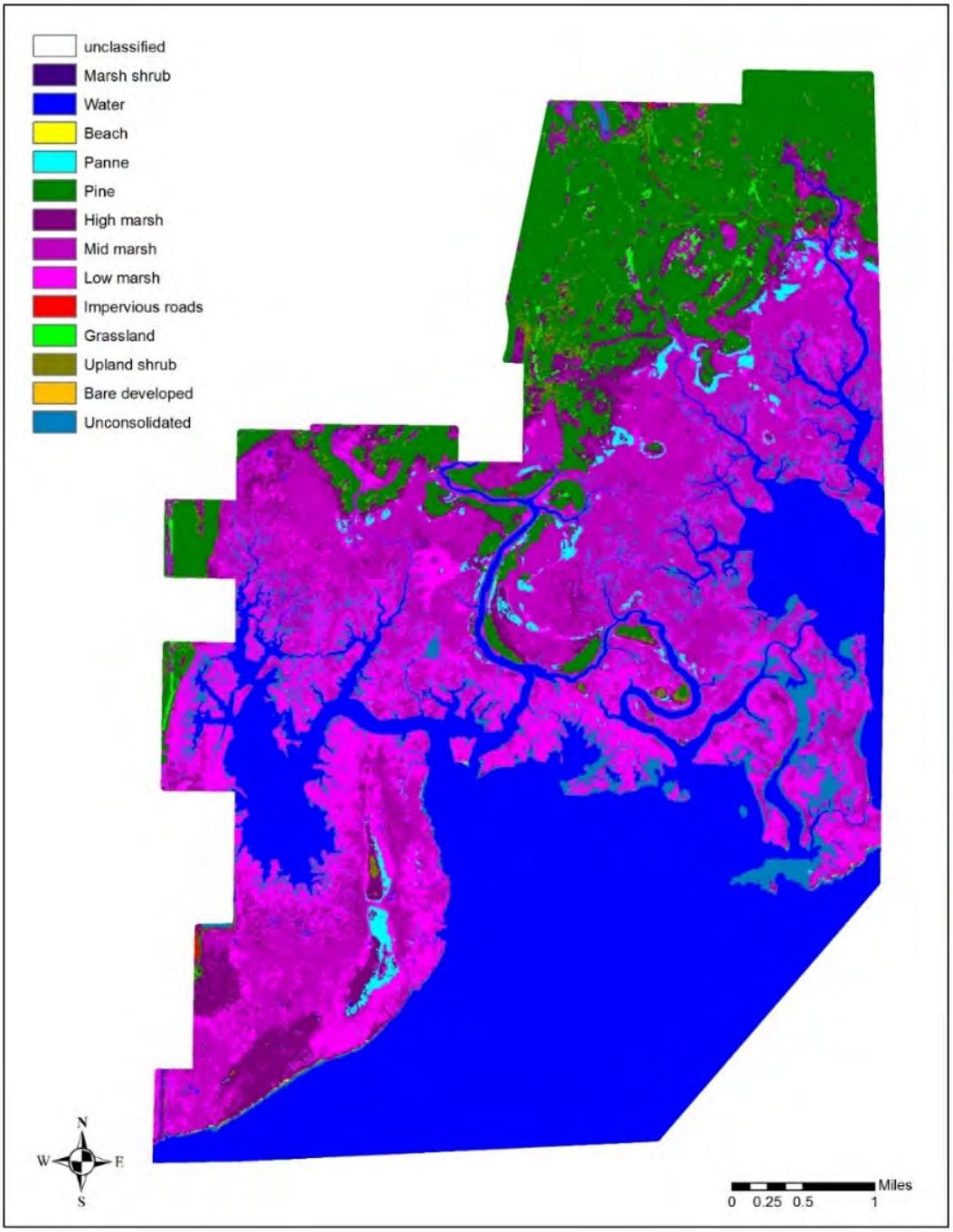

Figure 5. GNDNERR habitat map.

Socioeconomic Attributes

Population Demographics

According to U.S. census data, the human population in the zip code of the reserve (39562) was 13,350 on July 1, 2019. The median age is 42.7 and the median household income was $42,173 with 22.2% of the population living at or below the poverty level. The median home value is $90,800 and 72.1% of homes are owner occupied. Median gross rent (2015-2019) was $867. There were 1,075 businesses in

the area code in 2012. In 2017, 33% of the total jobs were related to the ocean (NOAA OCM Economics: National Ocean Watch), and 25.4% of jobs in Jackson County were related to tourism and recreation.

Archaeological and Cultural Resources

The reserve contains archaeological and cultural resources, including most notably, the shell middens. There are more than 16 shell middens in the reserve that are of various ages ranging from the relics of the recent past to ancient shell middens. These middens exist in many locations across the reserve. Archaeological study of these middens has revealed artifacts from 100 years to 5,000 years old (Huey 2014). The reserve collaborates with the state historic preservation office in any use or impact to these areas is anticipated by any project.

Threats and Stressors

Natural and Anthropogenic Stressors

A variety of threats and stressors are impacting the habitats at the reserve. Most notably is the shoreline retreat Grand Bay experiences as a retrograding delta which may be exacerbated by wave action and SLR, in addition to . An analysis of shoreline change from 1848-2017 was conducted by the United States Geological Survey (USGS) in partnership with the GNDNERR and our ongoing erosion monitoring data. Wave action and SLR-related erosion leads to the loss of marsh edge with a loss of up to 2.00 – 6.55 m a year in some areas (Figure 6; Terrano et al. 2019).

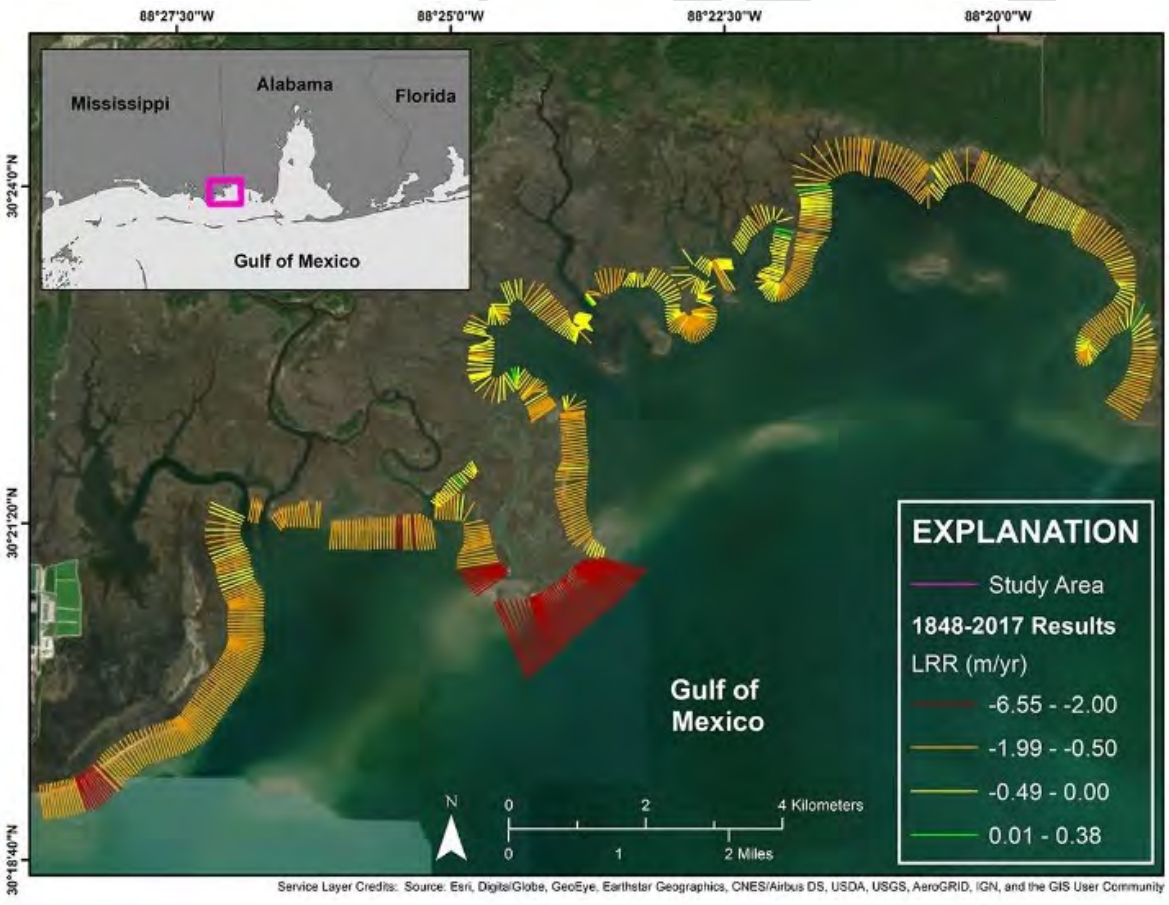

Figure 6. Shoreline change analysis (Terrano et al. 2019).

An analysis of surface elevation table (SET) data from 2012 – 2016 suggests that marshes in Grand Bay are experiencing varied responses to SLR along the elevation gradient. Generally, marshes lower in the estuary are increasing in elevation at higher rates than marshes higher in the estuary. Comparisons of elevation change rates with long-term SLR rates (1966 – 2016: 3.5 mm/yr) generally suggest that GNDNERR marshes are keeping pace with SLR; however, comparisons with short-term SLR (1998 – 2016: 6.97 mm/yr; Sweet et al. 2017) suggest marshes may not be keeping pace.

Invasive species are also impacting the marshes and upland areas of the GNDNERR, mostly feral hogs. Tracks and vegetation damage have been traced to the hogs in several locations. Invasive plant species also impact the landward wet pine savanna, including cogon grass, Chinese tallow tree, Japanese climbing fern, and others. However, the largest impact to the wet pine savanna is the lack of fire. Fire suppression leads to the overgrowth of the understory and the degradation of the diverse wet pine savanna plant community.

Risks and impacts from contaminants is an anthropogenic stressor in the reserve. The Bayou Casotte Industrial Complex, which contains the Chevron Pascagoula Refinery, Chemours Chemical Plant, and the defunct Mississippi Phosphates fertilizer facility, is found to the west of the GNDNERR. Mississippi Phosphates began making fertilizer in the 1950s. The manufacturing process resulted in large mounds of phosphogypsum waste, known as gypsum stacks. The West gypsum stack was capped in 2002, also when the newer East stack became active (Garrard 2016). The East gypsum stack has caused multiple wastewater inputs into GNDNERR via Bangs Lake. Phosphogypsum and associated process wastewater are known to be acidic (pH ~2.4) and high in nutrients including phosphate and ammonia (Garrard 2016). In 2005, a breach in the dike around the wastewater pond at the East gypsum stack caused 17.5 million gallons of this wastewater to be discharged into nearby waterways. An unknown amount of this reached Bangs Lake, dropping pH at the sampling station to 3.7 from a typical range of 7-8 and causing more than $2 million in damage by killing fish, shellfish, oysters, and vegetation in the area (Viskup 2005; State of Mississippi 2008; Beck et al. 2018). A large algae bloom also developed in Bangs Lake. A new nutrient monitoring station in North Bangs Lake was established and the water quality datalogger in Bangs Lake was connected to telemetry following these events. As a result of the 2005 spill and subsequent Agreed Order with MDEQ, Mississippi Phosphates Corporation began to enact better management practices, such as having more pH-neutralizing chemicals on-hand.

Following Hurricane Isaac in 2012, phosphate concentrations in Bangs Lake again rose to problematic levels (>1 mg/L measured by GNDNERR and 7 mg/L measured by Darrow 2015), though there were no fish kills. Phosphate concentrations slowly decreased over several months but remained above baseline concentrations for more than two years (Beck et al. 2018). In 2014, Mississippi Phosphates Corporation filed for Chapter 11 Bankruptcy, and ceased fertilizer production in December 2014. Minimal staff were kept on-site to manage wastewater operations.

In February 2017, the Environmental Protection Agency (EPA) took over operations of the site, and in January 2018, the site was added to the Superfund National Priorities List (EPA 2021). Capping of the East gypsum stack started in October 2018 and is near completion as of early 2021 (D. Shirley, pers. comm.).

The other areas adjacent to the reserve are sparsely populated but where a population exists, treatment and disposal of domestic wastewater is dependent on individual septic systems. Potential problems with residential and the risk of industrial sources to the east from the Bayou La Batre and Mobile Bay, AL area and natural levels of bacteria in the waters may contribute to degraded water conditions. Area VIII oyster-growing waters within the reserve are currently classified “prohibited”. Even though the growing water classification is listed as “prohibited”, the origin of periodic high bacteria levels is unknown. National Pollutant Discharge Elimination System (NPDES) permits at the MDEQ indicated that most point

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source discharges from the adjacent industrial sites are located and discharged to the west of the GNDNERR and do not impact the site directly (Coastal Environments, Inc. 1992). As of December 2020, no active NPDES permits listed on the MDEQ website regulate discharges into any tributaries of reserve waters.

Management efforts in the reserve focus on understanding shoreline retreat, reduction of invasive species, reintroduction of fire, and understanding and mitigating impacts from contaminants.

Climate Change Phenomena and Impacts

Several studies have looked at the expected environmental changes in the reserve, notably from SLR and climate change (Wu et al. 2017; Borchert et al. 2018; Alizad et al. 2018). There are anticipated changes with the position and extent of emergent marsh from these studies, including transition to open water and upslope retreat of emergent marsh. Alizad et al. (2018) indicates that the area of the CRC will be flooded in 80 years. The GNDNERR Sentinel Site work is evaluated periodically to understand and assess changes associated with increases in water levels across several marsh types in the reserve. Collaboration with these researchers from USGS, USM, and the Ecological Effects of Sea Level Rise project includes work to understand how mitigative actions (e.g., shoreline protection, barrier island nourishment, infrastructure revision, etc.) might influence the outcome for marshes. Management actions are being assessed in detailed workshops with researcher and stakeholder partners as part of this management plan. Although resurfacing of Bayou Heron Road in 2018 improved flooding frequency in some areas, increased road flooding along Bayou Heron Road and at the boat launch is common. The reserve includes road flooding in emergency management procedures. The CRC is in a higher area that is not expected to flood except with the most intense storm surges, however access to the center is restricted routinely during flood events. Sea level rise will likely increase flooding events especially south of the CRC at the boat ramp. Alizad et al. (2018) indicates that the area of the CRC will be flooded in 80 years.

Reserve Boundary

Boundary Map

The administrative boundaries of the GNDNERR include lands and waters in southeastern most Jackson County, MS (Figure 7). Of the 18,049 acres within this boundary there are 3,105 acres of private inholdings and 14,944 acres of public lands and waters. The reserve includes Middle Bay, Point Aux Chenes Bay, Bayou Cumbest, Crooked Bayou, Bayou Heron and associated coastal wetland habitats and selected portions of tidal and non-tidal habitats including lands and waters. It is bounded on the east by the waters of Grand and Middle Bay, and Bayou Heron on the Mississippi-Alabama state line, on the west by Bangs Lake bordering the Bayou Cassotte Industrial Park, on the north by the communities of Bayou Cumbest, Pecan, Kreole and Orange Grove and on the south by the Mississippi Sound. There have been no changes to the reserve boundary since the last management plan update, although some parcels within the boundary that were formerly privately owned now belong to the reserve.

Core and Buffer

The core area of the GNDNERR is comprised of approximately 13,334 acres of estuarine tidal marsh, tidal creek, shallow open-water habitats, oyster reefs, sea grass beds, maritime forest (pine, live oak), salt pannes, sandy beach, shell beach and shell middens (see Figure 5). The remaining lands of the GNDNWR serve as a functional buffer, including state lands which are within the GNDNWR boundary but outside of the GNDNERR boundary. Additionally, other functional buffers in the vicinity include GNDNWR lands in Alabama, a Mississippi Phosphates Mitigation Bank and a Jackson County Mitigation Bank (included in Figure 7), all located to the north of the GNDNERR buffer area.

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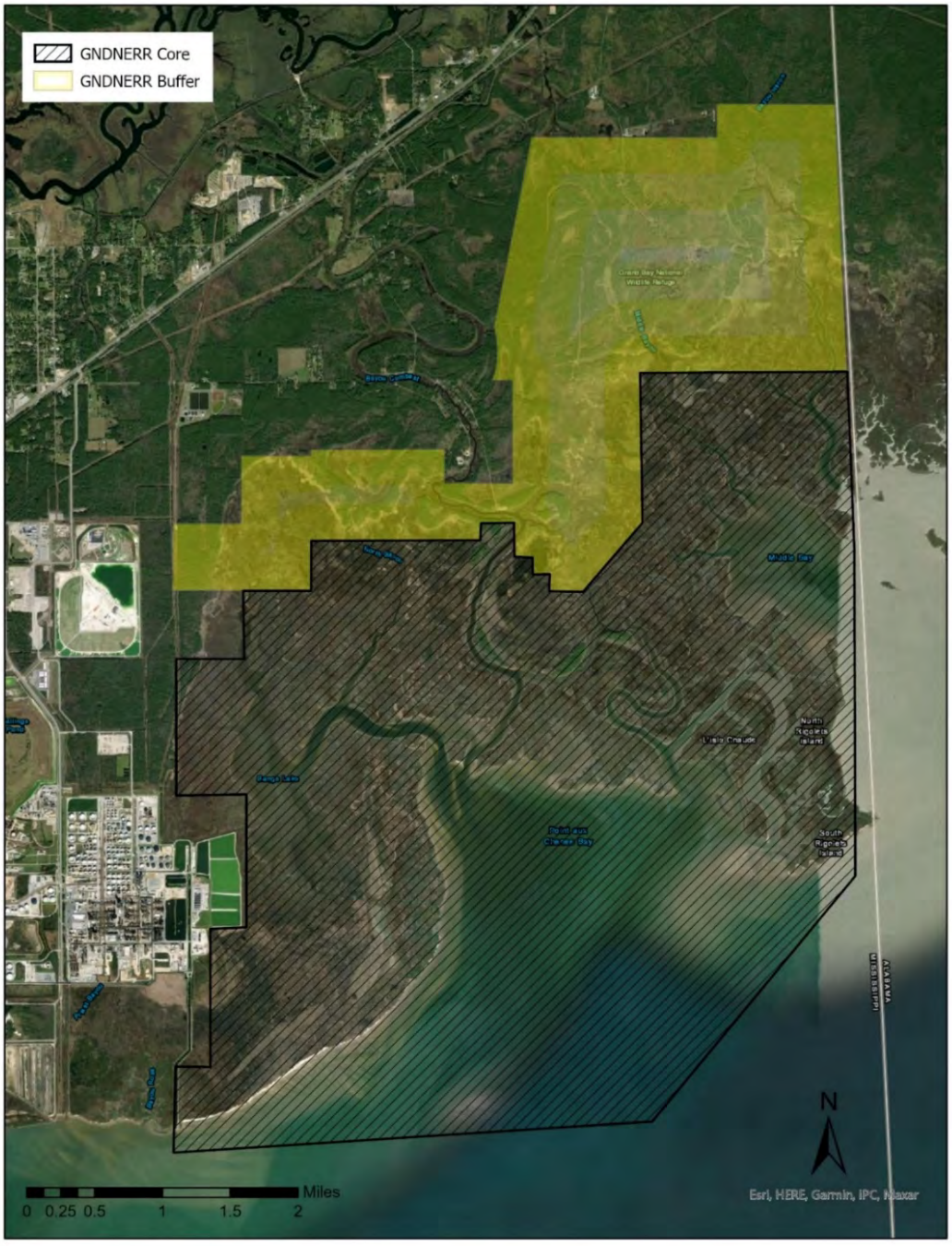

Figure 7. The GNDNERR boundary map with core and buffer.

Land Ownership and Land Use Type

Property ownership within the reserve boundary is state, federal, and private (Figure 8). There are many private parcels among the parcels in public ownership. Land use for most of the private parcels is housing, small businesses, or unmanaged lands. There is a privately-owned shooting range south of the reserve facility on Bayou Heron Road and a bait shop at the Bayou Heron Boat Launch. There is also a county boat launch, private boat launch and camping facility, and a limited number of houses on Bayou Cumbest.

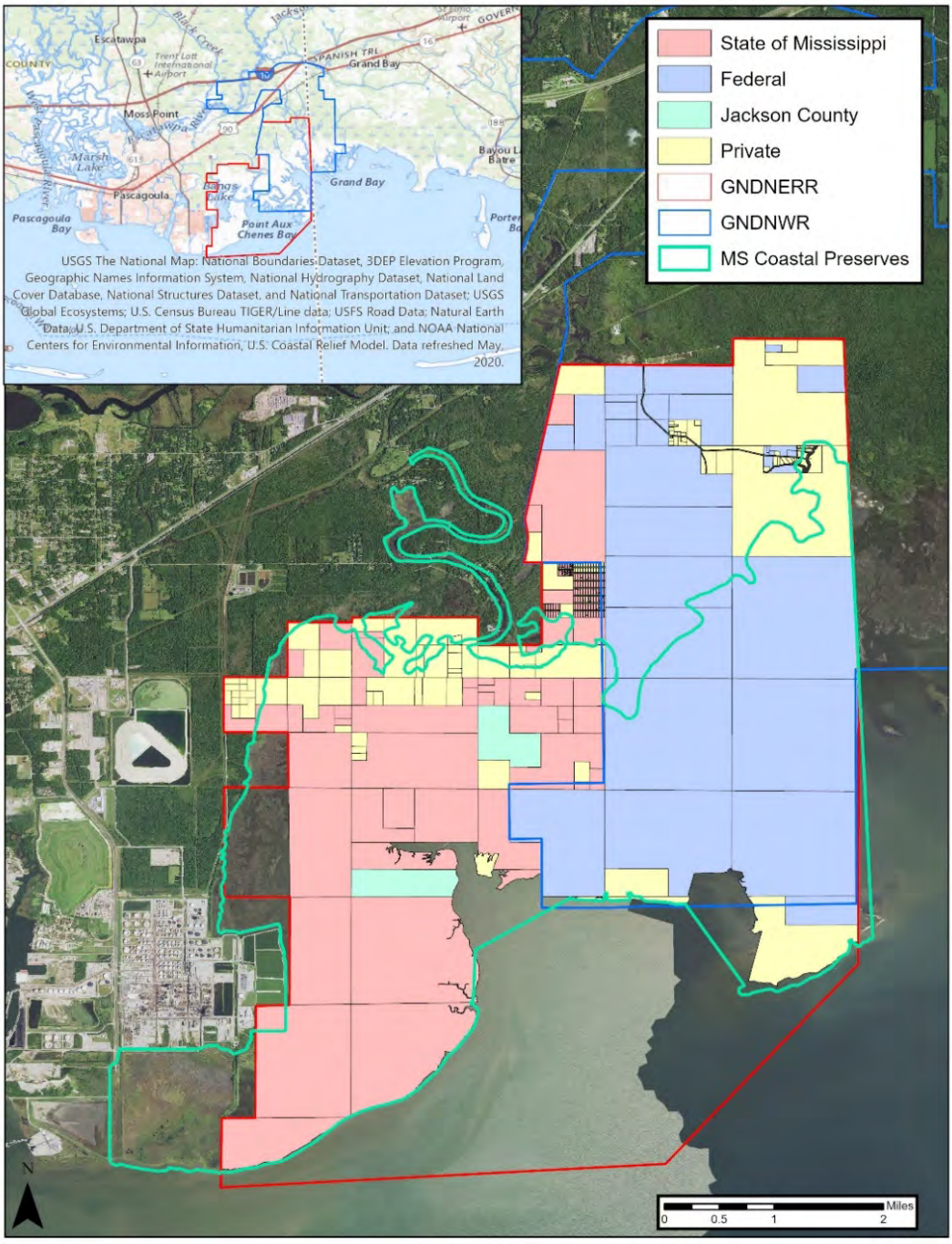

Figure 8. The GNDNERR and MDMR Coastal Preserves boundaries and property parcel ownership information.

Targeted Watershed Boundary

The reserve's watershed boundary is based on the subwatershed affecting the lands within the reserve boundary; HUC 03170009, the Coastal Streams Basin, has been identified to the Central Data Management Office (CDMO) and OCM as the targeted watershed for GNDNERR (Figure 9). The watershed boundary is impacted by Highway 90 and the CSX railway that disconnects the reserve from the Escatawpa River.

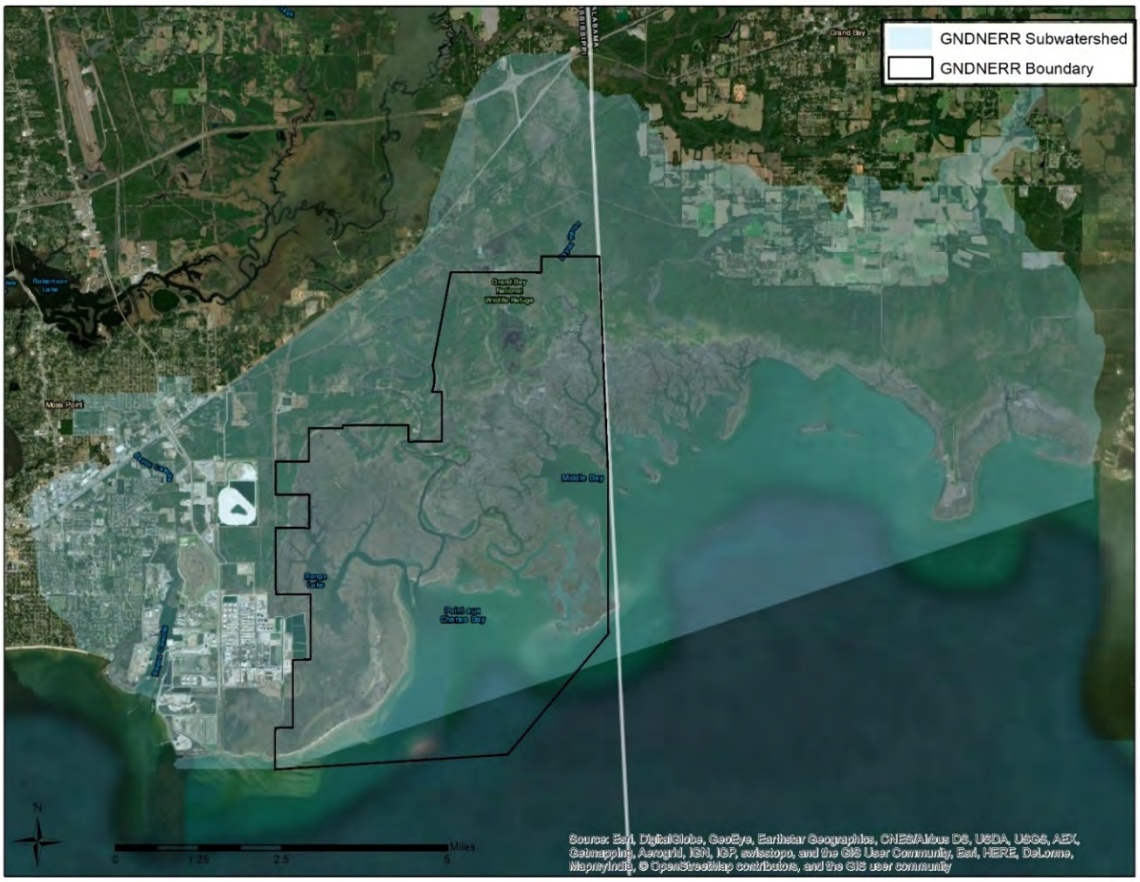

Figure 9. The GNDNERR with targeted watershed boundary.

Grand Bay National Estuarine Research Reserve Strategic Plan

The GNDNERR staff worked together to determine a vision, mission, and five goals as a framework for addressing the priority issues at the reserve. All reserve program sectors will work within this strategic planning framework. Each sector will identify specific actions associated with each goal, which will guide our pursuits. The sectors are identified as follows: A, Administration; R, Research and Monitoring; S, Stewardship; E, Education; and, CTP, Coastal Training Program.

Reserve Vision

Our vision is to inspire our community to value, support, and practice ecosystem conservation.

Reserve Mission

The GNDNERR is a leader in science and outreach, in service to our community.

Reserve Priority Coastal Management Issues

- Wetland conservation
- Ecosystem restoration
- Water quality protection
- Understanding ecosystem function, including fisheries and human values
- Understanding contamination (point and non-point source pollution)
- Improved coastal management
- Outreach and education

Reserve Goals, Objectives, and Actions

Goal 1: Systematically collect quality data and answer relevant questions that inform management.

Objective 1.1: Systematically collected data informs our understanding of Grand Bay NERR ecosystems (flora, fauna, and ecological conditions) (R, S, E, CTP)

Action: Conduct quantitative monitoring of Grand Bay's flora, fauna, and ecological conditions

Action: Collect qualitative data to address specific questions of GNDNERR's flora, fauna, and ecological conditions

Action: Maintain infrastructure and equipment, for both field and lab needs; and upgrade as necessary

Action: Develop and implement a data management framework

Action: Develop periodic summaries of data for target audiences

Action: Analyze and interpret monitoring data to answer relevant questions to support management needs

Action: Work with MDMR and partners to ensure that long-term monitoring efforts are supported with trained personnel

Action: Actively mentor intern and student researchers

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Action: Seek opportunities to weave reserve-generated data into other national monitoring networks.

Action: Disseminate data and research conclusions through workshops and research symposia

Objective 1.2: Systematically collected social science data improves our understanding of GNDNERR resource uses, users, and human values over time (R, E, CTP)

Action: Determine social science indicators to track over time

Action: Develop and implement a data management framework

Action: Develop periodic summaries and communications of data for target audiences

Action: Use data to enhance the reserve's existing activities, products, and services

Action: Work with partners to develop proposals and projects that incorporate use of social science data

Objective 1.3: Reserve monitoring data analyses are used to answer relevant management questions and form future questions (R, S, E, CTP)

Action: Develop relevant questions based on management priorities

Action: Use analyses of reserve data to address resource management questions

Action: Form future questions based on results and management applications

Action: Create products to share knowledge (e.g., summaries, peer-reviewed publications, newsletter articles, social media materials, curricula)

Objective 1.4: Researchers and others can easily access reserve data and collaborate (all)

Action: Disseminate quality information to improve management of resources through the GNDNERR website, CDMO, and providing GNDNERR data (referenced in Objective 1.1 above) by request

Action: Provide consistent access to reserve monitoring data to students, researchers, and managers

Action: Keep NERRS Research Database and GNDNERR Publication List updated and track the number of active research projects occurring in the reserve each year

Action: Reserve staff provide opportunities for researchers to collaborate on reserve management questions or issues

Action: Write and/or co-author grant proposals with external researchers and partners

Objective 1.5: External researchers conduct projects that contribute information to supporting reserve management priorities (R, S)

Action: Support external research by providing staff assistance and facilities to outside researchers interested in working at the GNDNERR

Action: Reserve research priorities are communicated to external researchers

Action: Promote reserve capabilities and research opportunities to researchers at external events, conferences, and at regional universities and colleges

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Objective 1.6: Reserve-specific data and scientific knowledge comprise 50% of reserve's outreach programming (E, CTP)

Action: Develop new reserve science-based outreach programs focused on GNDNERR management priorities, e.g., ecosystem restoration, water quality and weather, marsh vulnerability to sea level rise, fire ecology, and bird populations

Action: Integrate reserve-specific data and scientific knowledge into existing outreach programs

Action: Reserve data is translated to support outreach programs

Action: Visual aids for target audiences are developed using reserve data and knowledge

Goal 2: Conserve and manage natural resources to improve ecosystem function

Objective 2.1: By 2023, land management activities occur on at least 1,000 acres of land within the GNDNERR/GNDNWR to improve ecological function of upland habitats (S)

Action: Staff coordinate with partners to strategically implement land management activities

Action: Implement land management activities to improve ecological functions on upland habitats, such as mechanical clearing, herbicide treatments, and prescribed fire

Action: Staff vary land management treatments to test relevant hypotheses about restoration

Objective 2.2: Private lands are acquired from willing sellers and effectively managed/restored (S)

Action: Work with partners on identifying appropriate target parcels and supporting activities associated with land acquisition

Action: Annually, the reserve evaluates and revises (if necessary) land acquisition plans

Action: Create mapping products to support land acquisition and restoration planning

Action: Reserve staff track land acquisitions, science needs/priorities, and develop restoration and/or management plans for newly acquired lands

Objective 2.3: Effectiveness monitoring of restored reserve habitats evaluates changes in ecosystem function (R, S)

Action: Staff coordinate monitoring activities with restoration project partners

Action: Pre- and post-monitoring plans are developed and implemented for restoration projects within the GNDNERR/GNDNWR

Action: Staff use monitoring data and analyses to identify changes in ecosystem function

Action: Staff report on methods and results of effectiveness monitoring in the form of presentations, reports, and peer-reviewed publications

Action: Changes in management actions are evaluated based on conclusions from effectiveness monitoring data

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Objective 2.4: Coastal managers and researchers are knowledgeable about GNDNERR's natural resource management actions and changes to ecosystem function due to restoration (all)

Action: Coordinate and share natural resource management activities and results about changes in ecosystem functions of restored coastal ecosystems to partners

Action: Solicit partnerships to conduct research and leverage land management work

Action: Staff actively participate in the broader scientific conversation through society memberships, stakeholder meetings, workshops, and/or conferences where they share protocols, data, and knowledge with peers at least annually.

Action: Conduct training workshops to share management activities and results from the GNDNERR/GNDNWR

Goal 3: Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them

Objective 3.1: Coastal Mississippi and Alabama citizens with knowledge of GNDNERR and its work increase (all)

Action: Implement GNDNERR-specific and general estuarine science programming to targeted audiences and communities

Action: Plan and conduct K-12 and adult classroom and/or field-based programs on relevant coastal resources and resource management

Action: Conduct science-based community events to promote conservation of GNDNERR resources

Action: Collaboration with Friends of the Grand Bay NERR increases volunteer participation

Objective 3.2: Reserve visitors broaden their knowledge of Grand Bay ecosystems (all)

Action: Engage visitors through dynamic interpretive center displays and kiosk surveys to gain feedback on experience

Action: Implement citizen science programming to involve the local community in reserve activities

Action: Create new visitor experiences such as new trails and pollinator garden with interpretive signs and materials

Action: Develop interpretive materials for distribution

Objective 3.3: People are inspired to act on coastal conservation issues (all)

Action: Enhance the visitor experience by removing trash and debris on public trails, roadsides, and waterways

Action: Train and manage volunteer workforce in coordination with the Friends of the Grand Bay NERR

Action: Purposefully incorporate volunteer activities into new projects and programs when possible

Action: Staff engages with visitors to inspire interest and ownership in conservation and conservation action in communities

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Objective 3.4: Students and groups participate in programs at the GNDNERR that inspire and teach environmental leadership (E, CTP)

Action: Incorporate middle schools and high schools of local communities into education activities

Action: Develop opportunities for students and volunteers to gain experience in leadership roles

Action: Conduct at least one Teacher's on the Estuary (TOTE) professional development workshop per year

Action: Develop and strengthen connections with local communities using advisory boards and committees

Action: Annually, staff implement thirty (30) K-12 education and training programs focused on coastal ecosystems

Objective 3.5: Partners work with GNDNERR to enhance the understanding and conservation of coastal resources (all)

Action: Expand reserve training and outreach efforts to new targeted CTP audiences (e.g. real estate agents, developers, businesses) and broaden reach into the communities in Hancock, Harrison and Mobile counties.

Action: Staff establish and maintain partnerships with the research community and resource managers

Action: Staff inform national, state, and local elected and/or appointed officials about reserve mission and goals

Action: Staff participate in regional partnerships such as Gulf of Mexico Alliance (GOMA) or GNDNERR regional partnerships

Action: Create a collaborative atmosphere where existing and future partners, community businesses, organizations, and citizens work towards shared or common goals

Objective 3.6: The Grand Bay Community Collaborative (GBCC) contributes to the management of the reserve (A, CTP)

Action: Regular GBCC meetings provide opportunities to inform partners about reserve actions and priorities and solicit feedback and direction

Action: Reserve staff communicate to and receive feedback from GBCC members.

Action: Hold meetings of the GBCC each year

Objective 3.7: The GNDNERR is recognized as a reliable source for experts in natural resource science and land management, relevant scientific tools, and current scientific information (all)

Action: Staff lend their expertise to partners working on similar issues in natural resource science, land management, monitoring, outreach, or other relevant areas

Action: Staff continually participate in professional development trainings, workshops, and conferences

Action: Staff conduct research and effectiveness monitoring projects to better understand the Grand Bay ecosystem

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Action: Staff publish results from research and monitoring projects as summary reports and peer-reviewed publications.

Goal 4: Communicate efficiently and effectively

Objective 4.1: Staff demonstrate their ability to effectively communicate using established platforms (all)

Action: Update and maintain reserve signage, promotional materials, and field guides

Action: Update and maintain reserve website

Action: Reserve social media platforms are updated and maintained

Action: Effectiveness of website and social media presence is evaluated using analytics

Action: Staff participate in communication trainings to build skills

Action: Periodically evaluate whether there are opportunities to improve communication

Objective 4.2: Reserve audiences promote community awareness and stewardship of coastal resources (all)

Action: The GNDNERR staff disseminate quality scientific information and data to external audiences through events, workshops, projects, and partnerships

Action: Scientific outreach information disseminated by GNDNERR staff to local communities has been reviewed by Science staff for accuracy based on current state of knowledge

Action: Ensure two-way communication between the community and the reserve by establishing pathways to hear from community (e.g., surveys, feedback forms, solicitations, etc.)

Action: Use a variety of communication platforms to reach external audiences (e.g., signage, promotional materials, field guides, newsletters, website, social media)

Goal 5: Streamline administrative functions

Objective 5.1: Staff meetings effectively communicate and coordinate GNDNERR activities and events (A)

Action: Hold regular briefings and provide meeting minutes to update staff, make announcements, share schedules, and coordinate equipment and facilities use

Action: Hold Coordinators, Outreach, and Science meetings to coordinate team activities

Objective 5.2: The GNDNERR administration works directly with MDMR to have ample fiscal and human resources to accomplish its mission and goals (A)

Action: Streamline departmental communication pathways to accomplish administrative tasks

Action: Communicate administrative decisions to relevant staff as needed

Objective 5.3: Facilities are managed and maintained in optimal conditions (A)

Action: Implement annual maintenance agreements and schedule regular maintenance, including building inspections every five (5) years

Action: Reserve staff identify ways to improve how infrastructure is managed and maintained

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Action: Prepare for an aging building, vehicles, and vessels with renovation and fleet planning

Action: Protect facilities, infrastructure and employees from weather and wildland hazards

Action: Maintain, repair, and upgrade facilities and infrastructure

Objective 5.4: Emergency planning and management activities are coordinated with MDMR (A)

Action: Update and exercise disaster response and recovery planning

Action: Work with MDMR on emergency management and recovery

Objective 5.5: The GNDNERR has administrative tools (general office equipment, budget tracking processes, office manager) to accomplish mission and goals (A)

Action: Use pre-planning for annual activities to refine budgets

Action: Update office equipment as needed

Action: Work with MDMR finance department to track spending

Action: Create Office Manager position to help with financial processing, facilities maintenance contracts, and large-scale procurements

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Program Foundations – Science and Outreach

Science Program: Research, Monitoring, and Stewardship

Research and Monitoring

Reserves are created to provide a stable platform for long-term research on estuarine conditions and relevant coastal management issues. The SWMP delivers standardized measurements of short-term variability and long-term changes in water quality and biological systems, and maps land use and land cover characteristics across all reserves. The effort is focused on three ecosystem characteristics: abiotic characteristics (water temperature, salinity and quality, and weather); biotic characteristics (habitat types and species); and watershed and land use characteristics (land cover and elevation changes). Reserve-generated data meet federal geographical data standards and are available via the Reserve System's CDMO. Reserves also serve as sentinel sites for observing how coastal habitats respond to changing water levels. This program is guided by the reserves' System-wide Monitoring Program Plan, the Reserve Habitat Mapping and Change Plan, and Sentinel Sites Guidance.

The Reserve System also supports applied research through its Science Collaborative program and the Margaret A. Davidson Graduate Fellowship program. The Science Collaborative funds competitive research projects that engage end-users in the project design and address system-wide NERRS research and management needs. The goal of the Davidson Fellowship is to build the next generation of leaders in estuarine science and coastal management. Appendix 2 provides a comprehensive list of fellows at the GNDNERR since 1999. The fellowship provides opportunities for graduate students to conduct research within a reserve under the guidance of a mentor who also supports their professional development. The Reserve System Strategic Plan outlines research objectives to maintain and expand biophysical and socioeconomic monitoring to track environmental change, increase the use of collaborative research to address decision-maker needs, and ensure that scientific, education, and management audiences can use the data, research results, and tools developed by the system.

Research

Research Program Context

Setting and Context

The GNDNERR serves as a living laboratory for on-site staff, visiting scientists and graduate students who study coastal ecosystems, including wet pine savanna and emergent tidal marsh. The area within the GNDNERR and GNDNWR has been a platform for long-term research and monitoring for more than 20 years. The GNDNERR has been involved in the NERRS Sentinel Site Program since 2011, which is focused on understanding the impacts of climate change on estuaries. Also, because Grand Bay is an intact estuarine to upland ecosystem, the GNDNERR is used as a reference site for many research projects. More recently, the Grand Bay watershed has been selected for NRDA projects resulting from the *Deepwater Horizon* oil spill. This includes the NRDA Grand Bay Land Acquisition and Habitat Management Project and Restoring Subtidal and Intertidal Reefs in Mississippi Estuaries, part of NRDA Phase IV Early Restoration.

The GNDNERR research sector has evolved since the designation of Grand Bay in 1999. Prior to designation, very few research efforts were conducted within the reserve boundaries or vicinity. The GNDNERR now supports on average, approximately 15-20 discrete research and monitoring projects annually. Nearly 200 projects have taken place at GNDNERR over the past 20 years, resulting in 128 peer-reviewed publications (100 journal articles and 28 theses/dissertations; Appendix 3). The GNDNERR Ecological Characterization, or Site Profile, includes a basic overview of the Grand Bay ecosystem and a comprehensive list of specific research, monitoring, and management needs (Peterson et al. 2007). An important objective of the reserve is to encourage and facilitate the use of the reserve

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by external researchers. Thus, staff assists or collaborates with many researchers, frequently as co-principal investigators, as well as provides a variety of ecological data sets to visiting scientists to enhance their monitoring and research efforts. Internal research and monitoring projects are conducted as staff time and resources are available. The GNDNERR additionally participates in multi-reserve research projects and regional partnerships to address various management needs.

The major existing partners are the USFWS GNDNWR, Mississippi State University (MSU), MDEQ, University of Southern Mississippi (USM), USGS, and other colleges and universities in the region.

Priority Issues

The GNDNERR Science staff have developed several research priorities or focus areas that address critical coastal management issues for Grand Bay. These focus areas are based in part, on several elements: increased understanding of the Grand Bay ecosystem through reserve-focused projects, monitoring and research needs and data gaps identified in the Site Profile, areas of expertise of reserve staff, opportunities for collaboration with universities, research laboratories, and government scientists, and research needs arising from the impacts of the *Deepwater Horizon* oil spill. While there are interests in a variety of topics, including plant ecology, phytoplankton population dynamics, nutrient inputs, ecosystem services valuation, fish nursery function, and the potential for aquaculture, the following topics are the research/management thematic priorities for the GNDNERR.

Restoration effectiveness monitoring: Coastal habitats are being restored throughout the northern Gulf of Mexico, and many of these efforts have well-defined end points that can be used to determine restoration success, but effectiveness monitoring is rarely conducted and/or monitoring data is not often available for synthesis. Therefore, more information on the effectiveness of restoration approaches in both upland and estuarine systems to guide future management efforts in the region is needed.

Physical and hydrological processes: The GNDNERR marshes are affected by several ecological and physical processes, and are slowly being converted to open water, but the physical processes driving this conversion and how critical ecological functions are affected is not well understood. Therefore, studies to better understand overland flow, water circulation patterns, and sediment dynamics (e.g., erosion, transport, deposition) in the GNDNERR are needed to assess management actions with the potential to better conserve estuarine ecosystem function.

Sources and impacts of contaminants: The GNDNERR has experienced impacts from contaminants (industrial spills, see Water Quality) and the waters are currently closed to oyster harvest due to fecal coliform bacteria loads in excess of acceptable levels (per the National Shellfish Sanitation Program). While some sources and problems are understood (e.g., MS Phosphates), sources of fecal contamination or the potential impacts of contaminants from other nearby sources are not well understood; therefore, better information about the sources and impacts of contaminants across the reserve are needed to develop effective mitigation strategies.

Vertebrate population distribution and ecology: The GNDNERR is a reference site for many research studies and on-going restoration projects across the Mississippi Coast, but management questions remain specifically in terms of feral hog management, terrapin nesting success, occurrence of rare and endangered species, etc. Therefore, population distribution and ecological studies for terrestrial and aquatic vertebrates are needed to increase understanding of these species' population dynamics in GNDNERR and allow GNDNERR to serve in its role of a reference estuary.

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Socio-economic impacts of ecosystem restoration: Due to the impacts of the *Deepwater Horizon* oil spill, restoration of coastal habitats is occurring throughout the northern Gulf of Mexico, and many of these efforts are expected to improve the socio-economic condition of the Gulf Coast communities as well as the environmental condition. However, few research efforts focus on ecosystem valuation in terms of the socio-economic impacts of restoration; therefore, more information is needed on how and if restoration to the local environment impacts local communities and economies.

Research and monitoring studies are actively designed by GNDNERR staff to contribute to the scientific or management community, and major outcomes of the reserve research and monitoring program are expected to be used as a reference for ongoing monitoring, conservation, and restoration work. Better understanding of ecosystem dynamics will improve resource management and restoration techniques/approaches.

Priority Audiences

The target audiences for data and information generated from research at the reserve are our state partners (MDMR, MDEQ), federal partners (USFWS, USGS), academic community (MSU, USM, other university researchers), the educators who translate GNDNERR research into curricula and programming for students, and trainers who develop research-based workshops for local and regional coastal managers. Over the course of this management plan, our partner audiences will expand by building relationships with additional universities, research stations, resource managers, and municipal partners.

Research Program Capacity

The research sector at the GNDNERR is led by the Research Coordinator, a Research Associate with the MSU Coastal Research and Extension Center (CREC), and MDMR contractor. Activities for the research sector are supported by the GNDNERR facilities, including the labs and dorm, and the facilities at CREC. The Research Coordinator supervises the SWMP Manager (who supervises the SWMP Technician), Research Assistant, and any interns or graduate students at the GNDNERR whose work relates to research sector objectives. The Research and Monitoring, and Stewardship sectors at GNDNERR function under the umbrella of a Science program, which allows for efficient and effective coordination of science-based activities. The Science program works with a wide array of partners to accomplish its research objectives. Regular “Science Staff” meetings are the typical mechanism for communication and coordination of project activities across the reserve staff. The primary role of the Research Coordinator is to develop new research projects with partners, manage SWMP activities, promote and coordinate research activities among the GNDNERR Science staff and external researchers (including mentoring students), communicate research and monitoring results to external audiences, and integrate the scientific information obtained into the other GNDNERR sectors. In addition, they are responsible for initiating, promoting, supporting, and tracking priority research activities at the reserve. Through the Research Coordinator’s connection to MSU, the GNDNERR benefits from direct connections to researchers with diverse backgrounds relevant to reserve research needs. Further, this relationship gives reserve staff access to university software, as well as physical resources such as boats and laboratory equipment at CREC facilities.

Research Program Delivery

The research sector will implement the required (core) elements of SWMP using the Science team. The Research Coordinator’s primary responsibilities are described in the above section. The SWMP Manager reports to the Research Coordinator and oversees the day-to-day requirements of the water quality and weather monitoring, including equipment deployment and maintenance, nutrient analyses, data management and quality checks, and coordinating with the CDMO on data upload requirements. The

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SWMP Technician assists the SWMP Manager with all these tasks. The nutrient analyses are performed in-house, using our spectrophotometer, autoanalyzer, and other associated equipment to prepare and store samples. The reserve will provide funding for this work as part of the operations award annually. The reserve will also support annual technician trainings to further the knowledge and skills of the Science team.

Additional reserve monitoring activities, including the Sentinel Site Application Module 1 (SSAM-1), are implemented by collaboration between the research and stewardship sector and are described below. If additional components of SWMP are developed they will be managed and maintained within the research sector.

The Science staff excel at effectively delivering the results of their research to the scientific and management communities as well as sharing them with the public. Reserve staff use a variety of venues and formats for sharing their work. These include giving oral and poster presentations at international, national, regional, and local scientific conferences. Science staff members are also actively involved in publishing their research through peer-reviewed literature, technical bulletins, and popular, or public-oriented publications such as outdoor magazines and newsletters. To facilitate the distribution and application of their publications, the reserve provides a list of GNDNERR-related science publications on their website and maintains a searchable publications spreadsheet for use by researchers and educators. The research sector also maintains the GNDNERR portion of the National NERRS Research Database.

The Science staff also frequently participate in Outreach events and workshops. Staff participate in the annual National Estuaries Day celebration “Seaside with the Scientists”, present on research and management topics and lead field trips for the TOTE workshops, and mentor undergraduate interns and direct graduate student research projects, including serving as the student’s major professor/advisor. Finally, in collaboration with the education sector and Coastal Training Program (CTP), the staff organizes and hosts a GNDNERR Research Symposium every other year, typically during the fall. This collaborative effort facilitates the sharing of information and development of collaborative research projects through scientific presentations and workshop formats. The format includes virtual presentations that are live and recorded for later access. Attendees are a mix of scientists, land managers, and program managers, which provides ample opportunity for discussions across these groups.

Research Future Needs and Opportunities

The research sector has many opportunities for growth over the next five years, particularly associated with ongoing large-scale restoration projects. For example, the NRDA Land Acquisition and Habitat Management Project is funded until the end of 2029 and currently includes the restoration of 3,000 acres of wet pine savanna. This project provides an enormous opportunity to answer research questions regarding the change in the ecosystem and downslope effects. Funding opportunities are also plentiful (e.g., National Academy of Sciences Gulf Research Program, NERRS Science Collaborative, RESTORE-associated funding streams, and state-specific opportunities like the Tidelands Trust Fund) as are local and regional partnership opportunities. Challenges include developing competitive projects to acquire funding and ensuring sufficient staffing levels to accomplish project goals.

Additional needs and priorities are in the development process. In the next five years, as part of this management plan, communications with stakeholders will include an ecosystem-wide assessment of the Grand Bay estuary with the objective of determining research needs. Those needs may include studies associated with the restoration of the Grand Battures, hydrologic restoration by elevating HWY 90,

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and/or the implementation of off-bottom oyster aquaculture in the GNDNERR. These needs have yet to be determined and will be based on collaborative workshops on these topic areas.

Monitoring

Monitoring Program Context

Setting and Context

The SWMP provides standardized data on national estuarine environmental trends while allowing the flexibility to assess coastal management issues of regional or local concern and is guided by the Reserve System-Wide Monitoring Program Plan. The geographic scope of the GNDNERR SWMP program is four water quality monitoring stations in Bayou Heron, Bayou Cumbest, Point Aux Chenes, and Bangs Lake; a weather station in Crooked Bayou; fifteen surface elevation tables (SETs) along the estuarine gradient with associated vegetation monitoring transects; and erosion monitoring at stations on exposed shorelines in the reserve (Figure 10). Additionally, habitat maps of vegetation classification by spatial extent have been developed reserve wide (see Figure 5).

Priority Issues

The principal mission of the monitoring sector is to develop quantitative measurements of short-term variability and long-term changes in water quality, biological systems, and land use/ land cover characteristics of estuaries and estuarine ecosystems for the purposes of informing effective coastal management. The sector is designed to enhance the value of the reserve as a regional and national reference site. The priority issues for the monitoring sector mirror those in the research sector and can be found above. The GNDNERR's monitoring currently encompasses abiotic SWMP (water quality, weather, and nutrients), SSAM-1 (SETs, marker horizons, and vegetation monitoring), erosion monitoring, and atmospheric mercury monitoring (in partnership with NOAA's Air Resources Laboratory). SWMP is currently overseen by the SWMP Manager and Research Coordinator, and the other monitoring projects are overseen collaboratively by the Stewardship and Research Coordinators. The Stewardship Coordinator oversees field work and protocols, and the Research Coordinator oversees data and metadata management. A map of GNDNERR's monitoring stations is included at the end of this section (Figure 10). The scope of the monitoring sector is the entire reserve boundary. Since the last management plan, our monitoring data has contributed to the following: confirmation of nitrogen limitation in our estuary (Amacker 2013; Baine 2017), local and national analyses of SET data (Cressman et al. 2020) and a draft manuscript (Pitchford et al. in prep), additional information and publication about phosphate inputs into Bangs Lake (Beck et al. 2018), a publication on atmospheric mercury, additional information on above- and below-ground biomass and a submitted manuscript (Archer et al. in review), completion of sample processing, data entry and quality checks, analysis, and a draft final report for a 10-year fish monitoring project, digital elevation models for reserve sentinel sites, a new habitat map, and the design of new effectiveness monitoring for NRDA-related projects.

Priority Audiences

The target audiences for the monitoring sector are fellow researchers for whom our monitoring data provides a baseline for intensive research questions. Others include resource managers, such as those who are interested in the effects of the opening of the Bonnet Carré spillway, and educators, who can use the monitoring data to develop curricula for science classes.

Monitoring Program Capacity

The support for the monitoring sector overlaps with the research sector. Science staff work collectively to conduct long-term monitoring of GNDNERR resources. This includes atmospheric mercury, SSAM-1, and restoration monitoring. The SWMP Manager and SWMP Technician perform the abiotic sampling.

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Monitoring Program Delivery

There are several components to the GNDNERR monitoring sector, including those that are a formal part of the SWMP and those that are specific to GNDNERR (Figure 10).

Abiotic SWMP

The GNDNERR has four water quality SWMP stations (Bayou Heron, Bayou Cumbest, Point aux Chenes Bay, Bangs Lake), one meteorological station (Crooked Bayou), and six nutrient stations (Figure 10). The nutrient stations consist of the four water quality stations plus additional nutrient-only sites at Bangs Lake North (due to the 2005 phosphate spill) and Bayou Heron Surface (because the water column at the SWMP station is frequently stratified; Bayou Heron Bottom is the primary SWMP station for water quality and nutrients). Water quality stations were established in 2004; weather and nutrient monitoring began in 2005. Two of the water quality stations (Bangs Lake and Bayou Heron) and the weather station are currently telemetered and transmit data hourly to NOAA's Geostationary Satellite Server east satellite. Nutrients are analyzed in GNDNERR's in-house laboratory following in-house laboratory standard operating procedures (SOPs). All SWMP activities are performed in accordance with SWMP SOPs, the CDMO's Data Management Manual, and standard analysis methods. Primary staff contributing to SWMP are the SWMP Manager and SWMP Technician; interns and other staff members assist when needed. Field infrastructure for SWMP includes pilings and platforms at the water quality stations and additional pilings in each bayou in case of program expansion, YSI EXO2s, YSI 6600s (formerly the primary water quality instrumentation; replaced by EXOs), YSI Storm3 telemetry systems at two water quality stations, a weather station platform on pilings in Crooked Bayou, and Campbell Scientific weather station equipment (including telemetry equipment). The laboratory includes basic equipment for SWMP nutrient and chlorophyll analysis such as a discrete autoanalyzer, spectrophotometer, fluorometer, centrifuge, autoclave, deionized and ultrapure water systems, drying ovens, and various refrigerators and freezers.

SSAM-1

The GNDNERR installed 15 SETs along a coastal elevation transect in 2010-2011 as part of the Sentinel Site Monitoring Program. Each SET also has three associated marker horizon plots. Infrastructure includes boardwalks to reach the sites, platforms around the sites, SET heads attached to stainless steel rods driven into the sediment to refusal, a portable SET arm with pins that are used to take measurements, real-time kinematic (RTK) global position system (GPS) units, and a Sprinter level. The SET and marker horizon readings were taken quarterly from 2011-2016, and since 2017 are taken twice per year. Vegetation monitoring transects, associated with each SET, have been monitored every year since 2014, and will be monitored every two years after 2020. Stewardship staff, overseen by the Stewardship Coordinator, are primarily responsible for this monitoring. Other SSAM-1 electives include shoreline erosion monitoring (performed quarterly at GNDNERR since 2006), which was monitored with benchmarks and a measuring tape until 2010, a Total Station from 2010 – 2012, and RTKs since 2012. Another elective is digital elevation model monitoring using RTK GPS, which occurs every five years (2013 and 2018). Stewardship staff are responsible for this monitoring.

Atmospheric Mercury

A trailer and tower near the Bayou Heron boat ramp have been in place since September 2006, but ongoing monitoring of dry deposition of atmospheric mercury was discontinued in March 2020. The trailer and tower will be removed from the reserve by October 2021. The NOAA Air Resources Lab (ARL) and the GNDNERR continue to collect and maintain infrastructure to monitor wet deposition of mercury. Samples are sent to the National Atmospheric Deposition Program's Program Office at the Wisconsin State Laboratory of Hygiene at the University of Wisconsin-Madison. This monitoring is a partnership

with NOAA ARL who fund a small portion of the Coastal Ecologist position at GNDNERR to accomplish the collection and shipment of wet deposition samples.

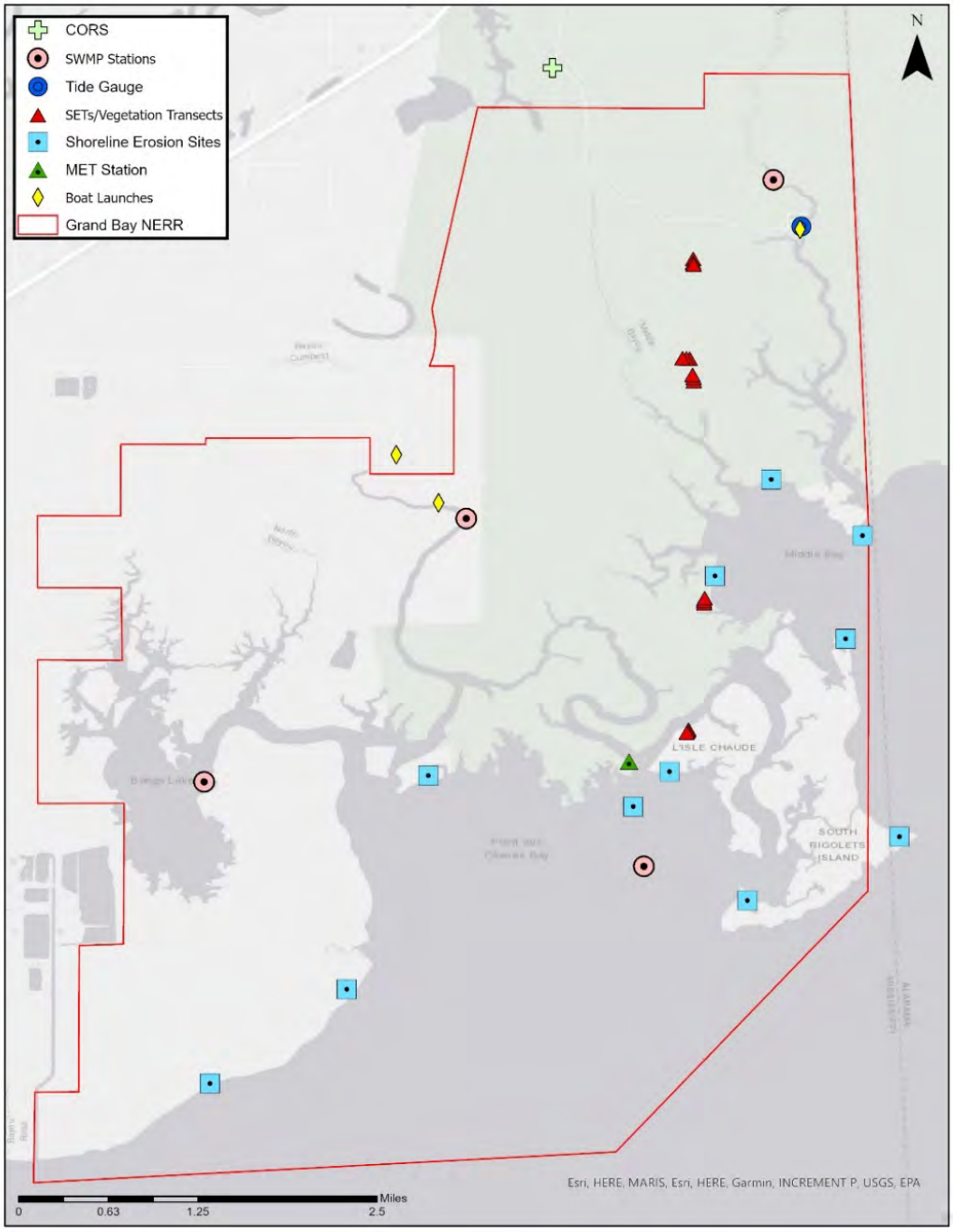

Figure 10. GNDNERR monitoring locations.

Monitoring Future Needs and Opportunities

There are a variety of needs and opportunities in the monitoring sector that are evident for the next five years. These include a need for continued funding for infrastructure maintenance and repairs, the need for continued consistent data management, metadata structures, and continued updates to the data sharing plan. Maintaining functioning equipment in difficult weather conditions, along with aging field

infrastructure, is challenging and expensive. Hurricane season in 2020 destroyed the Point Aux Chenes water quality station, the Bangs Lake telemetry equipment, and the weather station. Opportunities for the monitoring sector include collecting and analyzing long-term datasets to improve the understanding of baseline conditions in water quality or biological conditions, especially as they relate to restoration activities. Information from these analyses can be shared with wide audiences through coordination with other sectors and external researchers. For example, SWMP status reports may be shared with teachers and community groups, and lessons from long-term monitoring projects can be applied to our recent restoration effectiveness monitoring. There are also opportunities to explore technology such as flow cytometers for phytoplankton monitoring, and ample opportunities to work with the Outreach team on volunteer monitoring and citizen science projects.

Stewardship

The mission of the NERRS as stated in the 2017-2022 Strategic Plan is "To practice and promote stewardship of coasts and estuaries through innovative research, education, and training using a place-based system of protected areas." A key component of this mission is to promote stewardship within the reserves and in adjacent coastal areas, to maintain water quality and healthy habitats along our nation's coastlines. Specific goals and objectives of the national program relating to protected areas emphasizes that estuaries and coastal watersheds are better protected and managed by implementing place-based approaches that:

- Increase permanent protection and restoration of key areas in reserve watersheds to improve coastal habitat quantity, quality, and resiliency to environmental change,
- Enhance the connection of the community to stewardship of coastal resources, and
- Strategically expand the number of reserves to serve coastal communities' needs.

Stewardship Program Context

Setting and Context

The geographic scope of the reserve's stewardship sector extends beyond the GNDNERR boundary to the north and includes the boundary of the GNDNWR and state lands adjacent to Pecan Road (see Figure 7) due to state ownership of these lands and the scope of the upland restoration work. The GNDNERR Site Profile (Peterson et al. 2007) provides an excellent summary of historical stewardship and resource use along the Mississippi Coast including areas of the reserve. Many of the historical land practices had ecological benefits for the landscape. Lightning-ignited fires naturally shaped the landscape and were only interrupted by wet cypress drains and bayous. Early residents to the area used fire to drive game animals and to promote new vegetation for grazing. While somewhat more difficult to accomplish today because of habitat fragmentation, smoke management concerns, and private in-holdings, prescribed fire remains one of the most important habitat management tools at GNDNERR. The wet pine savanna and emergent marshes are the primary habitats being restored and studied in partnership with the GNDNWR and MDEQ.

Priority Issues

The priority issues for the stewardship sector mirror those in the research sector and can be found above. Most current and projected stewardship sector work is focused on wet pine savanna and marsh restoration and sentinel site monitoring.

Priority Audiences

The priority audiences for the work include the MDMR, GNDNWR, MDEQ, MS TIG, USGS, and a variety of university researchers and partners.

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Stewardship Program Capacity

The support for the stewardship sector has much overlap with the research and monitoring sectors, and the following staff, facilities, and infrastructure support the work, including a Stewardship Coordinator to lead and manage activities, Natural Resource Manager to direct and advise on management actions, and several natural resource specialists with various expertise. The infrastructure and equipment used include a tractor, all-terrain vehicle, RTKs, sprint leveling device, game cameras, and field supplies. An herbarium has been established by the stewardship sector and is helpful with cataloging and plant identification. The stewardship sector also is the primary user of geographic information systems. The sector works with a variety of partners to accomplish a range of land management and restoration activities including the USFWS, MDMR's Coastal Program, local university researchers from MSU and University of Alabama, and scientists across the NERRS.

Stewardship Program Delivery

There are several components to the GNDNERR stewardship sector including land management and associated effectiveness monitoring, trail management and debris removal, and testing concepts associated with restoring marshes. Other activities that are coordinated with the GNDNWR include trail development and maintenance, invasive species mapping and treatment, fire management, mechanical treatment (e.g., chain sawing, mulching, etc.), habitat assessments, habitat mapping and restoration planning.

Mastication, Invasive Treatments, Prescribed Burning

The GNDNERR, GNDNWR, and other partners are currently involved in a comprehensive effort to manage upland and estuarine resources on a landscape scale at Grand Bay (Figure 11). These efforts include multiple funding sources and involve many partners. A specific upland restoration effort funded by the MS TIG through the NRDA funding stream as a result of the 2010 *Deepwater Horizon* oil spill is detailed in the Restoration Plan.

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Figure 11. Prescribed burn of the wet pine savanna east of the Coastal Resources Center.

Effectiveness Monitoring

Stewardship sector work at GNDNERR includes effectiveness monitoring (to measure results of management actions) and research, land protection, ecological restoration, and resource enhancement. An important aspect of the reserve's work is to demonstrate best management practices that other professionals, local decision-makers, and the public can apply in their own communities. Additionally, it is vital that stewardship and resource management activities are consistent with maintaining the

integrity of the site for long-term research and monitoring. The reserve is a laboratory for examining landscape changes related to human population growth, natural disasters and impacts from sea level rise. Our resource management efforts are based upon the principles of adaptive management and seek to apply current methods in restoration science to enhance impaired habitats with a focus on improving ecological function. Long-term monitoring allows an evaluation of the effectiveness of restoration activities and functional integrity of natural processes. As such, all restoration activities have a monitoring component designed to help understand restoration effects over the long-term.

Trail Management and Debris Removal

Another component of stewardship at GNDNERR relates to the establishment and maintenance of public areas. There are three established public trails at the reserve, plans to create a pollinator garden, and re-establish native wetland vegetation at a stormwater wetland at the CRC. These areas all require periodic maintenance (e.g., mowing, chain sawing, invasive species removal and treatment, etc.) to ensure that they remain in good condition. This includes creation and maintenance of informational signs to educate visitors to the reserve.

Another focus of the stewardship sector is to actively remove debris and develop strategies to prevent future dumping within the reserve. Current upland restoration efforts are focused on areas within the reserve that contain large caches of debris that need to be removed prior to initiation of land management activities. A pro-active approach to debris removal that includes monthly trips with participation by all GNDNERR staff is being used to help combat debris issues. Further, we are working to limit access to several abandoned roads by establishing gates and signage in appropriate areas to discourage dumping and littering. Work continues with GNDNWR, MDMR, and Jackson County Sherriff's Department and includes reporting illegal dumping. This work also occurs in partnership with MSU CREC, the Coastal Cleanup Program, and volunteers to provide the public with opportunities to participate in debris removal and learn more about this important issue at the GNDNERR. The Education and Training sectors include programs focused on marine debris and its impact on coastal habitats.

Marsh Protection / Restoration

The focus of estuarine habitats is primarily on resource monitoring and demonstration of best management practices such as construction of living shorelines. As part of the NRDA Phase IV Early Restoration efforts, the Restoration of Subtidal and Intertidal Reefs in Mississippi Estuaries project was initiated that included components in GNDNERR. Those components included three acres of subtidal reef and 7.5 acres of intertidal reef composed of crushed limestone and oyster shell. The project was designed to allow for experimental analysis of the effectiveness of various approaches and an effectiveness monitoring study was designed to assess the project. Graduate students are also encouraged to develop projects associated with reef installation and include the Davidson fellow. The project is set to be installed in January 2021.

Stewardship Future Needs and Opportunities

Science staff work to increase the number of external research projects started at the reserve by facilitating research activities. This primarily occurs through provision of lab space and field equipment, advice on field sampling locations, and may involve field assistance for projects relevant to GNDNERR monitoring and research programs. Future needs and opportunities for the Science staff include assisting in the development of workshops to evaluate large-scale restoration efforts in Grand Bay, including the restoration of the Grand Battures and evaluation of the marsh migration pathways and landscape barriers. The Science staff will also be integral in evaluating the potential implementation of off-bottom oyster aquaculture.

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More specific information about other Stewardship activities and the related management plan objectives and actions can be found in the Public Access and Visitor Use, Land Acquisition, Resource Protection, Restoration, and Sentinel Site Monitoring Plans.

Outreach: Education and Training

Education

The NERRS seeks to enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation. The NERRS increases estuary literacy among students, teachers, and the public through the K-12 Estuarine Education Program (KEEP) and Conservation Action Education programs.

The KEEP helps educators bring estuarine science into the classroom through hands-on learning, experiments, fieldwork, and data explorations using grade-appropriate lessons, activities, and videos. Reserves also offer teacher development programs that use established coastal and estuarine science curricula aligned with state and national science education standards. Teachers on the Estuary workshops give teachers the opportunity to explore coastal habitats and conduct field investigations, learn how to integrate local and national monitoring data into the classroom, and gain hands-on experience using estuary education resources.

As part of the Conservation Action Education initiatives, reserves conduct formal and informal education activities and outreach activities that target educators, students, and environmental professionals; people who use these natural resources for work or play; and the public. Reserves integrate research and monitoring into their educational and outreach efforts, providing a multi-faceted, locally focused approach aimed at engaging the community.

The Reserve System Strategic Plan outlines education objectives designed to increase the public's awareness of and participation in stewardship activities; improve educators' and students' understanding and use of the system and NOAA resources for place-based and inquiry-based learning; and grow and motivate the next generation of coastal professionals through programs and research, resource management, and educational opportunities.

Education Program Context

Setting and Context

The educational programming at GNDNERR seeks to strengthen connections and understanding of coastal ecosystems within the local communities in Jackson, Harrison, Hancock, and George counties in Mississippi and Mobile County, AL. The ecological and socioeconomic context for the education program is described in previous sections. The reserve's education programs are linked to the reserve focus areas and priority issues and through an integrative process that involves regular coordination with reserve research and stewardship staff members programs accurately demonstrate the value and significance of coastal and estuary ecosystems to our audiences. The CRC provides a venue for a variety of learning experiences for many K-12 students, teachers, collegiate, and community audiences. Additionally, the varied habitats and associated plants and animals found at the reserve provide an excellent "living laboratory" for all types of outdoor educational activities. The reserve also promotes, produces, and participates in several educational and outreach activities at schools, community events and other programs with various partners. Field trips and community programs are hosted at the CRC and feature activities such as guided walking and boat tours, art workshops, and community education events. Another opportunity for new education programming comes with the addition of a large outreach vessel, *Miss NERR*. She will provide opportunities to engage our community in aspects of estuarine ecology from the water, for example a ship-side trawl can gather live organisms for display in a see-through tank on board.

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Over the course of this five-year management plan, the education sector will develop new programs on habitat restoration and effectiveness monitoring. Programs will educate our community on wet pine savanna ecology restoration practices, and restoration monitoring. Working with teachers, these topics will be introduced into classrooms across our service area, and students will visit the reserve for field trips to experience the habitats and monitoring work firsthand. Community education programming will also highlight restoration topics with an aim of creating broad engagement while restoration work transforms the landscape.

Priority Issues

The reserve staff work in an integrated manner to support, plan, and deliver effective, place-based educational programs and partnerships that align with the NOAA Education Strategic Plan, the 2017-2022 NERRS Strategic Plan, and other national and state guidance. The education sector's main priority issue is to create a science-informed community on the science priorities detailed above. As our education program is integrated with the Science staff, this goal is addressed by our various activities that translate and communicate reserve science to the public. Programs are created that highlight research and monitoring sector activity, and promote stewardship education to conserve, restore, and protect natural and cultural resources. Education staff also work to create school and community programs that improve preparedness, response, and resilience to the challenges of hazardous weather.

To address these issues, the education sector creates school and community programs, builds relationships with local teachers, and aligns GNDNERR programs with local and national educational standards. The programs highlight fire ecology, wet pine savanna vegetation restoration, marsh restoration, stormwater management, and Mississippi Coast natural history. Most programs are framed on the importance of healthy estuaries and coastal habitats, the biodiversity associated with them, and the importance of being good coastal stewards. Education staff work with Science staff to accomplish this by creating opportunities for audiences to participate in conservation and stewardship activities, including debris cleanups. Education staff also deliver and support hands-on educational programs that explore the influences of human activity on the environment. Education staff work with teachers through teacher professional development workshops (e.g., TOTE) to integrate these focus areas into their classroom by developing curriculum that integrates use of GNDNERR data, highlights science and conservation, stewardship of habitats, and restoration science. By developing a relationship with the teachers, more opportunities are created to engage with students in the classroom and at the reserve.

The education sector aligns programs with the 2018 Mississippi College- and Career-Readiness Standards for Science that highlights different areas of restoration and management from 5th to 12th grade. Educational programming is supported by the NOAA Education Strategic Plan and the NERRS Strategic Plan which emphasize creating a science-informed society that is actively involved in inquiry-based learning, conservation, preparedness, and training the next generation of scientists, coastal management professionals, and estuary stewards. College- and career-readiness standards and cross-concept disciplines are integrated into curriculum and activities to better prepare students for pursuits in science fields. These actions align with KEEP giving teachers and students knowledge and understanding of resources for place-based and inquiry-based learning, and also to become better stewards, providing audiences with the knowledge, appreciation, and skills to act as stewards of coastal resources to improve the resilience of estuaries.

Priority Audiences

The target audiences for the reserve education programming include the community in our service area, K-12 students, teachers, and non-traditional audiences (i.e., artists, veterans, seniors, pre-K, people with disabilities, and other non-traditional groups) within our geographic scope and outside our geographic

area as opportunities arise. The 'On the Road' program is focused on the K-12 student audience. By engaging with non-traditional audiences, the reach of our conservation and sense of place work is broadened outside of the community generally served by environmental education programming.

K-12 Students

The K-12 program activities focus on elementary, middle school, and high school audiences within our geographic area. Students are engaged primarily through our 'On the Road' program in their schools. The 'On the Road' program engages students in the classroom and with interactive field trips. Over the next five years, the education program will continue working with local schools and students who have a need for environmental education opportunities. The 'On the Road' program reflects reserve priorities and recent scientific inquiry at the reserve and is aligned with Mississippi College- and Career-Readiness Standards for Science making it useful and impactful programming for our local schools.

Additionally, due to COVID-19, a shift in service has led to more virtual programming. Outreach videos such as the Seaside with a Scientist virtual event provide additional resources for students in the classroom and connects them with GNDNERR research. Integrating virtual resources increases our ability to reach outside of our geographic area. These additional resources provide added value to the 'On the Road' program and also increase the audience reach for the GNDNERR.

Teachers

Teachers are a priority audience for the GNDNERR. The teachers' grade-levels and subjects taught vary based on the theme of the TOTE workshop. There are K-12 formal educators, college professors, and informal educators across a variety of subjects attending workshops. From 2017-2021, teacher attendance at TOTE workshops was: 10% Elementary (K-5), 39% Middle (6-8), 39% High (9-12), 2% College, and 10% Informal educators. At least one professional development workshop is provided each year and teachers earn continuing education credits by attending.

Non-traditional Audiences

The GNDNERR focuses on non-traditional audiences to broaden the scope of people who learn about estuaries and conservation beyond communities generally served by environmental educators. Art programs are developed in partnership with the Director, local artists, the Walter Anderson Museum of Art (WAMA), and other partners (Figure 12). Programs in partnership with the Veterans Administration for local veterans incorporate outdoor and classroom learning about the estuary, with kayaking, hikes in the reserve, art and photography workshops, and lessons on natural history, ecosystem restoration, and conservation with GNDNERR staff and other experts. Programs with the Grand Bay Community Center in Alabama engage seniors in the local area, including a few unique opportunities with the youngest school-aged students and the oldest seniors in programs that focus on water quality, natural history, and conservation.

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Figure 12. Artwork created at a block printing class, in partnership with WAMA.

Over the next five years, new non-traditional audiences will be added with programs that focus on pre-K audiences, people with disabilities, additional programs for seniors, and other groups. New programs will create opportunities for people who do not typically use the reserve or participate in events involving environmental education, nature, or science. For example, a Story Time YouTube playlist was created to engage younger audiences in GNDNERR priorities, including stories to teach young audiences about stewardship and the environment. Pre-K audiences are tactile learners and benefit from hands-on and experiential programs, including Scavenger Hunts, and introduction to animals. People with disabilities generally have limited access to our programming. The reserve already works with mentally and physically disabled peoples through our Veterans program. New programs will be developed that are disability-specific, for example birding by sound for the blind. Additional programming for seniors may use reserve facilities and partners to provide tailored outdoor learning experiences. Developing programs for these audiences requires creativity and forethought to consider the special needs, extra safety requirements and precautions, and information that is appropriate, but adding non-traditional audiences will give everyone in the community a sense of place at the GNDNERR.

Education Program Capacity

Internal and External Resources

The support for the education sector includes the following staff, facilities, and infrastructure. The sector is led by the Education Coordinator who is supported by the K-12 Education Specialist, Program Development Specialist, Director's Assistant, and contractors as grant funding allows. Additionally, an Education Assistant has been described in the Administrative Plan for future positions and would work to increase education sector capacity. The Grand Bay CRC is the main facility for programming and includes a large and small classroom, outdoor screened in area with a sink, a large porch with amphitheater-type seating, and our Interpretive Center. The work is also supported by the Savanna Trail boardwalk and beaten trail through the wet pine savanna restoration area, the Oak Grove birding trail,

and the new Grand Bay NERR Blueway kayak trail. There are 10 kayaks and our large outreach vessel, *Miss NERR*, to support water-based activities. The equipment and supplies available for use include classroom audio-visual equipment; laptops, microphones, and webcams; books, workbooks, and field guides; laminator, binding equipment, copier; handheld YSIs; microscopes; dipnets, buckets, and critter containers; art supplies; two live Mississippi diamondback terrapin exhibits; and, a wide range of biological specimens. The education sector also has access to the biological laboratory for demonstrations such as shark dissections. The GNDNERR has the capacity and resources it needs to meet all strategic objectives of hosting a TOTE workshop.

Strategic Partnerships

Building networks and partnerships is key to the success of the educational efforts. Coordination with our local partners allows us to design and implement more programs and fill identified gaps in environmental education along the north-central Gulf Coast. The sector works with a variety of local partners to accomplish the work including but not limited to the USM's Marine Education Center, Dauphin Island Sea Lab, GOMA, MDEQ, MDMR, and other NERR educators. The education staff also partner with regional and national professional education organizations such as National Science Teacher Association, its local chapter, Mississippi Science Teacher Association, and the National Marine Educators Association, and its local chapter, the Southern Association of Marine Educators to stay up-to-date on current teaching methods and educational technology, new funding opportunities, and to promote the products and programs that are developed within the NERRS. Walter Anderson Museum of Art, local artists, Art in the Pass, the Grand Bay Community Center, and the Veterans Administration are also partners. Coordination with our partners also allows us to design and implement more programs and fill identified gaps in environmental education along the north-central Gulf Coast.

Education and Science staff work closely together to align outreach programming with the research and initiatives occurring at the reserve. Education and Science staff partner to produce K-12 education programs that teach students science disciplines that can help them pursue future careers. Science staff also takes an active role in TOTE workshops. Past evaluations show teachers benefit from learning directly from the scientists who conduct the research.

Education Program Alignment and Delivery

The following describes the major activities and methodologies the education sector will implement in the next five years. The education sector is supported by all reserve sectors and works seamlessly with GNDNERR staff. Reserve scientists and university research partners are regularly incorporated into theeducation programs. The education sector delivers programs using a variety of means, locations, and resources including in-school, field trips and tours, extracurricular workshops, and off-site events. Programs are evaluated internally to improve and refine programming. The major impacts or outcomes the education sector wants to achieve includes increased knowledge of Mississippi natural history and estuarine conservation and increased program reach in terms of audiences. The reserve implements programs to change behavior in terms of plastic pollution and other debris reduction. Overall, the education program's objective is to engage our local community with their environment through enjoyable experiences that feed their curiosity and improve their sense of place.

Community Education

The Education staff will provide community education programs to help further the reserves mission of instilling a sense of place. Environmental education programs that combine direct-place experiences with instructional interpretation foster, nurture, and strengthen sense of place. Individuals with a sense of place are more likely to implement and engage in behaviors that support coastal conservation and restoration efforts (Kudryavtsev et al. 2012). Education staff will work closely with other reserve staff to

create place-based and science-based community programs. Staff will continue to offer community education favorites developed in previous years, and will develop new programs as opportunities arise. Potential programs include birdwatching, coastal heritage, kayak tours, ecology, habitat restoration, monitoring, and stewardship. Activities will be implemented through field trips, tours, and weekend programs. Monthly community education programs (Adventure Quenchers) relating to reserve focus areas will continue to be offered. The focus will be on the biodiversity, ecology, environmental issues and/or cultural heritage found in the coastal and estuarine watersheds within and adjacent to the reserve. Targeted audiences include individuals, families, clubs, civic organizations, local community centers, churches, and visitors to our region.

Teachers on the Estuary

One of the objectives of the education sector is to design, develop and implement teacher professional development opportunities that align with TOTE criteria (at least 15 hours long, nationally advertised, locally relevant, etc.). The TOTE workshops are designed to educate teachers on local research-based science applicable to the classroom. A new component of TOTE workshops is to incorporate more reflection practices (e.g., reflection bubbles, group discussions, visible thinking routines)(Ferreira et al. 2013). Reflective practice requires a conscious effort to think about events and develop insights from them. This technique gives TOTE participants an opportunity to reflect on the different aspects of the workshop and how to best incorporate information into classrooms. Education staff knowledge on how to adapt curriculum and programming to better suit teachers' needs. Reflective practices are shared with the teachers during the workshop so they may be used in the classroom to help students. At the end of the workshops, teacher evaluations are given that help design future programming.

Non-traditional Audiences

The Education staff will develop outreach programs for non-traditional audiences to capture their interest and highlight the local-based science conducted at the reserve. Staff will continue to offer previous programs and create new programs that provide opportunities for non-traditional audiences to participate in events at the reserve. These programs typically occur through partnerships with organizations in the community. Current program partners includethe Veterans' Administration and WAMA. Current non-traditional audiences include veterans, artists, and seniors. Educational programming will expand in the next five years to include pre-K and disabled people.

On the Road Program

The education staff will continue to coordinate and implement reserve educational programming with area schools, school groups, home schooled students, and others through the On the Road program. This program provides classroom instruction and onsite field trips. Field trips to the reserve provide students with an outdoor experience. The program also partners with nearby environmental centers and youth camps to facilitate onsite field experiences for their spring and summer camps. The education staff will continue to work with the Science staff to develop new curriculum for the On the Road program based on the ongoing scientific research and restoration activities at GNDNERR. Evaluation feedback from teachers and students will be used to refine and improve the program. New topic areas for the On the Road program will follow major initiatives in GNDNERR Science such as fire ecology, wet pine savanna vegetation restoration, green infrastructure.

Delivery and Evaluation

The Education staff will continue to develop a wide-range of new curricula and educational programs for the GNDNERR focused on K-12 students, walk-in visitors, families, and young children. Curriculum needs are based on surveys from our TOTE workshops, new topical initiatives associated with ongoing Science staff work, and other sources. These programs will include school-based curricula for classrooms based

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on the reserve research activities, field-based activities at the reserve, a variety of short programs for walk-ins, and other activities. Programs will be piloted during development and may be used as regular Saturday Adventure Quenchers or given in coordination with local schools. Virtual programming will be hosted on the reserve's YouTube channel. The education staff will implement both formal and informal assessments to improve reserve staff understanding of local school and community audiences. The staff will develop and/or adapt tools for assessing educational programs and attendees' experiences. To assess the attendee's experiences and to adaptively manage and design future events, either a written or verbal assessment will be given and analyzed. Assessments from teachers will determine the curriculum designed in the following year. Staff will provide short summaries or updates of assessments and analyses, regarding what was learned and how it was incorporated into programming.

Impacts and Goals

The education sector wants to enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation. The education staff will employ place-based approaches to connect people to science and nature. The TOTE program enhances capacity and the skills of teachers to understand the use of NERRS data and to use it in the classroom. The On the Road program will provide students with science-based, inquiry-based opportunities to foster student excitement for learning, to enhance their retention of information, and to help ready them for the workplace. Among public and non-traditional audiences, estuary literacy will increase, and active stewardship will be promoted through the development and delivery of tools and programs that address the reserve priorities. The objective is to inspire people to practice informed stewardship to protect and conserve the Grand Bay estuary and all of Mississippi's coastal resources.

Education Future Needs and Opportunities

The GNDNERR emphasizes place-based learning. Students, teachers, non-traditional audiences, and the community are engaged by on-site, hands-on learning experiences. Additionally, some programs are virtual. Training needs for the staff have been identified as some programming requires technical expertise, and efforts to fill those training gaps will be pursued in the next five years. The limitations of the program include limited capacity to fill the community demand, but these limitations also are future opportunities. With more virtual programs, the reach of GNDNERR education can increase within existing capacity. Future opportunities also include updates and new curricula added to the On the Road program, programs based on active wet pine savanna restoration work and results, and more opportunities for students to participate in stewardship and other citizen science projects.

Coastal Training Program

The CTP provides up-to-date scientific information and skill-building opportunities to coastal decision-makers on relevant coastal management issues. Target audiences may vary for each reserve, but generally include local elected or appointed officials, managers of both public and private lands, natural resource managers, coastal and community planners, and coastal business owners and operators. They may also include such audiences as farmers, watershed councils, professional associations, recreation enthusiasts, researchers, and more.

The place-based nature of reserves makes them uniquely positioned to deliver pertinent information to these audiences. Each reserve conducts an analysis of the training market and assessment of audience needs to identify how best to deliver relevant training on priority issues to their area.

Partnerships are integral to the program's success. Reserves work closely with a host of local partners, as well as several NOAA programs, to determine key coastal resource issues and the appropriate target audiences and expertise needed to deliver relevant and accessible programs.

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The *Reserve System Strategic Plan* outlines coastal training objectives designed to ensure that coastal decision-makers and environmental professionals understand and effectively apply science-based tools, information, and planning approaches that support resilient estuaries and coastal communities.

Coastal Training Program Context

The GNDNERR CTP is tasked with providing professional trainings to resource managers and decision makers whose actions and decisions impact coastal resources and habitats. The CTP attempts to bridge the gap between science and decision making by translating science generated by GNDNERR and others to local stakeholders to address coastal management issues. The CTP also provides technical assistance to a variety of diverse audiences. As communities begin embracing the concept of "community resilience" a shift is happening from having conversations to taking action to become more resilient. The GNDNERR CTP is positioned to support these actions as resiliency will continue to be the top priority of the CTP in the coming years.

Ecological and Socioeconomic Setting and Context

A description of the ecological and socioeconomic setting and context within which the CTP functions can be found in the Introduction of this plan.

Priority Issues

Specific training needs are assessed on an ongoing basis through post- training evaluations, periodic surveys, and discussion with the reserve's partners (Appendix 4), CTP Advisory Committee (Appendix 5), and GBCC members. Also, at the beginning of each new management plan the GNDNERR CTP conducts a needs assessment. This is usually done in partnership with Weeks Bay NERR CTP. The feedback received helps in planning and design of future workshops and gaining a better understanding of the issues facing our local audiences. The results of the 2019 assessment indicated that flood mitigation and community resilience is a high priority for many of the local municipalities. The GNDNERR CTP will work with Weeks Bay NERR CTP to look at the effectiveness of implementing green infrastructure for reducing peak flows to mitigate flooding. Other topics of interest for municipalities that will be a focus of GNDNERR CTP relate to the National Flood Insurance Program (NFIP) and Community Rating System, erosion and sediment control, base flood elevation, building codes, and coastal construction standards. Other topics of high priority for target audiences include wetlands delineation and protection, watershed management and planning, and SLR and adaptation. Grant writing, GIS training, courses in statistics using R and R studio, and living shoreline installation are examples of technical trainings that are of interest to target audiences. The GNDNERR CTP will also design trainings for invasive species, habitat restoration, coastal and estuarine processes, marsh and uplands ecology, coastal habitats, and SLR. These are just a few of the topics that CTP will tackle in the next five years. More trainings may be added as specific needs arise.

Looking forward, the GNDNERR CTP can be most effective working with nearby disadvantaged communities. These communities are disproportionately affected by the issues mentioned above compared to the more advantaged communities. They generally lack resources and expertise for combating issues relating to the impacts of flooding. In the coming years, the CTP will focus on these communities to transfer skills and knowledge relating to flood mitigation including the importance of wetland conservation and protection, open space preservation and conservation, impacts of development, sustainable development, Community Rating System, retaining rainwater where it falls, and much more.

Priority Audiences

The CTP's target audience includes those whose focus is on the above priority issues. These groups also overlap as many of the issues are interrelated. At times, these different audiences work together to

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address a specific issue. The CTP builds time into programming to allow for networking among participants. Examples of CTP audiences include elected and appointed officials and staff at the municipality, county, state and federal government levels (priority issues: flood mitigation, community resilience, NFIP, CRS SLR adaptation, grant writing, green infrastructure) resource managers and researchers, academia, (priority issues: watershed management, habitat restoration, invasive species, coastal processes, marsh and upland ecology, GIS, grant writing) private businesses (e.g., developers, contractors, eco-tour operators), (priority issues: erosion control, green infrastructure, sustainable development, community resilience, ecosystems, flora and fauna) industry (e.g., Chevron, Chemours) (priority issues: wetland delineation, SLR adaptation, green infrastructure, non-governmental organizations, landowners, and community members (priority issues: grant writing, green infrastructure, GIS, community resilience, flood mitigation, NFIP, easement regulation). Audiences are identified by surveys, participant feedback, through conversations, and learning about who is involved or needs to be involved on issues and what trainings might benefit their work. The CTP is about providing trainings needed by professionals so they can be more effective in their work. An emerging audience that the CTP will explore and place more emphasis on in the coming years is the real estate industry (priority issues: green infrastructure, flood mitigation, NFIP, CRS, resilient communities, wetland protection and related regulations). This includes developers, lending institutions and insurance companies, and real estate agencies and agents. Lending institutions can influence how coastal areas develop by requiring and defining sustainable practices as part of the terms to loan agreements. These industries are positioned to influence how coastal communities are built out. The CTP could provide a convincing message to assist lenders in understanding their potential role in this process by designing a series of trainings for this audience. These trainings will include topics covering the benefits and value of wetlands and the importance of why and how to build sustainably. Also included will be information about flood mitigation, non-point source pollution, benefits of green infrastructure and the NFIP.

Alignment with the Reserve

Good communication flow between sectors is important for aligning CTP programs with other GNDNERR activities. Staff from other sectors are tapped to provide lectures as subject matter experts or provide input and direction on specific topics and trainings when applicable. All reserve sectors have common goals set by the Director with staff input and work together as a team to accomplish these goals. Staff meetings are held on a regular basis. This provides an opportunity for keeping staff informed of upcoming programming and allows them to take advantage of opportunities to work across sectors when activities align. An example of how programs align is a living shorelines project near a public boat launch that was installed by the stewardship sector. This demonstration site can be incorporated into a CTP workshop showing contractors or homeowners what a living shoreline is and the benefits it can provide. Staff that participated with the installation can provide first-hand knowledge of installation, lessons learned, and the benefits. Workshops can also be developed so CTP audiences can participate side-by-side with staff during the installation for hands-on learning.

Coastal Training Program Capacity

Capacity

The GNDNERR CTP is staffed by the CTP Coordinator, the Program Development Specialist, and intern (when available). The CTP Coordinator is responsible for the overall administration of the program. The Program Development Specialist is tasked with searching for outside funding and securing grants. The specialist also assists the CTP Coordinator in developing new programming. When an intern is available, they will assist in meeting preparations and other activities associated with conducting workshops. Also, due to limited staffing capacity, CTP will enlist other GNDNERR staff, MDMR staff, or partners (e.g., personnel from local universities and colleges, federal agencies, non-profit organizations, municipality

staff, and private industry) to fill the gaps that may exist due to the lack of program staffing or expertise. There are many different issues and needs that exist within the CTP audience that require a level of knowledge and expertise that CTP staff may not possess. In these situations, the CTP relies on other GNDNERR staff, guest speakers from partner organizations and/or for hire professionals (i.e., wetland delineation consultants). These speakers are an important component of the program.

Strategic Partnerships

Strategic partnerships for the GNDNERR referenced in the introduction include MDMR, OCM, USFWS, Mississippi Secretary of State's Office (SOS), and MDEQ. Funding is one aspect of the important contribution these partners make to the CTP program. The Tidelands Trust Fund which comes through SOS to MDMR provides 30% of program funds for GNDNERR while NOAA provides the other 70%. MDMR also acts as the grant's administrator for potential outside funding as well as conducting any legal review that may be necessary for contracts, activities, and grants. MDMR staff is also available as subject matter experts. NOAA provides guidance on a national scale, supports program planning through the CTP Oversite Committee, and provides expertise on an array of workshop topics such as Meeting Facilitation and Planning, Introduction to Green Infrastructure, etc. NOAA also facilitates an annual meeting for the whole of the system, which allows for CTP staff from each reserve to collaborate and network on future projects or to gain benefit by learning from more experienced coordinators in the system.

Training Partnerships

Coastal Mississippi is rich with organizations that are working together to address common issues found on the Gulf Coast such as building resilient communities, planning for the impacts of SLR, habitat protection, and restoration. The GNDNERR CTP works with many of these organizations to provide professional trainings and education related to the many issues affecting coastal Mississippi. This coordination helps to eliminate duplication of trainings and messaging and extends the reach by combining resources. It also is a way of reducing "workshop fatigue" among participants. Examples of training partners include MS-AL Sea Grant Consortium, MSU CREC, USM Marine Education Center, NOAA OCM Digital Coast, local municipalities, The Nature Conservancy, GOMA, and private industries (e.g., Chevron, Chemours). In the coming years, the CTP is looking forward to working more closely with the Association of Floodplain Managers Mississippi chapter and national chapter, and the Realtors Association to continue building capacity to make an impact along the coast. A full list of partners can be found in the Appendix 4. The CTP currently works with these groups when it makes sense and looks forward to continuing collaborations in the future.

The GNDNERR CTP partners with other reserves within the national system. One example is through the NERRS Science Collaborative program. The GNDNERR CTP participates as a co-lead or co-collaborator on projects and received funding for two projects in 2018. This is an excellent opportunity to work with other reserves throughout the country and GNDNERR will continue to participate in the future. The GNDNERR also works on a smaller regional scale with Gulf Coast reserves. Over the years, a good working relationship has developed among the other programs and GNDNERR continues to look for opportunities to collaborate with the Gulf reserves on regional issues. Also, due to proximity, the GNDNERR CTP works closely with the CTP at Weeks Bay reserve in Alabama. This is a valued partnership as the two reserves share many of the same audiences with the same needs. The GNDNERR CTP looks forward to continuing the work with Weeks Bay on issues that impact coastal Mississippi and Alabama.

Finally, the GNDNERR CTP works across all sectors when projects are aligned with the needs of CTP audiences. Many grants being sought by the other sectors require a stakeholder engagement component. Generally, these stakeholders already make up the CTP audience so incorporating CTP into

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these projects is a logical step. The CTP will continue to incorporate all relevant reserve research, management and monitoring activity into trainings.

Coastal Training Program Delivery

Training delivery systems that will be utilized include classroom style lectures, audio/visual technology, and field-based and hands-on training where participants can tour an established project or participate in installing one (e.g., living shorelines). The use of virtual platforms for conducting workshops will also be utilized in future trainings. The Reserve is somewhat remote. Conducting online trainings provides participants with busy schedules the ability to also participate. This venue also allows virtually anyone with an interest and a connection to participate in meetings. A hybrid, virtual and in-person meeting can also be utilized. Having different meeting options available allow participants flexibility in the way they would like to participate. Lunch-and-Learn lectures, short one-hour meetings held during the lunch hour, may be useful in getting the message to municipal staff or officials that have limited time for attending meetings. The GNDNERR also organizes research symposiums every other year. These meetings allow researchers to showcase their work by providing a venue for interested researchers and practitioners to meet and discuss projects and creates an atmosphere for networking and planning future collaborations. Another delivery style is one-on-one conversations or small group meetings. The CTP can provide technical advice on certain topics or connect someone needing assistance to an expert who can provide information. In the future, CTP will incorporate peer-to-peer training so audiences can learn from colleagues that have shared experiences or situations. For example, engaging a developer that has experience installing green infrastructure. The developer would present an overview of the project, the lessons learned, and then the class would tour the project. Another potential training style to include in the future will be building relationships with prominent, well respected community members or leaders and enlisting their help to engage others. Finally, all meetings are designed with time for networking among participants. This builds relationships and comradery among audiences, partners, and GNDNERR staff.

Coastal Training Program Needs and Opportunities

The program addresses training needs on an ongoing basis through engagement with an advisory committee dedicated to advising on the training program. This committee includes four or five individuals representing a mix of CTP training partners and representatives from prominent target audience groups (see Appendix 5 for current list of members and affiliations). Through the advisory committee, surveys, evaluations, and one-on-one conversations, the CTP is able to ascertain ongoing training needs in the community and provide the best service. The emerging issues and training needs we anticipate in the next five years include stormwater management, the use of green infrastructure, storm preparedness, resilient development, and marine debris. Also, to fully understand the erosion issues in GNDNERR and to evaluate management actions taken to address them, CTP will conduct at least two in-depth workshops during this management plan timeframe. Expected outputs will include report summaries and recommendations.

Training Related Objectives and Actions

The CTP objectives and actions can be found starting on page 23 following the Reserve Vision, Mission, and the Priority Coastal Management Issues. The Objectives and Actions direct activities undertaken by each sector to achieve the goals that are set out in the plan. The Coastal Training sector is identified as “CTP”. If “CTP” is found in parentheses at the end of an objective, then the objective and actions are specific to the training program.

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Monitoring, Evaluation, and Marketing Strategies

The CTP will continue to use post-training questionnaires to evaluate the program. These evaluations include questions required for the CTP performance measures but also provide a mechanism to determine training effectiveness and future topics. These evaluations are used to better understand what trainings and skills are needed and used as a basis for future planning. Follow up surveys can be utilized to determine if participants find trainings useful and integrate learned skills and/or information into their work. Finally, input from the CTP advisory committee and GBCC will continue to help guide programming. The marketing and promotion of CTP programming is important for reaching our audiences. Using the established network of partners, professional associations (i.e., Association of Floodplain Managers of MS, etc.) and local organizations (i.e., Coastal Hazard Outreach Strategy Team, Audubon, Master Naturalists) to disseminate information about upcoming trainings is effective. An email list is maintained of past training participants and will be used to send out training notifications. The GNDNERR CTP works with professional associations to obtain continuing education credits for participants. This is an avenue for participants to fulfill professional education requirements. Trainings are also posted on the GNDNERR website, as well as the Gulf Coast Regional Training website and other social media platforms. The GNDNERR Newsletter will also include any upcoming workshops.

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Administrative Plan

Organizational Framework and Management Authorities

The Administrative Plan describes the context in which the reserve is housed within the MDMR and establishes the framework by which staff addresses reserve priorities. The MDMR administers reserve personnel, fiscal and grant management, and day-to-day operations, under applicable state and agency policies and procedures. Staffing, volunteer, partner, and advisory group support for the reserve are described in this chapter. The administrative function at the reserve seeks to provide adequate operational support and integration of programming and staff.

The GNDNERR operates as a federal/state partnership. The State of Mississippi, through MDMR manages the operations of the GNDNERR. Mississippi Department of Marine Resources is a separate governing agency, created in 1994 by the Mississippi Legislature, with the mission to enhance, protect and conserve the state's marine interests. The mission of the MDMR is in alignment with the mission of the GNDNERR and the NERRS. The federal government, represented by NOAA OCM, provides overall system policies, guidelines, and funding support. Pursuant to the CZMA, Section 312, NOAA periodically conducts performance evaluations of the operation and management of reserves. Section 315 of the CZMA is the foundation for the creation of the NERRS.

The GNDNERR is managed by the Chief Scientific Officer of the MDMR and represents the seventh program as identified in the MDMR Strategic Plan. A revised Memorandum of Agreement (MOU) between NOAA and MDMR was signed in 2013 detailing the State-Federal Roles in the operation of the GNDNERR (Appendix 6). An MOU also was extended on April 20, 2020 between the MDMR and SOS for the management of state held properties at the GNDNERR (Appendix 7). This provides the MDMR with the authority to take management actions on the state held properties along Bayou Heron and Pecan roads. These properties are outside of the GNDNERR boundary but exist within the boundary for the GNDNWR and are managed by direction from the GNDNERR staff.

Current Staff and Future Needs

Overview

This section outlines the number of staff members currently employed to support reserve programs and their roles and responsibilities. The administrative structure of the GNDNERR within MDMR is in Figure 13 and current GNDNERR staff is detailed in Figure 14. The descriptions for each current position are described below.

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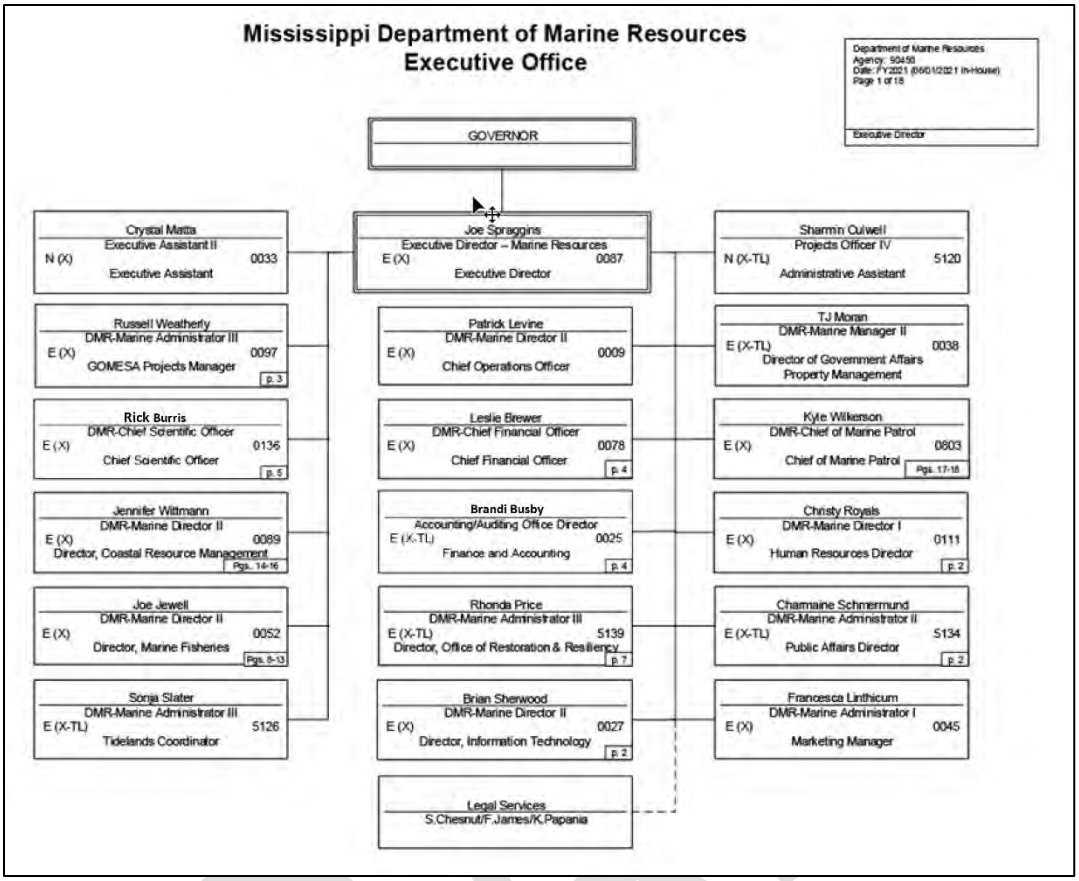
Mississippi Department of Marine Resources
Executive Office
Department of Marine Resources
Agency: 99450
Date: FY2021 (06/01/2021 In-House)
Page 1 of 18
Executive Director
GOVERNOR
Crystal Matta
Executive Assistant II
N (X) 0033
Executive Assistant
Joe Spraggins
Executive Director – Marine Resources
E (X) 0087
Executive Director
Sharmin Culwell
Projects Officer IV
N (X-TL) 5120
Administrative Assistant
Russell Weatherly
DMR-Marine Administrator III
E (X) 0097
GOMESA Projects Manager
p. 3
Patrick Levine
DMR-Marine Director II
E (X) 0009
Chief Operations Officer
TJ Moran
DMR-Marine Manager II
E (X-TL) 0038
Director of Government Affairs
Property Management
Rick Burris
DMR-Chief Scientific Officer
E (X) 0136
Chief Scientific Officer
p. 5
Leslie Brewer
DMR-Chief Financial Officer
E (X) 0078
Chief Financial Officer
p. 4
Kyle Wilkerson
DMR-Chief of Marine Patrol
E (X) 0803
Chief of Marine Patrol
Pgs. 17-18
Jennifer Wittmann
DMR-Marine Director II
E (X) 0089
Director, Coastal Resource Management
Pgs. 14-16
Brandi Busby
Accounting/Auditing Office Director
E (X-TL) 0025
Finance and Accounting
p. 4
Christy Royals
DMR-Marine Director I
E (X) 0111
Human Resources Director
p. 2
Joe Jewell
DMR-Marine Director II
E (X) 0052
Director, Marine Fisheries
Pgs. 8-13
Rhonda Price
DMR-Marine Administrator III
E (X-TL) 5139
Director, Office of Restoration & Resiliency
p. 7
Chamaine Schmermund
DMR-Marine Administrator II
E (X-TL) 5134
Public Affairs Director
p. 2
Sonja Slater
DMR-Marine Administrator III
E (X-TL) 5126
Tidelands Coordinator
Brian Sherwood
DMR-Marine Director II
E (X) 0027
Director, Information Technology
p. 2
Francesca Linthicum
DMR-Marine Administrator I
E (X) 0045
Marketing Manager
Legal Services
S.Chesnut/F.James/K.Papania

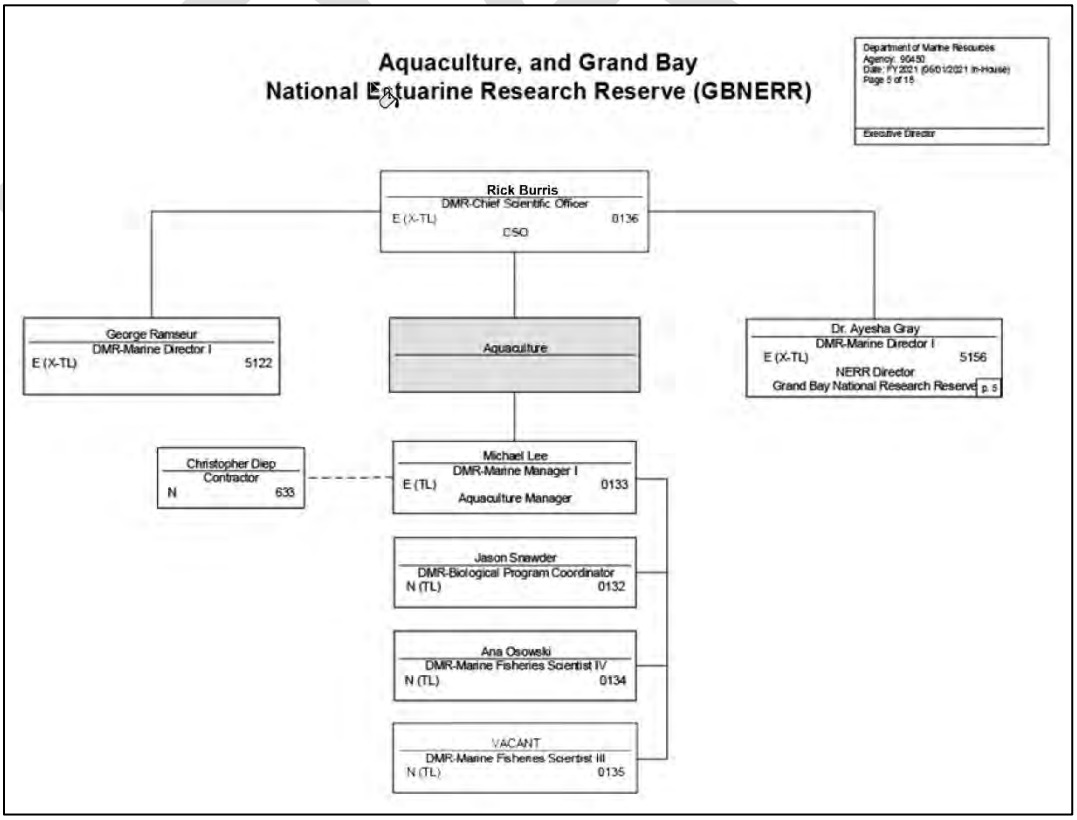
Aquaculture, and Grand Bay
National Estuarine Research Reserve (GBNERR)
Department of Marine Resources
Agency: 99450
Date: FY2021 (06/01/2021 In-House)
Page 5 of 18
Executive Director
Rick Burris
DMR-Chief Scientific Officer
E (X-TL) 0136
CSO
George Ramseur
DMR-Marine Director I
E (X-TL) 5122
Aquaculture
Dr. Ayesha Gray
DMR-Marine Director I
E (X-TL) 5156
NERR Director
Grand Bay National Research Reserve
p. 5
Christopher Diep
Contractor
N 633
Michael Lee
DMR-Marine Manager I
E (TL) 0133
Aquaculture Manager
Jason Snawder
DMR-Biological Program Coordinator
N (TL) 0132
Ana Osowski
DMR-Marine Fisheries Scientist IV
N (TL) 0134
VACANT
DMR-Marine Fisheries Scientist III
N (TL) 0135

Figure 13. Mississippi Department of Marine Resources organizational charts.

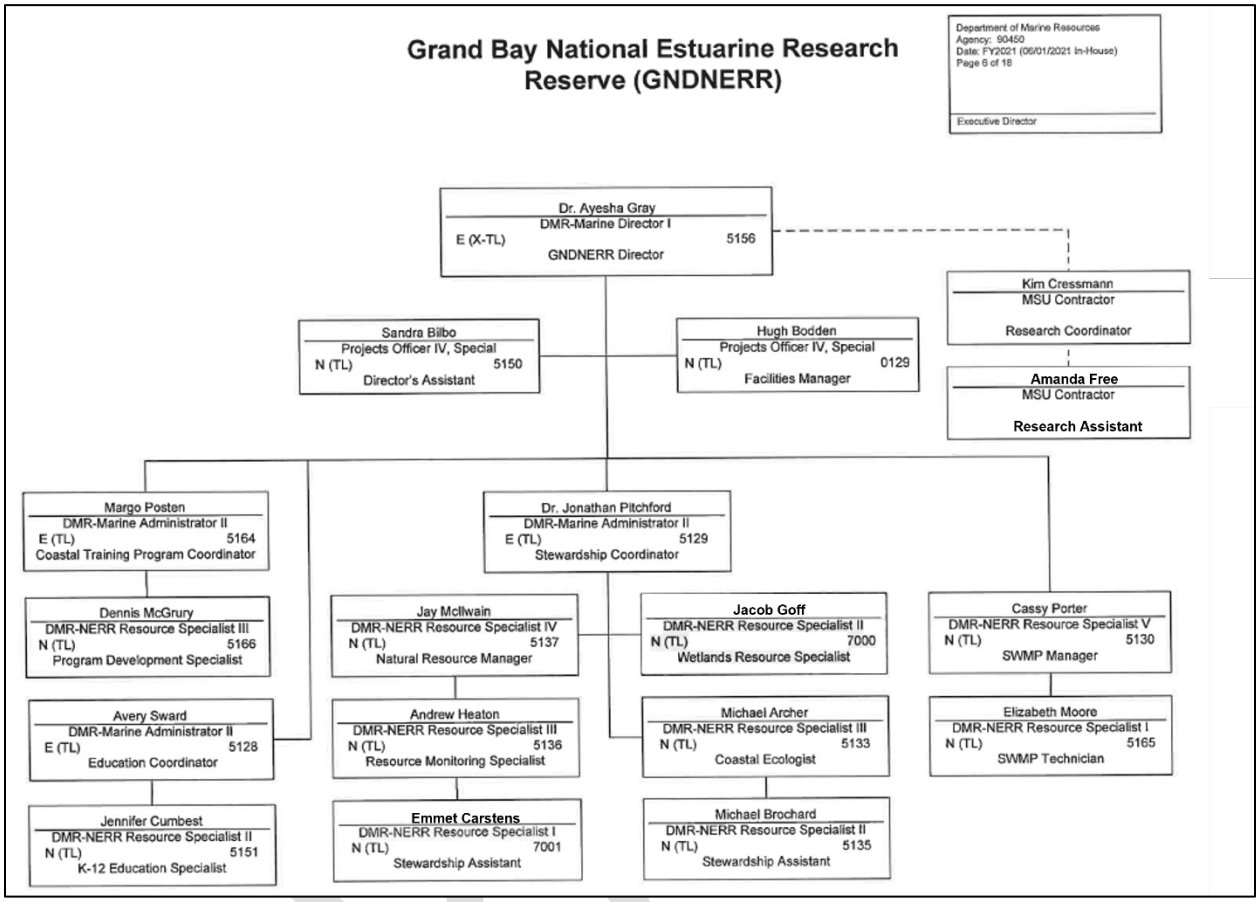

Figure 14. GNDNERR 2021 organizational chart.

Current Staffing

To achieve the goals and objectives of the GNDNERR's strategic plan, a staffing framework has been established that supports every sector and our capacity to accomplish additional work with external grant funded partners. The staff is comprised of a management team that guides operations led by the Director. The management team consists of the Director, Research Coordinator (MSU contractor), Stewardship Coordinator, CTP Coordinator, and Education Coordinator. Core staff, as required by NOAA, includes the manager (Director) and the Research and Education coordinators. The Grand Bay staff is operationally divided into two teams: Science and Outreach. Each team includes a variety of scientists and educators, and various contract positions, which are created as needed to achieve specific tasks. The Director's Assistant and Facilities Manager are direct administrative support to the Director and all the staff. The following descriptions include all current positions. All positions are currently MDMR employees unless otherwise specifically stated below.

Current Position Descriptions

Director

The Director oversees and manages all aspects of the GNDNERR and reports to the Chief Scientific Officer at MDMR. This includes reserve administration, funding, federal and state liaison activities, personnel, and the direction of all program efforts. The Director is the lead of the GBCC and the main liaison with the Friends of the Grand Bay NERR; serves on the NERRA Board of Directors, NERRA

committees (including the Bylaws Committee) and other board assignments; and is on the MDMR senior management team. The Director is the main point of contact for emergency management activities and the press (after approval from MDMR Public Relations).

Director's Assistant

The Director's Assistant provides support to the Director and to the staff, including administrative functions and special projects. The Director's Assistant is the main point of contact for dorm visitors, conducts orientation for new employees, schedules building use by outside entities, coordinates day-to-day and smaller procurements, and manages communications. This position reports to the Director.

Facilities Manager

The Facilities Manager coordinates all aspects of the facility including the electrical and mechanical systems, develops maintenance schedules, establishes relationships with vendors and contractors providing support services, maintains the grounds, conducts inventory with MDMR, and maintains all vehicles and vessels. The Facilities Manager reports to the Director.

Research Coordinator

The Research Coordinator oversees the research sector. This includes conducting and funding research studies, coordinating with local and regional university faculty, providing scientific mentorship to staff and graduate students, coordinating the Davidson Fellowship program, communicating research results on a variety of platforms, and assisting with translating research into management actions or activities. The Research Coordinator reports to the Director and works to integrate their work with all reserve sectors. The Research Coordinator represents the interests of the GNDNERR in the national research sector and promotes the NERRS Science Collaborative and other national initiatives locally and regionally. The Research Coordinator is a contractor through the MSU and is an MSU employee. The Research Coordinator contract is managed by the Director.

Stewardship Coordinator

The Stewardship Coordinator oversees the stewardship sector. This includes conducting and funding research studies, conducting ecosystem restoration efforts and associated effectiveness monitoring, all land management and resource use activities, monitoring efforts associated with sentinel sites, facilitation of research efforts, and coordination with land management partners. The Stewardship Coordinator coordinates with NOAA OCM on the sector work and national initiatives and serves on MDMR's Restoration Coordination Team (RCT). The Stewardship Coordinator reports to the Director.

Education Coordinator

The Education Coordinator oversees the education sector at the GNDNERR including community education, the On the Road program which is in-class and field experiences for students at local schools, regional environmental education initiatives with partners, teacher professional development workshops, and other aspects of informal estuary education. The Education Coordinator works with the CTP Coordinator and the Science team to translate GNDNERR science into curricula and programs for all ages. The Education Coordinator also works with community partners to engage non-traditional audiences, including veterans, artists, and all age groups from toddlers to the elderly. The Education Coordinator maintains the NOAA education database and represents GNDNERR in the national education sector. The Education Coordinator reports to the Director.

Coastal Training Program Coordinator

The CTP Coordinator develops the initiatives of the training sector, including communicating GNDNERR science to local stakeholders, developing and providing workshops in technical assistance, working with MDMR and other partners to improve coastal management using various approaches, and interfacing

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with local governments and decision-makers regarding their needs for information and science. The CTP Coordinator builds partnerships with local groups, including the Friends of the Grand Bay NERR, to establish sources for volunteers, citizen science projects, and other types of outreach activities. The CTP Coordinator manages the development of new outreach program initiatives, develops external grants to fund projects related to the goals and objectives of the GNDNERR, and coordinates activities with the national system, regional NERRs, and other partners. The CTP Coordinator reports to the Director.

Natural Resource Manager

The Natural Resource Manager reports to the Stewardship Coordinator and is mainly responsible for land management activities at the GNDNERR. This includes all aspects of prescribed burning and wildland firefighting in coordination with USFWS GNDNWR, invasive species treatment and removal, mastication and clearing of fire lanes and underbrush, equipment operation and maintenance, assistance with field studies, coordination and leadership of land management volunteer groups, and trail maintenance. For the period of this management plan this position is partially funded by the NRDA Grand Bay Land Acquisition and Habitat Management project.

Resource Monitoring Specialist

The Resource Monitoring Specialist reports to the Natural Resource Manager and is mainly responsible for effectiveness monitoring associated with land management activities, such as vegetation and vertebrate response to prescribed burns, invasive removal, and clearing. This position also is trained in prescribed burning and assists the Natural Resource Manager with land management activities. For the period of this management plan this position is partially funded by the NRDA Grand Bay Land Acquisition and Habitat Management project.

Wetland Resource Specialist

The Wetland Resource Specialist reports to the Stewardship Coordinator and is mainly responsible for assisting with the effectiveness monitoring associated with land management activities, such as vegetation and vertebrate response to prescribed burns, invasive removal, and clearing. This position also works on wetland restoration projects and is trained in prescribed burning and assists the Natural Resource Manager with land management activities. This Wetland Resource Specialist also develops outreach and citizen science projects to enhance visitor experiences at the GNDNERR. For the period of this management plan this position is partially funded by the NRDA Grand Bay Land Acquisition and Habitat Management project.

Coastal Ecologist

The Coastal Ecologist reports to the Stewardship Coordinator and is mainly responsible for monitoring activities associated with the sentinel sites and developing research projects associated with activities in the emergent marshes, including the determination of above- and below-ground biomass and studies on the Phase IV NRDA Restoration of Intertidal and Subtidal Reefs in Mississippi Estuaries project. The Coastal Ecologist pursues studies under the guidance of the Stewardship Coordinator that address the GNDNERR management priorities. Their work is coordinated with university partners and may or may not be associated with external grant funds.

Stewardship Assistant

There are two Stewardship Assistant positions at the GNDNERR. One reports to the Coastal Ecologist and aids all stewardship and research initiatives associated with sentinel site monitoring, fisheries and shellfish research, ecosystem function studies, and other work that addresses the GNDNERR management priorities. The other reports to the Resource Monitoring Specialist and assists with stewardship and research initiatives associated with the NRDA project management and monitoring, invasive species control, and vertebrate ecology studies.

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SWMP Manager

The SWMP Manager coordinates the day-to-day activities associated with water quality, weather and nutrient monitoring and reports to the Research Coordinator. This includes equipment maintenance, collecting and analyzing samples, troubleshooting, and calibrating systems, quality checking data in accordance with standard operating procedures, and following all other guidance from the CDMO.

SWMP Technician

The SWMP Technician assists the SWMP Manager with all monitoring activities and reports. This includes activities associated with water quality, weather and nutrient monitoring and assisting other staff and visiting researchers as needed. This position reports to the SWMP Manager.

Program Development Specialist

The Program Development Specialist reports to the CTP Coordinator and works on developing new programs for the GNDNERR, including curricula and outreach, training, and technical assistance initiatives, grant funded environmental education with various partners, and other informal education opportunities. The Program Development Specialist also assists the CTP Coordinator with training workshop logistics and planning.

K-12 Education Specialist

The K-12 Education Specialist mainly works on the On the Road education program and provides in-school and on-site environmental education opportunities for surrounding school districts. This position reports to the Education Coordinator.

Other Team Members

The GNDNERR will employ a variety of contractors to assist with various projects, including internships, graduate students, and others.

Future Needs

By the end of this management plan, efforts will be made to fill these additional four positions as funding allows. Figure 15 is an organizational chart for staffing at GNDNERR by the end of the management plan period, and the following descriptions provide information on the roles and responsibilities of future positions.

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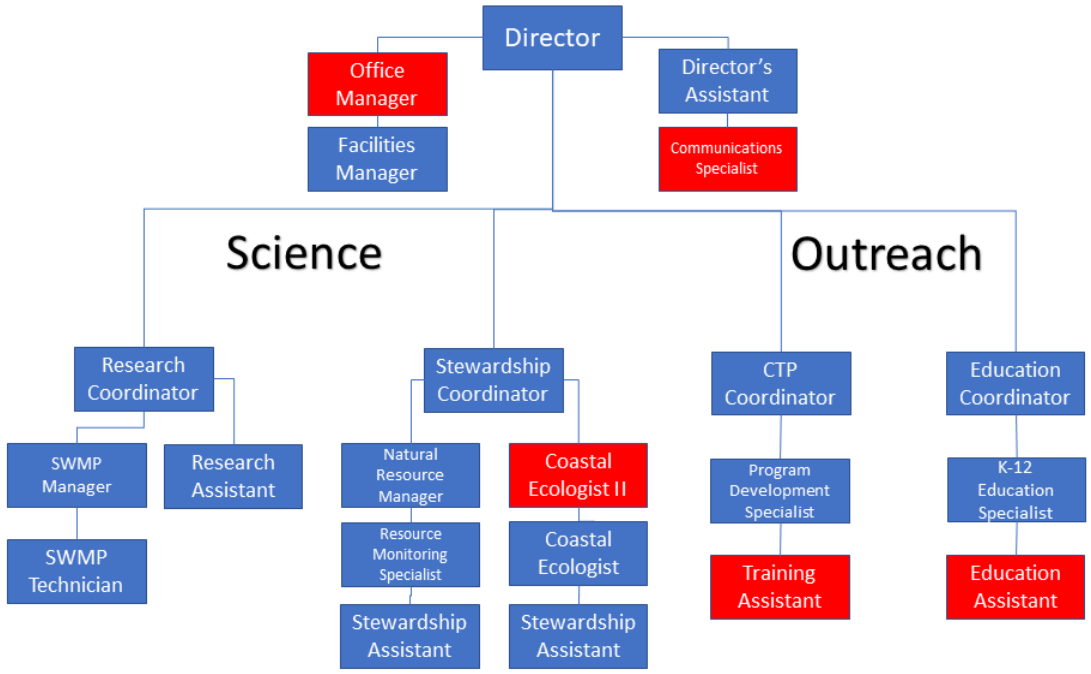

Figure 15. Future GNDNERR organizational chart.

Office Manager

The Office Manager position will assist the Director in certain tasks associated with the administration and management of the GNDNERR, specifically with finance processing, personnel support, facility management projects, coordinating large procurements, and day-to-day operations. The Office Manager will report to the Director.

Communications Specialist

A dedicated Communications Specialist will be added to work on all aspects of communications for the reserve including the website, social media, marketing and branding, event promotions, field guides and other publications, satellite displays, and assists staff with posters, presentations, graphics, etc. The Communications Specialist will report to the Director's Assistant.

Coastal Ecologist II

A supervisory Coastal Ecologist is needed to lead the sampling initiatives associated with Sentinel Site Application Module 1, effectiveness monitoring associated with the NRDA Phase IV reef restoration project, and internal projects in the stewardship sector addressing priority management issues. The Coastal Ecologist II position will be added that reports to the Stewardship Coordinator. This position will supervise the Coastal Ecologist, one of the Stewardship Assistants, and periodic internship positions.

Training Assistant

The Training Assistant will be added to assist with coordinating volunteer and training efforts. This position will be responsible for enhancing and coordinating volunteer efforts and be responsible for logistics associated with training workshops and other events. The position reports to CTP Coordinator.

Education Assistant

The Education Assistant will report to the Education Coordinator and assist with all aspects of the education sector including community education events, science fair, and short-term education initiatives associated with external grants.

Strategic Partnerships

The administration of the GNDNERR works through many collaborative partnerships with various agencies, organizations, and individuals at many levels of engagement from sponsoring events to teaching workshops, establishing contractual relationships, coordinating activities, and many more things. These partnerships leverage many participants and community support to achieve the core functions of the reserve more efficiently.

Key partnerships and opportunities for administration

In addition to the state partnership with MDMR, MSU is a key partner to the GNDNERR in that they provide our Research Coordinator and have provided avenues to train graduate students who sit at the GNDNERR and work on projects funded by MDMR. Future partnerships with the Friends of the Grand Bay NERR who provide a source of volunteers, promotion for our work, and limited support for events in the form of food, etc. are anticipated during this management plan. Chevron Pascagoula Refinery partners with the GNDNERR on outreach events where they provide boats, refreshments, booths at the Peter Anderson Festival, and other promotion and support for our program. New partnerships to further the goals and objectives of the GNDNERR are anticipated in the next five years.

Advisory Committees

Reserve advisory committees are a collection of stakeholders from the community who assist in guiding the programs at the reserve to ensure our service to the community. The main advisory committee for the GNDNERR is called the Grand Bay Community Collaborative (GBCC). The GBCC is made up of a variety of stakeholders from various local agencies including USFWS, MDMR, SOS, MDEQ, EPA, Desoto National Forest, and local teachers, university researchers, community members from the Friends of the Grand Bay NERR, and representatives from other non-governmental organizations, such as The Nature Conservancy and Chevron (Table 1). The purpose of the group is to review our plans and initiatives, and to provide feedback. They meet annually and review our management plans, trail construction projects, outreach projects and plans, research initiatives, large- and small-scale restoration, and other initiatives.

Table 1. Grand Bay Community Collaborative participant list.

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Administrative Objectives and Actions

The reserve has identified objectives and actions for the administrative plan that ensure we have adequate administrative, operational, and financial capacity to address our goals. These are included in the strategic plan under ***Goal 4: Communicate efficiently and effectively*** and ***Goal 5: Streamline administrative functions***. These two goals including the objectives and actions detailed in the strategic plan ensure adequate administrative and operational capacity and lend themselves to building financial capacity through efficient planning and use of resources, leveraging existing projects, and developing new external grants. Integrated administrative objectives and actions are essential to supporting all the goals of the reserve.

Volunteer Plan

Planning for Volunteers

Volunteer programs are common throughout the reserve system and provide an invaluable resource for accomplishing project outcomes. Developing a volunteer plan is helpful in strengthening connections with the local community, providing learning opportunities, and increasing staff capacity. Existing volunteer efforts will be enhanced in the next five years with the assistance of Friends of the Grand Bay NERR.

Recruiting and Organizing Volunteers

The responsibility for training, mentoring, and overseeing volunteers is shared across the staff. There are recruitment and organizing efforts that are incorporated into outreach activities and events, such as sign up for interested individuals, etc., and advertisements for field volunteers that include field protocols, expectations, and other information. Staff use a variety of resources to make initial contact and gauge interest and time availability.

Volunteer Activities

Volunteers have in the past and will continue to assist with restoration projects, cleanups, field sampling, administrative support, laboratory activities, trail construction, field trip support, training event assistance and teaching, etc. Volunteers are also recruited to assist in large community outreach events such as National Estuaries Day, Star Party, and Celebrate the Gulf Marine Education Festival. Several event volunteers return each year. Volunteer guidelines and a volunteer interest form are found on the GNDNERR website. Volunteer hours are tracked through self-reporting and staff reporting in a volunteer binder. Hours and tasks are then captured on a spreadsheet and categorized as 'administrative,' 'education,' or 'research/stewardship.' Volunteer hours are used in reporting and help identify needs for future opportunities. There are also citizen science opportunities available, including the Phenology Trail, which is on the Savanna Trail and linked to Nature's Notebook. Visitors input information associated with the Phenology Trail (e.g., presence/absence of flowers, leaves, etc.), but do not log their time as "volunteer hours" in that case.

Supervising, Evaluating, and Retaining Volunteers

Volunteers are ambassadors for GNDNERR. The Director's Assistant will give new volunteers an orientation on GNDNERR, which will include a building tour, staff introductions, and an overview of logging hours. The training and supervising of volunteers is the responsibility of the person on staff who is being assisted. There is no overarching volunteer program training at this time; volunteers are trained specifically for each job.

Friends of the Grand Bay NERR

The Friends of the Grand Bay NERR was established in 2019 and a MOU with the MDMR was executed in 2021 (Appendix 8). This group contributes to the GNDNERR volunteer program by providing a source of volunteers to support our activities. Work with the Friends group will continue to enhance opportunities

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for volunteer engagement in the next five years. Coordination with the Friends group will lead to a system of recruiting and organizing volunteers built on our existing structure. Engagement with volunteers fosters a greater appreciation and knowledge of coastal resources by the local community and serves the mission of ecosystem conservation.

Vessel and Vehicle Plan

The GNDNERR is supported by a fleet of vehicles and vessels including our newest addition, the *Miss NERR* (Table 2). Most of these vessels and vehicles have been provided by MDMR to support the GNDNERR program. The *Miss NERR* was custom built in 2018 according to specifications provided by the Director and staff, and the build was fully funded with state resources. Replacement boat motors have periodically been purchased for some vessels. The staff and MDMR conduct a portion of boat, trailer, and vehicle maintenance. Occasionally local service providers are needed to service equipment. As with all equipment, regular maintenance schedules are in place for our vessels and vehicles. The reserve uses several kayaks for education and research projects. All the equipment will depreciate and experience normal wear. The two vehicles already experiencing issues are the 2006 F-250 and the 2007 F-150, which are likely to need replacing within the next five years. There is a new motor on the 20' Lynn, and a motor in good condition on the 18' Lynn. The 20' trailer will probably need to be replaced within that five-year period. The 18' trailer has new springs and axle, and the tongue was replaced recently. A new trailer was recently purchased for *Miss NERR* that will be used for transport and storage during larger storms. *Miss NERR* is in good condition but needs ongoing, minor maintenance. One of her twin engines was overhauled in 2019, and several other motor issues have been repaired on the other one. New motors are under consideration. The 16' G3 is in good condition and is beneficial for many activities. The Gator is in good condition.

Table 2. The GNDNERR vehicle/vessel equipment inventory.

Model	Year	Motor	Trailer	Notes
1652SC	2007	50 HP Yamaha F50TLR 2007 G3 1652SC	16' Magic Tilt SKT1651A 2016 G3 1652	Should be used
Aluminum Flat Bottom	2003	70 HP Yamaha F70LA 2015 18' Lynn	19' Sport Trail 19' Trailer 1819? 2012 18' Lynn MP	Needs seats
Aluminum Flat Bottom	2003	115 HP Mercury N/A N/A 18' Lynn MP	18' Magic Tilt SKT-2070 2800 2015 18' Lynn	Needs new non skid
Aluminum Flat Bottom	2004	150 HP Yamaha VF150LA 2019 20' Lynn	20' Magic Tilt ALSK2028 2011 20' Lynn	Needs small holes fixed
Custom Estuary Traveler	2018	300 HP Etec Evinrude E300 DPX 2014 Miss NERR	Sport Trail CTTAL35 2021 (new)	Motor issues have been repaired; considering new motors
		300 HP Etec Evinrude E300DCX 2014 Miss NERR		
8 Tandem sit on top	2014	NA	KT Trailex Trailex UT 1000 6 2007 Kayak Trailer	
2 Single sit on top	2014	NA		
1 Single sit on top		NA		
3/4 T 4x4 F-250 RCAB	2006			Major issues
1/2 T 4x2 F-150 RCAB	2007			Major issues
1/2 T 4x4 F-150 Crew Cab	2010			Does well
1/2 T 4x4 F-150 KCAB	2010			Does well
12-Passenger Van, full size Express	2010			Does well
Fusion Hybrid Sedan	2011			Does well
Utility/SUV Tahoe	2012			Does well
SUV Traverse	2017			Excellent
Gator ATV 825i S4	2016	50hp – 812cc- 3 cylinder- EFI- DOHC- Gas	NA	Dependable, safe, off road transportation, frequently used research supporting asset.

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For natural disaster (i.e., tropical storms) preparation, vessels and vehicles are moved to predetermined locations for protection, as stated in the 2013 GNDNERR Disaster Response Plan (Appendix 9). Small engine vehicles are transported to the top of CRC amphitheater and locked, with a security camera positioned at the vehicles. Larger passenger vehicles and vessels (boats and kayaks) are relocated to a locked compound north of Interstate 10, which makes them available when road flooding blocks access to the CRC, and the compound is protected from storm surge flooding that the CRC may experience depending on the size of the storm. The trucks and boats are staged for use by MDMR Marine Patrol in case emergency response needs arise. The GNDNERR Director oversees emergencies and communicates with staff, MDMR, and other agencies.

Communications Plan

Good communication is essential to our mission. Communication with various audiences in many ways from providing essential and interesting information in field guides and general promotional materials to using short movies with inspiring visuals to communicate about a specific topic, finding, or discovery helps achieve our mission. Social media provides opportunities to find and connect with new audiences and followers. Audiences include local teachers and coastal managers, and this community is served by developing learning opportunities that provide lessons, information, and experiences. The main communication method is presentations at scientific conferences to communicate scientific findings, project actions, or research. Other venues are used to promote our program and the national system including visits by local government officials, state representatives, high level administrators, and national congressional staff and members, which requires being adept at communicating what the GNDNERR does and why it is important to the community. By adding a Communications Specialist to the team in the next five years, more information will be translated about our science work for outreach to our audiences. The GNDNERR Social Media Strategy (Appendix 10) provides a plan to stay consistent with our use of social media platforms and a GNDNERR Branding Guide (Appendix 11) assists in the development of all our materials and ensures consistent design. The following is an outline of communications products in use and planned for the next five years:

General

General avenues of public communication include digital and printed information. Our website, grandbaynerr.org, was last revised in 2014 and will undergo a major update in 2021 to be completed in Spring 2022. Event flyers are used to promote events online and by physical distribution. An annual newsletter will be produced and distributed to our local stakeholders through print and electronic means, such as email or posted on our website. Sector one-pagers will be used in the Interpretive Center to provide details on each sector, and available as hard copies for walk-in visitors and participants of events and workshops.

Social Media Presence

In the last five years, our social media presence has increased by making intentional educational Facebook posts, engaging with audiences through Twitter, and adding accounts and content on visual platforms such as Instagram and YouTube. Social media provides opportunities for online engagement and education while also recruiting individuals to visit or participate in events at GNDNERR. The GNDNERR Social Media Strategy (Appendix 10) was created in 2018 and will be updated in the next five years.

Public Presentations by Audience

Interacting with various audiences are avenues for communicating GNDNERR work. All GNDNERR staff participate in public presentations, from short conversations with walk-in visitors, to on-site presentations in schools, to formal presentations at national scientific and educational conferences. The

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following list highlights target audiences and modes of public presentations they may encounter with GNDNERR staff:

Walk-in Visitors and Families – Interpretive Center and building tours, outreach programming, open house events

Scientists and Educators – Conference presentations, professional development workshops

Pre-K – Story Time and other children engagement activities

K-12 Students – Field trips, in-school presentations, virtual programming

College Students – Field trips, volunteer work

Retired Audiences – Local community centers outreach, volunteer work

Veterans – Outreaching programming

Artists – Nature-based art workshops

Administrators, Policy Makers, Local Officials – Briefings, site visits, event engagement.

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Facility Development and Improvement Plan

Purpose of Facilities and Construction Principles

The Grand Bay CRC is the main facility for the reserve and its overall purpose is to support our programs, our partners' research and conservation efforts, and to provide a place for community events (Figure 16). The vision for the Grand Bay CRC is that it provides an example of sustainability for the Mississippi Coast and houses estuarine science and coastal management experts in partnership with the MDMR in service to the local community. Our facility includes offices, dormitory space, classrooms and meeting space, research laboratories, and an interpretive area. The Grand Bay CRC exists on the GNDNWR, i.e., a state-owned building on federal land. The building is a representation of a permanent partnership between the GNDNERR and the GNDNWR, and a portion of the building is rented to USFWS and houses refuge employees and other USFWS program's employees, such as the Coastal Program and the Ecological Services Program. A Memorandum of Agreement with the USFWS details the Rental Agreement for use of the Grand Bay CRC with MDMR (Appendix 12). The facility is a key part of our programming both through allowing visitors to be immersed in the habitats being restored and protected, and by encouraging use of the building by our community for meetings and functions. The facility is owned and maintained by the MDMR.

Figure 16. Map view of the Coastal Resources Center.

Description of Current Facilities

Grand Bay Coastal Resources Center

The location of the Grand Bay CRC is 6005 Bayou Heron Road, Moss Point, MS 39562. In 2004 initial funding was secured through a NOAA construction award to design and build permanent GNDNERR

facilities. Over time, additional state and federal funds were obtained to meet total facility costs. Construction of the Grand Bay CRC began in November 2007. Prior to that time, from 2000 until facilities were completed, the reserve offices and labs were housed in on-site modular office space. The facilities dedication was held December 7, 2009, also marking the 10th Anniversary of the reserve's original designation. The nearly 16,000 square foot facility is headquarters for the GNDNERR, GNDNWR, other USFWS programs, and Wildlife Mississippi (Figure 17). The CRC has an average of 2,000 visitors per year.

A boat shed and workshop was constructed in 2011 and in 2017 a 1,000 ft boardwalk was completed as part of the Savanna Trail. The trail visits a freshwater wetland behind the building called Hawk's Marsh, and a beaten trail circles through a restored wet pine savanna to the north of the building. These features not only enhance the ability of staff and partners to conduct research activities with storage for equipment and vehicles, it also greatly enhances the ability to engage the public on projects and activities supporting reserve priorities, such as citizen science. The GNDNERR also uses a USFWS pavilion and other lands located on Gautier Bayou for educational programs, and GNDNWR allows use of a storage facility north of I-10 on Independence Road.

Figure 17. East facing view of the Grand Bay Coastal Resources Center.

Green Building Design

A major consideration in planning for the facility was to design in the most environmentally sustainable manner as possible. Goals for such a design were to reduce operational costs, reduce construction material waste, reduce the carbon footprint, conserve water and energy and demonstrate resilience. The green design of the building focused on standards established by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) certification program. The CRC achieved a GOLD LEED Certification (Appendix 13), the second highest level possible, for the implementation of its

sustainable design. A 7,000- watt solar power system was added to the CRC power grid, the first of its kind in the local power cooperative's service area. In 2015, all the exterior and interior building lighting was converted to LED, which saves energy and reduces replacement costs. The deck of the building was also remodeled using composite decking. This is a recycled material with a long-life span. This re-decking was fully funded by the State of Mississippi.

Following these original intents in the building of the facility, the Grand Bay CRC has been used as an example in architecture and design for several buildings in the local area including the Pascagoula River Audubon Center and the USM's Marine Education Center. The facility was also used as an example for a Louisiana State University architecture class that was doing a design project for the future Louisiana NERR. The teachers and students made an overnight visit to the Grand Bay facility and used the building and the environment as inspiration for their designs.

Facility Challenges and Gaps

The most prevalent current facility gap to providing for programmatic activities is the limitation in office space. Reserve operations and leveraging capabilities for other projects has grown since the building was completed in 2009, and as of 2021, all available office space for the GNDNERR is in use. Additional office space is necessary to increase our programmatic and external grant capacity. Substantial remodeling of the building could accommodate this need by removing an air exchange system, energy recovery ventilator (ERV) that works but due to a poor design substantially increases electricity costs in the building and has not been used since 2014. A cost-to-benefit analysis will be completed with this management plan to fully understand the practicality, costs and benefits of remodeling and converting the space occupied by the ERV to additional offices.

Other challenges with the Grand Bay facility include cost, operation, and failure of the rainwater collection system, failure of some of the sustainability features (e.g., the Watt Stopper), problems associated with aging buildings (e.g., wind and water damage), and pest infestations. In 2016, the rainwater collection system was taken offline after numerous repairs, including replacing or repairing the collection liners, the gutter systems, and the control panel. Plumbing problems under the collection units and additional problems with the control panel prompted a reevaluation of the use of the system. The rainwater collection was used exclusively for boat water washdown and toilet water flushing. The costs associated with maintaining the system were not appropriate considering the building well could provide for both uses at no cost.

In 2019, the stormwater overflow pond in front of the building was restored with native vegetation and enhanced to collect runoff. This pond provides adequate collection of the stormwater runoff created by the building, an accessory function of the rainwater collection system, and therefore provides similar functionality with dramatically lower cost.

Sustainability features, such as the failed Watt Stopper, were replaced with simple solutions such as a timer. The timer is set to turn on and off the outside lights with the sunrise and sunset. It serves the same function as the Watt Stopper, but at a fraction of the cost. The timer was installed in 2015.

The facility has several problems associated with aging including cracks and cosmetic problems associated with beams twisting, but the most serious problem is associated with the settling that has caused numerous gaps where the walls and ceilings meet. The design of the building has made addressing this problem exceptionally challenging as the equipment needed to access the high relief roofs is not available from every vendor. These gaps have led to pest infestations including our current Guinea wasp infestation that has proved quite disruptive to staff and events. The wasps are aggressive, and many visitors and staff have been stung. This problem is exacerbated by our remote location which has a response time of at least 10 minutes for emergency services. Currently, the problem is being

addressed by treating the outside of the building with traditional pesticides to reduce the infestation. Remote facilities may enhance visitor experiences in several ways, but they also present important and practical challenges that should be included in any site evaluation.

There are gaps in facilities needed to support our programmatic activities and reserve operations, including new construction, repairs, and remodeling. The gaps include making repairs to the building to prevent pest infestations; enhancement of our storage facility for the outreach vessel, *Miss NERR*; adding a platform at the end of the Savanna Trail boardwalk for education programming; resurfacing the parking lot to prevent ponding and eliminate source of foreign sediment (from trucked in gravel); improving our exhibits; water filtration system; and remodeling the dorms to add more living space.

Planned Facilities and Infrastructure

The following provides the detailed description of the facilities in the planning process. Some have designs ready for bid and construction, and others are only identified as needs. The following list is prioritized by the highest need.

Facility Project Descriptions

Renovations to the building to improve resilience to water/wind damage and prevent wasp infestation

The Coastal Resources Center needs improvements to be more resilient to storms. Due to the design of the building and normal aging and settling, many gaps have occurred between the rafters and the ceiling. These gaps are allowing heat to escape in the wintertime, and insects, mostly wasps, to enter and nest. There has been an ongoing problem with wasp infestations since 2014, but the species of wasp changed in 2019 to the more aggressive, Guinea wasp. These wasps have a terrible sting, and many people are allergic to the sting. There is a potential for an anaphylaxis reaction which is especially troubling considering the emergency response time to the facility is at least 10 minutes. The recommendation for solving the problem is to seal all the cracks in the building. This sealing will also help with energy efficiency. Additionally, upon inspection, many areas of the building have been found to suffer from water and wind damage due to age and storm frequency. To make the building more resilient, these problems will also need to be fixed. The timeline for construction is within the next two years, and the estimated cost is $350,000.

Bayou Heron boat launch upgrades and storage facility for the Miss NERR

The Bayou Heron boat launch is heavily used by hunters, fisherman, and kayakers as one of the main access points for the GNDNERR. The pier and boardwalk are in disrepair and there are problems with shoreline erosion. *Miss NERR* is a large outreach vessel that is housed in the boat lift at the Bayou Heron boat launch. She needs additional boardwalk space for loading/unloading, better security and protection from the sun. An access launch for kayaks would also improve the visitor experience. This project would repair and enhance the pier and boardwalk, add a kayak launch, reinforce the area with green infrastructure, and build a roof over the boathouse with storage space for the vessel's accessories, such as a large Plexiglas viewing tank, crane, and haul seine. The timeline for construction is in the next 2-3 years and the estimated cost is $400,000.

Removal of the ERV and creation of additional office space

The ERV, in addition to requiring a large amount of energy to operate, also takes up a significant amount of space in the building (approximately 500 square feet). Depending on the results of the cost-to-benefit analysis, removal and remodeling of the ERV can provide additional space for offices. The timeline for potential construction is in the next 3-4 years with an estimated cost of $300,000.

Bird blind and viewing platform on Hawk's Marsh

The Savanna Trail was completed in 2017 and has attracted many visitors in addition to providing many opportunities for outreach and citizen science. Enhancements to the trail would include a bird blind and

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viewing platform overlooking the freshwater marsh and providing access to the water's edge. Through a collaborative process in 2016, working with the Grand Bay Community Collaborative, plans for these structures were developed. Those plans were put out to bid twice, but on both occasions the bids were higher than available funds, so the project was not completed. The timeline for construction is in the next 3-4 years and the estimated cost is $200,000.

Expansion and resurfacing the parking lot at the Grand Bay Coastal Resources Center

The parking lot at the facility was originally planned as porous asphalt but due to restrictions in available funds, only the handicap spaces were surfaced with this product. The parking lot is currently gravel and has significant issues with sedimentation and ponding, in addition to associated problems with bringing in foreign gravel and sediment to the area. Working with USFWS, in 2017, a proposal was developed to resurface the parking lot to reduce the sediment input, but the proposed project was not funded. In the next 5 years, we would like to expand and resurface the parking lot. The estimated cost is $300,000.

Improving the GNDNERR Interpretive Center exhibits

There is a need to improve the exhibits at the GNDNERR. In 2016, a terrapin live display was added and in 2017 a large viewing tank was built. This one live display greatly improved the quality of our outreach in the center. While our other displays are beautiful and tell an interesting story about the reserve and the refuge, they are ageing and suffering from wear and tear. Many of the aspects of the displays are also outdated and unworking. There is a need to improve the displays at the GNDNERR, to update them, and add more live displays. Interactive live displays would greatly enhance the experience in the Interpretive Center. The estimated timeframe is within the next 5 years and the estimated cost is $450,000.

Water filtration system

The water for the facility is provided by an on-site well, and due to the wet pine savanna environment, that surrounds the facility, that water is high in tannins. The water is functional and made potable by monthly treatments, but it is not the best to drink and does stain sinks, toilets, etc. A water filtration system could be installed to treat and filter the well water to eliminate problems with staining and flavor. The estimated timeframe in within the next 5 years and the cost is $45,000.

Remodeling the dorms to add more living space

The GNDNERR dorm is heavily used by visiting researchers, workshop participants, collaborating scientists, and others. Our occupancy rate is on average 200 days per year (before 2020). The dorm has sleeping space for 20, but only sitting space for eight. A remodeling of the dorms could improve the living space while keeping the same amount of sleeping space. The timeline for remodeling the dorms is within the next 5 years and the cost is $300,000.

Water quality and weather monitoring station upgrades and additions

The SWMP stations are aging and suffering impacts from storm events. Renovation and storm resilient upgrades of the water quality and weather monitoring stations is necessary and can include the addition of new sites located closer to the Sentinel Site monitoring and storm resilient design features. The timeline for these upgrades and additions is within the next five years and the cost is $150,000.

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Resource Protection Plan

Overview

A primary aim of GNDNERR staff is to protect the integrity of the Grand Bay landscape to sustain the area's long-term ecological viability and to provide a stable environment for research, monitoring, and education programs (see Appendix 1). While existing federal and state regulations provide significant protection to the resources of the reserve, the potential still exists for activities to be proposed that could have a negative ecological impact. For example, shoreline protection measures and sediment management activities, while well-intentioned, must be scrutinized for consistency with the management philosophies of reserve and NOAA regulations (15 CFR 921.1 (d-e)).

> {15 CFR 921.1 (d-e)} states: (d) Habitat manipulation for research purposes is allowed consistent with the following limitations. Manipulative research activities must be specified in the management plan, be consistent with the mission and goals of the program (see paragraphs (a) and (b) of this section) and the goals and objectives set forth in the reserve's management plan and be limited in nature and extent to the minimum manipulative activity necessary to accomplish the stated research objective. Manipulative research activities with a significant or long-term impact on reserve resources require the prior approval of the state and NOAA. Manipulative research activities which can reasonably be expected to have a significant adverse impact on the estuarine resources and habitat of a reserve, such that the activities themselves or their resulting short- and long-term consequences compromise the representative character and integrity of a reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as: (1) A restoration activity consistent with paragraph (e) of this section; or (2) an activity necessary for the protection of public health or the preservation of other sensitive resources which have been listed or are eligible for protection under relevant federal or state authority (e.g., threatened/endangered species or significant historical or cultural resources) or if the manipulative activity is a long-term pre-existing use (i.e., has occurred prior to designation) occurring in a buffer area. If habitat manipulation is determined to be necessary for the protection of public health, the preservation of sensitive resources, or if the manipulation is a long-term pre-existing use in a buffer area, then these activities shall be specified in the reserve management plan in accordance with Section 921.13(a)(10) and shall be limited to the reasonable alternative which has the least adverse and shortest-term impact on the representative and ecological integrity of the reserve.
>
> (e) Under the Act an area may be designated as an estuarine reserve only if the area is a representative estuarine ecosystem that is suitable for long-term research. Many estuarine areas have undergone some ecological change as a result of human activities (e.g., hydrological changes, intentional/unintentional species composition changes—introduced and exotic species). In those areas proposed or designated as NERRs, such changes may have diminished the representative character and integrity of the site. Although restoration of degraded areas is not a primary purpose of the system, such activities may be permitted to improve the representative character and integrity of a reserve. Restoration activities must be carefully planned and approved by NOAA through the reserve management plan. Historical research may be necessary to determine the "natural'' representative state of an estuarine area (i.e., an estuarine ecosystem minimally affected by human activity or influence). Frequently, restoration of a degraded estuarine area will provide an excellent opportunity for management-oriented research.

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State Management and Statutory Authorities

The protection of the GNDNERR relies on state and federal management and other regulatory authorities. In this section, we describe all the existing federal, state, and local authorities related to the protection and use of reserve resources, including the rules and regulations governing access and activities and the key partners in upholding these authorities. Existing state, federal and local regulatory agencies and programs that are relevant to the GNDNERR are summarized below.

State Programs and Agencies

Mississippi Department of Marine Resources

The MDMR is the state Coastal Zone Management agency in Mississippi. The MCP was established and approved in 1980 under provisions of state and federal statues: Enabling legislation for Department of Marine Resources (57-15), Mississippi Coastal Wetland Protection Law (49-27-1 to 69), the federal CZMA of 1972, as amended. The MDMR is also responsible for establishing and enforcing regulations regarding commercial and recreational fishing including shellfish harvesting. The MDMR's Coastal Ecology Division administers various portions of the MCP, including wetland permitting and federal consistency (Appendix 14). Likewise, Coastal Ecology and Marine Fisheries divisions both played an important role in site selection and reserve management plan development. The MDMR Marine Fisheries office manages the Scientific Collection Permits for research on GNDNERR. As a unit of the MDMR, the GNDNERR staff regularly interacts and coordinates management, research, and public outreach activities. Resource programs and policies are consistent to the maximum extent practical with the MCP.

Mississippi Department of Environment Quality

The MDEQ evaluates and permits regulated activities that affect air and water quality and dredge and fill projects in Mississippi including NPDES permits. As a Coastal Program agency, the MDEQ will continue to coordinate evaluation of these activities in eastern Jackson County. Various divisions within MDEQ have provided, and will continue to provide, technical assistance to the GNDNERR. The MDEQ also is the State Trustee for hazardous material spills along the coast and coordinated state efforts during *Deepwater Horizon* and the phosphates spill. MDEQ is currently a partner on the NRDA Grand Bay Land Acquisition and Habitat Management Project, funded by the MS TIG through the NRDA funding stream as a result of the 2010 *Deepwater Horizon* oil spill.

Mississippi Secretary of State

The SOS is the trustee of Public Trust Tidelands and charged with the policy of preservation of all state-owned water bottoms in the public interest. The SOS is a primary partner in the Coastal Preserves Program and jointly holds title to lands within the preserves. A Tidelands lease is required for all aquaculture projects, whether they are for production or research, within the reserve boundary. Tidelands leases require the written permission of the adjacent landowner.

Mississippi Department of Archives and History (MDAH)

The MDAH has oversight of the State Antiquities Act (Mississippi Code Section 39- 7-3) and serves as an advisory agency to assist in the management and protection of all historical and cultural sites located within the GNDNERR through the MCP. The MDAH is a Coastal Program agency.

Mississippi State Department of Health (MSDH)

The MSDH enforces state and local regulations relating to sanitation and individual wastewater treatment systems (i.e., septic systems). Under its authority, the MSDH approves and permits the siting of residential septic systems.

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Mississippi Department of Wildlife, Fisheries and Parks (MDWFP)

The MDWFP has primary responsibilities for management of the wildlife and fisheries resources of the state including its boat registration, hunting, fishing, and boating licensing programs. The MDWFP also provides enforcement of these programs, primarily in freshwater areas of the state. They work closely with USFWS on hunting enforcement at the GNDNWR and GNDNERR.

Mississippi Oil and Gas Board/Mississippi Development Authority (MDA)

The Mississippi Oil and Gas Board acts as the permitting agency for development of oil and gas resources within the state. The MDA promotes development activities across the state and establishes certain rules and regulations pertaining to oil and gas exploration and production in marine waters.

Federal Programs and Agencies

U.S. Fish and Wildlife Service

The USFWS is a primary GNDNERR partner. Approximately one quarter of the reserve acreage is located within the GNDNWR, the CRC is located on federal land, and the GNDNERR works in close partnership with the GNDNWR on all pine savanna and flatwoods management and restoration efforts. The USFWS has the regulatory authority (shared with NOAA Fisheries) regarding the Endangered Species Act of 1973 and is the primary regulatory authority on the Migratory Bird Treaty Act of 1918. Under the Marine Mammal Protection Act, USFWS is responsible for the protection of walrus, manatees, sea otters, and polar bears. These acts apply to reserve research and outreach activities. The USFWS is also responsible for protection of several other protected, threatened, and endangered plants and animals that may potentially be found in the reserve. An exhaustive list of all protected, threatened, and endangered species is provided in Appendix 15.

The USFWS also makes recommendation to the ACOE regarding wetland permits. An MOU with USFWS addresses these joint activities as well as enforcement within the GNDNERR (Appendix 16). The GNDNWR completed a Comprehensive Conservation Plan in 2008 (USFWS 2008) to guide activities and works cooperatively with the GNDNERR staff on portions of that plan. The GNDNWR and other USFWS staff are housed in the CRC, including USFWS enforcement.

U.S. Army Corps of Engineers

The ACOE administers the federal wetland permitting program for tidal and non-tidal wetlands within the GNDNERR and on adjacent waters and wetlands through its Mobile, Alabama District Office. The ACOE also manages the MsCIP across the Mississippi coast. This program includes the Franklin Creek Ecosystem Restoration which acquired property, removed infrastructure, and conducted some land management activities in the Pecan and Bayou Cumbest communities just north of the reserve boundaries. The properties bought by the ACOE were transferred to the SOS and are currently included in the NRDA Grand Bay Land Acquisition and Habitat Management Project. The ACOE remains interested in continuing work in the area through MsCIP and is also seeking reauthorization of the program as of June 2019.

NOAA Fisheries

NOAA Fisheries has the regulatory authority regarding the Magnuson-Stevens Fishery Conservation and Management Act and shared regulatory authority with USFWS on the Endangered Species Act (ESA) of 1973. Under the Marine Mammal Protection Act, NOAA Fisheries is responsible for whales, dolphins, porpoises, seals, and sea lions. The regulatory authority includes identifying and mitigating impacts to essential fish habitat for regulated species, preventing impacts to species listed under ESA, and protecting marine mammals. The Marine Mammal Commission provides independent, science-based oversight of policies and actions of federal agencies as they address human impacts on marine mammals

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and their ecosystems. Further, under the Endangered Species Act, the National Marine Fisheries Service (NMFS) helps protect threatened and endangered species such as sea turtles. The NMFS also is responsible for marine mammal protection under the Marine Mammal Protection Act and makes recommendations to the ACOE on wetlands permits under the Clean Water Act.

NOAA/Office of Response and Restoration/Disaster Response Center (DRC)

The DRC is the lead office for NOAA in preparing for and responding to oil and chemical releases in marine waters. The reserve was funded by the DRC to develop a Disaster Response Plan (Appendix 9) for GNDNERR and the four other Gulf NERRs to address response and coordination relating to the trust resources of these reserves. This integrated plan is coordinated with other local, state, and federal responders and will serve as a template for similar plans for other protected areas. This will aid efforts to protect reserve resources in the event of hazardous releases or other emergencies. The GNDNERR is considered a federal trust resource in the context of a NRDA, which is jointly addressed by NOAA and other federal agencies.

U.S. Environmental Protection Agency

The EPA has enforcement and commenting authority for the federal wetlands permitting program in addition to joint responsibilities with the MDEQ for administrating the Clean Air and Clean Water acts in Mississippi.

Local Programs and Agencies

Jackson County, Mississippi

The boundaries of the GNDNERR are located entirely within the Mississippi political subdivision of Jackson County. All local ordinances and restrictions will be followed on the reserve as applicable, however refuge lands are exempted. The Jackson County Sheriff 's Department provides routine local enforcement. The reserve has maintained a close working relationship with several county offices and administrators, including the District 1 Supervisor, Board Attorney, Emergency Response Coordinator and Fire Coordinator.

Allowable and Unallowable Uses

The reserve relies on the enforcement authorities of the USFWS, MDMR, MDWFP, and Jackson County Sheriff's Office to enforce regulations pertaining to public safety, traffic, hunting, fishing, and boating. Current regulations allow hunting on the reserve in compliance with special regulations, which are posted on the GNDNWR website and are available to the public at the CRC. All upland uses are restricted to daylight use only. Fishing within freshwaters of the GNDNWR and all-terrain vehicle use within the GNDNERR/GNDNWR are completely restricted. There are no reserve restrictions or use restraints on outside researchers; however, permits are required by USFWS and MDMR. Recreational activities such as bird watching and hiking (on two designated trails ONLY) are encouraged. Kayaking is also encouraged, especially on the Grand Bay Blueway. Fisheries within the GNDNERR include crabbing and oystering. Commercial and recreational crabbing is allowed within the GNDNERR and follows the same regulations as other areas within Mississippi waters. This includes periodic closures of the fishery and removal of all crab traps during derelict crab trap removal programs. Oyster harvest is currently restricted in GNDNERR because fecal coliform counts exceed maximum concentrations for approved waters. Should water quality improve in the future, reserve waters may become conditionally approved for recreational and commercial tonging following the same regulations as other approved oyster harvest areas within Mississippi waters as specified in Title 22, Part 1.

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Off-bottom aquaculture

Stakeholders in the GNDNERR have shown interest in allowing commercial off-bottom oyster aquaculture within the GNDNERR if the waters were approved for conditional harvest. To address this potential use of GNDNERR resources, staff have begun discussions related to potential areas for off-bottom aquaculture and have identified several pre-determined conditions that must be met by farmers, should this program be enacted. These include, but are not limited to:

All required leases and permits are obtained from MDMR,

An MDMR oyster check station is established,

Off-bottom aquaculture training offered by the MDMR is successfully completed,

No permanent structures are established,

Appropriate Environmental Impact Assessments are conducted,

Best farming practices are always used,

All gear is tagged with the owner information and permitting requires all gear maintain in owner's possession, i.e., retrieval due to a storm would be the responsibility of the owner,

No gear is staged in the marsh and if any gear enters the marsh (e.g., due to storm) the GNDNERR would be contacted for assistance with recovery,

Activities are conducted from a boat only,

Detailed descriptions of all activities are periodically submitted and approved by MDMR,

Detailed hurricane plans are submitted and approved by GNDNERR,

No impacts occur to resources (e.g., seagrasses) within the GNDNERR,

There are no conflicts with other uses of the reserve, and

A portion of the designated off-bottom area is used for educational purposes.

Further discussions of the potential to open an area for off-bottom aquaculture will occur in the next five years and be documented in meetings of the GBCC.

Surveillance and Enforcement Capacities

The MDMR Marine Patrol and USFWS Law Enforcement officers are responsible for the surveillance and enforcement of rules regarding resource use within the reserve and refuge boundaries. The Director and Stewardship Coordinator regularly interface with the Marine Patrol, and the USFWS Enforcement officer is housed in the facility. There are regular communications among all parties, and the staff document and report all suspicious activity to one or both entities that then coordinate on response. Several video cameras are located on the facility to record all activities occurring near the building 24 hours a day and seven days a week. Also, USFWS and MDMR law enforcement reserve the right to use surveillance equipment within the GNDNERR/GNDNWR to detect illegal activities including, but not limited to dumping, poaching, and hunting or fishing out of season or at night. Game cameras are also regularly used by the GNDNERR at several rotating locations within the reserve. These activities are always coordinated with enforcement entities and are used to support surveillance and enforcement as needed. Ongoing problems exist at the CRC with vandalism and theft.

Resource Protection Challenges

There is limited development within and surrounding the reserve, so most resource protection challenges are often related to misuse of reserve resources. For example, public dumping in the reserve,

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or trampling of marsh vegetation during duck hunting season are two common challenges. Other challenges to resource protection include natural processes associated with erosion of marsh habitats. This is very common in marshes in the southern portion of the reserve and is being addressed in part by research efforts to understand sediment movement as it relates to marsh erosion, suspension and redeposition of sediment on the marsh platform. This is also addressed by conducting research and monitoring to better understand the longevity and function of artificial reefs and living shorelines within the reserve. To better understand the impacts of SLR and erosion, we have a well-established sentinel site monitoring program, which is detailed in the Sentinel Site Plan. Continued discussions about erosion are encouraged by the reserve and the GBCC plans to take on those discussions in the next five years. The objective is to better understand the prevailing conditions and processes in GNDNERR through research, and then to assemble natural resource managers for discussions regarding potential management actions. In the next five years, at least two in depth workshops will be completed to evaluate management actions related to problems with erosion and summarize those workshop findings into a report that includes recommended actions.

Another resource protection challenge relates to the application of prescribed fire. This is one of the most important restoration tools available to manage properties in the GNDNERR, but there are several important considerations related to wildland fire that can prevent timely application. These include weather, smoke management, proximity to major roads, and availability of qualified staff. The best way for us to address these challenges is to strengthen partnerships and develop a team of trained personnel to use prescribed fire safely and effectively. An example of our efforts includes partnerships with MDMR Coastal Preserves and GNDNWR to develop a well-qualified team of wildland firefighters that have demonstrated experience and success with the landscape-scale application of prescribed fire. There are also efforts to acquire lands that are a barrier to the application of prescribed fire across the landscape, which is detailed in the Land Acquisition Plan.

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Public Access and Visitor Use Plan

Public use of the reserve provides opportunities to develop and strengthen connections with local communities, promote awareness and conservation of coastal resources, and improve understanding of coastal restoration practices. Our philosophy is that providing visitors with positive and memorable experiences will encourage positive behavioral changes related to the valuation and use of natural resources. For these reasons, staff are continually striving to increase public use and visitor experience through innovative programming and enhancement of habitats.

Current Public Access

Access to the GNDNERR via land is limited to Bayou Heron Road, which leads to the Grand Bay CRC at the northern boundary of the reserve (Figure 18). The CRC contains an interpretive center designed to teach visitors about the history, ecology, management, and conservation of reserve habitats. The CRC includes two classrooms that are used for education and outreach programs, and a dormitory for overnight guests (e.g., researchers). Current hours of operation at the CRC are Monday through Friday 9:00 a.m. to 3:00 p.m.

Water access to the GNDNERR includes a public boat launch owned by USFWS at the terminus of Bayou Heron Road, a public boat launch at the end of Bayou Cumbest Road owned by Jackson County, and a private boat ramp located at the end of Grand Bature Road at Point O'Pines. The reserve maintains two parking areas along Bayou Heron Road, the O'Sullivan and Hunter's parking lots, that provide hunters with parking and access to GNDNWR and state lands. The reserve also contains several public use trails listed below.

The **Grand Bay NERR Boardwalk** is located directly west of the CRC. This 1,000 ft boardwalk was constructed in 2016 and provides visitors with views of pine flatwoods, pine savanna and an emergent freshwater marsh called Hawk's Marsh. The boardwalk is also the location of the GNDNERR Phenology trail, which is a citizen science program developed in partnership with the National Phenology Network to document long-term changes in phenology of several common flora and fauna.

The **Savanna Trail** stems from the boardwalk and continues in a one-mile loop that passes through a wet pine savanna to the CRC parking lot. This site is considered a pristine wet pine savanna and is collectively managed by GNDNWR and GNDNERR staff since 2008. The Savanna Trail and boardwalk both contain informational signs to educate visitors on native habitats.

The **Oak Grove Birding Trail** is a 0.5-mile loop trail through oak hammock, pine savanna, and pine flatwoods habitats located approximately one mile south of the CRC on Bayou Heron Road. This trail is an active restoration site receiving prescribed fire and invasive species treatments, which should enhance visitor experience in the future.

The **Grand Bay NERR Blueway** was established with the MDMR's Mississippi Gulf Coast National Heritage Area Program in 2017 and provides kayakers with 12 miles of paddling from Bayou Heron boat launch to the Jackson County boat launch on Bayou Cumbest Road. Signage along the trail guides kayakers across the reserve. Points of interest include Bayou Heron, Middle Bay, Catch 'em All Bar, Bosarge Shell Midden, and the GNDNERR's SWMP weather and water quality monitoring stations.

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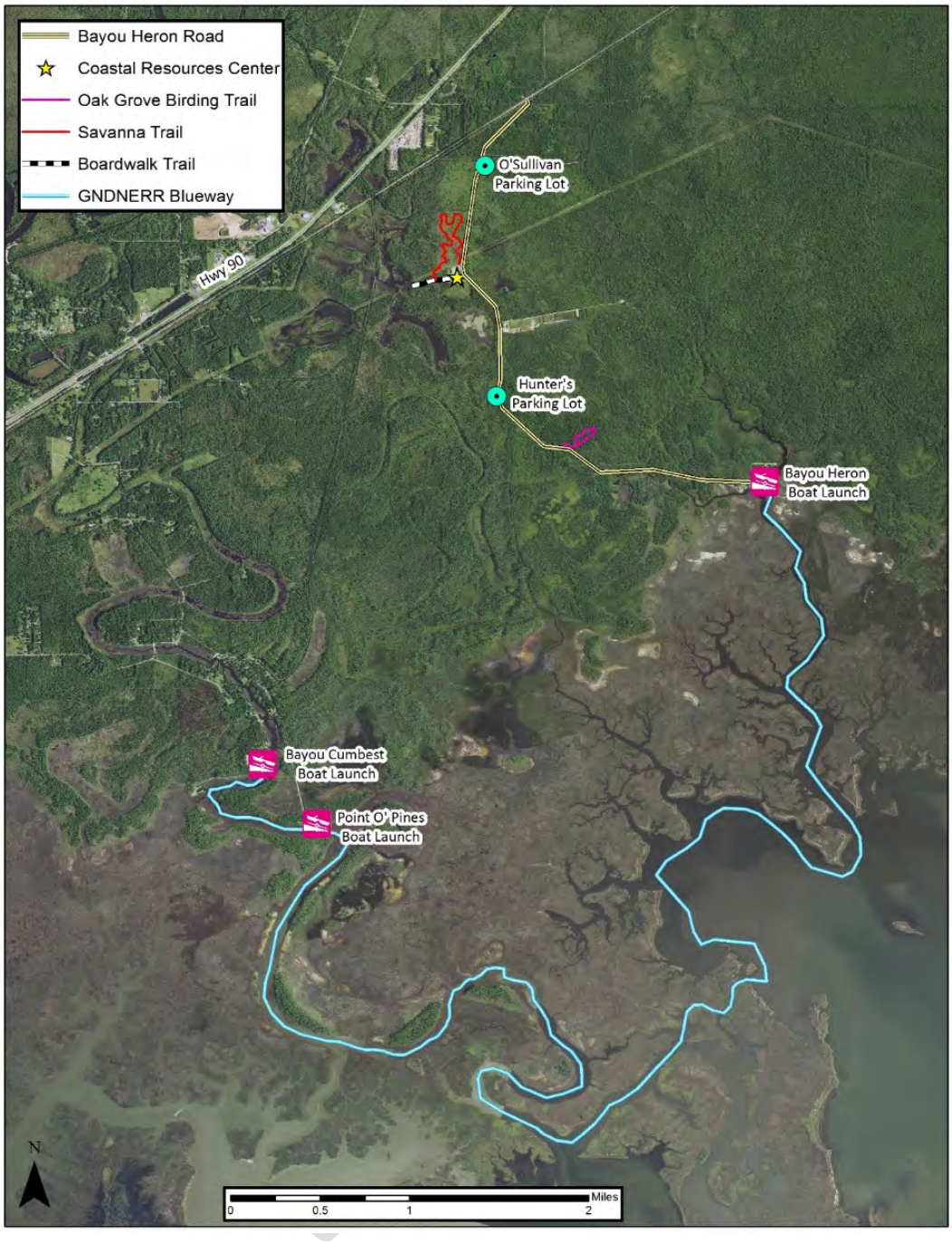

Figure 18. Public use and access points of interest within the GNDNERR.

Public Access Challenges

There are some challenges with public access related to dumping, poaching and other illegal activity. The reserve staff removes debris and tracks the pounds of trash as an evaluation metric. There is also dumping of animals, especially dogs, that are taken to the Jackson County Animal Shelter. A law enforcement officer is stationed at the reserve and Bayou Heron Road and associated waterways are patrolled by the MDMR Marine Patrol division. There have been gates installed on several dead-end roads on the state lands north of the reserve and this has alleviated some of the dumping problem.

Public Access Opportunities and the Visitor Experience

Current pine savanna and flatwoods restoration in the reserve has been carefully planned to increase visibility and public access potential. These efforts include application of mechanical and prescribed fire treatments to reduce woody mid- and overstory vegetation and promote pyrophytic vegetation (e.g., longleaf pine), and application of herbicides to reduce invasive vegetation. Many of the restoration areas were purposefully selected because of their visibility and potential for future public use. For example, there are restoration areas along Highway 90, Pecan Road and Bayou Heron Road with the intention of increasing interest in savanna restoration and use by visitors who want to see the restored habitats. It is anticipated that restoration will increase wildlife viewing opportunities, hunting access and success, and overall aesthetic value leading to enhanced visitor experience. Several other projects are currently being developed that will lead to increased public use and visitor experience. These include establishment of a pollinator garden and wildlife viewing trail within a restoration area north of the CRC, invasive species removal and re-establishment of native wetland vegetation at the stormwater retention pond at the CRC, gating of abandoned roads to limit undesirable activity and dumping, and debris removal activities to enhance visitor experience. Themes related specifically to upland restoration will be used in outreach efforts primarily through collaborations between Science and Outreach staff (e.g., signage, workshops, StoryMaps, etc.) to maximize the opportunity to engage our community about these projects.

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Land Acquisition Plan

Acquisition Context and Values

The administrative boundaries of the GNDNERR include approximately 18,049 acres of lands and waters in southeasternmost Jackson County, MS within the Mississippi Coastal Watershed (0317009). The GNDNERR includes Middle Bay, Point Aux Chenes Bay, Bayou Cumbest, Crooked Bayou, Bayou Heron and associated coastal wetland habitats and selected portions of coastal habitats within the boundaries of the GNDNWR (Figure 19). It is bounded on the east by the waters of Grand Bay and Middle Bay at the Mississippi-Alabama state line, on the west by Bayou Cassotte Industrial Park, on the north by Bayou Cumbest, Pecan, Kreole and Orange Grove, and on the south by the Mississippi Sound. Of the total acreage within the administrative boundary of the site, approximately 87% (15,761 acres) is publicly owned. On many of the publicly owned parcels, an undetermined acreage is at or below the mark of mean high tide and is thus considered to be Public Trust Tidelands, which are owned in trust by the State of Mississippi Coastal Wetlands Protection Act and the Public Trust Doctrine. The MS SOS documents a general determination of Tidelands status while detailed determinations are generally considered as individual parcels change ownership.

Habitats within the GNDNERR include estuarine tidal marsh, tidal creeks, shallow open-water habitats, oyster reefs, sea grass beds, salt flats, sandy beach, shell beach, shell middens, maritime forest, wet pine savanna and flatwoods, and freshwater marshes. The GNDNERR overlaps with the GNDNWR, which includes over 17,000 acres of upland habitats including wet pine savannas, pine flatwoods, oak hammocks, cypress drains, and freshwater marshes. These areas serve as a functional buffer for the estuarine habitats within the GNDNERR and provide an intact upland to estuarine ecosystem with limited development that is rare along the northern Gulf of Mexico coast. Additionally, other functional buffers in the vicinity include GNDNWR lands in Alabama, the Jackson County Mitigation Bank to the north of the GNDNERR, and several properties in Alabama east of the GNDNERR/GNDNWR that are owned by The Nature Conservancy or are part of the State of Alabama Grand Bay Forever Wild preserve. The entire GNDNERR/GNDNWR is located within the Grand Bay Savanna project area, which is an outstanding landscape in The Nature Conservancy's "Last Great Places" campaign because of the rarity and biological significance of the extensive and intact estuarine to upland ecosystem.

Public lands within the GNDNERR/GNDNWR are owned by a combination of state, federal, and local agencies, including the MDMR, SOS, Jackson County, and USFWS. The state lands are part of the Grand Bay Coastal Preserve, and the federal lands are part of the GNDNWR. Approximately 4,121 acres within the boundary of the reserve is in private ownership. Many of the public parcels include large expanses of black needlerush marsh and open water, both of which are at or near the level of mean high tide that are considered to be public tidelands owned in trust by the State of Mississippi. Future acquisitions will be evaluated as described below to facilitate ongoing, broad-scale restoration efforts, protect an intact ecosystem, and facilitate upland migration of marshes.

Priority Acquisition Areas

The objective of acquisition efforts is to acquire private lands from within the boundary of the reserve with priority given to those parcels that are barriers to landscape-scale restoration and conservation initiatives. Priority parcels are typically identified in partnership with GNDNWR and acquisition is always dependent on availability of funding and landowners that are willing to sell. During the 2021 – 2025 timeframe, funds will be available for land acquisition through the NRDA Grand Bay Land Acquisition and Habitat Management Project, which is funded by the MS TIG through the NRDA funding stream because of the 2010 *Deepwater Horizon* oil spill. The reserve's role in acquisition is to conduct periodic prioritization of private inholdings with GNDNWR and generate a prioritized list of parcels to share with

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project partners. This includes identifying private lands within the reserve boundary and prioritizing them based on their proximity to land management activities (e.g., prescribed fire) or estuarine project areas (e.g., reef deployment areas), if the parcel is owned by a willing seller, or for other reasons such as parcel size, development risk, impediment to restoration, or conservation of imperiled species or important reserve habitat.

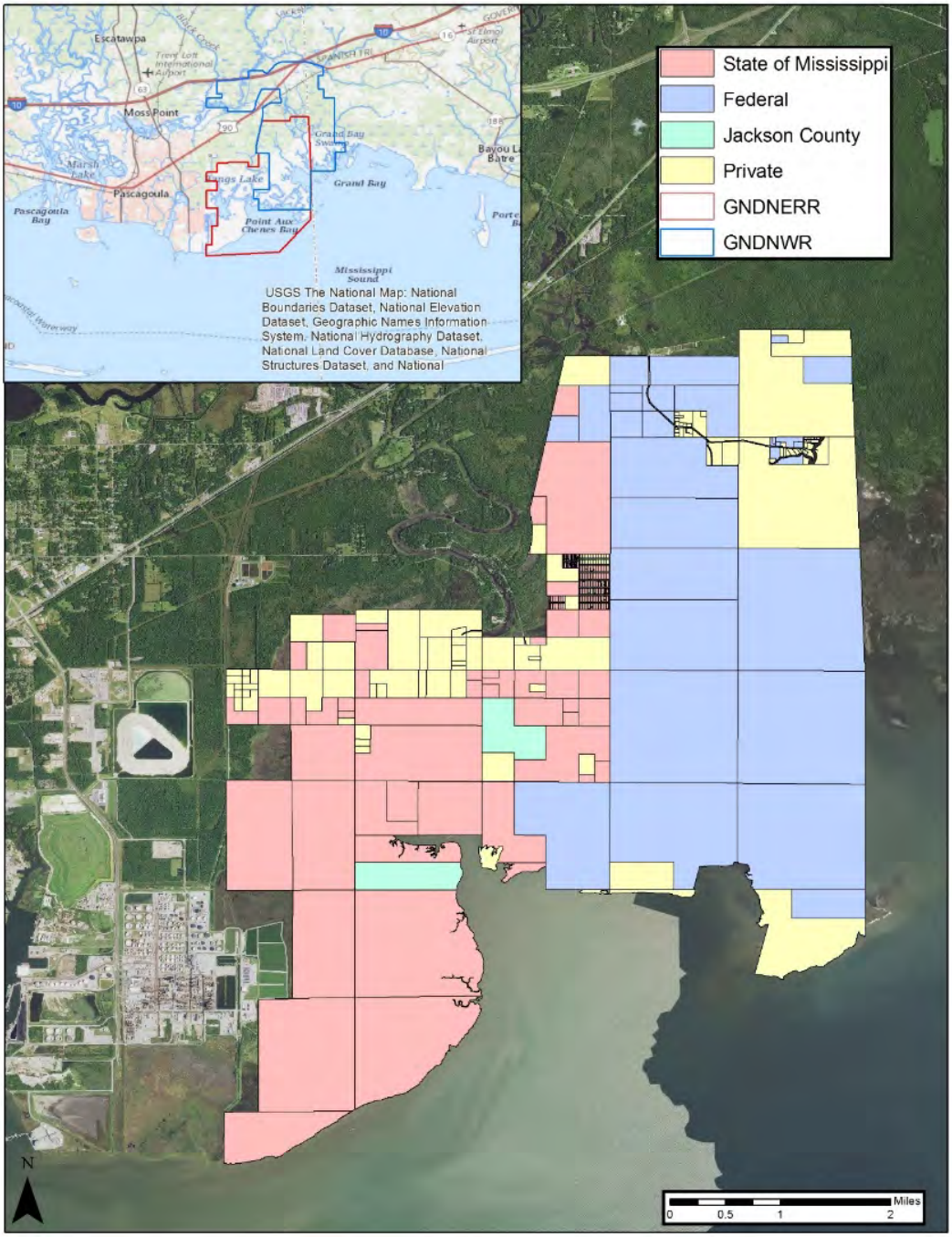

Figure 19. Boundary and land ownership within the GNDNERR.

A current approach for acquiring properties is to share our priority parcels with MDEQ, who communicates these priorities to non-governmental organizations (i.e., local land trusts who then work

directly with landowners to facilitate land acquisitions. For these lands to be transferred to the State of Mississippi, acquisitions follow the procedures set forth by the SOS, which includes due diligence for all acquisitions (e.g., Phase I Environmental Assessment, surveys, etc.) and limitations on purchase price for target parcels (i.e., purchase price must be at or below appraised "Yellow Book" value). The most recent land acquisition that serves as a model for future acquisitions occurred in 2018 and included 1,573 acres that was purchased by The Conservation Fund (TCF) from a private landowner as part of the Grand Bay Land Acquisition and Habitat Management Project. This land was purchased from TCF by MDEQ and was later transferred to the MDMR following procedures set forth by the MS SOS.

Prioritization Process and Criteria

Following NERRS regulations (§921.13), which state there should be a ranking of ecologically key land and water areas by their relative importance, GNDNERR and GNDNWR rank priority parcels targeted for acquisition. The prioritization process includes criteria such as size, location relative to active management units, potential for development, etc. All of the areas within the prioritization are either emergent marshland or wet pine savanna that contribute to the overall ecosystem restoration of GNDNERR and GNDNWR and include parcels along the estuarine/upland boundary to facilitate marsh migration. The prioritization of parcels is rated by A (Highest priority), B (Medium priority), and C (Lowest Priority) and agreed upon by GNDNWR and GNDNERR. A prioritized list is only made available to other agencies actively working on land acquisition projects.

Descriptions of Priority Acquisition Areas

Prioritized acquisition areas mostly consist of pine savanna and flatwoods, but also includes emergent marshes.

Priority Areas Acquisition Strategy

After determining the priority acquisition areas, the GNDNERR considered how to acquire lands within a priority acquisition area (waters already belong the State of Mississippi). For the next five years, the strategy consists of working with partners such as MDEQ and the MS TIG to help identify and prioritize lands, and then to work with GNDNWR to move newly acquired lands into management units.

Tract Acquisition Strategy

In general, the tract acquisition strategy relies on learning of willing sellers, determining potential funding sources, and working with partners to approach landowners. For the next five years, the majority of effort for tract acquisition will be with our project partners at GNDNWR and MDEQ. All land sales will go through the SOS and titled to the MDMR, if acquired with state funds and occurring within the boundary of the GNDNERR. Land management will mirror existing land management efforts. Our partners may or may not also work with conservation organizations and land trusts.

Fair Market Value Estimates

All lands to be acquired will be appraised by an appraiser approved by the state and project partners, and no land shall be acquired above appraised value.

Estimated Acquisition Timeline

Land is currently being acquired and active acquisitions are expected to continue until 2029.

Potential Acquisition Partners

Our main partners in acquisitions are the GNDNWR, MDEQ, and MS TIG.

Funding Sources

The current potential funding sources are associated with the NRDA Grand Bay Land Acquisition and Habitat Management Project, which has funding until 2029.

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Restoration Plan

Priority Restoration Areas

The highest priority management areas within the GNDNERR are wet pine savannas and flatwoods, which often have overgrown mid- and overstory vegetation due to fire suppression for the last several decades. Some of these areas are previous homesites, or roadbeds with extensive invasive species infestations. Prescribed fire is being applied to these areas to reduce mid-story vegetation and spatial coverage of invasive species, thereby increasing habitat quality for many fire-dependent species of plants and animals. Management priority is also given to estuarine-upland ecotones where marsh vegetation transitions to slash pine flatwoods. Fire management along the marsh-upland ecotone will facilitate upland migration of marshes by reducing the barrier created by overgrown mid- and overstory vegetation as sea level rises. In addition to fire, mechanical treatments in the form of mulching and select cutting, and herbicide treatments targeting invasive vegetation are used as needed to modify fuel density and distribution in order to initiate restoration of fire-dependent habitats where fire treatments alone would take longer to produce desirable effects. Restoration efforts within the reserve are linked with long-term monitoring of vegetation and avian community structure to help inform future restoration plans in the GNDNERR and similar restoration efforts occurring along the Gulf Coast.

Another restoration priority includes experimental efforts to protect eroding shorelines and re-establish a viable oyster population within the GNDNERR. The GNDNERR is considered a retrograding deltaic system due to the absence of river input to the estuary. Marsh edges that are exposed to wind and high-energy waves experience erosion rates as high as 6.5 meters/year (Terrano et al. 2019). Potentially contributing to shoreline loss is a decline in oyster reefs, which were historically abundant along marsh edges throughout the reserve. Oysters have declined across the Mississippi Sound due to stressors associated with freshwater inputs and loss of structured habitats (i.e., historical oyster beds). The implementation of RESTORE projects across the Gulf has resulted in many efforts to restore oysters that include components to reduce shoreline erosion. As such, the GNDNERR will implement and comprehensively monitor, in collaboration with partner agencies and universities, different strategies to increase the abundance of oysters and reduce shoreline erosion within the timeframe of this management plan.

Description of Restoration Areas

A large area from the northern boundary of the GNDNERR to the salt marsh ecotone is currently part of a broad-scale effort to restore wet pine savanna and flatwoods habitats (Figure 20). These efforts include restoration and habitat management with funding made available from multiple sources (e.g., NRDA, National Fish and Wildlife Foundation, GNDNERR), all in partnership with USFWS. The level of intervention needed in each area differs depending on the fire history, coverage by invasive species, etc., but the goal across the landscape is the same: to restore intact, functional wet pine savanna and flatwoods habitats as evidenced by biological community monitoring.

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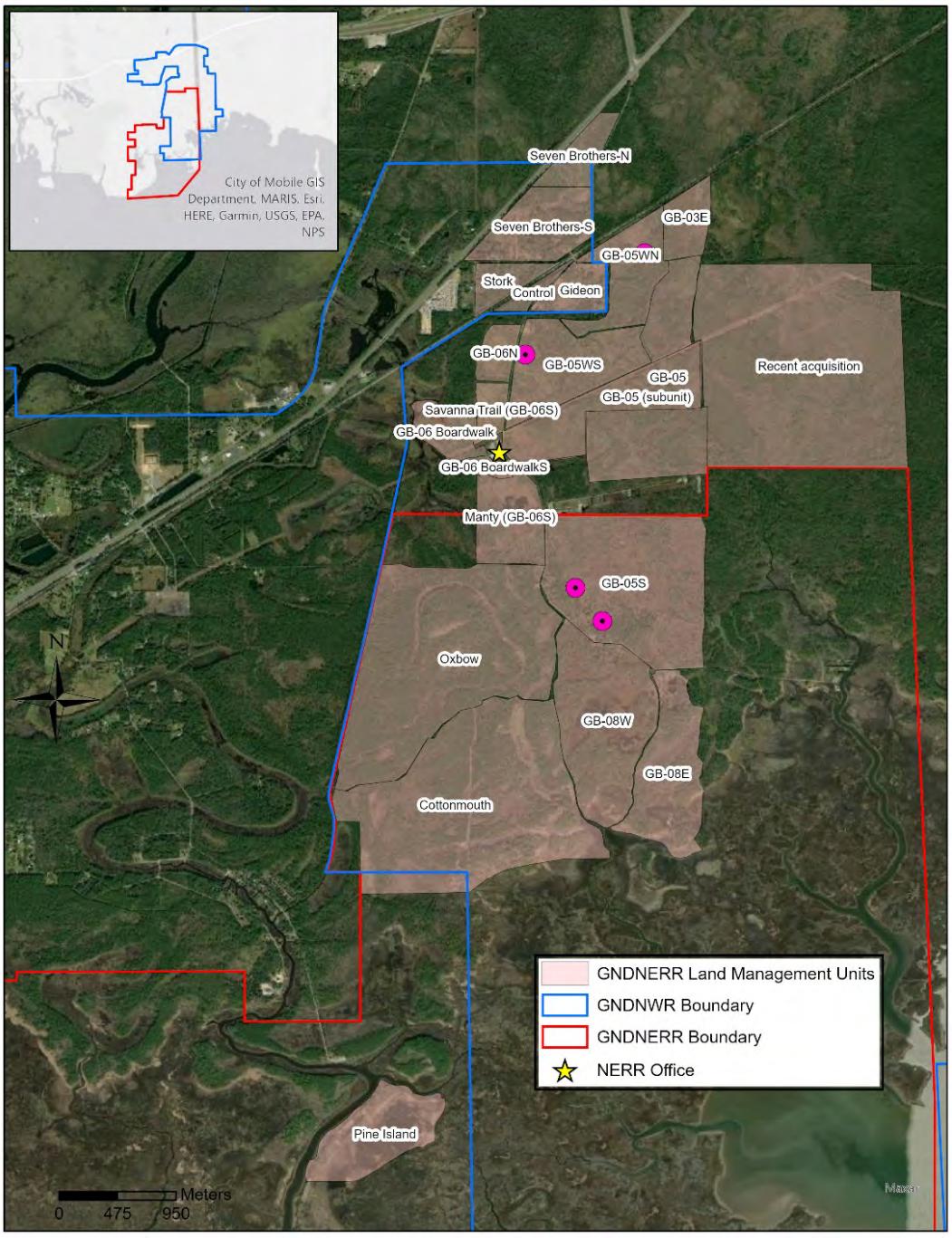

Figure 20. Active restoration areas in relation to the GNDNERR and GNDNWR and names of the 22 management units within the larger restoration footprint. Note that the "Recent Acquisition" will be subdivided into smaller management units in the future.

Areas selected for testing shoreline protection and oyster restoration strategies include an eroding shoreline at Point Aux Chenes Bay and a portion of Bangs Bayou selected for reef construction in 2021. Other areas may be selected to test strategies to reduce shoreline erosion and/or restore oyster habitat during the timeframe of this management plan; however, staff will focus on comprehensive monitoring of current projects to improve decision making about future projects (e.g., location, approach, etc.)

within the GNDNERR. This should also help to inform decisions about projects outside the GNDNERR, primarily through staff involvement with the RCT at MDMR and through outreach efforts and involvement in management application teams for restoration projects along the Gulf Coast.

Factoring Climate and Non-climate Stressors into Restoration Planning

Recently modeled projections showed that sea level rise will have large effects on the GNDNERR (Wu et al. 2017, Alizad et al. 2018). While there are a range of potential scenarios, it is highly probable that the reserve will be affected and that the ability for marshes to migrate upslope will be important for their persistence into the future. Our upland restoration plans include areas adjacent to the salt marsh/upland ecotone that would serve as corridors or zones for upland migration of marshes. The approaches previously mentioned for upland restoration (e.g., prescribed burning, select cutting, etc.) will reduce the density of mid- and overstory vegetation to facilitate this process.

As previously mentioned, our estuarine restoration efforts are designed to increase secondary productivity and reduce erosion of marsh habitats. Stressors associated with shoreline loss (e.g., increased wave energy and exposure of seaward marsh habitats, etc.) are related to climate, but may also stem from other sources (e.g., boat wakes, etc.). In either case, biotic and abiotic responses to restoration are closely monitored to ensure the complex interactions between interventions and response are understood. For example, there is evidence that reducing headland erosion may result in decreases in sediment accretion on the marsh platform. Our partners at USGS are closely looking at the relation between shoreline erosion and sediment accretion before and after reef deployments to better understand marsh response to inform future interventions within the GNDNERR and beyond.

Anthropogenic development is always a threat to Gulf Coast habitats, but our efforts to acquire and protect lands within the GNDNERR/GNDNWR are our best defense against such threats. As previously mentioned, the GNDNERR is part of the Grand Bay Savanna Complex, which is an expansive, intact ecosystem that will remain in conservation in perpetuity. Even so, there is adjacent industry and remnants of previous anthropogenic development (e.g., septic systems) that threaten reserve resources. While no current projects are aimed specifically at abating the impacts of these threats, resource monitoring efforts (e.g., SWMP, MDMR fecal coliform monitoring) will be used to better understand sources of pollutants and design mitigation strategies as needed. Further, the long-term impacts of hydrological barriers to the reserve (e.g., Highway 90, CSX Railroad) will also be explored as funding allows and may include designing comprehensive restoration plans to increase hydrological connectivity from upland to estuary.

Determining Restoration Priorities

Our utmost priority for restoration is to protect and restore wet pine savanna and flatwoods, including dependent native flora and fauna, which are imperiled habitats across their historic range. Funding exists to continue land acquisition, restoration, and monitoring of these habitats through 2029. Through this work, upland migration of marsh habitats in the future will be facilitated. Other restoration priorities are identified as opportunities and funding allows. These include efforts to enhance structured habitats for oysters and protect marsh habitats through placement of artificial reefs. This project was selected for funding by several partner agencies within the NRDA Phase IV Early Restoration Program many years ago. This provided us with a unique opportunity to comprehensively monitor this project with our partners as previously mentioned. Other approaches that are currently available for marsh protection (e.g., thin layer placement of dredged materials, etc.), or efforts to restore hydrologic connectivity may also be explored in the future as opportunities and funding allows.

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Priority Restoration Project Planning

A variety of restoration projects are being discussed among GNDNERR staff and within the MDMR RCT. As such, involvement is anticipated in several restoration efforts at GNDNERR during the timeline within this management plan. However, our current focus is on understanding the effects of ongoing restoration projects, detailed below, to inform future project design and implementation.

Grand Bay Land Acquisition and Habitat Management Project

In 2018, NRDA monies were allocated to the Grand Bay Land Acquisition and Habitat Management Project, which was initiated by the MS TIG to partially restore birds and wetland, coastal, and nearshore habitats in the project area. Objectives of this project include habitat management to restore the structure and function of target habitats within the project boundary. Staff from GNDNERR and partners from GNDNWR are working together to develop and carry out land management activities. Staff from GNDNERR are also conducting monitoring of avian and vegetation communities to inform adaptive management of the project area. Land management includes mechanical clearing to reduce woody vegetation, chemical treatments to reduce invasive species, and prescribed fire to top kill woody vegetation, decrease light attenuation and support pyrogenic vegetation. All monitoring is being designed and implemented in accordance with the *Monitoring and Adaptive Management Plan for the Deepwater Horizon NRDA Project: Grand Bay Acquisition and Management* and monitoring data will be used by MDEQ for annual trustee reporting. Further, monitoring and management staff will work closely throughout the project to understand treatment effects on vegetation structure and composition, distribution of invasive vegetation, and abundance and distribution of selected avian species and adaptively manage project lands. The project area (currently 3,138 acres) contains lands within the GNDNERR/GNDNWR, lands only within the GNDNWR, and 17 established monitoring plots (Figure 21). Future acquisitions resulting from this project may result in an increased project footprint.

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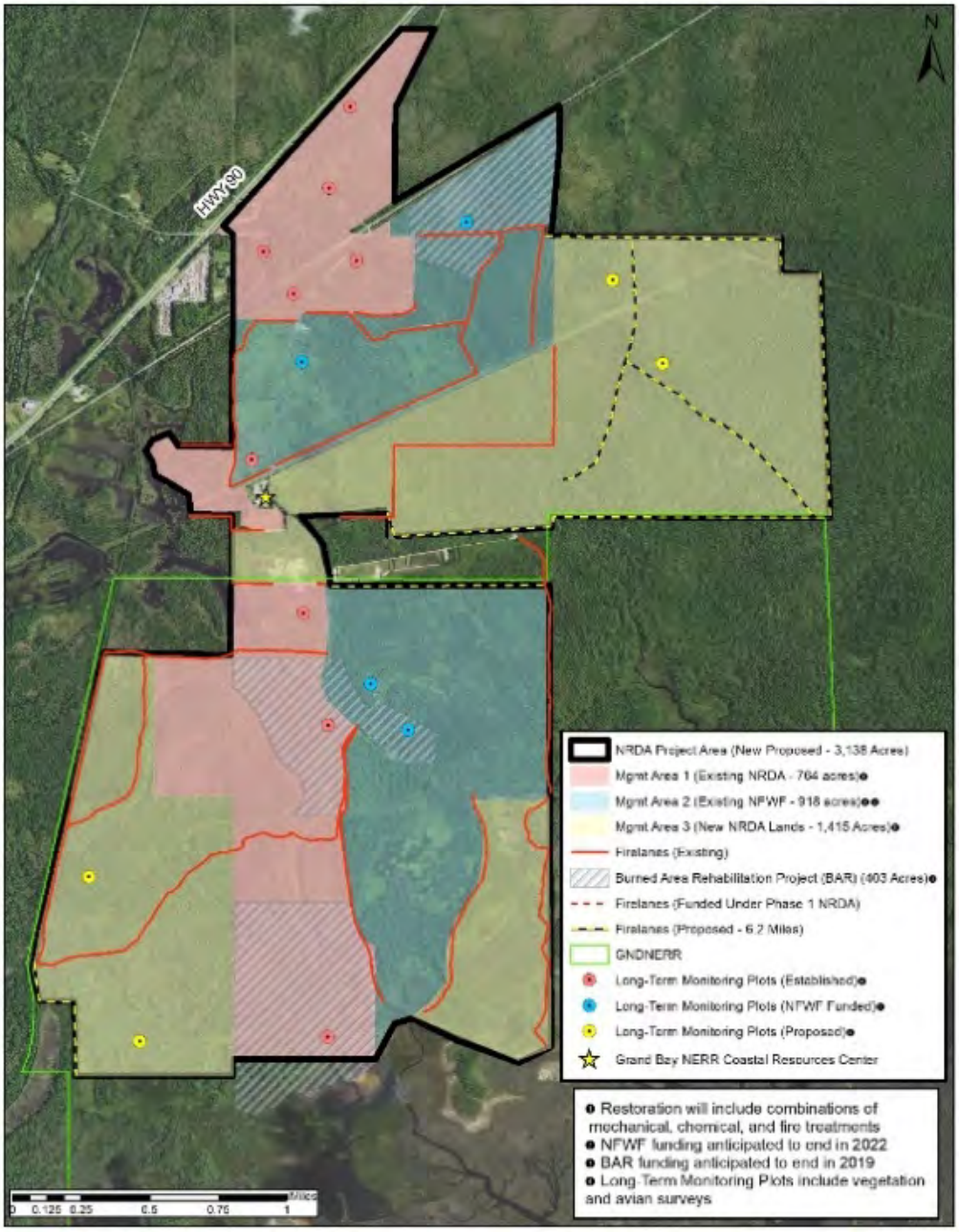

Figure 21. Priority areas and long-term monitoring stations for wet pine savanna restoration within the GNDNERR and GNDNWR.

Comprehensive monitoring of NRDA Phase IV sub- and intertidal reefs

A current effort is underway to quantify the effectiveness and functioning of artificial reefs at GNDNERR. Artificial reefs are funded by the NRDA Phase IV Early Restoration Program and include 6.5 acres of subtidal reef along an eroding shoreline at Point Aux Chenes Bay and three acres on intertidal reef in Bangs Bayou (Figure 22). The primary material selected for the reefs is graded limestone aggregate with varying applications of crushed oyster shell and oyster bags. Material size will range from 1-inch to 4-inch stone (i.e., reef aggregate). This gradation is readily made and available from a variety of vendors. Based on experiences in Texas and Louisiana, the coarseness of this reef aggregate gradation provides a

greater surface area for shellfish spat attachment and growth. The arrangement of the subtidal reefs will include a multiple ridge design (0.2 – 3 ft) across the reef footprint. The intertidal reefs will be constructed in roughly six, 0.5-acre units. Three units will be composed of either 100% oyster shell in wire mesh bags or 30% oyster shell bags and 70% subtidal reef aggregate (i.e., limestone). Oyster shell bags will be constructed using recently shucked shell packaged in a chicken wire basket that measures 2-foot by 2-foot by 4-6 inches thick. The primary objectives of the project are to increase secondary production and reduce shoreline erosion. Monitoring for the project began in 2019 and includes multiple components including wave energy, shoreline erosion, sedimentation, shoreline vegetation, and benthic and fish communities. Project partners include USGS and MSU. The GNDNERR Davidson Fellow, an MSU Master's student is also involved. Reef deployments took place in early 2021.

Figure 22. Priority areas selected for construction of sub- and intertidal reefs within the GNDNERR. The polygons show the areas being permitted for reef construction, which are larger than the final project area.

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List of Appendices

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List of Acronyms and Definitions

GNDNERR	Grand Bay National Estuarine Research Reserve
MDMR	Mississippi Department of Marine Resources
NERRS	National Estuarine Research Reserve System
CZMA	Coastal Zone Management Act of 1972
CFR	Code of Federal Regulations
MCP	Mississippi Coastal Program
NOAA	National Oceanographic and Atmospheric Association
OCM	NOAA's Office for Coastal Management
USFWS	U.S. Fish and Wildlife Service
GNDNWR	Grand Bay National Wildlife Refuge
CRC	Coastal Resources Center
ACOE	Army Corps of Engineers
McCIP	Mississippi Coastal Improvements Program
NRDA	Natural Resources Damage Assessment
MDEQ	Mississippi Department of Environmental Quality
MS TIG	Mississippi Trustee Implementation Group
SWMP	System-wide Monitoring Program
EPA	U.S. Environmental Protection Agency
NPDES	National Pollution Discharge Elimination System
SLR	Sea level rise
USGS	U.S. Geologic Survey
SET	Surface elevation tables
CDMO	Central Data Management Office
TOTE	Teachers on the Estuary
MSU	Mississippi State University
USM	University of Southern Mississippi
CREC	Coastal Research and Extension Center
SSAM-1	Sentinel Site Application Module 1
CTP	Coastal Training Program
NFIP	National Flood Insurance Program
SOPs	Standard Operating Procedures

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RTK	Real time kinematic
GPS	Global positioning system
ARL	NOAA's Air Resources Laboratory
KEEP	K-12 Environmental Education Program
WAMA	Walter Anderson Museum of Art
GBCC	Grand Bay Community Collaborative
MOU	Memorandum of Understanding
SOS	Mississippi Secretary of State's Office
RCT	Restoration Coordination Team
LEED	Leaders in Energy Efficiency and Design
ERV	Energy Recovery Ventilator
MDAH	Mississippi Department of Archives and History
MSDH	Mississippi State Department of Health
MDWFP	Mississippi Department of Wildlife, Fisheries, and Parks
MDA	Mississippi Development Association
ESA	Endangered Species Act of 1973
NMFS	National Marine Fisheries Service
TCF	The Conservation Fund

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Appendix 1: Code of Federal Regulations

PART 921 - NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM REGULATIONS

Authority: Section 315 of the Coastal Zone Management Act, as amended (16 U.S.C. 1461).

Source: 58 FR 38215, July 15, 1993, unless otherwise noted.

Subpart A - General

§ 921.1 Mission, goals and general provisions.

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

(b) The goals of the Program are to:

(1) Ensure a stable environment for research through long-term protection of National Estuarine Research Reserve resources;

(2) Address coastal management issues identified as significant through coordinated estuarine research within the System;

(3) Enhance public awareness and understanding of estuarine areas and provide suitable opportunities for public education and interpretation;

(4) Promote Federal, state, public and private use of one or more Reserves within the System when such entities conduct estuarine research; and

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

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

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

term consequences compromise the representative character and integrity of a Reserve, are prohibited. Habitat manipulation for resource management purposes is prohibited except as specifically approved by NOAA as:

(1) A restoration activity consistent with paragraph (e) of this section; or

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

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

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

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

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

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

§ 921.2 Definitions.

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

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

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

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

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

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

§ 921.3 National Estuarine Research Reserve System biogeographic classification scheme and estuarine typologies.

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

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

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

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

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

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

(c) The National Estuarine Research Reserve Program will be administered in close coordination with the National Marine Sanctuary Program (Title III of the Marine Protection, Research and Sanctuaries Act, as amended, 16 U.S.C. 1431-1445), also administered by NOAA. Title III authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect or restore such areas for their conservation, recreational, ecological, historical, research, educational or esthetic values. National Marine Sanctuaries and Estuarine Research Reserves may not overlap, but may be adjacent.

Subpart B - Site Selection, Post Site Selection and Management Plan Development

§ 921.10 General.

(a) A coastal state may apply for Federal financial assistance for the purpose of site selection, preparation of documents specified in § 921.13 (draft management plan (DMP) and environmental impact statement (EIS)), and the conduct of limited basic characterization studies. The total Federal share of this assistance may not exceed $100,000. Federal financial assistance for preacquisition activities under § 921.11 and § 921.12 is subject to the total $5 million for which each Reserve is eligible for land acquisition. Notwithstanding the above, when financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, such assistance may be

used to pay 100 percent of all actual costs of activities carried out with this assistance, as long as such funds are available. In the case of a biogeographic region (see appendix I) shared by two or more coastal states, each state is eligible for Federal financial assistance to establish a separate National Estuarine Research Reserve within their respective portion of the shared biogeographic region. Each separate National Estuarine Research Reserve is eligible for the full complement of funding. Financial assistance application procedures are specified in subpart I.

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

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

§ 921.11 Site selection and feasibility.

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

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

(1) A description of the proposed site selection process and how it will be implemented in conformance with the biogeographic classification scheme and typology (§ 921.3);

(2) An identification of the site selection agency and the potential management agency; and

(3) A description of how public participation will be incorporated into the process (see § 921.11(d)).

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

(1) The site's contribution to the biogeographical and typological balance of the National Estuarine Research Reserve System. NOAA will give priority consideration to proposals to establish Reserves in biogeographic regions or subregions or incorporating types that are not represented in the system. (see the biogeographic classification scheme and typology set forth in § 921.3 and appendices I and II);

(2) The site's ecological characteristics, including its biological productivity, diversity of flora and fauna, and capacity to attract a broad range of research and educational interests. The proposed site must be a representative estuarine ecosystem and should, to the maximum extent possible, be an estuarine ecosystem minimally affected by human activity or influence (see § 921.1(e)).

(3) Assurance that the site's boundaries encompass an adequate portion of the key land and water areas of the natural system to approximate an ecological unit and to ensure effective conservation. Boundary size will vary greatly depending on the nature of the ecosystem. Reserve boundaries must encompass the area within which adequate control has or will be established by the managing entity over human activities occurring within the Reserve. Generally, Reserve boundaries will encompass two areas: Key land and water areas (or “core area”) and a buffer zone. Key land and water areas and a buffer zone will likely require significantly different levels of control (see § 921.13(a)(7)). The term “key land and water areas” refers to that core area within the Reserve that is so vital to the functioning of the estuarine ecosystem that it must be under a level of control sufficient to ensure the long-term viability of the Reserve for research on natural processes. Key land and water areas, which comprise the core area, are those ecological units of a natural estuarine system which preserve, for research purposes, a full range of significant physical, chemical and biological factors contributing to the diversity of fauna, flora and natural processes occurring within the estuary. The determination of which land and water areas are “key” to a particular Reserve must be based on specific scientific knowledge of the area. A basic principle to follow when deciding upon key land and water areas is that they should encompass resources representative of the total ecosystem, and which if compromised could endanger the research objectives of the Reserve. The term buffer zone refers to an area adjacent to or surrounding key land and water areas and essential to their integrity. Buffer zones protect the core area and provide additional protection for estuarine-dependent species, including those that are rare or endangered. When determined appropriate by the state and approved by NOAA, the buffer zone may also include an area necessary for facilities required for research and interpretation. Additionally, buffer zones should be established sufficient to accommodate a shift of the core area as a result of biological, ecological or geomorphological change which reasonably could be expected to occur. National Estuarine Research Reserves may include existing Federal or state lands already in a protected status where mutual benefit can be enhanced. However, NOAA will not approve a site for potential National Estuarine Research Reserve status that is dependent primarily upon the inclusion of currently protected Federal lands in order to meet the requirements for Reserve status (such as key land and water areas). Such lands generally will be included within a Reserve to serve as a buffer or for other ancillary purposes; and may be included, subject to NOAA approval, as a limited portion of the core area;

(4) The site's suitability for long-term estuarine research, including ecological factors and proximity to existing research facilities and educational institutions;

(5) The site's compatibility with existing and potential land and water uses in contiguous areas as well as approved coastal and estuarine management plans; and

(6) The site's importance to education and interpretive efforts, consistent with the need for continued protection of the natural system.

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

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

(1) An analysis of the proposed site(s) based on the biogeographical scheme/typology discussed in § 921.3 and set forth in appendices I and II;

(2) A description of the proposed site(s) and its (their) major resources, including location, proposed boundaries, and adjacent land uses. Maps are required;

(3) A description of the public participation process used by the state to solicit the views of interested parties, a summary of comments, and, if interstate issues are involved, documentation that the Governor(s) of the other affected state(s) has been contacted. Copies of all correspondence, including contact letters to all affected landowners must be appended;

(4) A list of all sites considered and a brief statement of the reasons why a site was not preferred; and

(5) A nomination of the proposed site(s) for designation as a National Estuarine Research Reserve by the Governor of the coastal state in which the state is located.

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

§ 921.12 Post site selection.

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

(1) A draft management plan outline (see § 921.13(a) below); and

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

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

§ 921.13 Management plan and environmental impact statement development.

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

(1) Reserve goals and objectives, management issues, and strategies or actions for meeting the goals and objectives;

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(2) An administrative plan including staff roles in administration, research, education/interpretation, and surveillance and enforcement;

(3) A research plan, including a monitoring design;

(4) An education/interpretive plan;

(5) A plan for public access to the Reserve;

(6) A construction plan, including a proposed construction schedule, general descriptions of proposed developments and general cost estimates. Information should be provided for proposed minor construction projects in sufficient detail to allow these projects to begin in the initial phase of acquisition and development. A categorical exclusion, environmental assessment, or EIS may be required prior to construction;

(7)(i) An acquisition plan identifying the ecologically key land and water areas of the Reserve, ranking these areas according to their relative importance, and including a strategy for establishing adequate long-term state control over these areas sufficient to provide protection for Reserve resources to ensure a stable environment for research. This plan must include an identification of ownership within the proposed Reserve boundaries, including land already in the public domain; the method(s) of acquisition which the state proposes to use - acquisition (including less-than-fee simple options) to establish adequate long-term state control; an estimate of the fair market value of any property interest - which is proposed for acquisition; a schedule estimating the time required to complete the process of establishing adequate state control of the proposed research reserve; and a discussion of any anticipated problems. In selecting a preferred method(s) for establishing adequate state control over areas within the proposed boundaries of the Reserve, the state shall perform the following steps for each parcel determined to be part of the key land and water areas (control over which is necessary to protect the integrity of the Reserve for research purposes), and for those parcels required for research and interpretive support facilities or buffer purposes:

(A) Determine, with appropriate justification, the minimum level of control(s) required [e.g., management agreement, regulation, less-than-fee simple property interest (e.g., conservation easement), fee simple property acquisition, or a combination of these approaches]. This does not preclude the future necessity of increasing the level of state control;

(B) Identify the level of existing state control(s);

(C) Identify the level of additional state control(s), if any, necessary to meet the minimum requirements identified in paragraph (a)(7)(i)(A) of this section;

(D) Examine all reasonable alternatives for attaining the level of control identified in paragraph (a)(7)(i)(C) of this section, and perform a cost analysis of each; and

(E) Rank, in order of cost, the methods (including acquisition) identified in paragraph (a)(7)(i)(D) of this section.

(ii) An assessment of the relative cost-effectiveness of control alternatives shall include a reasonable estimate of both short-term costs (e.g., acquisition of property interests, regulatory program development including associated enforcement costs, negotiation, adjudication, etc.) and long-term costs (e.g., monitoring, enforcement, adjudication, management and coordination). In selecting a preferred method(s) for establishing adequate state control over each parcel examined under the process described above, the state shall give priority consideration to the least costly method(s) of attaining the minimum level of long-term control required. Generally, with the possible exception of buffer areas required for support facilities, the level of control(s) required for buffer areas will be

considerably less than that required for key land and water areas. This acquisition plan, after receiving the approval of NOAA, shall serve as a guide for negotiations with landowners. A final boundary for the reserve shall be delineated as a part of the final management plan;

(8) A resource protection plan detailing applicable authorities, including allowable uses, uses requiring a permit and permit requirements, any restrictions on use of the research reserve, and a strategy for research reserve surveillance and enforcement of such use restrictions, including appropriate government enforcement agencies;

(9) If applicable, a restoration plan describing those portions of the site that may require habitat modification to restore natural conditions;

(10) If applicable, a resource manipulation plan, describing those portions of the Reserve buffer in which long-term pre-existing (prior to designation) manipulation for reasons not related to research or restoration is occurring. The plan shall explain in detail the nature of such activities, shall justify why such manipulation should be permitted to continue within the reserve buffer; and shall describe possible effects of this manipulation on key land and water areas and their resources;

(11) A proposed memorandum of understanding (MOU) between the state and NOAA regarding the Federal-state relationship during the establishment and development of the National Estuarine Research Reserve, and expressing a long-term commitment by the state to maintain and manage the Reserve in accordance with section 315 of the Act, 16 U.S.C. 1461, and applicable regulations. In conjunction with the MOU, and where possible under state law, the state will consider taking appropriate administrative or legislative action to ensure the long-term protection and operation of the National Estuarine Research Reserve. If other MOUs are necessary (such as with a Federal agency, another state agency or private organization), drafts of such MOUs must be included in the plan. All necessary MOU's shall be signed prior to Reserve designation; and

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

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

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

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

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Subpart C - Acquisition, Development and Preparation of the Final Management Plan

§ 921.20 General.

The acquisition and development period is separated into two major phases. After NOAA approval of the site, draft management plan and draft MOU, and completion of the final EIS, a coastal state is eligible for an initial acquisition and development award(s). In this initial phase, the state should work to meet the criteria required for formal research reserve designation; e.g., establishing adequate state control over the key land and water areas as specified in the draft management plan and preparing the final management plan. These requirements are specified in § 921.30. Minor construction in accordance with the draft management plan may also be conducted during this initial phase. The initial acquisition and development phase is expected to last no longer than three years. If necessary, a longer time period may be negotiated between the state and NOAA. After Reserve designation, a state is eligible for a supplemental acquisition and development award(s) in accordance with § 921.31. In this post-designation acquisition and development phase, funds may be used in accordance with the final management plan to construct research and educational facilities, complete any remaining land acquisition, for program development, and for restorative activities identified in the final management plan. In any case, the amount of Federal financial assistance provided to a coastal state with respect to the acquisition of lands and waters, or interests therein, for any one National Estuarine Research Reserve may not exceed an amount equal to 50 percent of the costs of the lands, waters, and interests therein or $5,000,000, whichever amount is less, except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of all actual costs of activities carrier out with this assistance, as long as such funds are available.

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

§ 921.21 Initial acquisition and development awards.

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

(1) Acquiring a fee simple or less-than-fee simple real property interest in land and water areas to be included in the Reserve boundaries (see § 921.13(a)(7); § 921.30(d));

(2) Minor construction, as provided in paragraphs (b) and (c) of this section;

(3) Preparing the final management plan; and

(4) Initial management costs, e.g., for implementing the NOAA approved draft management plan, hiring a Reserve manager and other staff as necessary and for other management-related activities. Application procedures are specified in subpart I.

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

(c) Only minor construction activities that aid in implementing portions of the management plan (such as boat ramps and nature trails) are permitted during the initial acquisition and development phase. No more than five (5) percent of the initial acquisition and development award may be expended on such

activities. NOAA must make a specific determination, based on the final EIS, that the construction activity will not be detrimental to the environment.

(d) Except as specifically provided in paragraphs (a) through (c) of this section, construction projects, to be funded in whole or in part under an acquisition and development award(s), may not be initiated until the Reserve receives formal designation (see § 921.30). This requirement has been adopted to ensure that substantial progress in establishing adequate state control over key land and water areas has been made and that a final management plan is completed before major sums are spent on construction. Once substantial progress in establishing adequate state control/acquisition has been made, as defined by the state in the management plan, other activities guided by the final management plan may begin with NOAA's approval.

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

(1) Title to the property conveyed by this deed shall vest in the [recipient of the award granted pursuant to section 315 of the Act, 16 U.S.C. 1461 or other NOAA approved state agency] subject to the condition that the designation of the [name of National Estuarine Reserve] is not withdrawn and the property remains part of the federally designated [name of National Estuarine Research Reserve]; and

(2) In the event that the property is no longer included as part of the Reserve, or if the designation of the Reserve of which it is part is withdrawn, then NOAA or its successor agency, after full and reasonable consultation with the State, may exercise the following rights regarding the disposition of the property:

(i) The recipient may retain title after paying the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the current fair market value of the property;

(ii) If the recipient does not elect to retain title, the Federal Government may either direct the recipient to sell the property and pay the Federal Government an amount computed by applying the Federal percentage of participation in the cost of the original project to the proceeds from the sale (after deducting actual and reasonable selling and repair or renovation expenses, if any, from the sale proceeds), or direct the recipient to transfer title to the Federal Government. If directed to transfer title to the Federal Government, the recipient shall be entitled to compensation computed by applying the recipient's percentage of participation in the cost of the original project to the current fair market value of the property; and

(iii) Fair market value of the property must be determined by an independent appraiser and certified by a responsible official of the state, as provided by Department of Commerce regulations at 15 CFR part 24, and Uniform Relocation Assistance and Real Property Acquisition for Federal and Federally assisted programs at 15 CFR part 11.

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

(g) Federal funds or non-Federal matching share funds shall not be spent to acquire a real property interest in which the state will own the land concurrently with another entity unless the property interest has been identified as a part of an acquisition strategy pursuant to § 921.13(7) which has been approved by NOAA prior to the effective date of these regulations.

(h) Prior to submitting the final management plan to NOAA for review and approval, the state shall hold a public meeting to receive comment on the plan in the area affected by the estuarine research reserve.

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NOAA will publish a notice of the meeting in the Federal Register at least 15 days prior to the public meeting. The state shall be responsible for having a similar notice published in the local newspaper(s).

Subpart D - Reserve Designation and Subsequent Operation

§ 921.30 Designation of National Estuarine Research Reserves.

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

(1) The area is a representative estuarine ecosystem that is suitable for long-term research and contributes to the biogeographical and typological balance of the System;

(2) Key land and water areas of the proposed Reserve, as identified in the management plan, are under adequate state control sufficient to provide long-term protection for reserve resources to ensure a stable environment for research;

(3) Designation of the area as a Reserve will serve to enhance public awareness and understanding of estuarine areas, and provide suitable opportunities for public education and interpretation;

(4) A final management plan has been approved by NOAA;

(5) An MOU has been signed between the state and NOAA ensuring a long-term commitment by the state to the effective operation and implementation of the area as a National Estuarine Research Reserve;

(6) All MOU's necessary for reserve management (i.e., with relevant Federal, state, and local agencies and/or private organizations) have been signed; and

(7) The coastal state in which the area is located has complied with the requirements of subpart B.

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

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

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

§ 921.31 Supplemental acquisition and development awards.

After National Estuarine Research Reserve designation, and as specified in the approved management plan, a coastal state may request a supplemental acquisition and/or development award(s) for acquiring additional property interests identified in the management plan as necessary to strengthen protection of key land and water areas and to enhance long-term protection of the area for research and

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

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

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

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

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

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

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

(1) Eligible coastal state agencies may apply for up to the maximum share available per Reserve for that fiscal year. Share amounts will be announced annually by letter from the Sanctuary and Reserves Division to all participating states. This letter will be provided as soon as practicable following approval of the Federal budget for that fiscal year.

(2) No more than ten percent of the total amount (state and Federal shares) of each operation and management award may be used for construction-type activities.

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

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

(a) Changes in the boundary of a Reserve and major changes to the final management plan, including state laws or regulations promulgated specifically for the Reserve, may be made only after written approval by NOAA. NOAA may require public notice, including notice in the Federal Register and an opportunity for public comment before approving a boundary or management plan change. Changes in the boundary of a Reserve involving the acquisition of properties not listed in the management plan or final EIS require public notice and the opportunity for comment; in certain cases, a categorical exclusion, an environmental assessment and possibly an environmental impact statement may be required. NOAA will place a notice in the Federal Register of any proposed changes in Reserve boundaries or proposed major changes to the final management plan. The state shall be responsible for publishing an equivalent notice in the local media. See also requirements of §§ 921.4(b) and 921.13(a)(11).

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

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

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

Subpart E - Ongoing Oversight, Performance Evaluation and Withdrawal of Designation

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

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

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

(1) Inadequate implementation of required staff roles in administration, research, education/interpretation, and surveillance and enforcement. Indicators of inadequate implementation could include: No Reserve Manager, or no staff or insufficient staff to carry out the required functions.

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(2) Inadequate implementation of the required research plan, including the monitoring design. Indicators of inadequate implementation could include: Not carrying out research or monitoring that is required by the plan, or carrying out research or monitoring that is inconsistent with the plan.

(3) Inadequate implementation of the required education/interpretation plan. Indicators of inadequate implementation could include: Not carrying out education or interpretation that is required by the plan, or carrying out education/interpretation that is inconsistent with the plan.

(4) Inadequate implementation of public access to the Reserve. Indicators of inadequate implementation of public access could include: Not providing necessary access, giving full consideration to the need to keep some areas off limits to the public in order to protect fragile resources.

(5) Inadequate implementation of facility development plan. Indicators of inadequate implementation could include: Not taking action to propose and budget for necessary facilities, or not undertaking necessary construction in a timely manner when funds are available.

(6) Inadequate implementation of acquisition plan. Indicators of inadequate implementation could include: Not pursuing an aggressive acquisition program with all available funds for that purpose, not requesting promptly additional funds when necessary, and evidence that adequate long-term state control has not been established over some core or buffer areas, thus jeopardizing the ability to protect the Reserve site and resources from offsite impacts.

(7) Inadequate implementation of Reserve protection plan. Indicators of inadequate implementation could include: Evidence of non-compliance with Reserve restrictions, insufficient surveillance and enforcement to assure that restrictions on use of the Reserve are adhered to, or evidence that Reserve resources are being damaged or destroyed as a result of the above.

(8) Failure to carry out the terms of the signed Memorandum of Understanding (MOU) between the state and NOAA, which establishes a long-term state commitment to maintain and manage the Reserve in accordance with section 315 of the Act. Indicators of failure could include: State action to allow incompatible uses of state-controlled lands or waters in the Reserve, failure of the state to bear its fair share of costs associated with long-term operation and management of the Reserve, or failure to initiate timely updates of the MOU when necessary.

§ 921.41 Withdrawal of designation.

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

Subpart F - Special Research Projects

§ 921.50 General.

(a) To stimulate high quality research within designated National Estuarine Research Reserves, NOAA may provide financial support for research projects which are consistent with the Estuarine Research Guidelines referenced in § 921.51. Research awards may be awarded under this subpart to only those designated Reserves with approved final management plans. Although research may be conducted within the immediate watershed of the Reserve, the majority of research activities of any single research project funded under this subpart may be conducted within Reserve boundaries. Funds provided under this subpart are primarily used to support management-related research projects that will enhance scientific understanding of the Reserve ecosystem, provide information needed by Reserve management and coastal management decision-makers, and improve public awareness and

understanding of estuarine ecosystems and estuarine management issues. Special research projects may be oriented to specific Reserves; however, research projects that would benefit more than one Reserve in the National Estuarine Reserve Research System are encouraged.

(b) Funds provided under this subpart are available on a competitive basis to any coastal state or qualified public or private person. A notice of available funds will be published in the Federal Register. Special research project funds are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with § 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs.

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

§ 921.51 Estuarine research guidelines.

(a) Research within the National Estuarine Research Reserve System shall be conducted in a manner consistent with Estuarine Research Guidelines developed by NOAA.

(b) A summary of the Estuarine Research Guidelines is published in the Federal Register as a part of the notice of available funds discussed in § 921.50(c).

(c) The Estuarine Research Guidelines are reviewed annually by NOAA. This review will include an opportunity for comment by the estuarine research community.

§ 921.52 Promotion and coordination of estuarine research.

(a) NOAA will promote and coordinate the use of the National Estuarine Research Reserve System for research purposes.

(b) NOAA will, in conducting or supporting estuarine research other than that authorized under section 315 of the Act, give priority consideration to research that make use of the National Estuarine Research Reserve System.

(c) NOAA will consult with other Federal and state agencies to promote use of one or more research reserves within the National Estuarine Research Reserve System when such agencies conduct estuarine research.

Subpart G - Special Monitoring Projects

§ 921.60 General.

(a) To provide a systematic basis for developing a high quality estuarine resource and ecosystem information base for National Estuarine Research Reserves and, as a result, for the System, NOAA may provide financial support for basic monitoring programs as part of operations and management under § 921.32. Monitoring funds are used to support three major phases of a monitoring program:

(1) Studies necessary to collect data for a comprehensive site description/characterization;

(2) Development of a site profile; and

(3) Formulation and implementation of a monitoring program.

(b) Additional monitoring funds may be available on a competitive basis to the state agency responsible for Reserve management or a qualified public or private person or entity. However, if the applicant is other than the managing entity of a Reserve that applicant must submit as a part of the application a

letter from the Reserve manager indicating formal support of the application by the managing entity of the Reserve. Funds provided under this subpart for special monitoring projects are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with § 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs.

(c) Monitoring projects funded under this subpart must focus on the resources within the boundaries of the Reserve and must be consistent with the applicable sections of the Estuarine Research Guidelines referenced in § 921.51. Portions of the project may occur within the immediate watershed of the Reserve beyond the site boundaries. However, the monitoring proposal must demonstrate why this is necessary for the success of the project.

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

Subpart H - Special Interpretation and Education Projects

§ 921.70 General.

(a) To stimulate the development of innovative or creative interpretive and educational projects and materials to enhance public awareness and understanding of estuarine areas, NOAA may fund special interpretive and educational projects in addition to those activities provided for in operations and management under § 921.32. Special interpretive and educational awards may be awarded under this subpart to only those designated Reserves with approved final management plans.

(b) Funds provided under this subpart may be available on a competitive basis to any state agency. However, if the applicant is other than the managing entity of a Reserve, that applicant must submit as a part of the application a letter from the Reserve manager indicating formal support of the application by the managing entity of the Reserve. These funds are provided in addition to any other funds available to a coastal state under the Act. Federal funds provided under this subpart may not exceed 70 percent of the total cost of the project, consistent with § 921.81(e)(4) ("allowable costs"), except when the financial assistance is provided from amounts recovered as a result of damage to natural resources located in the coastal zone, in which case the assistance may be used to pay 100 percent of the costs.

(c) Applicants for education/interpretive projects that NOAA determines benefit the entire National Estuarine Research Reserve System may receive Federal assistance of up to 100% of project costs.

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

Subpart I - General Financial Assistance Provisions

§ 921.80 Application information.

(a) Only a coastal state may apply for Federal financial assistance awards for preacquisition, acquisition and development, operation and management, and special education and interpretation projects under subpart H. Any coastal state or public or private person may apply for Federal financial assistance awards for special estuarine research or monitoring projects under subpart G. The announcement of opportunities to conduct research in the System appears on an annual basis in the Federal Register. If a state is participating in the national Coastal Zone Management Program, the applicant for an award under section 315 of the Act shall notify the state coastal management agency regarding the application.

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(b) An original and two copies of the formal application must be submitted at least 120 working days prior to the proposed beginning of the project to the following address: Sanctuaries and Reserves Division Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration, 1825 Connecticut Avenue, NW., suite 714, Washington, DC 20235. Application for Federal Assistance Standard Form 424 (Non-construction Program) constitutes the formal application for site selection, post-site selection, operation and management, research, and education and interpretive awards. The Application for Federal Financial Assistance Standard Form 424 (Construction Program) constitutes the formal application for land acquisition and development awards. The application must be accompanied by the information required in subpart B (predesignation), subpart C and § 921.31 (acquisition and development), and § 921.32 (operation and management) as applicable. Applications for development awards for construction projects, or restorative activities involving construction, must include a preliminary engineering report, a detailed construction plan, a site plan, a budget and categorical exclusion check list or environmental assessment. All applications must contain back up data for budget estimates (Federal and non-Federal shares), and evidence that the application complies with the Executive Order 12372, "Intergovernmental Review of Federal Programs." In addition, applications for acquisition and development awards must contain:

(1) State Historic Preservation Office comments;

(2) Written approval from NOAA of the draft management plan for initial acquisition and development award(s); and

(3) A preliminary engineering report for construction activities.

§ 921.81 Allowable costs.

(a) Allowable costs will be determined in accordance with applicable OMB Circulars and guidance for Federal financial assistance, the financial assistant agreement, these regulations, and other Department of Commerce and NOAA directives. The term "costs" applies to both the Federal and non-Federal shares.

(b) Costs claimed as charges to the award must be reasonable, beneficial and necessary for the proper and efficient administration of the financial assistance award and must be incurred during the award period.

(c) Costs must not be allocable to or included as a cost of any other Federally-financed program in either the current or a prior award period.

(d) General guidelines for the non-Federal share are contained in Department of Commerce Regulations at 15 CFR part 24 and OMB Circular A-110. Copies of Circular A-110 can be obtained from the Sanctuaries and Reserves Division; 1825 Connecticut Avenue, NW., suite 714; Washington, DC 20235. The following may be used in satisfying the matching requirement:

(1) Site selection and post site selection awards. Cash and in-kind contributions (value of goods and services directly benefiting and specifically identifiable to this part of the project) are allowable. Land may not be used as match.

(2) Acquisition and development awards. Cash and in-kind contributions are allowable. In general, the fair market value of lands to be included within the Reserve boundaries and acquired pursuant to the Act, with other than Federal funds, may be used as match. However, the fair market value of real property allowable as match is limited to the fair market value of a real property interest equivalent to, or required to attain, the level of control over such land(s) identified by the state and approved by the Federal Government as that necessary for the protection and management of the National Estuarine

Research Reserve. Appraisals must be performed according to Federal appraisal standards as detailed in Department of Commerce regulations at 15 CFR part 24 and the Uniform Relocation Assistance and Real Property Acquisition for Federal land Federally assisted programs in 15 CFR part 11. The fair market value of privately donated land, at the time of donation, as established by an independent appraiser and certified by a responsible official of the state, pursuant to 15 CFR part 11, may also be used as match. Land, including submerged lands already in the state's possession, may be used as match to establish a National Estuarine Research Reserve. The value of match for these state lands will be calculated by determining the value of the benefits foregone by the state, in the use of the land, as a result of new restrictions that may be imposed by Reserve designation. The appraisal of the benefits foregone must be made by an independent appraiser in accordance with Federal appraisal standards pursuant to 15 CFR part 24 and 15 CFR part 11. A state may initially use as match land valued at greater than the Federal share of the acquisition and development award. The value in excess of the amount required as match for the initial award may be used to match subsequent supplemental acquisition and development awards for the National Estuarine Research Reserve (see also § 921.20). Costs related to land acquisition, such as appraisals, legal fees and surveys, may also be used as match.

(3) Operation and management awards. Generally, cash and in-kind contributions (directly benefiting and specifically identifiable to operations and management), except land, are allowable.

(4) Research, monitoring, education and interpretive awards. Cash and in-kind contributions (directly benefiting and specifically identifiable to the scope of work), except land, are allowable.

§ 921.82 Amendments to financial assistance awards.

Actions requiring an amendment to the financial assistance award, such as a request for additional Federal funds, revisions of the approved project budget or original scope of work, or extension of the performance period must be submitted to NOAA on Standard Form 424 and approved in writing.

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Appendix 2: List of Graduate Research Fellows and Davidson Fellows since designation in 1999

Grand Bay NERR Graduate Research Fellows (pre-2012) and Margaret A. Davidson Fellows (2020-present)

Graduate Research Fellows:

2001-2002: Guillermo Sanchez, University of Southern Mississippi. Habitat mapping of oyster resources and submerged vegetation for the Grand Bay National Estuarine Research Reserve, Mississippi.

2002: Donna Drury, University of Southern Mississippi. Effects of invertebrate grazer density manipulations on wigeongrass, Ruppia maritima, exposed to nutrient enrichment.

2003: Virginia Shervette, Texas A&M University. Assessment of essential fish habitats in Grand Bay as nurseries for economically important fishes: tools for management and conservation.

2004-2005: Zhijun Lui, Mississippi State University. Guidelines for the development of a Grand Bay hydrology and water quality simulation model: Criteria and data assessments.

2004-2006: Megan Hughes, University of Southern Mississippi. Assessing the value of coastal hammocks as stopover habitat for passerine migrants: Habitat selection and resource acquisition on the Grand Bay NERR.

2006-2007: Gabe Langford, University of Nebraska. Parasite biodiversity of amphibians and reptiles from the Grand Bay NERR.

2007-2008: Scott Rush, University of Georgia. Ecology of Mississippi's tidal marsh birds: Perspectives gained through the application of surveys, telemetry and ecological tracers.

2008: Becca Cripps, University of Alabama. Reconstruction of vegetation history and accretion rates in coastal marshes: Understanding past responses to sea-level rise at Grand Bay.

2009-2010: Christina Nica, Jackson State University. Ecological modeling of potential habitat for submerged aquatic vegetation at Grand Bay National Estuarine Research Reserve, Mississippi.

2011-2012: Jessica Dean Carrier, University of South Alabama. Differences in Herbivore Pressure Across Northern Gulf of Mexico Salt Marsh Habitats.

2011-2014: Adam Chupp, Southern Illinois University at Carbondale. Multi-trophic consequences of an emerging disease: sources of functional redundancy and ecosystem resilience.

2011-2014: Kelly Darnell, University of Texas at Austin. Assessing reproductive dynamics of four dominant seagrass species in the Mission Aransas and Grand Bay National Estuarine Research Reserves for development of effective conservation and management strategies.

Davidson Fellows:

2020-2022: Matt Virden, Mississippi State University. Evaluating the Effectiveness of Restoration Approaches for Nearshore Habitat.

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Appendix 3: List of Peer-Reviewed Journal Articles and Theses Resulting from Research at GNDNERR

1. Abbott, M. J. (2017). Conditions Responsible for the Success of Carnivorous Plants in Nutrient-Poor Wetlands [Ph.D. Dissertation, The University of Mississippi]. https://www.proquest.com/docview/1925634275/abstract/3DE88247D4A94DC7PQ/95
2. Akpovo, C., Martinez Jr., J. A., Lewis, D., Branch, J., Schroeder, A., Edington, M., & Johnson, L. (2013). Regional discrimination of oysters using laser-induced breakdown spectroscopy. Analytical Methods, 5. https://doi.org/10.1039/C3AY40491A
3. Alizad, K., Hagen, S. C., Medeiros, S. C., Bilskie, M. V., Morris, J. T., Balthis, L., & Buckel, C. A. (2018). Dynamic responses and implications to coastal wetlands and the surrounding regions under sea level rise. PLOS ONE, 13(10), e0205176. https://doi.org/10.1371/journal.pone.0205176
4. Alizad, K., Medeiros, S. C., Foster-Martinez, M. R., & Hagen, S. C. (2020). Model Sensitivity to Topographic Uncertainty in Meso- and Microtidal Marshes. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 13, 807–814. https://doi.org/10.1109/JSTARS.2020.2973490
5. Allen, L. (2015). Spatiotemporal Patterns in Biomarkers of Polycyclic Aromatic Hydrocarbon (PAH) Exposure in Livers and Bile of Fish from the Northern Gulf of Mexico after the Deepwater Horizon Oil Spill [Ph.D. Dissertation, Florida Agricultural and Mechanical University]. https://www.proquest.com/docview/2054278545/abstract/3DE88247D4A94DC7PQ/72
6. Amacker, K. S. (2013). Comparison of nutrient and light limitation in three Gulf of Mexico Estuaries [Master's Thesis]. University of West Florida.
7. Archer, M. J., Pitchford, J. L., Biber, P., & Underwood, W. (2021). Assessing Vegetation, Nutrient Content and Soil Dynamics Along a Coastal Elevation Gradient in a Mississippi Estuary. Estuaries and Coasts. https://doi.org/10.1007/s12237-021-01012-2
8. Baine, G. C. (2017). Effects of Nutrient Input and Microzooplankton Grazing on Phytoplankton Productivity in the Grand Bay Estuary, Mississippi [Master's Thesis]. University of West Florida.
9. Beck, M. W., Cressman, K., Griffin, C., & Caffrey, J. (2018). Water Quality Trends Following Anomalous Phosphorus Inputs to Grand Bay, Mississippi, USA. Gulf and Caribbean Research, 29(1), 1–14. https://doi.org/10.18785/gcr.2901.02
10. Blackburn, B. R. (2000). The effects of industrial and cultural development on phytoplankton community dynamics within three bayou systems of Jackson County, Mississippi [Master's Thesis]. University of Southern Mississippi.
11. Boswell, C. G. (2005). Nitrogen economy of the purple pitcher plant, Sarracenia purpurea L., in the Gulf of Mexico coastal plain [Ph.D. Dissertation, Tulane University]. https://www.proquest.com/docview/305391217/abstract/B293D0F516094E8CPQ/25
12. Braswell, A. E. (2010). The interactive effects of hurricanes and fire on plant productivity, accretion and elevation of a saltwater marsh at Grand Bay NERR, Mississippi [Master's Thesis]. University of Alabama.

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13. Braswell, A. E., May, C. A., & Cherry, J. A. (2019). Spatially-dependent patterns of plant recovery and sediment accretion following multiple disturbances in a Gulf Coast tidal marsh. Wetlands Ecology & Management, 27(2/3), 377–392. https://doi.org/10.1007/s11273-019-09666-3
14. Caffrey, J. M., Murrell, M. C., Amacker, K. S., Harper, J. W., Phipps, S., & Woodrey, M. S. (2014). Seasonal and Inter-annual Patterns in Primary Production, Respiration, and Net Ecosystem Metabolism in Three Estuaries in the Northeast Gulf of Mexico. Estuaries and Coasts, 37(1), 222–241. https://doi.org/10.1007/s12237-013-9701-5
15. Carrier, J. M. (2013). Differences in herbivore pressure across northern Gulf of Mexico salt marsh habitats [Master's Thesis]. University of South Alabama.
16. Carrier, J., Sparks, E. L., Woodrey, M. S., Cebrian, J., & Boettcher, A. (2020). Small-scale variation in herbivore abundance and grazing on Juncus roemerianus dominated salt marshes. Wetlands Ecology and Management, 28(6), 983–991. https://doi.org/10.1007/s11273-020-09755-8
17. Chen, Y. (2011). Relationship between coastal vegetation biomass with elevation and salinity gradients [Master's Thesis, The University of Mississippi]. https://www.proquest.com/docview/905163048/abstract/B293D0F516094E8CPQ/15
18. Cho, H. J., & Biber, P. D. (2010). Seed Propagation Protocol for Wigeongrass (Ruppia maritima) (Mississippi). Ecological Restoration, 28(2), 135–137.
19. Cho, H. J., & Biber, P. D. (2016). Habitat Characterization for Submerged and Floating-Leaved Aquatic Vegetation in Coastal River Deltas of Mississippi and Alabama. Southeastern Geographer, 56(4), 454–472. https://doi.org/10.1353/sgo.2016.0046
20. Cho, H. J., Biber, P. D., Darnell, K. M., & Dunton, K. H. (2017). Seasonal and Annual Dynamics in Seagrass Beds of the Grand Bay National Estuarine Research Reserve, Mississippi. Southeastern Geographer, 57(3), 246–272. https://doi.org/10.1353/sgo.2017.0024
21. Cho, H. J., & May, C. (2008). Short-term Spatial Variations in the Beds of Ruppia maritima (Ruppiaceae) and Halodule wrightii (Cymodoceaceae) at Grand Bay National Estuarine Research Reserve, Mississippi, USA. Journal of the Mississippi Academy of Sciences, 53, 133–145.
22. Chupp, A. D. (2015). Predicting multi-trophic consequences of an emerging disease [Ph.D. Dissertation]. Southern Illinois University at Carbondale.
23. Chupp, A. D., & Battaglia, L. L. (2014). Potential for host shifting in Papilio palamedes following invasion of laurel wilt disease. Biological Invasions, 16(12), 2639–2651. https://doi.org/10.1007/s10530-014-0693-2
24. Chupp, A. D., & Battaglia, L. L. (2017). Sprouting capacity of Persea borbonia and maritime forest community response to simulated laurel wilt disease. Plant Ecology, 218(4), 447–457. https://doi.org/10.1007/s11258-017-0702-5
25. Chupp, A. D., Battaglia, L. L., Schauber, E. M., & Sipes, S. D. (2015). Orchid–pollinator interactions and potential vulnerability to biological invasion. AoB PLANTS, 7(plv099), Article plv099. https://doi.org/10.1093/aobpla/plv099
26. Cimprich, D. A., Woodrey, M. S., & Moore, F. R. (2005). Passerine migrants respond to variation in predation risk during stopover. Animal Behaviour, 69(5), 1173–1179. https://doi.org/10.1016/j.anbehav.2004.07.021

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27. Cohen, E. B., Barrow, W. C., Buler, J. J., Deppe, J. L., Farnsworth, A., Marra, P. P., McWilliams, S. R., Mehlman, D. W., Wilson, R. R., Woodrey, M. S., & Moore, F. R. (2017). How do en route events around the Gulf of Mexico influence migratory landbird populations? The Condor, 119(2), 327–343. https://doi.org/10.1650/CONDOR-17-20.1
28. Comyns, B. H., Rakocinski, C. F., Peterson, M. S., & Shiller, A. M. (2008). Otolith chemistry of juvenile spotted seatrout Cynoscion nebulosus reflects local natal regions of coastal Mississippi, USA. Marine Ecology Progress Series, 371, 243–252. https://doi.org/10.3354/meps07604
29. Conroy, M. J., Cooper, R. J., Rush, S. A., Stodola, K. W., Nuse, B. L., & Woodrey, M. S. (2010). Effective use of Data from Marshbird Monitoring Programs for Conservation Decision-Making. Waterbirds, 33(3), 397–404. https://doi.org/10.1675/063.033.0318
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31. Cripps, R. M. (2009). Past responses to climate change: Reconstruction of vegetation histories in three brackish marshes [Master's Thesis]. University of Alabama.
32. Dailey, M. (2012). Temporal and Spatial Assessment of PAHs in Water, Sediment, and Oysters as a Result of the Deepwater Horizon Oil Spill [Master's Thesis, The University of Mississippi]. https://www.proquest.com/docview/1095358498/abstract/3DE88247D4A94DC7PQ/79
33. Darrow, E. S. (2015). Biogeochemical and microbial indicators of land-use change in a Northern Gulf of Mexico Estuary [Ph.D. Dissertation]. University of South Alabama.
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39. Drury, D. M. (2004). Effects of grass shrimp (Palaemonetes spp.) density manipulations and nutrient enrichment on widgeongrass (Ruppia maritima) condition, epiphyte load, and epiphyte functional groups [Ph.D. Dissertation, The University of Southern Mississippi]. https://www.proquest.com/docview/305122840/abstract/3DE88247D4A94DC7PQ/81
40. Ehmen, B. W. (2012). Seagrass abundance and population structure in Grand Bay National Estuarine Research Reserve, Mississippi [Master's Thesis]. University of South Alabama.

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43. Ennis, B., Peterson, M. S., & Strange, T. P. (2014). Modeling of Inundation Characteristics of a Microtidal Saltmarsh, Grand Bay National Estuarine Research Reserve, Mississippi. Journal of Coastal Research, 30(3), 635–646. https://doi.org/10.2112/JCOASTRES-D-13-00041.1
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53. Formby, J. P., Krishnan, N., & Riggins, J. J. (2013). Supercooling in the Redbay Ambrosia Beetle (Coleoptera: Curculionidae). Florida Entomologist, 96(4), 1530–1540. https://doi.org/10.1653/024.096.0435
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58. Grigas, D., Lehrter, J., Cebrian, J., Chen, Y., Ehmen, B., & Woodrey, M. (2015). Effects of Stormwater Pipe Size and Rainfall on Sediment and Nutrients Delivered to a Coastal Bayou. Water Environment Research, 87(9), 796–804. https://doi.org/10.2175/106143015X14362865226275
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61. Hendon, J. R. (2013). Habitat characterization, habitat use and associated growth of juvenile spotted seatrout (Cynoscion nebulosus) in a Mississippi bay system: Implications for stock enhancement practices [Ph.D. Dissertation]. The University of Southern Mississippi.
62. Hilbert, K. W. (2006). Land Cover Change within the Grand Bay National Estuarine Research Reserve: 1974–2001. Journal of Coastal Research, 2006(226), 1552–1557. https://doi.org/10.2112/05-0582.1
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66. Jeon, B. (2021). Application of Passive Air Samplers for Atmospheric Research, and Determination of Metals in Tree Rings and Marine Sapropel by ICP-MS [Ph.D. Dissertation, The University of Mississippi]. https://www.proquest.com/docview/2585827010/abstract/10A08A5D6B72466CPQ/1
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Appendix 4: Full List of GNDNERR CTP Partners

Mississippi Department of Marine Resources

NOAA's Office of Coastal Management and Digital Coast

USFWS Grand Bay and Sandhill Crane National Wildlife Refuge

Mississippi Department of Environmental Quality

Gulf of Mexico Alliance

Gulf Coast NERRS – Weeks Bay, Mission-Aransas, Apalachicola, Rookery Bay

Mississippi State University – Dr. Eric Sparks, Renee Collini, David Perks

Southern Illinois University – Dr. Loretta Battaglia

University of Alabama – Dr. Julia Cherry

University of Southern Mississippi – Dr. Wei Wu

U.S. Coast Guard

U.S. Forest Service

MS-AL Sea Grant – Tracie Sempier, Stephen Deal

Mississippi and Florida Chapter Association of Floodplain Managers

Wildlife Mississippi

The Nature Conservancy – Tom Mohrman

USGS Wetlands & Aquatics Research Center – Beth Middleton

Christian Preus Landscape Architecture – Oliver Preus

Hal Needham Marine Weather and Climate LLC

Nature's Notebook Phenology Network, University of Arizona

Pascagoula River Audubon Center

Chevron Pascagoula Refinery

Chemours Delisle Plant

Jackson County

City of Ocean Springs – Ocean Springs Environmental Committee

City of Moss Point

City of Pascagoula

South Alabama Flood Engagement Team (SAFE-T)

South Alabama Regional Planning Commission

Longleaf Wilderness Medicine

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Appendix 5: List of CTP Advisory Committee Members, Roles and Responsibilities

Member	**Affiliation**	**Responsibilities**
Mike Shelton, Coastal Training Coordinator	Weeks Bay NERR	Mentoring, Program Development
Ann Weaver (retired), Training and Development Coordinator	NOAA/NMFS	Meeting Facilitation
Dale Shirley, Chevron	Chevron	Industry Perspective
Carolyn Martin, City Planner and Grants Administrator	City of Ocean Springs	Municipal codes & Process
*Del Schwalls, Director of Region 4 ASFPM**	*Schwalls Consulting, LLC*	*CRS/NFIP/Elevation Certificates*
**pending*		

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Appendix 6: Memorandum of Agreement (MOU) between NOAA and MDMR

(forthcoming)

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Appendix 7: MOU between MDMR and SOS for Management of State Held Properties at GNDNERR

STATE OF MISSISSIPPI
Tate Reeves
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
Joe Spraggins, Executive Director

EXTENSION OF MEMORANDUM OF UNDERSTANDING

BETWEEN THE

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES

AND

MISSISSIPPI SECRETARY OF STATE

FOR THE MANAGEMENT OF STATE HELD PROPERTIES AT GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE

MOU-MSOS-NERR-01

The Memorandum of Understanding ("MOU") between the Mississippi Department of Marine Resources ("MDMR"), and the Mississippi Secretary of State ("MSOS") for the management of state held properties located at the Grand Bay National Estuarine Research Reserve ("GBNERR") and entered April 9, 2019 is hereby extended by the MDMR and MSOS for a period of one year to April 9, 2021. All other terms and conditions of the MOU entered on April 9, 2019, remain in full effect.

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES

Joe Spraggins, Executive Director — Date: 3-12-2020

MISSISSIPPI SECRETARY OF STATE

Michael D. Watson, Jr., Secretary of State — Date: 4/22/2020

Appendix 8: MOU between GNDNERR and Friends of the Grand Bay NERR

STATE OF MISSISSIPPI
Tate Reeves
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
Joe Spraggins, Executive Director

MEMORANDUM OF UNDERSTANDING BETWEEN THE MISSISSIPPI DEPARTMENT OF MARINE RESOURCES AND FRIENDS OF THE GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE

This Memorandum of Understanding (MOU) is between the Mississippi Department of Marine Resources (MDMR), and Friends of the Grand Bay National Research Reserve (hereinafter "FGBNERR").

BACKGROUND

The MDMR manages the Grand Bay National Estuarine Research Reserve (hereinafter "NERR") as part of the National Oceanic and Atmospheric Administration's Office for Coastal Management. The mission of the Reserve is to practice and promote informed stewardship of the Grand Bay NERR and Mississippi coastal resources through innovative research, education and training.

The FGBNERR is a Mississippi non-profit corporation focused on engaging local and regional citizens and communities about the value of the Reserve and the work that it does to support conservation and stewardship of estuarine environments, locally and regionally. It is dedicated to promoting and supporting the vision and mission of the NERR through activities as requested by the MDMR.

DESCRIPTION OF COOPERATIVE EFFORT

The MDMR and the FGBNERR, each respectively, understand the need to promote a strong partnership to enhance the NERR's research, education and stewardship capabilities locally and regionally.

The FGBNERR agrees to assist the NERR by providing a pool of available volunteers to assist

with events and programs, participate in limited fund raising through the printing and selling of promotional items approved by the MDMR, and assist with projects that enhance the NERR facilities and/or capabilities. The FGBNERR also agrees to sponsor food services at events mutually agreed upon, in advance, by both parties. These activities will be provided voluntarily by the FGBNERR at no cost to the MDMR.

TERMS OF AGREEMENT

This agreement shall remain valid unless cancelled by one of the parties in writing. Either party may terminate this agreement by giving a 30-day written notice to the other party. This agreement may be modified by the parties if agreed to in writing.

INDEMNIFICATION

To the fullest extent allowed by law, FGBNERR shall indemnify, defend, save and hold harmless, protect, and exonerate the MDMR, its commissioners, board members, officers, employees, agents, and representatives, and the State of Mississippi from and against all claims, demands, liabilities, suits, actions, damages, losses, and costs of every kind and nature whatsoever including, without limitation, court costs, investigative fees and expenses, and attorney's fees, arising out of or caused by FGBNERR and/or its partners, principals, agents, employees and/or subcontractors in the performance of this agreement.

SEVERABILITY

If any term or provision of this agreement is prohibited by the laws of the State of Mississippi or declared invalid or void by a court of competent authority, the remainder of this agreement shall not be affected thereby and each term and provision of this agreement shall be valid and enforceable to the fullest extent permitted by law.

COMPLIANCE WITH LAWS

This agreement shall be governed by and construed in accordance with the laws of the State of Mississippi, excluding its conflicts of laws provisions, and any litigation with respect thereto shall be brought in the state courts of Harrison County, Mississippi.

ENTIRE AGREEMENT

This agreement constitutes the entire agreement of the parties with respect to the subject matter contained herein and supersedes and replaces all prior negotiations, understandings, and agreements, written or oral, between the parties relating hereto.

NO THIRD-PARTY BENEFICIARIES

This agreement is for the sole benefit of the parties and nothing herein, express, or implied, is intended to or shall confer upon any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever, under or by reason of this agreement.

NOTICES

All notices required or permitted to be given under this agreement must be in writing and personally delivered or sent by Certified United States mail, postage prepaid, return receipt requested, to the party to whom the notice should be given at the address set forth below. Notice shall be deemed given when received or when refused. The parties agree to promptly notify each other in writing of any change of address.

For the MDMR:
Dr. Ayesha Gray, Director
6005 Bayou Heron Road
Moss Point, MS 39562
ayesha.gray@dmr.ms.gov

For the FGBNERR
Dale Shirley, Incorporator
250 Industrial Road
Pascagoula, MS 39581
DShirley@chevron.com

AUTHORITY

The parties hereby represent and warrant that the execution of this agreement has been duly authorized by the requisite authorities and the parties, and that this agreement will be valid and legally binding upon the parties and enforceable in accordance with its terms when executed and delivered.

Joe Spraggins, Executive Director
Mississippi Department of Marine Resources

5-20-2021
Date

Dale Shirley, Incorporator
Friends of the Grand Bay Estuarine Research Reserve

5-18-21
Date

Appendix 9: GNDNERR Disaster Response Plan 2013

(separate file)

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Appendix 10: GNDNERR Social Networking Strategy

GRAND BAY
NATIONAL ESTUARINE RESEARCH RESERVE

2018 SOCIAL NETWORKING STRATEGY

May 7, 2018

Sandra Huynh

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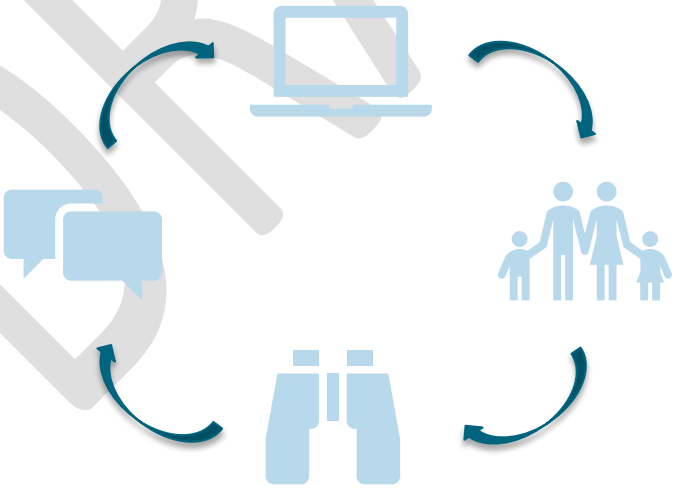

Introduction

With increased use of social media in today's culture, the Grand Bay NERR embraces social media as a tool to connect and network with audiences. We utilize social media to promote events, keep our followers updated to current happenings at the Reserve, and engage with people using posts that promote inquiry-based approaches to learn new things.

Grand Bay NERR's mission is to practice and promote stewardship of our local coastal resources through our programs. We believe a social networking strategy will help us accomplish this mission. Our primary goal for social networking is two-fold:

1) We hope to keep visitors connected with the Grand Bay NERR after their visit.

2) We hope Grand Bay NERR social media will bring in potential new visitors.

By increasing numbers in virtual and physical visitors, we encourage repeated visits to the Reserve. Thus, conservation messaging and understanding of scientific and management practices will better resonate with our audiences after multiple visits.

Our 2018 social media strategy outlines our goals, objectives, and accomplishments to date. We discuss our target audiences, appropriate media to post to those audiences, and methods to achieve best responses to our media. We plan to update this strategy as needed.

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Goals

To create an online presence

- Increase our followers and the people we follow to establish a true “network.”

To promote information exchange, events, science, and breaking news

- Maintain an online presence by communicating relevant content

To increase social and physical engagement

- Increase social networking engagement
- Increase number of physical visitors to the Reserve through events advertising online
- Establish a core group of followers in our online and physical community

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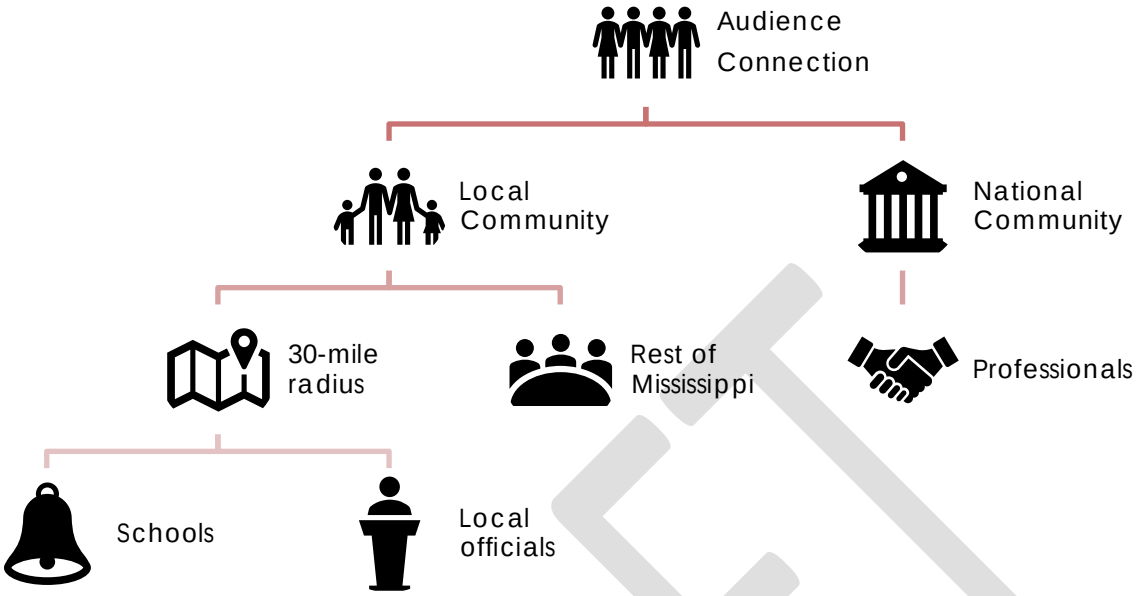
Audiences



Primarily, we focus our efforts to the local community. Seventy-five percent (75%) of our audiences live within 100 miles of the Grand Bay NERR, with most of our audience concentrated within a 30-mile radius of the Reserve, reaching cities such as Ocean Springs and Hurley, MS, and across the state line into Mobile, AL. Typical visitors to the Grand Bay Coastal Resources Center in Moss Point, MS vary seasonally and by visitor type. As we develop and implement a Grand Bay NERR Visitor Use study, results will inform updates for future social media strategies.

School audience

In the spring, we have many school field trip groups. Summertime draws in families and children, as well as larger summer camp groups. We see less students at the Coastal Resources Center in the fall, but our staff sees students by going to schools instead, encouraging schools to visit in the springtime.

Hobbyist Audience

In late fall and throughout winter, we have “snowbirders,” or visitors escaping the northern United States for more warmth in the south. Throughout the year, we may have

occasional recreational hunters stop in for permits or photography hobbyists stopping in to see what's in bloom or flying around that day.


Family audience

Most of our visitors come in pulses during large Grand Bay NERR Outreach events, such as National Estuaries Day and Star Party. These visitors are typically family groups with children, and family groups average 4 people per group (Star Party, 2017).


Professional audience

The Grand Bay NERR also reaches a professional audience. This audience keeps in touch with Grand Bay NERR all year-round through various onsite- and offsite-workshops and conferences.


Current Social networking Platforms

We currently utilize Facebook and Twitter as our primary social networking platforms. These two platforms can host information, photos, videos, links to events, and most importantly interaction with others through questions, comments, messages, and reposts. We use these two platforms in addition to our official website, www.grandbaynerr.org.

Facebook

The Grand Bay NERR Facebook page's goal is to encourage inquiry-based science/learning, meaning the posts ask questions that help our followers learn how to get answers. With over 2,000 followers, our Facebook audience is the largest we have. Followers include locals within the community, visitors, teachers, and researchers. Most of our event participants find event information through our Facebook page (based on "How did you hear about this event?" on sign-in sheets).

We currently employ Tuesday Trivia, Creature Feature, Fun Fact Friday, social media campaigns, and create "events" for workshops, trainings, and community outreach programs. Facebook posts are scheduled at peak hours (7pm and 8pm). It is our most interactive and updated platform: https://www.facebook.com/GrandBayNERR/.

Twitter

The Grand Bay NERR Twitter account was established in August 2013. While Facebook schedules posts and focus on interactive learning, the goal for our Twitter account is to post breaking news or "in-the-moment" posts. With character count limits, photos and quick facts are popular among the Twitter audience. The most interactive Tweets occur during conference travels and participation, with the use of clever hashtags and increased interactions with professional colleagues. Social networking campaigns are most active on Twitter, as it is the preferred platform for other organizations to chime in and participate in campaigns.

Currently, we occasionally retweet other happenings, promote events, post pictures of events/wildlife, and conference travels. The Twitter "voice" we've adopted is personal, clever, and funny (if appropriate). Our goal is to increase followers in both our local and national audiences and maintain communication and updates with our professional networks.

https://twitter.com/GrandBayNERR

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Future social media platforms

Soon, we would like to use visual platforms such as YouTube and Instagram to reach audiences that are creative and appreciate aesthetic. Both platforms are highly thoughtful, but low maintenance. Unlike Facebook and Twitter, event updates are not as important on YouTube and Instagram. Instead, we would showcase beautiful work created by staff and visitors. Both platforms would highlight media related to **Reserve**, **Habitats**, and **People**.

youtube

Grand Bay NERR staff have the interest and talent to produce high-quality and engaging videos for wider networking. Inspired by videos from Mission-Aransas NERR in Texas, we would like to create our own YouTube channel for current and future visitors and stakeholders to watch what's happening at Grand Bay NERR.

Example: https://www.youtube.com/channel/UCdc705qda7wnTf1QGOq0q3w

One video will introduce Grand Bay NERR, and highlight the three focus points of **Reserve**, **Habitats**, and **People**. Subsequent videos will incorporate content highlighting at least one of the focus points. Each video will have the Grand Bay NERR logo, and the video caption will include all credits for sound, footage, and production. At Grand Bay, the Director and Director's Assistant will undertake all video projects including capturing footage, writing stories, editing, and publishing.

The advantage of a YouTube channel is having one host site for content, where links can be shared through other outlets (Facebook, Twitter) and video analytics are tracked. This will streamline analytics for the Social Networking Team, as we will be able to access and view data through one account.

instagram

Instagram is a low-maintenance social networking platform that will act as an archive for beautiful Grand Bay imagery. Posts are opportunistic, and many talented photographers within NERR or DMR staff can all contribute to content. Instagram will allow us to share aspects of research and education projects to emphasize the **Reserve**'s activities. We will be able to share stunning visual imagery of the NERR's **Habitats**. For **People**, we will share our favorite stories and photos to personalize interactions and connect with various audiences. The goal is to create an awe-inspiring media presence for nature and connecting people with nature.

Currently, the Director's Assistant has been piloting a public page for nature photography on her personal account to experiment with finding an Instagram "voice," knowing what works well with audiences, figuring out how to get followers, finding creative hashtags, and looking at other pages to see what looks good. Example: https://www.instagram.com/sandra_nature_photos/

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Social Networking campaigns in 2017

With a new Social Networking Team, we were challenged with vamping our social media game. We participated in internally and externally organized social media campaigns. **Internal campaigns** included Earth Week in April, and Grand Bay NERR Day in June. **External campaigns**, or campaigns driven by a national entity, included: #iheartestuaries in February, and National Estuaries Week in September.

These campaigns have had the biggest impact for engaging Facebook followers and increasing the number of Twitter followers. While Facebook and Twitter posts differ daily, we align the two platforms during large campaigns to administer matching content.

February: #iheartestuaries

NERRA encourages all reserves around the country to participate in the #iheartestuaries social media campaign. The goal is to flood social media platforms with reasons why estuaries are loved. This campaign is strategically placed around Valentine's Day, and the campaign itself lasts a week.

In 2017, the Grand Bay NERR social media team held a contest as an incentive for staff participation, which seemed to work very well. We asked staff to submit a photo and caption describing why "iheartestuaries." We aligned Facebook and Twitter for consistent messaging for the week. Each day, a new picture and caption was posted, and the most "likes/retweets" we captured for each post determined our staff winner of that social media campaign.

April: Earth Week

Earth Week 2017 highlighted staff photos with a contest again, and the theme asked staff why they celebrate Earth Day. We had less staff participation for this campaign, but it was still overall successful online. On Earth Day, we posted a video of the Grand Bay NERR to celebrate our special little corner of earth. The video created by Dr. Ayesha Gray can be found here: What Do Birds See? - https://youtu.be/Ej4HsUozGzw.

June: Grand Bay NERR Designation Day

We celebrated Grand Bay NERR's designation day for the first time in our Reserve's history. While planning for this event, the social media team decided June was appropriate for another miniature social media campaign. This time, we collected video clips from our external partners, who wished us "happy birthday." We used these clips to produce one video, which we added to our event marketing strategy for our event that Friday, June 16, 2017. The video can be found here: https://twitter.com/GrandBayNERR/status/875734166964457473.

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September: National Estuaries Week

The final social media campaign of 2017 was once again led by NERRA. Our strategy for this campaign was to highlight our science staff by finding cool pictures of them in the field or lab, and we created "movie posters" for each scientist for artistic flair. Each day we posted a different scientist, and on each poster, was event information to "meet the scientist" at our National Estuaries Day event. On the Friday before the event, we posted a newly produced video with drone footage of the estuary, trails, buildings, and up-close footage of people at the Coastal Resources Center: https://twitter.com/GrandBayNERR/status/913776121946284035.

*Radio silence

In the event of disasters and emergencies, social media platforms will not be utilized unless necessary. We will observe "radio silence" out of respect for the situation, and to open lines (including social media "timelines") for emergency responders to communicate. This includes cancelling scheduled posts if necessary, and keeping up with breaking news to stay updated and informed. In the event of a disaster response situation at the Grand Bay Coastal Resources Center (NERR and USFWS), we will follow the communications protocol from our Disaster Response Plan.

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Analytics

What we know

We know there has been an increase in activity since we started analyzing social media, and since we had two people splitting the social media platforms. Before, one staff member monitored social media accounts and opted to focus more on Facebook.

Facebook activity is geared towards learning, through use of "trivia," "creature features," and "fun facts." Facebook is also our main outlet for advertising events to the mass public.

Most of our virtual connections with other reserves occur on Twitter through large social media campaigns. However, the most personal NERR connections happened in person through the NMEA conference in Charleston, SC, and when visiting NERRs in New England.

Detailed analytics for each platform

The data we are most interested in collecting, analyzing, and reporting will help us inform our networking and media strategies. For instance, what time of day does most of our engagements occur? What's the difference between posts that relate to a workshop or event, versus one with a photo? What about activity during a national campaign compared to daily tweets? Which types of posts are most engaging?

To answer these questions, we will pull analytics provided from our social media platforms to compile **semi-annual reports** (see Semi-Annual Reports Outline). In these reports, we hope to include visuals like **maps** and **graphs** that show trends, and we hope to comment on anomalies unusual from daily activities (e.g. national campaigns, conferences). Each of the semi-annual reports will outline **goals** for reporting periods. For instance, did we meet our goals of creating presence, promoting events, engaging with the community? What standards do we choose to say we met those goals? These standards will be set by the Social Networking Team and the Grand Bay NERR Director.

The necessity and longevity of these analytics and reports will be determined by the Grand Bay NERR Director.

Google analytics for website

Details coming soon.

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Semi-Annual reports outline

I. **Introduction** (highlight main events or successes)
II. **Goals for this reporting period**
    a. Statement
    b. Summary Table with outcomes, met, did not meet
III. **Website Updates** (ties in anything we've done to improve the website, as far as redesign, content, postings, malware, etc.)
IV. **Facebook**
    a. Highlights (expanded from Introduction)
    b. Reach
        i. Photos vs Videos
        ii. Type of Post
            1. Tuesday Trivia
            2. Creature Feature
            3. Fun Fact Friday
            4. Event
    c. Engagement
        i. Likes
        ii. Comments
        iii. Shares
    d. Change in number of followers
    e. Map (s)
V. **Twitter**
    a. Highlights
    b. Reach/Impressions
        i. Photos vs Videos
        ii. Type of Post
            1. Retweet (Grand Bay retweets something else)
            2. Mentions (Grand Bay mentions someone else)
            3. Event announcement
            4. Other announcements
            5. Random (anything else not outlined)
    c. Engagement
        i. Likes
        ii. Retweets (someone else retweeted a Grand Bay NERR-created post)
        iii. Replies (someone as replied to a Grand Bay NERR-created post)
        iv. Mentions (someone else mentioned Grand Bay NERR)
    d. Change in number of followers
    e. Map (s)
VI. **Visual Platforms Updates (Instagram and YouTube)**
VII. **Goals for next reporting period**
VIII. **Appendix of images/best posts**

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Appendix 11: GNDNERR Branding Guide

(separate file)

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Appendix 12: GNDNERR Building Rental Agreement with USFWS

STATE OF MISSISSIPPI
Phil Bryant
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
Joe Spraggins, Executive Director

MEMORANDUM OF AGREEMENT

This Memorandum of Agreement ("Agreement") is between the Mississippi Department of Marine Resources Grand Bay National Estuarine Research Reserve and U.S. Department of Interior, Fish and Wildlife Service.

FWS Agreement: F19MU00032

SUMMARY

Purpose: The Annual Operation and Maintenance of the Grand Bay Coastal Resources Center

Term: Five years, with one optional renewal for an additional five years, for a total of ten years

AUTHORITY

This Agreement is between the Mississippi's Department of Marine Resources Grand Bay Estuarine Research Reserve (MDMR/GBNERR) and the U.S. Department of Interior, Fish and Wildlife Service (Service). The Service is entered into this agreement under the authority of the National Wildlife Refuge System Administration Act, 16 U.S.C. S 668dd (Act). The U.S. Department of Commerce/National Oceanic and Atmospheric Administration (NOAA) has approved a Grand Bay National Estuarine Research Reserve Final EIS and Management Plan that authorizes the Grand Bay National Estuarine Research Reserve under the Coastal Zone Management Act (CZMA) of 1972, as amended, 16 IJ.S.C. Section 1461. Additionally, a Memorandum of Understanding (MOU) between NOAA and MDMR/GBNERR details the State and Federal (NOAA) Roles in the Grand Bay National Estuarine Research Reserve. There is also an MOU, executed November 22, 2002, among MDMR/GBNERR, Mississippi Secretary of State, the Service, The Nature Conservancy, Mississippi State University and the University of Southern Mississippi forming an Agreement relating to the partnerships at the Grand Bay National Estuarine Research Reserve (MDMR/GBNERR).

HISTORY AND BACKGROUND

The Coastal Zone Management Act establishes National Estuarine Research Reserve System to provide opportunities for long-tern research, education and interpretation. Based out of Moss Point, Mississippi, the MDMR/GBNERR is one of the 27 reserves in the National Estuarine Reserve System. In the early 1 990's, along with MDMR, a broad-based support group pursued the designation of the Grand Bay site as a National Estuarine Research Reserve to preserve a critical coastal Mississippi ecosystem.

The Grand Bay National Estuarine Research Reserve is comprised of approximately 18,800 acres of coastal wetlands and waters in southeastern Jackson County, Mississippi, with office space located at 6005 Bayou Heron Road, Moss Point, MS.

The Service manages approximately 14,400 acres of coastal wetland and marsh in Jackson County, MS as the Grand Bay National Wildlife, with temporary office space located at 6005 Bayou Heron Road, Moss Point, MS.

Both the MDMR/GBNERR and the Service are federally funded programs with similar goals for conserving, studying and educating the public about wildlife and habitats, including, estuarine and marine resources. The benefits of developing a partnership between these agencies for a facility in Moss Point include sharing costs; obtaining funding from multiple sources; collaborative development and implementation of research, management and education programs; and offering improved and consolidated services and facilities to the public.

The MDMR/GBNERR will be largely funded through NOAA under Section 315 of the Coastal Zone Management Act and the Mississippi Department of Marine Resources. The Service will be funded through the Department of Interior or other sources as appropriated by Congress, both Agencies will meet the administrative requirements associated with those funding sources.

As portions of the Service property have been included in the MDMR/GBNERR boundaries, some lands and waters are intended to be co-managed. The November 22, 2002 partnership MOU outlines commitments of all parties, including:

1. The MDMWGBNERR partner MOU states that the MDMR shall:
   a. Serve as the NOAA-designated lead agency for the project and will be responsible to NOAA for compliance with federal law and regulations of the national Estuarine Research Reserve System and the goals and objects of the Grand Bay NERR Management Plan.
   b. Provide for the operation and management of Reserve facilities and equipment.

c. Serve as the responsible state agency for NERR proposals, funding requests and general administration services, including compliance review and administrative oversight.

d. Provide staff, including, but not necessarily limited to the Reserve Manager and/or other staff and other financial support, including operational or matching funds, subject to availability.

e. Designate a representative to the Reserve Management Board (Board).

f. Provide technical support to assist with resource management, research and monitoring, and educational activities, including legal assistance.

g. In conjunction with the Board, implement management activities on State controlled lands or waters of the NERR, consistent with the Reserve Management Plan.

h. Assist with the acquisition of lands within the NERR core and buffer boundaries.

2. The MDMR/GBNERR partner MOU states that the US Fish and Wildlife Service shall:

a. Provide lands and facility support for NERR facilities, as detailed in the MDMR and the Service's SOS Reserve operations MOU, which will identify the Service's land where NERR facilities may be located and/or constructed.

b. Coordinate law enforcement activities within the Reserve with the MDMR.

c. Designate a representative to the Board.

d. Provide technical support as possible and seek funding or in-kind support through the Service for Reserve related activities, including management, research and monitoring, and educational activities in conjunction with the Board.

e. In conjunction with the Board, implement management activities on Service controlled lands and waters that are consistent with National Wildlife Refuge compatibility guidelines and are consistent with the Reserve Management Plan.

f. Assist with the acquisition of lands located within the MDMWGBNERR that also are within the Grand Bay NWR boundaries.

g. Manage Grand Bay National Wildlife Refuge in accordance with the Service's Refuge management policy and the MDMR/GBNERR Management Plan. In the rare instance of conflict, the Service's policy supersedes NERR policy on Refuge lands.

PURPOSE AND OBJECTIVES

The purpose of this MOA is to establish a working partnership between the MDMR/GBNERR and the Service by providing a framework for occupation, operation

and maintenance of the Grand Bay Coastal Resources Center at the 5-acre site located at 6005 Bayou Heron Road in Moss Point, Mississippi. This facility was built on the Service's lands with funds awarded to and secured by MDMR/GBNERR. Title to the facility shall be vested with the State of Mississippi. Ownership of the facility shall be vested as a capital outlay of the State of Mississippi. Staffs from MDMWGBNERR and the Service will each occupy their own portions of the facility, although various portions will be shared by both entities as shown in Attachment A-Table 1.

RESPONSIBILITIES OF THE PARTIES

MDMR/GBNERR and the Service agree to the following provisions; The MDMWGBNERR shall:

a. Provide utilities and support for the operation of the Facility including insurance, telephone system and associated maintenance. electricity, fuel oil, gas, water and waste. and security system.

b. Provide all services. including janitorial, window cleaning, carpet cleaning, waste removal and grounds keeping.

c. Provide all service contractors for maintenance and repair of mechanical, electrical, plumbing, cabinetry and other facility components resulting from the general construction of the project.

d. Provide maintenance staff or contractor for the general maintenance of the Facility.

e. Ensure compliance with all requirements of any NOAA operations or construction award regarding the use and operation of the Facility.

The Service shall:

a. Maintain the Service's personal property located in the Facility, including but not limited to audiovisual (AV) equipment, personal computers, scientific equipment, printers, and other office equipment/furnishings. The Service assumes responsibility for payment of all its own monthly obligations incurred for telephone use (e.g., monthly charges for long distance and local service), Internet charges by providers, and/or other communications used in the performance of daily operations and special events (satellite downlinks, broad band telecasts, video conferencing, conference calling, etc.).

b. Provide funding for the operation and maintenance of the Service's portion of the Facility and one-quarter (1/4) of the shared areas. (See Table 1).

c. Pay for repair of any damage to the Facility as a result of negligence on the part of the Service employees, volunteers and sponsored agents' actions, to the extent authorized by the Federal Tort Claims Act, 28 USC S 1291 et seq.

All parties agree:

a. Security for events and functions at the Facility shall be the responsibility of the sponsoring entity.

b. Third party events will be administered according to the Grand Bay Coastal Resources Center, Space Use and Rental Policy, to be developed jointly as needed.

c. Responsibility for deferred maintenance needs (e.g., roof or flooring replacement. broken water lines, etc.) shall be allocated between the parties based on the percentage of occupancy as set forth in Operational Costs below.

d. In the performance of this MOA, employees or agents of each respective party are not to be considered employees of the other party or parties.

e. The participation of each party to this agreement in activities conducted pursuant to this MOA is not intended to place either party or its representatives in a position of incurring tort liability arising from an action of the other party. Each party is responsible for any injury or property damage to third parties caused by negligence of its own employees acting within the scope of their employment/official duty subject to such limitation as may be prescribed by applicable laws. Specifically, tort liability arising from negligent or wrongful acts or omissions of Service employees acting within the scope of employment shall be adjudicated pursuant to the Federal Tort Claims 28 U.S.C. Section 2671 et seq., the Federal Employees Compensation Act, U.S. Section 8101 et seq., or such other federal legal authority as may be pertinent. Likewise, tort liability arising from negligent or wrongful acts or omissions of the Mississippi State Department of Marine Resources employees while acting within the scope of their employment shall be governed by the Mississippi Tort Claims Act, Mississippi Code S 11-46-1, et seq.

f. Nothing in the MOA is intended to supersede any laws, regulations, or directives by which the parties must legally abide.

g. This MOA is neither a fiscal nor a funds obligation document. Nothing in this agreement may be construed to obligate the Service to any current or future expenditure of resources in advance of the availability of appropriations from Congress. Any endeavor involving reimbursement or contribution of funds between the Parties to this MOA will be handled in accordance to applicable regulations, and procedures including those for federal government procurement and printing. Such endeavor will be outlined in separate agreements that shall be made in writing by representatives of the Parties and shall be independently authorized in accordance with appropriate statutory authority. This MOA does not provide such authority.

TERM OF AGREEMENT

This agreement shall be in effect from September 28, 2019, for a period of five (5) years, with one optional renewal for an additional five (5) years, for a total of ten (10) years and replaces the previous agreement executed September 5, 2018 which established the occupancy of the Facility.

OPERATIONAL COSTS

The MDMR/GBNERR and the Service will support the operation and maintenance of the facility, which in total are $190,632.00 ($12-individual, $6-shared per square foot) annually during the Term of Agreement. The MDMR/GBNERR will contribute an amount of $158,040.00 annually for the operation and maintenance based on its occupation of 9,903 square feet of the facility (62.34 [0] 0) and 1/2 of the 4,356 square feet of shared space (2,178 square feet) (13.71 %). The Service will contribute $32,592.00 annually for the operation and maintenance based on its occupation of 1,627 square feet (10.24 %) of the facility and 1/2 of the 4,356 square feet of shared space (2,178 square feet) (13.71 %).

(1627 x 12 = 19,524.00) +(2178 x 13,068.00) $32,592.00. see Attachment A-Table 1.

As this MOA is renewed MDMR/GRNERR and the Service re-evaluates operation and maintenance costs at the time of renewal of the agreement, the Service will make a determination of whether the cost per square foot of occupied space will be adjusted based on the actual operation and maintenance costs of the facility. This review may include a study of the use and expenses associated with the individual and common spaces. Every two (2) years thereafter, a similar assessment will occur, and the parties will agree to any necessary modifications.

PAYMENT

The MDMR/GBNERR shall be responsible for administering payments for the facility and grounds, excluding those identified as the responsibility of the Service in Responsibilities of the Parties.

The MDMR will invoice the Service for the Services' share annual operational costs outlined above in April each year. The Service will provide payment of operational costs invoiced if appropriations have been made available by Congress.

TERMS AND CONDITIONS

a. A third-party Space Use and Rental Policy will be developed jointly, as needed, by both parties.

b. The Service may share its administered space with other partner government and nongovernment organizations if consistent with the mission of the Service and if agreed to by MDMR/GBNERR. Use of the Service's space by such entities is the

responsibility of the Service, which will not be relieved thereby from any obligation under this Agreement.

c. All parties may, upon reasonable prior notice, enter each other's designated space and all other areas of the Facility. Maintenance staff and contractors will have access to all areas of the Facility at all times.

d. The MDMR/GBNERR and the Service will work collaboratively to agree on needed improvements and alterations to the shared portions of the facility and grounds. MDMR/GBNERR will have final approval of all improvements and alterations to designated Service space and the Service will carry any financial obligations incurred by the changes. The MDMR/GBNERR will have final authority on all improvements and alterations to designated MDMR/GBNERR space. All changes and or alterations will be consistent with state and local building codes.

e. The Service shall have use of its portion of the Facility throughout the life of the Facility or until such time as both parties agree that the Service no longer has a use for the assigned spaces. If the Service no longer needs to occupy a specific portion of the space in the facility to support its mission, and thus vacates that portion of the space, this Agreement will be modified to adjust the payments due under Operational Costs, based on the reduced square feet occupied by the Service. The MDMR/GBNERR may not use the vacated space formerly shared, or any part of the facility, for any purpose inconsistent with the NOAA approved MDMR/GBNERR Management Plan without prior written consent from the Service.

Should the Service vacate the Facility entirely, it shall make final operational cost payments under Operational Costs and Payment by the termination date. Additionally, the Service shall at that time offer MDMR/GBNERR the right to purchase the land on which the Facility is located, subject to the approval of the Secretary of the Interior and the Migratory Bird Commission, as required by 16 USC S 668dd(a)(5)(A). The amount MDMWGBNERR shall pay for the land shall be its fair market value, or other value that is consistent with the requirements of 15 USC S 668dd (a) (5) (B).

f. The MDMR/GBNERR shall not lease the facility or assign any rights under this Agreement without the written approval of the Service. Under no circumstances shall the MDMWGBNERR suffer or permit any lien or encumbrance to be imposed on the Reserve facility. Violation of this provision shall be a default of a material

obligation and this agreement will be subject to termination as provided in Termination.

MODIFICATION

Modifications or renewals of this Agreement may be proposed at any time during the period of performance by either party and shall become effective only when put in writing and signed by all parties. The MDMR Executive Director and the Administrative Services Office Director are the only persons authorized to sign the agreement for the MDMR/GBNERR. The Regional Director and the Contracting Officer are the only persons authorized to sign modifications on behalf of the Service.

SPECIAL PROVISIONS

a. No member of, or delegate to, Congress, the Mississippi State Legislature or the MDMR Commission on Marine Resources shall be admitted to any share or part of this Agreement or to any benefit that may rise therefrom. This provision shall not be construed to extend to this Agreement if made with a corporation for its general benefit.

b. Nothing in this Agreement shall obligate any party in the expenditure of funds, or for future payments of money, in excess of provisions of this agreement or appropriations authorized by law.

c. The parties accept responsibility for any property damage, injury or death, caused by the acts or omissions of their respective employees/volunteers acting within the scope of their employment, to the fullest extent permitted by law.

d. Both parties agree to comply with all applicable federal or state laws regulating ethical conduct of public officers and employees.

e. Each party will comply with all applicable laws, regulations and executive orders relative to Equal Employment Opportunity.

f. Nothing herein is intended to conflict with federal, state or local laws or regulations. If there are conflicts, this Agreement will be amended at the first opportunity to bring it into conformance with conflicting laws or regulations.

TERMINATION

The Service may terminate their participation in this MOA by giving 60-day written notice to the MDMR/GBNERR. Upon delivery and receipt of this notice, the parties will promptly meet to resolve their differences. If such efforts are unsuccessful, the Service shall bring its activities to a prompt and orderly close and vacate the facility at the expiration of the notice period.

Termination or non-renewal of the MOA by the Service shall not affect the use of the grounds and the operation of the facility by the MDMR/GBNERR. In the event that the

Service should vacate, the Service shall offer MDMR/GBNERR the right to purchase the land on which the facility is located, as provided for in Terms and Conditions.

The MDMR/GBERR may terminate their participation in this MOA by giving 60-day written notice to the Service. Upon delivery and receipt of this notice, the parties will promptly meet to resolve their differences. If such efforts are unsuccessful, the MDMR/GBNERR shall bring its activities to a prompt and orderly close and vacate the facility at the expiration of the notice period. In the event that the MDMR/GBNERR elects to vacate the shared facility, the Service may, but is not obligated to, take possession of the facility after compensating the MDMR/GBNERR for the fair market value of the facility. Any disposition of the facility shall be subject to the approval of the Service, MDMR/GBNERR and NOAA.

MISCELLANEOUS

Choice of Law

Each provision of the MOA, as applicable to each agency, is subject to the laws of the State of Mississippi; the laws, regulations, and policies of the Service; and the policies and standard operating procedures of MDMR. Any litigation with respect to this MOA shall be brought in the applicable state or federal court of Mississippi. The Service and its employees are governed by Federal Law.

Entire Agreement

This Agreement expresses the complete understanding of the parties with respect to the subject matter and supersedes all prior proposals, agreements, representations and understandings.

Transparency

This Agreement is subject to the "Mississippi Public Records Act of 1983," Miss. Code Ann. 25-61-1 et seq. and Miss. Code Ann. 79-23-1 and may be shared with the public on request. Information identified by the MDMR as trade secrets, or other proprietary information, including confidential vendor information, or any other information which is required confidential by state or federal law or outside the applicable freedom of information statutes, will be redacted. In the event the MDMR receives a public records request for documents containing information identified by the MDMR as trade secrets or proprietary information, the MDMR will notify the MDMR who will be given a reasonable time to obtain a court order protecting the information. See Miss. Code Ann. 25-61-9(1).

Severability

If a court finds any provision of this Agreement invalid or unenforceable, the remainder of this Agreement shall be interpreted so as best to affect the intent of the parties.

Statement Regarding Liabilities

The MDMR and the Service each, respectively, agree to be responsible only to the extent allowed by applicable law for the negligent and intentional acts of their respective employees that arise out of or are related to their performance under this agreement. However, this must not be construed as conflicting with the Mississippi Tort Claims Act (Miss. Code Ann. I 146-1 et seq.) or the Federal Tort Claims Act, (28 USC 1291 *et seq.*).

No Third-Party Beneficiaries

This agreement is for the sole benefit of the parties and nothing herein, express, or implied, is intended to or shall confer upon any other person or entity any legal or equitable right, benefit, or remedy of any nature whatsoever, under or by reason of this agreement.

Notices

All notices required or permitted to be given under this agreement must be in writing and personally delivered or sent by Certified United States mail, postage prepaid, return receipt requested, to the party to whom the notice should be given at the address set forth below. Notice shall be deemed given when received or when refused. The parties agree to promptly notify each other in writing of any change of address.

For the MDMR:
Joe Spraggins, Executive Director
Mississippi Department of Marine Resources
1141 Bayview Avenue
Biloxi, MS 39530

For the U.S. Department of Interior, Fish and Wildlife Service:
Leopoldo Miranda, Regional Director
U.S. Fish and Wildlife Service
1875 Century Boulevard
Atlanta, GA 30345

Summary

The Summary in this Agreement is for convenience only and is not a complete expression of the terms of this Agreement. In any case in which the terms of the Agreement and the Summary conflict, the terms of the Agreement will control.

Attachment

The attachment to this Agreement, Attachment A-Table 1, Grand Bay Coastal Resources Center Space Allocation Summary, is incorporated herein by reference.

IN WITNESS WHEREOF, the parties hereto have caused this Memorandum of Agreement to be executed as of the date of the last signature below.

Mississippi Department of Marine Resources

Joe Spraggins, Executive Director — Date: 12-13-19

U.S. Fish and Wildlife Service

for Leopoldo Miranda, Regional Director — Date: 12/12/2019

Attachment A-Table 1

Grand Bay Coastal Resources Center Space Allocation Summary (Conditioned Space)

Room #	Room Name	Area	USFWS	GBNERR	Shared
100	Classroom	1122		1122	
100A	Classroom Storage	180		180	
101	Computer Classroom	575		575	
101A	Conference Storage	100		100	
102	Women	180			180
103	Janitor	44			44
104	Men	180			180
105	Interpretive Area	935			935
106	Educational Storage	65			65
107	USFW Open Office Area	875	875		
107A	USFW Reserve Manager	172	172		
107B	USFW Office	114	114		
107C	USFW Office	114	114		
107D	USFW Office	114	114		
107E	USFW Law Enforcement	170	170		
107E2	USFW Storage	68	68		
108	Lobb	884			884
109	Men	50			50
110	Women	50			50
111	Kitchen/Breakroom	168			168
112	Meeting Room	290			290
113	Office/Workroom	330		330	

113A	Storage	126	126	
114	GIS Office	238	238	
115	Specimen Storage	200	200	
116	Equipment Storage	196	196	
117	Chemical Analysis Lab	725	725	
117A	Microbiology Lab	124	124	
118	Biological Research Lab	725	725	
119	Lockers	50	50	
119A	Toilet	50	50	
120	Mechanical	780		780
122	NERR Office	96	96	
123	NERR Office	96	96	
124	NERR Office	96	96	
125	NERR Office	96	96	
126	NERR Office	96	96	
127	NERR Office	96	96	
128	NERR Office	96	96	
129	NERR Office	96	96	
130	Tech Work Area	285	285	
131	NERR Office	96	96	
132	NERR Office	96	96	
133	NERR Office	96	96	
134	NERR Office	96	96	
135	NERR Office	96	96	
136	NERR Reserve Manager	280	280	

137	NERR Office	138		138		
138	Resource Room	138		138		
139	Mechanical	280			280	
140	Data	46			46	
141	NERR Office	86		86		
001	Corridor	404			404	
002	Corridor	679		679		
002A	Janitor	12		12		
002B	Washer/Dryer	12		12		
003	Corridor	490		490		
D1OO	Commons	270		270		
D1OOB	Laundry	26		26		
D101	Kitchen	112		112		
D102	Mechanical	60		60		
D103	Bunks	236		236		
D103A	Bath	142		142		
0104	Bunks	236		236		
D104A	Bath	142		142		
D105	Dorm	140		140		
D105A	Bath	55		55		
D106	Dorm	140		140		
D106A	Bath	55		55		
D001	Corridor	180		180		
	Parking Lot					
Total Assignable Square Footage		15886	1627	9903	4356	

Percentage of Total Square Footage			10.24%	62.34%	27.42%	
Price Per Square Foot		12	12	12	3.9	
Total		190632				
USFWS			19524		13068	**32592**
GBNERR				118836	39204	**158040**
	Unconditioned Space					
121	Screened Mudroom	380		380		
100B	Screened Porch	455		575		

Appendix 13: Gold LEED Certification in 2010

(forthcoming)

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Appendix 14: Federal Consistency Determination

(forthcoming)

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Appendix 15: All Listed Species in the GNDNERR

Plants				
Family	**Scientific Name**	**Common Name**	**State Ranking**	**Global Ranking**
Acanthaceae	Ruellia noctiflora	Nightflowering Wild Petunia	S2	G2
Aquifoliaceae	*Ilex amelanchier*	Swamp Holly	S3	G4
Aquifoliaceae	*Ilex cassine*	Dahoon Holly	S2	G5
Aquifoliaceae	*Ilex myrtifolia*	Myrtle Holly	S3S4	G5?
Asteraceae	*Cirsium lecontei*	Le Conte's Thistle	S2	G2G3
Asteraceae	*Coreopsis nudata*	Georgia Tickseed	S1S2	G3?
Asteraceae	*Helianthus heterophyllus*	Wetland Sunflower	S3	G4
Cannaceae	*Canna flaccida*	Golden Canna	S1	G4?
Cupressaceae	*Chamaecyparis thyoides*	Atlantic Whitecedar	S2	G4
Cupressaceae	*Juniperus virginiana* var. *silicicola*	Southern Redcedar	S2	G5T4T5
Cyperaceae	*Carex verrucosa*	Warty Sedge	S1S2	G4
Cyperaceae	*Cladium mariscoides*	Smooth Sawgrass	S1	G5
Cyperaceae	*Cyperus polystachyos*	Manyspike flatsedge	S2S3	G5T5
Cyperaceae	*Eleocharis cellulosa*	Coastal Spikerush	S1	G4G5
Cyperaceae	*Eleocharis elongata*	Slim Spikerush	S1	G5
Cyperaceae	*Eleocharis equisetoides*	Jointed Spikesedge	S3S4	G4
Cyperaceae	*Eleocharis rostellata*	Beaked Spikerush	S1	G5
Cyperaceae	*Eleocharis tortilis*	Twisted Spikerush	S2S3	G5
Cyperaceae	*Fimbristylis caroliniana*	Carolina Fimbry	S3	G4
Cyperaceae	*Fimbristylis castanea*	Marsh Fimbry	S3	G5
Cyperaceae	*Fuirena breviseta*	Saltmarsh Umbrella-sedge	S3S4	G5
Cyperaceae	*Rhynchospora baldwinii*	Baldwin's Beaksedge	S2	G4
Cyperaceae	*Rhynchospora breviseta*	Shortbristle Beaksedge	S1	G3G4
Cyperaceae	*Rhynchospora cephalantha*	Bunched Beaksedge	S3	G5

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Plants				
Cyperaceae	*Rhynchospora colorata*	Whitetop Beaksedge	S3S4	G5
Cyperaceae	*Rhynchospora corniculata*	Shortbristle Horned Beaksedge	S3S4	G4
Cyperaceae	*Rhynchospora filifolia*	Threadleaf Beaksedge	S3	G5
Cyperaceae	*Rhynchospora inundata*	Narrowfruited Beaksedge	S2S3	G4?
Cyperaceae	*Rhynchospora latifolia*	Sandswamp Whitetop Sedge	S2S3	G5
Cyperaceae	*Rhynchospora rariflora*	Fewflower Beaksedge	S3S4	G5
Cyperaceae	*Rhynchospora stenophylla*	Coastal Plain Beaksedge	S1S2	G4
Cyperaceae	*Rhynchospora tracyi*	Tracy's Beaksedge	S1	G4
Cyperaceae	*Schoenoplectus tabernaemontani*	Softstem Bulrush	S2S3	G5
Cyperaceae	*Scleria baldwinii*	Baldwin's Nutrush	S2S3	G4
Cyperaceae	*Scleria muhlenbergii*	Muehlenberg's Nutrush	S3	G5
Cyperaceae	*Scleria reticularis*	Reticulated Nutrush	S1	G4
Dryopteridaceae	*Dryopteris ludoviciana*	Louisiana Shield Fern	S1	G4
Fagaceae	*Quercus minima*	Dwarf Live Oak	S1	G5
Fagaceae	*Quercus myrtifolia*	Myrtle Oak	S2	G5
Gentianaceae	*Bartonia verna*	White Screwstem	S3S4	G5?
Gentianaceae	*Eustoma exaltatum*	Catchfly Prairie Gentian	S1	G5T4T5
Hypericaceae	*Hypericum myrtifolium*	Myrtleleaf St. Johnswort	S2	G4G5
Lentibulariaceae	*Pinguicula planifolia*	Chapman's Butterwort	S2S3	G3?
Lentibulariaceae	*Utricularia purpurea*	Eastern Purple Bladderwort	S2	G5
Menyanthaceae	*Nymphoides aquatica*	Banana Lily	S2	G5
Menyanthaceae	*Nymphoides cordata*	Floating Heart	S1S2	G5
Orchidaceae	*Calopogon barbatus*	Bearded Grass Pink	S2	G4?
Orchidaceae	*Calopogon multiflorus*	Many Flowered Grass Pink	S1	G2G3
Orchidaceae	*Platanthera integra*	Yellow Fringeless Orchid	S3	G3G4
Orchidaceae	*Platanthera nivea*	Snowy Orchid	S3	G5
Orchidaceae	*Spiranthes longilabris*	Giant Ladies' Tresses	S2	G3
Orobanchaceae	*Agalinis aphylla*	Coastal Plain False-Foxglove	S3	G3G4

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Plants				
Orobanchaceae	*Agalinis filicaulis*	Thin Stemmed False-Foxglove	S2	G3G4
Orobanchaceae	*Agalinis linifolia*	False-Foxglove	S2	G4?
Orobanchaceae	*Agalinis maritima*	Saltmarsh False-Foxglove	S3S4	G5
Poaceae	*Aristida spiciformis*	Bottlebrush Threeawn	S1	G4
Poaceae	*Dichanthelium erectifolium*	Erectlelaf Panicgrass	S2	G4
Polygalaceae	*Polygala crenata*	Scalloped Milkwort	S2	G4?
Rhamnaceae	*Sageretia minutiflora*	Smallflower Mock Buckthorn	S2	G4
Sarraceniaceae	*Sarracenia leucophylla*	Whitetop Pitcher Plant	S2	G3
Sarraceniaceae	*Sarracenia rosea*	Rose Pitcher Plant	S1	G5T3
Solanaceae	*Lycium carolinianum*	Carolina Wolfberry	S1	G4
Solanaceae	*Physalis angustifolia*	Coastal Groundcherry	S3	G3G4
Animals				
Family	**Scientific Name**	**Common Name**	**State Ranking**	**Global Ranking**
Sirenia	*Trichechus manatus*	West Indian Manatee	S1N	G2
Gruidae	*Grus canadensis pulla*	Mississippi Sandhill Crane	S1	G5T1
Charadriidae	*Charadrius melodus*	Piping Plover	S2N	G3
Scolopacidae	*Calidris canutus*	Red Knot	S2N	G5
Picidae	*Leuconotopicus borealis*	Red-cockaded woodpecker	S1	G3
Ciconiidae	*Mycteria americana*	Wood Stork	S2N	G4
Emydidae	*Pseudemys alabamensis*	Alabama Red-Bellied Turtle	G1	S1
Testudinidae	*Gopherus polyphemus*	Gopher Tortoise	S2	G3
Cheloniidae	*Eretmochelys imbricata*	Hawksbill Sea Turtle	SNA	G3
Cheloniidae	*Lepidochelys kempii*	Kemp's Ridley Sea Turtle	S1B, S1N	G1
Cheloniidae	*Chelonia mydas*	Green Sea Turtle	SNA	G3
Dermochelyidae	*Dermochelys coriacea*	Leatherback Sea Turtle	SNA	G2
Cheloniidae	*Caretta caretta*	Loggerhead Sea Turtle	S1B, S1A	G3
Ranidae	*Lithobates sevosus*	Dusky Gopher Frog	S1	G1
Acipenseridae	*Acipenser oxyrhynchus oxyrhynchus*	Atlantic Sturgeon	S1	G3T2

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Appendix 16: Memorandum of Agreement between USFWS and MDMR for Land Management

(forthcoming)

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Appendix 17: Public Comments and Responses

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