

JOBOS BAY NATIONAL ESTUARINE RESEARCH RESERVE

2026 - 2030 Management Plan



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DEPARTAMENTO DE
RECURSOS NATURALES
Y AMBIENTALES
DRNA
GOBIERNO DE PUERTO RICO



**Estudios
Técnicos
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Yo amo al tinglar

All photographs used in the document have been taken by the JBNERR staff, unless stated otherwise.

Estudios Técnicos, Inc. prepared the maps and figures, unless stated otherwise.

Acronyms and abbreviations

ACS	American Community Survey
AO	Administrative Order
CariCOOS	Caribbean Coastal Ocean Observing System
CEAP	Conservation Effects Assessment Project
DNER	Puerto Rico's Department of Natural and Environmental Resources
EPA	Environmental Protection Agency
ETI	Estudios Técnicos, Inc.
HMC Plan	Habitat Mapping and Change Plan
JBNERR	Jobos Bay National Estuarine Research Reserve
KEEP	K-12 Estuarine Education Program
MPA	Marine Protected Areas
MOU	Memorandum of Understanding
NERRS	National Estuarine Research Reserve System
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCM	Office for Coastal Management
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRCZMP	Puerto Rico Coastal Zone Management Program
PRLA	Puerto Rico Land Authority
PRSGP	Puerto Rico Sea Grant Program
PUCPR	Pontifical Catholic University of Puerto Rico
SPA	Special Planning Area
SSAM-1	Sentinel Site Application Module
SWMP	System-Wide Monitoring Program
TEP	Training and Engagement Program
TOTE	Teachers on the Estuary
UPR	University of Puerto Rico
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSFR	Wildlife and Sport Fish Restoration Program
ZMT	Maritime-Terrestrial Zone

Executive Summary

Purpose and Scope of the Plan

In 1981, the National Oceanic and Atmospheric Administration (NOAA) designated the Jobos Bay National Estuarine Research Reserve (hereinafter, JBNERR or the Reserve) as part of the National Estuarine Research Reserve System (NERRS). The system, in turn, was established under Section 315 of the federal Coastal Zone Management Act, as amended. It comprises thirty protected areas representing diverse types of biogeographic and estuarine regions in the United States.

JBNERR is the only estuarine research reserve in Puerto Rico and the Caribbean. It is also one of two reserves representing the West Indies Biogeographic Region, the traditional name NOAA retains for this region.

The Reserve is administered through a memorandum of understanding (MOU) between NOAA's Office for Coastal Management and the Puerto Rico Department of Natural and Environmental Resources (DNER). NOAA provides funding, guidance, technical assistance for operations and programs, facility construction, land acquisition, graduate fellowships, and collaborative scientific projects. Implementation of the Reserve's programs, in turn, is carried out by local and regional partners, academic institutions, and nongovernmental organizations.

Federal regulations require reserves to maintain a NOAA-approved management plan containing goals, objectives, and strategies. More specifically, the Management Plan describes how the Reserve will conduct its research, education, and training programs. It also supports progress monitoring and outlines matters such as resource protection, public access, and land acquisition, among other provisions. In summary, JBNERR's mission is to practice and promote coastal and estuarine stewardship through research, monitoring, education, training, and public engagement.

Federal regulations also require the plan to be updated every five years to incorporate the findings of recent research and monitoring; update information on the condition of the Reserve and its watershed; and identify management issues and emerging problems that must be addressed. The most recent update to the JBNERR Management Plan dates to 2017, making a new review necessary.

The current review was conducted in accordance with NOAA regulations (15 CFR Part 921), provisions related to public participation, and the Reserve System Management Plan Guidelines and Resources. Appendix 4 presents a summary of the comments received on the Plan during the public review period. Once approved, the Management Plan will guide actions for the Reserve from 2026 through 2030.

Reserve context

JBNERR is located on the southeastern coast of Puerto Rico, between the municipalities of Salinas and Guayama. It encompasses approximately 2,800 acres of diverse habitats, including salt flats, mudflats, shallow lagoons, cays, and mangroves. The Reserve is Puerto Rico's second-largest estuary. Even more notably, as part of NERRS, it maintains an uninterrupted monitoring dataset spanning approximately three decades. These data contribute to understanding estuarine conditions and how these ecosystems respond to environmental and climate stressors.

The Reserve's formal boundaries are the Aguirre community to the north; the Mar Negro coastal lagoon to the northwest; and the Caribe Cays and the coastal waters of Jobos Bay to the south, excluding the navigation channel. To the east, JBNERR adjoins two protected natural areas: Aguirre State Forest and Punta Pozuelo.

The Reserve is also surrounded by privately owned lands where several communities have been established. Between 2015 and 2016, the boundary between JBNERR and adjacent communities was formally delineated, particularly in the area adjoining Las Mareas and Camino del Indio along the western boundary. However, some of this development has continued to expand into the Reserve.

Since adoption of the 2000 Management Plan, DNER has acquired land and established new Reserve boundaries, although these areas have not yet been formally incorporated. The additional parcels include 416.9 acres of mangroves, salt flats, and dry forests. To expand the boundaries, an amendment will be submitted in accordance with 15 CFR 921.33. The current Plan review identifies these areas as the "proposed boundaries." They include acquired lands and public-domain coastal waters under DNER's control.

Once incorporated, these areas will allow better oversight of the Reserve and direct access to the Jobos Bay waterfront. Along the eastern boundary, the lands will support protection of mangroves that are currently subject to fragmentation from illegal construction.

Coastal management issues and reserve goals

The Management Plan is organized around the following priority issues affecting JBNERR, its watershed, and adjacent communities.

- **Environmental stressors:** Coastal hazards and other events, such as ocean acidification and sargassum influxes, pose challenges to the Reserve's ecosystems and surrounding communities, which are already vulnerable. However, additional research is needed to assess the effects of these factors on the Reserve's ecosystems. Other hazards affecting the area's cays, mangroves, and wildlife include drought, sea-level change, storm surge, erosion, and increases in the frequency and intensity of storms.
- **Habitat loss and degradation:** Coastal and marine habitats in Jobos Bay are experiencing loss and degradation. Several factors contribute to this problem, including illegal mangrove clearing, wetland filling, and construction within the maritime-terrestrial zone. Urban expansion near Jobos Bay is directly associated with mangrove loss.
- **Water quality:** Agricultural and industrial activities in the region, wastewater systems, and upstream impoundments contribute to the degradation of Jobos Bay and its mangroves. Sedimentation has also affected offshore corals. In recent years, water-quality analyses have shown a steady increase in turbidity levels and dissolved organic matter concentrations.

Environmental stressors, habitat protection, and water quality are priorities aligned with the National Estuarine Research Reserve System's priority topics. These issues, which affect the Reserve and adjacent communities, are also relevant to Puerto Rico and the Caribbean as a whole. JBNERR will strengthen its role

as a living laboratory, classroom, and reference site for investigating the effects of climate and land-use-related stressors on habitats and communities in Puerto Rico and the Caribbean.

JBNERR's goals are as follows:

- Strengthen the protection and management of the Jobos Bay NERR to advance estuarine conservation, research, and education.
- Increase the use of Reserve science to address priority coastal management issues.
- Advance stakeholders' environmental literacy and provide them with the knowledge and tools needed to make informed decisions.
- Improve ecosystem and water quality through science-based, adaptive, and collaborative management
- Enhance the administrative capability and infrastructure of the Jobos Bay NERR to meet the stewardship, research, education, and training future objectives.

Reserve programs overview

The Management Plan focuses on expanding knowledge of the effects of environmental stressors on the Reserve's resources; reducing anthropogenic pressures on its ecosystems; educating students and the public to assume responsibility for protecting coastal resources; and providing appropriate tools to communities and decision-makers responsible for the Reserve. These actions will foster more resilient coastal resources and communities. The Plan is divided into the ten major components described below. Four focus on programs the Reserve will implement; the other six address components essential to JBNERR's management.

Research and Monitoring Program

Research and monitoring projects provide the foundation for developing management actions, education, and training strategies at JBNERR. Research efforts will focus on: 1) improving understanding of the Reserve's hydrologic changes and estuarine dynamics, the effects of environmental stressors, and social dynamics; 2) increasing the availability and accessibility of scientific data, research findings, and Reserve capabilities for researchers, resource managers, and other audiences; and 3) expanding the System-Wide Monitoring Program (SWMP), which identifies short-term variability and long-term changes caused by both human activities and natural environmental processes.

Education Program

This program will focus on several audiences: students, teachers, local communities, volunteers, and visitors. Participation by these Reserve constituencies will be expanded through educational activities, evaluation of those activities, and assessment of participant satisfaction. Specifically, education efforts will focus on: 1) providing high-quality educational activities based on Reserve resources to increase student and teacher participation; 2) developing a conservation education program that increases knowledge and promotes participation among community members and volunteers; 3) effectively communicating the

Reserve's ecological and historical significance as an educational resource to strengthen community resilience and increase visitation; and 4) evaluating participants' satisfaction with the various education program activities.

Training and Engagement Program

This program focuses on strengthening decision-makers' capacity to use scientific information when making decisions about estuaries and coastal watersheds. It also seeks to expand the network of partners committed to the Reserve. During the next management period, the program will focus on: 1) providing annual training and technical assistance to decision-makers to strengthen their capacity to protect and improve coastal resources and assess community vulnerability; 2) providing training and technical assistance for the development of adaptation measures addressing environmental stressors, disaster risk reduction, and emergency response in coastal communities; 3) strengthening collaboration with decision-makers representing local and federal governments and community organizations; and 4) determining the needs of the program's audience to continue providing relevant services.

Stewardship Program

This NERRS program focuses on defining how coastal ecosystems are actively protected, managed, and restored. Previous versions of the JBNERR Management Plan did not include a separate section for the Stewardship Program. The current revision includes a dedicated chapter for the program, in accordance with the 2023 mandate. Accordingly, JBNERR intends to implement projects to protect Reserve ecosystems from natural and anthropogenic stressors. In particular, it seeks to address: 1) protection and restoration of critical coastal habitats (mangroves, salt flats, coral reefs, and seagrass beds); 2) community participation and collaborative management; 3) strengthening the resilience of vulnerable coastal ecosystems; 4) biodiversity conservation and protection of endangered species; 5) land encroachment; and 6) habitat degradation.

Administrative Plan

This Plan establishes the actions needed to strengthen the Reserve's administrative and operational capacity and support implementation of its programs. During the next period, JBNERR will focus on improving administrative efficiency, managing financial resources, and recruiting additional staff to address its operational and programmatic needs. It will also continue strengthening coordination with DNER, NOAA, and its partners to support the Reserve's functions and needs.

Facility Development and Improvement Plan

This Plan identifies JBNERR's facility needs and the actions and projects required to support Reserve operations and programs. JBNERR facilities support research, monitoring, education, training, stewardship, administration, and public-use activities. They include the Visitor Center, offices, research laboratory, conference room, dormitories, trails, boardwalks, docks, and boat ramp. Over the next five years, the Reserve will continue addressing facility maintenance and improvement needs. Planned projects include rehabilitating and repurposing the former plantation restaurant as an Education and Training Center, for which funding will be sought through the Land Acquisition, Property Acquisition, and Construction (PAC)

program, and repairing the Visitor Center roof with funding from the U.S. Federal Emergency Management Agency (FEMA).

Resource Protection Plan

Protecting JBNERR's resources requires addressing anthropogenic activities occurring within and around the Reserve that may affect its habitats and species. Key challenges include unauthorized activities such as land filling and clearing, mangrove removal, illegal docks, and land encroachment; development and land uses within the watershed; and other industrial and energy-related activities that may affect Reserve resources. JBNERR documents potential violations and observed conditions and coordinates with DNER offices and other entities with jurisdiction to support appropriate actions. Over the next five years, the Reserve will continue strengthening this coordination, surveillance, and visitor management, as well as monitoring and other actions aimed at protecting JBNERR's habitats and natural resources.

Public Access and Visitor Use Plan

JBNERR provides opportunities for recreation, education, and enjoyment of its natural resources while ensuring that visitor access and activities are compatible with protecting Reserve ecosystems. Public-use management includes visitor facilities and areas, trails and other access points, and interpretation of JBNERR's natural and cultural resources. Over the next five years, the Reserve will evaluate opportunities to expand staffed access and public programming, particularly on weekends, and to improve accessibility and the visitor experience. Needs related to pedestrian access, rest and shaded areas, and other improvements for older adults and visitors with mobility or accessibility needs will be evaluated. JBNERR will also continue improving signage for parking areas, entrances, trails, and points of interest; bilingual interpretive resources; and directional signage on state and municipal roads, the latter in coordination with the appropriate entities.

Land Acquisition Plan

This Plan identifies areas of interest for acquisition and other mechanisms that can strengthen the long-term protection of JBNERR's resources and support the Reserve's programmatic needs. Lands have been identified for potential long-term acquisition to strengthen the protection and management of its natural resources and ecological connectivity and to improve terrestrial and coastal access to the Reserve. Potential acquisitions identified for the next management period would be intended to incorporate lands into JBNERR's boundaries; however, expansion of the Reserve is not an immediate priority.

Restoration Plan

This Plan describes ecological restoration efforts undertaken within and around JBNERR and establishes the framework for continuing to restore degraded habitats during the next management period. The Reserve participates primarily in mangrove restoration projects. These efforts include a mangrove restoration project led by DNER in collaboration with The Ocean Foundation, Merello Marine Consulting, JBNERR, and BoriCorps, which includes restoration areas within the Reserve. Current efforts are concentrated in the Laguna Negra and Mar Negro areas, identified as D and E in Figure 20 of the Management Plan. The other areas, identified as F and G, have also been confirmed and have feasibility studies and permits, although

funding for their restoration has not yet been secured. Over the next five years, JBNERR will continue supporting the implementation, monitoring, and maintenance of these efforts.

Draft

Introduction to National Estuarine Research Reserve System

The National Estuarine Research Reserve System is a network of 30 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, currently protects over one million acres of estuarine lands and waters. The system is managed in accordance with federal regulations at 15 CFR Part 921.

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.

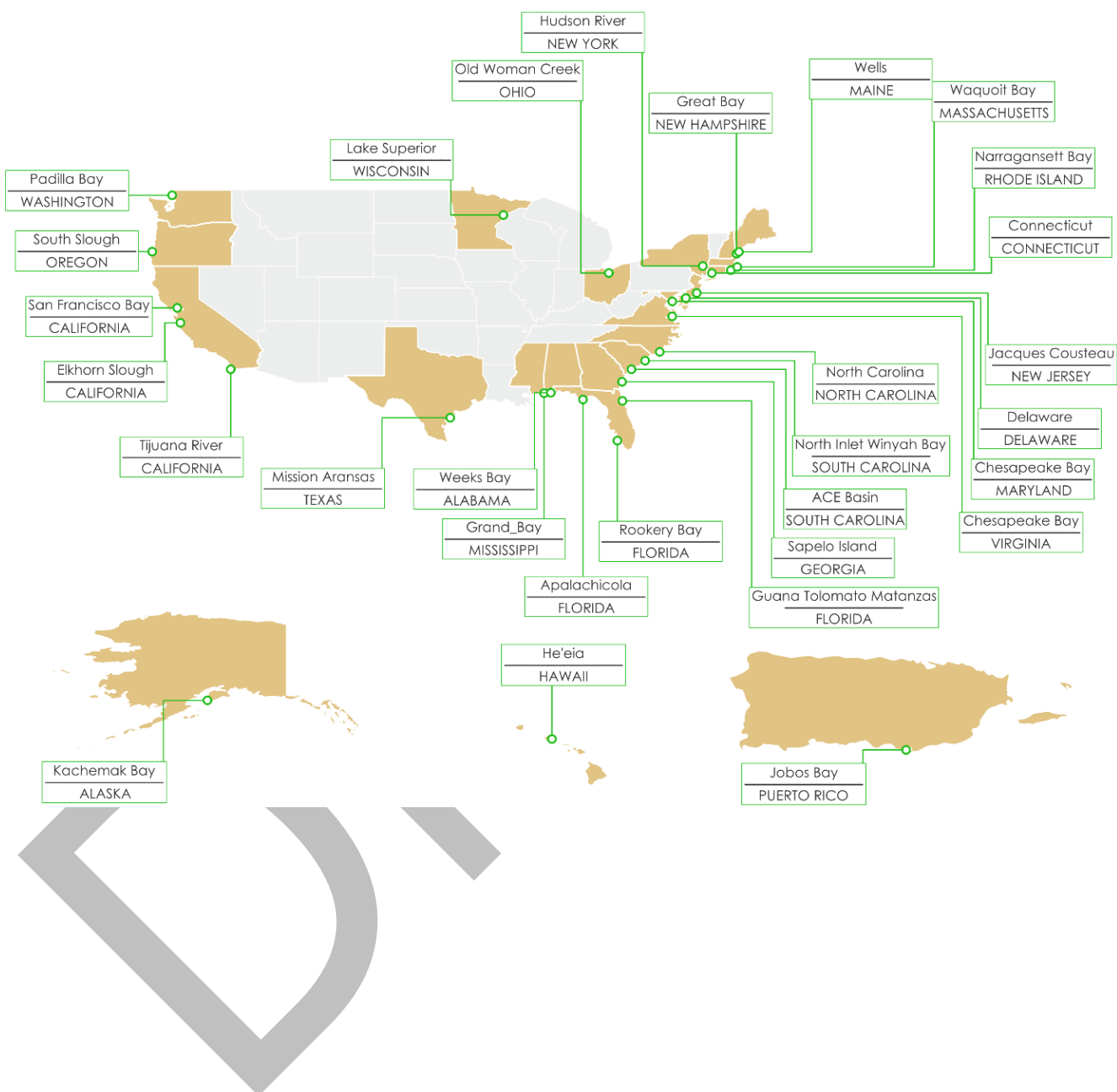
The Reserve System is a partnership program between the National Oceanic and Atmospheric Administration (NOAA) and the coastal states. NOAA provides funding, national guidance, and technical assistance for reserve operations and system-wide programs, facilities construction and land acquisition, graduate 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.

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 National Estuarine Research Reserve System can be found at <https://coast.noaa.gov/data/docs/nerrs/StrategicPlan.pdf>. The 2017-2022 NERRS strategic plan describes the following goals for the system:

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

Figure 1. Map of Reserves in the National Estuarine Research Reserve System



Introduction to the Reserve

History and local management

In 1981, NOAA designated Jobos Bay a National Estuarine Research reserve (NERR), recognizing its high ecological value. It is the only NERR in Puerto Rico and the Caribbean and covers an area of approximately 2,800 acres of coastal ecosystems.

The Jobos Bay NERR is administered through a partnership between NOAA's Office for Coastal Management and the Puerto Rico Department of Natural and Environmental Resources (DNER). Many other partners assist the Reserve's program implementation, such as federal, state and municipal government, academic institutions, and non-governmental organizations.

Jobos Bay NERR was designated as a part of a larger Special Planning Area (SPA) in 1978, with the approval of the Puerto Rico Coastal Zone Management Program (PRCZMP). The PRCZMP (1978) also recommended the protection of Jobos Bay and Mar Negro as a Natural Reserve. This designation took place following a Resolution Num. P.U.-002-2010-(69-71)-01, emitted June 4, 2010, by the Puerto Rico Planning Board. Jobos Bay NERR also forms part of the NOAA's National System of Marine Protected Areas (MPA).¹

Ecological attributes

Geomorphology

Jobos Bay NERR is in the South coastal plain of Puerto Rico, between the Municipalities of Guayama and Salinas. The south coastal plain is narrower than the northern plain, with shorter and smaller rivers, and with an irregular insular shelf that extends two to five miles (3-8 km) seaward.

JBNERR is the second largest estuary in Puerto Rico, with three times as much shoreline as any other estuary on the Island. Its habitats vary from the coastal fan-delta and alluvial deposits of the landward transition zone to offshore cays in the Caribbean Sea (Kuniansky & Rodríguez, 2010). The North Equatorial Current, flowing in a west-northwesterly direction, dominates the entire south coast of Puerto Rico (Laboy, 2009).

The fault zone near the southern coast, where JBNERR is located, is about 2 km wide and contains two main fault strands: the Río Jueyes and the Esmeralda faults (Piety et al., 2018). The area around Central Aguirre includes northwest-trending scarps facing both southwest and northeast; they cross alluvial deposits for a distance of 8 km (Piety et al., 2018).

Jobos Bay NERR watershed is mostly underlain by 10 to 200 ft. thin fan delta and alluvial deposits that are predominantly Quaternary in age. Deposits within Jobos Bay NERR consist predominantly of

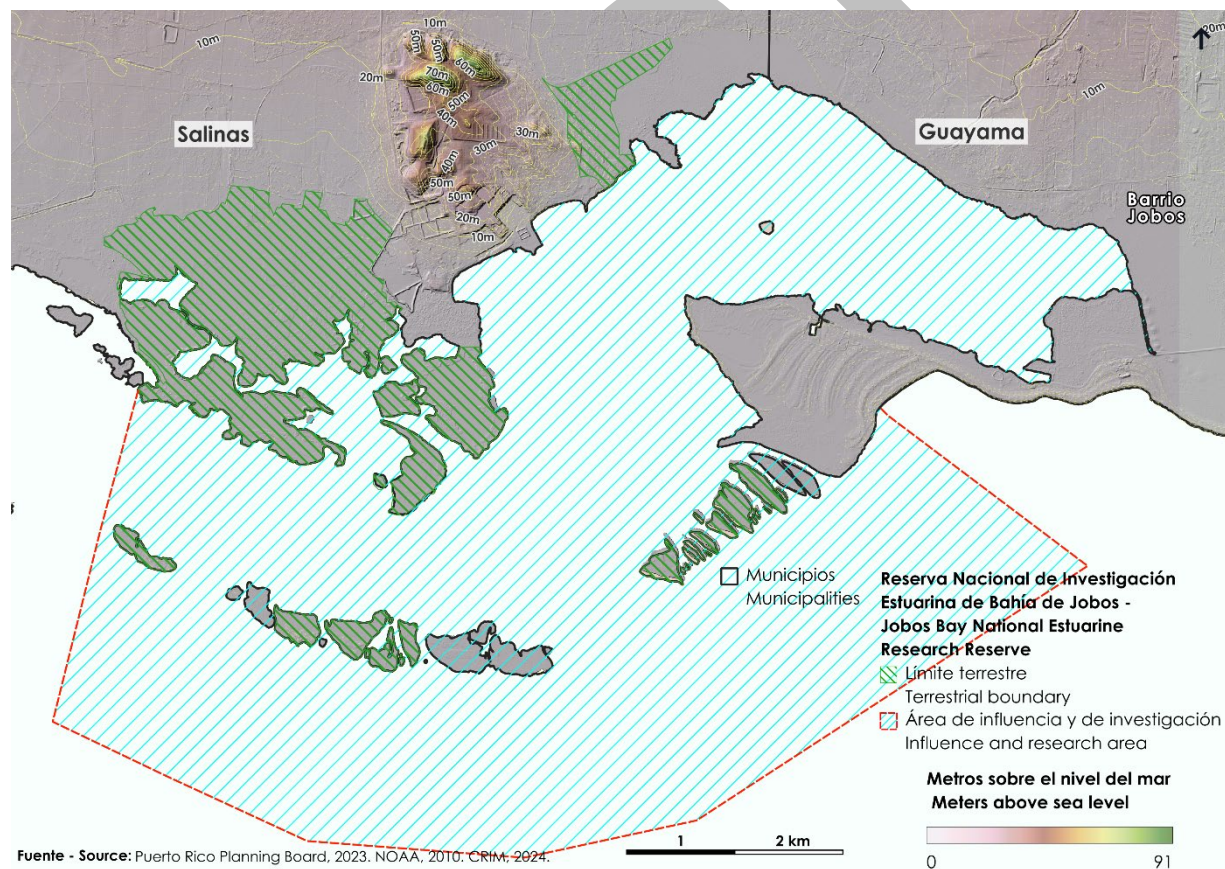
¹ MPA is "any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein". The purpose of the framework is to "build management capacity among MPA programs, coordinate collaborative efforts to address common management issues and identify ecosystem-based gaps in the protection of significant natural and cultural resources for possible future action by the nation's MPA authorities" (<https://marineprotectedareas.noaa.gov/nationalsystem/framework/>).

swamp, beach and alluvial deposits. Swamp deposits cover most of the surface of the Reserve. They consist of unconsolidated clay, silt, and organic matter, and are covered almost entirely by mangroves. Beaches along the coastal margin consist primarily of carbonate sand derived from nearby fringing reefs. Alluvial plain deposits (Alluvium) dominate the northern part of the Reserve and consist of unconsolidated sand, gravel and pebbles.

Along the coast, the surface of the fan-delta sequence is separated from the Caribbean Sea by a narrow land-marine transition zone of marsh and mangrove swamps, tidal and supratidal salt flats, and beach deposits. In the Jobos Bay area, mangroves, marshes, and tidal flats are mostly restricted to those areas protected by offshore, fringing reefs. Within the marsh and mangrove swamp area, the fan-delta deposits are mostly overlain by organically rich clay deposits.

The cays are composed of sand, gravel, volcanic rock cobbles and shell fragments. Beaches along the coastal margin consist primarily of carbonate sand derived from nearby fringing reefs. The JBNERR topography is primarily flat, with most of the Reserve located within an elevation of 10 meters (32.8 ft) or below.

Map 1. JBNERR Topography



Hydrology

The hydrologic conditions of the area are typical of a semiarid region. The Río Seco, in the east, is the only major river that discharges seasonally into Jobos Bay through the Reserve (Whitall et al., 2011). Many streams do not reach the coastal systems because they percolate into the aquifer in the upper valley, limiting freshwater inflows to the downstream estuaries. The Reserve forms part of three watersheds – East of Río Nigua, Aguas Verdes stream, and Río Seco.

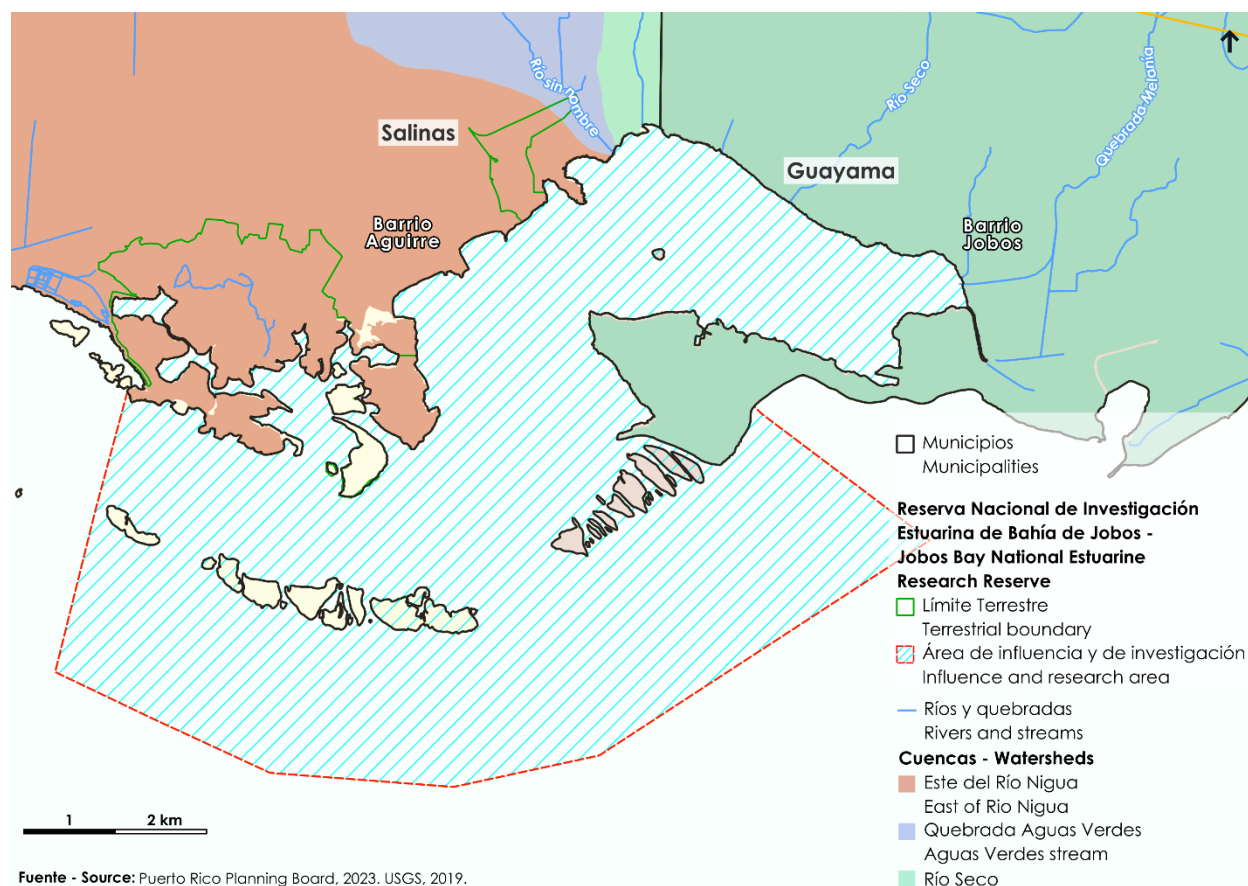
Groundwater is the main source of freshwater for the Jobos Bay estuary. JBNERR is located along the South Coastal Plain aquifer, which extends from the municipalities of Ponce to Patillas. The source of fresh water to this aquifer resides further up, in the high rainfall Cordillera Central Mountain slopes where the aquifer is unconfined. Freshwater inflow to the mangrove wetlands occurs through groundwater seepage from the shallow aquifer and the adjacent watershed (Quiñones-Aponte & Gómez-Gómez, 1987).

Groundwater from the South Coast aquifer is the principal source of potable water for towns along the southern coast of the Island and for agricultural irrigation (Torres-González & Rodríguez, 2016). In July 2015, the southwestern portion of Puerto Rico was classified as Extreme Drought area by the US Drought Monitoring Program, and the South Coast aquifer declared in critical state (DRNA, 2015). Groundwater levels below sea level for several consecutive years (Torres-González & Rodríguez, 2016), combined with excessive use and reduced precipitation, have contributed to this situation.

Another issue that affect the Reserve's water quality is sargassum brown tides (Black et al., 2025). During the sargassum events, the nearshore water presented higher content of total suspended solids, higher turbidity, and lower pH (Black et al., 2025). Point pollution sources from nearby industries also have affected water quality and contributed to mangrove mortality (Spencer et al., 2021). Water quality is further impacted by mangrove loss and development's encroachment.

Recent research suggests that Jobos Bay is a highly dynamic ecosystem which is affected by tidal and river flow factors (Spencer et al., 2021). Tidal flushing is limited, with water exchange in hyper saline lagoons and salt flats during spring tides. Tidal waves pattern includes a daily cycle and a cycle of 13.3 days (Nelson & Laboy-Nieves, 2009). Tides are primary diurnal, with average tide height of 0.137 m. Lowest tides occur in the beginning of the year and the highest take place around October.

Map 2. Watersheds and Surface Water Bodies Around JBNERR



Climate and weather

Jobos Bay NERR is on the leeward side of Puerto Rico. It is located within the Subtropical Dry Forest Zone, characterized by a mean annual rainfall that ranges from a minimum of about 600mm to a maximum of 1,000-1100mm (Ewel & Whitmare, 1973). Orographic factors give rise to a zone of low precipitation throughout the entire length of the South coast (Whitall et al., 2011). As a result, the South coastal plain is warmer and drier than the rest of the Island. Temperature at JBNERR shows little seasonal fluctuation.

In 2025, the mean annual temperature was 80.3 °F (26.8 °C), ranging from 77.9 °F (25.5 °C) in December to 83.1 °F (28.4 °C) in August. Monthly cumulative precipitation ranged from 0.5 inches (13.5 mm) in December 2025 to 8.1 inches (205.2 mm) in October, with an average monthly cumulative rainfall of 2.8 inches (69.9 mm). Historical trends indicate a shift in the precipitation, with a decrease in spring and increase in the fall (Jury, 2022).

Figure 2. Average Monthly Temperature (°F) in JBNERR, 2021 vs. 2025

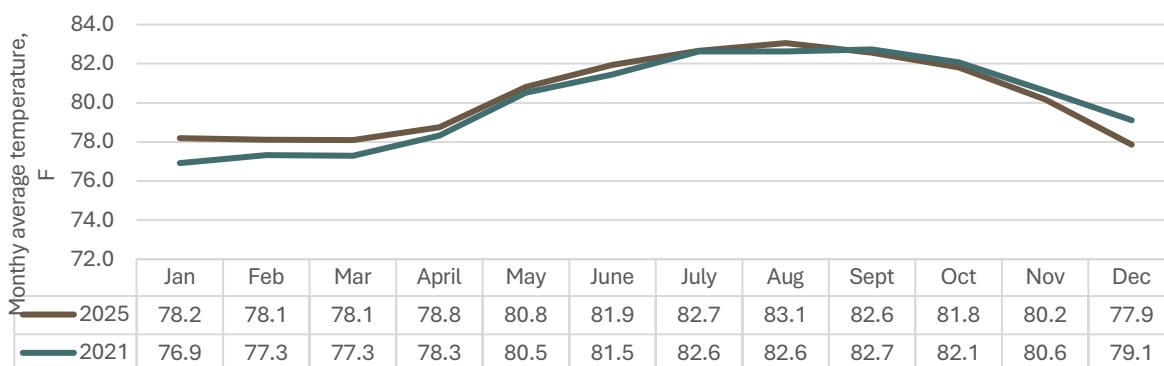
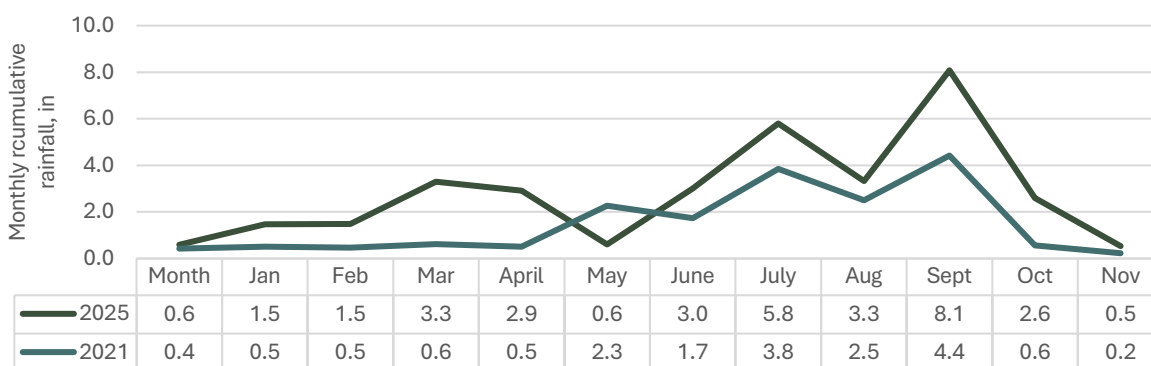


Figure 3. Cumulative Monthly Precipitation (inches) in JBNERR, 2021 vs. 2025



Trade winds in the Reserve blow regularly (46.8%) from an easterly direction, averaging six to seven knots (7-8 mph) (Laboy, 2009; Whitall et al., 2011). The strongest winds occur in the winter with a slight decrease in strength during the summer (Federal Energy Regulatory Commission, 2015).

JBNERR is exposed to the effects caused by weather systems that have the potential to create higher than average rainfall and flooding in short periods of time, as well as strong winds and storm surges. The hurricane season in the Atlantic and the Caribbean is from June to November. Hurricane trajectories and the shallow coasts make Puerto Rico's Southern and Eastern coasts the most vulnerable areas for storm surges.

Flora and fauna

Flora

Swamp deposits cover most of the Reserve's surface, dominated by the mangrove. Other species include the portia tree (*Thespesia populnea*), trumpet tree (*Tabebuia* spp.) and short leaf fig (*Ficus laevigata*), sea grape (*Coccoloba uvifera*), white cedar (*Tabebuia* spp.), manchineel (*Hippomane mancinella*), and gumbo limbo (*Bursera simaruba*). Littoral woodland contains more than 220 species of which 26% are trees and the majority are native.

Fauna

Marine fauna consists primarily of macroinvertebrates and bony fishes (Vega Pérez et al., 2026). Oysters, tunicates, sponges, crustaceans, and cnidarians present some of the most abundant groups of invertebrates (Laboy, 2009), with upside-down jellies (*Genus cassiopea*) as the most abundant macroinvertebrate (Vega Pérez et al., 2026).

Vertebrate communities comprise amphibians, reptiles, fish, mammals, and birds. Reptiles include the endemic garden snake (*Alsophis portoricensis*) and the snapping turtle (*Pseudemys terrapen*). Three federally listed species of reptiles have been documented in the Reserve and Jobos Bay: one threatened, green sea turtle (*Chelonia mydas*), and two endangered, leatherback sea turtle (*Dermochelys coriacea*) and hawksbill sea turtle (*Eretmochelys imbricata*) (López-Morales et al., 2019).

Among the bony fish species, *Anchoa* spp. (bay anchovy), *Gerres cinereus* (yellowfin mojarra), and *Scarus iseri* (striped parrotfish) are the most frequent across evaluated sites (Vega Pérez et al., 2026). The abundance of bony fish varies seasonally and spatially, attributed to variation in temperature (Vega Pérez et al., 2026). However, Cayos Caribe presents a dramatic decline in fish density (García-Sais et al., 2024; Vega Pérez et al., 2026), which potentially indicate the effects of site-specific factors such as habitat quality, predation pressure, and environmental stressors (Vega Pérez et al., 2026).

JBNERR is one of the few reproduction sites for the nurse shark (*Ginglymostoma cirratum*) in Puerto Rico. The DNER Fishing Regulation Num. 7949 – 2010 prohibits the capture, possession, and sale of this species.

The Antillean manatee (*Trichechus manatus manatus*), a federally endangered species, frequently forages in the seagrass beds of Jobos Bay. Jobos Bay is one of four areas in Puerto Rico with relatively higher concentrations of manatees (US Fish and Wildlife Service, 2023). Out of approximately 700 specimens² in Puerto Rico, about 150 may live in the waters of Jobos/Salinas Bays (DNER, n.d.).

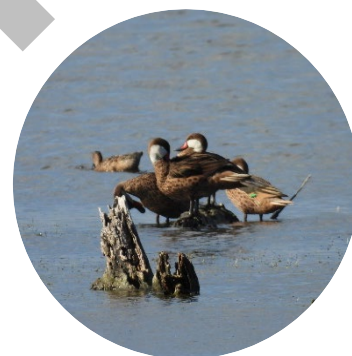
Birds

Recent bird monitoring, research, and inventory efforts at JBNERR, including activities supported through Wildlife Restoration funds administered by the U.S. Fish and Wildlife Service (USFWS), have strengthened knowledge of the Reserve's avifauna. Together with collaborative surveys and other monitoring initiatives, these efforts have contributed to a preliminary inventory of 210 bird species

Figure 4. Semipalmated Sandpiper, a Near-threatened Species



Figure 5. White-cheeked Pintail, a Nesting Species



² According to Collazo et al. (2019), 2005 estimates suggest population of 360, whereas the Puerto Rico Manatee Conservation Center data indicates a number fewer than 700. The study indicates a need for improved estimates.

reported within the Jobos Bay watershed, including JBNERR, and provide a foundation for future research, conservation, and adaptive management. Some of the documented species include:

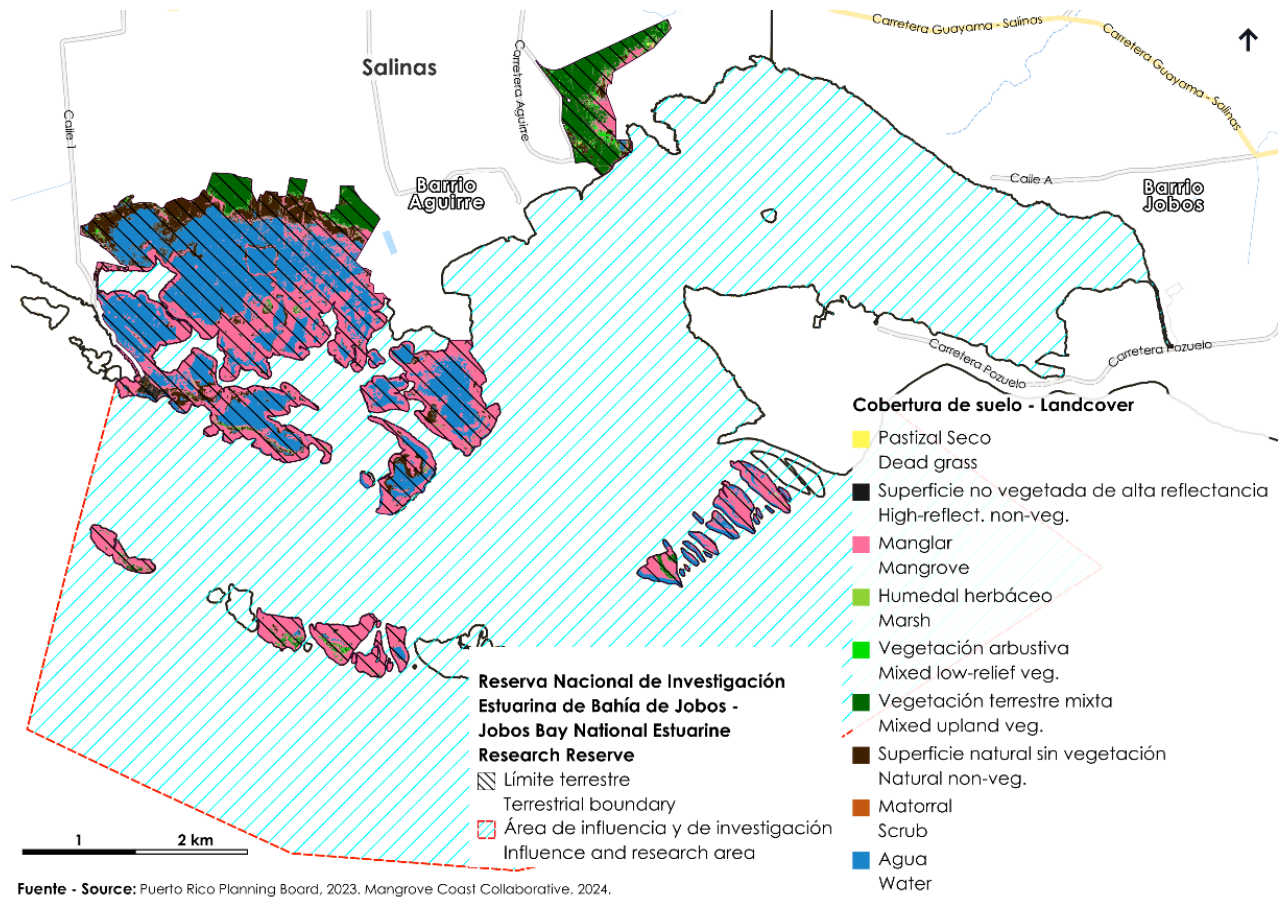
- Seventy species nesting within the watershed
- Seventeen species classified as endemic
- Two endangered species, the Puerto Rican plain pigeon (*Patagioenas inornata wetmorei*) and the yellow-shouldered blackbird (*Agelaius xanthomus*)
- At least seven near threatened species
- Three species, listed as vulnerable by the IUCN Red List of Threatened Species: Lesser Yellowlegs (*Tringa flavipes*), Black-bellied Plover (*Pluvialis squatarola*), and Short-billed Dowitcher (*Limnodromus griseus*)

Key habitats

Estuarine habitats

- Mangrove forests: Four species of mangroves are found within JBNERR; red mangrove, black mangrove, white mangrove, and buttonwood mangrove. Most of Jobos Bay's shoreline is dominated by the saltwater-tolerant red mangrove. In 2017, mangrove cover had an extent of 10.02 km² (Oliver et al., 2022). It drastically decreased to 1.25 km² following the hurricanes Irma and María in September 2017 (Oliver et al., 2022). The mangrove cover recovered to 7.25 km² in 2021 but remained below the pre-hurricane area (Oliver et al., 2022). Mangrove restoration efforts in JBNERR are ongoing.
- Salt flats and hyper saline lagoons: Occur inland from the mangrove forests. Vegetation is limited mostly to the black mangrove and other salt-tolerant species, such as saltwort (*Batis maritima*) and sea purselane (*Sesuvium portulacastrum*).
- Mudflats: Exposed at low tide and contain considerable quantities of detritus, a mixture of sand, mud, and plant and animal remains.

Map 3. JBNERR Landcover



Marine habitats

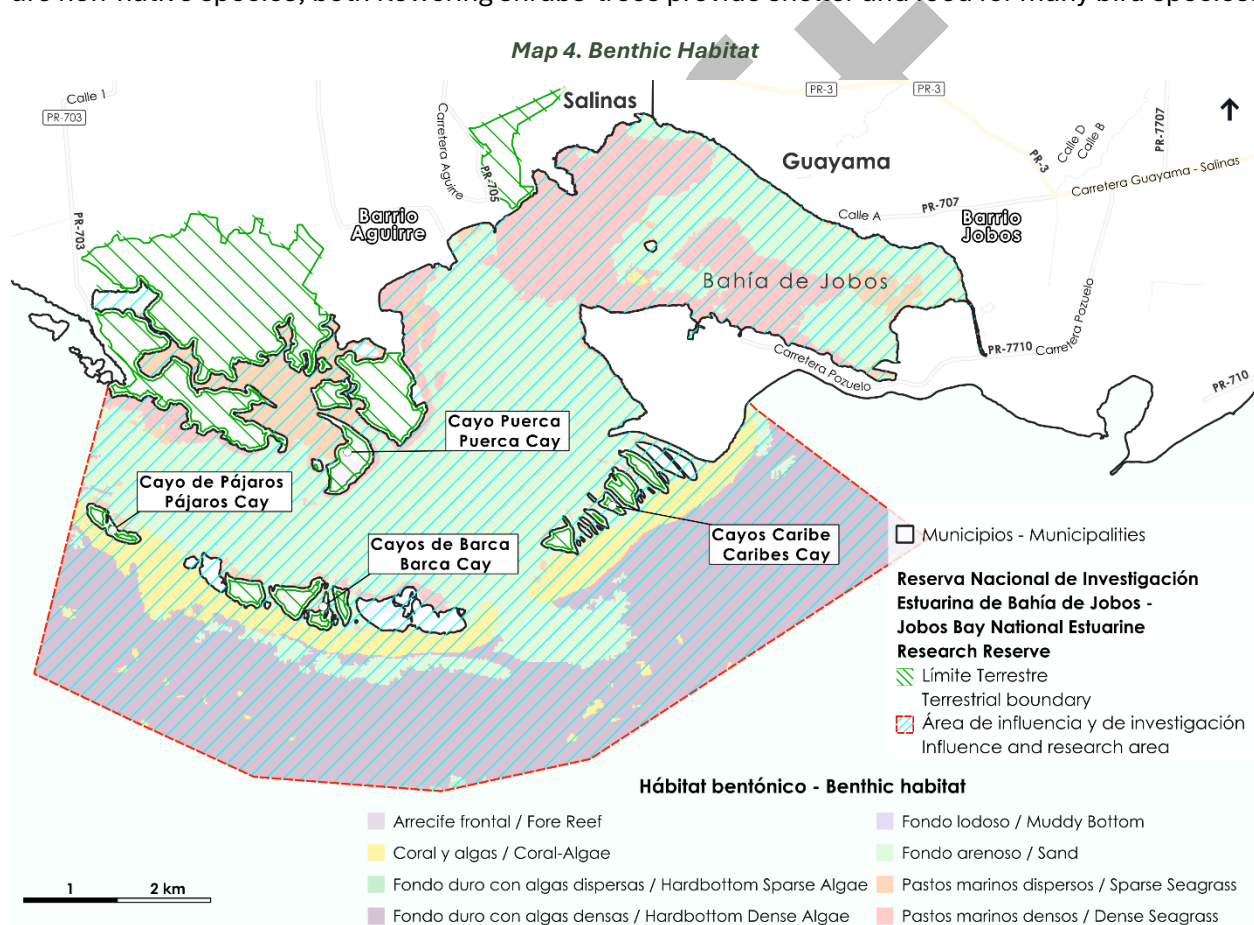
- I Algae: On hardbottom, turf algae accounted for the highest overall mean percent cover, followed by macroalgae, hard coral, sponges, and gorgonians and zoanthids. Other algae groups included crustose coralline algae, cyanobacteria and filamentous algae and rhodoliths (Whitall et al., 2011).
- I Seagrass: Comprises about 17% of JBNERR marine boundary.³ At greater depth, the seagrass coverage decreases, whereas the plant's leaves length increases (López-Morales et al., 2019). *T. testudinum* and *S. filiforme* are predominant species (López-Morales et al., 2019).
- I Coral reefs: Most of Jobos Bay's coral reefs are linear in formation, running along cays encircling the central bay (García-Sais et al., 2003). Research suggests that water quality in the Reserve is suitable for reef accretion (Rosa Marín et al., 2024). The most recent Coral Reef Monitoring Program report that includes a monitoring site in Cayos Caribe found a decline of 74.5% of the density of erect soft corals (gorgonians) (García-Sais et al., 2024). The assessment identified five species of stony corals, dominated by great star coral (*Montastrea*

³ Calculations conducted by ETI (2026) using The Nature's Conservancy Caribbean Benthic Maps data, last updated in 2024, <https://www.arcgis.com/home/item.html?id=3f7a7f61ae314f278707b8bf92806ff8> this data source was used as most recent available for the area.

cavernosa), four species of soft corals, one zoanthids, and twenty-six species of sponges (García-Sais et al., 2024).

Upland habitat

Upland vegetation in the Reserve is characteristic of the Subtropical Dry Forest. The littoral or coastal scrub (lacustrine habitat) is a dry, mainly evergreen community. In some areas at the Aguirre Unit, the wild tamarind (*Leucaena leucocephala*) is among the most dominant species due to anthropogenic disturbances. In the Mar Negro Unit, toward the mangrove ecotone, the area is dominated by evergreen flora such as wild tamarind, and mesquite (*Prosopis* spp.), although they are non-native species, both flowering shrubs-trees provide shelter and food for many bird species.



Socioeconomic attributes

This section examines the socioeconomic characteristics of Jobos ward in Guayama and Aguirre ward in Salinas — two wards that border the JBNERR. For context, municipality-level data for both municipalities as well as for Puerto Rico are also provided. Demographic and socioeconomic conditions may influence community needs, social vulnerability, and long-term planning in support of the JBNERR area management. All data presented in this section come from the U.S. Census Bureau’s American Community Survey (ACS) 2024, five-year estimates.

The population profile of Jobos and Aguirre is broadly characterized by a predominance of working-age residents, consistent with the profiles of Salinas, Guayama, and Puerto Rico as a whole. Across all five geographies, the largest proportion of residents is between 18 and 64 years of age.

Table 1. Population Statistics

Age Group	Jobos	%	Aguirre	%	Salinas	%	Guayama	%	Puerto Rico	%
Under 18	850	12.9%	1,987	18.0%	4,360	17.4%	5,895	16.7%	521,389	16.1%
18 to 64	4,668	70.7%	6,789	61.4%	15,073	60.1%	21,986	62.3%	1,954,834	60.4%
65 years and over	1,082	16.4%	2,279	20.6%	5,646	22.5%	7,417	21.0%	758,086	23.4%
Total population	6,600	100.0%	11,055	100.0%	25,079	100.0%	35,298	100.0%	3,234,309	100.0%

Source: US Census Bureau, ACS 2020-2024

Jobos has a higher concentration of working-age residents and a lower proportion of both younger and older residents. The population under 18 accounts for 12.9% of its residents, while those aged 65 and over represent 16.4% of the population. Aguirre, by contrast, more closely resembles the broader age structure observed at the municipal and Puerto Rico levels.

The income distribution of Jobos and Aguirre differs from that of Salinas, Guayama, and Puerto Rico, particularly at the lower end of the income scale. Jobos has the highest concentration of households in the lowest income categories, with 39.1% of households reporting incomes below \$15,000 and another 22.1% between \$15,000 and \$24,999. Together, more than six in ten households in Jobos earn less than \$25,000 annually. This share is notably higher than in Aguirre, where 50.2% of households fall below that threshold, Salinas (54.0%), Guayama (57.3%), and Puerto Rico (48.3%).

Although 31.3% of households in Aguirre report incomes below \$15,000, its middle-income categories are somewhat more represented than in the other study geographies. 29.5% of households in Aguirre fall between \$25,000 and \$49,999, compared with 23.6% in Jobos, 27.8% in Salinas, and 22.8% in Guayama. Aguirre also has a slightly larger share of households earning \$100,000 or more than Jobos, Salinas, and Guayama, although they remain below the Puerto Rico average.

Table 2. Household Income Distribution (yearly, \$)

Income	Jobos	%	Aguirre	%	Salinas	%	Guayama	%	Puerto Rico	%
Less than \$15,000	977	39.1%	1,478	31.3%	3,905	36.3%	6,330	40.1%	398,252	30.9%
\$15,000 – \$24,999	551	22.1%	891	18.9%	1,902	17.7%	2,721	17.2%	224,222	17.4%
\$25,000 – \$49,999	590	23.6%	1,393	29.5%	2,990	27.8%	3,608	22.8%	330,667	25.6%
\$50,000 – \$74,999	280	11.2%	488	10.3%	1,083	10.1%	1,620	10.3%	156,702	12.1%
\$75,000 – \$99,999	48	1.9%	192	4.1%	478	4.4%	826	5.2%	79,148	6.1%
\$100,000 or more	51	2.0%	273	5.8%	403	3.7%	687	4.4%	101,875	7.9%
Total	2,497	100.0%	4,715	100.0%	10,761	100.0%	15,792	100.0%	1,290,866	100.0%

Source: US Census Bureau, ACS 2020-2024

These differences are also reflected in the summary income indicators. Median household income (\$19,005) and per capita income (\$10,533) is the lowest in Jobos (Table 3). Poverty rates follow similar pattern: 58.9% of the population in Jobos falls below the poverty level.

Table 3. Income and Poverty

	Jobos	Aguirre	Salinas	Guayama	Puerto Rico
Median household income (\$)	\$ 19,005	\$ 24,731	\$ 21,901	\$ 20,402	\$ 26,297
Per capita income (\$)	\$ 10,533	\$ 14,922	\$ 14,275	\$ 13,751	\$ 17,981
Population below poverty level (%)	58.9%	41.3%	47.9%	49.0%	40.5%

Source: US Census Bureau, ACS 2020-2024

Overall, the data indicate that Jobos experiences the greatest level of economic disadvantage among the geographies compared, with a higher concentration of households in the lowest income brackets, lower overall income levels, and a substantially higher poverty rate. Compared with Jobos,

Aguirre exhibits comparatively less socioeconomic disadvantage and more closely resembles the surrounding municipal and Puerto Rico-wide patterns.

Employment indicators show that Jobos has a notably weaker labor market profile, with the lowest labor force participation rate (28.0%). Aguirre presents a stronger employment profile and is more closely aligned with Salinas and Puerto Rico. Its labor force participation rate is slightly above those of Salinas and Guayama, although still below Puerto Rico overall.

Unemployment rates show a somewhat different pattern. Jobos have the lowest unemployment rate (2.0%), yet it should be interpreted alongside its very low labor force participation rate, which suggests that a relatively small share of the working-age population is active in the labor market. In other words, the low unemployment rate in Jobos does not necessarily indicate stronger employment conditions, but rather a more limited level of labor force engagement.

Table 4. Employment Characteristics

	Jobos	Aguirre	Salinas	Guayama	Puerto Rico
Population 16 years and over	5,846	9,443	21,487	30,324	2,788,407
Labor force participation rate	28.0%	43.3%	42.0%	37.7%	46.4%
Unemployment rate	2.0%	3.2%	7.2%	4.5%	10.7%

Source: US Census Bureau, American Community Survey 2024

Overall, the comparison indicates that Jobos and Aguirre do not share the same socioeconomic profile, despite their location within the broader preservation area. Aguirre generally aligns more closely with the patterns observed in Salinas, Guayama, and Puerto Rico, particularly in terms of age structure, income levels, poverty, and employment conditions. Jobos, by contrast, stand out as more economically vulnerable, with lower income levels, a higher concentration of households in the lowest income brackets, higher poverty, and substantially lower labor force participation.

These findings suggest that the communities around JBNERR are not socioeconomically uniform and may face different levels of need and vulnerability. In this context, the socioeconomic profile of the area should be understood as varied rather than homogeneous, with Jobos showing greater signs of disadvantage and Aguirre reflecting conditions that are comparatively closer to the surrounding municipal and island wide context. This distinction is relevant for planning purposes because it highlights the importance of considering local differences in community conditions when evaluating the broader social setting of a natural reserve.

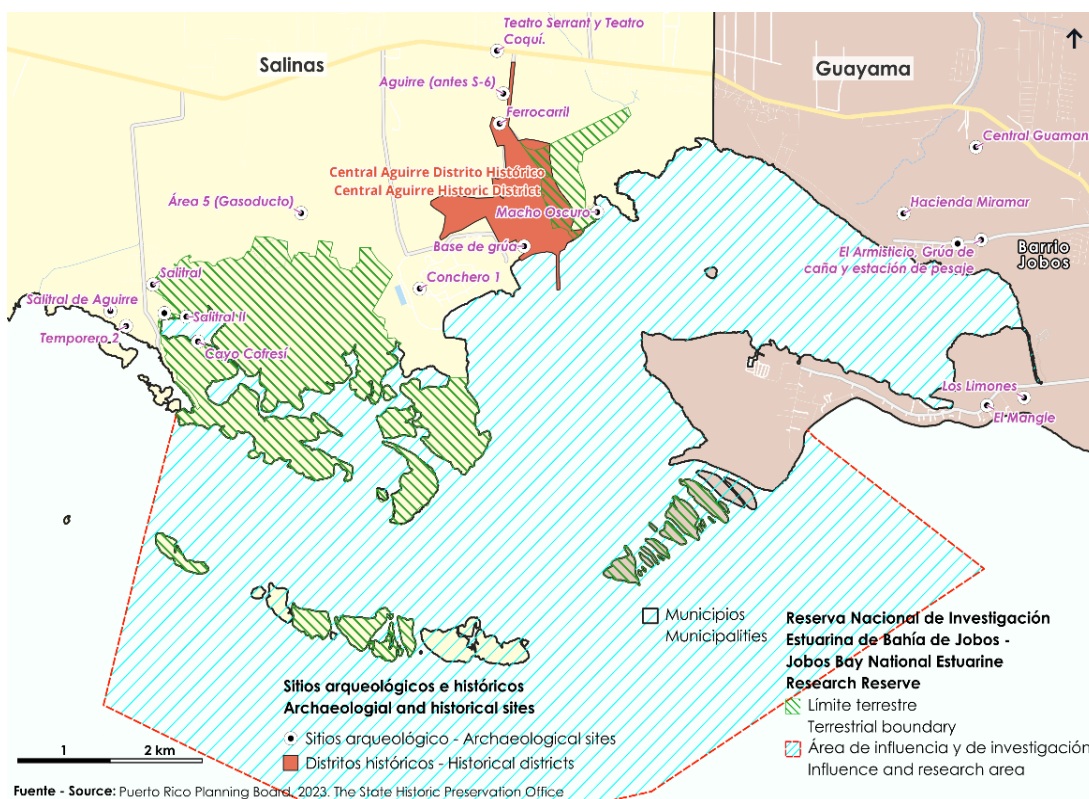
Archaeological and cultural resource

The JBNERR and its surrounding areas contain important archaeological, cultural, and historical resources that provide evidence of historic patterns of human occupation and coastal use. The Central Aguirre Historic District, listed in the National Register of Historic Places in 2002, is considered the most representative example of a company town in Puerto Rico, encompassing industrial, administrative, residential, and recreational components historically associated with the sugar industry (DNER, 2017). Remnant structures within the Reserve, such as the Visitor Center

(former American Club House) and the train station, continue to reflect this legacy. There are also at least five archaeological and historic sites within the Reserve boundaries, including Cayo Cofresí, an Archaic-period (ca. 300 B.C.) shell midden site considered diagnostic for understanding early human occupation in the region (OECH, 2015, p. 8). The site, located within the Jobos Bay system, reflects early coastal resource use through the presence of shell, bone, and lithic materials associated with subsistence activities (OECH, 2015, p. 8). Other sites include Salitral I, Salitral II, Plaza Recreativa Las Mareas, and Macho Oscuro. Continued coordination with the Puerto Rico State Historic Preservation Office and other relevant local entities and experts is recommended to support their long-term protection and interpretation. In addition, historic resources within the Reserve include sites such as Hacienda Esperanza in the Aguirre sector, which preserves structural remains associated with agricultural production (OECH, 2015, p.12), and the Central Aguirre industrial complex, which includes infrastructure such as offices, warehouses, workshops, and crane systems that reflect the scale and organization of the sugar industry (OECH, 2015, p.13).

As shown in Map 5, archaeological sites are widely distributed across the coastal zones of Salinas and Guayama, with a higher concentration along the western portion of the Reserve, particularly in the Aguirre area, overlapping with its coastal and marine components. These spatial patterns are supported by archaeological records indicating a concentration of sites in coastal and transitional zones such as Barrio Aguirre and Río Jueyes (OECH, 2015, p. 2). The Las Mareas–Salich site, located in the Aguirre sector, corresponds to an Agro-ceramic occupation (ca. 600–1200 AD) and represents one of the most significant shell midden complexes in the region, with evidence of organized settlement features such as habitation areas and possible batey structures (OECH, 2015, p. 9). More broadly, archaeological evidence from the southern coastal plain indicates that many of these sites correspond to organized indigenous settlements, including midden deposits and structural features, reflecting varying levels of occupation intensity and social organization over time (Rodríguez López, 1986, pp. 16-18). The coastal plain of Salinas has also been identified as an area of high archaeological potential due to its environmental and settlement characteristics, including productive ecosystems such as mangroves and estuarine systems that historically supported fishing, shellfish gathering, and sustained human occupation (Rodríguez López, 1986, p.7).

Map 5. Archaeological and Historic Sites Located Within and Adjacent to the JBNERR



Threats and stressors

Although reserves within the NERRS were designated as representative and relatively pristine estuarine ecosystems, the JBNERR has increasingly been exposed to a range of environmental and anthropogenic stressors that affect its ecological condition, public access, infrastructure, and long-term management capacity. Many of these stressors operate cumulatively and may intensify during episodic disturbance events such as tropical storms, hurricanes, droughts, and coastal flooding. Moreover, urban, industrial, recreational, and coastal development in the surrounding area places additional pressure on the Reserve's ecosystems, resources, and management capacity. This section summarizes the main stressors on the JBNERR.

Figure 6. Summary of the Main Stressors on the JBNERR

Environmental stressors	Anthropogenic stressors
• Coastal hazards • Natural disasters • Sargassum events • Species diseases	• Illegal activities • Water quality • Coastal development • Conflciting uses • Institutiunal management constaints

Environmental stressors

Natural stressors affecting the Reserve include natural hazards (flooding, storm surge and resulting hypersalinity, coastal erosion, drought, extreme heat, strong winds), natural disasters, sargassum influxes, and diseases affecting terrestrial and marine species.

Natural disasters such as hurricanes can have severe effects on Reserve's ecosystems and facilities. Recent hurricanes, including Irma and María in 2017 and Fiona in 2022, demonstrated the Reserve's vulnerability to wind damage, prolonged inundation, storm-driven overwash, erosion, and rapid changes in salinity and water quality. These disturbances affect mangrove forests, seagrass beds, benthic habitats, and nearshore ecosystems, while also damaging trails, access roads, monitoring stations, and visitor infrastructure. In an estuarine system — where ecological processes are strongly influenced by tidal flushing, salinity dynamics, and freshwater inflows — storm damage may contribute to longer-term habitat degradation and conversion when combined with pre-existing environmental stressors.

In addition, recent sargassum events and associated “brown tide” conditions have contributed to elevated turbidity, increased suspended solids, and lower pH conditions in nearshore waters, potentially affecting water quality and light availability for submerged aquatic habitats.

Prolonged drought conditions and reduced freshwater inflows may increase hypersaline conditions within portions of the estuary, contributing to vegetation stress, reduced ecological productivity, and increased vulnerability of mangrove communities and submerged aquatic vegetation. Extreme heat and reduced water circulation may also increase physiological stress on estuarine ecosystems and contribute to low dissolved oxygen conditions during periods of limited tidal flushing.

Anthropogenic stressors

Anthropogenic stressors within and adjacent to the Reserve include illegal activities (land encroachment, wetland alteration, unauthorized vegetation removal, wetland excavation), water quality, coastal development, institutional management constraints, and conflicting uses (e.g., recreational boating, conflicts among user groups). Recreational boating contributes to shoreline disturbance, wildlife impacts, and localized habitat degradation in sensitive coastal areas. Additional concerns include vandalism, infrastructure deterioration, insufficient public awareness of the Reserve's mission and programs, and concerns regarding enforcement and patrolling capacity.

The Reserve also continues to experience pressures associated with water quality from human activities within the coastal plain. Roads, filling activities, drainage modifications, groundwater extraction, and legacy infrastructure may alter freshwater inflows, water residence time, and salinity dynamics, increasing ecological stress on mangrove systems and other estuarine habitats. Water-quality impairments associated with stormwater runoff, sediment delivery, nearby industrial activities, and other point and nonpoint pollution sources may further affect ecological condition, particularly during high rainfall events and periods of limited flushing.

Reserve Boundary

The Jobos Bay estuary is part of the South coastal plain of Puerto Rico. The formal boundaries include Aguirre in the northeast, Mar Negro in the northwest, Cayos Caribe and the coastal waters of the Jobos Bay (excluding the navigation channel) in the south.

Core and buffer

For management purposes, JBNERR current boundaries are subdivided into five management units. The terrestrial units are Mar Negro Unit; Aguirre Unit; Cays Unit (includes Cayos de Barca (4 of 7 islands); Cayos Caribe (15 of 17 islands); and Cayo Pájaros. The marine component includes Coral Reef Unit and Jobos Bay Unit.

Management within each unit is guided by whether the unit, in whole or in part, is classified as a core or buffer area. Core areas at JBNERR are those that include habitats essential to the functioning of the estuarine ecosystem. They protect a full range of significant physical, chemical, biological and ecological attributes that support the diversity of fauna, flora and natural processes occurring within Jobos Bay. Public access is limited to low impact activities such as observation of nature, guided tours by the Reserve staff, research and education. The core areas of the Reserve include the Mar Negro and the Cays Units.

Buffer zones within the Reserve protect the core areas and provide additional protection for estuarine-dependent species, including endangered listed species. Buffer areas also include facilities for public access. The Aguirre Unit, where the Visitor Center Complex is located, the Jobos Bay Unit as well as the Coral Habitat Unit, serve as buffer areas.

Map 6. JBNERR Marine and Terrestrial Boundaries, Including Core and Buffer Areas



Land ownership and type

All lands that comprise JBNERR are either public lands or public domain lands; reserve lands are under DNER ownership. The marine component (waters and submerged lands) is of public domain, which according to the Commonwealth legal framework (Civil Code, Subtitle 2, part I, Chapter 127), “does not belong to anyone in particular.” However, waters and submerged lands are administered by the DNER, through its Organic Act, which provides that the agency has the duty to exercise surveillance and ensure the conservation of territorial waters, submerged lands thereunder, and the maritime terrestrial zone.

To the east, JBNERR is surrounded by two natural protected areas: Aguirre State Forest and Punta Pozuelo Natural Protected Area. Both protected areas represent an opportunity for a comprehensive management of these coastal resources.

To the north, the Reserve is surrounded by agricultural lands, property of the Puerto Rico Land Authority (PRLA) that are leased to private parties for agricultural activities, specifically crop cultivation. These areas must be properly managed to avoid impacts on the coastal waters’ resources and surrounding wildlife.

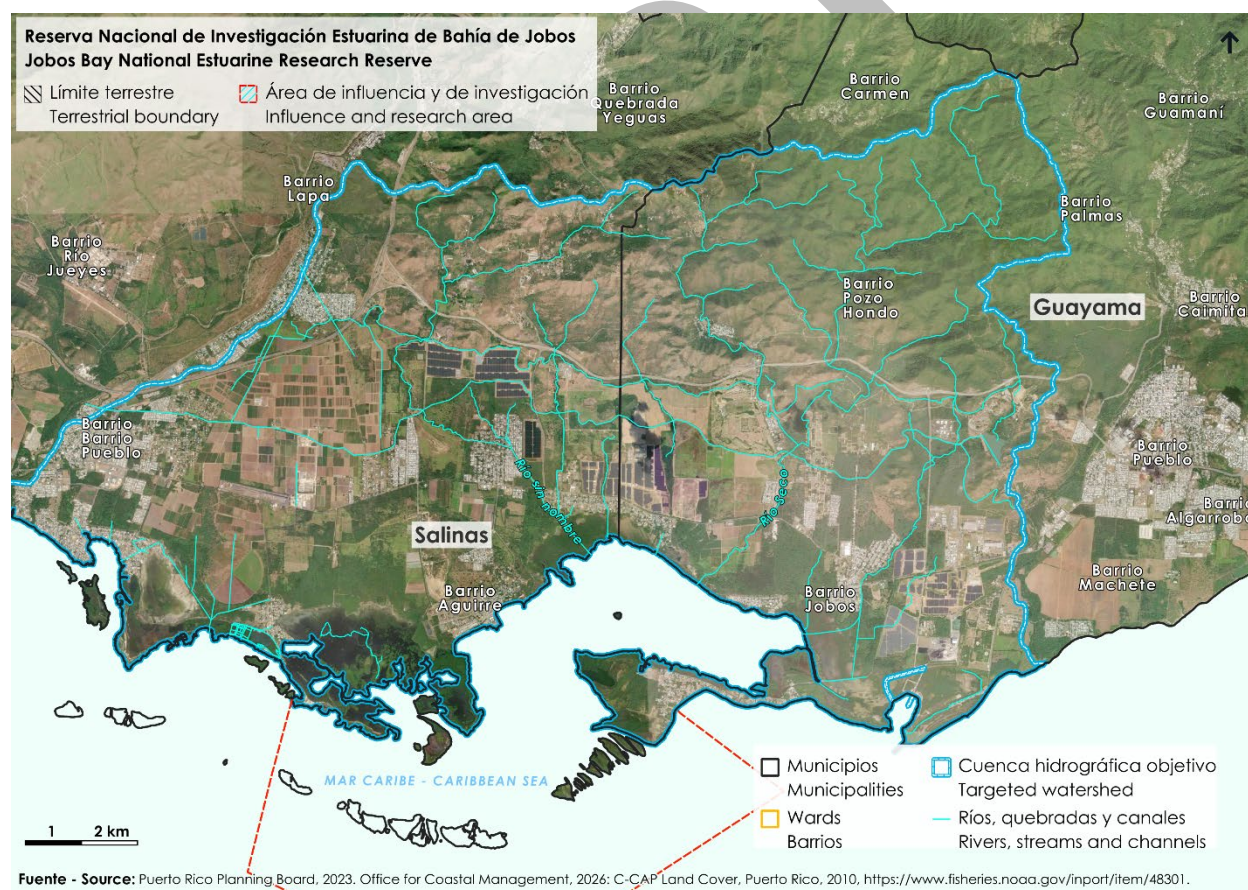
Between Mar Negro and Aguirre Units is the Aguirre Power Plant, property of the Puerto Rico Power Authority, and the old Aguirre Sugar Mill, with some parts owned by the Municipality of Salinas and remaining, by the PRLA ownership.

The Reserve is also surrounded by private lands where various communities have been established. Bordering the western limits of the Reserve is Las Mareas community and other residential construction along El Camino del Indio. Some of the development has encroached into the Reserve; this situation is listed as part of threats and stressors.

Targeted watershed boundary

Targeted watersheds represent those watersheds that directly flow into and impact the habitats within reserves. The targeted watershed for the JBNERR was established based on the U.S. Geological Survey Hydrologic Unit Codes that encompass the river systems directly flowing into the reserves. The boundary comprises three watersheds – East of Río Nigua, Aguas Verdes stream, and Río Seco.

Map 7. JBNERR Targeted Watershed Boundary



Boundary modifications

Since the adoption of the 2000 management plan, the DNER has acquired lands, clarified boundaries and identified important species in the Jobos Bay waters. As a result, a boundary

amendment will be submitted as per 15 CFR 921.33 to expand the Reserve’s boundaries. This management plan identifies these areas as “proposed boundaries”, since they have not been formally incorporated in the Reserve’s boundaries. These proposed boundaries include lands that were purchased and coastal waters of public domain that are under the DNER control. These areas, when incorporated, will provide the Reserve with better control over its resources and direct access to Jobos Bay’s waterfront. Further, the acquisition of lands east of the Reserve would protect a stretch of mangrove forests, currently subject to fragmentation due to the illegal construction of water access routes and improvised boat ramps, particularly south of the Mosquito and Puerto de Jobos communities. Land Acquisition Plan contains more details about the proposed future incorporations.

Draft

Reserve Strategic Plan

JBNERR Vision

Puerto Rico fosters healthy and resilient estuaries and watersheds by advancing science, strengthening sustainable stewardship, empowering communities, and protecting the connections among their land, water, peoples and culture.

JBNERR Mission

To practice and promote coastal and estuarine conservation through innovative research and long-term monitoring, education, training, stewardship, and community involvement at the Jobos Bay NERR.

Priority Coastal Management Issues

For the 2026-2030 management period, Jobos Bay NERR will focus on addressing the following priority coastal management issues:

Environmental stressors

Coastal hazards and other events such as ocean acidification and sargassum pose a challenge for the Reserve's ecosystems and the already vulnerable surrounding communities. However, specific impacts on the Reserve's habitats and species are not well known. Drought, changing sea levels, storm surge, erosion, and increase in frequency and intensity of storms present risks for cays, mangroves, and wildlife that inhabit them (Murry et al., 2019).

Given the breadth of potential impact of environmental stressors on JBNERR and its surrounding communities, it is imperative to work with the communities to increase resiliency, reduce stressors, and improve knowledge on their potential effects on the Reserve and its watershed. Information generated through research in this topic will be the baseline for the development of management measures, as well as education and training activities in the Reserve and its watershed.

Habitat protection and restoration

Coastal and marine habitats in the Jobos Bay experience loss and degradation. Several factors contribute to this problem, such as illegal cutting of mangroves, filling of wetlands, and development in the maritime terrestrial zone. The Reserve is also affected by the watershed's sprawling development. Urban expansion in Jobos Bay vicinity directly correlates with the loss of mangrove habitat, observed in recent years (Spencer et al., 2021).

Habitat protection and restoration are thus critical activities to increasing the resiliency of ecosystems and coastal communities. Measures that seek to enhance habitat and promote inter-habitat connectivity are key to mitigating the effects of environmental stressors. They support species migration and biodiversity and can be achieved through proper management of the watershed's public and private lands and the cays.

Water quality

Agricultural and industrial activities in the region, wastewater systems, runoff, and upstream impoundment contribute to the impairment of Jobos Bay waters (Environmental Quality Board, 2014). Severe sedimentation affected offshore corals in Jobos Bay, contributing to decreased growth rates and reduced recruitment (Whitall et al., 2011). Poor water quality also affects mangrove's extent (Spencer et al., 2021). Water quality analysis of Jobos Bay conducted between 2017 and 2021 indicated that the turbidity levels and Colored Dissolved Organic Matter (CDOM) concentration have been steadily increasing over the years (Spencer et al., 2021).

Water quality issues may affect ecological condition, particularly during high rainfall events and periods of limited flushing. The watershed's sources of pollution and their effects on marine and terrestrial ecosystems should be targeted through effective management, education, training, and collaboration. Proactive surveillance by the DNER Ranger Corps, and proper coordination and partnerships with decision makers in the watershed is essential to address this issue.

JBNERR Goals and Objectives

Goals

Strengthen the protection and management of the Jobos Bay NERR to advance estuarine conservation, research, and education.	1
Increase the use of Reserve science to address priority coastal management issues.	2
Advance stakeholders' environmental literacy and provide them with the knowledge and tools needed to make informed decisions.	3
Improve ecosystem and water quality through science-based, adaptive, and collaborative management	4
Enhance the administrative capability and infrastructure of the Jobos Bay NERR to meet the stewardship, research, education, and training future objectives.	5

Objectives

Research and Monitoring Program				
1. Conduct research to better understand the Reserve's hydrological changes and estuarine dynamics, effects of environmental stressors, and social dynamics.	2	3	4	
2. Increase availability and accessibility of scientific data, research findings and the Reserve's capabilities to researchers, resources managers and other audiences.	1	2	3	4
3. Expand the SWMP and Non-SWMP monitoring initiatives to enhance understanding of the key habitats in the Reserve and their stressors.	1	2	3	4

Education Program				
1. Increase the participation of students and teachers in the Reserve by providing high-quality, place-based educational activities.	1	2	3	
2. Develop a Conservation Action Education Program to increase knowledge and engagement among community members as well as to increase the volunteer base.	1		3	4
3. Increase the number of visitors who engage with Jobos Bay NERR as a resource for learning about its ecological and historical significance and community resilience.	1	2	3	4
4. Assess the effectiveness and satisfaction of participants on each Educational Program activity.	1	2	3	4
Training and Engagement Program				
1. Strengthen the capacity of decision makers, resource managers, and communities to support effective coastal resource management and protection.	1	2	3	4
2. Build the capacity of decision makers and communities to address environmental stressors, coastal vulnerability, and adaptation.	1	2	3	4
3. Increase collaboration with coastal decisionmakers representing the Commonwealth, federal, and community organizations.	1	2	3	4
4. Determine the needs of target audiences for the TEP program to continue providing relevant services.	1	2	3	4
Stewardship Program				
1. Carry out habitat enhancement projects to benefit local ecosystems and migratory species.	1			4
Administrative Plan				
1. Recruit additional JBNERR staff to support administrative and programs' efforts.	1			5
2. Strengthen JBNERR staff capabilities by providing trainings and developing annual work plans.	1			5
Resources Protection Plan				
1. Improve law enforcement in the Reserve and its watershed.	1			5
2. Protect sensitive areas from human induced perturbations.	1		4	5
Public Access and Visitor Use Plan				
1. Establish a baseline to develop the necessary visitor control measures.	1			5
2. Enhance and improve trails connecting areas of interest in the Reserve.	1			5
3. Enhance public access and the visitor experience.	1		3	5

Each objective corresponds to one or more JBNERR goals and includes numerous actions to achieve them. To facilitate implementation, objectives and actions are divided by their corresponding program area. The specific actions are detailed below in their corresponding sections.

Program Foundations

Research and Monitoring

National Estuarine Research Reserves are created to provide a stable platform for long-term research on estuarine conditions and relevant coastal management issues. The national System-Wide Monitoring Program (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 Centralized Data Management Office. 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 guidance for monitoring Coastal Habitat Response to Changing Water Levels.

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 systemwide 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. 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 and Monitoring Program Context

Program Setting

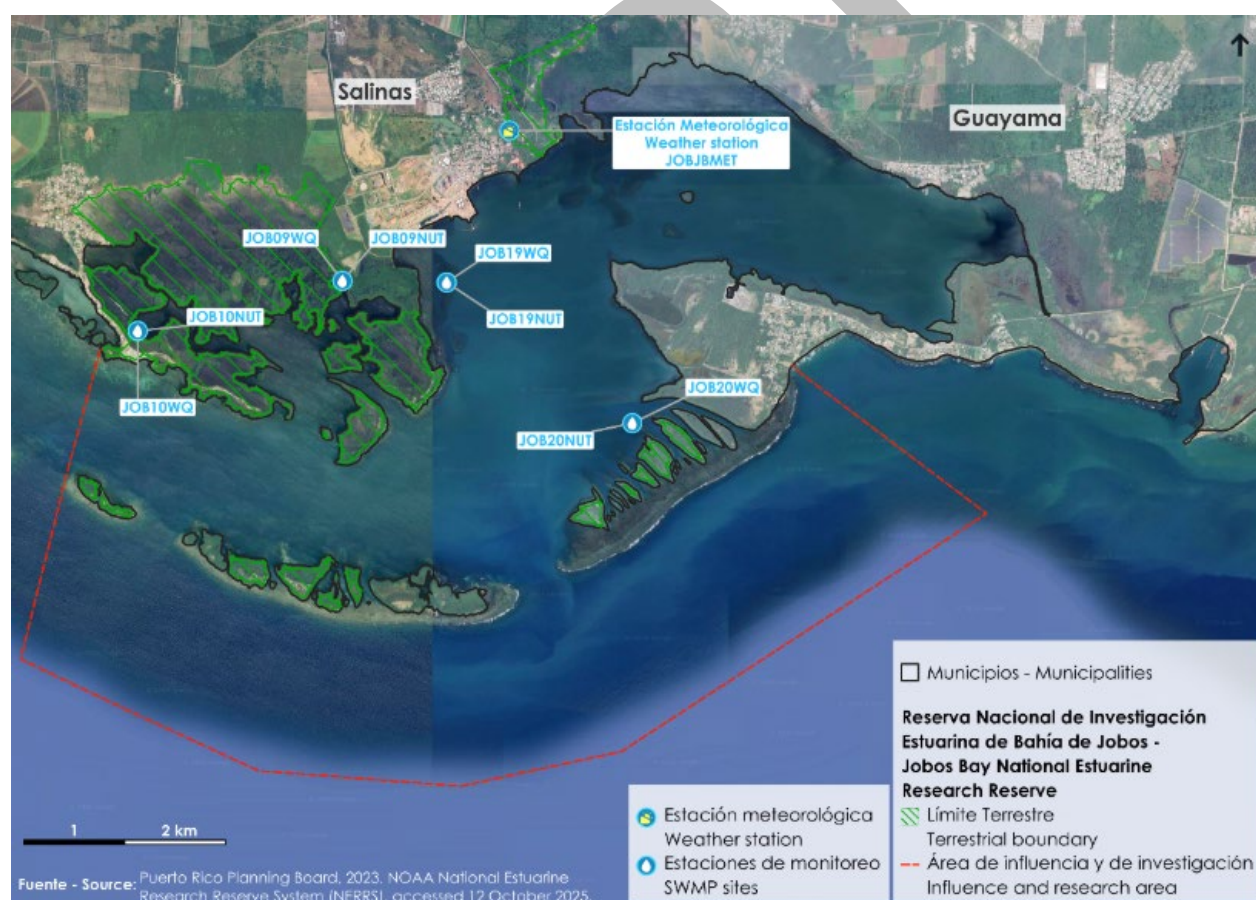
The JBNERR Research and Monitoring Program focuses on providing a data-rich environment to support and attract research that explores the interactions of watershed, oceanic and climatic forces on coral and coral-related environments. The Program contributes to science by implementing long-term water quality and biological monitoring programs, supporting visiting investigators, mentoring graduate researchers and Hollings Scholars, and partnering with university and governmental programs. The Program covers the entire extent of the Reserve's limit, with the focus on the current monitoring stations (Map 8):

- Four System-Wide Monitoring Program (SWMP) sites, implemented since 1995. The program monitors temperature, conductivity, salinity, turbidity, dissolved oxygen, pH, depth and chlorophyll parameters.

- I Sentinel site, which provides the necessary information to understand sea level change impacts on the Reserve’s ecosystems and coastal communities. JBNERR is the only NERR Sentinel Site representative of the West Indian biogeographic region. The long-term expected outputs of the monitoring are: (1) understanding the interrelationship between changes in the water budget and sea-level rise and their impacts on mangroves; (2) monitoring of changes in water quality resulting from sea-level rise, including changes in water levels and their impacts on coastal vegetation and freshwater resources; and (3) monitoring of water-level changes associated with episodic storm events and flood and inundation predictions.
- I Weather station, established in 2011. The principal objective is to record long-term meteorological data to track changes in conditions that can be associated with changes in estuarine habitats.

The Program also supports monitoring and research projects in other areas of the Reserve through research collaborations.

Map 8. JBNERR Monitoring Sites



Priority Issues

The Program collects data to support priority coastal management issues discussed above. It also integrates with other programs and incorporates the watershed, Jobos Bay, and nearshore

environments through a ‘Summit to Sea’ approach. Over the next five years, the Program aims to address the following issues:

- Continue and expand its research and monitoring projects.
- Leverage collaborations to address staff and equipment limitations. Through collaborations with faculty members, seek to involve more students in JBNERR research, particularly for long-term projects.
- Strengthen data communication.
- Foment work on the impact of sargassum and other environmental stressors on the Reserve’s ecosystems.
- Reinforce the meetings with the Research Advisory Committee.

Priority Audiences

Target audiences include graduate and undergraduate students and academics from Puerto Rico, universities in the U.S. and the Caribbean, as well as independent researchers. They closely overlap with research partners, discussed below. During this management period, the Program is interested in expanding its outreach to volunteers who could assist staff with data collection and data entry.

Research and Monitoring Program Capacity

Staff

The Program is managed by a Research Coordinator with the support of a SWMP Technician, who is responsible for data acquisition and processing. The coordinator develops the long-term vision for the program and oversees all aspects of research and monitoring, including the coordination with the researchers doing work at the Reserve. The coordinator also supports other Reserve’s programmatic areas by providing talks and trainings as well as other management assistance needed. The coordinator designs and leads the research and monitoring program in accordance with NERRS guidelines, serves as a liaison with the public, and translates scientific findings into practical public applications.

The SWMP Technician works with the boat operator to access the SWMP monitoring sites to collect the abiotic data. The Technician further maintains and submits the data associated with the SWMP Program, including data logger maintenance and database management. In addition, the Technician manages lab space and equipment used by staff, graduate students and visiting researchers, and analyzes samples collected for the interstitial pore water and watershed monitoring programs.

Additional positions are needed to strengthen the Program’s capacity. The Reserve should have dedicated administrative personnel, allowing each Program’s staff to concentrate on their operational functions. The Program also needs to fill the chemist position.

Facilities

The Reserve has a research laboratory for staff, dormitory facilities that have been expanded to provide more rooms, a lab for students and visiting researchers and a living room, and office space

to support Reserve staff. The JBNERR facilities have reliable and fast internet connection which is an essential tool to deliver data to researchers at any location worldwide.

Vehicles and equipment include a 17' Boston Whaler (El Manatí), 22' Boston Whaler (El Estuarino), 25' Boston Whaler, twelve YSI EXO multiparametric water quality instruments, one weather station, and four drones. Additional equipment desired to enhance the Program's capacity includes a camera to be permanently installed on the boat, as well as an aquatic drone. This equipment can help visualize density and population of seagrass, sargassum events, and complement the water monitoring.

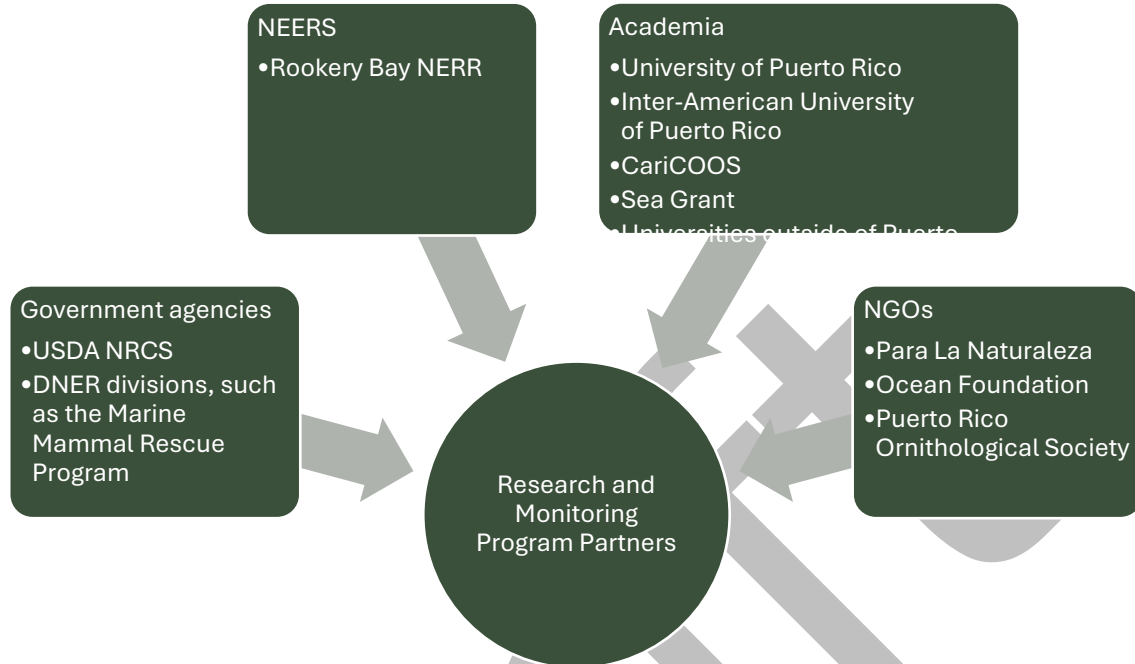
The research conducted in the Reserve as well as monitoring data is organized using Mendeley Reference Manager and is available digitally upon request. It includes all research publications, peer reviewed, technical reports, theses, and dissertations.

Research Partners

The Program collaborates with local and nationwide universities and programs to develop research and student internship opportunities. Collaborations is an important achievement and core element of the Program; they help the Program to expand research projects and address some of the limitations associated with lack of personnel and equipment.

The coordinator continually carries out efforts to recruit graduate students from local universities to support the Reserve's water quality and biological monitoring initiatives. Research partners include federal and state agencies, other NERRS, universities and research institutions in and outside of Puerto Rico, and nongovernmental organizations.

Figure 7. Research and Monitoring Program Partners



In addition to external collaborators, the Program also works closely with all JBNERR programs, particularly Education. Education Program’s audiences are closely related to Research topics and want to know about the research work conducted at the Reserve. Research staff, thus, often accompanies visitors of the Education program during the guided walks, tailoring the communication based on the audience’s characteristics and interests.

The Program also has Research Advisory Committee which provides guidance on research, monitoring, restoration, and science initiatives within the Reserve and its watershed. Due to COVID-19 pandemic and other challenges, the frequency of meetings with the Committee has declined and have mostly used the format of individual consultations. Retaking group meetings is one of the priorities for the Program for the next five years.

Research and Monitoring Program Delivery

Reserve research and monitoring activities are guided by the “National Estuarine Research Reserve System Research and Monitoring Plan 2012-2017”, which identifies goals, priorities and implementation strategies. In turn, the Reserve has developed complimentary objectives and actions which aim to expand knowledge, disseminate and increase access to information, and strengthen monitoring initiatives.

The Research and Monitoring Program will help ensure the availability of scientific information that has long-term, system-wide consistency and utility for managers and members of the public involved in protecting or improving coastal ecosystems. The Program’s results will support DNER

coastal natural protected areas' managers and decision makers in addressing complex coastal management issues. In the Reserve, research and monitoring are the baseline for the development of management measures and provide the basis for the Education and TEP programmatic efforts.

A priority area during the next management period is to improve data communication and widen its use to support management. The Program is also interested in conducting systematic research and monitoring of sargassum; however, due to limited staff, the Program seeks to conduct this research through existing and new collaborations. Strengthening its collaboration network, such as partnership with NGOs and academia, is another priority area for the Program. Specifically, the Program wants to strengthen collaboration with CariCOOS, Sea Grant, University of Puerto Rico (UPR), and establish new partnership with the researchers at the Interamerican University.

During the last management period, the Program completed one full sentinel site (SSAM-1), in compliance with the 312 performance measures and to increase understanding of how environmental and other stressors affect coastal ecosystems in the Reserve and the wider Caribbean. This is a long-monitoring project; the Program has proposed to monitor the site annually.

Since 2017, the Program has directly participated in NERRS Science Collaborative projects, a program that links decision-makers with research and applies science and technology to the coastal zone. The Research and Monitoring Program will continue to integrate and apply the principles of collaborative research, engagement, post-secondary education, and adaptive management with the goal of developing and applying science-based tools to detect, prevent, and reverse the impacts of anthropogenic stressors in the context of climate change.

Research and Monitoring Future Needs and Opportunities

Program needs and opportunities were identified in coordination with different stakeholders, and include:

Needs

- I Improve administrative processes: Equipment acquisition, contracting, and hiring are managed at the central DNER administration level. These processes often result in delays and affect the Reserve's ability to meet its research and monitoring needs. Examples include the need for at least one additional technician (chemist) and personnel dedicated to administrative tasks. The Reserve also lacks staff to process and communicate collected data to the lay audience. The Program also needs to have all necessary sensors for the SWMP program and functioning boats and vehicles to conduct regular and comprehensive monitoring, but the purchase or repairs of this equipment often experiences lengthy administrative delays. To address this need, the DNER has contracted a company that will assess the current administrative processes and provide recommendations on how to improve.
- I Expand research and monitoring projects: The Program has identified a need for additional projects, subject to availability of staff and equipment. Possible projects include:

- Monitoring of invasive species, such as *Halophila stipulacea*. This seagrass species should be monitored as it is very challenging to eradicate and can affect local habitats.
 - The Program observes sargassum events but identified a need for a monitoring program specifically dedicated to sargassum. The Program has established a collaboration with research organizations to study heavy metals associated with sargassum and their impacts in ecosystems.
 - Current species monitoring focuses on birds and some large marine mammals but could be expanded to other important elements of ecosystems such as coral reefs.
 - Improve knowledge on the saline intrusion and underground waters. The U.S. Geological Survey (USGS) has documented the hydrologic conditions in the South Coast aquifer since 1958, including groundwater levels and withdrawals, and water quality. However, it could be useful to obtain data on salinity, temperature, and conductivity of the underground water wells. There is also a need to know the location of the aquifer points of discharge, the amount of groundwater entering the system, and the discharge points to develop management measures.
 - Update previous research on contaminants (runoff, atmospheric heavy metals) and consider new sources of contamination (e.g. sargassum).
 - Through collaborations, strengthen socio-ecologic research and studies on the economic valuation of JBNERR ecosystems services.
 - Implement research that involves remote sensing.
 - Explore the topic of blue carbon at JBNERR.
- I Disseminate scientific information generated by the JBNERR: The Program has an interest to enhance its data communication. One idea, subject to staff availability, is a web portal that functions as data and visualization center to support decision-making and communicate environmental quality parameters. Specific examples include the effects of environmental stressors on ecosystems and water quality indices. The web portal could be hosted at DNER website or at another domain.

Opportunities

- The Reserve offers one of the most data rich, stable, and equipped protected areas for conducting research in the Caribbean. These research opportunities make the Reserve well-suited to leverage collaborations (academia, state and federal agencies) to address staff shortage and expand current research projects.
- Create citizen science and participatory monitoring initiatives. JBNERR would need additional staff who could help run the program. The volunteers would also need to be trained in data quality.

Research and Monitoring related objectives and actions

Objective 1. Conduct research to better understand the Reserve's hydrological changes and estuarine dynamics, effects of environmental stressors, and social dynamics.

1.1 Establish collaborative networks with existing research stations in Puerto Rico and the Caribbean

Collaboration is essential to position the Reserve and to generate the necessary knowledge about the estuarine ecosystems in Puerto Rico and the Caribbean. During this planning period, the Program seeks to strengthen collaborations with CariCOOS, Sea Grant Puerto Rico, and International Institute of Tropical Forestry. These collaborations will strengthen the Program's ability to address emerging research needs, discussed above.

1.2 Convene social science researchers and historians to discuss research needs and opportunities

The Reserve will convene social scientists and historians that are knowledgeable in the Reserve to identify: future research needs and topics, infrastructure, equipment and materials as well as the potential for collaboration. Potential collaborators include Sea Grant, Rural Community Assistance Partnership (RCAP), Pontifical Catholic University of Puerto Rico (PUCPR), and Smith fellows.

1.3 Develop a hydrodynamic model for the Jobos Bay in collaboration with CariCOOS or other research partners

This model will: (1) aid in defining the longshore transport component that delivers sediments and contaminants to coral reefs; (2) link the pathways of contaminants present in Jobos Bay and offshore coral reefs to their likely origins within nearby watersheds; (3) serve as a valuable tool for responding to potential hazardous material spills from shipping activities and the adjacent industrial facilities; and (4) aid in identifying habitats affected by the thermal discharge from the thermoelectric plant through an outfall pipe into the center of Jobos Bay. The TEP will apply this model to determine where to target training efforts to reduce the impacts of contaminants and sediments from the adjacent watershed. The Education Program will also use the model to produce targeted outreach efforts. CariCOOS may collaborate to develop this model.

1.4 Develop a hydrologic model in the Jobos Bay NERR watershed to better define the contribution of surface and groundwater to the estuary in collaboration with the research partners

The groundwater flow model developed by the USGS provides the baseline for the development of this hydrologic model. The USGS also collects the surface data needed to develop this numeric model, with the support of the Reserve, and will be an important collaborator in the development of this model.

1.5 Conduct research on the Jobos Bay NERR blue carbon processes

Understanding the carbon storage capacity of the Reserve will be an important tool for its protection and other wetlands in Puerto Rico. Research in blue carbon processes will help to understand how wetlands store and sequester carbon to reduce the impacts of air contaminants. NERRS and their partners are exploring ways to use blue carbon financial markets to support wetland restoration and improve resilience (NOAA, 2024).

Objective 2. Increase availability and accessibility of scientific data, research findings and the Reserve's capabilities to researchers, resources managers and other audiences.

2.1 Keep the Reserve website updated and active to engage researchers, graduate students, and the public and to make known the availability of the Reserve's resources and research facilities

The Reserve has a wealth of historical and current data characterizing its ecosystems. The integration of these data will have powerful analytic implications. By making the data and/or metadata accessible via the Reserve's website, researchers and students can apply this information towards further research at the Reserve. The Reserve webpage will list research capabilities, including available infrastructure, equipment, staff, past, ongoing and future research opportunities, and available data and models. This is essential for credibility and positioning.

2.2 Update the Reserve Site

The Reserve Site Profile will be updated to include detailed descriptions and analyses of the history, ecology, climatology, research, and monitoring activities. This includes the ecological characterization that resulted from recent and ongoing research, among other relevant sources. This is an additional tool that allows documenting and disseminating Reserve research.

2.3 Celebrate two Research Symposiums per management period

The Research and Monitoring Program will continue facilitating information exchange by conducting research symposium. During the last management period, the Reserve hosted two events. The inaugural symposium took place in 2019 and hosted over 70 participants from federal and state government, NGOs, and academia. The Program would like to continue offering two events during each management period and invite researchers from other estuaries in Puerto Rico and the

Caribbean. The symposium will help to exchange information generated within and outside of the Reserve, as well as identify research topics and collaborative research opportunities.

2.4 Develop a georeferenced research and monitoring database

Given the high level of research activity at the Reserve, it is extremely important to understand who is conducting research, the themes, and location of the research. A database will be developed to provide this information to interested researchers. A GIS-based map of research sites will be developed and populated with attributes such as contact information, research topic, year and estimated duration and other project-relevant information and location. It could also include monitoring stations and the USGS monitoring wells and CariCOOS stations.

Objective 3. Expand the SWMP and Non-SWMP monitoring initiatives to enhance understanding of the key habitats in the Reserve and their stressors.

2.5 Keep updating and refining the SWMP time series data analysis to have a robust long-term basis to support management decisions

The Research and Monitoring Coordinator will continue working to have robust SWMP data to support management decisions. In 2015, CariCOOS published Exploratory JBNERR System Wide Monitoring Program Time Series Data Analysis report which included several data analysis recommendations to provide a useful management tool for the Reserve. These included (1) select data trends and correlations that may be of interest to explore further; (2) update time series to 2015 due to drought events; (3) add USGS hydrological time series to the analysis, as well as other suitable data sets to be determined; (4) increase the density of nutrient sampling to obtain a more robust nutrient dataset; (5) explore the suitability of the JBNERR data set for ecological modeling and forecasting; (6) consider alternate “general direction of change” scenarios for JBNERR that may be investigated through ecological modeling and forecasting; and (7) include SWMP data trends in the updated JBNERR Site Profile. The Program will continue to incorporate these recommendations.

2.6 Continue Sentinel Site monitoring, specifically the sentinel site application module (SSAM-1)

During the next management period, the Program will continue Sentinel Site monitoring, according to the NOAA guidelines. The Puerto Rico Coastal Management Program will continue to support this monitoring program.

2.7 Establish a ground-water quality monitoring program through a contractor

During this next planning period, will explore establishing aquifer water quality monitoring program through contracted services. Eventually, and according to the availability of resources, the Reserve will continue the long-term monitoring plan that was developed for the Conservation Effects Assessment Project (CEAP), a 2007-2009 collaborative project to determine environmental effects that agricultural conservation practices may have on coastal waters and associated habitats in a tropical ecosystem and coral reefs. The Reserve will explore options for the support for long-term data analysis.

2.8 Periodically update the Habitat Mapping and Change Plan (HMC Plan)

The Reserve has previously developed a HMC Plan, using the NERRS-Standard Operating Procedures Mapping Land Use and Habitat Change. HMC Plan allows for the assessment of long-term changes of habitats in the Reserve related to local sea level change and human-caused stress from the watershed. The HMC Plan enables the Research and Monitoring Program to carry out habitat monitoring in a coordinated and standardized way within the system. This action proposes to update HMC Plan every five years.

2.9 Conduct a biennial water column monitoring in the Jobos Bay to assess conditions of the estuarine waters

Zooplankton and phytoplankton form the foundation of the ecosystem upon which coral and coral-related species depend; their health is impacted by both anthropogenic and environmental factors. In the previous management period, the Program conducted a surface flow study. With this action, it seeks to continue the plankton long-term monitoring program, with the support of external sources.

2.10 Support contracting or collaborations to monitor mudflats to assess for environmental changes

Although Oliver et al. (2022) conducted some work to classify Jobos Bay mudflats, they remain the least-studied community in the Reserve. The Program seeks to support collaboration efforts or contracting services to conduct a more detailed assessment of the physical and biological attributes of this ecosystem.

2.11 Continue monitoring key species to increase the knowledge on the status of their populations and distribution in the Reserve, as well as their conditions and threats

During the last management period, a monitoring network was established to study the use of the Reserve's habitats by key species, particularly those that are endangered and threatened, but whose populations' status and habits are not well known. The Program conducts birds and manatee surveys, in partnership with USFWS and Margaret A. Davidson fellows. The Reserve has also installed a Motus Antenna, an automated radio telemetry that tracks the movement and behavior of small animals, like birds, bats, and insects.⁴ Availability of the antenna expands opportunities for long-term monitoring of bird species. During the next five years, the Program will continue the monitoring program.

⁴ See <https://motus.org/> for more information about Motus network.

Education

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

Environmental Action Education programs focus primarily on fostering and modeling behavioral change that leads to resource conservation and advances the mission of the reserve. Such programs are specifically designed with the intention of creating behavioral change and/or fostering wise stewardship of estuaries. The goal is to help audiences make personal choices and collective actions that help them conserve, protect, and restore our estuaries and their associated watersheds. Target audiences include, but are not limited to, residents of the watershed and surrounding communities, and recreational users of the reserve. Participants in the reserve's coastal training program are not included in this category.

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 Reserve System and NOAA resources for place-based and inquiry-based learning; and grow and motivate the next generation of coastal professionals through access to programs and facilities that facilitate research, resource management, and educational opportunities.

Education Program Context

Setting and Context

The JBNERR Education Program operates within a unique ecological, historical, and community setting, serving public and private schools, homeschooling, teachers, universities, community organizations, visitors, and the public throughout Puerto Rico, with the Reserve's watershed as its primary service area. Using the estuary as a living laboratory, the program integrates research, monitoring, restoration, and stewardship into field-based education that promotes a deeper understanding of native species, watershed processes, ecosystem interconnections, the ecological importance of mangroves, and the need for long-term conservation and climate resilience. The historic visitor center, interpretive exhibits, classroom, and interpretive trails provide a distinctive

learning environment that connects environmental education with the cultural history of Aguirre and Salinas.

Since the previous Management Plan, the Education Program has experienced several important changes. Positive developments include increased stability of the TOTE program, greater interest in teacher professional development, growth in student scientific research and science fair participation, and stronger integration of research, habitat restoration, and field-based learning into educational programming. At the same time, the Education Coordinator position has remained vacant for approximately four years, while school closures, declining participation among younger elementary students, local administrative barriers affecting teacher participation, and staffing limitations have influenced program delivery and community engagement.

Priority Issues

In the next five years, the Program seeks to address the following issues:

Strengthen program capacity and staffing:

- Fill the vacant Education Coordinator position.
- Increase education and administrative support staff.
- Improve strategic planning, teacher follow-up, evaluation, community engagement, and offering some type of weekend programming.

Expand and formalize community education and engagement:

- Develop structured programs for youth, adults, volunteers, community leaders, and local organizations.
- Increase education on climate resilience, mangrove protection, watershed management, conservation, and stewardship.
- Promote citizen science, restoration, interpretation, and volunteer opportunities.

Strengthen K–12 and teacher professional development through TOTE:

- Continue and enhance the TOTE program.
- Expand field-based learning, curriculum-aligned instruction, and use of SWMP and water quality data.
- Improve post-workshop follow-up and document how teachers implement Reserve-based learning in classrooms.

Improve program evaluation, need assessment, and impact measurement:

- Develop systematic methods to evaluate audience reach, teacher implementation, student outcomes, partnership effectiveness, and long-term program impacts.

Strengthen strategic partnerships and integration across programs:

- Expand collaborations with local universities, research groups, other Reserve programs, and community partners.

- Increase the use of research, monitoring, and restoration activities within educational programming.
- Enhance coordination across education, research, stewardship, and the Training and Engagement Program.

Priority Audiences

Five primary audience groups comprise the priority audiences for the Jobos Bay NERR Education Program: K-12 teachers, K-12 students (including Homeschool students), university students, surrounding communities within the Reserve, and the public, including visitors and community organizations. These audiences will continue to be the primary focus of the Education Program over the next five years because they directly support the Reserve's goals of environmental literacy, stewardship, community resilience, and place-based learning. The Program seeks to strengthen existing relationships with these audiences, foster long-term engagement, and expand participation through field experiences, professional teacher development, community outreach, and partnerships.

Based on current program experience, the Education Program estimates its priority audience distribution as approximately 75% K-12, 5% homeschool students, 5% university students, and 15% community groups and summer camps. These estimates serve as a programmatic baseline for establishing future audience priorities.

Table 5. Priority Audiences for the JBNERR Education Program

Priority Audience	Current Reach (Oct 2025-Mar 2026)	Why this audience is prioritized	Priority Issues Supported (2027-2032)
K-12 Teachers	52 teachers participating in school visits; 29 teachers completed TOTE professional development	▪ Teachers extend the Reserve's impact by incorporating estuarine education into classrooms across Puerto Rico.	▪ Strengthen K-12 and teacher professional development through TOTE ▪ Improve program evaluation through teacher follow-up and implementation tracking ▪ Strengthen strategic partnerships with the Department of Education and educational partners

Priority Audience	Current Reach (Oct 2025-Mar 2026)	Why this audience is prioritized	Priority Issues Supported (2027-2032)
K-12 Students	626 students from 21 school groups	Provides place-based environmental education and supports environmental literacy at an early age.	- Expand field-based learning - Increase education on climate resilience, watershed management, and conservation - Improve evaluation of student outcomes
University Students	53 students from 7 university groups	Supports experiential learning, research, and future environmental professionals.	- Strengthen strategic partnerships with universities - Integrate research, monitoring, and restoration into education - Expand citizen science opportunities
Communities	65 community/adult participants	Builds stewardship, resilience, and understanding of the Reserve among nearby communities.	- Expand and formalize community education and engagement - Promote citizen science and volunteer opportunities - Increase education on climate resilience, mangrove protection, watershed management, and stewardship

Priority Audience	Current Reach (Oct 2025-Mar 2026)	Why this audience is prioritized	Priority Issues Supported (2027-2032)
General Public and Visitors	97 Visitor Center visitors; approximately 340 Aqua Fest participants	Increases public awareness and appreciation of the Reserve through informal education and outreach.	- Expand community engagement - Increase public understanding of conservation and stewardship - Strengthen partnerships through public events and outreach

Note: The visitation data presented represent a six-month reporting period (October 2025-March 2026). Annual program reach is typically greater when both semiannual reporting periods are combined.

Future Audience Focus

Over the next five years, the Education Program will continue prioritizing its current audiences while expanding engagement with watershed communities, youth, volunteers, community leaders, citizen scientists, educators, businesses, and recreational users. Education efforts will also strengthen awareness of protections for endangered species and sensitive areas within Jobos Bay and the Reserve.

The five-year target percentages represent independent reach goals for each priority audience and are not intended to represent a percentage distribution of total program participants. The Program anticipates reaching 90% of the identified K-12 audience, 15% of homeschool students, 20% of university students, and 35% of community groups and summer camps.

Current audience estimates and five-year targets are informed by Education Program participation records, semiannual reports, and staff experience with participation and visitation trends. TOTE also contributes to program reach, as participating teachers often return to the Reserve with student groups.

Education Program Capacity

Staff

The Education Program is currently staffed by one Environmental Educator. The Environmental Educator develops and delivers presentations for schools, organizations, and community groups; leads field-based educational activities; and supports the implementation of the Reserve's education and interpretation initiatives. National Association for Interpretation certification is recommended for both the Environmental Educator and Education Coordinator to strengthen professional capacity in environmental interpretation and experiential learning.

The Education Coordinator position has remained vacant for approximately four years, following the departure of the previous coordinator. As a result, many programmatic and administrative responsibilities have been absorbed by the Environmental Educator, limiting the program's capacity to expand educational programming and conduct long-term program evaluation and follow-up.

The Reserve also relies on strategic external partnerships to expand its educational capacity. Through a contractual partnership with Taller Ecológico de Puerto Rico, under the leadership of Dr. Áurea E. Rodríguez-Santiago, Director of Taller Ecológico and a biological oceanographer, the partnership provides specialized scientific expertise while supporting workshop planning, participant recruitment, logistics, instructional materials, field instruction, and program implementation. This collaboration significantly expands the Reserve's technical and operational capacity to deliver high-quality professional development for educators.

Reserve staff also provide educational support to students, teachers, and community groups through interpretive programming, field experiences, and guidance related to the Reserve's natural resources and educational initiatives.

Facilities

The Education Program is based at the Jobos Bay National Estuarine Research Reserve Visitor Center, where classrooms, interpretive exhibits, and meeting spaces support educational programming, teacher professional development, and community outreach. The Reserve's estuarine ecosystems, trails, boardwalks, and other outdoor environments serve a field-based education and interpretation.

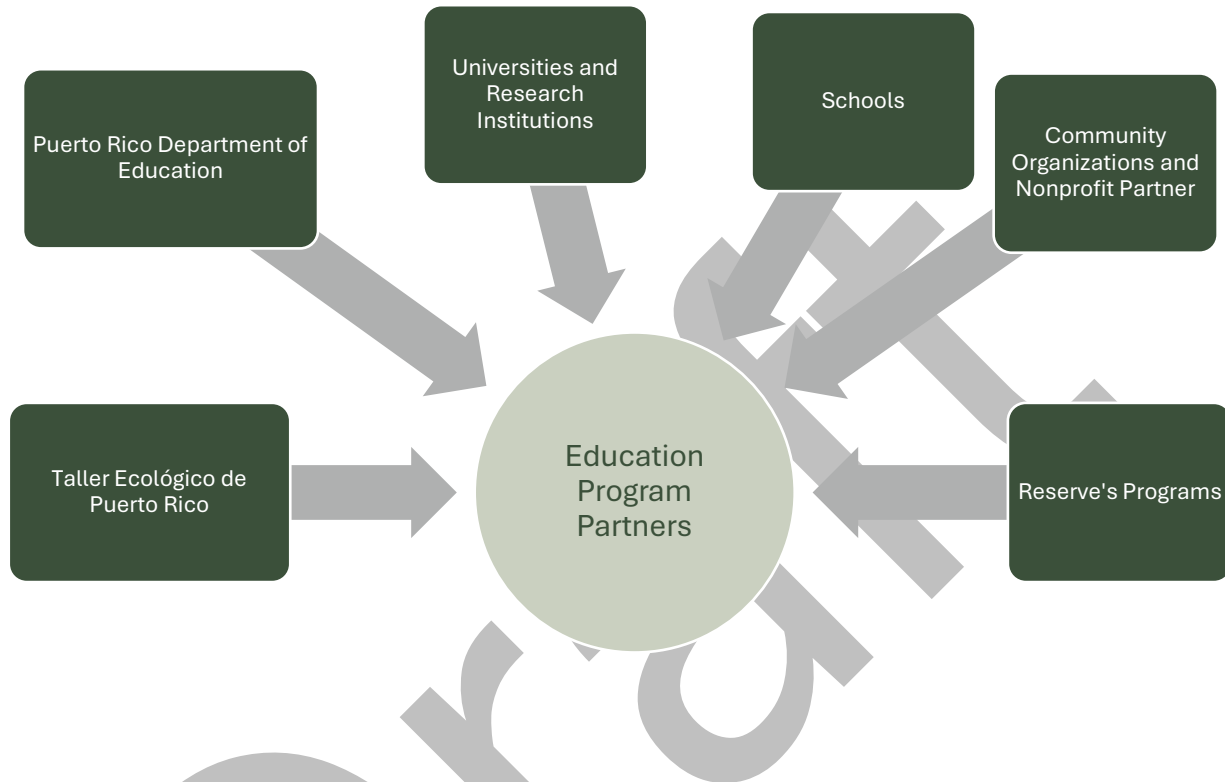
The TOTE program uses both indoor instructional space and field sites throughout the Reserve to provide hands-on learning experiences. Participants also have access to a "Loan box TOTE program" containing scientific equipment and educational materials, including water quality instruments, microscopes, and field guides, which support classroom instruction and field investigations beyond the workshop.

Partners

The Education Program relies on strategic partnerships to expand its educational capacity, strengthen technical expertise, and extend the Reserve's reach throughout Puerto Rico. These collaborations support educator professional development, student learning, community engagement, and environmental stewardship.

Although the Reserve previously maintained an Education Advisory Committee, the Committee is not currently active. Reserve staff continue to consult informally with former committee members and education partners, and reactivating the Committee is identified as a future opportunity to strengthen program planning and collaboration.

Figure 8. Education Program Partners



Internal and External Resources

The Reserve supplements its internal capacity through strategic external partnerships. Collaboration with external entities is coordinated through mutual agreements to arrange the participation for specialized education staff to deliver or supplement presentations and workshops and participate in open houses and other educational activities through informational tables and outreach.

In addition to staff expertise, the Program benefits from the Reserve’s educational facilities and scientific resources, including its visitor center, classroom, interpretive exhibits, field sites, and monitoring data. These assets are incorporated into educational programming to provide place-based learning experiences. The Program also collaborates closely with other Reserve programs and staff to integrate ongoing research, monitoring, and restoration activities into educational content.

Although these internal and external resources enable the Program to maintain its core educational services, current staffing is not sufficient to fully achieve all the Program’s strategic objectives. Limited personnel capacity constrains strategic planning, program evaluation, long-term teacher follow-up, volunteer coordination, curriculum development, community engagement, and the expansion of educational programming, particularly community and weekend activities.

Over the next five years, the Program's primary capacity-building priority is to fill the vacant Education Coordinator position and strengthen educational and administrative support. Additionally, with the Environmental Educator anticipated to retire within the next year, planning for continuity of this position will be an important priority to ensure continuity of the Program's educational services and institutional knowledge. Strengthening staffing, while continuing to leverage strategic partnerships, will enhance the Program's capacity to achieve its strategic objectives and integrate Reserve science, monitoring, and restoration activities into educational programming.

Strategic Partnerships

The Education Program leverages strategic partnerships to expand its educational capacity, strengthen technical expertise, and connect educators and communities with estuarine science. Within the Reserve, the Program collaborates with the Research and Monitoring, Stewardship, and Training and Engagement Programs to incorporate Reserve science and program activities into educational programming. In collaboration with the Research and Monitoring Program, the TOTE workshop includes presentations on Jobos Bay monitoring results and activities that introduce educators to the scientific equipment used for monitoring and its applications. Participants are also trained to access data through the National Estuarine Research Reserve System's Centralized Data Management Office. The Jobos Bay Education Guide further incorporates educational and research activities from Estuaries 101 and other relevant resources.

A key strategic partnership is the TOTE program, delivered through a contractual partnership with Taller Ecológico de Puerto Rico. In collaboration with Reserve staff, Taller Ecológico supports workshop planning, logistics, participant recruitment, instructional materials, and field-based instruction while contributing specialized expertise. The Puerto Rico Department of Education further strengthens TOTE by endorsing the workshops and supporting teacher recruitment through its professional development network. The Program also collaborates with schools, universities, community organizations, government agencies, and nonprofit partners like Bori Corps to expand environmental education and stewardship opportunities.

The Education Program has established a niche in educator professional development through its experiential, field-based approach, using the estuary as a living laboratory to connect teachers with Reserve science and coastal resource management. The Program conducted a Needs Assessment and Market Analysis (NA/MA) in 2016, which identified opportunities to expand education efforts to additional watershed audiences whose actions may benefit or impact Reserve resources, strengthen teacher training, increase access to downloadable educational materials, and enhance engagement with communities surrounding the Reserve. Interviews conducted for this Management Plan continue to identify the Program's place-based approach as a key strength, with statewide reach and value among participating educators.

Over the next five years, the Program will strengthen existing partnerships while expanding interdisciplinary collaborations that support teacher professional development, curriculum integration, environmental literacy, and community stewardship.

Education Program Alignment and Delivery

The Education Program delivers teacher workshops, student field experiences, classroom presentations, interpretive programs, public outreach, and the TOTE program to advance environmental literacy and teacher professional development. The Program uses experiential, inquiry-based, and place-based learning through field investigations, water quality monitoring, habitat observations, data interpretation, and other hands-on activities.

TOTE workshops equip educators with the knowledge, tools, and instructional resources needed to incorporate estuarine science into classroom instruction. Educational materials include the Jobs Bay Education Guide, Estuaries 101, and other NOAA and partner-developed resources. The Jobs Bay Education Guide is provided digitally to teachers participating in TOTE workshops and shared with educators visiting the Reserve with student groups. For Estuaries 101, educators are provided with links to the educational resources available through the NERRS. Additional educational resources are shared from NOAA, the Puerto Rico Sea Grant Program, CariCOOS, Taller Ecológico, and other program partners.

The Program delivers educational opportunities and communicates results through teacher workshops, classroom resources, community events, social media platforms, partner networks, and Reserve reporting. Participant surveys, attendance records, and teacher feedback evaluate immediate program outcomes, while expanding long-term teacher follow-up and impact evaluation remains a priority.

The Program seeks to increase estuarine literacy, strengthen teachers' capacity to incorporate estuarine science into classroom instruction, expand the use of Reserve science in education, and promote environmental stewardship by encouraging students and community members to support the conservation of estuarine and coastal resources.

Education Program Future Needs and Opportunities

Future education programs needs and opportunities were identified through interviews with Reserve staff and program partners. Priority needs include:

Needs

- Increase program capacity by filling the vacant Education Coordinator position and strengthening administrative support.
- Strengthen program evaluation through systematic participant follow-up and impact assessment.
- Expand community programming and educational services.
- Enhance educational content related to climate resilience, watershed management, ecosystem services, and coastal conservation.
- Address operational and infrastructure needs that affect program delivery.

Opportunities

- Expand citizen science, volunteer initiatives, youth engagement, and community-based learning.
- Build strategic partnerships with local schools, universities, community organizations, and government.
- Increase the use of Reserve research and monitoring data to support place-based education.
- Continue using the Reserve's natural and cultural resources as a living laboratory.
- Reactivating the Education Advisory Committee to guide program planning and evaluation. new opportunities for collaboration through the Green Contact Program and Green Contact Network.

Over the next five years, the Reserve's ability to meet these education needs will depend on rebuilding staffing capacity, stabilizing administrative support, and aligning education priorities with available partnerships, facilities, and funding. Filling the Education Coordinator position will be central to restoring consistent program leadership, coordinating school and community activities, strengthening evaluation systems, and using Reserve research and monitoring information in education products. Partnerships with schools, universities, community organizations, local governments, and program networks will also be essential for expanding reach without exceeding staff capacity.

Education- related objectives and actions

Objective 1. Increase the participation of students and teachers in the Reserve by providing high-quality, place-based educational activities.

1.1 Continue performing TOTE workshops with the aim to offer hands on, field based, professional teacher development opportunities by the Reserve

The Education Program will continue TOTE as a core professional development activity for educators. It will promote participation through the Jobos Bay NERR Certification initiative, recognizing schools that apply TOTE knowledge and activities in classrooms. As resources allow, the Reserve may provide scientific equipment kits to support classroom and field-based data collection.

TOTE will provide 20 hours of teacher professional development: a 15-hour workshop and a 5-hour follow-up session. During 2026-2030, these sessions will support educators in integrating estuarine science, stewardship, and place-based learning into classrooms.

1.2 Facilitate workshops to teachers in collaboration with partners to increase their knowledge in various emerging topics such as climate stressors adaptation and resiliency

The Education Program will continue offering teacher training workshops on topics relevant to the Reserve's priority issues, including climate stressor adaptation, resilience, estuarine science, and coastal resource conservation. The Education Program will continue collaborating with the PRCZMP and the Puerto Rico Sea Grant Program (PRSGP) to develop and deliver teacher and community education workshops that complement the Jobos Bay Education Guide and address emerging environmental issues and educational needs.

1.3 Develop a “School Interactive Estuarine Literacy Pilot project”

The Education Program will explore opportunities to develop a School Interactive Estuarine Literacy Initiative that promotes student engagement in environmental education and stewardship. As staffing and resources allow, the Program will support participating schools in developing student-generated digital content that highlights educational initiatives, science projects, field experiences, and reflections related to the Reserve. This initiative will encourage students to share their learning experiences and strengthen environmental literacy through place-based education.

The Education Program will continue using social media and other digital communication platforms to expand outreach to students, educators, and the broader community. As resources allow, the Program will also explore opportunities to develop a Student's Corner on the Reserve's website to showcase student work, educational resources, and other materials that support environmental education and stewardship.

1.4 Continue supporting summer camps

The Education Program will continue collaborating with schools, educators, and community partners to provide environmental education opportunities for youth through field experiences and educational programming at the Reserve. Although the Reserve is not currently offering its own summer camp due to limited staffing capacity and changes in public policies, it will continue supporting summer camps organized by schools, faith-based organizations, and other partners. As staffing and resources allow, the Education Program will explore opportunities to reestablish Reserve-sponsored summer camps with content addressing emerging coastal issues, including climate stressors, resilience, estuarine science, and coastal resource conservation.

Objective 2. Develop a Conservation Action Education Program to increase knowledge and engagement among community members as well as to increase the volunteer base.

This program is expected to increase community awareness and stewardship while reducing anthropogenic stressors that impact Reserve ecosystems.

2.1 Provide conferences for community members on the importance of coastal ecosystems to reduce vulnerability

Educational workshops will continue addressing topics such as the role of estuaries and mangroves in coastal protection and the importance of reducing anthropogenic stressors affecting coastal ecosystems. As staffing and resources allow, the Program will offer these workshops through classroom and field-based learning opportunities. Expanding weekend programming will depend on the availability of personnel dedicated to community engagement and outreach.

2.2 Work with partners to develop educational materials to target businesses, tour providers, boat and other users of marine resources

The Education Program will continue collaborating with the NOAA Coral Reef Conservation Program, the USFW, the PRSGP, the PRCZMP, the DNER, and the Stewardship Program to develop education and outreach strategies that reduce threats and stressors affecting the Reserve's ecosystems. The Program will continue developing and distributing educational materials through partner networks and digital platforms to promote responsible recreation, increase awareness of environmental regulations, and encourage the protection of coastal resources among visitors accessing the Reserve from nearby docks and marinas.

2.3 Provide a workshop to enhance the community's adaptive capacity through the protection of coastal resources

The Education Program will continue collaborating with the TEP and the Stewardship Program to provide training opportunities for community members interested in volunteering at the Reserve. Workshops will build skills in ecosystem restoration, ecosystem-based adaptation, stewardship, and other emerging coastal issues, preparing volunteers to support Reserve programs and promote conservation within their communities. Implementation will continue in collaboration with the TEP and Stewardship and will be expanded following the hiring of an Education Coordinator.

2.4 Implement a program of activities within the Reserve and its surrounding communities to promote its presence within the community.

The Education Program will continue developing a year-round schedule of educational and community engagement activities, including talks, field trips, outdoor events, youth programs, and open houses, to strengthen the Reserve's visibility and community participation. Implementation will continue in collaboration with the TEP and will be expanded following the hiring of an Education Coordinator.

2.5 Develop a Citizen Science Program at the Reserve

The Reserve's ability to protect its natural resources depends on an informed and engaged community. The Education Program will continue collaborating with the Research & Monitoring, Stewardship, and TEP to expand citizen science opportunities that engage community members, visitors, and local schools in long-term environmental monitoring and stewardship activities. As

staffing and resources allow, the Program will strengthen volunteer coordination to support these initiatives.

Objective 3. Increase the number of visitors who engage with Jobos Bay NERR as a resource for learning about its ecological and historical significance and community resilience.

3.1 Enhance and update indoor and outdoor educational exhibits and signage

The Education Program will continue maintaining, updating, and enhancing interpretive exhibits, digital displays, and educational signage to improve visitor engagement and access to information about the Reserve's habitats, species, research, and stewardship initiatives. As needed, interpretive, directional, and regulatory signage will be updated, and digital tools, including QR codes and other technologies, will be incorporated to provide visitors with access to current educational resources and NOAA and NERRS information.

Objective 4. Assess the effectiveness and satisfaction of participants on each Educational Program activity.

4.1 Evaluate knowledge acquisition during the workshops and talks performed for teachers

Continue using pre- and post-workshop evaluations, particularly through TOTE program, to assess participant learning and improve educational content, instructional methods, and program delivery.

4.2 Evaluate participant satisfaction to evaluate the program of activities

Develop and implement participant satisfaction surveys to assess the quality, relevance, and effectiveness of educational activities. Results will be used to improve educational content, instructional methods, and program delivery.

4.3 Conduct participant follow-up and impact assessments

Implement a systematic participant follow-up process to evaluate knowledge retention, classroom implementation, and program outcomes, and use the results to strengthen future education programs.

4.4 Evaluate the fulfillment of the exhibitions and guided tours that are provided to visitors and tourists

Develop and implement a bilingual (English and Spanish) visitor satisfaction survey to evaluate the quality and effectiveness of exhibits and guided tours. Survey results will be used to improve interpretive materials, visitor experiences, and educational programming.

Training and Engagement Program

The TEP provides up-to-date scientific information and skill-building opportunities to coastal decision-makers on relevant coastal management issues and facilitates collaboration among coastal communities and researchers. 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, social service providers, and coastal business owners and operators. They may also include such audiences as farmers, fishers and aquaculture professionals, watershed councils, professional associations, recreation enthusiasts, and interdisciplinary researchers.

The place-based nature of reserves makes them uniquely positioned to deliver pertinent information to these audiences. Each reserve tracks audience needs and partner strengths to identify how best to interact with audiences through virtual and in-person training, or the provision of technical assistance and engagement activities that focus on identifying 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 audiences and expertise needed to deliver relevant and accessible programs.

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.

Training and Engagement Program Context

Setting and Context

The JBNERR Training and Engagement Program supports coastal resource management through education, capacity building, and technical assistance for decision-makers and community leaders. Its primary service area includes the Jobos Bay watershed and nearby communities in Salinas and Guayama, with broader reach across Puerto Rico.

The TEP operates within a region shaped by fishing, agriculture, recreation, industry, and the socioeconomic disparities associated with Aguirre's plantation and corporate history. Surrounding communities that maintain strong cultural ties, local knowledge, and interest in Reserve activities.

The TEP considers the participation needs of underserved populations and supports inclusive access to program activities and resources.

Priority Issues

The following priority issues were identified through the current TEP assessment, including staff interviews and the SWOT analysis, and are consistent with needs identified in the previous Management Plan. In the next five years, the TEP seeks to address the following issues:

- Climate stressors and application of scientific information: Increasing environmental pressures and gaps in understanding can limit the application of scientific information to coastal-management decisions.
- Environmental compliance: Construction, land development, coastal businesses, and resource use can adversely affect protected habitats when users lack awareness of or fail to follow environmental requirements.
- Agricultural practices: Agricultural activities within the watershed can affect water quality and coastal resources through erosion and the movement of sediment, fertilizers, herbicides, and pesticides, creating a need for sustainable practices and pollution prevention.
- Waste management and pollution: Restaurants, service stations, automotive businesses, and used-tire operations can contribute pollutants and improperly managed waste to the watershed.
- Fishing, boating, and coastal recreation: These activities can affect habitats, wildlife, and coastal resources when users do not follow sustainable practices and applicable regulations.
- Integration of social sciences and community perspectives: Effective coastal management requires greater attention to social conditions, everyday practices, and community knowledge alongside scientific and technical approaches.

Priority Audiences

The Training and Engagement Program primarily serves coastal decision-makers and stakeholders whose governmental, professional, community, or economic activities influence Jobos Bay and Puerto Rico’s coastal resources. For the next management period, priority audiences include coastal decision-makers and the public.

Table 6. JBNERR TEP Priority Audiences

Priority Audience	Why this audience is prioritized	Priority Issues Supported (2026-2030)
Federal, Commonwealth, and municipal officials and personnel	■ Their responsibilities influence planning, permitting, public works, agriculture, emergency management, and the management and protection of natural resources and ecosystems.	■ Climate stressors; environmental compliance; agricultural practices; waste management and pollution
Planners, engineers, surveyors, architects, landscape architects, agronomists,	■ Their professional work shapes land development, infrastructure,	■ Coastal management; environmental compliance; agricultural practices;

Priority Audience	Why this audience is prioritized	Priority Issues Supported (2026-2030)
scientists, consultants, and professional associations	watershed conditions, and the application of scientific information.	integration of social sciences and community perspectives
Emergency managers, paramedics, firefighters, police officers, DNER rangers, and natural-resource managers	They support emergency response, public safety, environmental enforcement, and the protection of natural resources and ecosystems.	Climate stressors; environmental compliance; fishing, boating, and coastal recreation
Community leaders, community-based organizations, nonprofit organizations, and applied-science groups	They contribute local knowledge, connect the Program with residents, and support community participation and stewardship.	Integration of social sciences and community perspectives; public trust and participation; waste management and pollution
Universities, researchers, adults, and academic collaborators	They provide research, monitoring, technical expertise, and professional-development opportunities.	Climate stressors; science-based coastal management; integration of social sciences and community perspective
Farmers, agricultural operators, agronomists, land developers, and construction contractors	Their land-management and development practices can affect erosion, runoff, water quality, and coastal habitats.	Agricultural practices; environmental compliance; waste management and pollution
Commercial fishers, tour operators, marina and boating operators, personal-watercraft users, nautical-facility operators, and recreational groups	Their activities directly interact with coastal habitats, wildlife, and protected resources and ecosystems	Fishing, boating, and coastal recreation; environmental compliance

Priority Audience	Why this audience is prioritized	Priority Issues Supported (2026-2030)
Merchants, restaurants, automotive businesses, service stations, and used-tire operators	▪ Their operations may generate oil, grease, tires, and other wastes that can enter the watershed.	▪ Waste management and pollution; environmental compliance

Alignment within the Reserve

The TEP prepares two-year proposals identifying ten workshops (five per year) and their proposed topics. The TEP Coordinator and Reserve Director jointly identify and refine these topics based on documented needs, participant feedback, emerging coastal-management issues, and Reserve priorities. Workshop topics may include environmental science, biodiversity, natural-resource management, and other identified coastal-management needs. The coordinator also consults with Advisory Committee members, presenters, audiences, and partners when developing workshop topics. Through this coordination, the Program supports the Reserve’s goals by strengthening the capacity of coastal decision-makers to apply scientific information, improve coastal-resource management, and support conservation and stewardship.

The TEP coordinates with other Reserve programs and staff to support program delivery and reduce duplication. The Coordinator consults with the Stewardship Coordinator to identify workshop topics, obtain input on marine biology and JBNERR ecosystems, and consider Advisory Committee recommendations in relation to Reserve needs. As needed, the coordinator also consults with the Research Coordinator on relevant topics and regularly seeks guidance from the Environmental Educator on workshop methods and materials. The TEP assists the Education Program with large-group activities and educational exhibits. Community members and community leaders also participate in TEP workshops. In addition, the TEP interaction with SWMP occurs sporadically. Reserve staff also share equipment, technical expertise, professional contacts, and language support.

The TEP participates indirectly in a Science Collaborative project involving Rookery Bay NERR and Florida International University by attending meetings and providing end-user input. The Research Coordinator and Reserve Director lead the Reserve’s participation. The TEP is not currently involved in the NERRS Margaret A. Davidson Graduate Research Fellowship program.

The TEP contributes to Reserve and system-wide efforts by:

- Aligning its program-development process with national NERRS priorities and the progression from needs assessment through evaluation.
- Coordinating with the Education Program to distinguish responsibilities, avoid duplication, and support community-based capacity.
- Providing training related to vulnerability, adaptation planning, climate stressors, ecological resilience, and long-term ecosystem functioning.
- Connecting coastal decision-makers with scientific information, practical management approaches, subject-matter experts, and professional networks.

The Program shares audience and partners needs and proposed topics with other Reserve programs, including through annual cross-program meetings, to promote coherence and alignment with NOAA requirements. Input from Stewardship and Education programs informs workshop topics and methods. Because coordination with SWMP and Research and Monitoring is limited, findings from these efforts are not yet incorporated consistently into TEP programming. Technical expertise is incorporated into workshops when relevant to the identified topic and audience.

Coastal Training Program Capacity

Capacity

The TEP relies on one full-time Coordinator, who is responsible for program planning, training development and delivery, participant coordination, outreach, scheduling, budgeting, procurement, logistics, recruitment, evaluation, data entry, reporting, and other administrative duties. With no dedicated assistant or additional program staff, the Coordinator collaborates with the Stewardship Coordinator and Environmental Educator and consults with the Research Coordinator as needed. This internal coordination includes meetings to identify relevant workshop topics and support through technical expertise, shared equipment, professional contacts, language assistance, and other resources.

Technology and equipment available to support the TEP include a modern interactive display panel with Android and PC operating capabilities, a desktop computer, and a laptop. This equipment is used for TEP workshops, meetings, and other activities and is also shared with other JBNERR programs and used for JBNERR staff meetings

A broad external network also supports the TEP, including federal, Commonwealth, and municipal agencies; universities; professional associations; community organizations; businesses; subject-matter experts; and other partners. These partners provide technical expertise, speakers, outreach support, professional networks, and institutional coordination, as described in the Strategic Partnerships section.

The TEP Advisory Committee represents an additional source of program capacity by providing technical expertise, professional connections, and support in identifying speakers and collaborators.

TEP completed all twelve actions from the previous Management Plan, and each was recommended for continuation. This demonstrates that the TEP fulfilled its previous commitments. However,

reliance on one staff member may limit service expansion, participant follow-up, impact evaluation, field-based and hybrid programming, and responses to emerging priorities.

Over the next five years, additional administrative or program support would improve TEP capacity. The Program would also benefit from stronger communication and promotional assistance, as well as expertise in the social dimensions of environmental management and community-government communication. Strengthening the Advisory Committee's role and sustaining external partnerships would add support. The program will prioritize its commitment to five workshops annually. If additional capacity is unavailable, new or expanded activities should be phased according to audience needs, Reserve priorities, available resources, and expected outcomes.

The TEP faces the following major capacity needs:

- Additional personnel and specialized support; the Program needs greater staffing support for field-based activities, expertise in the social dimensions of environmental management and communication between communities and government agencies, and administrative assistance with recordkeeping, scheduling, outreach, and workshop coordination.
- Timely administrative processing; Administrative processes beyond the Reserve level may delay the authorization and implementation of planned TEP activities, even when funding is available.
- Communication and promotional support; The Program needs additional capacity to promote its activities, develop outreach materials, produce audiovisual content, and manage media and social-media communications.

The TEP has no current program-specific capital-improvement needs.

Strategic Partnerships

TEP works across sectors, organizations, and government levels to deliver training, share Reserve information, and build partnerships shaped by training topics, audience needs, and coastal management priorities.

The TEP's internal coordination and participation in Reserve System initiatives are described in the Alignment within the Reserve section. In the context of strategic partnerships, the Reserve Director and program staff provide programmatic, scientific, and educational support.

Key current and recurring partners, together with anticipated collaborators for the next five years, include:

- Federal agencies: NOAA Office for Coastal Management, U.S. Environmental Protection Agency (EPA), USDA Natural Resources Conservation Service, U.S. Fish and Wildlife Service (USFWS), and U.S. Coast Guard. These agencies contribute technical information, program resources, and subject-matter expertise according to the training topic. EPA has provided technical guidance for workshops, and NOAA and USDA Natural Resources Conservation Service have supported training related to coastal and natural-resource management.

- Commonwealth and municipal entities: DNER and its Coastal Zone Management Program, Puerto Rico Planning Board, Permit Management Office, Puerto Rico Department of Agriculture, Puerto Rico Department of Health, Puerto Rico Tourism Company, and the municipalities of Salinas, Guayama, Arroyo, and Yauco. These partners provide technical expertise, presenters, institutional coordination, and connections with municipal and professional audiences. The Puerto Rico Department of Health has collaborated in several workshops and provided subject-matter experts. Personnel from the Municipality of Salinas Tourism Office have also participated in TEP workshops.
- Academic and professional organizations: Puerto Rico Sea Grant; the University of Puerto Rico at Mayagüez's Division of Continuing Education and Professional Studies, Department of Civil Engineering, and Agricultural Extension Service; the University of Puerto Rico at Cayey; the University of Puerto Rico at Humacao; the Rafael Hernández Colón School of Architecture at the Pontifical Catholic University of Puerto Rico; the Puerto Rico Architects and Landscape Architects Association; the Puerto Rico College of Engineers and Land Surveyors; the Puerto Rico College of Automotive Mechanics and Technicians; and the Puerto Rico Chamber of Commerce. These organizations provide subject-matter expertise, presenters, professional outreach, and continuing-education opportunities. The Puerto Rico College of Engineers and Land Surveyors has awarded continuing-education credits to members participating in the TEP Oil Management Workshop. The Puerto Rico College of Automotive Mechanics and Technicians recently joined the TEP's partner network following the participation of its president, Prof. Rafel De León Mitchell, in the Tire Management Workshop. Prof. Edmundo Colón, an architect and landscape architect, and the Rafael Hernández Colón School of Architecture have also collaborated repeatedly with the Program.
- Community and sector partners: community-based organizations, businesses, subject-matter experts, BoriCorps, and other collaborators selected according to each training topic and audience. These partners may provide presenters, practical knowledge, outreach assistance, participant recruitment, and connections with specific communities or economic sectors.

Partner roles vary by training topic, audience, and objectives. Collectively, partners provide technical expertise, speakers, outreach, participant recruitment, professional networks, continuing-education opportunities, and institutional coordination.

Current TEP Advisory Committee list, affiliations, and areas of expertise are provided in Appendix 6. Although the full Committee does not meet regularly, the Coordinator maintains communication with some members individually or in smaller groups. The Reserve will work to reestablish regular meetings and strengthen member participation to improve partner coordination, identify training needs, and reach priority audiences.

These partnerships support science-based decision-making, sustainable coastal-resource management, pollution prevention, environmental compliance, water safety, adaptation to environmental stressors, and access to scientific information, expertise, and management tools.

Over the next five years, the TEP will maintain existing relationships and expand collaboration with stakeholders representing agriculture, construction, fisheries, boating and marina operations, tourism—including programs administered by the Municipality of Salinas—service businesses, and underserved communities. These partnerships will help identify participation barriers, incorporate community knowledge, and improve the accessibility, relevance, and impact of training and technical-assistance services.

Coastal Training and Engagement Program Delivery

The Jobos Bay NERR TEP was established in 2003. It follows a systematic program-development process that includes periodic review of the Reserve’s role within the broader training-provider landscape and assessments of priority audiences and training needs. The process is informed by Advisory Committee input when available.

The TEP aligns with National Estuarine Research Reserve System training priorities and uses the national program-development framework to guide activities from needs assessment through delivery and evaluation. Through education and capacity building, the Program supports improved coastal-resource management at local and regional levels in Puerto Rico and provides specialized training in conservation and stewardship.

The TEP delivers most of its training and services through in-person events. The Program has also used a hybrid format when presenters could not travel to JBNERR, allowing them to participate remotely by telephone or Zoom.

The TEP uses the following training, service-delivery, and engagement methods:

- Workshops addressing topics established through the Program’s two-year proposals.
- Presentations by subject-matter experts.
- In-person training and remote participation by telephone or Zoom when presenters cannot attend in person.
- Practical exercises, facilitated discussions, question-and-answer sessions, and participant exchanges.
- Straightforward language, concise presentations, photographs, diagrams, and speakers from diverse backgrounds to support inclusive and accessible learning.
- Pre- and post-training assessments, anonymous participant feedback, and post-event evaluations.
- Direct outreach through municipal visits, telephone calls, official email, returning participants, and the Program’s network of collaborators.
- Coordination with professional associations, universities, government agencies, businesses, community organizations, and another partner
- Information exchange with other reserves.

NOAA’s Meeting Engagement Tools⁵ provide guidance that the TEP can use to support meeting planning, facilitation, and participant engagement. Current TEP facilitation practices include active listening, asking questions, paraphrasing, summarizing and synthesizing ideas, restating the activity’s purpose, and remaining neutral. At the end of an activity, the Coordinator facilitates a discussion period during which participants can interact with presenters, ask questions, and share ideas.

Current service delivery is centered primarily on training events. Although participants may receive information, referrals, or connections to subject-matter experts through these activities, the Program has not documented a separate formal system for delivering or tracking technical assistance. Similarly, the TEP’s current role in collaborative research is limited to attending project meetings and providing end-user input

The TEP selects its delivery, and engagement approaches according to the topic, intended audience, desired outcome, and available resources. Activities for government agencies, municipalities, professionals, and industries emphasize scientific information, regulatory requirements, management tools, and practical applications. Activities involving community organizations, businesses, agricultural producers, contractors, fishers, and recreational users emphasize locally relevant concerns and practical management actions.

The TEP supports inclusive participation by using bias-free and straightforward language, avoiding unnecessary jargon, applying adult-learning principles, and adapting communication to participants’ learning needs. The Program also draws on the NOAA Office for Coastal Management’s Using Inclusive Language in Meetings: 6 Guidelines for Inclusive Language.

⁵ NOAA’s Meeting Engagement Tools provide practical techniques and resources to support effective, inclusive, and participatory meetings and stakeholder engagement. [NOAA Meeting Engagement Tools](#)

Existing physical accommodations at JBNERR include ramps, accessible restrooms, and an interactive display with adjustable visual settings. The Reserve Director and program coordinators are bilingual in Spanish and English. The TEP Coordinator's academic preparation in adult teaching and learning, biomedical sciences, and education supports the identification of different learning styles and communication needs. Within the Reserve's capacity, the Coordinator seeks to provide reasonable accommodations for participants with physical, cognitive, sensory, or communication needs.

Documented outreach and networking methods include municipal visits, telephone calls, official email, returning participants, word-of-mouth referrals, and the communication networks of Advisory Committee members and partner organizations. Professional associations, universities, government agencies, businesses, and community organizations also assist with outreach and participant recruitment. Official JBNERR boats, trucks, and all-terrain vehicles display DNER and NOAA logos but are not used as dedicated TEP marketing vehicles.

Upcoming training topics will respond to identified coastal-resource management needs and priorities, including biodiversity conservation, hazard preparedness, sustainable land and water management, and community stewardship. The TEP will select appropriate subject-matter experts and delivery methods for each topic and audience.

Over the next five years, the TEP seeks to expand its delivery and outreach through:

- Two- or three-day intensive workshops combining classroom instruction, practical exercises, and field demonstrations.
- Site visits connected to workshop topics.
- Expanded hybrid and remote-participation opportunities, when appropriate.
- Continuing-education accreditation through additional professional organizations.
- Targeted outreach, accessible communication and materials, and participation by people from different educational, professional, and community backgrounds, including underserved communities and people with access needs.
- More consistent use of Reserve communication channels and partner networks to promote services and share program information.

These practices will help the TEP reduce participation barriers and improve the accessibility, relevance, and effectiveness of its training and technical-assistance services.

Coastal Training and Engagement Program Future Needs and Opportunities

The TEP tracks training needs through pre- and post-training assessments, post-event evaluations, attendance trends, participant discussions, and consultation with participants and intended audiences, the Reserve Director and program staff, partners, subject-matter experts, and Advisory Committee members. The Coordinator documents significant feedback and reviews it after training

activities and when preparing two-year proposals and annual work plans to refine priority audiences, topics, presenters, and outreach strategies.

Advisory Committee members provide guidance on emerging issues, training needs, priority audiences, topics, speakers, collaborators, outreach strategies, and program delivery. Although the full Committee has not met regularly, the Coordinator maintains communication with some members individually or in smaller groups. Strengthening regular participation is a five-year priority; Appendix 6 provides the Committee's current membership, affiliations, and areas of expertise.

Over the next five years, the TEP anticipates the following needs and opportunities:

- Audience capacity: strengthen the capacity of coastal decision-makers, resource managers, enforcement personnel, community organizations, businesses, agricultural producers, fishers, and other groups whose activities affect coastal resources.
- Priority training topics: planned near-term workshops reflect needs related to biodiversity and species conservation, hazard preparedness, sustainable agriculture and soil and tree management, invasive-species management, aquifer and drinking-water protection, and wastewater and septic-system management. Other five-year priorities may include land-use planning, stormwater management, pollution prevention, permitting and compliance, enforcement related to illegal uses, habitat restoration, fishing-related issues, and adaptation to environmental stressors.
- Integration of knowledge: more consistently incorporate Reserve research and monitoring information, community knowledge, and social-science approaches into training.
- Participation and access: expand engagement with underserved communities, reduce barriers to participation, and strengthen targeted outreach.
- Program and service capacity: reliance on one full-time Coordinator may limit service expansion, documentation of technical assistance, participant follow-up, and impact evaluation; related staffing and administrative needs are described in the Capacity section.

Training Related Objectives and Actions

Objective 1. Strengthen the capacity of decision makers, resource managers, and communities to support effective coastal resource management and protection.

1.1 Provide workshops and technical assistance to municipalities, professionals, and other decision makers to strengthen their skills to develop mandatory plans

The TEP will provide education and technical assistance to municipalities, land use planners, and related professionals to increase their knowledge on best practices related to land use and management. Land use plans can be used to reduce hazard exposure and to enhance the ecosystem's structure and function. Training programs can be developed in areas such as available mechanisms for the development of green infrastructure networks and projects (e.g. green corridors) and its benefits as a landscape conservation strategy; the use of green infrastructure in storm water design (e.g. materials to reduce runoff), and several other topics. Storm water management plans can be used to address groundwater recharge, storm water quantity, and storm

water quality impacts. On this topic, the TEP will continue working with the EPA to assist municipalities in developing municipal storm water management plans.

1.2 Provide trainings and workshops to businesses, NGOs, and communities to reduce nonpoint sources of pollution that affect coastal and marine ecosystems

TEP will conduct workshops and training activities to address issues such as construction and maintenance of septic tanks, management and impacts of chemicals such as fertilizers, erosion control, and proper management and handling of chemicals in businesses such as oils and greases, among other topics. The TEP Coordinator plans to assess industry leaders and regulators to determine the need for capacity building. The Reserve's database on contaminants, compiled by a Graduate Research Fellowship as part of the habitat characterization conducted by NOAA's National Centers for Coastal Ocean Science, provides an excellent resource to target the appropriate businesses and industry- specific audiences for training activities.

1.3 Provide education and technical assistance to DNER's coastal managers and supporting staff to address issues affecting coastal resources

The TEP will provide assistance to coastal managers and other DNER supporting staff in strengthen their skills and understanding of the collaborative dimensions of ecosystem management. Using the concept of "train the trainers" the managers will be in a good position to collaborate with volunteers and coastal communities in the protection of coastal resources (i.e. transferring information and knowledge and implementing the necessary tasks).

1.4 Provide knowledge and technical assistance to community organizations that have cooperative agreements with the DNER for the management of coastal resources

The TEP will partner with organizations and agencies with expertise in ecosystem restoration and monitoring, among other disciplines. The purpose is to train community representatives, giving priority to those with collaborative agreements with the DNER, to support management efforts in coastal areas. The TEP Coordinator will conduct a needs assessment with these groups and their liaisons within the DNER to determine the education, training, and capacity building needs. Topics could include the ecosystem's ecology and anthropogenic impacts; restoration techniques, such as mangrove planting, and seagrass restoration; identification and monitoring of key species such as shorebirds and manatees, water quality monitoring, among other relevant resource-based topics.

1.5 Provide technical assistance and workshops to the Ranger Corps and other officials collaborating in the Reserve's patrol and surveillance team, as proposed in the "Surveillance and Prevention Enforcement Strategic Plan of the DNER at JBNERR"

The plan proposed coordinated training and workshops to strengthen the Ranger Corps' capacity to address the Reserve's surveillance needs. The Ranger Corps supports implementation of the Management Plan through enforcement, surveillance, resource protection, and public guidance activities, including enforcing crab-harvesting and fishing regulations; pursuing cases involving illegal construction; monitoring mangroves and other wetlands; and protecting threatened,

endangered, endemic, native, and migratory species. The TEP and Stewardship coordinators will organize training and workshops on topics identified in the plan, including the Reserve's values, JBNERR Management and Monitoring Plans, enforcement needs, management challenges, encroachment issues, and applicable laws and regulations.

Objective 2. Strengthen the capacity of decision makers and communities to address environmental stressors, coastal vulnerability, and adaptation.

2.1 Continue providing workshops related to sustainable use of water

Recent drought, extreme heat, and the status of the aquifer, make it necessary to strengthen and expand education and training on sustainable practices for water management in the watershed, including rainwater harvesting and water recycling and reuse. Specific trainings will be organized to meet the needs of diverse audiences in the watershed: farmers, businesses, residences, and other institutions, such as schools.

2.2 Provide trainings and technical assistance on ecosystem-based management in coastal communities

During the past years, multiple events have occurred that required immediate response, but that the coastal decision-makers were unprepared to handle due to their lack of proper management skills. Examples of these events are the massive arrival of sargassum to the coasts of Puerto Rico, coastal erosion, flooding, and wildfires. The TEP Advisory Committee identified the need to train coastal municipalities and other decision-makers in the best management practices to address these issues. Through this support, the TEP seeks to improve knowledge among coastal decision-makers so that decisions do not negatively impact coral reefs and related ecosystems. This can also support the limited staff of the DNER in addressing coastal management needs.

2.3 Enhance the capacity of natural resource managers to understand the vulnerability of coastal habitats to environmental stressors impacts and adaptation strategies using relevant decision-support tools and resources.

The TEP will provide training opportunities on relevant decision-support tools and resources that help natural resource managers understand environmental stressors and their potential effects on coastal ecosystems and identify appropriate adaptation and restoration strategies. Training will target DNER decision-makers, particularly managers of coastal and other protected areas, as well as decision-makers from other agencies and municipal governments. The TEP will strengthen outreach to these audiences to encourage participation in training opportunities, including future training offered through the NERRS or other partners on relevant vulnerability assessment tools. These efforts will complement ongoing efforts to evaluate coastal ecosystem vulnerability and promote collaboration among those involved in coastal resource management.

2.4 Provide capacity building and technical assistance in adaptation to environmental stressors, disaster risk reduction and emergency response

The TEP and its Advisory Committee have identified a continuing need to strengthen municipal and community capacity in these areas. The Program will engage subject-matter experts and use relevant tools, reports, and models from FEMA, PRCZMP, the University of Puerto Rico, the NERRS network, and other partners. Over the longer term, information generated through the Sentinel Site project may also inform future training. Activities may incorporate social-science research methods, including participatory mapping, to support local planning and zoning.

Objective 3. Increase collaboration with coastal decisionmakers representing the Commonwealth, federal, and community organizations.

3.1 Continue raising awareness of the TEP and the opportunities it provides

The TEP will continue participating in meetings with professional organizations, agencies, and other entities to foster additional partnerships and increase its audiences.

3.2 Continue using digital media to promote the TEP and reach larger audiences

The TEP will use available JBNERR digital communication channels and partner networks to announce training opportunities and share program information and resources with priority audiences. The Program will also explore partnerships that can expand its digital outreach and connect with new audiences. Digital communications will use clear, accessible language and be coordinated with Reserve staff and partners.

Objective 4. Determine the needs of target audiences for the TEP program to continue providing relevant services.

4.1 Revise and update the Needs Assessment and Market Analysis for 2026-2030 management period

The last Needs Assessment (NA) was conducted in 2013 and provides direction for the TEP program through 2018. There is a need to revise and update the NA to determine priority issues and services required by coastal decision makers. The NA will ensure that TEP continues to provide relevant services to its audiences.

Desired Program Impacts

Over the next five years, the TEP is expected to strengthen the capacity of municipalities, natural-resource managers, enforcement personnel, community organizations, businesses, and other coastal decision-makers to protect and enhance coastal resources. Participants will be better equipped to assess vulnerabilities; reduce nonpoint-source pollution; advance sustainable water management; prepare for environmental stressors, disasters, and emergencies; develop and implement land-use, stormwater-management, resource-management, and adaptation plans; and apply appropriate restoration practices.

Expected program-level impacts include increased knowledge and practical skills; greater use of science-based information, decision-support tools, participatory methods, and best practices;

stronger coordination and partnerships; broader awareness and reach of the TEP; and training and technical assistance that respond to the needs of priority audiences and identified service gaps.

Over time, these impacts are expected to support more informed land-use and resource-management decisions, reduced pollution and hazard exposure, improved stewardship, enforcement, and compliance, stronger protection of habitats and species, and greater resilience of Jobos Bay and Puerto Rico's coastal communities.

Monitoring and Evaluation Strategies

The TEP evaluates training activities using pre- and post-training assessments, anonymous participant feedback, and post-event evaluations. The Program also reviews attendance, the relevance of participating audiences, and participant comments and recommendations concerning training content, delivery, and presenters. The TEP Coordinator uses this information to assess changes in participants' understanding and inform future programming.

The TEP Coordinator reports available data through applicable operational-grant progress reports. Performance indicators address participants' understanding, application of learning, and connections with peers and subject-matter experts. Advisory Committee members may also provide feedback on program delivery when available. The TEP Coordinator also communicates with training program coordinators from other reserves during annual NERRS meetings.

Current evaluation practices primarily address training events. The Program has not documented a separate formal system for tracking technical assistance. Over the next five years, the TEP seeks to strengthen the compilation and review of evaluation results and participant follow-up. Findings will continue to inform training topics, delivery approaches, presenters, outreach, two-year proposals, and annual work plans.

Stewardship Program

The NERRS stewardship program works collaboratively with the other reserve programs to ensure the lands and waters of the research reserve system are cared for and can continue to support the plants, animals and people that depend on the health of these places.

Caring for lands and waters within the reserve is primarily accomplished through science-based management — applying western and Indigenous knowledge to inform management approaches, within the reserves and beyond, including adapting to environmental changes. Commonly used approaches include ecological restoration; prevention and control of invasive species; managing lands to sustain species, biodiversity and natural systems, including important cultural lifeways; conducting prescribed burns; and conducting research, monitoring, or mapping that directly informs the management of natural and cultural resources. Many stewardship programs also plan or inform public access and resource use programs to minimize negative impacts to natural resources from visitor use; manage and remove land-based and marine debris; inventory and protect historic or cultural resources; provide volunteer hands-on stewardship or community science opportunities; help identify and acquire additional lands for protection; and support disaster response planning. These activities can vary across reserves due to their unique natural resources and local conditions, as well as different land ownership and administrative structures, at each site.

Stewardship and research programs work together closely to understand the condition of and changes in reserve habitats and then use this information to inform, monitor, and adapt stewardship actions. This includes land use and habitat mapping as part of the national SWMP, inventorying and monitoring species and other natural resources, and assessing habitat condition and vulnerability, such as how wetlands respond to changing water levels, as well as testing innovative methods and locally relevant stewardship practices.

Stewardship programs work with the training programs to extend stewardship practices beyond reserve boundaries through outreach and training for community decision-makers and landowners. Education and stewardship programs collaborate to increase public awareness of good stewardship practices to support estuary health through various means, including displays, signage, written materials, education curricula, and hands-on learning opportunities.

The Reserve System Strategic Plan outlines objectives to improve the protection and function of coastal habitats, and inspire stewardship, protection, and management of estuaries and their watersheds in coastal communities through place-based approaches.

Stewardship Program Context

Previous versions of the JBNERR management plans did not contain a separate section on the Stewardship Program. Instead, as per the Reserve System Management Plan Guidelines (NOAA, 2023), stewardship functions were distributed across other chapters “due to the complexity and variability of the ways that stewardship programs are focused and operated at each reserve” (NOAA,

2023, pg. 28). This update includes a stand-alone chapter on the Stewardship Program as part of Program Foundations.

Setting and Context

JBNERR's Stewardship Program seeks to protect the Reserve's ecosystems and minimize anthropogenic and natural impact. It collaborates closely with other Programs to integrate science-based decision-making into restoration and management practices. It is an ongoing and strategic process that seeks to maximize limited resources. Specifically, it uses SWMP data and collaborates on applied research projects, provides technical content and support for interpretive education programs, integrates coastal management and resilience best practices together with TEP, and supports planning, zoning, and adaptive management.

The Stewardship Program directly manages the land within the Reserve, with support from volunteers and other partners. Historic and cultural settings shape the Program's work. The Reserve is located near several archaeological sites and contains part of the Central Aguirre Historic District. These resources are considered when making decision regarding public access and visitors' use. The Program also considers the socioeconomic characteristics of adjacent communities when developing public engagement and collaboration strategies.

Priority Issues

Over the next five years, the Stewardship Program aims to address the following issues:

- Protection and restoration of critical coastal habitats (mangroves, salt flats, coral reefs, and seagrass beds).
- Community engagement and collaborative management with local stakeholders.
- Resilience to environmental stressors, particularly for vulnerable coastal ecosystems.
- Biodiversity conservation and protection of endangered species.
- Land encroachment.
- Habitat degradation.

Priority Audiences and Strategic Partnerships

Six main groups comprise the primary audiences for the Stewardship Program at the Reserve. These audiences will continue to be important over the next five years to support conservation and restoration goals. The Program seeks to strengthen and foster continuity of their involvement.

Table 7. Primary Audiences for the JBNERR Stewardship Program

Audience group	How the Program identified these audience groups	Needs and priority issues for this revision
Adjacent local communities (Pozuelo, Aguirre, Las Mareas, San Felipe, and Coquí)	Based on their proximity to the Reserve, historical dependence on its natural resources, and participation in JBNERR activities	■ Address gaps in scientific knowledge and sustainable resource-use practices. ■ Provide training in collaborative resource

Audience group	How the Program identified these audience groups	Needs and priority issues for this revision
		management and support sustainable economic opportunities, such as ecotourism, restoration work, and citizen science.
Commercial and recreational fishers	Community consultations, historical observations of resource use, and coordination with the DNER and local organizations	▪ Training in sustainable fishing practices. ▪ Greater clarity regarding sensitive areas and applicable regulations. ▪ Integrate into co-management processes.
Partner agencies (DNER, NOAA, USFWS, USDA, Municipal governments, USGS)	Based on their regulatory roles and involvement in joint conservation projects	▪ Better data integration. ▪ Increase awareness of the data that JBNERR collects.
Academic institutions and researchers (e.g., local and outside universities, CariCOOS)	Through formal collaborative agreements	▪ Improve the logistics for access, permits and institutional support.
Visitors and the public	Visitor Center statistics, trail-use monitoring, and participation in guided activities	▪ Interpretive guidance. ▪ Improved signage. ▪ Better access management.
Non-governmental organizations (NGOs) and community environmental groups (IDEBAJO, Scuba Dogs Society, Ocean Foundation)	Collaborative restoration projects and participation in resource management	▪ Continue and expand the collaboration.

Current and Anticipated Partnerships

Program currently partners with volunteers, BoriCorps, and the Ocean Foundation for restoration activities. These collaborations play a key role in implementing the program's objectives.

The Program also seeks to strengthen partnerships with the community. The Stewardship Program has gathered informal input from neighboring communities in multiple ways. However, there is no formal process for incorporating or consistently following up on community perspectives regarding Reserve's management and performance. Suggested opportunities to formalize the collaboration include:

- Establish a "Friends of JBNERR" group.
- Increase community participation in decision-making by encouraging greater involvement in program advisory committees, particularly the Stewardship Program and the Training and Engagement Program.
- Develop long-term volunteer programs instead of isolated volunteer events.
- Formally involve youth and local schools in long-term collaborative projects, rather than limiting participation to science fairs, one-time activities, or community service ("green hours") requirements.

Stewardship Program Capacity

The Stewardship Program is currently actively recruiting personnel. After JBNERR Director's position became vacant, the Stewardship Coordinator was promoted to assume this responsibility. The Director remains involved in all stewardship activities associated with trail, access, and maintenance, enforcement, boundary demarcation, mapping, and restoration until the vacancy is filled.

DNER rangers are key partners of the Stewardship Program. Currently, JBNERR has five assigned rangers to support continuous surveillance and enforcement at the site. Together with JBNERR Director, they are working on implementing the recently updated Surveillance and Prevention Enforcement Strategic Plan for the DNER Rangers at JBNERR (DNER, 2026).

The Program also receives support of a biologist, a DNER employee, funded by a USFWS proposal and stationed at JBNERR. This staff member, in addition to administering the hunting program at the Reserve, provides support with habitat restoration projects.

The Program also collaborates with other NERRS reserves, particularly Rookery Bay National Estuarine Research Reserve in Naples, Florida. It participates in national thematic networks on mangroves, environmental stressors, and restoration and develops integrated projects focused on habitat restoration, environmental monitoring, and ecosystem resilience, particularly for mangrove forests and seagrass beds. Examples include HiTIDER habitat mapping project, conducted in 2022 and 2024 (<https://nerrssciencecollaborative.org/project/Wasson20>), and Bridging the Gap between Quadrats and Satellites [Drone the SWMP]: Assessing Utility of Drone-based Imagery to Enhance Emergent Vegetation Biomonitoring, conducted together with the JBNERR Research and Monitoring

Program and Rookery Bay NERR (<https://nerrssciencecollaborative.org/project/Puckett20> ; <https://nerrssciencecollaborative.org/project/Ogurcak23>).

Stewardship Program Alignment and Delivery

Over the next five years, the Stewardship Program seeks to focus on protecting and restoring ecosystems, mitigating impacts from natural events, land encroachment, and nearby industrial activities. Specific projects include:

- Science-based monitoring and adaptive management integrated with the SWMP. SWMP data is used to guide restoration, enforcement, and water quality management decisions.
- Restoration of the illegally occupied area at the end of Camino del Indio. Unauthorized structures, including docks and boat ramps, should be removed, and the site restored, as ordered by the Court of First Instance of Guayama in its February 2025 ruling. This project has the highest priority for the Program and the Reserve.
- Address habitat degradation resulting from groundwater (aquifer) extraction.
- Strengthen enforcement and visitor management, together with the DNER rangers assigned to the Reserve.
- Continue restoration of mangroves, coral reefs, and seagrass beds.
- Protect vulnerable and threatened species and areas where they reproduce, such as manatee, Yellow-shouldered blackbird, and other endemic and migratory birds.

Other major activities the Program seeks to prioritize over the next five years are:

- Improve management of sensitive habitats, including cays, coral reefs, and mangroves.
- Strengthen enforcement by implementing the Reserve-wide enforcement plan, including water patrols conducted by the DNER Marine Patrol Unit in Salinas.
- Expand structured citizen science programs focused on mangrove monitoring, water quality, and key species.
- In collaboration with Research and Monitoring, develop a climate vulnerability assessment for JBNERR.
- Reduce recreational impacts through improved access management and signage.
- Expand education programs that build community climate resilience.
- Improve educational infrastructure and controlled access, particularly at Cayo Caribe, where visitor and recreational boating activities are currently unmanaged.

These projects directly align with NERRS priorities, including:

- Ecosystem-based restoration, with emphasis on mangroves and seagrass beds. As an example, the Program is implementing the Mangrove Restoration Project with The Ocean Foundation and BoriCorps, which includes hydrologic reconnection and mangrove planting in seven restoration areas across the Aguirre State Forest in Pozuelo, JBNERR, and coastal public lands west of the Las Mareas community. The Program also implements NOAA best management practices for restoration projects (e.g., coral, mangrove, and seagrass) and climate resilience planning tools to guide local adaptation strategies.

- Adaptive management in response to multiple stressors, including increasingly frequent hurricanes that accelerate coastal erosion through storm surge. Examples of JBNERR areas with adaptive management include Mar Negro, beaches, and degraded mangrove areas.
- Prioritizing scientific projects with results that directly inform management decisions.
- Building local capacity. JBNERR supports citizen science programs that follow national monitoring standards.

The Program applies the "Science to Management" approach by connecting researchers with community members and Reserve managers.

The Program also relies on the local knowledge of the adjacent communities to understand the causes of coastal challenges and possible impacts of proposed measures. Many residents are descendants of the Central Aguirre workers and have generational knowledge of the land use trends and issues in the area. Local knowledge also helps to better understand how different projects proposed in the adjacent areas can affect the Reserve's resources — for example, the effects of photovoltaic farms on the runoff generated in the area and its impact to the aquatic resources.

On July 13th, 2026, the DNER Secretary emitted Administrative Order 2026-05 which prohibits the use of jet-skis in the section of Jobos Bay known as "Mar Negro". The Order seeks to protect marine fauna, particularly manatees, and institutes a \$5,000 fine for its violation. The Order contributes to habitat restoration and management projects of the Program.

Stewardship Future Needs and Opportunities

The Stewardship Program had operated with limited personnel due to administrative delays in hiring the minimum staff needed for effective program operations. It currently does not have staff. Timely recruitment of the Stewardship staff is essential to successful delivery of the proposed projects. There is also need for additional technical staff and knowledge transfer process. Other challenges include:

- Insufficient enforcement capacity across the Reserve. Although additional DNER enforcement officers have recently been hired, staffing levels still do not consistently support nighttime patrols. This shortage has resulted in reduced capacity to prevent and respond to ecological impacts and continued degradation of critical habitats.
- Limited visitor and public-use infrastructure. The Visitor Center facilities remain in poor condition following Hurricane María, and repairs have been delayed due to the slow allocation of FEMA recovery funds.
- Insufficient funding dedicated exclusively to restoration.
- Lack of a Reserve-specific climate vulnerability assessment, despite collaborative data collected through projects with Rookery Bay NERR.
- Difficulty maintaining long-term engagement with neighboring communities.
- Reduced competitiveness for larger federal funding opportunities.
- Vandalism of the signs that indicate allowed and prohibited uses (e.g. litter, crab hunting). These signs require frequent replacement.

Current projects and collaborations provide several stewardship opportunities, such as:

- Support from the academia, research alongside the management, involve more research in the current activities to support stewardship (e.g., monitoring, use of drones, use of mapping). Be able to use technology to detect ecosystem changes or deterioration sooner, cover larger areas. Involve university's capacity to cover larger area.
- Improve navigation in the area (velocity, speed limit – compliance) to protect manatee, restrict jet ski use. Recognizes the tension, challenges it may cause for recreational uses and commercial.
- Greater involvement of adjacent communities.

Stewardship-Related Objectives and Actions

In addition to its objectives, Stewardship Program also advances objectives from other areas, such as Research and Monitoring, Resource Protection, and Public Use and Access. Specific stewardship activities related to those objectives are discussed in the corresponding sections below.

Objective 1. Carry out habitat enhancement projects to benefit local ecosystems and migratory species.

1.1 Carry out the collaborative mangrove restoration project

The Jobos Bay area was significantly affected by Hurricane María. Strong winds, wave energy, storm surge, and increased sedimentation damaged mangrove's structural properties and affected ecosystem's ability to reproduce and regenerate (The Ocean Foundation & Merello Marine Consulting, 2024). In response, the JBNERR is conducting a collaborative mangrove restoration project, funded by NOAA, in collaboration with The Ocean Foundation, Merello Marine Consulting, and BoriCorps.

Figure 9. The Ocean Foundation Mangrove Restoration Project – Sites within JBNERR



Source: Figure prepared by ETI based on data from The Ocean Foundation & Merello Marine Consulting (2024) and with permission from Manuel Merello

1.2 Continued habitat enhancement projects in the Aguirre and Mar Negro Units

The Program will continue enrichment planting in the disturbed lands in the Aguirre Units. This will be conducted with native species appropriate to its habitats. In addition, restoration of mangroves will be a continued task during the next management period. The Reserve staff will continue to seek volunteer support to carry out this action. The Program also seeks to restore habitat in the currently encroached areas of the Mar Negro unit. This action will commence once the legal proceedings for each encroachment case have been completed and the illegal structures have been demolished.

1.3 Continue providing support to other restoration and habitat protection projects

Numerous restoration projects take place within JBNERR, its influence and research area, and areas adjacent to the Reserve. Examples include seagrass restoration project in Salinas and Guayama coastal waters, conducted by the DNER, hydrological connectivity restoration projects, led by USFWS, and installation of marine buoys in Salinas Bay by DNER to communicate speed limit and prevent accidents with marine mammals. JBNERR staff will continue to actively support and collaborate in these projects.

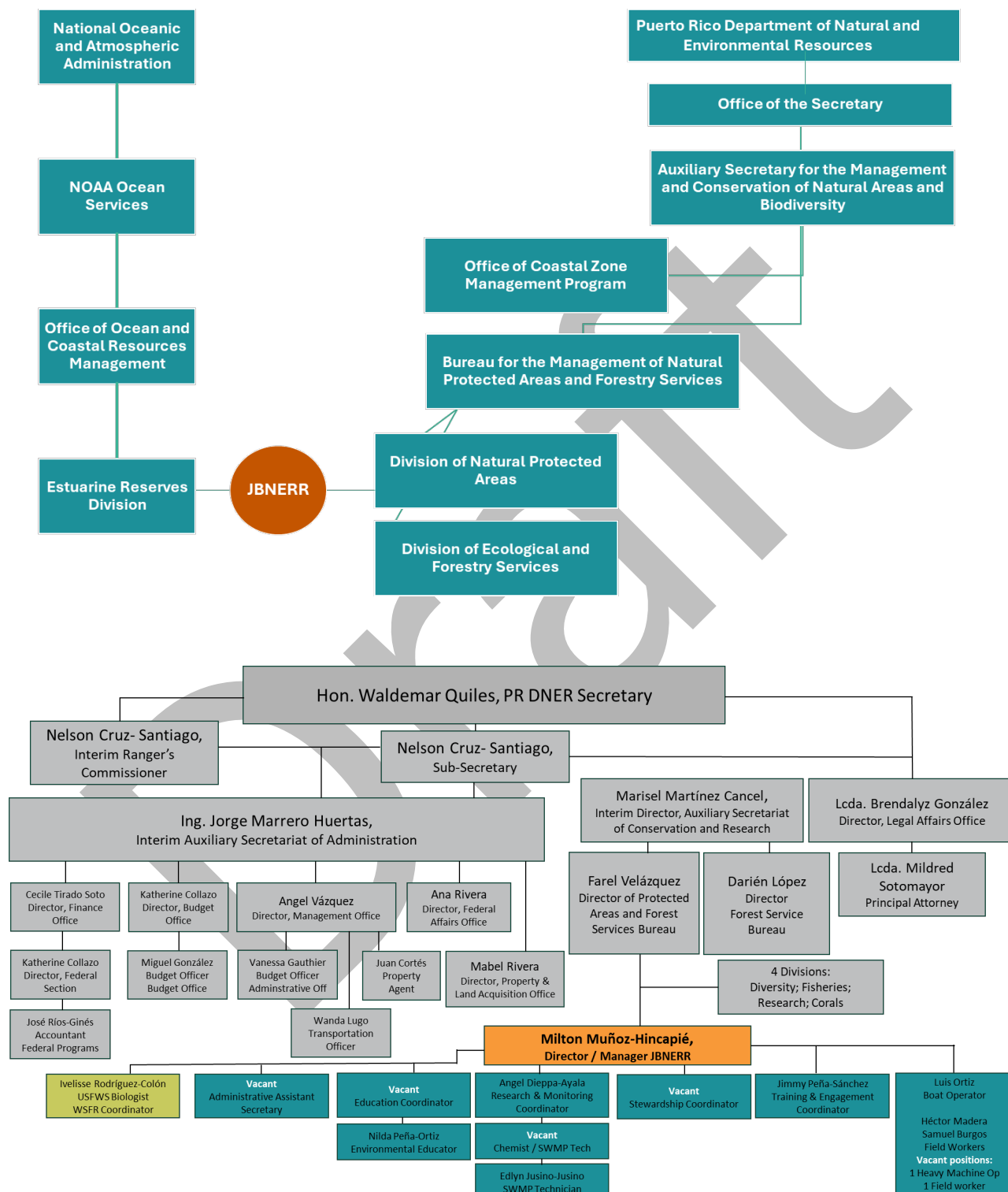
Administrative Plan

Organization Framework and Management Authorities

The DNER is responsible for the administration and management of JBNERR. DNER derives its powers and authorities from its Organic Act, Law No. 23 - 1972, and the Act to Implement the DNER Reorganization Plan, Law No. 171-2018. Law No. 23 delegates to DNER the responsibility of implementing the operational phase of the public policy contained in the Commonwealth's Constitution for the use and conservation of natural resources. DNER's mission focuses on protecting, conserving, and managing Puerto Rico's natural and environmental resources to ensure their enjoyment by future generations and promote a better quality of life (Puerto Rico Department of Natural and Environmental Resources, n.d.). DNER's mission aligns with JBNERR's conservation and stewardship mandate, while DNER's broader responsibility for the conservation, management, and study of Puerto Rico's natural protected areas provides the institutional framework necessary to administer the Reserve. Appendix 5 provides a summary of the laws and regulations relevant to the protection and use of natural resources and the administration of the Reserve, along with links to access the full text of the original documents, where available.

The DNER Bureau for the Management of Natural Protected Areas and Forestry Services is ascribed to the Auxiliary Secretariat of Conservation and Research and is responsible for implementing the Commonwealth's public policy for the conservation, management, and study of natural protected areas. This Bureau is responsible for management, conservation, and administration of the State Forests, Natural Reserves, Marine Reserves, Fisheries, Coral Reefs, Wildlife Refuges, and the Jobos Bay NERR.

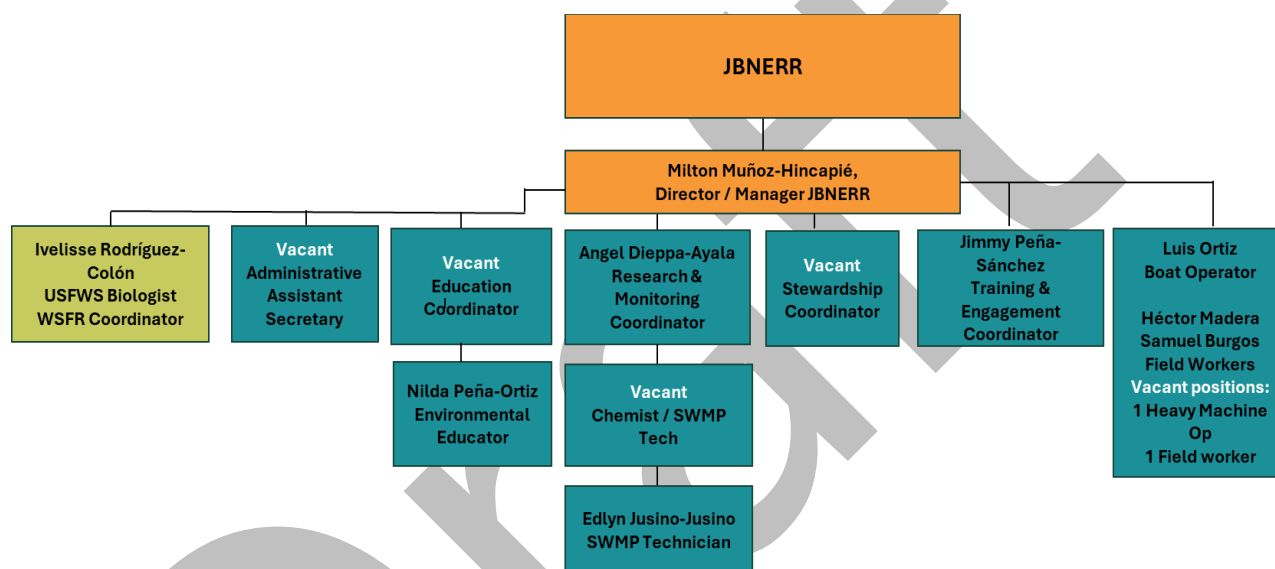
Figure 10. Organizational Framework for the Administration of JBNERR under the DNER and NOAA Management Structure



Current Staff and Needs

Reserve employees include mainly permanent, full-time staff, as well as support positions for programs and facilities. The Reserve Director supervises program coordinators who organize their work plans to implement the strategies identified in this Plan. Some staff has been hired during the last management period whereas other team members have been working in the Reserve for over ten years. The Reserve also has a DNER employee, funded by a USFWS proposal, to administer the hunting program and provide support with wildlife restoration activities, as part of the USFWS Wildlife and Sport Fish Restoration Program.

Figure 11. Organizational Chart of the JBNERR



Several core and support positions are currently vacant. The most recent vacancies request included Education Coordinator, Administrative Assistant, Heavy Machine Operator, and a Chemist, to be fully funded by NOAA funds. Further, the Reserve is working to add to the request two more positions that recently became vacant: Stewardship Coordinator and Field worker (a worker hired on March 16th, 2026, resigned August 5th, 2026). Filling these vacancies is a high priority for the Reserve, supported by the NOAA Final Evaluation Findings for JBNERR for June 2017 to June 2023 period (April 2025). Specifically, the Evaluation directs the DNER to fill vacancies in all positions necessary to meet the operational and management requirements outlined in the Reserve's approved Management Plan as Necessary Action 2. Furthermore, Recommendation 2 states that the DNER should develop a staffing plan that includes strategies for staff recruitment and retention.

The staff's primary office is located at the Reserve's Visitor Center Complex. The following table presents the staff position and responsibilities.

Table 8. Current JBNERR Staff and their Responsibilities

<u>Position</u>	<u>Responsibilities</u>
Reserve Director Full-time 100% PR funding	Responsible for overall program development and management, monitoring day-to-day operations of the Reserve, and progress of programs and projects. Prepares annual budget requests for state and federal funds. Oversees expenditures of funds. Prepares required quarterly and annual reports for NOAA. Supervises Program Coordinators, and administrative and facilities staff. Represents Jobos Bay NERR at the national level.
Research and Monitoring Coordinator Full-time 100% NOAA funding	Responsible for the design and implementation of the Reserve's Research and Monitoring Program. Carries out research projects and monitoring activities where appropriate. Ensures that the results of research projects are compiled and translated into usable information that is available for diffusion to the public. Serves as a liaison with the scientific community, promotes data utilization, and serves as the primary contact for scientists conducting research in the Reserve. Coordinates SWMP implementation.
SWMP Technician Full-time 100% NOAA funding	Assists Research Coordinator with SWMP research and monitoring activities, maintaining computer software, hardware, and databases, as well as maintaining scientific collections and analytical equipment. Assists in field research, collecting and analyzing SWMP data, and preparing technical reports. Conducts literature review and database searches and synthesizes the findings. Assists visiting investigators in the calibration and maintenance of the Reserve's laboratory and field equipment. Oversees the operation of the Reserve's laboratory facilities.
Environmental Educator Full-time 100% NOAA funding	Responds to the information requests of schools, communities, and visitors. Assists in the maintenance of educational materials, development of presentations and group activities within the Visitor Center and local schools. Provides field support in educational activities and volunteer programs at Reserve sites. Maintains a record of visitors, information requests, educational materials, publications, and audiovisual materials.
TEP Coordinator Full-time 100% NOAA funding	Coordinates and implements the Reserve's TEP. Identifies and develops partnerships. Promotes professional training programs and services to target audiences, including coastal managers and decision-makers. Provides instructional design, program development, and facilitation services. Develops and distributes training materials. Evaluates program's activities. Maintains and submits performance measures to NOAA's Office for Coastal Management.
Grounds Keeper 90% PR funding	One position responsible for maintaining facility grounds and ensuring that signs and boundary markers are in place. Periodically inspects areas

10% NOAA funding	frequented by visitors. Responsible for general maintenance and management of outdoor facilities.
Boat Operator 100% NOAA funding	Responsible for captaining the reserve's research boats. Works closely with the Research and Monitoring Coordinator and the System Wide Monitoring Program (SWMP) technician. Occasionally participates in the installation and retrieval of multiparameter probes, as well as in trail and physical plant maintenance activities.
Brigade Leader 100% PR funding	The brigade leader coordinates and supervises the field maintenance work in each of the different areas and paths of the reserve
Field Worker 100% NOAA funding	The field Worker carries out maintenance and improvement work on green areas, trails, sidewalks, gazebos, docks, boardwalks, and everything related to the physical plant of the reserve.
Law Enforcement Officers Full-time 100% PR funding	Five law enforcement officers are assigned to Jobos Bay NERR. They conduct routine patrols and respond to resource violations affecting Reserve's resources.

Strategic Partnerships

The JBNERR does not have the legal authority to enter into agreements with other entities; instead, such agreements are signed by the DNER Secretary. At present, there is an agreement between the DNER and the Ocean Foundation related to JBNERR. Specifically, agreement provides a framework for cooperation between the two entities for the restoration and rehabilitation of coastal ecosystems within the JBNERR, the Aguirre State Forest, and surrounding coastal areas. Appendix 2 contains a copy of this agreement.

JBNERR also works with strategic partners that provide resources and support for core Reserve functions. These partnerships are distinguished from the program-specific collaborations described elsewhere in this Management Plan.

The Sociedad Ornitológica Puertorriqueña collaborates with JBNERR in conducting quarterly monitoring of endemic and migratory bird species in several sectors of the Reserve. These monitoring efforts contribute to expanding data for the Puerto Rico Bird Atlas and are carried out with SOPI volunteers and volunteers from other organization

The San Juan Bay Estuary Program continues to collaborate with the Reserve through its participation in National Water Quality Monitoring Day and related water quality monitoring activities. JBNERR encompasses Puerto Rico's second-largest estuary, after the San Juan Bay Estuary, providing a relevant context for collaboration between the two estuarine systems.

The Boy Scouts of America–Puerto Rico Council continues to be an important partner in supporting trail and facilities maintenance and enhancement within the Reserve. JBNERR will continue this partnership during the next management period to support these efforts.

Since October 2023, BoriCorps has collaborated with JBNERR in infrastructure improvements, maintenance of green areas, and mangrove restoration activities. BoriCorps receives NOAA funding to support its participation in the mangrove restoration effort.

In addition, the Reserve collaborates with the Hunters Association of the South to organize and supervise activities during the waterfowl hunting season, while protecting Reserve resources. Although members of the Association and their families have previously volunteered to maintain the Reserve’s trails, this volunteer participation is not currently active.

The Reserve continues to seek partnerships, alliances, and community volunteer support for efforts that support its management needs and core functions.

Advisory Committees

The JBNERR Programs have Advisory Committees that provide input, guidance, and support for programmatic direction for each program. They offer advice on topics such as management priorities, uses, acquisitions, restoration priorities, and enforcement. Committee members also provide guidance on program needs, priorities, and opportunities for collaboration, as applicable to the scope of each Program. In the recent years, due to staff transitions and COVID-19 restrictions, meetings with the Advisory Committees have decreased in frequency, although Program’s Coordinators and the Director have continued to consult with committee members individually. Further, members of the Advisory Committees participated in the revision of this management plan, through individual interviews and group meetings.

The composition of each committee varies by scope, focusing on the stakeholders and key collaborators relevant to each Program. For instance, the Stewardship Advisory Committee includes a variety of stakeholders, assigned by their respective organizations, and includes representatives from federal government, nongovernmental organizations, and community groups. The Research and Monitoring Committee includes researchers with different fields of expertise who can provide the Program with guidance on research needs, knowledge gaps, and opportunities for collaboration. The Education Advisory Committee includes representatives and collaborators with experience in environmental education, interpretation, and engagement with educational audiences. The TEP Advisory Committee includes representatives from agencies, professional organizations, academia, and other stakeholders relevant to the Program’s training and engagement audiences and priorities. Lists of members and their affiliations for the Education and TEP Advisory Committees are provided in Appendices 6 and 7, respectively.

Table 9. Entities Represented in the Stewardship Advisory Committee

Name	Organization	Position
Carlos Vega Santos	Land Surveying and Topography	Director
Ruth Santiago	IDEBAJO	Member
Roberto Thomas Ramírez	IDEBAJO	President
Nelson Santos Torres	IDEBAJO	Member
Iván Llerandi	US Fish & Wildlife Service	Habitat Conservation Program Coordinator
José Rivera	NOAA - NMFS - Habitat Conservation Division	Fish Biologist
Alexandra Galindo	US Fish & Wildlife Service	Fish Biologist
Félix López	US Fish & Wildlife Service	Ecologist
José Cruz-Burgos	USFWS - Endangered Species	Program Coordinator
Reynold Ribould	Southern Hunters Sport Association, Inc	Member
Néstor Rivera	Southern Hunters Sport Association, Inc	President
Frank Alicea	Southern Hunters Sport Association, Inc	Vice-president
Gustavo Crespo	Tour Operator - Bahía de Jobos	President
Miguel Viqueira	Protectores de Cuencas, Inc.	Director
Áurea Rodríguez	Taller Ecológico de Puerto Rico	Director
Angel Dieppa	Reserva Bahía de Jobos - JBNERR	Coordinator, Research and Monitoring
Milton Muñoz	Reserva Bahía de Jobos - JBNERR	Director
Manuel Merello	Merello Marine Consulting MMC In	Ecologist, Marine Consultant

Table 10. Research and Monitoring Advisory Committee

Name	Organization	Field/Area of expertise
Ariel Lugo, Ph.D.	USDA- Forest Service IITF, Retired	Ecology
Carlos J. Rodríguez-Sierra, Ph.D.	University of Puerto Rico	Public Health
Michael Martínez, Ph.D.	Florida A&M University	Geology-Pollution
Elvira Cuevas, Ph.D.	University of Puerto Rico, Rio Piedras Campus	Ecology
Deborah Parrilla, Ph.D.	University of Puerto Rico, Humacao Campus	Marine Biology
Imar Mansilla-Rivera, Ph.D.	University of Puerto Rico	Public Health
Jesús Rodríguez, Ph.D.	Geologist-USGS-Retired	Geology
Julio M. Morell-Rodríguez, Ph.D.	UPR-CariCOOS	Chemist

Name	Organization	Field/Area of expertise
Ricardo Colón, Ph.D.	DNER, Manager	Ecology
René Estévez, Ph.D.	PR Sea Grant	Biological Oceanography
José Rodríguez, Ph.D.	Hydrologist-USGS-Retired	Hydrology
Alejandro Torres, Ph.D.	University of Puerto Rico, Humacao Campus	Social Sciences
Ángel Dieppa Ayala, MS.	JBNERR, Research Coordinator	Biological Oceanography

Objectives and Actions

During the next management period, the Reserve will continue strengthening its administrative efficiency and ability to secure funding and additional positions. Recruiting additional staff is a key priority; thus, the administrative objectives are reported as part of the strategic plan. This section details specific actions, corresponding to each objective.

Objective 1. Recruit additional JBNERR staff to support administrative and programs' efforts.

1.1 Recruit an Administrative Assistant/Facilities Coordinator

This position will manage grants, contracts, and purchase requests, as well as coordinate financial matters with DNER headquarters and NOAA and manage facility use and maintenance. The Director will continue working with the DNER to identify available sources, such as the Law Num. 8 of 2017, to recruit the Administrative Assistant/facilities coordinator within the next vacancies request, submit to the DNER headquarters.

1.2 Recruit Stewardship Program Coordinator

Stewardship Program Coordinator position became vacant after the previous Coordinator assumed the responsibility as JBNERR Director. Although the Director continues to support Stewardship Program tasks, it needs full-time personnel. This position will be added in the next vacancies request to the DNER central administration.

1.3 Recruit Education Program staff

Education Program does not currently have a Coordinator, and its Environmental Educator plans to retire in a year. It is necessary to fill these vacancies to offer continuity to the Education Program tasks and support knowledge transfer. The Coordinator Position has been included in the current vacancies request. The recruitment for an Environmental Educator should take place following the retirement of the current one.

1.4 Recruit Heavy Machine Operator

This position has been included in the most recent vacancy request but remains unfilled, in part due to the multiple administrative review and approval steps required before the position can be

advertised. This process can extend the time needed to open and fill vacancies and applies broadly to government positions rather than being specific to the Heavy Equipment Operator position. The Reserve will continue pursuing the position through the established recruitment process request to the DNER central administration.

1.5 Recruit an additional Field Worker

A field worker, recruited earlier this year, resigned in August. To replace this position, the reserve will submit a vacancy request to the DNER central administration.

Objective 2. Strengthen JBNERR staff capabilities by providing trainings and developing annual work plans.

2.1 Each Reserve staff will be engaged in one professional development training per year

The Reserve has highly qualified staff. This activity seeks to continue strengthening their skills and capabilities to address education, training, research, monitoring, administrative, and maintenance needs.

Creative avenues will be explored to provide both in-person and remote training opportunities. The Reserve will work closely with academic institutions and other collaborators to provide staff with training and continuing education opportunities in areas such as project management, grant writing, maintenance, marine mechanics, and GIS.

2.2 Develop work plans to support the management plan implementation

The Reserve staff will continue to prepare annual work plans to develop specific activities under each objective and action presented in this management plan. These annual work plans, or operational plans, will align with the goals and objectives of this management plan. Any emerging issue that needs to be addressed will be discussed with the members of the Advisory Committees, as needed, and the NOAA Office for Coastal Management Program Specialist before being considered in the annual work plans.

Facility Development and Improvement Plan

Purpose of Facilities and Construction Principles

The Reserve's facilities serve as a regional showcase of cultural values, environmental education, and ecosystem restoration. JBNERR maintains historic buildings and uses them as spaces that provide services to communities, students, and researchers. The Reserve contains exhibits on topics such as ecosystem protection and terrestrial and marine species. During the last management period, the Reserve updated the welcoming area in the Visitor Center and added exhibits. The Visitor Center is one of the Reserve's main facilities and showcases recent trends and research related to habitat restoration practices, such as the mangrove nursery and bridges over hydrological connection channels, discussed below.

The Reserve's Facilities Master Plan, developed during the previous management period, continues to guide its future facility development and improvements. It draws from prior plans that address facility uses and needs, including cost-benefit considerations related to repurposing existing structures rather than constructing new ones. The Plan, essential for coordinating and executing facility improvements, includes an analysis of the historical background of the existing structures. In particular, it considers the adaptive reuse of deteriorating historic structures associated with the Aguirre Sugar Mill to meet program needs while retaining their historic character. These structures are part of the Central Aguirre Historic District and are recognized for their historic, architectural, and cultural significance. The Plan also envisions a campus-like setting in which new or repurposed facilities are connected by walking paths that support non-motorized access throughout the Reserve's facilities. This approach is consistent with previous facility planning, which identified the adaptive reuse of historic Aguirre Sugar Mill structures as an opportunity to support Reserve programs.

Following Hurricane María, Reserve staff implemented measures to enhance hazard resilience and minimize impacts to facilities, equipment, and other infrastructure. Facility development and improvements will also consider sustainable and resilient design principles, including energy efficiency, appropriate siting, long-term maintenance needs, and vulnerability to coastal and environmental stressors. These principles are intended to support the long-term functionality of Reserve facilities while preserving historic character and responding to the environmental conditions of the Reserve. They are consistent with previous facility planning, which emphasized green building design, energy efficiency, historic preservation, and consideration of environmental conditions in facility siting and development.

The Facilities Master Plan was developed in collaboration with several academic institutions, with students incorporated into the design process. This collaborative approach supported the exploration of sustainable design technologies and principles while engaging academic institutions and future generations in the stewardship of the Reserve. The collaborative approach also supported consideration of the needs of future facility users.

Description of Current Facilities

The existing facilities within JBNERR include the Visitor Center, offices, dormitories, a cetacean skeletal remains exhibition area, a trail system, boardwalks, two docks, and a boat ramp (Map 9). These facilities support the Reserve’s research, monitoring, education, training and engagement, stewardship, administration, and public-use activities.

Visitor Center

The Visitor Center includes exhibits, staff offices, a research laboratory, a conference room, and restrooms. The Visitor Center is housed in the restored former Aguirre Sugar Plantation town clubhouse, located adjacent to the vacant historic hotel, and retains its historic architecture.

The Visitor Center includes numerous permanent exhibits. Interpretive exhibits in the 2,800 square-foot space were refurbished, including interactive displays, photos, a watershed model, coral reef dioramas, fossils, and pictorial exhibits of key ecosystems. School groups have contributed to the creation of some exhibits. The Visitor Center also provides exhibits and informational materials on the Reserve’s principal natural resources, including invertebrates and birds. These displays complement educational presentations and other interpretive activities provided by Reserve staff.

The conference room functions as a multi-use space, with partition doors that allow it to be expanded to accommodate groups of more than 30 people. It supports meetings, presentations, trainings, and other Reserve activities.

The dormitory is a two-story building that supports 26 individuals (four 4-beds rooms, four two-beds rooms, and one room with a full bed that can accommodate two people). The dormitory was renovated and expanded with a second story, with the improvements completed in December 2016. It includes a living room, student lab, laundry facilities, and a kitchen. The interior garden includes multiple trees that provide shade for two picnic tables and create a shaded outdoor gathering area. The dormitory supports students, researchers, and other participants engaged in Reserve programs and activities

Figure 12. Boat Parking Area



Adjacent to the Visitor Center, there is a small parking lot that supports staff and visitor vehicles s, as well as the Reserve’s vehicles, boats, and trailers. The parking lot is often over capacity and is not large enough to handle the number of cars during Reserve events. This represents an existing facility capacity constraint that should be considered in future facility planning.

In addition, there is a boat ramp, a dock and a gazebo close to the Visitor Center that are used by the Reserve’s staff and visitors.

Figure 13. Boat Ramp and Dock

Although visitors may access the Reserve on foot or by bicycle to enjoy the natural environment and engage in passive recreational activities, the ramp and dock are not intended for general recreational use. Their primary purpose is to support the Reserve’s research, monitoring, education, and management activities, including access by staff, researchers, students, and vessels used for these purposes.



Photo by ETI, 2026

The Visitor Center has an access ramp for individuals with mobility limitations. Accessible ramps also serve the student dormitory area and visitor laboratory.

There are opportunities to further enhance the Visitor Center exhibits and welcoming area.

Old Train Depot

The historic Old Train Depot is intended to serve as an extension of the Reserve’s facilities for education, training, community events, and other Reserve activities. It is located in the area proposed as a new entrance to the Reserve campus. The building has undergone renovations; however, it currently lacks electrical and water service and restroom facilities. The facility use permit is conditional upon the installation of electrical service and restroom facilities. These additional infrastructure improvements would be needed to support its full intended use.

Figure 14. Old Train Depot



Cetacean Skeletal Remains Exhibition Area

Near the Visitor Center, there is a partially open older structure. Its large, unobstructed space, covered area, and natural ventilation provide a suitable setting for exhibiting cetacean skeletal remains. The Reserve obtained the skeleton in 2025, after a humpback whale carcass drifted ashore at Cayo Caribe. Given the size and weight of the carcass, DNER retained it at the Reserve for preparation and educational use. The skeletal remains are now exhibited as part of the Reserve’s educational tours. The structure also provides an opportunity to further develop the area as an exhibition and educational space.

Figure 15. Cetacean Skeletal Remains Exhibition Area



Other Infrastructure

The Reserve has several temporary structures that support restoration projects. Examples include a mangrove nursery, located near the boat ramp, and wooden bridges, constructed as part of the habitat enhancement project to improve water circulation in the salt marsh near the boat ramp. The wooden bridges provide crossing over the hydrological connection channels, created as part of the project.

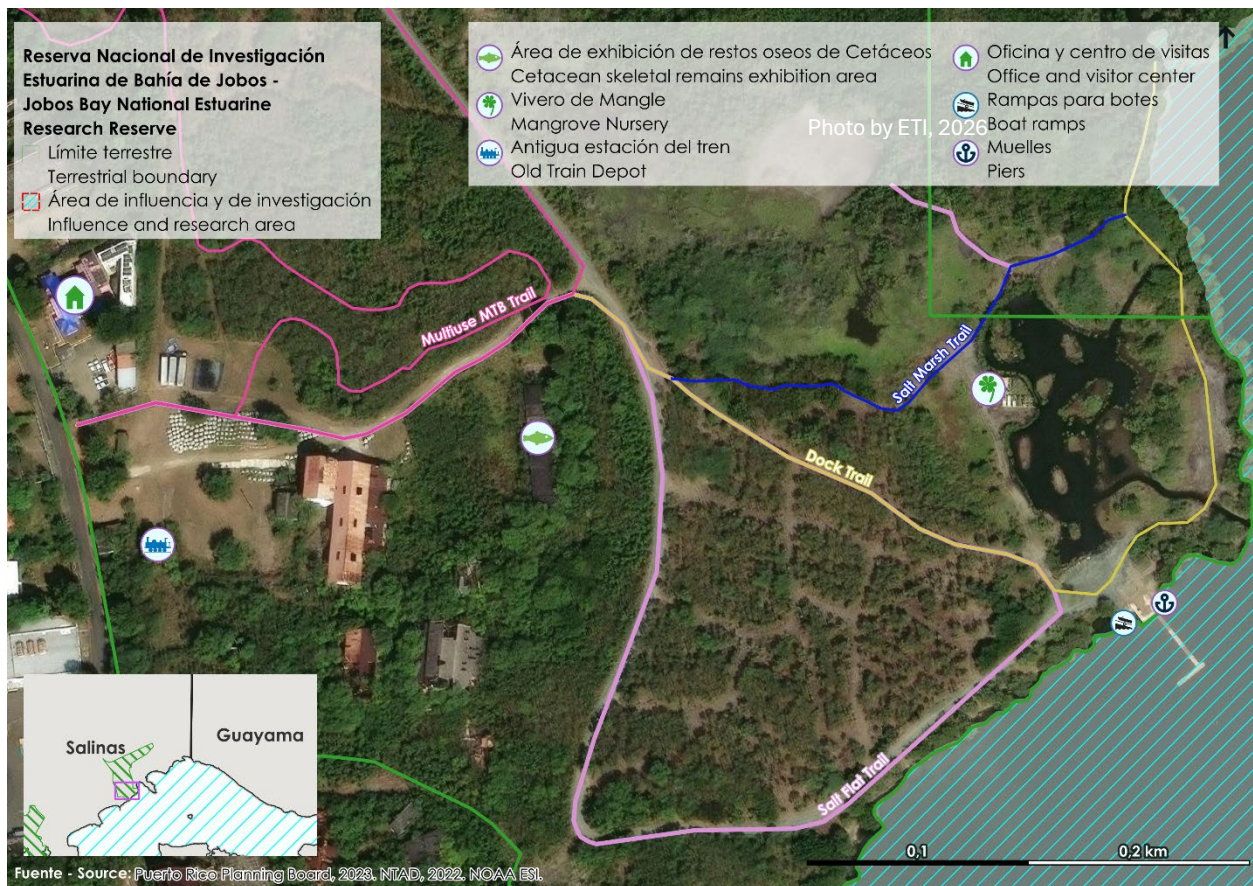
Figure 16. Wooden Bridge Across a Hydrological Connection Channel



Trails

Within the Reserve’s grounds, there are numerous hiking and mountain bike trails. All terrestrial segments of the Reserve have trails, and one trail is in Cayos Caribe. The trails are marked with maps and signs. The Public Access and Visitor Use Plan discusses the trails in more detail.

Map 9. JBNERR Facilites



Facilities are developed and maintained as deemed necessary for the operations of the Reserve and based on the needs of visitors and staff. The Reserve contracts groundskeeping services to maintain its facilities and grounds. DNER also includes JBNERR facilities under its agency-wide cleaning services contract, which provides 40 hours of janitorial services per week at the Visitor Center and dormitories. In addition, Reserve staff recruit and coordinate volunteers who assist with the maintenance and repair of boardwalks, trails, facilities, gardens, and exhibits.

Facility Challenges and Gaps

Hurricanes present a challenge to the Reserve's facilities, especially those built in wood. Hurricane Maria, which made landfall in Puerto Rico on September 20, 2017, destroyed part of the Visitor's Center roof. The impact resulted in water infiltration and damage to the library and equipment. The disbursement of recovery funds to complete the repairs has faced delays, a situation experienced across Puerto Rico. Until the repairs are complete, the library has been removed to avoid further damage to the materials.

Furthermore, the hurricane destroyed the gazebo and wooden docks. These structures were repaired with help from the volunteers. Specifically, a boy scout repaired the gazebo as part of 2020-2021 Eagle Service project, and Mars Hills University students repaired wooden docks Cayo Caribe and Aguirre Unit.

Other environmental stressors include events such as flooding due to rising sea levels, increased temperatures, and drought. Problems with water quality and supply in the South aquifer, for example, impedes reconstruction of former hotel's restaurant into the Education and Training Center, as the project did not receive a PRASA permit.

Anthropogenic stressors include vandalism and destruction and/or theft of property and equipment, and human-induced fires. Exposed equipment, surveillance equipment, and signage are particularly vulnerable to vandalism and theft, and has been targeted in the past. Regular presence of the DNER rangers, recently assigned to the Reserve, will assist with this challenge. Another consideration is the age of the infrastructure, as many facilities in the Reserve were part of Aguirre Sugar Plantation, built over hundred years ago.

Current facilities have been found inadequate to accommodate all the Reserve's programmatic, operational, and functional needs. Problems include the lack of operational and support space, such as dedicated space for DNER rangers. Additional space is also needed to support education, training, community engagement, and other programmatic activities. The proposed adaptive reuse of the former plantation restaurant as an Education and Training Center would help address these needs. Although the Old Train Depot has undergone substantial renovation, it currently lacks electrical and water service and restroom facilities. The facility use permit is conditional upon the installation of electrical service and restroom facilities, limiting its full intended use for education, training, community events, and other Reserve activities.

These facility constraints are further affected by growing institutional interest in using the Reserve as a research station. In the past few years, the number of visitors and researchers coming to the Reserve has increased. The new dormitories have generated expectations for the future of the Reserve. With better lodging capabilities, the Reserve will enjoy a higher participation of professors and students from different universities using the facilities for academic purpose. Additionally, the Reserve has been successful at recruiting volunteers in the past few years, and there has been an increase in the number of workshop and conference attendees. While improvements provide increased access to visitors, and the new dormitories have greatly improved the ability of the Reserve to host researchers, additional improvements are required to numerous facilities.

Planned Facilities and Infrastructure

A future Facilities Master Plan should identify a range of potential facility improvements to support the Reserve's programmatic and operational needs. A feasibility component within the future Facilities Master Plan should evaluate the potential uses for existing structures and provide a cost-benefit analysis comparing the use of existing infrastructure versus constructing new facilities. The Plan should identify priority needs, opportunities, limitations and timing of construction, as well as cost estimates.

New or restored facilities at JBNERR will implement sustainable designs principles, such as incorporating green building design concepts, to the extent possible, water and energy efficiency, and use of reinforced concrete to increase resilience to strong winds. Further, the historic character

of the structures will be maintained to the greatest extent possible in consultation with the Institute of Puerto Rican Culture and the PR State Historic Preservation Officer.

For the next management period, the potential facility improvement and construction projects identified by the Reserve include the following, subject to further planning, feasibility assessment, and funding availability:

- I Rehabilitate the former hotel's restaurant into the Education and Training Center: The intention is to transform this historic structure into the Reserve's Education and Training Center. The Center will be used for training and education and will contain a room to host workshops and lab space. The total programmed area is 2,875 square feet. However, during the permit process, the project did not receive an authorization from the Puerto Rico Aqueduct and Sewer Authority (PRASA) to connect to the PRASA system. This area is served by the Salinas well system, and PRASA indicated that the system was operating at maximum capacity. In addition, the restaurant/JBNERR area is located within the primary interest zone of the Southern Aquifer where groundwater withdrawals from existing wells are being reduced, and the construction of new wells is restricted.
- I Complete the transformation of the old plantation Train Depot into the Resiliency and Community Meeting Center: The transformation will be completed after installing bathrooms, electricity, exhibits and repairing damage from Hurricane María. The focus of the Center will be on resiliency strategies, geared towards local schools and communities. The building will be used as a center for meetings and workshops and will be instrumental to achieving the Reserve's goal of becoming a hub for resilience education. Service-learning teams will help refurbish the facilities in and around the center, including the rain gardens, rain barrels, and water harvesting elements. In addition, there will be spaces available for community use (e.g., for renting kayaks and bicycles). The building connects to the Visitors' Center and the Reserve trails via a bike path. Once the Hurricane María recovery funds are disbursed, the DNER will conduct a bidding process and award the repair work.
- I Renovate one of the buildings for the enforcement staff: The Reserve currently has five rangers, with two rangers per shift on average. For effective enforcement, the rangers need constant presence at the Reserve. However, they do not have assigned office space and currently share office with JBNERR staff in the Visitor Center. One possible option for their office is a building owned by the PRLA, located within the Reserve's premises. The Reserve will coordinate with PRLA to request the ownership's transference to the DNER. The structure will be assessed, and if it is in good condition, will be re-purposed as dedicated office for the rangers. At present, the rangers use office space assigned to the vacant Education Coordinator position and the T&EP Coordinator. During this management period, the Reserve will seek NERRS PAC or state funding for the potential renovation of a former Aguirre Sugar Mill building that could be adapted as office space for DNER rangers assigned to JBNERR.

Resource Protection Plan

Commonwealth's Management and Statutory Authorities

In Puerto Rico, the Constitution and other overarching statutes establish the environmental public policy. The DNER has a comprehensive legal framework for the protection and use of natural resources, which is applicable to the protection and use of the Reserve's resources. The rules and regulations cover wildlife resources, fisheries, coral reefs, habitat protection, enforcement, and navigation and safety:

- Department of Natural and Environmental Resources of Puerto Rico Organic Act, Law No. 23 -1972, as amended, and Reorganization Plan of the Department of Natural and Environmental Resources, Law No. 171-2018.
- New Wildlife Act of Puerto Rico, Law No. 241 - 1999, as amended and its regulations:
 - Regulation to govern the conservation and management of wildlife, exotic species, and hunting in the Commonwealth of Puerto Rico, Regulation No. 6765 - 2004.
 - Regulation to govern vulnerable species and species in danger of extinction in the Commonwealth of Puerto Rico, Regulation No. 6766 - 2004.
- Puerto Rico Fisheries Act, Law No. 278 - 1998, as amended.
- Law for the protection, conservation, and management of coral reefs in Puerto Rico, Law No. 147 - 1999.
 - Puerto Rico Fishing Regulation Num. 7949 - 2010.
 - Administrative Order (AO) No. 2016-08 To Establish Measures to Protect and Prohibit the capture of sea cucumbers (*Holothuria* spp.) and sea urchins (Class Echinoidea)
- Puerto Rico Forest Act, Law No. 133 - 1975, as amended.
- Law for the Public Policy on Wetlands in Puerto Rico, Law No. 314 - 1998, as amended.
- Puerto Rico Navigation and Aquatic Safety Act, Law No. 430 - 2000 as amended.
 - Regulation for the registration of navigation and Aquatic Safety, No. 6979, as amended.
 - Administrative Order Num. 2026-05 To Prohibit the Use of Jet ski in the Jobos Bay in Municipality of Salinas, as a Measure to Protect Marine Fauna
- Department of Natural and Environmental Resources Rangers Act, Law No. 110 - 2020 and its regulations.
- Regulation for the administration of uses through authorizations and concessions in Natural Protected Areas, Reg. 8013 - 2011.

The Puerto Rico Planning Board is responsible for land use and must ensure federal consistency with the PRCZMP. Federal agencies responsible for the protection of natural resources within the Reserve include the USFWS, NOAA, US Army Corps of Engineers, EPA, and U.S. Coast Guard.

Allowable and Unallowable Uses

Permitted and prohibited uses in the Jobos Bay NERR are determined by the current legal framework, the fragility of resources, the availability of infrastructure to provide access, and human resources to actively manage and patrol the various areas. Multiple signs throughout the Reserve provide visitors with information about permitted uses.

Research and monitoring: The use of all units for research and monitoring purposes is allowed, in coordination with the Reserve staff. All research and monitoring activities must be approved and registered at the Reserve Visitor Center.

Passive recreation/education/training: Guided tours for educational and training purposes are allowed within identified areas. Access off the trails must be authorized by the Reserve or otherwise, visitors must be accompanied by the Reserve’s staff. Passive recreation activities, such as bird watching and hiking, are permitted where trails and infrastructure allow. Public access is allowed in designated areas. Water activities such as snorkeling (including around the cays), kayaking and diving are permitted.

The Mar Negro unit has physical and biological characteristics that require careful protection like coves, shallow semi-enclosed areas, seagrass beds, offshore cays, and fringing mangroves within the lagoon system. These are spawning areas and nursery grounds for valuable commercial fish species. The protection of these resources is vital to maintain the equilibrium and population dynamics of the estuary.

Navigation: The use of kayaks and boats is allowed in the Reserve, according to the provisions of Law No. 430-2000 as amended, and its Regulation Num. 6979, as amended. The use of jet skis or other similar motorized water bikes or non-fishing boats in transit is prohibited within Mar Negro, located in Jobos Bay, Municipality of Salinas, Puerto Rico, as established in the DNER Administrative Order 2026-005, except for the exemptions specified in the same Order, such as transit of fishing boats up to twenty-five feet in length. It is also prohibited for boats to transit at speeds higher than 5 MPH within 150 feet from shore, in Manatee Area or in No Wake Zone, as per Law No. 430-2000.

A maximum anchoring or dock-use period of three hours in designated restricted-use areas, such as the Cayo Caribe dock, is encouraged so that multiple users can benefit from access to these areas. However, the Reserve currently does not have the capacity to verify how long vessels remain anchored or use the dock. Visitor use of designated restricted-use areas is subject to surveillance or patrol by personnel of the DNER Ranger Corps’ Salinas Maritime Unit. Anchoring facilities have been installed by the DNER and appropriate signage posted. These measures will allow proper management of public use in a manner that will not threaten or significantly disturb the natural ecosystems.

Near the Reserve’s boundaries, Jobos Bay has a navigation channel established to bring oil and gas to the Aguirre Power Plant (Whitall et al., 2011). To facilitate access to the Las Mareas community, a right-of-way has been established for boat traffic through the central corridor of Mar Negro. The

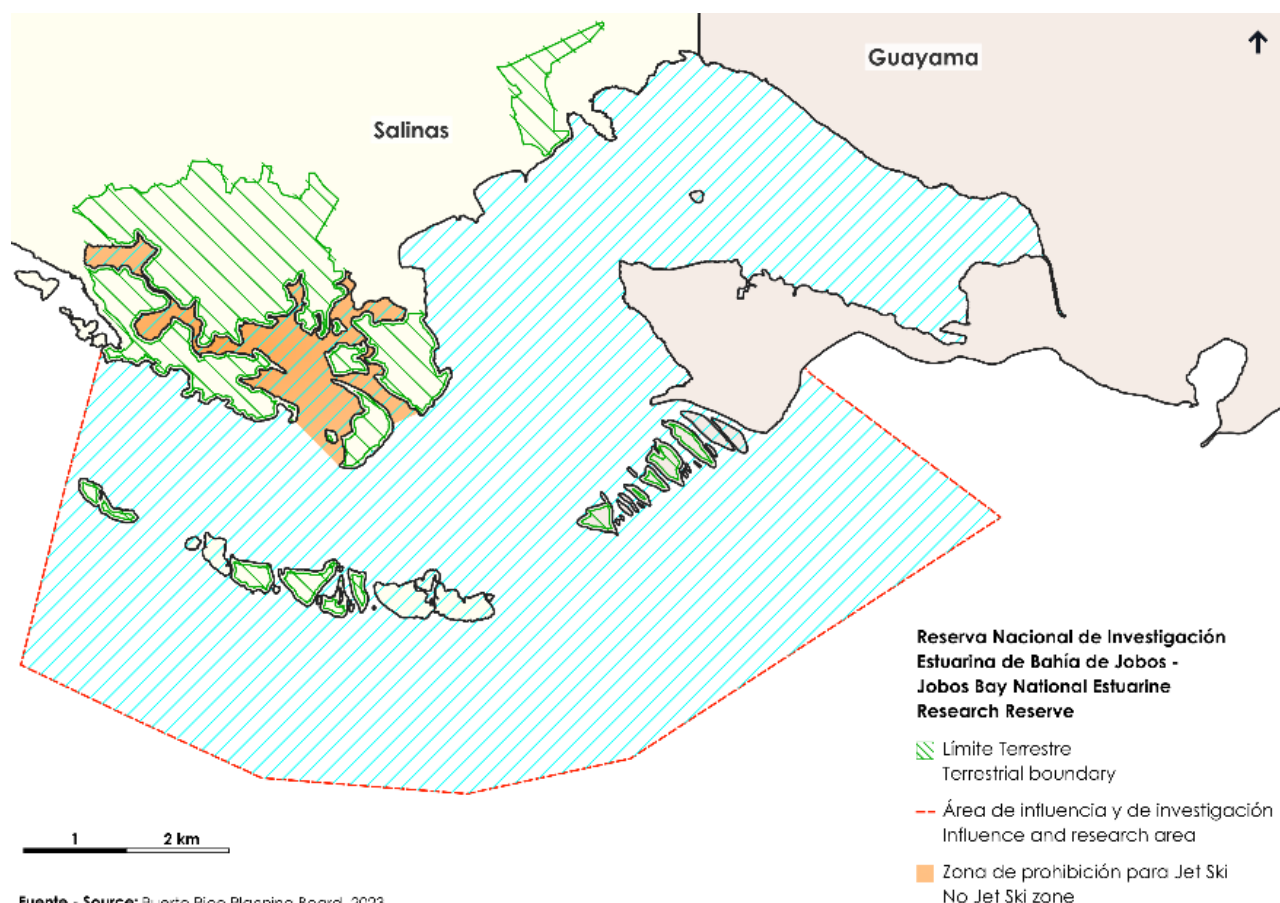
Figure 17. Example of Signs Posted in JBNERR to Communicate Uses



Photo by ETI, 2026

primary users of this route are local fishers. Vessel size is limited to a maximum of twenty- two feet and speed limit of five knots (5.7 mph) for all motorized vessels using the area.

Map 10. Navigation Uses in JBNERR



Fuente - Source: Puerto Rico Planning Board, 2023.

Fishing: Fishing is regulated by Commonwealth and federal regulations. All persons who fish for commercial purposes must have a DNER-issued license, according to Law No. 278-1998 and Reg. 7949.

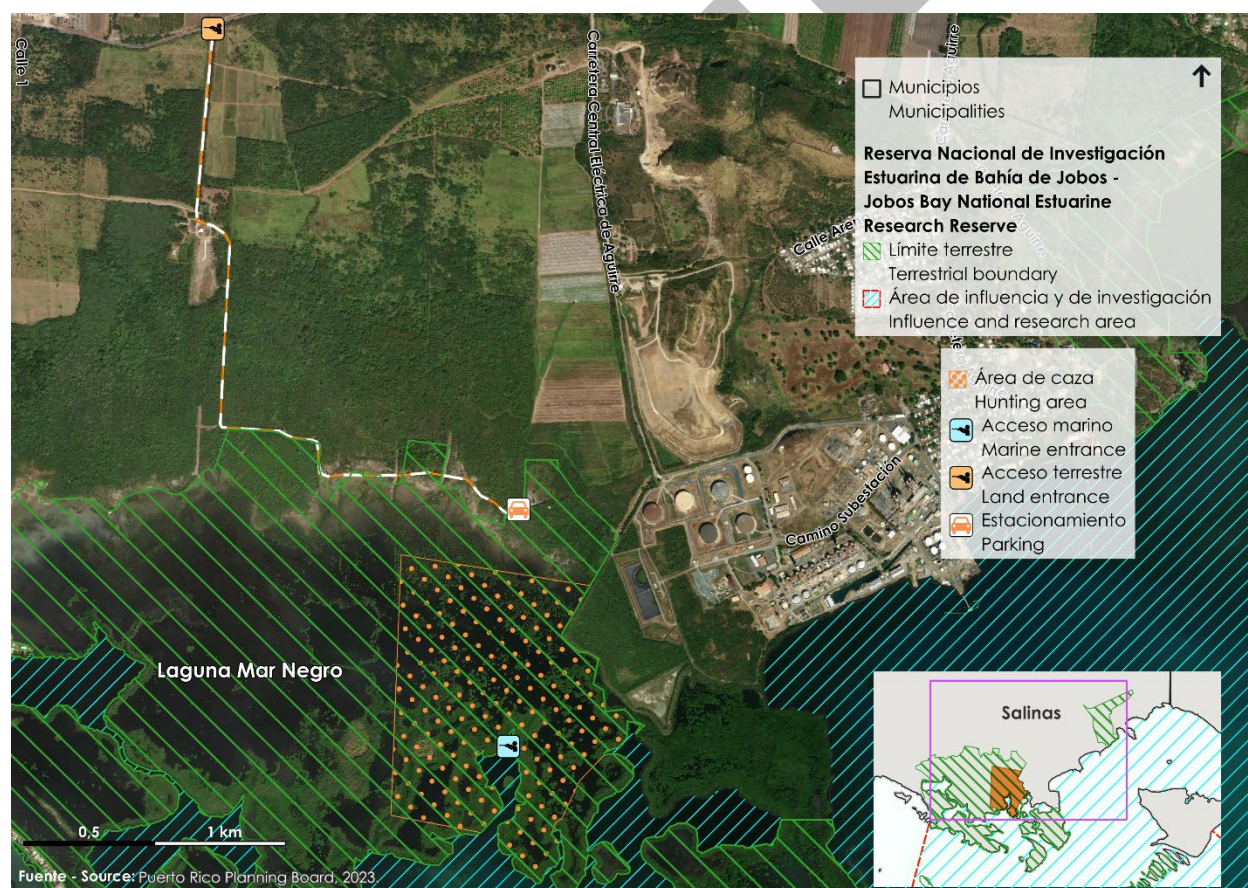
Capture of invasive species in these protected waters requires a DNER permit. Capture or possession of blue land crab is prohibited by Regulation No. 7949 as well as harvesting the nurse shark in territorial waters. AO 2016-08 prohibits capture and possession of sea cucumbers (*Holothuria* spp.) and sea urchins (Class Echinoidea).

Hook and line fishing is allowed, but small or immature specimens must be released to ensure sustainability. Pot and net fishing are not allowed inside the Mar Negro area. Traditional shellfish harvesting from mangrove roots is allowed. Shellfish fishermen will be encouraged to provide harvesting reports to the Reserve.

Hunting: Hunting is prohibited in the pond area, along the Jagüeyes Trail, and from observation platforms, boardwalks, or towers. Hunting is also prohibited in the Las Mareas Sector, Camino del Indio, and Camino Galileo. Hunting for aquatic birds is allowed during the hunting season in a

designated area in the Mar Negro Unit (Figure 18). Hunters need a DNER license and must follow the provisions established in Regulation Num. 6765. This area is open for hunting between December and January, only on selected dates that vary by hunting year. During 2025-2026, the hunting season took place between November 15th and January 26th, Saturday-Monday and holidays, from 30 min before sunrise till midday. To use the hunting area, the hunters must first pass by the JBNERR administrative offices in the Visitor Center to receive educational materials, rules, and an authorization pass. They must also sign an order to state their agreement and compliance with the rules. There is one terrestrial and one marine access. Dogs must be on leashed outside of the hunting zone.

Figure 18. JBNERR Designated Hunting Area



The following table summarizes the permitted and unallowable uses. This list is not exhaustive and may change based on new regulations. JBNERR is under the purview of all Commonwealth and federal laws and regulations for the protection of natural resources in Puerto Rico and its coastal waters.

Table 11. Allowable and Unallowable Uses in JBNERR

Allowable uses	Unallowable uses
✓ Research and monitoring ✓ Education and training ✓ Hunting: In designated areas ✓ Fishing: Hook and line fishing ✓ Recreational uses: birdwatching, hiking, biking (in designated areas), kayaking, snorkeling, diving, swimming, photography ✓ Anchoring on mooring buoys ✓ Guided tours for educational and research purposes within identified areas ✓ Collection of coral and other related species for scientific purposes (prior authorization required, as established by Law No. 147-1999) ✓ Removal or protection of any sick or contaminated marine species provided that all required permits are in order and that guidance is given by JBNERR authorized personnel ✓ Use of dead coral for artisanal purposes. Artisans should be registered in the Artisan Register of the Puerto Rico Economic Development Company and comply with the required permitting process ✓ Collection of dead materials of the shore, if guidance is given by JBNERR authorized personnel ✓ Traditional shellfish harvesting from mangrove roots	⊗ Pot, net fishing, harpoon fishing in Mar Negro Unit ⊗ The use of motor vehicles outside designated areas ⊗ Hunting: outside designated areas ⊗ Jet skis or other similar motorized water bikes. ⊗ Capture or possession of blue land crab ⊗ Capture, possession or transport of sea urchins and sea cucumbers ⊗ Capture or collection of species of flora and fauna without required permits ⊗ Use of any kind of chemical or explosive fishing practices ⊗ Collection or extraction of corals and related species, including aquarium fishes ⊗ Walking on or touching of corals ⊗ Anchoring without using mooring buoys ⊗ Waste discharge ⊗ Cutting, pruning or any other practice that may in any way damage the mangroves or other vegetation ⊗ Campfire ⊗ Camping ⊗ The use, operation, circulation, parking, access, or transit of personal watercraft (jet skis) within Mar Negro, as established in the DNER Administrative Order 2026-005, except for the exemptions specified in the same Order, such as transit of fishing boats up to twenty-five feet in length. ⊗ Travel with speed over 5 mph in areas with buoys that indicate Manatee Area or No Wake Zone, as per Law No. 430-2000. ⊗ Transit at speeds higher than 5 MPH within 150 feet from shore. ⊗ Use of hammocks ⊗ Touch the animals ⊗ Excessive noise ⊗ Pets⁶

Surveillance and Enforcement Capacities

Primary responsibility for enforcement of Commonwealth laws for the protection of the Reserve's resources rests on the DNER's Ranger Corps and Legal Division. Jobos Bay NERR is an area administered by the DNER and has the same level of protection against violations as other protected areas. The Director and Stewardship Coordinator work closely with the Rangers to improve enforcement by providing technical assistance and presenting detailed reports on ecosystems impacts resulting from violations within the Reserve's boundaries and its surroundings.

The Puerto Rico Police Department also can enforce the DNER laws for the protection of natural resources. Through its Joint Forces of Rapid Action Maritime Surveillance Unit, it is responsible for ensuring the safety in territorial waters.

To address land encroachment in Las Mareas and Camino del Indio, the JBNERR staff and the DNER Legal Office developed a "Legal Strategic Plan for the Removal of Illegal Structures", according to the previous JBNERR §312 Final Evaluation Recommendations. This strategic plan consists of several tasks, including formal delineation of boundaries and installation of boundary monuments, development of a surveillance and enforcement plan, prioritization of cases related to the Reserve that have been filed in the DNER Legal Office, and the establishment of partnerships with all the Commonwealth and Federal agencies with jurisdiction in the area to discuss and take the available legal measures to address violations and avoid future infringements. During the last management period, one illegal structure has been demolished. The DNER contracted legal company to represent JBNERR. In 2022, the DNER presented the case of claiming the JBNERR land, eviction and demolition of structures, to the Guayama court of first and sued twelve people. Currently, the cases are under different instances in court, as the residents of the structures claim to have title over these properties. Once the Court reaches the final determination and the defendants have exhausted the appeal options, the JBNERR can proceed with the next steps. In the meantime, the Reserve Director works closely with the Rangers Corps to monitor changes to the present illegal structures or possible emergence of new ones. The Reserve staff also installed cameras for remote surveillance of high traffic and remote areas.

The DNER has also updated the DNER Rangers Corps Surveillance and Enforcement Plan. The Plan seeks to inform the users and intervene, if necessary, to:

- I Eliminate illegal land crab harvesting activities within the Reserve.
- I Eliminate illegal fishing of species protected by seasonal closures.
- I Eliminate the use of prohibited fishing practices.
- I Eliminate construction of docks, ramps, fill, and other structures within the maritime-terrestrial zone and on Reserve property.
- I Eliminate unauthorized vehicle access to the Reserve.
- I Eliminate the passage of horses through the Reserve.

⁶Note: For Pets the Exception: Dogs used to retrieve legally hunted waterfowl are permitted within the designated hunting area in Mar Negro during the authorized waterfowl hunting season. Dogs must enter with their owners and remain leashed until used to retrieve hunted birds.

- Eliminate picnic activities (cooking fires) on the Reserve’s docks.

The Surveillance and Enforcement Plan establish an operational framework for coordination between JBNERR and the Ranger Corps. The JBNERR Director and assigned Ranger coordinate a biweekly work plan based on the Reserve’s management and surveillance needs. The work plan is shared with Ranger Corps and DNER supervisory personnel involved in its implementation. The Enforcement Plan also proposes the coordination of training workshops to strengthen the Ranger Corps’ capabilities to address the Reserve’s surveillance needs, as described in the TEP section. Annual training will address Reserve management and surveillance priorities, applicable laws and regulations, and coordination with communities and municipalities.

Surveillance strategies include preventive land and marine patrols, a dedicated patrol vehicle, and monthly UAV monitoring of encroachment at Camino del Indio. Patrols are conducted throughout the week by the Salinas Maritime and Land Units, with support coordinated from State and Municipal Police in Salinas and Guayama as needed.

The Director coordinates with Ranger supervisors to address violations and management concerns, including encroachment, filling and deforestation, illegal structures, crab harvesting and fishing violations, boating and anchoring violations, waste, poaching, and illegal hunting. The Ranger Corps also provides enforcement during the authorized waterfowl hunting season.

To support consistent documentation and referral of violations, the JBNERR Director, Ranger supervisor, and DNER Legal Office will review and update a standardized intervention form aligned with Legal Office procedures.

The Director and the Stewardship Coordinator have been working with the DNER in the implementation of both plans.

At the federal level, the U.S. Coast Guard has responsibilities associated with marine environmental protection, surveillance and port security, navigation safety of recreational crafts, and the defense of maritime areas. Other federal agencies, such as the USFWS, NOAA and the U.S. Army Corps of Engineers have enforcement officers who have the responsibility of implementing the laws administered by each of the agencies. NOAA’s National Marine Fisheries Service and the DNER signed a collaboration agreement that authorizes the Rangers Corps to enforce the following federal laws: Magnuson-Stevens Fishery Conservation and Management Act, the Endangered Species Act, the Marine Mammal Protection Act and amendments to the Lacey Act.

Currently, there are five rangers assigned to the Reserve who report and coordinate directly to the Reserve Director, responding to complaints and observations, as well as conducting routine patrols of areas with a history of violations. The Salinas and Guayama Ranger supervisors also prepare monthly reports on surveillance and enforcement activities and provide copies to the JBNERR Director and relevant DNER officials, establishing a regular reporting mechanism between enforcement personnel and Reserve management. Additional surveillance has been accomplished

through concerned citizens and community members, who contact the Reserve or Rangers if they observe or encounter a violation.

Implementation of the Surveillance and Enforcement Plan is evaluated twice a year by JBNERR and DNER personnel based on enforcement interventions and cases submitted to the DNER Legal Office. Evaluation measures include interventions involving illegal land crab harvesting and confiscated traps, reduction in illegal construction cases, and the number of cases submitted to the DNER Legal Office.

Resource Protection Challenges

Resource protection challenges at JBNERR are associated with unauthorized activities within and around the Reserve, anthropogenic stressors affecting sensitive habitats and species, and activities and land uses occurring outside the Reserve boundaries that may affect Reserve resources. Some challenges occur within the Reserve, while others originate in the surrounding watershed and coastal areas beyond JBNERR's direct management authority.

Unauthorized activities and land alterations continue to present resource protection challenges within and around the Reserve. These include encroachment, filling and deforestation, unauthorized docks and other structures, fishing violations, boating and anchoring violations, waste disposal, poaching, and illegal hunting. As described in the previous section, addressing these violations requires continued surveillance and coordination between JBNERR and the entities responsible for enforcement and legal actions.

Anthropogenic stressors also affect sensitive coastal and marine habitats and species. Boating, fishing, anchoring, and other recreational uses may disturb sensitive habitats, particularly mangroves, seagrass beds, and shallow coastal waters. Public education and awareness remain important to complement enforcement efforts and promote appropriate use of these areas.

Activities and land uses in the surrounding watershed represent an additional resource protection challenge. Urban development, land alterations, agricultural activities, and industrial and energy-related uses may affect the estuarine system through changes in drainage and runoff and the transport of sediments and contaminants into coastal waters. Previous assessments of the Jobos Bay watershed have documented changes in urban, residential, agricultural, and industrial land uses and identified contaminants and sediments associated with land-use practices, industries, urban runoff, and wastewater as stressors affecting the estuarine system.

Anthropogenic activities in surrounding coastal and marine areas may also affect sensitive habitats and species. Boating, fishing, and other recreational uses in adjacent waters are among the activities that may require coordination with entities having jurisdiction outside areas directly managed by JBNERR.

JBNERR does not directly control land-use and permitting decisions for activities outside the Reserve. Addressing potential effects from these activities depends on coordination with the entities responsible for the applicable land-use, environmental, and permitting processes. During the next

management period, JBNERR will seek to strengthen its participation in these processes by providing relevant scientific and technical information regarding activities that may affect the Reserve and its watershed.

Objectives and Actions

Objective 1. Improve law enforcement in the Reserve and its watershed.

1.1 Continue implementing the DNER Rangers Corps Surveillance and Enforcement Plan Rangers Corps Enforcement Plan for the JBNERR

This is an ongoing task that requires close coordination and follow up from the Reserve’s Director, with the support of the Stewardship Coordinator. The JBNERR updated its Surveillance plan and has five rangers currently assigned to JBNERR. During the next management period, the Reserve’s staff will continue coordinating the biweekly work plans to address illegal and unauthorized activities and ensure proper surveillance.

1.2 Strengthen surveillance and enforcement capacity within the Reserve.

Currently, five Rangers are assigned to JBNERR and work eight-hour shifts on variable schedules, including some weekends. JBNERR will continue to support surveillance and enforcement efforts by strengthening communication and coordination with the DNER Ranger Corps and supporting regular patrols by land and water to address the Reserve’s management and protection needs.

1.3 Continue coordinating efforts to implement the Legal Strategic Plan for the Removal of Illegal Structures

The Reserve Director, the Stewardship Coordinator, and the DNER Legal Office developed a strategic plan for the removal of illegal structures inside the Reserve terrains at Las Mareas and Camino del Indio. During the next management period the Reserve Staff and the Stewardship Coordinator will continue to implement this plan.

1.4 Strengthen JBNERR's participation in regulatory and permitting processes for activities that may affect the Reserve and its watershed.

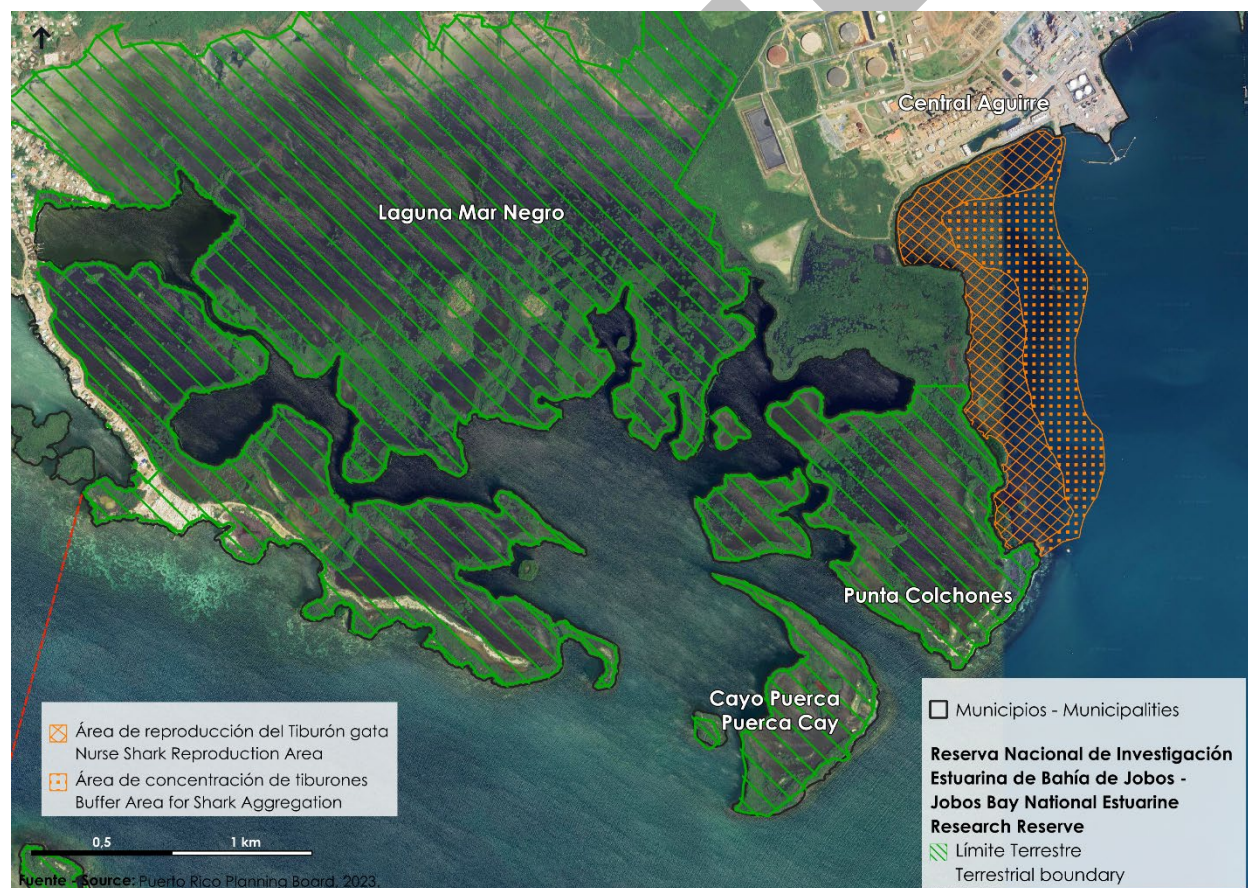
Although activities may occur outside the Reserve’s boundaries, DNER offices, municipalities, and other entities with applicable responsibilities for land-use, environmental, and permitting processes can coordinate with JBNERR to incorporate the Reserve’s scientific and technical expertise when evaluating activities that may affect JBNERR and its watershed. The Reserve will continue working with the DNER Legal Office to strengthen this coordination and facilitate JBNERR staff participation in applicable review and permitting processes.

Objective 2. Protect sensitive areas from human induced perturbations.

2.1 Designate the nurse sharks (*Ginglymostoma cirratum*) mating grounds as a “No Take Zone” for the period of reproduction (June-July)

To protect this species during their mating activity and to conduct further research and monitoring to better inform management of future actions, this management plan proposes to set up an area in the Jobos Bay, east of Mar Negro Lagoon, for protection of mating nurse sharks, as presented in the following map. The Reserve will work with the DNER to establish the required administrative procedures to designate the nurse shark reproduction area as a no take zone. This area will be temporary closed for navigation during the June/July mating season. The use of motorboats will be prohibited, except for official and DNER vessels to conduct research and monitoring, provide surveillance, and assist in emergencies. Kayaks will be allowed, but speed will be limited to 5 mph. The measure also includes signs and educational materials to notify the users.

Map 11. Nurse Shark Reproduction Area



2.2 Install signage indicating prohibited and/or allowed activities

This is a continuous activity. The signs identify restricted areas, prohibited activities, sensitive habitats, or areas where certain activities can occur (e.g. uses allowed, areas where boats are allowed to anchor, speed limits, areas where certain types of fishing practices are prohibited or allowed). During previous management period, JBNERR installed additional signs in the access channels of Cayos Barca as part of the seagrass restoration project. Further, DNER and USFWS will install additional signs on navigation area and navigation buoys. Further, signs need to be replaced periodically due to damage from weather or vandalism.

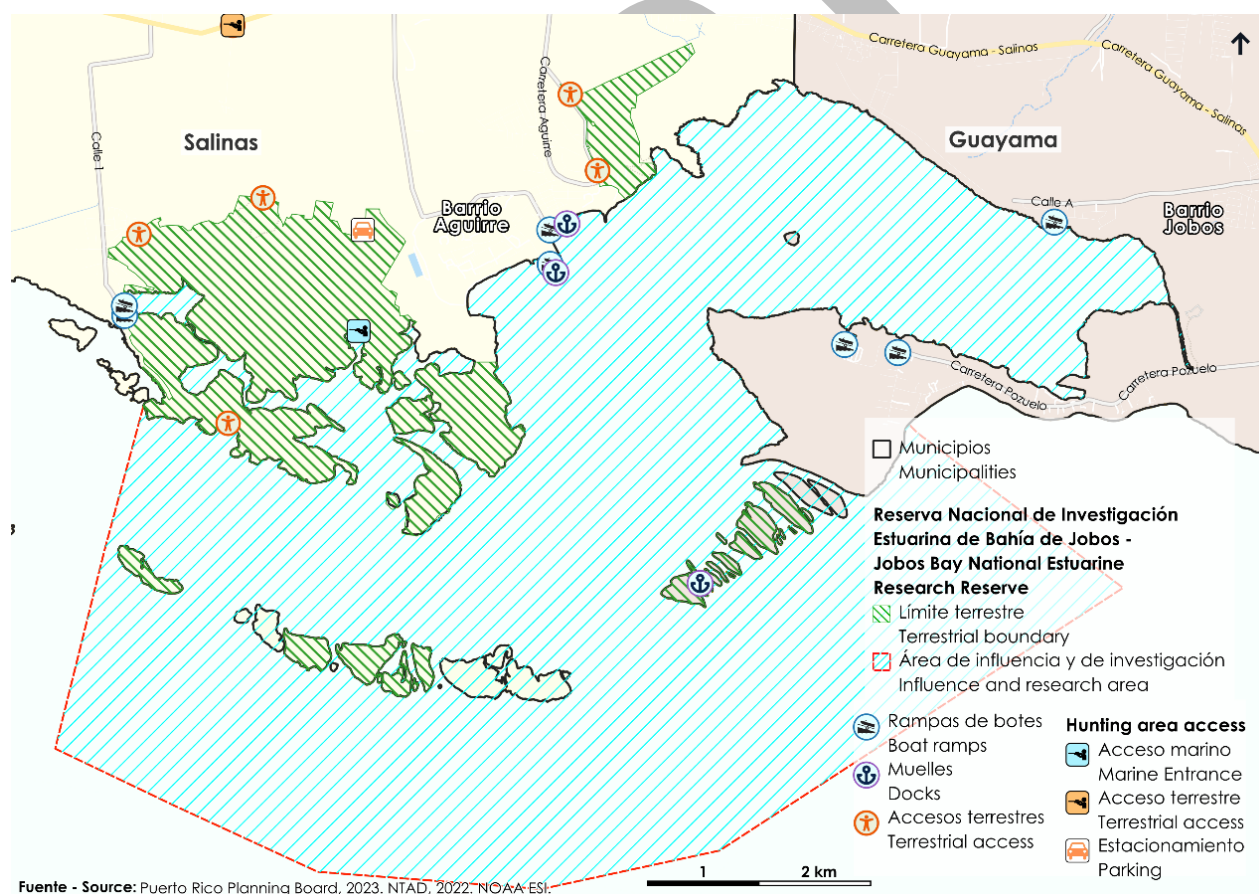
Public Access and Visitor Use Plan

Current Public Access

JBNERR received more than 4,000 visitors annually in 2016. Currently, between 2,000 and 3,000 visitors are recorded annually at the Visitor Center, including students, teachers, and tourists, in addition to recreational boaters who visit the Reserve's cays, particularly on weekends. JBNERR expects visitation to increase in the coming years as a result of efforts across its various programmatic areas. The Visitor Center is open from Monday through Friday from 7:30 a.m. to 12:00 p.m. and from 1:00 p.m. to 4:00 p.m. However, most of the Reserve's premises and cays can be accessed by visitors at any time. There is no entrance fee. A section of the eastern portion of the Reserve forms part of the Central Aguirre Historic District. Visitors can access these areas, but entry into the structures is not permitted for safety reasons.

Currently there are several points of land and water access to the Reserve, as well as a network of trails and facilities that permit access within the Reserve, as described below.

ap 12. JBNERR Land and Water Access



Land Access

The major access road to the Reserve is State Highway PR-3, which can be reached from San Juan via the Luis A. Ferré Expressway (PR-52) or from the Guayama Expressway extension (PR-53) via State Highway 706. Highway 3 leads to the three main access roads: Highway 703 to Las Mareas, Highway 705 to Aguirre (Reserve facilities and Visitor Center), and Highway 7710 to Punta Pozuelo. Access to hunting grounds is permitted at one designated land entrance (17° 58.055'N, 66° 15.204'W) and one designated marine entrance (17° 56.560'N, 66° 14.588'W).

Water Access

Water access to the Reserve occurs through the various ports or docking facilities within the Bay: one at Puente de Jobos, two in Las Mareas, one at Pozuelo Marina, and two in Aguirre. Boaters have access to Mar Negro, Cayos Caribe, Cayos La Barca, and Pájaros from these facilities. The Aguirre Thermoelectric Power Plant also has a pier that serves the industrial facilities. There is also a dock in Cabezas de Cayos Caribe that belongs to the DNER and the Reserve. The visitors can use the Cabezas de Cayos Caribe dock under certain restrictions.

The boat ramp and a dock in the Aguirre Unit are not intended for general recreational access. They are used by staff, researchers, and students for research, monitoring, education, and management activities.

Trails

Within the Reserve's grounds, there are numerous trails that allow visitors to explore the terrain by hiking or biking. Permitted uses include hiking, bird watching, biking in selected trails, and kayaking and snorkeling in water areas. Below is a description of the key elements of the Reserve's trail network:

Camino del Indio Trail and Boardwalk: Located in the Mar Negro Unit. This trail extends approximately for 4.7 km along the coastline on the western boarder of the Reserve, after which point it becomes a boardwalk extending for an additional 1.0 km. There is a small spur off the boardwalk in the south leading to an entry point for kayaks. The Camino del Indio trail and boardwalk provide access to diverse ecosystems such as coastline and mangrove. The trail head is in the Las Mareas Fisherman Village and is accessed via a dirt road extending from PR-3, west of the entrance to the Visitor Center. Upon reaching the Village, but before the start of the trailhead, a small spur branching east from the dirt road leads to an observation tower.

Jagüeyes Trail: The 0.75-mile (1.2-km) Jagüeyes Loop Trail borders farmlands on the north boundary of Mar Negro Unit and includes an observation platform. Named for the white jagüey tree, this trail passes through a secondary dry forest, mangroves, salt flats, and a seasonal lagoon which provide great opportunities for birdwatching. The trail is accessed by a dirt road extending from PR-3.

Dock-Salt Flats Trail (El Salitral trail): Located in the Aguirre Unit, this series of trails extends from the parking lot just south of the Visitor Center. It begins as a small boardwalk next to the Visitor Center, heads eastward toward the bay, crosses a dirt road, and continues through the brush and over the

salt flats. Upon reaching the bay there is a small loop that passes by a wooden pier, a small shelter, and two spurs that connect to points of ecological interest. The trail provides access to salt flats, mangrove ecosystems, lagoons, and the waterfront with views across the bay. Visitors can walk out over the water on the pier, which extends about 50 feet into the bay and serves as a docking point for boats. The ruins of the sugar mill are visible from this area, as well as the Aguirre power plant, providing important points of discussion in educational activities. There is signage along this section with maps. Another section of the trail extends northward as a bike/pedestrian path along the dirt road towards the old Train Depot.

Cayo Caribe Trail: Located on la Cabeza de Cayos Caribe, the 0.68-mile (1.1-km) trail is only accessible by water. Traversing mangrove forests, seagrass beds and coral reefs, the trail highlights the barrier island coastal strand community.

Sugar Mill Trail: Located in the Aguirre Unit, near the Reserve’s research pier, this trail is frequently accessed by groups on educational field trips. There is an opportunity to connect the Reserve with the Aguirre State Forest by extending this trail to the east along the footprint of the old railroad corridor.

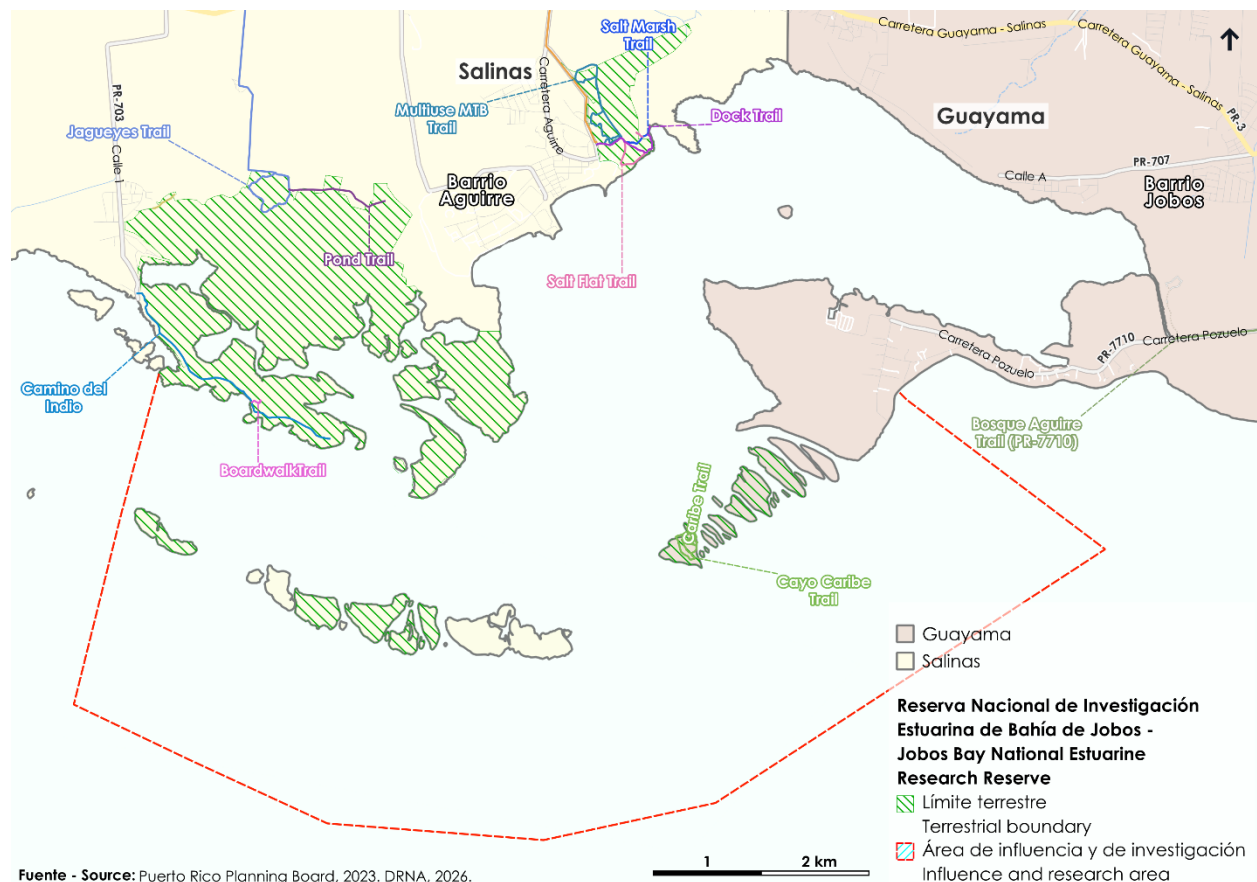
Kayak trails: The protected waters of Mar Negro provide opportunities for kayaking. Although the kayas routes have not been assessed nor signalized, some visitors use the area to kayak and explore the many inlets and coves among the mangrove system.

Figure 19. Cayo Caribe Trail



Photo by ETI, 2026

Map 13. JBNERR Trails



Public Access Challenges

There have been significant advances in access to and within the Reserve. These include access to new infrastructure, enhancement of the existing buildings, and promoting access for different user groups. Road access to the Reserve is good, and signs have been installed along the access roads to direct visitors to the Reserve. However, wayfinding could be further improved, particularly from the expressway to the Reserve. Visitors exploring the Reserve outside of guided activities may also have limited opportunities to identify and learn about the ecological and historical significance of specific areas.

However, the Reserve continues to experience the challenge of limited staffing capacity to receive and manage visitors, particularly on weekends. Another potential challenge relates to Puerto Rico's demographic changes. The proportion of older people in Puerto Rico has been increasing, which may necessitate modifications to access and visitor experience, particularly for older adults and visitors with mobility or other accessibility needs. The approximately 0.36-mile route from the entrance gate to the dock has limited shaded seating areas, located only near the beginning and end of the route, which may present challenges for some visitors.

The Reserve must also plan for challenges posed by environmental stressors. Rising sea levels, storm surges, and increased frequency and intensity of storms and hurricanes may pose a threat to existing and planned public access points and infrastructure. For example, following Hurricane María, infrastructure such as observation towers was destroyed, and many trails were obstructed by debris. Similar events may temporarily limit public access and affect the condition and availability of trails, facilities, and other public access infrastructure.

Another challenge is balancing public access with the protection and management of Reserve resources. During the public engagement process, concerns reflected differing expectations regarding the type and extent of access to the Reserve. Some community members remember having vehicular access and use of the dock before the area was managed as a protected site dedicated to research and conservation. Today, public access remains available, but vehicular access and public use of the dock and boat ramp are restricted. These differing expectations present an ongoing public access management challenge for JBNERR.

Public Access Opportunities and the Visitor Experience

Over the next years, the Reserve anticipates continued interest and a potential increase in visitation as outreach efforts are conducted across programmatic areas. Institutional communication channels, including those of DNER, will provide additional opportunities to increase the Reserve's visibility and communicate its programs, research, and management efforts.

The Reserve will continue working with local communities, volunteers, and partners to accommodate and manage visitor use while balancing the need for resource protection. Increasing staff and volunteer capacity would provide opportunities to extend staffed access to the Reserve beyond current operating hours, particularly on weekends, and expand the availability of guided visits, interpretive activities, and other public programming. Guided opportunities during weekends are currently generally available when coordinated in advance. The Reserve will also continue to encourage volunteer participation as a way for community members and the public to become directly involved with Reserve programs and activities.

Public access is not limited to guided visits or regular Visitor Center hours. Pedestrian and low-impact non-motorized access provides opportunities for visitors to experience the Reserve grounds through activities such as walking, bicycling, wildlife observation, stargazing, and nocturnal walks. Public motorized vehicle access will continue to be restricted to protect natural resources and visitor safety. The boat ramp and docks, which support Reserve operations, research, and monitoring, will continue to be managed for these purposes rather than as general recreational access points.

During this management period, the Reserve will focus on enhancing the visitor experience and improving existing access infrastructure. The Reserve will assess accessibility needs and consider improvements to better accommodate older adults and visitors with mobility or other accessibility needs. Existing accommodations, including accessible entry to the Visitor Center by ramp and van

access during coordinated visits when arranged in advance, will continue to provide alternatives where pedestrian access may be difficult. If adjacent lands are acquired and formally incorporated into JBNERR in the future, additional trail connections may also be considered.

The Reserve will continue improving wayfinding and interpretation. This includes identifying opportunities to support and improve directional signage along highways and municipal roads to increase the visibility and identification of the Reserve, as well as improving signage for parking, entrances, trails, and areas of interest within JBNERR. Informational signs are posted in English and Spanish. The Reserve will continue improving these resources and may use other tools, such as QR codes, to provide visitors with educational and interpretive information about the Reserve's ecological, historical, and cultural significance. The Reserve will also seek to improve and streamline visitor record keeping maintaining more consistent information on visitation and visitor needs. Where feasible, streamlined tools may be considered to facilitate visitor check-in and feedback without creating significant additional administrative demands on Reserve staff.

During guided visits, the visitor experience typically begins at the Visitor Center, where exhibits and a brief presentation introduce the Reserve, its programs, and the natural resources it protects. The outdoor experience builds on this information through direct observation and hands-on learning. Visitors can explore the mangrove nursery, the station where the cetacean carcass is housed, and trails where they can learn about restoration efforts and observe and identify vegetation and wildlife. Interpretive signs, opportunities for bird observation and listening, information about nesting areas, and water-retention features also help visitors understand the connections between terrestrial and coastal environments. Together, these indoor and outdoor experiences help visitors understand the ecosystems and resources that the Reserve manages, protects, and studies.

In some places, increasing visitors' numbers can lead to decreasing satisfaction (Leung et al., 2018). This understanding must guide plans for the Reserve that simultaneously consider a potential increase in visitation and the importance of maintaining a high level of visitor satisfaction. The Reserve will seek to better understand the type and level of visitor use that can be accommodated in different areas without negatively affecting natural resources or the visitor experience. A carrying capacity study will help determine whether additional visitor management measures are needed in heavily used or sensitive areas.

If visitors' experiences are well-managed, their visit can generate social, cultural, and economic benefits as well as an increase in the interest of protecting the area. However, without appropriate visitor management, the activities of visitors can cause a wide range of negative impacts, including increased costs and lost opportunities.

Objectives and Actions

The following objectives and actions support the Reserve's approach to public access and visitor use. The carrying capacity study will provide a baseline to inform future visitor management

decisions, while implementation of the other actions will be evaluated through their progress during the management period.

Objective 1. Establish a baseline to develop the necessary visitor management measures

1.1 Develop a carrying capacity study

A carrying capacity study is suggested to better monitor the type and level of uses that can be accommodated at the Reserve without negatively impacting its ecosystem, while maintaining a positive visitor experience. Such study will allow the Reserve to better justify increased monitoring of areas that are traditionally overused, such as the cays, and help determine if there is a need to limit the number of visitors accessing certain parts of the Reserve, especially in sensitive areas or periods such as nesting or reproduction.

Objective 2. Enhance and improve trails connecting areas of interest in the Reserve.

2.1 Assess the feasibility of connecting the Jobos Bay NERR with the Aguirre State Forest

Currently there is a small trail in the eastern part of JBNERR that has the potential to connect with the Aguirre State forest along the footprint of the old railroad corridor. Further, the lands east of JBNERR are proposed for acquisition and inclusion into the Reserve; if acquired and formally incorporated into JBNERR, they could provide further connection to the Aguirre State Forest. The area will be assessed to determine the feasibility of developing this trail, to connect the JBNERR trail network to the Aguirre Forest.

2.2 Expand the Camino del Indio Trail and establish a kiosk and signage marking the trail

Currently at the end of Camino del Indio peninsula, a trail connects to Mar Negro on one side (eastern) and Mar Blanco the other side (western). The trail does not have a sign. The area is heavily impacted, and the mangrove forest has been partially cut. A welcoming kiosk will promote the adequate use of the area and will provide information to visitors. It is expected that during the next management period, the land encroachment cases will reach their final resolution in court, and the legal structures will be removed, allowing mangrove restoration in the area and space for expanding the trail.

Objective 3. Enhance public access and the visitor experience.

3.1 Assess opportunities to expand staffed access and public programming

The Reserve will assess opportunities to increase staff and volunteer capacity to extend staffed access beyond current operating hours, particularly on weekends, and expand the availability of guided visits, interpretive activities, and other public programming.

3.2 Assess opportunities to improve accessibility and the visitor experience

The Reserve will assess accessibility needs and identify feasible improvements to existing access infrastructure and visitor amenities, particularly for older adults and visitors with mobility or other

accessibility needs. This assessment will consider pedestrian access, shaded seating and resting areas, and other improvements that could support a more accessible visitor experience.

3.3 Improve wayfinding and interpretive resources

The Reserve will identify opportunities to support and improve directional signage along highways and municipal roads, in coordination with the appropriate entities, and improve and maintain signage for parking, entrances, trails, and areas of interest within the Reserve. The Reserve will also continue improving bilingual interpretive resources and may incorporate tools such as QR codes to support self-guided learning about JBNERR's ecological, historical, and cultural resources.

3.4 Improve visitor record keeping

The Reserve will identify opportunities to support and improve directional signage along highways and municipal roads, in coordination with the appropriate entities, and improve and maintain signage for parking, entrances, trails, and areas of interest within the Reserve. The Reserve will also continue improving bilingual interpretive resources and may incorporate tools such as QR codes to support self-guided learning about JBNERR's ecological, historical, and cultural resources.

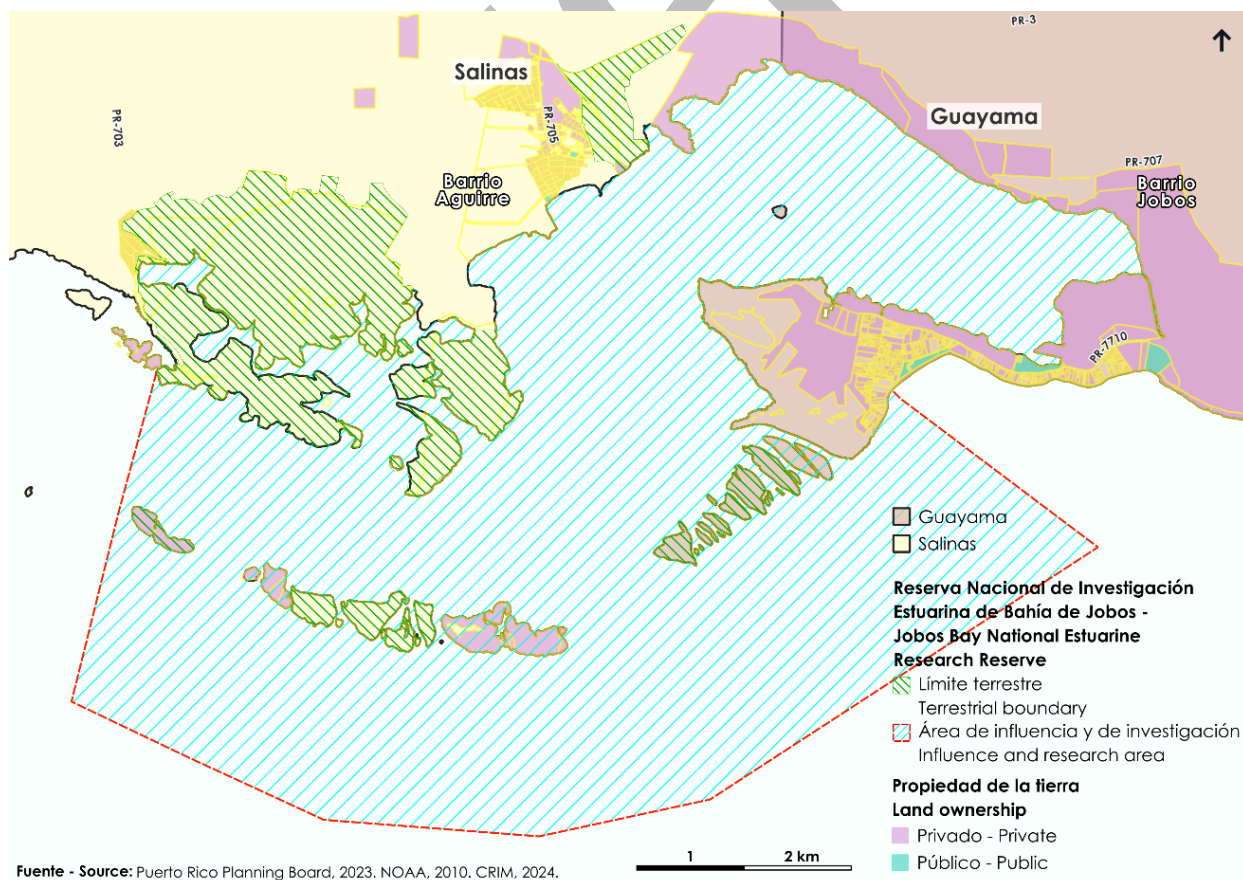
Land Acquisition Plan

Acquisition Context and Values

Over the past years the Reserve has acquired five properties. These purchases provide the Reserve with greater control over its resources and direct access to the Jobos Bay waterfront. Additional land remains under consideration for potential long-term acquisition, including areas adjacent to the northeastern terrestrial segment of the Reserve and the Cabeza de Barca and Rabo de Barca areas. While these areas have been previously identified for potential acquisition, the extent of any future acquisition remains to be determined and would be subject to future evaluation.

JBNERR recognizes the potential to acquire land over the long term to protect and enhance the natural and cultural heritage of the estuary and prevent ecosystem defragmentation. Although surrounding developments may prohibit a broad acquisition, there are limited opportunities on small expansions over time greatly contribute to the education, training and stewardship programmatic areas. They allow the Research Program to further study restoration and adaptation in the face of different environmental stressors, increase public access, and support long-term protection of the estuarine and coastal resources.

Map 14. Land Ownership Within and Adjacent to the JBNERR Boundaries



Priority Acquisition Areas

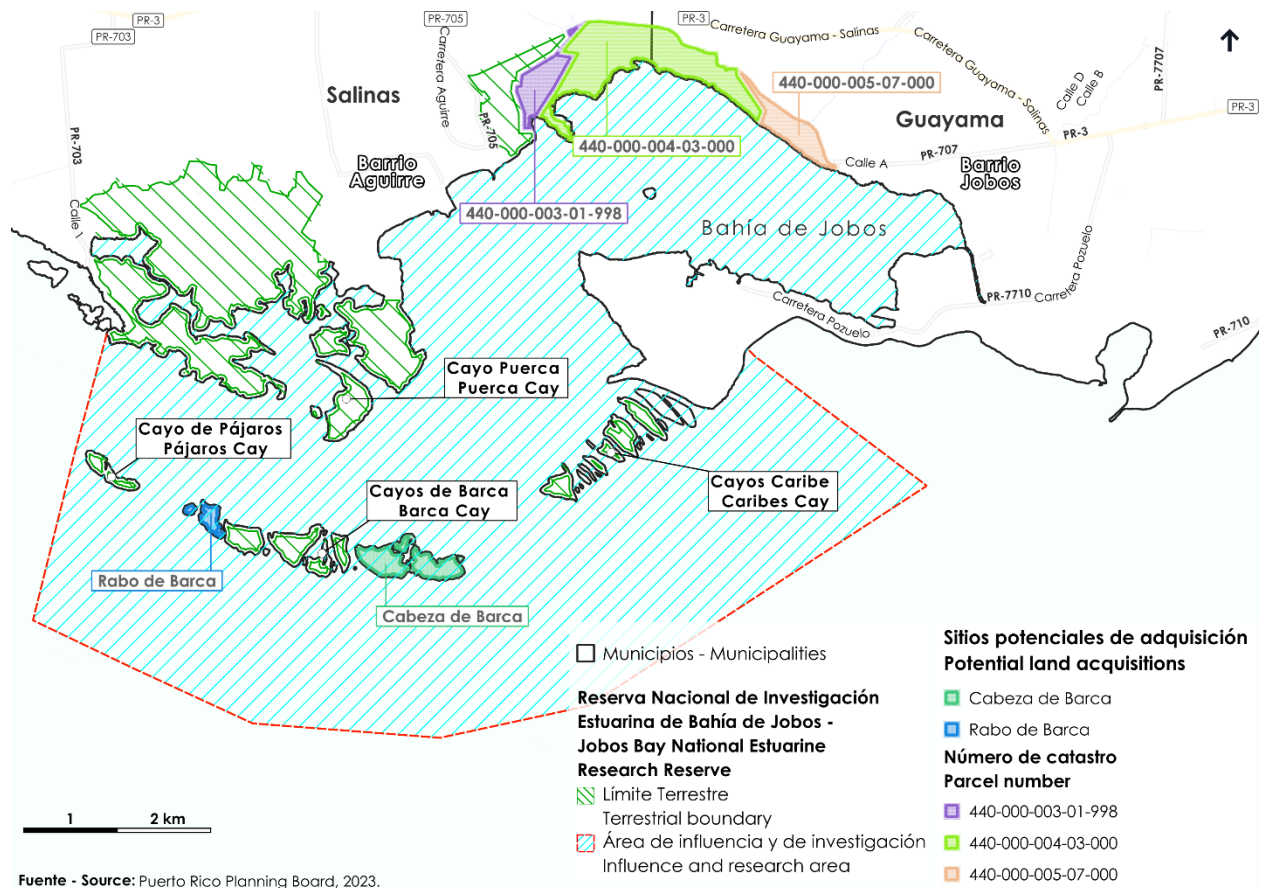
Coastal area surrounding the Reserve experience development pressures, clearing and filling of wetlands. These trends weaken ecosystems’ resilience and the services they supply such as habitat provision and erosion mitigation. The JBNERR staff identified lands to the east of the Reserve that form part of coastal mangrove and hold high ecological value. They provide habitat to numerous species of vertebrates and invertebrates; native and migratory birds use the area for feeding, rest, and reproduction. Land and coastal access are also important considerations for potential long-term acquisition, particularly where terrestrial access may facilitate activities that can contribute to fragmentation of the mangrove system. These lands include three parcels: # 440-000-003-01-998, # 440-000-004-03-000, and # 440-000-005-07-000, discussed in the Introduction to the Reserve. In 2022, JBNERR staff began conversations with a private company that offered to purchase and donate these lands to DNER. The potential long-term acquisition of these lands remains under consideration; however, the lands remain privately owned. The original landowners could not be contacted to pursue a potential purchase.

The Reserve recognizes the potential to acquire parts of the Barca cay islands that remain private over the long term. The cays consist mainly of red and white mangrove fringe; the acquisition will support ecosystem connectivity. This action was proposed in the previous management plan but has not advanced due to funding and staff capacity limitations. One of the islands of Cayos de Barca will serve for passive recreation, while the others will become reference sites for research and education. Interpretative field trips will be facilitated within the Cayos de Barca, and long-term monitoring programs will be encouraged to monitor use impacts.

Table 12. Areas for Potential Future Incorporations to the JBNERR Boundaries

Proposed future acquisition and incorporation	Description	Identified Area (acres)
Private lands adjacent to the northeastern terrestrial segment of the Reserve: # 440-000-003-01-998 # 440-000-004-03-000 # 440-000-005-07-000	The proposed parcels are high-value coastal wetlands composed of mangrove forests that form a nearly continuous ecological corridor with the JBNERR near the Aguirre community in Salinas and the Aguirre State Forest in Guayama. These lands provide habitat for a wide variety of vertebrate and invertebrate species and serve as feeding, resting, and breeding areas for native and migratory birds. Acquisition and inclusion of these lands into the Reserve would strengthen ecosystem integrity and maintain habitat connectivity, protecting them from development pressures.	416.6
Cabeza de Barca and el Rabo de Barca	Parts of the Barca cay islands remain private. These islands support mangroves, consist mainly of red and white mangrove, and are fringed by coral habitat. Potential acquisition could strengthen the protection of the cay system.	96.5

Map 15 . Current Boundaries and Areas Identified for Potential Long-term Acquisition and Future Incorporation into the Reserve



Prioritization Process and Criteria

Expansion of the Reserve through land acquisition is not considered an immediate priority for the next several years, given current needs to increase the capacity of the Reserve's core team. However, as opportunities for potential long-term acquisition arise, all identified tracts and parcels are considered of equal importance. Considerations for potential acquisition include ecological value, habitat connectivity, resource protection needs, and land and coastal access.

The Reserve considers the potential long-term acquisition of the Sucesión Vázquez-Bruno parcel (#440-000-003-01-998) to facilitate public access, facility construction, and coordination between the JBNERR and the Aguirre Forest. The mainland Sucesión Vázquez parcel, located behind the Visitor Center, could provide numerous benefits for the Reserve as it develops into an integrated management component with the Aguirre State Forest. This parcel, dominated by scrub wetland, could serve as an ecological corridor, by connecting the JBNERR to the Aguirre State Forest. This could facilitate the coordination of education and public access strategies between the two natural areas. This acquisition could augment the Reserve's habitats with their diversity of flora and fauna and serve as buffer areas to Jobos Bay. This parcel, besides being a valuable addition to JBNERR, would contribute to preserving the unique habitats of the South coast of Puerto Rico. The remaining Barca cays are also considered for potential long-term acquisition and could potentially receive

greater priority. In addition to their ecological value, their consideration for potential acquisition reflects recreational impacts and resource protection needs, as there is no management of these habitats. There are pressures on the mangroves, coral reefs, and sea grass habitats, which are additional issues of great concern.

Priority Areas Acquisition Strategy

The Reserve will consider potential land acquisitions over the long term. Expanding the Reserve is not an immediate priority for the next several years, as current efforts focus on increasing the capacity of the Reserve's core team. The extent of future acquisitions will depend on opportunities that may become available and will be evaluated as part of the acquisition process.

Fair market values and funding sources have not been identified at this time. These will be evaluated if future acquisition opportunities arise.

Tract Acquisition Strategy

The Reserve will consider the acquisition of the identified private tracts over the long term, including the three parcels adjacent to the northeastern terrestrial segment of the Reserve and the remaining private areas of the Barca cays. The intent of future acquisitions would be to incorporate acquired lands into the JBNERR boundaries. While these tracts have been identified for potential acquisition, acquisition is not considered an immediate action for the next several years. Future acquisitions will be considered as opportunities become available and based on the Reserve's capacity to provide long-term management and stewardship of additional lands.

Preferred Methods for Establishing State Control

The appropriate method for establishing long-term state control will be determined based on the circumstances of each acquisition opportunity and the level of control needed to protect and manage the land as part of the Reserve. Potential methods may include fee-simple acquisition, donation, or other mechanisms that provide adequate long-term state control.

Fair Market Value Estimates

Fair market value estimates have not been determined for the areas identified for potential acquisition. These estimates will be developed as part of the future acquisition process

Estimated Acquisition Timeline

Expansion of the Reserve through land acquisition is not anticipated as an immediate action during the next several years. Potential acquisitions are considered a long-term opportunity, and a specific acquisition timeline has not been established.

Restoration Plan

Priority Restoration Areas

During the last management period, JBNERR advanced several habitat restoration and enhancement efforts, some of which have been completed while others are ongoing. For the upcoming management period, mangrove restoration remains a priority within the Reserve.

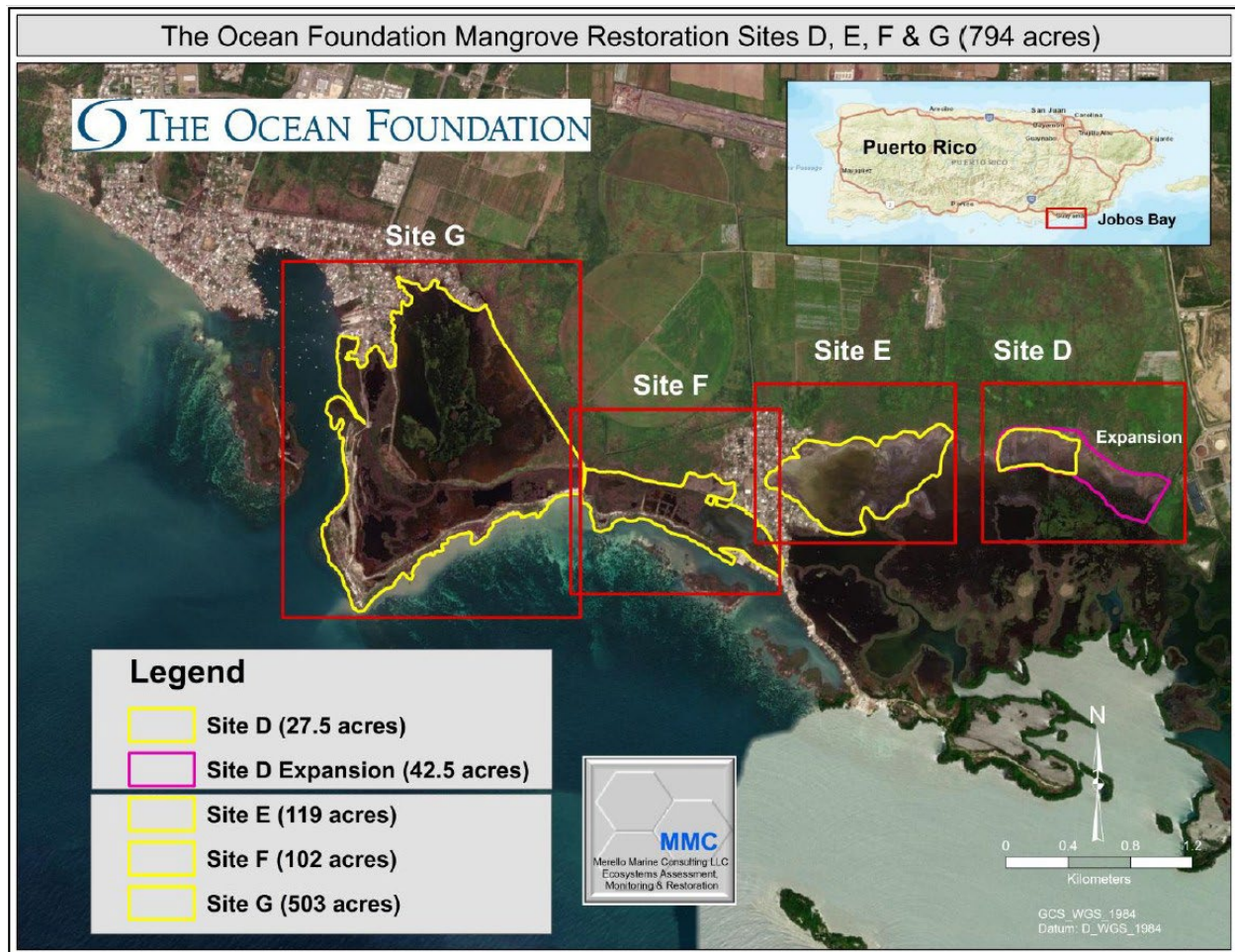
JBNERR is also part of a large mangrove restoration project which has been underway since 2019. The initiative focuses on mangrove-dominated areas within Jobos Bay and Aguirre State Forest affected by Hurricane Maria and past hydrological alterations. Three years after Hurricane Maria, natural recovery remained low in some areas due to changes in hydrology, erosion, and loss of soil surface organic matter, indicating the need for targeted interventions to support regeneration (The Ocean Foundation & Merello Marine Consulting, 2024).

Within JBNERR, priority restoration areas include Site D and its expansion area, as well as Site E (Laguna Negra). Sites F and G have also been identified for restoration; feasibility studies have been completed, and permits have been secured for these areas, although NOAA funding is not currently available for their restoration. It is expected that TOF may continue advancing the restoration of Sites F and G, with JBNERR providing logistical support in collaboration with TOF and BoriCorps. The restoration areas were identified based on hurricane impacts, existing mangrove conditions, hydrological alterations, and the potential for mangrove recovery. The project combines hydrological, topographic, and biological restoration approaches to support mangrove recovery. Restoration focuses on improving hydrological conditions to support natural mangrove regeneration, supplemented by targeted planting where natural recruitment is insufficient (The Ocean Foundation & Merello Marine Consulting, 2024). The overall restoration approach seeks to restore impacted mangrove areas toward pre-hurricane conditions

Description of Restoration Areas

Within JBNERR, the broader mangrove restoration initiative includes four restoration sites (D, E, F, and G), with Site D also including an expansion area. The initiative addresses mangrove impacts associated with Hurricane Maria and previous hydrological alterations. Restoration efforts currently focus on Site D and D-Expansion and Site E (Laguna Negra), while Sites F and G are expected to follow as the restoration initiative advances, although funding for restoration activities at these sites has not yet been secured. As shown in the map below, the restoration sites are located within JBNERR and vary in extent.

Figure 20. The Ocean Foundation Mangrove Restoration Sites



Source: Mangrove Restoration Sites D, D-Expansion, E, F, and G. Map from The Ocean Foundation & Merello Marine Consulting (2024) and with permission from Manuel Merello.

- Site D and D-Expansion.** Site D covers approximately 27.5 acres of salt flats and mangrove forest north of the Mar Negro area. Site D-Expansion covers approximately 42.5 acres of mangrove forest within JBNERR in the municipality of Guayama. At D-Expansion, field observations found no live trees along two surveyed transects, high densities of woody debris, and patches of scrub mangroves. Woody debris also affects water circulation in low-lying areas (Merello Marine Consulting, 2024).
- Site E (Laguna Negra).** Site E covers approximately 119 acres of mangrove forest within JBNERR in the municipality of Guayama. The site has similar mangrove habitat and is affected by similar ecological conditions as D-Expansion. Its feasibility study and restoration plan have been completed, and the corresponding USACE permit has been secured.

Restoration of these areas is intended to improve hydrological conditions, support natural mangrove regeneration, and restore impacted areas to pre-hurricane conditions. Restoration of mangrove habitat also supports surrounding seagrass and coral reef habitats, which are ecologically connected to the mangrove system (Merello Marine Consulting, 2024).

- I **Sites F and G.** Sites F and G are also part of the broader mangrove restoration initiative. Feasibility studies and permits have been completed for these sites; however, NOAA funding is not currently available for their restoration. It is expected that TOF may complete the restoration project, with JBNERR continuing to provide logistical support in collaboration with TOF and BoriCorps.

Factoring Climate and Non-climate Stressors into Restoration Planning

Restoration planning at JBNERR considers environmental and anthropogenic stressors that may affect mangrove recovery and the feasibility, timing, and effectiveness of restoration activities. Environmental stressors affecting restoration areas include hurricanes and storm impacts, altered hydrology and hydroperiod, erosion and sediment loss, salinity conditions, and the accumulation of woody debris that can affect drainage and water circulation (Merello Marine Consulting, 2024). These conditions can limit natural mangrove regeneration and influence the approach and maintenance needs for restoration activities.

Anthropogenic stressors include human activities that may affect mangrove habitat and hydrological conditions. As described in the Resource Protection Plan, unauthorized filling, cutting and removal of mangroves, encroachment, and land-use and development activities in the surrounding watershed may also affect Reserve resources. The availability of funding and other resources will also be considered when determining the timing and feasibility of restoration activities. Site conditions and potential sources of continued disturbance will inform the approach for hydrological, topographic, and biological restoration, including maintenance of channels and culverts as needed to support hydrological connectivity and mangrove recovery.

Determining Restoration Priorities

The Reserve prioritizes restoration activities based on management and conservation needs, evaluated together with the Management and Research and Monitoring Advisory Committees. Ecological considerations include habitat condition, hydrological alterations, potential for natural regeneration, and the presence of sensitive habitats and species. JBNERR provides habitat for species of conservation concern, including the brown pelican, peregrine falcon, hawksbill and green sea turtles, manatees, and several shark species. Its mangrove forests, composed primarily of red, black, and white mangroves and buttonwood, also provide habitat for fish, invertebrates, birds, and other wildlife and are ecologically connected to adjacent seagrass and coral reef habitats.

The Reserve also considers how environmental and anthropogenic stressors may affect habitat resilience and restoration success, including the role of mangrove habitats in attenuating wave and protecting shorelines from erosion. Based on available project information, including feasibility studies and progress reports, information on habitat condition, hydrology, and recovery trajectories is considered when determining restoration priorities. Where information is insufficient to assess site conditions or recovery potential, additional baseline information may be needed before restoration activities are developed or implemented.

In addition to ecological consideration, the staff also considers funding availability and requirements. Restoration activities tend to be funded by NOAA or by USFWS, via an amendment or a new proposal under the Wildlife and Sport Fish Restoration Program (WSFR). For USFWS WSFR, the team uses the TRACS Performance Matrix as a guide to determine whether an activity aligns with eligible strategies and objectives. If the proposed activity is not eligible or funding is unavailable, JBNERR assesses partnerships and other external funding sources to proceed with implementation.

Priority Restoration Project Planning

The priority restoration projects, their intended outcomes, affected acreage, and locations are described in the previous sections and shown in the *Mangrove Restoration Sites D, D-Expansion, E, F, and G* map. Project planning and implementation are conducted in collaboration with The Ocean Foundation, Merello Marine Consulting, and BoriCorps. As described under Stewardship-Related Action 1.1, JBNERR will continue supporting implementation of the collaborative mangrove restoration project. Project monitoring includes assessment of mangrove conditions and recovery, hydrological conditions, and biological monitoring to assess restoration success.

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Appendices

Appendix 1. Memorandum of Understanding (MOU) between State and NOAA

Draft

Contrato # 2018-00024

Registro # 22-12-17

Memorandum of Agreement
Between the
National Oceanic and Atmospheric Administration
And the
Puerto Rico Department of Natural and Environmental Resources
Detailing the state-federal roles in the
Management of the Jobos Bay National Estuarine Research Reserve

This Memorandum of Agreement states the provisions for the cooperative management of the Jobos Bay National Estuarine Research Reserve (NERR) in the Commonwealth of Puerto Rico (Commonwealth), between the Puerto Rico, Department of Natural and Environmental Resources (DNER) and the National Oceanic and Atmospheric Administration, Office for Coastal Management (OCM).

WHEREAS, this Memorandum of Agreement supersedes the previous "Memorandum of Understanding between NOAA and DNER regarding the Jobos Bay NERR made on November 16, 2006.

WHEREAS, the Commonwealth of Puerto Rico has determined that the waters and related coastal habitats of the Jobos Bay NERR provide unique opportunities for study of natural and human processes occurring within the estuarine ecosystems of the Commonwealth to contribute to the science of estuarine ecosystem processes, enhance environmental education opportunities and public understanding of estuarine areas, and provide a stable environment for research through the long-term protection of reserve resources; and

WHEREAS, the Commonwealth of Puerto Rico has determined that the resources of the Jobos Bay NERR and the values they represent to the citizens of Puerto Rico and the United States will benefit from the management of these resources as part of the National Estuarine Research Reserve System; and

WHEREAS, the National Oceanic and Atmospheric Administration finds that the Commonwealth has satisfied the legal and procedural requirements for designation and, pursuant to section 315 of the Coastal Zone Management Act of 1972, as amended (CZMA, 16 U.S.C. 1461) and in accordance with implementing regulations at 15 C.F.R. 921.30, has designated the Jobos Bay NERR; and

WHEREAS, the DNER as the agency designated by the Governor of Puerto Rico is responsible for maintaining, operating and managing the Jobos Bay NERR in accordance with Section 315 of the CZMA and and acknowledges the value of state-federal cooperation for the long-term management and protection of the reserve in a manner consistent with the purpose of its designation; and

WHEREAS, the Jobos Bay management plan approved by NOAA describes the goals, objectives, strategies/actions, administrative structure, and institutional arrangements for the reserve, including this MOA and others;

NOW THEREFORE, in consideration of the mutual agreements herein, NOAA and DNER agree to the following:

ARTICLE I: COMMONWEALTH-FEDERAL ROLES IN RESERVE MANAGEMENT

~~A. DNER's Role in Reserve Management~~

The DNER shall:

1. be responsible for compliance with all federal laws and regulations, and ensure that the Jobos Bay NERR management plan is consistent with the provisions of the CZMA and implementing regulations;
2. ensure protection of the natural and cultural resources of the reserve, and ensure enforcement of the provisions of state law, including rules and regulations of the Puerto Rico coastal management program and those aimed at protecting the reserve;
3. ensure adequate, long-term protection and management of lands included within the reserve boundary;
4. annually apply for, budget, and allocate and expend funds received in accordance with federal and state laws, the reserve management plan, and annual funding guidance for reserve operations, research and monitoring, education and stewardship; and, as necessary, land acquisition and reserve facility construction;
5. conduct and coordinate research and monitoring programs that encourage scientists from a variety of institutions to work together to understand the ecology of the reserve ecosystem to improve coastal management;
6. conduct and maintain programs that disseminate research results via materials, activities, workshops, and conferences to resource users, state and local agencies, school systems, general public, and other interested parties;
7. provide staff, and endeavor to secure state funding for the manager, education coordinator and research coordinator;
8. secure facilities and equipment required to implement the provisions within the reserve management plan;
9. ensure adequate funding for facilities operation and maintenance;
10. maintain effective liaison with local, regional, state, and federal policy makers, regulators and the general public;

11. serve as principal contact for issues involving proposed boundary changes and/or amendments to the reserve management plan; and
12. respond to NOAA's requests for information, particularly cooperative agreement and grant progress reports and evaluation findings, including necessary actions and recommendations, made pursuant to Section 312 of the CZMA.

B. Federal Role in Reserve Management

NOAA's Office for Coastal Management shall:

1. administer the provisions of the Sections 315 and 312 of the CZMA to ensure that the reserve operates in accordance with goals of the reserve system and the Jobos Bay NERR reserve management plan;
2. review and process applications for financial assistance from the DNER consistent with 15 C.F.R Part 921, for management and operation of the reserve, and as appropriate, land acquisition and facility construction;
3. advise DNER of existing and emerging national and regional issues that have bearing on the reserve and reserve system;
4. maintain an information exchange network among reserves, including available research and monitoring data and educational materials developed within the reserve system; and
5. to the extent possible, facilitate NOAA resources and capabilities in support of reserve goals and programs.

C. General Provisions

- 
1. Nothing in this agreement or subsequent financial assistance awards shall obligate either party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.
 2. Upon termination of this agreement or any subsequent financial assistance awards to DNER, any equipment purchased for studies to further this agreement will be disposed of in accordance with applicable Federal law, regulations, and the terms and conditions, including special award conditions, applicable to financial assistance awards.
 3. A free exchange of research and assessment data between the parties is encouraged and is necessary to ensure success of cooperative studies.

D. Other Provisions

1. Nothing in this agreement diminishes the independent authority or coordination responsibility of either party in administering its respective statutory obligations.

Nothing in this agreement is intended to conflict with current written directives or policies of either party. If the terms of this agreement are inconsistent with existing written directives or policies of either party entering this agreement, then those portions of the agreement which are determined to be inconsistent with such written directives or policies shall be invalid; but the remaining terms not affected by the inconsistency shall remain in full force and effect. In the event of the discovery of such inconsistency, and at the first opportunity for revision of this agreement, all necessary changes shall be made by either an amendment to this agreement or by entering in a new superseding agreement, which ever is deemed expedient to the interested parties.

2. Any disagreement on the interpretation of a provision, amendment, or other matter related this agreement shall be resolved by informal negotiations at the lowest operating level of each party. If such disagreement cannot be resolved, then the area(s) of disagreement shall be stated in writing and promptly presented to the other party for further consideration. If agreement is not reached within thirty (30) days of presentation, the parties shall forward the written presentation of the disagreement to their respective higher official for appropriate resolution.

ARTICLE II: REAL PROPERTY ACQUIRED FOR PURPOSE OF THE RESERVE

The DNER specifically acknowledges and will fully comply with conditions set forth at 15 C.F.R. 921.21 (e), which establishes legal documentation requirements concerning the use and disposition of real property acquired for reserve purposes with federal funds under Section 315 of the CZMA.

ARTICLE III: PROGRAM EVALUATION

NOAA's Office for Coastal Management will schedule periodic evaluations of DNER performance in meeting the terms of this agreement, financial assistance awards, and the reserve management plan. Where findings of deficiency occur, NOAA may initiate action in accordance with the designation withdrawal or interim sanctions procedures established by the CZMA and applicable regulations at 15 C.F.R. 921, Subpart E.

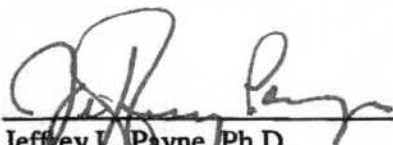
ARTICLE IV: EFFECTIVE DATE, REVIEW, AMENDMENT AND TERMINATION

- 
- A. This agreement is effective on the date of the last signature on this agreement and shall be in effect until terminated by either party.
 - B. The Parties will review this Agreement at least once every five years to determine whether it should be renewed, amended, or terminated. The Agreement may only be amended by the mutual written consent of both parties.
 - C. This agreement may be terminated by mutual consent of both parties, or by unilateral termination by either party. Termination of this agreement may provide grounds for NOAA (at its discretion) to withdraw designation of the reserve from the reserve system, pursuant to applicable provisions of the CZMA and its implementing regulations as described under 15

C.F.R. Parts 921 (Subpart E) and 923 (Subpart L). Section 315 of the CZMA provides that NOAA may withdraw designation of a National Estuarine Research Reserve if: 1) NOAA finds that any of the criteria for establishing the reserve no longer exist; or 2) a substantial portion of the research conducted within the reserve fails to meet reserve system guidelines. In making any decision to withdraw designation, NOAA will take into consideration factors set forth in 15 C.F.R. 921.40.

- D. Should this agreement be terminated or designation of the reserve be withdrawn by NOAA, reimbursement of unexpended funds from financial assistance awards shall be determined on a pro rata basis according to the amount of work done by the parties at the time of termination or withdrawal. Additionally, reimbursement for land purchased and facilities constructed with NOAA funds shall be consistent with terms and special award conditions of financial assistance awards.
- E. If any clause, sentence or other portion of this MOA shall become illegal, null, or void for any reason, the remaining portions of this MOA shall remain in full force and effect.
- F. No waiver of right by either party of any provision of this MOA shall be binding unless expressly confirmed in writing by the party giving the waiver.

IN WITNESS THEREOF, the parties have caused this agreement to be executed.


Jeffrey L. Payne, Ph.D.
Director
Office for Coastal
Management
National Ocean Service
National Oceanic and
Atmospheric Administration
U.S. Department of Commerce

12/21/2017
Date
SSP 520-82-1608


Tania Vazquez-Rivera
Secretary
Puerto Rico Department of Natural
and Environmental Resources

22 DEC. 2017
Date
SSP 660-43-3481

Appendix 2. MOUs with Other Key Partners

This appendix includes an MOU between The Department of Natural and Environmental Resources and The Ocean Foundation for the purpose of supporting ecosystem restoration in the Jobos Bay National Estuarine Research Reserve, Aguirre State Forest, and surrounding coastal zone areas. It also includes an MOU between the National Oceanic and Atmospheric Administration and The Ocean Foundation for the purpose of supporting international and other activities.

Draft

GOVERNMENT OF PUERTO RICO
THE DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES
AND
THE OCEAN FOUNDATION

AGENCY: 050

CONTRACT NO. _____

REGISTRATION NO. _____

MEMORANDUM OF AGREEMENT
FOR THE PURPOSE OF SUPPORTING ECOSYSTEM RESTORATION
IN THE JOBOS BAY NATIONAL ESTUARINE RESEARCH RESERVE, AGUIRRE
STATE FOREST, AND SURROUNDING COASTAL ZONE AREAS

APPEAR

-----AS PARTY OF THE FIRST PART: THE DEPARTMENT OF NATURAL AND ENVIRONMENTAL RESOURCES OF PUERTO RICO, a government agency created and authorized to award contracts by virtue of Act No. 23 of June 20, 1972, as amended, known as the *Organic Law of the Department of Natural and Environmental Resources*, with offices in San Juan, Puerto Rico, herein represented by its **SECRETARY**, Anaïs Rodríguez Vega, of legal age, married, lawyer and resident of San Juan, Puerto Rico; hereinafter referred to as the "**THE DEPARTMENT**".

-----AS PARTY OF THE SECOND PART: THE OCEAN FOUNDATION is an IRC § 501(c)(3) not-for-profit incorporated under the laws of the State of California (Registry No. 2369365 under the California Registry), with its headquarters at 1320 19th Street NW, Suite 500, Washington, D.C. 20036, represented in this act by its President, Mark J. Spalding, of legal age, single, lawyer by profession, and resident of Arrowsic Island, ME, duly authorized by a Board of Directors Resolution issued on August 1, 2003; hereinafter referred to as "**TOF**".

-----The Entities that appear in this Act shall be collectively called "**THE PARTIES**".

-----**THE PARTIES** assure they have the legal authority for this **AGREEMENT** in the capacity that they say they hold above, agreeing to accredit such authority and capacity where and when necessary, for which they freely and voluntarily:

EXPOSE

-----**WHEREAS**, TOF is a nonprofit corporation organized and operated for charitable purposes within the meaning of section 501(c)(3) of the Internal Revenue Code ("Code") and desires to provide to collaborate with the **DEPARTMENT** to conduct educational activities and support ecosystem restoration. TOF is the only international public foundation dedicated to the ocean and the animal, plant, and human communities that depend on its health. The mission of TOF is to support, strengthen, and promote those organizations dedicated to reversing the trend of destruction of ocean environments around the world. It supports ocean conservation solutions on every continent, focusing on all aspects of a healthy ocean, at local, regional, national, and global scales.

-----**WHEREAS**, TOF wants to provide a framework for cooperation with the **DEPARTMENT** and TOF participants regarding the restoration and rehabilitation of coastal ecosystems and nuisance sargassum seaweed mitigation within the *Jobos Bay National Estuarine Research Reserve, Aguirre State Forest*, and surrounding coastal zone areas. Areas of cooperation include, but are not limited to scientific research, environmental impact assessments, hydrological and topographical restoration, ecosystem restoration of mangroves, seagrasses, and coral reefs, long-term monitoring

of the degraded area pre-, during, and post-restoration, and the conversion of nuisance sargassum seaweed into organic compost;

----**WHEREAS**, the parties hereto recognize that every effort shall be made to safeguard the integrity of TOF's tax status under section 501(c)(3) of the Code;

----**WHEREAS**, the Parties share common goals and objectives with regard to the coherent implementation of the environmental dimensions of sustainable development, and wish to collaborate in areas of mutual concern, with transparency and efficiency, in the development of initiatives and actions of joint interest within their respective mandates and governing regulations;

----**WHEREAS**, Section 5(e) of Act No. 23, *supra*, provides that the **DEPARTMENT** can enter into agreements or necessary and convenient agreements to achieve the objectives of the **DEPARTMENT** and its programs, with agencies of the Government of the United States of America, with state governments, with other departments, agencies or instrumentalities of the Government of Puerto Rico, municipalities and with private institutions or entities;

----**NOW, THEREFORE**, in consideration of the mutual covenants and promises of the parties, the parties agree as follows:

TERMS AND CONDITIONS

----ARTICLE 1: GENERAL PROVISIONS

1.1. **Definitions.** The following definitions, used in the singular or plural, will also apply to the grammatical variations of the terms defined herein, when these variations have an initial capital letter.

1.1.1 **Agreement:** Means this document, its annexes and any extension, renewal, addendum, or amendment agreed in writing by the Parties.

1.1.2 **Day:** Refers to the calendar days within a fiscal year, which begins on July 1 and ends on June 30.

1.1.3 **Start Date:** Date on which this Agreement is executed or signed.

1.1.4 **Services:** These are the activities established and detailed in Article 2 of this MOA, and/or in those future addenda that, if granted in writing, so establish.

1.1.5 **Department:** Department of Natural and Environmental Resources created under the provisions of Act No. 23-1972, as amended.

1.1.6 **TOF:** The Ocean Foundation is a Washington, D.C.-based nonprofit corporation organized and operated for charitable purposes within the meaning of section 501(c)(3) of the Internal Revenue Code ("Code").

1.1.7 **MOA:** Refers to the Memorandum of Agreement.

1.2. **Headings.** The headings contained in this MOA are for convenience and reference only and shall not define or limit the scope, or affect the interpretation of, its provisions.

----ARTICLE 2: SCOPE OF AGREEMENT

2.1. The **DEPARTMENT** will cooperate with **TOF** addressing its mission to support of strengthen, and promote communities and organizations dedicated to reversing the trend of destruction of ocean environments around the world, including:

- 2.1.1. Providing material information to **TOF** regarding coastal habitat degradation and monitoring data in the *Jobos Bay National Estuarine Research Reserve, Aguirre State Forest*, and surrounding coastal zone areas.
- 2.1.2. Respecting the proprietary nature of the analysis of environmental impacts at the site performed by **TOF** and its subcontractor, Merello Marine Consulting, LLC, to-date, including the preparation of coastal habitat restoration feasibility studies and plans whose distribution or reproduction of any section is prohibited without prior consent.
- 2.2. To support the **DEPARTMENT**, **TOF** will:
- 2.2.1. Provide all data collected to-date on environmental impacts observed, restoration plans developed, and scientific monitoring data at the *Jobos Bay National Estuarine Research Reserve, Aguirre State Forest*, and surrounding coastal zone areas.
- 2.2.2. Provide feasibility studies and restoration plans for the *Jobos Bay National Estuarine Research Reserve, Aguirre State Forest*, and surrounding coastal zone areas and whose distribution or reproduction of any section is prohibited without prior consent.
- 2.2.3. Offer expert consultation and contracted services to conduct ecosystem restoration and rehabilitation in the *Jobos Bay National Estuarine Research Reserve, Aguirre State Forest*, and surrounding coastal zone areas.
- 2.2.4. **Authorized Representative.** The **DEPARTMENT** designates Aitza Pabón Valentín, Director of the *Jobos Bay National Estuarine Research Reserve*, as the liaison for this agreement, or her authorized representative, and who will supervise the compliance of this MOA. On the other hand, **TOF** designates Ben Scheelk, Program Officer, as the liaison for this agreement.
- 2.3. The Parties will support each other in working toward the achievement of the objectives and the fulfilment of their respective missions, by building on elements of their respective programs and by pursuing effectiveness while avoiding unnecessary duplication of efforts.
- 2.4. To ensure the harmonious implementation of the Parties' collaboration and the successful achievement of the objective of this MOA, the Parties undertake actively to support each other in the performance of agreed tasks, activities and to take all reasonable steps to make the most effective use of the collaboration hereunder in furtherance of their respective missions.
- 2.5. The Parties shall, on a regular basis, keep each other informed of and consult on matters of common interest, which in their opinion are likely to lead to mutual collaboration, and shall, at such intervals as deemed appropriate, convene meetings to review the progress of activities being carried out under this MOA and to plan future activities. Either Party may invite the other to send observers to meetings or conferences convened by them or under their auspices in which, in their opinion, the other may have an interest. Invitations shall be subject to the procedures applicable to such meetings or conferences. Consultation and the exchange of information and documents under the present MOA shall be without prejudice to arrangements that may be required to safeguard the confidential and restricted character of certain information and documents. Such arrangements will survive the termination of the present MOA and of any agreements signed by the Parties within the scope of the present collaboration.
- 2.6. The Parties will develop a plan under the present MOA, including specific activities, projects and programs, whose definition and implementation shall be subject to detailed separate agreements, in accordance with

-----**ARTICLE 3: FUNDING, PROGRAMMING, PAYMENT, AND REIMBURSEMENT ARRANGEMENTS**

- 3.1. This MOA defines, in general terms, the basis on which the Participants will cooperate, and as such, does not constitute a financial obligation to serve as the basis for expenditures.
- 3.2. Expenditures of funds, human resources, equipment, supplies, facilities, training, public information, and technical expertise will be coordinated by each Participant to the extent that their participation is necessary or appropriate and resources are available.
- 3.3. This MOA does not restrict the Participants from participating in similar activities or arrangements with other public or private agencies, organizations, or individuals.
- 3.4. This MOA does not oblige the Parties to expend funds or to enter into any other agreements, contracts, or other obligations.

-----**ARTICLE 4: TERM, TERMINATION AND NOTIFICATIONS**

- 4.1. **Term and Termination:** The parties hereby agree that this MOA shall be in effect from the signing of the agreement, until April 19, 2028; provided that if the term of the Agreement is extended, the Parties shall determine whether to renew or amend this MOA by executing a written amendment prior to its expiration.
- 4.2. The MOA may be terminated by (1) written mutual consent; (2) one Participant's written notice ninety (90) days in advance; or (3) completion of the Terms and Conditions of the Agreement. The rights, duties and responsibilities of the Parties shall continue in full force and effect during the ninety (90) days' notice period.
- 4.3. **Notices.** If any notice is required to be given in accordance with the terms of this MOU, it shall be made in writing and it is understood that it shall be effective at the time of its personal, email or mail delivery to the following addresses:

If to the Department:

To the attention of:
Anaïs Rodríguez Vega
Secretary

Mailing address:
San José Industrial Park
1375 Ponce de León Ave.
San Juan, Puerto Rico 00926

If to The Ocean Foundation:

To the attention of:
Mark J. Spalding
President

Mailing address:
1320 19th Street NW
Suite 500
Washington, DC 20036

-----**ARTICLE 5: MISCELLANEOUS**

- 5.1. **Assignment of rights.** Neither **PARTY** may assign rights or delegate any responsibility under this MOA without the prior written consent of the other party.
- 5.2. **Agreement.** This MOA contains all the terms agreed between the Parties. Neither Parties have relied on representations other than those contained in this MOA. No agent, employee, or representative of the Parties has the power to alter any of these terms unless it is done in writing under the signature of the authorized representative of each party.
- 5.3. **Compliance With Act 1-2012, Government Ethics Law.** The Parties certify that none of its agents, employees or officials have a pecuniary interest, direct or indirect, in the obligations and benefits contracted by virtue of this MOA, pursuant to Act 1-2012, known as the Puerto Rico Government Ethics Law, as amended. In

the same way, they certify that the officials who represent them in this act do not have any type of pecuniary interest in carrying it out.

- 5.4. **Document Conservation.** The Parties agree to conserve all documentation in relation to this MOA, so that de can be examined or copied by the Internal Audit Office of the Parties, by a firm of external auditors contracted by the Parties or by the Office of the Comptroller of Puerto Rico. This documentation must be conserved for a period of no less than six (6) years or until an investigation of the Office of the Comptroller of Puerto Rico is carried out, whichever happens first.
- 5.5. **Non-Discrimination Clause.** The Parties certify that there will be no discrimination for reasons of age, sex, race, color, sexual orientation, gender identity, birth, origin, or social condition, physical or mental handicap, beliefs political or religious or veteran status, or for being a victim of domestic violence, sexual assault or stalking, or any other cause of discrimination prohibited by applicable laws and regulations, in employment, hiring and subcontracting practices.
- 5.6. **Applicable Law, Jurisdiction, and Interpretation.** The Parties agree to comply with all laws, rules, and regulations of the Government of Puerto Rico. This Agreement will be subject to and construed in accordance with the laws of the Government of Puerto Rico. The Parties expressly agree that the Courts of Puerto Rico based in San Juan will be the courts with exclusive jurisdiction to resolve all disputes arising in connection with this MOA and expressly agree that the Terms and Conditions of this MOA are independent and separate. The Parties expressly waive trial by jury in connection with any cause of action relating to this MOA.
- 5.7. **Amicable Settlement.** The Parties shall use their best efforts to settle amicably any dispute, controversy or claim arising out of, or relating to this MOA or the breach, termination, or invalidity thereof.
- 5.8. **Waivers.** None of the provisions of the MOA shall be construed as a waiver by the Parties of said provisions unless the waiver is made in writing.
- 5.9. **Successors and Assignees.** This MOA shall be binding upon and inure to the benefit of the parties and their successors and permitted assigns.
- 5.10. **Severability.** The Parties hereby agree to comply with all regulations and applicable laws in connection with the execution of this MOA. This MOA will be governed by, construed, interpreted, and enforced in accordance with the laws of Puerto Rico. It is understood by the Parties that if any portion of this MOA is held to be void, invalid, or otherwise unenforceable, in whole or in part, its remaining portions shall remain in effect.
- 5.11. **Sole Agreement.** This MOA constitutes the entire agreement between the Parties and supersedes any prior agreement, written or verbal, pertaining to the subject matter hereof. This MOA may not be changed orally, but may be amended in writing, by mutual agreement of the Parties.
- 5.12. **No Agency.** No legal partnership or agency is established by this MOA. Neither Party is authorized or empowered to act as an agent, employee, or representative of the other, nor transact business or incur obligations in the name of the other Party or for the account of the other Party. Neither Party shall be bound by any acts, representations, or conduct of the other.
- 5.13. **Registration in the Office of the Comptroller of Puerto Rico, Act No. 18 of October 30, 1975, as amended.** The Parties agree to register this MOA at the Office of the Comptroller of Puerto Rico. No benefit or contract object of this MOA may be required until it has been submitted for registration in the Comptroller's Office in accordance with the provisions of Act No. 18-1975, as amended.

- 5.14. **Waiver of rights.** No waiver or failure by the Parties to enforce their right or insist on strict performance of this MOA shall be deemed to prevent the Parties from subsequently enforcing their rights or insist on strict performance under the MOA. No waiver or failure to strictly enforce rights shall affect the validity of this MOA.
- 5.15. **Language.** The Parties have requested that this MOA be drafted in English.
- 5.16. **Counterparts.** This MOA may be executed in counterparts either through original or electronic transmission of signatures, which together shall form an MOA. An executed copy of the MOA delivered by facsimile or electronic copy shall constitute valid execution and delivery of this MOA.
- 5.17. **Intellectual Property.** The Parties agree that all rights concerning the results from the MOA will correspond to TOF and the Department, who will be able to use them, create derived works and make them available to the public as each sees fit, without exclusivity and duly crediting the authors.
- 5.18. **Security Measures.** The Parties agree and undertakes to take the necessary measures to ensure that the Confidential Information is not released and/or distributed in violation of the legal provisions of this MOA. The violation of this Article will lend itself to the MOA being canceled immediately, in addition to being subject to the civil and criminal penalties established in the applicable laws.
- 5.19. **Indemnification.** The Parties shall indemnify, hold, and save harmless and defend at its own expense to its counterpart, their officers, agents, servants, and employees from and against all suits, claims, demands and liability of any nature or kind, including costs and expenses, arising out of acts, omissions, negligence or misconduct of other Party or its officers, agents, servants, representatives, or employees, in the performance of this MOA. This requirement shall extend to claims or liabilities in the nature of workmen's compensation and to claims or liabilities arising out of the use of patented inventions or devices. The obligations under this paragraph do not lapse upon termination of this MOA.
- 5.20. **Force Majeure.** Force Majeure as used herein shall mean acts laws or regulations, industrial disturbances, civil disturbances, explosions, and any other similar event of equivalent force not caused by nor within the control of other Party and which neither Party is able to overcome. As soon as possible after the occurrence of any event constituting Force Majeure, and if any of the Parties is thereby rendered unable, wholly or in part, to perform its obligations and meet its responsibilities under this MOA, shall give notice and full particulars thereof in writing to the other Party. In this event, the following provisions shall apply:
- 5.20.1. The obligations and responsibilities under this MOA shall be suspended to the extent of its inability to perform them and for as long as such inability continues; and
- 5.20.2. If any of the Parties is rendered permanently unable, wholly or in part, by reason of Force Majeure, to perform its obligations and meet its responsibilities under this MOA, the DEPARTMENT or TOF shall have the right to terminate this MOA.
- 5.21. **Termination by the Office of the Puerto Rico Chief of Staff.** TOF accepts and acknowledges that the Office of the Puerto Rico Chief of Staff will have the power to terminate this MOA at any time.
- 5.22. **Incorporation.** The following Appendix are incorporated by reference and made an integral part of this Agreement:

Appendix A: Pilot Project mangrove seagrass

Appendix B: Pilot Project seagrass

Appendix C: Large seagrass / Mata Redonda project

Appendix D: Large-scale mangrove project

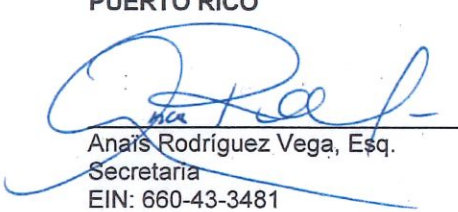
Appendix E: Proposed expansion of the project area

- 5.23. **Provisions Required by Law Deemed Inserted.** Each provision of law and clause required by Federal or State law, regulation, executive order, policy, procedure, directive, Federal grant award or agreement, or cooperative agreement with any Federal or State agency to be inserted in this MOA or the resulting amendments shall be deemed to be inserted herein and the MOA shall be read and enforced as though it were included herein. If, through mistake or otherwise, any provision is not inserted, or is not correctly inserted, then upon the application of either party the contract shall be amended to make such insertion or correction.

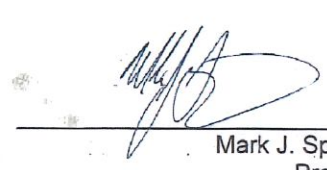
—The **PARTIES** have read this MOA carefully and understand each of its terms and conditions. Each **PARTY** has sought independent legal counsel of his choice to the extent the **PARTY** deemed such advice necessary in connection with the review and execution of this MOA.

In witness whereof, the undersigned, being duly authorized to do so, have executed this Agreement, in the English language in two (2) counterparts, this 3rd day of May, 2023.

**DEPARTMENT OF NATURAL AND
ENVIRONMENTAL RESOURCES OF
PUERTO RICO**


Anaïs Rodríguez Vega, Esq.
Secretaria
EIN: 660-43-3481

THE OCEAN FOUNDATION


Mark J. Spalding
President
EIN: 71-0863908

**MEMORANDUM OF AGREEMENT
BETWEEN THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
AND
THE OCEAN FOUNDATION
FOR THE PURPOSE OF
SUPPORTING INTERNATIONAL AND OTHER ACTIVITIES**

**NOAA-NOS Agreement Code: MOA-2020-161/12105
TOF Agreement Code: MOA- 2020 – International**

I. PARTICIPANTS, PURPOSE, AND SCOPE

- A. This Memorandum of Agreement (MOA) is between the National Oceanic and Atmospheric Administration (NOAA), and The Ocean Foundation (TOF).
- B. The purpose of this MOA is to provide a framework for cooperation between NOAA and TOF (Participants) regarding international and other activities of mutual interest including, but not limited to: research, cooperation, education, capacity building, exchange programs, outreach and communication.
- C. Specific areas of focus may include:
 - special marine areas, sister marine protected areas (including marine sanctuaries);
 - biological diversity;
 - ecosystem sciences and management;
 - impacts of climate change;
 - science and technical issues; and
 - other areas as identified by the Participants.

II. BACKGROUND ON PARTICIPANTS

- A. NOAA's mission is to understand and predict changes in climate, weather, and ocean and coasts; share that knowledge and information with others; and conserve and manage coastal and marine ecosystems and resources. NOAA's mission of science, service, and stewardship is directed to a vision of the future where societies and their ecosystems are healthy and resilient in the face of sudden or prolonged change.

- B. TOF is an IRS § 501(c)(3) not-for-profit international community foundation based in Washington, DC. TOF is an international public foundation dedicated to the ocean and the animal, plant, and human communities that depend on its health. The mission of TOF is to support, strengthen, and promote those organizations dedicated to reversing the trend of destruction of ocean environments around the world. It supports ocean conservation solutions globally, focusing on all aspects of a healthy ocean, at local, regional, national, and global scales.

III. AUTHORITIES

- A. The legal and programmatic authorities for NOAA to enter into this MOA include the National Marine Sanctuaries Act, 16 U.S.C. § 1442; the Coastal Zone Management Act, 16 U.S.C. § 1456c(a); the Agreements to Foster Public Understanding of NOAA Act, 15 U.S.C. § 1540; the National Climate Program Act, 15 U.S.C. § 2902; and the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1829; Coast and Geodetic Survey Act, 33 U.S.C. §§ 883a-883l; Federal Ocean Acidification Research and Monitoring Act of 2009, 33 U.S.C. §§ 3701-3708.
- B. Section 5.3 of the TOF's by-laws authorizes the Chairperson of the Board of Directors to sign agreements to be executed by the corporation, and section 8.1 of the TOF's by-laws allows the Board of Directors to delegate its authority to its President for the purposes of all grant and contract activities. As such, the President is the duly authorized officer of the foundation for signing any agreement, award or contract.

IV. TERMS AND CONDITIONS

- A. NOAA intends to cooperate with TOF to advance the agency's missions, including through:
1. protecting and managing natural and cultural heritage in special marine areas, including but not limited to the National Marine Sanctuary System and the National Marine Monuments;
 2. fostering research within the National Estuarine Research Reserve System;
 3. monitoring, protecting, and managing of marine mammals and endangered and threatened species;
 4. understanding climate change and ocean acidification effects on oceans

and coasts;

5. increasing coastal resilience and strengthening capacity for climate and acidification adaptation and mitigation;
6. working toward the goals of the UN Decade of Ocean Science for Sustainable Development that are relevant to the participants' missions; and
7. fostering the development of sustainable U.S. marine aquaculture, to support healthy, productive coastal ecosystems and local economies.

B. TOF intends to cooperate with NOAA to advance the foundation's missions, including its activities to support, strengthen, and promote communities and organizations dedicated to reversing the trend of destruction of ocean environments around the world. More specifically, TOF intends to cooperate with NOAA by:

1. engaging in cooperative activities that advance the protection and sustainability of natural, cultural, social, and economic resources of coastal and ocean areas;
2. applying and/or searching for external funding opportunities to carry out some of the activities described in this MOA; and
3. establishing a restricted fund within TOF to be used solely for the purpose of this MOA as identified herein, with TOF intending to receive and deposit all contributions to the fund from donors; hold, manage, invest, and reinvest the assets of the fund; and establish and maintain a separate account register to account for the fund's contributions and distributions.

V. FUNDING, PROGRAMMING, PAYMENT, AND REIMBURSEMENT ARRANGEMENTS

- A. This MOA defines, in general terms, the basis on which the Participants intend to cooperate, and as such, does not constitute a financial obligation to serve as the basis for expenditures.
- B. The Participants intend to coordinate the expenditure and/or deployment of funds, human resources, equipment, supplies, facilities, training, public information, and technical expertise where feasible and appropriate. Participants do not intend to independently make commitments to projects or activities that are dependent on

the allocation of resources by the other party.

- C. This MOA is not intended to limit or in any way affect the ability of each Participant to engage in similar activities or participate in similar arrangements with other organizations or individuals.
- D. Any activity contemplated under this MOA is subject to the availability of funds and other resources, and does not obligate the Participants to expend, or refrain from expending, any funds or to enter into, or refrain from entering into, arrangements of any kind with other organizations or individuals.
- E. This MOA is not intended to be legally binding.
- F. The parties will execute an annex to this MOA, or other documentation, to document any future activities that involve a transfer of funds or the provision of specific goods or services between the parties.

VI. CONTACTS

- A. The points of contact for any activities contemplated under this MOA are:

NOAA

Elizabeth McLanahan
Director
Office of International Affairs
14th & Constitution Avenue, NW
Washington, DC 20235
+1-202-482-5140
Elizabeth.McLanahan@noaa.gov

TOF

Mark J. Spalding
President
The Ocean Foundation
1320 19th Street NW, Ste 500
Washington, DC 20036
+1-202-887-8996
mspalding@oceanfdn.org

- B. In the event of a change regarding the point of contact information in this section, the Participant making the change will notify the other Participant in writing of such change as soon as practicable. Such changes regarding points of contact will not require written mutual decision of the Participants pursuant to Section VII.B.

VII. DURATION OF MOA, MODIFICATION, EXPIRATION, DISCONTINUATION

- A. This MOA becomes operational upon the date it is signed by both Participants, with a duration of five (5) years from the date of signature.
- B. This MOA may be amended within its scope or renewed prior to the expiration date, through the written mutual decision of the Participants.

- C. This MOA may be discontinued at any time by (1) written mutual decision of the Participants; or (2) one Participant's written notice to the other 90 days in advance.

VIII. SIGNATURE

SIGNED FOR THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION,
U.S. DEPARTMENT OF COMMERCE

BY: _____



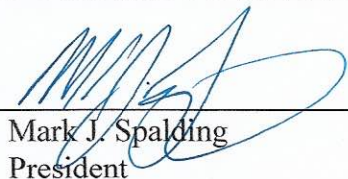
RDML Tim Gallaudet, PhD, USN Ret.
Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy NOAA
Administrator

DATE: _____

11/20/20

SIGNED FOR THE OCEAN FOUNDATION

BY: _____



Mark J. Spalding
President

DATE: _____

3 Dec 2020

Appendix 3. Federal Consistency Determination

This appendix is currently under development. Its applicability and inclusion as a requirement for the current revision are being evaluated.

Draft

Appendix 4. Response to Public Comments

This appendix is currently under development. Comments received during the second public meeting and throughout the public comment period will be incorporated herein.

Draft

Appendix 5. Summary of Puerto Rico's laws and regulations that impact the administration of the reserve

Management and Regulatory Authorities		Resources Protected
Commonwealth		
DNER		
General- Resources protection	Constitution of the Commonwealth of Puerto Rico	Guarantees the protection and use of natural resources. Applicable to all Commonwealth agencies, corporations and municipalities (Sec. 19 Part.VI)
	DNER Organic Act, Law No. 23 of 1972 as amended	Designates the DNER as the Commonwealth agency responsible for the implementation of the constitutional mandate regarding the protection and use of natural resources.
	Environmental Public Policy Act, Law No. 416 of September 22, 2004, as amended	Establishes the environmental public policy of the Government and its municipalities for the promotion and protection of the environment.
Wildlife resources	New Wildlife Act of Puerto Rico, Law No. 241 of August 15, 1999	Establishes the public policy for the protection of wildlife and their habitats in the Commonwealth of Puerto Rico, including jurisdictional waters.
	Regulation to govern the conservation and management of wildlife, exotic species, and hunting in the Commonwealth of Puerto Rico, Regulation No. 6765 of February 11 th , 2004.	Promotes the protection, conservation, and management of wildlife species. Establishes a mechanism to mitigate the modification of natural habitats. More rigorously regulates the granting of hunting licenses, the inscription of hunting weapons, and the renovation and suspension of these weapons for infractions set forth in the law and in this regulation.
	Regulation to govern vulnerable species and species in danger of extinction in the Commonwealth of Puerto Rico, Regulation No. 6766 of February 11 th , 2004.	The purposes of this regulation are: a) to identify, conserve, and preserve vulnerable and endangered species, b) to stimulate the propagation and survival of these species, c) to identify and promote the conservation of the critical natural habitats and essential critical natural habitats, d) to regulate the import and export of vulnerable or endangered species, e) to adopt the criteria used by the international scientific community to designate species whose population could rapidly become critically endangered or extinct within a very short time period.
Fisheries (including coral reefs)	Puerto Rico. Fisheries Act, Law No. 278 of November 29, 1998, and its' respective amendments.	Promotes the use, management, and conservation of fishery resources and regulates activities that have an impact on these resources.
	Law for the protection, conservation, and management of coral reefs in	Declares as public policy the protection, preservation, and conservation of coral reefs in the territorial waters of Puerto Rico.

Puerto Rico, Law No. 147 of July 15th, 1999.	
Fishing Regulations of Puerto Rico, Regulation No. 7949 of 2010	Administers fisheries in the territorial waters of Puerto Rico. – Establishes the off-season for the capture of certain species; – Establishes the size limitations of the species that can be captured; – Identifies the species for which it is prohibited to capture, sell, or transport; – Establishes the provisions describing the appropriate methods of capture of aquarium fish that are permitted; – Identifies invasive species that can be fished or captured; – Establishes the requirements for the solicitation and renovation of commercial, recreational, and charter fishing licenses.
Spiny Lobster Fishery Control Regulation, Regulation No. 4087 of January 10, 1990.	Establishes the regulations to control the Spiny Lobster (<i>Panulirus argus</i>) fishery activities within the jurisdictional waters surrounding the Commonwealth of Puerto Rico.
Regulation to control the extraction, possession, transportation, and sale of coral resources in Puerto Rico, Regulation No. 2577 of September 28, 1979	Regulates the extraction, possession, transportation, and/or sale of coral resources in Puerto Rico.
Administrative Order 2016-08	Prohibits the harvesting of sea cucumbers (<i>Holothuria</i> spp.) and sea urchins (Class <i>Echinoidea</i>) in the jurisdictional waters of Puerto Rico
Puerto Rico Coral Reef Regulation, Regulation No. 8809 of 2016	Establishes regulatory provisions for the protection, conservation, management, and restoration of coral reef resources in Puerto Rico. It supports the implementation of coral reef protection policy and may apply to activities that affect coral reefs, associated habitats, anchoring, boating impacts, extraction, possession, transportation, and other uses within jurisdictional waters, as applicable.
Executive Order 2021-066 and DNER Administrative Order 2021-10 addressing Stony Coral Tissue Loss Disease	Recognize and address the threat posed by Stony Coral Tissue Loss Disease to Puerto Rico's coral reef ecosystems. These executive and administrative instruments support monitoring, coordination, response, and management actions to reduce impacts to coral reef resources and associated marine habitats.

	Puerto Rico legislation designating coral reefs as essential infrastructure, Law No. 72 of July 23, 2020	Recognizes coral reefs as essential or critical natural infrastructure because of their role in coastal protection, risk reduction, and ecosystem resilience. This designation supports conservation, restoration, and mitigation actions and may strengthen eligibility or prioritization for federal recovery, mitigation, and resilience funding, including where reef resources protect coastal communities and infrastructure.
Habitat protection (forests, wetlands, watersheds)	Law for the Natural Heritage Program, Law No. 150 of August 4th, 1988.	The purpose of the law is to identify and delimit land of natural value and prepare plans for the acquisition and protection of such territory, as well as mechanisms to strengthen non-profit organizations to share responsibilities for acquiring, restoring, and managing these lands.
	Law of Conservation Easements of Puerto Rico, Law No. 183 of December 27 of 2001, as amended.	Develops incentives for the creation of easements for the protection in perpetuity of private lands that have natural, cultural, or agricultural value.
	Fund law for the Acquisition and Conservation of the Lands of Puerto Rico, Law No. 268 of September 2003.	Approved for the acquisition, improvement, conservation, and maintenance of lands that are considered to have a high ecological value.
	Puerto Rico Forest Act, Law No. 133 of July 1st, 1975, as amended.	Declares the public policy for the governance of the forests of Puerto Rico, which includes –among other subjects-- the maintenance, conservation, protection, and expansion of forests for use and enjoyment.
	Law for the Public Policy on Wetlands in Puerto Rico, Law No. 314 of 1998, as amended.	Establishes the protection of wetlands as public policy in Puerto Rico. The law promotes the preservation, conservation, restoration, and management of natural wetland resources.
	Law for the Protection of Watersheds and for the Prevention of Flooding, Law No. 47 of June 6th, 1963 (12 L.P.R.A. § 251-§254)	Declares, as a public policy of the Government of Puerto Rico, the preservation of rivers and streams as ecosystems that provide multiple benefits. Establishes as ministerial duties of the DNER the surveillance, conservation, and cleaning of beaches, as well as the conservation and cleaning of rivers.
	Law for the conservation, use, and development of water resources in Puerto Rico, Law No. 136 of June 3rd, 1976.	This Law and its regulation, Regulation for the enjoyment, use, conservation, and administration of the waters of Puerto Rico, establishes control of the use, enjoyment, and development of the waters and water bodies of Puerto Rico.
Enforcement	Department of Natural and Environmental Resources Rangers Act, Law No. 1 of June 27th of 1977.	Creates the Ranger Corps and establishes its tasks and responsibilities which include: protecting wildlife, policing activities and operations relating to the earth's crust, assuming park ranger responsibilities and inspecting fishing activities, among others. The rangers

	Regulation of the Ranger Corps of the Department of Natural and Environmental Resources, Regulation No. 5916 of February 8th 1999.	are responsible for carrying out arrests and enforcing the law, among other tasks.
Navigation	Law of Navigation and Aquatic Security of Puerto Rico, Law No. 430 of 2000	Establishes the public policy for security in the aquatic and maritime recreational activities and practices.
	Regulation for the inscription, navigation, and aquatic security of Puerto Rico, Regulation No. 6979, of May 31st 2005, as amended.	Regulates the inscription and enumeration of vessels, establishes security measures, regulates recreational practices in maritima and aquatic bodies of water, establishes the measures to protect fauna, flora and other natural resources that could be impacted by recreational activities, and establishes the infractions and administrative fines, among other subjects.
Uses	Regulation for the administration of uses through authorizations and concessions in Natural Protected Areas, Regulation No. 8013 of 2011	This regulation establishes the criteria to determine the authorizations and concessions of the sale and the acquisition of products, embarkation and disembarkation, excursion services or the interpretation of designated areas, and the administration of recreational areas as well as camp sites and eco-lodges
Land Use/Watershed		
Land Uses	Joint Permit Regulation for the Evaluation and Issuance of Permits Related to Development and Land Use, Regulation No. 31	– Land-use and construction permits – Habitat modification – Extraction of materials from the earth's crust
Flood Hazard Areas	Special Flood Hazard Areas Regulation (Planning Regulation No. 13), Eighth Revision, effective January 9, 2021	– Establishes floodplain management and construction requirements for development in designated special flood hazard areas. It regulates building elevations, subdivisions, fill, drainage modifications, floodways, and other development activities to reduce risks to life and property, prevent increases in flood levels or velocities, and maintain compliance with the National Flood Insurance Program.

Appendix 6. List of Education Advisory Committee members, roles, and responsibilities

Name	Organization	Role
Astrid J Green	DNER	Assistant Secretariat for Information and Education. Co-managing agency
Hiram Cruz Santiago	DNER	Community Relations Division, Co-managing agency
Delmis Alicea, Ph.D.	Puerto Rico Sea Grant Program	Academia
Eliezer Nieves-Rodríguez	San Juan Bay Estuary Program	Nongovernment organization
Miriam Gallardo	Retired teacher / community leader	Community organization
Aúrea E. Rodríguez, Ph.D.	Environmental educator	Education
Dr. Luis Mateo	Teacher, Josefa Vélez School, Peñuelas	Education
Cinthia Félix	Teacher, Las Mareas bilingual school, Salinas	Education
Ray Rodriguez Colón	Veredas de Mi Tierra Education Center	Education
Prof. Pedro Sanabria	Aguirre community, Salinas	Community organization

Appendix 7. List of Training and Engagement Advisory Committee members, Field and Expertise

The Advisory Committee serves in a collaborative advisory capacity, providing guidance and support to the TEP Coordinator without making final program decisions. Its responsibilities include advising on training needs, audiences, topics, and delivery; identifying appropriate speakers, resources, and collaborators; and facilitating outreach, partnerships, and networking that advance coastal stewardship.

Name	Organization	Field/Area of expertise
Dr. Conrado M. Calzada	Pontifical Catholic University of Puerto Rico	Higher Education / Academia
Dr. Carlos Carazo	Puerto Rico Department of Health, State Veterinarian	Public Health / Veterinary Medicine
Pablo García	Puerto Rico Energy Power Authority (PREPA)	Electric Power / Energy Infrastructure
Prof. Amaris Guzmán	Interamerican University of Puerto Rico	Higher Education / Academia
Plan. Carlos Maldonado	Guayama Municipality	Municipal Government / Local Planning
Tamara Orego	PDEDC, Tourism	

		Tourism / Economic Development
Prof. Lillian Ramírez	PRSGP, UPR	
Dr. Wilma Rivera	Puerto Rico Department of Health, Animal Control Office	Public Health / Veterinary Medicine
Dr. Aurea Rodríguez	Puerto Rico Ecological Workshop	Ecology / Environmental Education
Biol. Juan Rodríguez	DNER, Environmental Quality Board	Environmental Quality / Environmental Regulation
Raúl Santini	DNER, Coastal Zone Management Program	Coastal Zone Management / Coastal Resource Management