



Image: Keri Turner

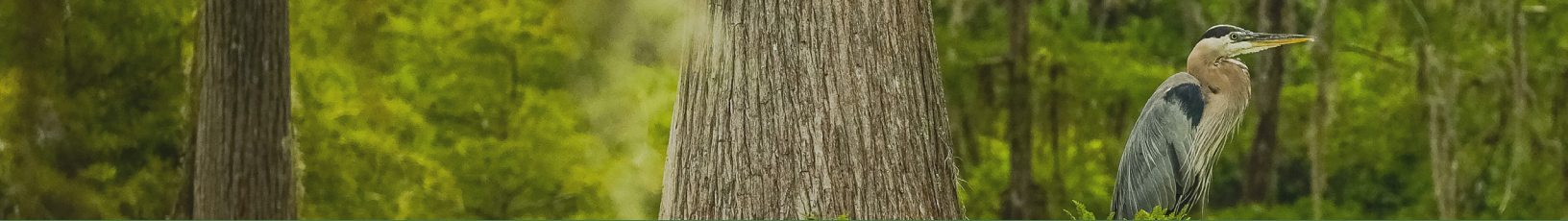
# HABITAT PROTECTION AND RESTORATION STRATEGY SUMMARY

Outline of goals, directions, and  
projects

BTNEP has worked for more than 25 years with federal, state, and local government organizations, business leaders, environmental organizations, and various local stakeholder communities to identify and prioritize the problems in our estuary. This redeveloped CCMP contains specific actions that address the whole range of environmental problems facing the estuary, including habitat loss and degradation. Many of the issues in the estuary are directly related to land loss and climate change vulnerability. Each of the Action Plans related to the BTNEP priority problems is addressed earlier in this document. It should be noted that the BTES is changing not on a geologic time scale but right before the people who call this land home; the changes are occurring in human lifetimes. This fastest disappearing landmass on Earth requires extreme measures for restoration. The restoration and protection actions reflect an ongoing adaptation to subsidence, rapid land loss, and climate change vulnerability.

The restoration *strategy* outlines the overall goals for the restoration program and defines the major directions in which a program should proceed to meet these goals. Because ecosystem restoration projects can be very expensive to plan and implement in coastal Louisiana, and our EPA resources are currently limited, and project success is uncertain, substantial pressure exists to select projects that have the highest probability of meeting performance expectations. Details of these plans can be





found in the Action Plans of Chapter 5. Louisiana's coastal restoration projects typically cost tens of millions to hundreds of millions of dollars - well beyond BTNEP's budget capabilities. BTNEP must, therefore, rely on other partner entities to help to implement the CCMP habitat protection and restoration blueprint. The primary goal of land restoration in the estuary is to respond to the land loss by identifying a long-term blueprint of project construction, operations, maintenance, and adaptive management using science-based techniques and consensus-driven decision making. The major direction includes a multiple, pronged approach targeted at the varying habitat types and using the finest existing methods. The BTNEP MC members and their related organizations understand the fiscal commitment it takes for restoration and continue to engage in this ongoing effort to protect and preserve this unique ecosystem.

A wide range of habitat restoration efforts are occurring within the estuary. The level of involvement of the BTNEP MC members and BTNEP staff varies greatly, but the mission of implementation of the CCMP is a driving force in the estuary.

## PRIORITY HABITATS AND KEY SPECIES FOR PROTECTION AND RESTORATION EFFORTS

The BTB provides habitat for a multitude of invertebrates, birds, finfish, shellfish, reptiles, amphibians, and mammals with all contributing to the living fabric of the BTB. It is estimated that the BTE's ecosystems provide habitat for approximately 735 species of native birds, finfish, shellfish, reptiles, amphibians, and mammals.

Key species of interest in the BTES have been fully identified in Action Plan EM-15 Protection

and Enhancement of Native Biological Resources. Discussion of plants and animals in EM-15 are separated into six categories to describe the BTB living resources which are of greatest interest. These include: (1) Plants, (2) Pollinators, (3) Fish and Shellfish, (4) Birds, (5) Wildlife, and (6) Threatened and Endangered Species.

The goals and/or objectives identified in EM-15 include the following.

- **Plants** - To support conservation efforts for ecological succession patterns of plant diversity from up-basin to down-basin within each of the habitat zones of the BTB delta ecosystem
- **Pollinators** - To build a framework that encourages landowners to manage their land in a way that maximizes its suitability as habitat for pollinators
- **Fish and Shellfish** - To support conservation efforts to maintain the diverse recreational and commercial invertebrate and vertebrate species harvested for pleasure and profit
- **Birds** - To support conservation measures that maximize available natural habitats that maintain healthy populations of migratory and resident birds across the BTB system
- **Wildlife** - To support conservation efforts to maintain the diverse amphibian, reptile, and mammal populations
- **Threatened and Endangered Species** - To support recovery and conservation

Full descriptions of the BTES priority habitats can be found in Chapter 2. See EM-15 Protection and Enhancement of Native Biological Resources for additional information about species. The Species





*Bottomland hardwood forests are in the northernmost region of the estuary. Image: USFWS*

of Concern identified in the subsequent pages are the LDWFs currently identified key species for protection and restoration efforts. In EM-16, the Reduction of Impacts from Invasive Species is fully investigated. The summary in the following pages helps readers understand the vast need for ongoing habitat restoration across the landscape.

### **Bottomland Hardwood Forests**

**Bottomland Hardwood Forests** are forested, alluvial wetlands occupying broad floodplain areas that flank large river systems. These forested areas occasionally flood but are usually dry.

**Key Plants Species** include overcup oak, water hickory, sugarberry, swamp dogwood, privet, water elm, water oak, sweet gum, box elder, and winged elm, hawthorns, red mulberry, pecan, hackberry, honey locust, and elderberry.

**Key Animal Species** include a broad range of animals such as frogs, turtles, ducks, black bears, alligators, muskrats, mink, otters, egrets, herons, and hawks. These forests are also important for migratory songbirds including summer tanagers, red-eyed vireos, and great-crowned flycatchers.

### ***Animal Species of Concern for Protection (as defined by LDWF)***

**AMPHIBIANS:** southern dusky salamander, Louisiana slimy salamander, Strecker's chorus frog, eastern spadefoot, and southern crawfish frog

**BIRDS:** yellow-crowned night-heron, wood stork, swallow-tailed kite, bald eagle, American woodcock, yellow-billed cuckoo, wood thrush, yellow-throated vireo, northern parula, prothonotary warbler, Swainson's warbler, Louisiana waterthrush, Kentucky warbler, hooded warbler, field sparrow,



rusty blackbird, and orchard oriole

**BUTTERFLIES:** Celia's roadside skipper, falcate orangetip, 'Seminole' Texan crescent,

**MAMMALS:** southeastern shrew, southeastern myotis, Louisiana black bear, long-tailed weasel, and eastern spotted skunk

**REPTILES:** alligator snapping turtle, western worm snake, common rainbow snake, and timber rattlesnake

**Detrimental Invasive Plant Species:** Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

**Detrimental Invasive Animal Species:** feral hogs, nutria, apple snails, emerald ash borer, Asian tiger mosquito, red imported fire ant, tawny crazy ant, Cuban tree frog, brown anole, and Formosan termite

## Swamps

**Swamps** are densely stocked, often-flooded forested wetlands that develop in broad, shallow, braided drains or along margins of creeks. Trees and shrubs have evolved to tolerate prolonged flooding in swamps.

**Key Plants Species** include bald cypress and moss-draped water tupelo. The other dominate species include swamp red maple, black willow, pumpkin ash, green ash, water locust, and buttonbush.

**Key Animal Species** include most notably alligators, crawfish, bullfrog, and choupique. Swamps are also an ideal nesting habitat to herons, ibises, and egrets.

*Animal Species of Concern for Protection (as defined by LDWF)*

**AMPHIBIANS:** southern dusky salamander and Gulf Coast mud salamander



*The alligator snapping turtle is largest freshwater turtle species in North America. Image: USFWS*



*Otters live on land and prefer to be near bodies of water with good water quality. Image: USFWS*

**BIRDS:** American woodcock, yellow-billed cuckoo, wood thrush, yellow-throated vireo, northern parula, prothonotary warbler, Swainson's warbler, Kentucky warbler, hooded warbler, painted bunting, rusty blackbird, and orchard oriole

**BUTTERFLIES:** pepper and salt skipper and falcate orangetip harvester

**MAMMALS:** southeastern shrew and southeastern myotis

**Detrimental Invasive Plant Species:** Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

**Detrimental Invasive Animal Species:** feral hog, nutria, apple snail, emerald ash borer, Asian tiger mosquito, red imported fire ant, tawny crazy ant, Formosan termite, Cuban tree frog, brown anole,

Asian clam, zebra mussel, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

### **Freshwater Marsh**

**Freshwater Marsh** is normally located adjacent to intermediate marsh along the northern most extent of the estuary's coastal marshes. As its name implies, it generally has salinities less than three ppt. This habitat supports the greatest plant diversity of all marsh habitats.

**Key Plant Species** include maidencane, spikeseed, bulltongue, alligatorweed, giant cutgrass, pickerelweed, pennywort, cattail, southern wildrice, coontail, common duckweed, waterlilies, irises, and bullwhip.

**Key Animal Species** include a wide range of animals such as frogs, turtles, ducks, muskrats, mink, otters, egrets, herons, and hawks.

**Animal Species of Concern for Protection (as defined by LDWF)**





*The reddish egret is one of the rarest egrets in North America. Image: USFWS*

**BIRDS:** American bittern, yellow-crowned night-heron, wood stork, mottled duck, northern pintail, canvasback, redhead, lesser scaup, bald eagle, northern harrier, yellow rail, black rail, clapper rail, king rail, sandhill crane, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern common tern, Forster's tern, short-eared owl, sedge wren, loggerhead shrike, and Nelson's sharp-tailed sparrow

**BUTTERFLIES:** Neamathla skipper, dion skipper, and great southern white

**REPTILES:** alligator snapping turtle

**Detrimental Invasive Plant Species:** Johnson grass, cogon grass, giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

**Detrimental Invasive Animal Species:** feral hog, nutria, apple snail, Asian tiger mosquito, Asian clam, zebra mussel, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

A significant portion of freshwater marsh in the estuary is floating marsh locally known as "flotant." Flotant marsh is marsh which is buoyant during certain times of the year. Wildlife use the flotants frequently because they provide a "dry land" refuge in regions where flooding is frequent.

### Intermediate Marsh

**Intermediate Marsh** is a unique habitat zone characteristic of delta regions that are influenced by freshwater and slight oceanic processes that produce a mixture of plants that can tolerate some osmotic tolerance to salinity. The salinity ranges of 3 to 10 ppt.

**Key Plants Species** include the two dominant plants that can tolerate salinity in the region which are wiregrass and widgeongrass alongside freshwater species such as cattails, bulltongue, giant bulrush, common threesquare, deer pea, switch grass, Walter's millet, alligator weed, and southern naiad.

**Key Animal Species** include waterfowl, wading birds, marsh hawks, and fur bearers, and nursery habitat for brown shrimp, blue crab, gulf menhaden,

and a variety of other commercially and recreationally valuable fishery resources.

***Animal Species of Concern for Protection (as defined by LDWF)***

**BIRDS:** brown pelican, American bittern, reddish egret, yellow-crowned night-heron, mottled duck, northern pintail, canvasback, redhead lesser scaup, bald eagle, northern harrier, black rail, clapper rail, king rail, sandhill crane, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, common tern, Forster's tern, short-eared owl, sedge wren, and loggerhead shrike

**BUTTERFLIES:** Neamathla skipper, dion skipper, obscure skipper, great southern white, and western pygmy-blue

**Detrimental Invasive Plant Species:** giant reed, Japanese climbing fern, torpedo grass, water hyacinth, common and giant salvinia, hydrilla, myriophyllum (parrot feather), alligator weed, Cuban sedge, wild taro, purple loosestrife, and Brazilian peppertree

**Detrimental Invasive Animal Species:** feral hog,

nutria, apple snail, Asian tiger mosquito, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

**Brackish Marsh**

**Brackish Marsh** is usually found between salt marsh and intermediate marsh although it may occasionally lie adjacent to the Gulf of Mexico. Salinity averages about eight ppt.

**Key Plant Species** include mostly wiregrass that thrive in this habitat; other species in this habitat are Onley bulrush, leafy threesquare, and widgeongrass.

**Key Animal Species** include oysters, speckled trout, redfish, muskrats, raccoons, mink, otters, and other mammals. Brackish marsh is also of very high value to estuarine larval forms of marine organisms such as shrimp, blue crab, and menhaden, known locally as pogey.

***Animal Species of Concern for Protection (as defined by LDWF)***

**BIRDS:** brown pelican, American bittern, reddish egret, yellow-crowned night-heron, mottled duck,



*Menhaden (also locally called pogey) is a small filter feeding fish that is both economically and ecologically important. Photo: NOAA*



northern pintail, canvasback, redhead, lesser scaup, bald eagle, northern harrier, yellow rail, black rail, clapper rail, king rail, whooping crane, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common tern, forster's tern, black skimmer, short-eared owl, loggerhead shrike, seaside sparrow, and Nelson's sharp-tailed sparrow

**BUTTERFLIES:** Neamathla skipper, palatka skipper, dion skipper, great southern white, and western pygmy-blue

**REPTILES:** Mississippi diamondback terrapin

**Detrimental Invasive Plant Species:** torpedo grass, water hyacinth, common and giant salvinia, purple loosestrife, and Brazilian peppertree

**Detrimental Invasive Animal Species:** feral hog, nutria, snakehead, Rio Grande cichlid, Asian carp, Asian swamp eel, and tilapia

## Salt Marsh

**Salt Marsh** is the marsh area closest to the beach rim of the Gulf of Mexico; it varies from 1 to 15 miles

in width. Generally, vertebrate species population levels are higher in brackish marsh compared to salt marsh. The mean salinity of salt marsh is about 16 ppt.

**Key Plant Species** include smooth cordgrass (oystergrass) and black mangroves. Other minor species include saltgrass, black needlerush, and saltwort. Relatively few species can tolerate the salinity stress.

**Key Animal Species** include redfish, speckled trout, blue crabs, and shrimp. Many species must move in and out of the salt marsh at different stages in their life cycles. After these species spawn offshore, larval and juvenile fish and shellfish move through the passes into the estuary where they feed and grow.

**Animal Species of Concern for Protection (as defined by LDWF)**

**BIRDS:** reddish egret, yellow-crowned night-heron, northern harrier black rail, clapper rail, whooping crane, American oystercatcher, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common



*Saltgrass helps to keep soils in place in the salt marsh. Image: NRCS*



*Painting buntings are easy to identify because of their beautiful plumage. Image: USFWS*

tern, Forster's tern, black skimmer, short-eared owl, seaside sparrow, and Nelson's sharp-tailed sparrow

**BUTTERFLIES:** Neamathla skipper, dion skipper, obscure skipper, great southern white, and western pygmy-blue

**REPTILES:** Mississippi diamondback terrapin

**Detrimental Invasive Plant Species:** purple loosestrife and Brazilian peppertree

**Detrimental Invasive Animal Species:** feral hog, nutria, and Asian carp

## **Rivers, Bayous and Streams**

*Rivers, bayous, and streams* carry water through all of the estuarine habitat types such as swamps and marshes. The key species of plants and animals and detrimental species are captured in those habitat types. Because of this interconnection, the estuary is dynamic by its very nature.

## **Maritime Ridges**

**Maritime Ridges** are remnant natural levees of rivers, bayous, salt dome islands, or shell middens; natural stranded beach ridges ("Cheniere" – French for "place of oaks"); or anthropogenic to create elevation above the surrounding marsh. These ridges are mostly four to five feet above sea level.

**Key Plant Species** include live oak and hackberry as the dominant canopy species. Plant types that have been planted by BTNEP and have survived well include sand live oak, American beautyberry, honeylocust, persimmon, dogwood, yaupon, Hercules club, and salt matrimony vine.

**Key Animal Species** which use this habitat include migratory birds, reptiles, and mammals such as songbirds, rabbits, and coyote.

## **Animal Species of Concern for Protection (as defined by LDWF)**

**BIRDS:** yellow-billed cuckoo, painted bunting, orchard oriole, and various migratory birds (continue efforts to support conservation of remaining habitat)

**REPTILES:** eastern glass lizard





*Barrier island restoration projects provide habitat for migratory shorebirds and colonial nesting water birds.  
Image: NRCS*

**Detrimental Invasive Plant Species:** Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

**Detrimental Invasive Animal Species:** feral hog and nutria

## **Bays**

**Bays** are natural embayments, lakes, or ponds with fluctuating salinities and depths. Salinities range from 0.5 to 30 ppt. Most of the primary production of this community occurs in phytoplankton (diatoms, blue-greens, and green algae), nanoplankton, and ultraplankton.

**Key Plant Species** include various phytoplankton.

**Key Animal Species** are located at the bay/marsh interface which serves as a nursery ground area for fish, shrimp, and shellfish. Brown shrimp, white shrimp, oysters, blue crabs, menhaden, spotted sea trout, mosquito fish, killifish, sea catfish, silversides, anchovies, common loons, horned grebes, gulls, lesser scaup, and red-breasted mergansers are found in the estuary's bays.

## ***Animal Species of Concern for Protection (as defined by LDWF)***

**MAMMAL:** bottlenosed dolphin, manatee, and Gulf sturgeon

**REPTILES:** loggerhead sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, green sea turtle, hawksbill turtle, and Mississippi diamondback terrapin

**Detrimental Invasive Plant Species:** None identified in the estuary to date.

**Detrimental Invasive Animal Species:** Asian carp, lion fish, Asian tiger shrimp, and spotted jellyfish

## **Barrier Islands, Beach Dunes, Barrier Shorelines and Headlands**

*Barrier Islands, Beach Dunes, Barrier Shorelines and Headlands* are long narrow islands or headlands, many with dunes, exposed to moderate to high amounts of salt spray. In addition, the areas have limited nutrient availability and substrate instability.

**Key Plant Species** include succulent species and vines found on the beach fronts, wiregrass on highest dunes, and black mangrove and smooth cordgrass on the sheltered bayside areas. Additionally, wiregrass, sea oats, beach panic, saltwort, morning glory, and seaside goldenrod are found in these areas. If dunes remain stable, allowing natural succession to progress, coastal dune shrub thickets are formed.

**Key Animal Species** use this habitat for important breeding and nesting of migratory shorebirds and colonial nesting water birds.

### *Animal Species of Concern for Protection (as defined by LDWF)*

**BIRDS:** brown pelican, reddish egret, yellow-crowned night-heron, snowy plover, wilson's plover, piping plover, American oystercatcher, marbled godwit, dunlin, short-billed dowitcher, gull-billed tern, Caspian tern, royal tern, sandwich tern, common tern, Forster's tern, black skimmer, and red knot

**BUTTERFLIES:** obscure skipper and eastern pygmy blue

**REPTILES:** loggerhead sea turtle, Kemp's Ridley sea turtle, leatherback sea turtle, and Mississippi diamondback terrapin

**Detrimental Invasive Plant Species:** Chinese tallow, camphor tree, chinaberry, privet, cat claw vine, air

potato, Japanese honeysuckle, kudzu, Johnson grass, cogon grass, giant reed, Japanese climbing fern, and torpedo grass

**Detrimental Invasive Animal Species:** feral hog and nutria

## **PRIORITY HABITAT TYPES AND LAND RESTORATION ACTIONS OR TECHNIQUES**

Much progress has been made to implement large-scale ecosystem restoration projects across coastal Louisiana by CWPPRA, CPRA, USACE, USDA NRCS, EPA, USFWS, and NOAA NMFS since the early 1990s. Smaller projects have also been implemented by BTNEP and its other BTNEP MC members and partners. The map on the following pages identifies the major projects completed prior to 2017. Partners' websites should be consulted for detailed lists and descriptions of past work.

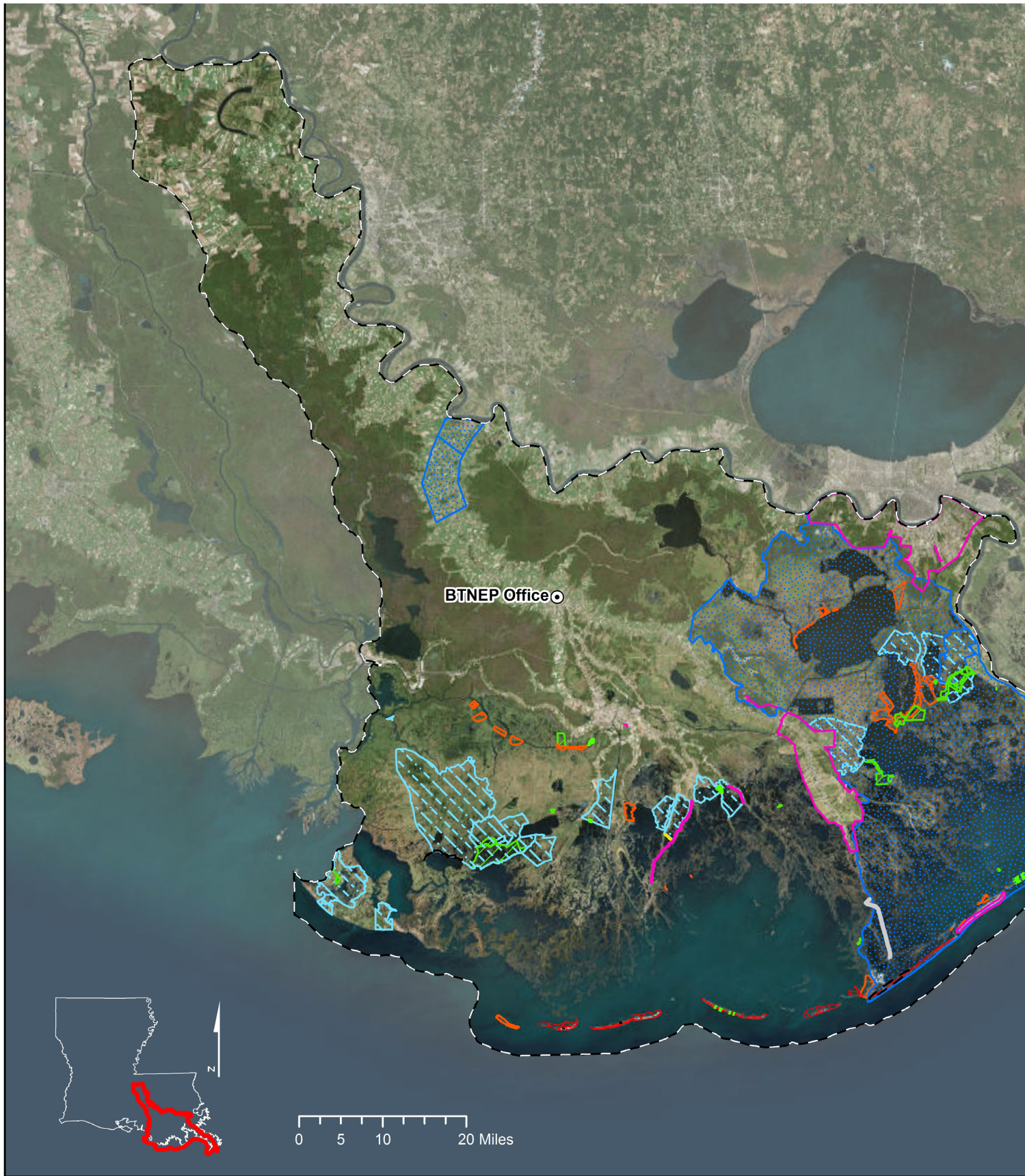
The overarching goal of many land conservation plans is to focus conservation on those lands and waters that are most important for conserving living resources - native plants, animals, and natural and human communities - and water quality in the coastal watershed. This summary will share the state and local perspective on habitat protection and restoration strategies.

### **Projects Constructed in the BTES Prior to 2017**

CPRA, USACE, and CWPPRA, the primary organizations that work on large scale coastal restoration and protection, have identified the following habitat types or categories and related restoration techniques in the estuary. Because climate change vulnerability is a way of life in coastal Louisiana, CPRA has made a resolute effort to incorporate the impacts of climate change in its plans to restore coastal landscapes in the estuary.

Coastal restoration in Louisiana is also an unapologetic political issue that has unprecedented bipartisan









support. In 2017, the Louisiana State Legislature passed, with a nearly unanimous approval, the 2017 Coastal Master Plan. (The Coastal Master Plan was approved unanimously in the House and by a 33 to 1 margin in the Senate.) In CPRA's Coastal Master Plan, which calls for spending \$50 billion for coastal restoration and protection during the next 50 years, estimates of sea level rise along Louisiana's coast caused by climate change may range between 1.4 to 2.7 feet during that time span. This makes the issue of prime importance to our residents.

This sea level rise estimate is consistent with recent scientific studies which forecast this change in our children's and grandchildren's lifetimes. This view is supported by a vast array of nonpartisan scientific associations, including the American Meteorological Society and the American Association for the Advancement of Science. Protecting coastal landscapes in the estuary is, therefore, very costly. These habitat types and the related restoration techniques are captured in detail in the CCMP under the Ecological Management Action Plans.

## Categories and Priority Habitat Types for Restoration

**Hydrologic Restoration and Management (EM-1)** can be effectively used for marshes and swamps.

The **goals** include:

- To improve wetland habitats negatively impacted by local hydrologic modifications
- To improve hydrology through the effectual use of the freshwater, sediments, and/or nutrients that already reach the basins
- To stabilize water levels and salinity to provide conditions conducive to the establishment and growth of emergent and submergent marsh plants

### Actions or Techniques

Earthen and rock plugs prevent unnatural tidal flow through abandoned canals, and water-control





*Hydrologic restoration projects often use water control structures to improve hydrology. Image: CWPPRA*

structures help regulate water and salinity levels. In some cases, large culverts are installed under roads, levees, or other obstructions that have impounded wetlands. (See EM-1 for additional information.)

**River Reintroductions (EM-2)** including the Freshwater Reintroduction into Bayou Lafourche (EM-3) can also be effectively used for restoring marshes, swamps, and drinking water quality.

The **goals** include:

- To use riverine resources of freshwater and sediment from the Mississippi and Atchafalaya Rivers in order to decrease salinities and preserve and/or create marshes
- To support and encourage reintroduction of Mississippi River flows into Bayou Lafourche in order to bring freshwater and sediments to the BTB marshes to help address coastal land loss and to ensure adequate consumptive freshwater supplies by combating saltwater intrusion

### **Actions or Techniques**

The river presents a great opportunity for rebuilding land but also the greatest challenges, as competing needs are inevitable. Controlled sediment diversions

route river water through strategic locations in the levees to feed starving marshes. Crevasses, or cuts, are constructed through levees to allow passive creation of smaller deltas. (See EM-2 and EM-3 for additional information.)

**Marsh Creation (EM-5)** projects that beneficially use dredged material are important for saving vanishing marshes.

The **goal** is:

- To make use of material when dredging activities or dedicated dredging occurs within or adjacent to the BTES in order to create, maintain, and/or restore marsh, coastal ridges, and islands

### **Actions or Techniques**

Open water is reclaimed into new or preexisting land. A pipeline dredge that removes sediment from a “borrow site” by using a specialized vessel outfitted with a drill, suction pump, and pipe moves sediment. As the drill, or cutterhead, spins, it agitates sediment at the bottom of the borrow site. This sediment is then pumped with water into a pipe that carries the resultant slurry to the restoration site. Once the slurry is in place, the water runs off as the sediment settles to form new land. Native vegetation is then installed

to jump-start wetland productivity. Marsh creation projects result in restored wetlands in areas that were open water just weeks before. This process uses dredged material for ecosystem restoration. (See EM-5 for additional information.)

## Barrier Islands and Shorelines

**Barrier islands and shorelines** (EM-5 and EM-6) require a host of methods to properly restore because these areas are exposed to moderate to high amounts of salt spray and abut the Gulf of Mexico. In addition, limited nutrient availability, substrate instability, and island evolution also affect restoration strategies.

The **goal** is:

- To preserve and restore barrier islands in order to protect environmental and economic resources

### Actions or Techniques

Sediment is dredged and pumped to the project site which is then vegetated with native dune and marsh plants. Sand fencing is used when needed or as funding is available.

Shorelines may also be protected by rock revetments, oyster reefs, concrete panels, and other fabricated materials have been constructed along otherwise

unstable shorelines to abate wave energy and reduce erosion. (See EM-5 and EM-6 for additional information.)

## Ridge Restoration

**Ridge Restoration (EM-4)** is important as it recreates habitat similar to what was once natural stranded beach ridges (“Cheniere” – French for “place of oaks”). These anthropogenic ridges create elevation above the surrounding marsh. These ridges are mostly four to five feet above sea level.

The **goal** is:

- To preserve and restore ridges in order to protect environmental and economic resources

### Actions or Techniques

Ridge restoration takes place when dredged sediment is used to reconstruct elevated ridges where trees can grow. The sediment is piled up into tall, linear features rather than spread out. The “crown” of the ridge is planted with native woody tree species selected for their hardiness and habitat value. A marsh “apron” is then constructed alongside the ridge to protect it and to provide additional wetland habitat. This, in general, is done by beneficially using dredged material (See EM-4 for additional information.)



*Barrier island restoration projects resemble construction sites. Image: CPRA*



## Terracing

**Terracing (EM-7)** can be used in shallow water areas near marshes.

The **goals** include:

- To trap or induce sediment deposits in order to maintain and restore existing marshes
- To create a landform that would act as a sediment trap to help build new land, reducing wave fetch and erosion on adjacent marsh shorelines, creating habitat for fish and waterfowl, and improving water quality to promote the growth of aquatic vegetation

### Actions or Techniques

Terraces are long, earthen berms that are built by mechanically dredging material and piling and shaping the material to a desired height. Most terraces average around three feet tall, with shallow side slopes and a wide base. This size and shape optimize the amount of terrace that falls in the intertidal zone and will support wetland vegetation. This process uses dredged material for ecosystem restoration. (See EM-6 for additional information.)

## Levees

**Levees (EM-7)** or man-made structures designed for flood protection are used to protect communities and other populated areas.

The **goal** is:

- To provide flood risk reduction measures for property, population centers, and ecosystems

### Actions or Techniques

Ecosystem restoration projects may be used in tandem with structural flood protection systems, such as levees. Levees provide a man-made engineered structure to provide storm protection for important infrastructure and people. (See EM-7 for additional information.)

## Flood Gates

**Flood Gates (EM-7)** protect communities and other populated areas by using adjustable gates to control water flow along rivers.

The **goal** is:

- To provide flood risk reduction measures for property, population centers, and ecosystems



*Levees provide flood risk reduction measures for property, population centers, and ecosystems. Photo: USACE*

# Morganza to the Gulf

## Levee Alignment and Structures

### Interim Flood Risk Reduction Project



Flood gates are an important part of levee systems. Image: TLCD

## Actions or Techniques

Flood gates engineered in conjunction with levees and ecosystem restoration provide protection to people in the event of hurricanes or spills. (See EM-7 for additional information.)

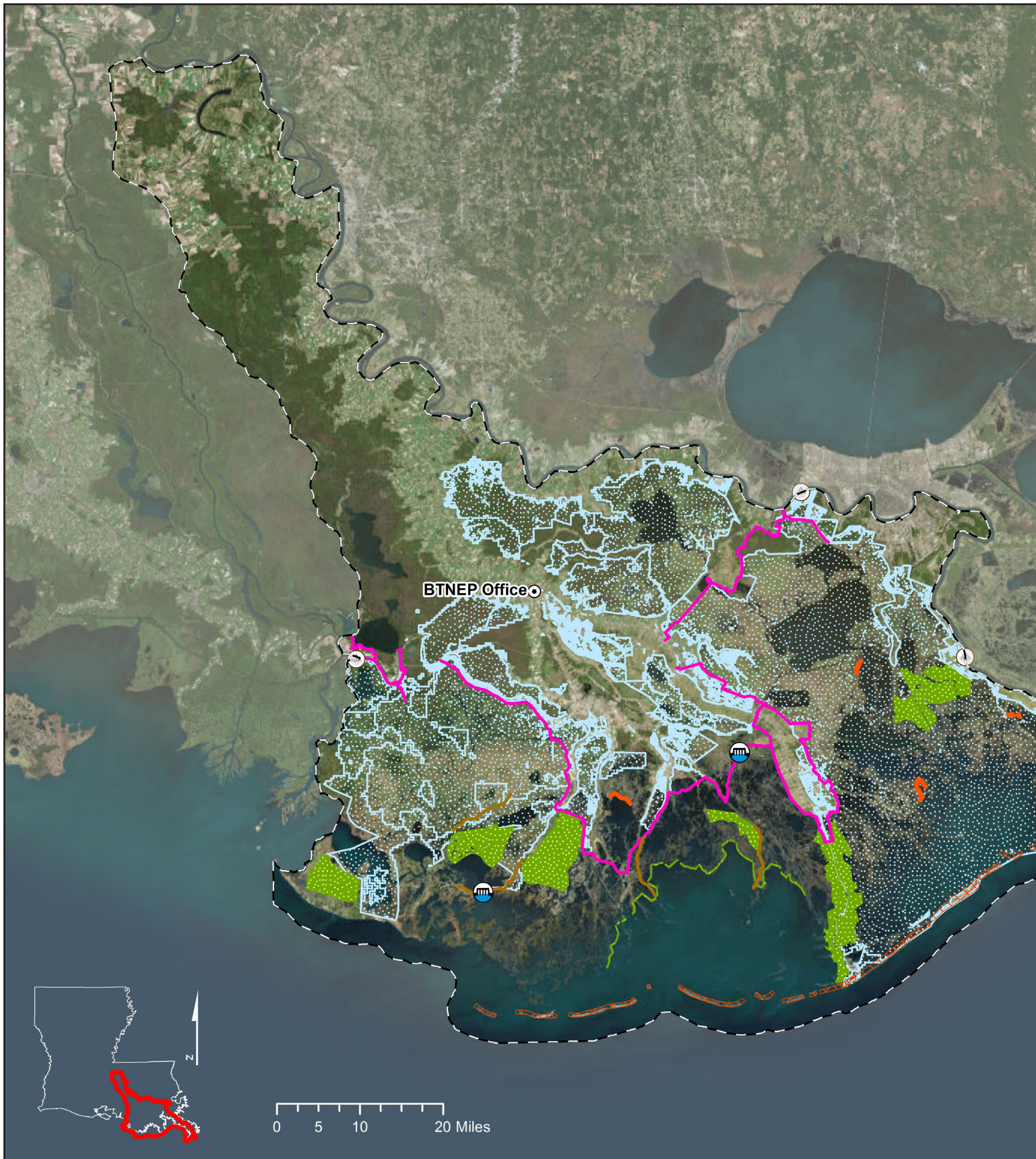
CPRA's 50-year plan for coastal restoration covers the entire coast of Louisiana. Fourteen of the sixteen BTES parishes are included in the plan; only Pointe Coupee and West Baton Rouge parishes are not in the plan. Ascension, Assumption, Iberia, Iberville, Jefferson, Lafourche, Orleans, Plaquemines, St. Charles, St. James, St. John the Baptist, St. Martin,

St. Mary, and Terrebonne parishes are all included in the plan. For more detailed information visit <http://coastal.la.gov>.

A general map of the proposed 50-year plan of projects in the CPRA 2017 Coastal Master Plan is provided on the following pages. These proposed projects are taken in the context of what might be created in the long term future should CPRA be able to secure funds.

Additionally, nonstructural measures are being encouraged by CPRA. These offer a flood mitigation alternative to structural measures by accommodating









floodwaters and either removing structures from harm's way or reducing risk to existing buildings and infrastructure by elevating them above flood waters. Nonstructural projects include flood-proofing commercial structures, elevating residential structures, and voluntary residential acquisition.

All of these efforts are carried out through partnerships between federal, state, and local agencies with assistance from private and nonprofit sectors and citizens.

In addition to these large scale restoration activities, BTNEP, working with BTEF and a host of BTNEP MC partners, performs a variety of smaller habitat restoration projects including but not limited to ridge restoration, species specific restoration, and water quality restoration activities. Water quality restoration plans are outlined in great detail in EM-8, EM-14, EM-17, and EM-18. These actions reflect an ongoing adaptation to land loss and climate change vulnerability.

Large scale ecosystem restoration projects proposed for the 50-year 2017 Coastal Master Plan

Habitat enhancement projects in the estuary generally involve working with both protection and restoration and can take place across multiple habitat types and numerous species. Many BTNEP MC members and partners work cooperatively to coordinate efforts to maximize benefits.