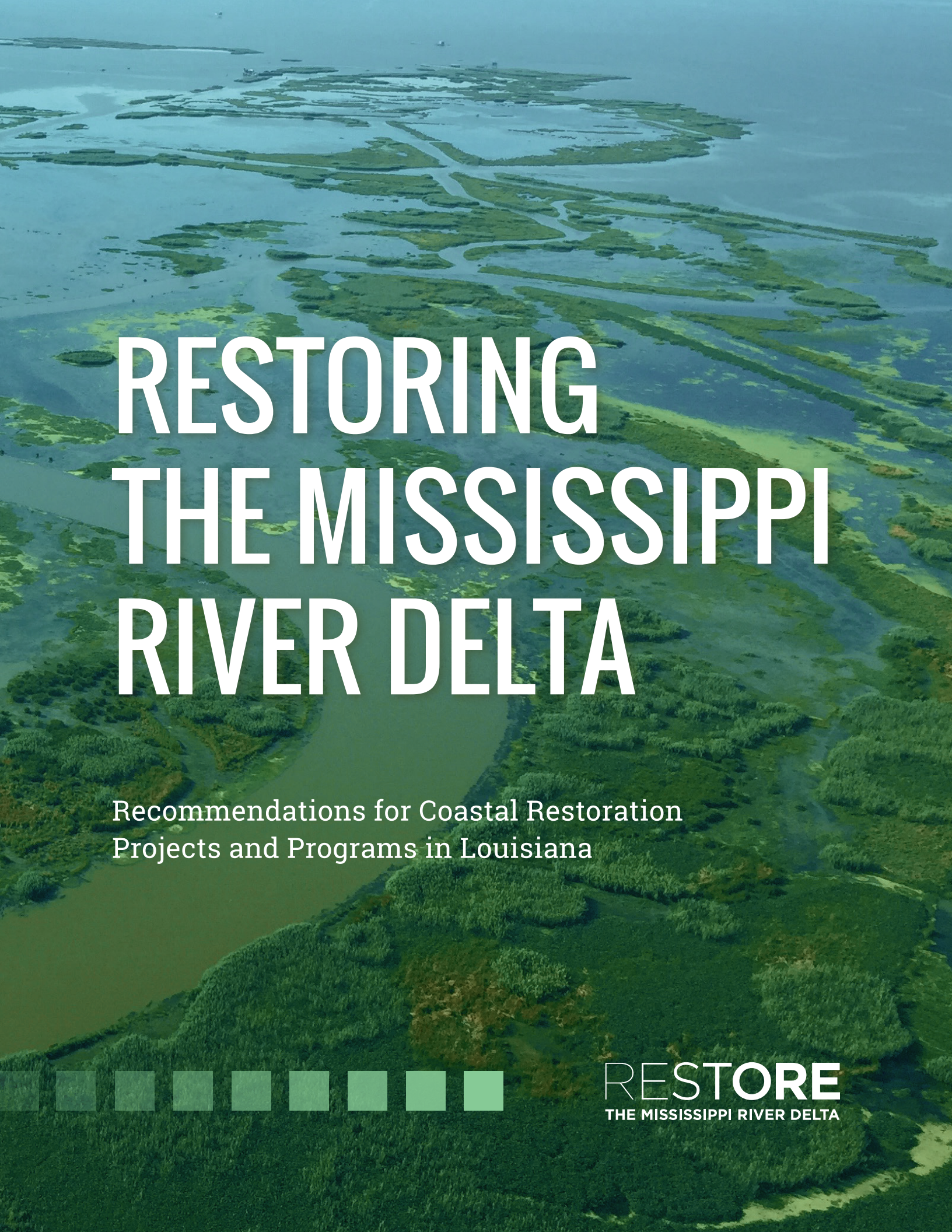

RESTORING THE MISSISSIPPI RIVER DELTA

Recommendations for Coastal Restoration Projects and Programs in Louisiana

RESTORE
THE MISSISSIPPI RIVER DELTA

What is the Mississippi River Delta?

For 7,000 years, the Mississippi River snaked across southern Louisiana, depositing sediment from 31 states and two Canadian provinces into the warm waters of the northern Gulf of Mexico. As this sand, silt and clay accumulated under water, plant communities began to develop, trapping more sediment and building land. The Mississippi River Delta includes the "Birdsfoot Delta" found at the mouth of the river, but extends far beyond to include the coastal plain of Louisiana, from the state of Mississippi to the east through the Atchafalaya Basin to the west. Extending to the Texas border is an area of coastal marsh known as the Chenier Plain which was also built indirectly with sediment from the Mississippi River.

RESTORE

THE MISSISSIPPI RIVER DELTA

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OUR VISION

Reconnect the Mississippi River to its delta to protect people, wildlife and jobs.

The Mississippi River Delta and coastal Louisiana provide unique and varied landscapes that offer an array of benefits to Louisiana, the Gulf Coast and the entire nation. Coastal Louisiana feeds and fuels the country, and its ports connect the United States to the world. The most important contributor to the ecological health of Louisiana's coast is the Mississippi River – the largest river in North America, which delivers fresh water and sediment that mix with the salty Gulf waters to create expansive estuaries that are the biological engines for the abundance of life found in coastal Louisiana.

Unfortunately, Louisiana's coast – including the Mississippi River Delta – is vanishing at an alarming rate. Since the 1930s, about 2,000 square miles of land have turned into open water – an area nearly the size of the state of Delaware.[v] *See "Causes of Louisiana Land Loss" on page 32 for more information.*

This loss poses a growing threat to some of the nation's most productive wildlife habitat, critical energy infrastructure, largest ports, busiest shipping corridors, leading commercial seafood producers, vibrant tourism economy and other important business sectors. Additionally, coastal Louisiana is home to more than two million people who make up a cultural fabric unlike anywhere else in the world.

Since the passage of the 2012 Coastal Master Plan and our coalition's first priority projects report, the state of Louisiana has made significant progress in advancing priority restoration projects, particularly a number of barrier island and marsh creation projects. The Caminada Headland Beach and Dune Restoration project, the largest restoration project in Louisiana's history, is complete, and the Large-Scale Barataria Marsh Creation project has restored or maintained 1,700 acres of marsh in the Barataria Basin.

With the recent unanimous passage of the 2017 Coastal Master Plan, and with significant revenue coming to Louisiana from the BP oil spill settlement and the Gulf of Mexico Energy Security Act (GOMESA), now is the time for state and federal decision makers, business leaders and the public to work together to quickly advance even more restoration projects and help avoid a future in which our state could lose an additional 2,250 square miles of land over the next 50 years.[iii]

Without swift, decisive action and bold, large-scale restoration efforts, our coastal land loss crisis will only worsen.

Restore the Mississippi River Delta has identified 17 projects in Louisiana's 2017 Coastal Master Plan that, if prioritized and implemented quickly, will help restore and maintain as much of Louisiana's coast as possible to achieve a resilient future not only for the people, wildlife and industries across the region – but also throughout the United States.

RESTORE
THE MISSISSIPPI RIVER DELTA

LOUISIANA'S 2017 COASTAL MASTER PLAN

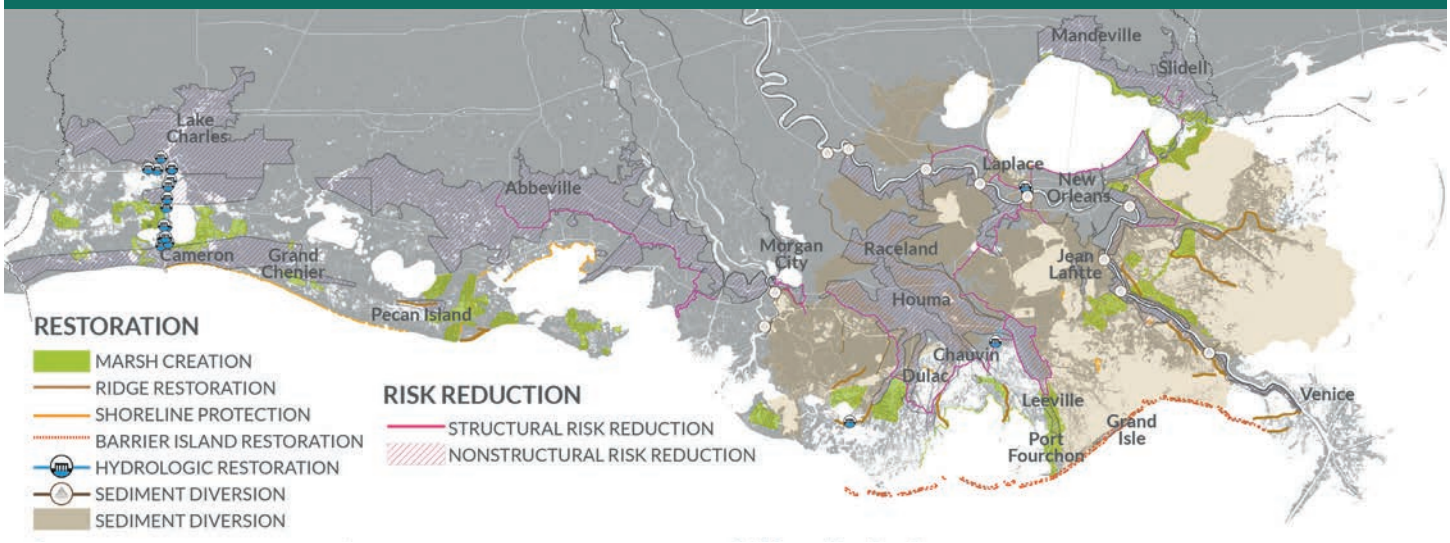
Louisiana's 2017 Master Plan for a Sustainable Coast (Coastal Master Plan) is the state's 50-year blueprint for large-scale restoration and protection of Louisiana's critical coastal areas. The plan, authored by the Louisiana Coastal Protection and Restoration Authority (CPRA), is updated every five years as required by law to account for evolving science and changing environmental conditions. It received unanimous, bipartisan support from both houses of the state Legislature.

Developed using a science-based and publicly informed process, the 2017 Coastal Master Plan recommends 124 restoration, protection and risk-reduction projects, to be implemented over the next 50 years, that maximize land building and reduce flood risk. These projects are expected to build or maintain more than 800 square miles of land compared to a future without action, reduce damages by $8.3 billion annually by year 50 and pay for themselves three times over throughout the course of implementing the plan.[iii]

In its 2017 plan, CPRA transitioned individual oyster reef restoration and barrier island restoration projects into "programs" rather than identifying specific projects to pursue and construct. Since the 2012 plan, barrier island restoration projects have enjoyed widespread success, with many projects being constructed in recent years. Although a few remaining barrier islands remain in queue for restoration, going forward, the program will focus on as-needed maintenance for these important ecological and risk-reduction features. Oyster reef projects, though smaller-scale, are sustainable features that grow and expand over time and also provide essential ecological and risk-reduction benefits. Both of these programs will receive funding on a case-by-case basis to implement projects across the coast.

2017 Coastal Master Plan

Credit: Louisiana Coastal Protection and Restoration Authority (CPRA)



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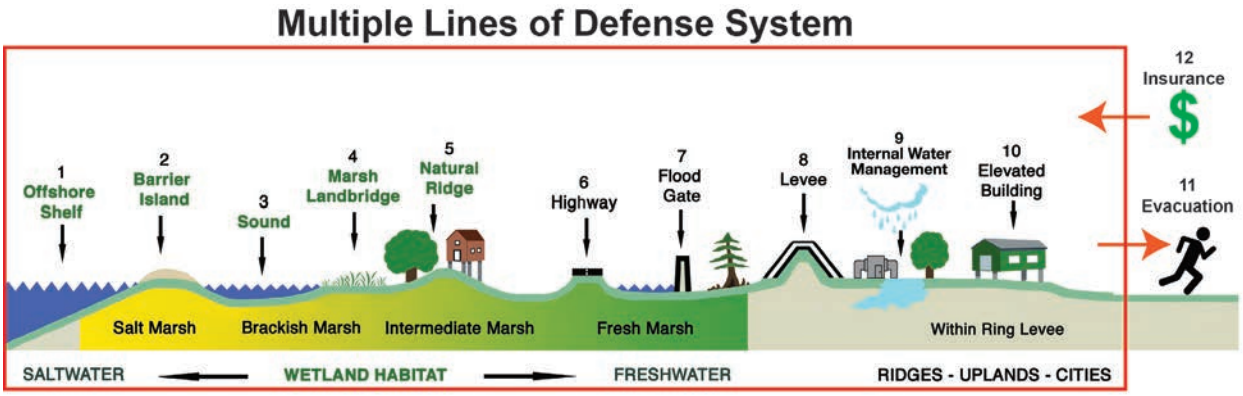

© John Lopez, Lake Pontchartrain Basin Foundation

The Coastal Master Plan combines projects that restore, build or maintain coastal wetlands with projects that provide enhanced risk reduction for coastal communities from storms and flooding. One of the benefits of restoration projects is that healthy wetlands and coastal areas serve as a crucial buffer for communities and industries from storm surge. This coastal buffer also increases the effectiveness and sustainability of risk-reduction measures, such as levees and floodwalls. This approach to storm protection – combining wetland restoration and natural land features with flood protection and risk reduction measures – is known as the "Multiple Lines of Defense Strategy." [vi.]

As seas continue to rise and land continues to sink, the 2017 Coastal Master Plan aims to create a sustainable future for coastal Louisiana and all the people, wildlife and industries that depend on it.


RESTORATION
SOLUTIONS

USING A FULL SUITE OF RESTORATION SOLUTIONS

There is no single restoration solution that will solve Louisiana's land loss crisis. Maintaining as much of Louisiana's coast as possible will require a suite of restoration projects and programs planned and operated together to maximize their effectiveness and benefits over time, allowing land to be built and sustained in a way that surpasses the benefits of any single project or project type.

Sediment Diversions

Sediment diversions mimic nature's historic land-building processes by using the power of the river to move sediment and fresh water from the river into nearby basins. This project type can not only build new land but also provide a sustainable source of sand and mud necessary to sustain and increase the health of existing wetlands over time. Sediment diversions can also re-establish or maintain the fresh end of the estuary, originally lost to saltwater intrusion, ensuring that the range of fresh to saltwater habitats that makes Louisiana's estuaries so productive persists into the future. Sediment diversions also help sustain nearby marsh creation, barrier island and ridge restoration projects.

Freshwater Diversions

Freshwater diversions restore the historic processes that once helped sustain wetlands by channeling fresh water from the river into nearby basins. This project type helps maintain and increase the health of existing wetlands over the long term by reducing saltwater intrusion, preventing the loss of highly productive freshwater marshes and swamps in the upper ends of the estuary. Freshwater diversions work with hydrologic restoration projects to maintain optimal salinities and lengthen the lifespan of marsh creation projects.

Hydrologic Restoration

Hydrologic restoration improves freshwater retention to reduce or prevent harmful saltwater intrusion. These projects control salinity levels, preventing the die-off of freshwater plants and trees. Hydrologic restoration projects can also help maintain optimal salinities needed for the success of other restoration types, such as oyster reef and marsh creation projects.

What is an estuary?

Estuaries are found where a river meets the sea and fresh water mixes with saltier waters. A healthy estuary contains a range of habitat types and landscape features. Habitats tend to shift from the fresher areas in the landward parts of an estuarine basin (bottomland hardwoods, swamps and fresh marsh) to the intermediate and more saltwater-dominated habitats closer to the Gulf (intermediate, brackish and saline marsh and mangroves.)

Marsh Creation

Marsh creation or "dredging" uses sediment from the Mississippi River, nearby water bottoms or offshore shoals to build land in shallow, open water areas, typically where land has been lost. These projects can build land fairly quickly, but will eventually fall victim to the same process that caused the land to disappear originally. This type of project can be used in conjunction with sediment diversions to trap sediment, and sediment diversions can lengthen the lifespan of marsh creation projects by providing a continual source of sediment to the subsiding marsh surface.

Ridge Restoration

A ridge is a strip of land, usually a remnant of the bank of an abandoned bayou or stream, which is naturally elevated above the marsh surface and typically populated with trees. Restoring ridges can protect important habitat, provide storm surge protection to nearby communities and help prevent saltwater intrusion into freshwater wetlands. Ridge restoration projects can work with hydrologic restoration projects to reestablish historic salinities within the basin, reduce shoreline erosion of marsh creation projects and trap sediment from sediment diversions to help build land more quickly.

Barrier Island and Headland Restoration

Barrier islands and headlands are an essential first line of defense against storms. These projects use sand to rebuild and restore beaches and dunes, creating or enhancing important wildlife and shorebird habitats and sheltering inland wetlands from erosion. Barrier island restoration can also increase the lifespan of marsh creation projects by providing a buffer against wave action and tidal flows.

Oyster Reef Restoration

Oyster reef restoration uses natural and man-made materials to encourage the establishment of oysters to create living shorelines. Oyster reefs have the advantage of long-term sustainability, continuing to grow vertically to offset relative sea level rise, while providing significant fisheries habitat and improving water quality. Robust oyster reefs can reduce waves on adjacent wetlands, thereby reducing erosion on marsh creation and barrier island restoration projects.

The Coastal Master Plan's **124 restoration and protection projects** are expected to build or maintain more than **800 square miles of land** and reduce damages by **$8.3 billion** annually by year 50.[iii]

PRIORITY PROJECT SELECTION

The 2017 Coastal Master Plan contains 79 restoration projects to be implemented over the next 50 years. In order to prioritize these projects, our coalition has developed this recommended list of 17 projects that should be implemented in the near term to build and maintain our critical coastal land.

In order to make informed decisions about what to include on this updated priority project list, we evaluated each project against five key objectives:

1. Projects that are large-scale and work together to significantly increase the coastal landscape compared to a future without action
2. Projects that restore natural ecosystem functions, with emphasis on utilizing deltaic processes
3. Projects that enhance ecosystem services, specifically contributions to community resilience and species diversity and abundance
4. Projects that are sustainable and robust in the face of climate change
5. Projects that are reasonably implementable in the next 3-5 years and projects that should see acceleration of Engineering & Design timelines in order to be implemented as soon as construction funding becomes available

After these objectives were developed, our technical staff created a robust evaluation process which could be applied to all the projects in the Master Plan. The results from this analysis helped inform our final priority project list.

Project Synergies: Working Together to Maximize Restoration and Protection

To address Louisiana's land loss crisis, we need projects working together to create "synergies," or benefits achieved by two or more projects working in tandem.

A prime example of a project synergy is the relationship between sediment diversions and marsh creation projects.

Sediment diversions and marsh creation projects each have their own unique benefits. Marsh creation projects can build land fairly quickly, but these projects are costly and, without a regular replenishment of sediment, these created marshes will begin to sink and erode. On the other hand, sediment diversions may take time to build land, but will provide a necessary source of sediment that will build and maintain land into the future.

Marsh creation projects will degrade over time largely due to subsidence, sea level rise and erosion. When paired together, sediment diversions provide valuable sediment to the surface of the marsh that helps the marsh combat these degrading forces and increase the sustainability of these wetlands. This synergy between sediment diversion and marsh creation projects can add years to the life of man-made marshes and accelerate the land-building process from both projects.

Louisiana accounts for **80% OF TOTAL COASTAL WETLAND LOSS** in the U.S.[ii]

Projects in the 2017 Coastal Master Plan will reduce expected annual **STORM SURGE FLOODING DAMAGES**, which could exceed **$150 billion** over the next 50 years without the Master Plan.[iii]

Restoring a Naturally Functioning and Sustainable Delta

The technical team evaluated each basin for the suite of projects that achieved the greatest long-term benefits, while also favoring projects that use the river as a resource to build and maintain land and improve the health of the entire ecosystem. The team considered reestablishing natural processes or historic conditions as a cornerstone to improving the health of an entire basin. This is important, as the estuary where the Mississippi River meets the Gulf of Mexico is one of the most productive in the world.

Protecting Habitats with Natural Landscape Features

Landscape features such as natural levees, ridges, distributaries, barrier islands and landbridges help dictate how habitat types are distributed throughout the basin and can be key to maintaining the integrity of an estuary. For instance, barrier islands in Barataria Basin provide protection to marshes from erosion by waves and storm surge. Without these features, wetland loss rates in the basin would increase dramatically.

Advancing Coastal Restoration in the Face of Climate Change

Coastal Louisiana is not a static landscape. It includes very different regions and ecosystems in constant states of flux. In areas dominated by the influence of the river, land builds. In areas dominated by the influence of the sea, land erodes. A future for coastal Louisiana without large-scale restoration would result in victory by the sea and the near complete loss of the region's ecologically and economically diverse and significant coastal areas.

2012 PRIORITY PROJECT SUCCESSES

A number of our priority projects have advanced since our original 2012 report. The Mid-Barataria and Mid-Breton Sediment Diversions and East Maurepas and Increase Atchafalaya Flow to Terrebonne Diversions are currently in Planning and Engineering & Design phases. Calcasieu Ship Channel Salinity Control Measures and the Houma Navigational Canal (HNC) Lock have had funding identified and secured for future implementation and construction. The HNC Lock was also moved into the "Future Without Action" for the 2017 Coastal Master Plan analysis, indicating it is advancing toward construction and is considered part of the baseline analysis for evaluating other Master Plan projects. Thus, the advancing HNC Lock project has been removed from our priority project list.

Some of the most impressive progress in restoration over the past few years has been in barrier island and headland restoration projects, resulting in CPRA transitioning this restoration project type into a "program." Restoration of the Barataria Pass to Sandy Point barrier island chain will be complete once West Grand Terre is restored. Once restoration of Caillou Lake Headlands is complete, over three-quarters of the Isles Dernieres will have been restored. The beach and dune areas of the Belle Pass to Caminada Pass barrier island chain have been restored, and the back barrier marsh restoration projects are currently being developed. Over $200 million has been invested in Caminada Headland Beach and Dune restoration.[iii] The barrier island program will focus on as-needed maintenance for these important ecological and risk reduction features.

CPRA has been able to leverage funding from the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast Act (RESTORE Act), Natural Resource Damage Assessment (NRDA), National Fish & Wildlife Foundation (NFWF) and Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) to design and construct parts of the New Orleans East Landbridge Restoration, Large-Scale Barataria Marsh Creation, Golden Triangle Marsh Creation, Biloxi Marsh Oyster Reef Restoration and Bayou la Loutre Ridge Restoration projects. *See "Funding Restoration" on page 28 for descriptions of these funding sources.*

Two additional projects on our 2012 Priority Project list were not included in the 2017 Coastal Master Plan: Lower Barataria Sediment Diversion and Gulf Shoreline Protection and Freshwater Bayou to Southwest Pass. These projects, although important, were deemed too vulnerable to sea level rise and did not make it through CPRA's rigorous analysis.

See "2012 Priority Project Progress" on page 34 for more information.

The growing **WATER MANAGEMENT SECTOR** - which includes coastal restoration, coastal protection and urban water management - is the **#1 DRIVER OF JOBS IN SOUTHEAST LOUISIANA** and **#2 ACROSS THE ENTIRE COASTAL ZONE.**[viii]

Nearly **60,000 JOBS** will be supported by investments in coastal restoration and protection **OVER THE NEXT 10 YEARS.**[iii]

OUR PRIORITY PROJECTS

Our updated list of 17 priority projects encompasses a wide variety of project types, including sediment and freshwater diversions, hydrologic restoration, marsh creation and ridge restoration. We have also selected two programmatic priorities from the 2017 Coastal Master Plan, including barrier island restoration and oyster reef restoration.

These projects and programs are grouped within five distinct basins across coastal Louisiana and advance critical restoration priorities that have benefits to the entire ecosystem.

PONTCHARTRAIN-MAUREPAS BASIN PROJECTS

The Pontchartrain-Maurepas Basin is dominated by three large estuarine lakes that are connected by tidal passes, with a fresh-to-salt gradient that runs from west to east. Coastal habitats in the basin include freshwater bottomland hardwood and swamp forest, and fresh, brackish and saltwater marshes. In the upper basin, the swamps are cut off from the nourishing fresh water, nutrients and sediment of the Mississippi River by levees installed for flood protection and navigation. Because of this and the Mississippi River Gulf Outlet (MRGO) shipping channel, these swamps have suffered from saltwater intrusion and are sinking and converting into marsh and open water. Although the MRGO was closed in 2009, restoration of the vast damage due to the MRGO has not been done, and nearby wetlands continue to suffer losses. The freshwater swamps once found in the lower basin have almost completely disappeared due to the lack of river water.

In the upper basin, Union Freshwater Diversion, East Maurepas Freshwater Diversion and Manchac Landbridge Diversion provide fresh water and sediment to the Maurepas Landbridge, which separates Lakes Maurepas and Pontchartrain and provides critical storm surge protection to surrounding communities, including Louisiana's capital of Baton Rouge. In the lower basin, Central Wetlands Diversion will divert fresh water and sediment to the surrounding wetlands. Together, these diversion projects help to prevent the three lakes from becoming a single arm of the Gulf and provide storm surge protection for millions of people. The diversions will also help strengthen and maintain the marsh creation projects, New Orleans East Landbridge Restoration and Golden Triangle Marsh Creation. These marshes will provide important habitat for birds, fish and wildlife and help buffer the new surge barrier on the east side of Lake Borgne.

1 **Central Wetlands Diversion**

2 **East Maurepas Diversion**

3 **Manchac Landbridge Diversion**

4 **Union Freshwater Diversion**

5 **Golden Triangle Marsh Creation**

6 **New Orleans East Landbridge Restoration**

Central Wetlands Diversion

This diversion will benefit the Central Wetlands Unit ecosystem east of New Orleans, an area destroyed by logging and by saltwater intrusion from the now-closed Mississippi River Gulf Outlet (MRGO). Once primarily a freshwater system dominated by bald cypress swamp and freshwater marsh, the predominant habitat type today is brackish marsh. Regional MRGO-area ecosystem restoration will help rebuild and sustain marsh and swamp, providing storm surge protection for New Orleans and nearby communities.

East Maurepas Diversion

Also known as Mississippi River Reintroduction into Maurepas Swamp, this diversion, planned near Angelina, will provide sediment and fresh water to existing wetlands in East Maurepas swamp. Dominated by bald cypress and water tupelo trees, the Maurepas swamp complex is one of the largest forested wetlands in the nation. However, levees constructed along the river have isolated the area from spring floods and the vital fresh water, nutrients and sediment they bring. This isolation, coupled with rising salinities throughout the Pontchartrain Basin while the MRGO was open, has left the swamp in a state of rapid decline – trees are dying, and young trees are not growing to replace them. The East Maurepas Diversion will benefit the swamp by reconnecting it with the river, aiding the prevention of further wetland loss and the conversion of swamps to marshes, as well as helping to offset future increases in salinity throughout the western Pontchartrain Basin. The fine grain sediment may also increase elevation to a point where there are periods without inundation so that seeds can germinate, perpetuating the forest into the future.

Manchac Landbridge Diversion

Manchac Landbridge Diversion will be constructed within the existing western guide levee of the Bonnet Carre Spillway. Currently, when the Bonnet Carre Spillway is opened to reduce river flood risk in New Orleans, all of the sediment, fresh water and nutrients are directed into Lake Pontchartrain, wasting these vital resources and causing water quality issues. The Manchac Diversion will direct some of these flows into degraded swamps and marshes adjacent to the spillway to increase nutrient input and improve water quality, fostering vegetation growth. Located near Lakes Pontchartrain and Maurepas, the diversion will benefit a variety of habitats, from freshwater forests to brackish marsh. The restoration of these habitats will help St. Charles and St. John the Baptist parishes become more resilient to flooding and storms. The Manchac landbridge is identified by the Army Corps of Engineers (Corps) as a vital landscape feature that serves as a critical line of defense from storm surge for nearly 1.5 million people in eight parishes, especially the Greater Baton Rouge region, but also including the cities of New Orleans, Laplace, Madisonville, Mandeville and Slidell.

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Union Freshwater Diversion

Union Freshwater Diversion will convey fresh water from the Mississippi River into West Maurepas swamp near Burnside. Nutrient-rich freshwater inputs to the fresh-forested, flotant and freshwater marsh environments will prevent saltwater intrusion and encourage vegetation growth. The diversion will also convey fine sediment to nourish existing wetlands or create new wetlands in Maurepas swamp. Ascension, Livingston, St. James and St. John the Baptist parishes are all expected to receive flood-reduction benefits from this project. The fine grain sediment may also increase elevation to a point where there are periods without inundation so that seeds can germinate, perpetuating the forest into the future.

Golden Triangle Marsh Creation

This marsh creation project is located near the confluence of two major navigation and shipping channels — the Mississippi River Gulf Outlet (MRGO) and the Gulf Intracoastal Waterway. Dominated by brackish marsh, this area was badly damaged by saltwater intrusion and erosion following the dredging of the MRGO. This project will use sediment to create and restore marsh. The restored marsh will help buffer the recently constructed surge barrier, protecting some of the most populated areas of New Orleans, and will eventually provide important estuarine habitat for Lake Borgne.

New Orleans East Landbridge Restoration

This large-scale marsh creation project is located in eastern New Orleans on a landbridge separating Lake Pontchartrain from Lake Borgne, which is the major control on the potential flow of hurricane surge into Lake Pontchartrain. The exposure to wave energy and storm surge has resulted in rapid retreat of the shoreline and the expansion of ponds and lakes within the marsh. The New Orleans East Landbridge Restoration project will create and restore marsh via a sediment conveyance pipeline. The project area includes the Fort Pike State Historic Site, U.S. Highway 90 and the Bayou Sauvage National Wildlife Refuge, the largest urban refuge in the nation, which provides significant estuarine habitat. The New Orleans East Landbridge is identified by the Corps as a critical landscape feature that serves as a crucial line of defense from storm surge for nearly 1.5 million people in eight parishes, including the cities of New Orleans, Laplace, Madisonville, Mandeville and Slidell.

What is a basin?

A basin is an area that is hydrologically connected, such as a river basin, lake basin or drainage basin. In the Mississippi River Delta, large basins are separated by hydrologic barriers, or landscape features, that do not allow water to cross from one side to the other. For example, the Mississippi River and its levee system create a hydrologic barrier between the Breton Sound Basin on the east and the Barataria Basin on the west. Other major basins in the Mississippi River Delta include the Pontchartrain Basin, Terrebonne Basin and Atchafalaya Basin.

BRETON-CHANDELEUR BASIN PROJECTS

The Breton-Chandeleur Basin is a marsh and adjacent sound bordered on the southeast by remnants of the Chandeleur barrier island chain and on the west by the Mississippi River. Habitats in the basin range from freshwater forests to barrier island habitat. Marshes in the mid-part of the basin have been starved of sediment for almost a century and have some of the highest recent marsh loss rates along the coast. In contrast, some portions of marshes in the lower basin periodically receive fresh water and sediment from the river during high flows and have much lower rates of loss.

The priority projects selected for this basin reintroduce sediment and freshwater flows from the river to slow the rate of land loss, strengthen soils and build new land in the mid-basin (Mid-Breton Sediment Diversion) and in the lower basin (Lower Breton Sediment Diversion.) The ridge restoration projects (Bayou Terre aux Boeufs and Bayou la Loutre) will provide natural, structural protection by reducing wave and wind energy and buffering storm surge. Together, the diversions and ridges will prolong the life of the surrounding marshes while providing unique habitat for migratory birds.

1 **Lower Breton Sediment Diversion**

2 **Mid-Breton Sediment Diversion**

3 **Breton Ridge Restoration: Bayou Terre aux Boeufs**

4 **Breton Ridge Restoration: Bayou la Loutre**

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Lower Breton Sediment Diversion

This sediment diversion project is planned for lower Breton Sound along the east bank of the Mississippi River, likely across from Port Sulphur. Below the reach of the federal, man-made levees on the east bank, the brackish and salt marshes in the influence area have low rates of loss relative to many other parts of the coast. These low rates of land loss may be attributed to the sediment and fresh water these marshes periodically receive when the river overtops the banks during high flows. This project will divert sediment and fresh water into the basin to build new land, maintain existing marshes and increase the resiliency of the influence area to sea level rise and storm events.

Mid-Breton Sediment Diversion

To be located along the east bank of the Mississippi River near Wills Point and upriver of the White Ditch siphon, this sediment diversion will convey fresh water and sediment into deteriorating marshes that drain into middle Breton-Chandeleur Basin. The swamps and marshes in the influence area have disappeared due to a combination of changes in the supply and distribution of fresh water, subsidence, saltwater intrusion, sediment starvation and storm events. This project will reconnect the influence area with the river and divert sediment and fresh water, building new land and sustaining existing marsh. If built in coordination with other projects in the basin, such as the Lower Breton Sediment Diversion and the Bayou Terre aux Boeufs Ridge Restoration, the Mid-Breton Sediment Diversion could build land more quickly. Additional benefits of this project include storm surge buffering for Plaquemines Parish.

Coastal Louisiana is home to a number of federally **ENDANGERED OR THREATENED ANIMALS**, such as the Louisiana black bear, piping plover and green sea turtle, that struggle to survive in the remaining coastal habitat.

The total cost of **NOT PURSUING SIGNIFICANT COASTAL RESTORATION** in Louisiana could reach **$133 billion.**[iii]

Breton Ridge Restoration: Bayou Terre aux Boeufs & Bayou la Loutre

Breton Ridge Restoration includes the restoration of two historic ridges on either side of the Mississippi River Gulf Outlet (MRGO).

Bayou Terre aux Boeufs stretches from Delacroix to Black Bay and has historically helped buffer storm surges for St. Bernard and Plaquemines parish communities and provided critical habitat for migratory birds and other wildlife. Severe erosion around the ridge and adjacent marsh has resulted in a loss and narrowing of the ridge. Subsidence of the ridge and saltwater intrusion has killed most of the trees on the ridge. This restoration will raise the ridge to an elevation of five feet to provide coastal upland habitat, restore natural hydrology, and provide wave and storm surge attenuation.

Bayou la Loutre begins in Yscloskey and extends into the southeastern Biloxi marshes. Bayou la Loutre ridge is actually two parallel natural levees flanking old Bayou la Loutre (Otter Bayou), which is part of the structural underpinning of the Biloxi marshes. Construction of the MRGO breached the ridges, dramatically altering the hydrology of the area and leading to saltwater intrusion and extensive wetland loss. The rock dam built across the MRGO in 2009 helped restore the hydrology but not the actual, previously lost marsh or ridge habitat. The ridge has suffered from subsidence, saltwater intrusion and canal breaches. The project will use dredged sediment, likely from Bayou la Loutre, to reestablish the ridge. This will add elevation to the ridge and help improve hydrology, provide storm surge protection, decrease saltwater intrusion and provide important resting habitat for migratory birds.

320 different species of birds call coastal Louisiana home.[vii.]

Louisiana's coastal region provides critical breeding, wintering and migratory stopover habitat for **100 million birds** each year.[i.]

BARATARIA BASIN PROJECTS

The Barataria Basin is one of the nation's most productive estuaries. The basin is bounded on the north and east sides by man-made levees along the Mississippi River, to the west by Bayou Lafourche and to the south by barrier islands. The ecosystems in the Barataria Basin provide a vital storm surge buffer for communities on the west bank of the river and in Plaquemines Parish.

The basin hosts a variety of coastal habitats, including bottomland hardwood forests, swamps, marshes ranging from fresh to saltwater, bays and barrier islands. The basin also contains the Barataria Preserve, which is the only natural area on the Louisiana coast that is part of the National Park system.

Starved of sediment, habitats throughout the estuary system are collapsing. In the upper basin, cypress trees stand in stagnant waters, too deep for new trees to sprout, while freshwater marshes are converting to floating peat in the absence of a sediment source. The sediment-starved marshes in the mid-basin have all but disintegrated.

The priority projects chosen for this basin include two sediment diversions, Mid-Barataria and Ama, and the rebuilding of a key marsh area in the mid-basin via the Large-scale Barataria Marsh Creation project. The marsh creation will accelerate land building from the diversions, and the diversions will maintain and create a diversity of wetland types over time. These projects can work in concert to protect the upper basin's freshwater wetlands, enhance storm surge protection and reintroduce annual infusions of fresh water, sediment and nutrients to build land and sustain existing wetlands throughout the basin.

1 **Ama Sediment Diversion**

2 **Mid-Barataria Sediment Diversion**

3 **Large-Scale Barataria Marsh Creation**

Ama Diversion

The Ama Sediment Diversion will divert sediment, nutrients and fresh water from the Mississippi River to existing wetlands in the upper Barataria Basin and will also likely benefit marsh creation projects further down in the basin. The project will build and sustain wetland forests, fresh marsh and intermediate marsh by increasing sediment input, water flow and nutrients in the basin. Land building by the diversion will likely be accelerated by the presence of the Large-Scale Barataria Marsh Creation and Mid-Barataria Sediment Diversion projects. The Ama Sediment Diversion project is still conceptual but will ultimately be constructed near Ama.

Mid-Barataria Sediment Diversion

This sediment diversion is located along the west bank of the Mississippi River near Myrtle Grove. The brackish and freshwater wetlands in the influence area are highly degraded due to a combination of saltwater intrusion, decreased fresh water supply, alterations to the natural hydrology of the area and a lack of sediment input. This project will reconnect the river to the influence area and divert sediment, nutrients and fresh water to build new land, maintain existing marshes and increase habitat resiliency to sea level rise and storm events. Project synergies with marsh creation projects in the influence area of the diversion create the potential for hundreds of acres of restored wetlands to be enhanced by the Mid-Barataria Sediment Diversion as soon as it is constructed and operated.

Large-Scale Barataria Marsh Creation

This marsh creation project is located in Barataria Bay near Lafitte. Historically, only a limited hydrological connection existed between the fresher upper basin and the saltier lower basin. Canal networks, erosion and subsidence have severely degraded the natural barriers between the upper and lower basin, exposing freshwater wetlands to saltwater intrusion and increased wave energy. This project will continue to build on its components that are already in place or under construction to strengthen the Barataria Landbridge, such as Bayou Dupont Marsh Creation project, the Long-Distance Sediment Pipeline project, the Northwest Turtle Bay Marsh Creation project and the Barataria Basin Landbridge Shoreline Protection project. Sediment conveyed from the river through a pipeline will be used to build new marsh, nourish existing marsh in the area, help restore historic salinities in the upper basin and provide benefits to the nearby community of Lafitte, by buffering storm surge and tidal flooding.

TERREBONNE-ATCHAFALAYA BASIN PROJECTS

The Terrebonne and Atchafalaya basins occupy the central coast of Louisiana. The Terrebonne-Atchafalaya Basin has the highest rate of land loss in Louisiana, making the need to rebuild these coastal wetlands even more urgent. The area is bordered to the east by Bayou Lafourche, a former outlet of the Mississippi River, and to the west by the Chenier Plain. The basin includes the growing Wax Lake and Atchafalaya deltas of the Atchafalaya River, which is the largest remaining natural distributary of the Mississippi River. However, in Terrebonne Bay, on the eastern side of the basin, wetlands are collapsing and becoming open water as the sediment-starved land sinks and salt water intrudes into freshwater wetlands. Habitats in this basin include bottomland hardwood forests, swamps, barrier islands and freshwater, brackish and saltwater marsh.

The priority projects selected for this basin focus on reestablishing a balance of fresh and salt water as well as sediment and nutrient distribution. To accomplish this goal, the Increase Atchafalaya Flow to Terrebonne Diversion project will take advantage of the Atchafalaya River and the Intracoastal Waterway to move fresh water and sediment eastward. This project will work in conjunction with the Houma Navigational Canal Lock, a successful 2012 priority project that is moving toward construction, to reintroduce and increase the retention of fresh water into Terrebonne's marshes. Atchafalaya River Sediment Diversion will also direct sediment and fresh water to marshes in southwest Terrebonne, restoring freshwater flows and habitats. Both diversions will provide freshwater inputs and some sediment to the Terrebonne Ridge Restoration, which will create maritime forest, improve water quality and protect marsh from storm surge and wind energy. All three of these projects will help fight saltwater intrusion by restoring freshwater inputs and natural hydrologic patterns.

1 **Atchafalaya River Sediment Diversion**

2 **Increase Atchafalaya Flow to Terrebonne Diversion**

3 **Terrebonne Ridge Restoration: Mauvais Bois**

4 **Terrebonne Ridge Restoration: Bayou DuLarge**

Atchafalaya River Sediment Diversion

To be constructed off the Atchafalaya River, the Atchafalaya River Sediment Diversion will provide basin-wide benefits to marshes in southwest Terrebonne Parish. Sediment and fresh water diverted into the marshes will help build land and sustain other nearby projects planned for construction, like Mauvais Bois Ridge Restoration. This project will have the greatest benefits to freshwater habitats, such as forested areas, flotant and fresh and intermediate marsh, which are threatened by saltwater intrusion and sediment starvation.

Increase Atchafalaya Flow to Terrebonne Diversion

This hydrologic diversion project stretches from the Atchafalaya River to the Houma Navigation Canal, which is part of the Gulf Intracoastal Waterway system. The marshes in the influence area are nearly an equal distance from the Mississippi and Atchafalaya rivers and are blocked from significant amounts of river water and sediment. These marshes have been rapidly converted to open water because of saltwater intrusion and sediment starvation. This project would dredge and deepen a portion of the Gulf Intracoastal Waterway to increase the flow of fresh water from the Atchafalaya River to help sustain Terrebonne marsh. Additional benefits from this project include using the dredged material to create marsh and increase flow capacity using two southern-flowing canals (Minor's and Bayou Copasaw.)

Terrebonne Ridge Restoration: Mauvais Bois & Bayou DuLarge

This project will restore the historic Mauvais Bois and Bayou DuLarge Ridges located in Terrebonne Parish near Lake Mechant and Caillou Lake. The project will restore and construct maritime forest in the lower Terrebonne marshes by using dredged sediment to increase the elevation of the relict ridges. Both ridges will help restore historic hydrologic patterns and reduce saltwater intrusion. They will also buffer storm surge and wind energy for inland communities. Two diversions, Atchafalaya River Diversion and Increase Atchafalaya Flow to Terrebonne, will work synergistically with these ridges to restore natural ecosystem processes in the area, including patterns of freshwater flows, salinities and land building.

CHENIER PLAIN PROJECTS

The Chenier Plain in southwestern Louisiana was built by sediment drifting westward over the last 7,000 years from the shifting deltaic lobes of the Mississippi River as well as the Atchafalaya River distributary. Cycles of shoreline erosion and sediment deposition built ridges, or cheniers, running east-west between wide expanses of marsh. Sediment transport westward along the coast from both the Atchafalaya and Mississippi rivers has been limited by coastal infrastructure.

The Chenier Plain is characterized by fresh to brackish marshes and interior lakes that are fed by the Vermilion, Mermentau, Calcasieu and Sabine rivers. But for decades, navigation features, such as the Calcasieu Ship Channel, Sabine Waterway, the Mermentau Navigation Channel and the Freshwater Bayou Canal, have allowed salt water from the Gulf to penetrate formerly freshwater marshes. Today, the Chenier Plain is being overwhelmed by saltwater intrusion, leading to widespread marsh loss, while the jetty systems of the many navigation channels have interrupted the flow of sediment from east to west.

The priority projects chosen in this basin include Calcasieu Ship Channel Salinity Control Measures Hydrologic Restoration, which focuses on increasing sustainability of the basin by reducing tidal action and interior salinity to marshes and water bodies adjacent to Calcasieu Ship Channel. In addition, Freshwater Bayou North Marsh Creation project will build land quickly, creating critical wetland habitat and maintaining hydrologic barriers between inland lakes and navigation channels.

1 **Calcasieu Ship Channel Salinity Control Measures Hydrologic Restoration**

2 **Freshwater Bayou North Marsh Creation**

Calcasieu Ship Channel Salinity Control Measures Hydrologic Restoration

The Calcasieu Ship Channel, which connects the Gulf of Mexico to Calcasieu Lake, is located within the Chenier Plain. The once stable platform of the Chenier Plain has experienced decades of dredging navigation canals, which has dramatically changed the hydrology of the system. Saltwater intrusion led to the extensive loss of freshwater marshes, increasing the threat of storm surge to communities. This project will aim to isolate the ship channel through a network of dike and sill structures designed to limit saltwater intrusion through the Calcasieu Ship Channel and into adjacent marshes. This project will also support storm surge protection by increasing the sustainability of adjacent marshes and dissipating wave energy and tidal flows within the ship channel.

Freshwater Bayou North Marsh Creation

Freshwater Bayou North Marsh Creation is planned for Vermilion Parish, just west of Freshwater Bayou and north of the bayou locks. The project is one of the largest and fastest land-building priority projects, projected to build around 9,000 acres upon construction. It will restore marshes degraded by hurricanes Rita, Gustav and Ike and prevent Freshwater Bayou from continuing to enlarge and further erode interior marshes. Sediment will be delivered via pipeline to the site from either the Gulf of Mexico or the Freshwater Bayou Canal. The newly created marsh will protect against storm surge, wave energy and flooding. It will also foster nutrient transport, vegetation growth and soil accretion, helping set the marsh on a path to rebuilding rather than washing away.

The five lower Mississippi River ports handle more than **500 MILLION TONS** of domestic and foreign cargo annually, accounting for **20 PERCENT** of all U.S. waterborne commerce.[iv]

PROGRAMMATIC PRIORITIES

Beyond specific projects outlined as recommended priorities, CPRA is also advancing its new restoration programs – barrier islands and oyster reef restoration – that we also support as essential tools in the restoration toolkit. Although there are not specific barrier island or oyster reef restoration projects identified in the 2017 Coastal Master Plan, our coalition views the restoration of these habitats as vital pieces of a comprehensive coastal restoration program. We will continue to advocate that restoration funds be strategically invested in these programs and any related projects.

Louisiana could lose **2,250 SQUARE MILES OF LAND OVER THE NEXT 50 YEARS** without action to restore the coast.[iii]

Barrier Island and Headland Restoration

Over the past two decades, Louisiana has invested hundreds of millions of dollars in restoring barrier islands, and the state has committed to continuing that investment in these vital landscape features by dedicating $1.5 billion of the $25 billion Coastal Master Plan restoration budget to the Barrier Island Program.

Over the next five years, we expect the Barataria and Terrebonne barrier shorelines will be fully restored and significant progress will be made in restoring the Timbalier barrier island chain. Regular monitoring, assessment and rebuilding will help maintain these important barrier island features.

Oyster Reef Restoration

Our coalition has also selected Oyster Reef Restoration as a priority program. Oyster reefs contribute to an important economic fishery and also provide crucial ecosystem services, such as shoreline protection, water quality improvement through filter feeding, habitat for other fish and shellfish and foraging habitat for wildlife. Investing in a sustainably managed reef-building program will allow Louisiana to take advantage of prime oyster production conditions, including ideal climate, hydrology and water quality factors. Responding quickly to these key opportunities will help address restoration needs and ensure long-term reef sustainability.

FUNDING RESTORATION

FUNDING RESTORATION

An Investment in Our Future

In July 2015, the U.S. Department of Justice reached an agreement in principle between the Gulf Coast states, the federal government and BP for the company's role in the largest offshore oil disaster in U.S. history. The global settlement, officially approved on April 4, 2016, set in motion the payment of more than $20 billion, with the overwhelming majority of these funds returning to the Gulf Coast states through dedicated funding streams for restoration and repair of damages. Louisiana is slated to receive more than $6 billion from the settlement alone, which will be paid out through 2031. This funding is in addition to previous allocations through NFWF and RESTORE for a total restoration budget of $7.7 billion.

For the first time in its history, Louisiana has the ingredients needed to advance comprehensive, large-scale coastal restoration, including the science-based, publically-supported Coastal Master Plan; broad-based, bipartisan political will and support; and now significant funding from the BP settlement and other sources. Through this funding, Louisiana will have the ability to advance large-scale restoration projects across the coast. However, the existing revenue streams are not enough. There is an urgent need to identify additional sources of funding to implement more of these priority projects over time.

Coastal restoration funding sources include:

Natural Resource Damage Assessment (NRDA)

NRDA is the federally-administered damage assessment and restoration process used to determine damages caused by an oil spill and to restore natural resources. The total Deepwater Horizon NRDA settlement was $8.8 billion, and Louisiana will receive $5 billion of those funds to be used for ecosystem restoration. $4.3 billion of these funds will be used to restore and conserve habitat, while the remaining funds will be used to replenish and protect living coastal and marine resources ($343 million); for monitoring, adaptive management and administration oversight ($258 million); to provide and enhance recreational opportunities ($60 million); and to restore water quality ($20 million).

NFWF Gulf Environmental Benefit Fund

The National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund was established in 2013 following the Gulf oil disaster with funds from criminal settlements involving BP and Transocean. The fund contains $2.544 billion, half of which ($1.3 billion) is to be spent in Louisiana on barrier island restoration and sediment diversion projects.

RESTORE Act

In 2012, two years after the Gulf oil disaster, the federal Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (RESTORE) Act was signed into law. This law ensures that 80 percent of all civil Clean Water Act penalties stemming from the spill flow through the RESTORE Act and are used for Gulf Coast restoration.

The majority of funding flows through the RESTORE Act via three "pots":

- Pot 1 evenly distributes 35 percent of RESTORE funding directly to the Gulf Coast states.
- Pot 2 allocates 30 percent of funding to ecosystem restoration projects selected by the RESTORE Council.
- Pot 3 distributes 30 percent of funding to the Gulf states based on an oil spill impact allocation formula.

Louisiana is set to receive more than $930 million in RESTORE Act funding and has committed to use all of its Pot 1 and 3 funding on the Coastal Master Plan. From the initial round of funded projects in Pot 2, Louisiana has received an additional $52.2 million to fund coastal restoration projects included in the RESTORE Council's Funded Priorities List, which includes marsh creation, hydrologic restoration and beach nourishment projects.

In addition to funds from the BP settlement, other critical sources of restoration funding include:

Gulf of Mexico Energy Security Act (GOMESA)

GOMESA was signed into law in 2006 and shares 37.5 percent of qualified Outer Continental Shelf oil drilling revenues with oil-producing Gulf Coast states for coastal restoration activities. To date, more than $30 million has been distributed via GOMESA Phase I. GOMESA Phase II is underway with annual payments to the State of Louisiana and coastal parishes increasing considerably. In 2018, revenues from GOMESA are expected to be nearly $100 million. As these payments are commodity-based, there will be variance in the exact amount from year-to-year. Thirty percent of this funding will go directly to parishes, and the rest will go to the state's Coastal Protection and Restoration Trust Fund, per a constitutional amendment overwhelmingly passed by Louisiana voters.

Coastal Wetlands Planning Protection and Restoration Act (CWPPRA)

CWPPRA was enacted in 1990 to provide funding for Louisiana wetland restoration. The program is administered by the state of Louisiana and members of a task force of federal agencies, including the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Environmental Protection Agency, Natural Resources Conservation Service, and National Marine Fisheries Service.

Louisiana currently receives more than $80 million per year, with an 85 percent-15 percent federal-state matching arrangement. These agencies oversee the design and implementation of projects that restore, maintain, enhance or create wetland areas along the Louisiana coast.

State Mineral Revenues

Traditionally, the state's Coastal Protection and Restoration Fund (Trust Fund) has received $25 million to $35 million annually through mineral revenues and severance taxes on oil and gas production on state lands. In recent years, however, that number has dropped due to a dramatically low per-barrel price for oil. The Trust Fund supports the coastal program's ongoing operating expenses and the overall state efforts in coastal restoration and protection, particularly by providing revenue to match incoming federal project dollars.

These funding streams present an unprecedented opportunity for Louisiana to make urgent strides toward Master Plan implementation. However, to advance these priority restoration projects and ensure comprehensive restoration of the Mississippi River Delta in the long run, funding allocated for restoration must be protected, additional funding sources must be identified, and creative funding mechanisms must be employed to spend money efficiently and achieve cost savings over time. Investing in coastal restoration creates jobs, boosts the economy and helps protect a region home to more than two million people, nationally significant infrastructure and industry and habitat critical to a wide variety of fish and wildlife species.

CONCLUSION

As Louisiana's coast continues to disappear at the average rate of one football field every 100 minutes, the very existence of this nationally significant region, as well as the economic and ecological benefits it provides to the entire country, is in jeopardy.

Restoring the Mississippi River Delta and coastal Louisiana will take large-scale projects that can restore or mimic the river's natural processes. This involves projects, such as sediment diversions, that will take advantage of the sediment and natural land-building power of the Mississippi and Atchafalaya Rivers. These projects will return the delta to a more natural order and help build and maintain land over time, while protecting investments in other projects, communities and infrastructure.

It is especially important that we quickly advance sediment diversion projects, such as the Mid-Barataria and Mid-Breton Sediment Diversions, to reconnect the Mississippi River with surrounding wetlands and take advantage of the precious sediment that is currently wasted every year. These projects have been studied for decades and have been highlighted as a cornerstone of the Coastal Master Plan. Sediment diversions will not only help build and maintain land over time, but they will also support investments made in other restoration and risk-reduction projects, such as marsh creation and levees, and help increase their lifespan.

Any delay in using the available funding for priority projects will continue to put coastal cities, communities and vital ecosystems at increased risk from hurricanes and rising seas.

These priority projects were identified as the most urgent and most beneficial to the long-term sustainability of the delta. Equally important, these 17 projects are a central part of the Coastal Master Plan, which was developed and passed after months of comprehensive scientific research, modeling and stakeholder input. By expediting funding and construction of these projects, we have a historic opportunity to restore our coastal wetlands and protect the thousands of businesses and jobs that depend on a healthy Mississippi River Delta.

ABOUT RESTORE THE MISSISSIPPI RIVER DELTA

Restore the Mississippi River Delta is a coalition of Environmental Defense Fund, National Audubon Society, the National Wildlife Federation, Coalition to Restore Coastal Louisiana and Lake Pontchartrain Basin Foundation. Comprised of conservation, policy, science and outreach experts, we are working to rebuild coastal Louisiana's nationally-significant landscape by reconnecting the river with its wetlands to protect people, wildlife and jobs. As our region faces an ongoing and severe land loss crisis, we offer science-based solutions through a comprehensive approach to restoration.

Our Mission:

Advancing Coastal Restoration Solutions

Louisiana's land loss crisis is due to many contributing factors. Similarly, building and sustaining land across our coast cannot be achieved through any single project type. Restoring Louisiana's coast will require a suite of complementary projects from the state's Coastal Master Plan.

Engaging Coastal Stakeholders

Our staff seeks to raise awareness to Louisiana's land loss crisis and build broad-based support for addressing it with urgency. We work with coastal residents, business owners, industry representatives, local and state government officials and other groups and organizations to educate and engage them on our changing coastal landscape and the solutions available to secure a more resilient future.

Championing the Best Science

In a dynamic and ever-changing landscape like the Mississippi River Delta, it is of utmost importance to use the latest research and modeling to understand what the future coast will look like, with and without restoration. From sea level rise to subsidence, fisheries to hydrology and more, our scientists are approaching the coastal crisis from multiple angles and using the best-available data to support a path for restoration.

Maximizing Coastal Funding

Restore the Mississippi River Delta is working to maximize and leverage currently available funding for coastal restoration as well as identify additional funding streams. We also seek to ensure that existing and future coastal funding is safeguarded for coastal restoration and protection projects.

APPENDIX

CAUSES OF LOUISIANA LAND LOSS

Over the last few hundred years, human alterations to the Mississippi River system, along with a variety of other natural factors, have resulted in a land loss crisis that threatens the very existence of coastal Louisiana as we know it. Every 100 minutes, a football field of land disappears into the Gulf of Mexico, affecting people, wildlife and jobs not only across the region, but throughout the entire United States.

So what went wrong?

Leveeing of the Mississippi River

One of the most significant causes of land loss is the strait-jacketing of the lower Mississippi River with levees to control the river and protect surrounding areas from riverine flooding. However, these levees also cut the tie between the sediment-filled river and nearby wetlands, preventing the river from maintaining this critical habitat and building new land. Instead of being deposited in nearby wetlands and replenishing marshes, this sediment is largely wasted – lost out of the mouth of the river and deposited into the deep waters of the Gulf of Mexico. Without land-building sediment from the river, Louisiana's land loss crisis will worsen.

Subsidence

Land formed by river sediment naturally subsides and sinks over time as part of the delta cycle. Historically, sediment deposition and increases in plant growth and land building outpaced the natural subsidence, resulting in coastal land gain. Without sediment deposits from the river, subsidence dominates and massive areas of land sink and disappear below sea level.

Hurricanes

Storm surge from hurricanes Katrina and Rita destroyed hundreds of square miles of coastal wetlands in a matter of days. The damage they wrought from flooding and storm surge was made worse by the previous loss of miles of protective wetlands. The continued loss of wetlands will make coastal communities, from New Orleans to Lake Charles, even more vulnerable to future storms and hurricanes.

Shipping Channels and Canals

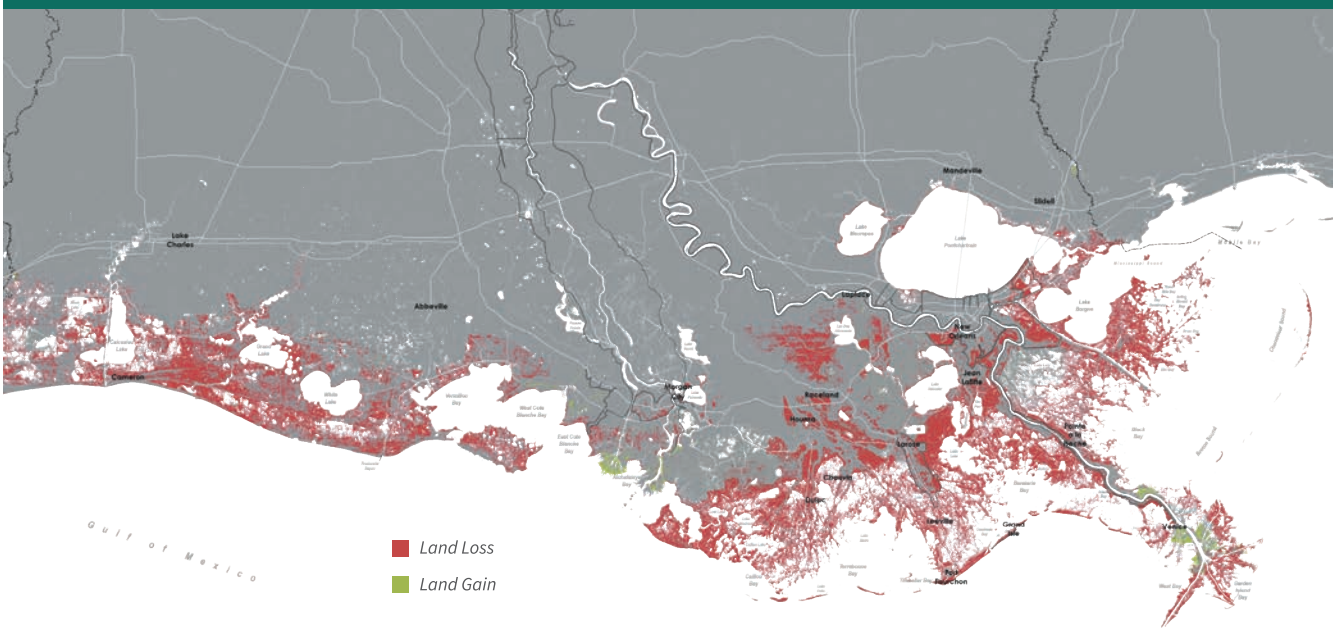
The vast network of shipping channels along the coast allow salt water to penetrate deep into the wetlands, destroying an ecosystem built by fresh water. Large waterways, such as the Houma Navigational Canal, Freshwater Bayou Canal and now-closed Mississippi River Gulf Outlet, allow this saltwater damage to occur.

Upriver Dams

Since the construction of dams on the Missouri, Mississippi and Ohio Rivers in the 1950s, the amount of valuable, land-building sediment in the Lower Mississippi River has decreased by about 50 percent.

Without Action, Predicted Land Change Over the Next 50 Years Under the Master Plan's Medium Environmental Scenario

Credit: Louisiana Coastal Protection and Restoration Authority (CPRA)



Oil and Gas Infrastructure

Thousands of offshore oil rigs and onshore wells dot Louisiana's coastline. Thousands of miles of oil and gas canals have been dug to accommodate this energy infrastructure and extraction, altering the natural hydrology, disrupting the salinity balance and killing the vegetation of freshwater wetlands. The fluid extraction also increases the rate of subsidence. Over time, these activities have directly impacted thousands of acres of coastal wetlands, speeding our land loss crisis.

BP Oil Disaster

The BP Deepwater Horizon oil disaster resulted in 206 million gallons of oil spewing into the Gulf, damaging hundreds of miles of delicate shoreline and accelerating coastal erosion. Thousands of acres of marsh were damaged, and the communities, economy and wildlife of the Gulf Coast were disrupted. The spill's long-term effects will continue to impact coastal Louisiana and its inhabitants for decades to come.

Sea Level Rise

Scientists say that the level of the world's oceans will rise from less than one foot to six feet over the next century. Rising seas combined with subsiding land, called "relative sea level rise," make the threat of submergence even greater for coastal Louisiana.

Invasive Species

Though several harmful invasive species exist in coastal Louisiana, a few are particularly detrimental to wetlands. Nutria are fast-breeding, voracious rodents that were introduced into Louisiana for the fur trade. But their impact on the coastline has been disastrous, as they eat the roots of wetland marsh plants and devour swamp seedlings. Feral hogs have also become a serious problem, destroying wetlands through aggressive foraging. Recently, the mealy bug has destroyed large areas of roseau cane, an erosion-resistant wetland plant that helps build land by trapping sediment, stands up well to tropical storm events and generally helps protect the coast.

2012 PRIORITY PROJECT PROGRESS

PROJECT TYPE	2012 PRIORITY PROJECT	2017 PRIORITY STATUS	PROGRESS AS OF NOVEMBER 2017
Sediment Diversion	Mid-Breton Sediment Diversion	✔ Included in 2017 Priority Projects	This project is in Engineering & Design and is included in implementation period 1 (year 1-10) of the 2017 Master Plan.
	Lower Breton Sediment Diversion	✔ Included in 2017 Priority Projects	This project is in Feasibility & Planning and is included in implementation period 1 (year 1-10) of the 2017 Master Plan.
	Mid-Barataria Sediment Diversion	✔ Included in 2017 Priority Projects	This project is in Engineering & Design and is included in implementation period 1 (year 1-10) of the 2017 Master Plan.
	Lower Barataria Sediment Diversion	✖ Not in 2017 Master Plan	This project was informally suspended in Feasibility & Planning and is not included in the 2017 Master Plan.
Freshwater Diversion	Increase Atchafalaya Flow into Terrebonne Marshes	✔ Included in 2017 Priority Projects	This project is in Engineering & Design.
	Central Wetlands Diversion and Wetland Restoration	✔ Included in 2017 Priority Projects	This project is in Feasibility & Planning.
	West Maurapas Freshwater Diversion	✔ Included in 2017 Priority Projects	Both components of this project, River Reintroduction into Maurepas Swamp and Small Diversion at Convent/Blind River are in Engineering & Design and awaiting funding. This project was renamed to East Maurepas Diversion in the 2017 Master Plan.
Hydrologic Restoration	Calcasieu Ship Channel Salinity Control Measures	✔ Included in 2017 Priority Projects	This project is in Engineering & Design and is included in implementation period 1 (year 1-10) of the 2017 Master Plan.
	Houma Navigation Canal Lock Hydrologic Restoration	→ Moved to "Future Without Action"	This project is in Engineering & Design and has been moved to "Future Without Action," meaning its completion was included as a baseline for modeling the 2017 Master Plan projects.
Marsh Creation	Golden Triangle Marsh Creation	✔ Included in 2017 Priority Projects	This project is in Engineering & Design.
	New Orleans East Land-Bridge Restoration	✔ Included in 2017 Priority Projects	Both components of this project, New Orleans East Landbridge Shoreline Stabliziation and Marsh Creation and St. Catherine Island Marsh Creation and Shoreline Protection, are in Engineering & Design.
	Barataria Land-Bridge, Large Scale Marsh Creation	✔ Included in 2017 Priority Projects	This project is well into implementation with Mississippi River Long-Distance Sediment Pipeline, Bayou Dupont Marsh and Ridge Creation, Bayou Dupont Sediment Delivery, Dedicated Dredging on the Barataria Landbridge, Mississippi River Sediment Delivery System – Bayou Dupont, and Barataria Basin Landbridge Shoreline Protection completed; and Northwest Turtle Bay in Engineering & Design.
Ridge Restoration	Bayou La Loutre Ridge Restoration	✔ Included in 2017 Priority Projects	This project is in Engineering & Design and was combined with Bayou Terre aux Boeufs and renamed Breton Ridge Restoration in the 2017 Master Plan.
Barrier Island Restoration	Barataria Pass to Sandy Point Restoration	→ Moved to Programmatic	This project is nearly complete with restoration of Chenier Ronquille, Shell Island West, Scofield Island, Shell Island East, Pelican Island and Pass la Mer to Chaland Pass, East Grand Terre, and Pass Chaland to Grand Bayou Pass completed; and West Grand Terre in Engineering & Design.
	Belle Pass to Caminada Pass Restoration	→ Moved to Programmatic	This project is well into implementation with restoration of Caminada Headland beach and dune and West Belle Pass completed, and Caminada Headland back barrier marsh in Engineering & Design and awaiting funding.
	Isles Dernieres Restoration	→ Moved to Programmatic	This project is well into implementation with restoration of Whiskey Island back barrier marsh and New Cut dune and marsh completed, and Caillou Lake Headlands in construction.
	Timbalier Islands Restoration	→ Moved to Programmatic	This project is in Engineering & Design.
Shoreline Protection	Freshwater Bayou to Southwest Pass Shoreline Protection	✖ Not in 2017 Master Plan	This project was suspended at the Conceptual phase and is not included in the 2017 Master Plan.
Oyster Reef Restoration	Biloxi Marsh Oyster Reef Restoration	→ Moved to Programmatic	Living Shoreline Demonstration project is complete and Biloxi Marsh Living Shoreline is in Engineering & Design

For the latest status of these priority projects and programs, visit ***MississippiRiverDelta.org/map***

2017 PRIORITY PROJECTS MAP

CHENIER PLAIN | TERREBONNE-ATCHAFALAYA BASIN | BARATARIA BASIN | PONTCHARTRAIN-MAUREPAS BASIN | BRETON-CHANDELEUR BASIN

PRIORITY PROJECTS

1 Ama Diversion
2 Atchafalaya River Diversion
3 Lower Breton Diversion
4 Mid-Barataria Diversion
5 Mid-Breton Diversion
6 Central Wetlands Diversion
7 East Maurepas Diversion
8 Increase Atchafalaya Flow to Terrebonne
9 Manchac Landbridge Diversion
10 Union Freshwater Diversion
11 Calcasieu Ship Channel Salinity Control Measures
12 Freshwater Bayou North Marsh Creation
13 Golden Triangle Marsh Creation
14 Large-scale Barataria Marsh Creation
15 New Orleans East Landbridge Restoration
16 Breton Ridge Restoration:
A Bayou Terre aux Boeuf
B Bayou la Loutre
17 Terrebonne Ridge Restoration:
A Mauvais Bois
B Bayou DuLarge

PRIORITY PROGRAMS

Barrier Island program components currently supported:

18 Barataria Pass to Sandy Point Restoration
19 Belle Pass to Caminada Pass Restoration
20 Timbalier Islands Restoration
21 Isles Dernieres Restoration

Oyster Reef program component currently supported:

22 Biloxi Marsh Oyster Reef Restoration

For the latest status of these priority projects and programs, visit ***MississippiRiverDelta.org/map***

ABRIDGED PROJECT DESCRIPTIONS

Sediment Diversions

1. Ama Diversion
The Ama Sediment Diversion will divert sediment, nutrients and fresh water from the Mississippi River to existing wetlands in the upper Barataria Basin and will also likely benefit marsh creation projects further down in the basin. The project will build and sustain wetland forests, fresh marsh and intermediate marsh by increasing sediment input, water flow and nutrients in the basin. Land building by the diversion will likely be accelerated by the presence of the Large-Scale Barataria Marsh Creation and Mid-Barataria Sediment Diversion projects. The Ama Sediment Diversion project is still conceptual but will ultimately be constructed near Ama.

2. Atchafalaya River Diversion
To be constructed off the Atchafalaya River, the Atchafalaya River Sediment Diversion will provide basin-wide benefits to marshes in southwest Terrebonne Parish. Sediment and fresh water diverted into the marshes will help build land and sustain other nearby projects planned for construction, like Mauvais Bois Ridge Restoration. This project will have the greatest benefits to freshwater habitats, such as forested areas, flotant and fresh and intermediate marsh, which are threatened by saltwater intrusion and sediment starvation.

3. Lower Breton Diversion
This sediment diversion project is planned for lower Breton Sound along the east bank of the Mississippi River, likely across from Port Sulphur. Below the reach of the federal, man-made levees on the east bank, the brackish and salt marshes in the influence area have low rates of loss relative to many other parts of the coast. These low rates of land loss may be attributed to the sediment and fresh water these marshes periodically receive when the river overtops the banks during high flows. This project will divert sediment and fresh water into the basin to build new land, maintain existing marshes and increase the resiliency of the influence area to sea level rise and storm events.

4. Mid-Barataria Diversion
This sediment diversion is located along the west bank of the Mississippi River near Myrtle Grove. The brackish and freshwater wetlands in the influence area are highly degraded due to a combination of saltwater intrusion, decreased fresh water supply, alterations to the natural hydrology of the area and a lack of sediment input. This project will reconnect the river to the influence area and divert sediment, nutrients and fresh water to build new land, maintain existing marshes and increase habitat resiliency to sea level rise and storm events. Project synergies with marsh creation projects in the influence area of the diversion create the potential for hundreds of acres of restored wetlands to be enhanced by the Mid-Barataria Sediment Diversion as soon as it is constructed and operated.

5. Mid-Breton Diversion
To be located along the east bank of the Mississippi River near Wills Point and upriver of the White Ditch siphon, this sediment diversion will convey fresh water and sediment into deteriorating marshes that drain into middle Breton-Chandeleur Basin. The swamps and marshes in the influence area have disappeared due to a combination of changes in the supply and distribution of fresh water, subsidence, saltwater intrusion, sediment starvation and storm events. This project will reconnect the influence area with the river and divert sediment and fresh water, building new land and sustaining existing marsh. If built in coordination with other projects in the basin, such as the Lower Breton Sediment Diversion and the Bayou Terre aux Boeufs Ridge Restoration, the Mid-Breton Sediment Diversion could build land more quickly. Additional benefits of this project include storm surge buffering for Plaquemines Parish.

Freshwater Diversions

6. Central Wetlands Diversion
This diversion will benefit the Central Wetlands Unit ecosystem east of New Orleans, an area destroyed by logging and by saltwater intrusion from the now-closed Mississippi River Gulf Outlet (MRGO). Once primarily a freshwater system dominated by bald cypress swamp and freshwater marsh, the predominant habitat type today is brackish marsh. Regional MRGO-area ecosystem restoration will help rebuild and sustain marsh and swamp, providing storm surge protection for New Orleans and nearby communities.

7. East Maurepas Diversion
Also known as Mississippi River Reintroduction into Maurepas Swamp, this diversion, planned near Angelina, will provide sediment and fresh water to existing wetlands in East Maurepas swamp. Dominated by bald cypress and water tupelo trees, the Maurepas swamp complex is one of the largest forested wetlands in the nation. However, levees constructed along the river have isolated the area from spring floods and the vital fresh water, nutrients and sediment they bring. This isolation, coupled with rising salinities throughout the Pontchartrain Basin while the MRGO was open, has left the swamp in a state of rapid decline – trees are dying, and young trees are not growing to replace them. The East Maurepas Diversion will benefit the swamp by reconnecting it with the river, aiding the prevention of further wetland loss and the conversion of swamps to marshes, as well as helping to offset future increases in salinity throughout the western Pontchartrain Basin. The fine grain sediment may also increase elevation to a point where there are periods without inundation so that seeds can germinate, perpetuating the forest into the future.

8. Increase Atchafalaya Flow to Terrebonne
This hydrologic diversion project stretches from the Atchafalaya River to the Houma Navigation Canal, which is part of the Gulf Intracoastal Waterway system. The marshes in the influence area are nearly an equal distance from the Mississippi and Atchafalaya rivers and are blocked from significant amounts of river water and sediment. These marshes have been rapidly converted to open water because of saltwater intrusion and sediment starvation. This project would dredge and deepen a portion of the Gulf Intracoastal Waterway to increase the flow of fresh water from the Atchafalaya River to help sustain Terrebonne marsh. Additional benefits from this project include using the dredged material to create marsh and increase flow capacity using two southern-flowing canals (Minor's and Bayou Copasaw.)

9. Manchac Landbridge Diversion
Manchac Landbridge Diversion will be constructed within the existing western guide levee of the Bonnet Carre Spillway. Currently, when the Bonnet Carre Spillway is opened to reduce river flood risk in New Orleans, all of the sediment, fresh water and nutrients are directed into Lake Pontchartrain, wasting these vital resources and causing water quality issues. The Manchac Diversion will direct some of these flows into degraded swamps and marshes adjacent to the spillway to increase nutrient input and improve water quality, fostering vegetation growth. Located near Lakes Pontchartrain and Maurepas, the diversion will benefit a variety of habitats, from freshwater forests to brackish marsh. The restoration of these habitats will help St. Charles and St. John the Baptist parishes become more resilient to flooding and storms. The Manchac landbridge is identified by the Army Corps of Engineers (Corps) as a vital landscape feature that serves as a critical line of defense from storm surge for nearly 1.5 million people in eight parishes, especially the Greater Baton Rouge region, but also including the cities of New Orleans, Laplace, Madisonville, Mandeville and Slidell.

10. Union Freshwater Diversion
Union Freshwater Diversion will convey fresh water from the Mississippi River into West Maurepas swamp near Burnside. Nutrient-rich freshwater inputs to the fresh-forested, flotant and freshwater marsh environments will prevent saltwater intrusion and encourage vegetation growth. The diversion will also convey fine sediment to nourish existing wetlands or create new wetlands in Maurepas swamp. Ascension, Livingston, St. James and St. John the Baptist parishes are all expected to receive flood-reduction benefits from this project. The fine grain sediment may also increase elevation to a point where there are periods without inundation so that seeds can germinate, perpetuating the forest into the future.

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Hydrologic Restoration

11. Calcasieu Ship Channel Salinity Control Measures

The Calcasieu Ship Channel, which connects the Gulf of Mexico to Calcasieu Lake, is located within the Chenier Plain. The once stable platform of the Chenier Plain has experienced decades of dredging navigation canals, which has dramatically changed the hydrology of the system. Saltwater intrusion led to the extensive loss of freshwater marshes, increasing the threat of storm surge to communities. This project will aim to isolate the ship channel through a network of dike and sill structures designed to limit saltwater intrusion through the Calcasieu Ship Channel and into adjacent marshes. This project will also support storm surge protection by increasing the sustainability of adjacent marshes and dissipating wave energy and tidal flows within the ship channel.

Marsh Creation

12. Freshwater Bayou North Marsh Creation

Freshwater Bayou North Marsh Creation is planned for Vermilion Parish, just west of Freshwater Bayou and north of the bayou locks. The project is one of the largest and fastest land-building priority projects, projected to build around 9,000 acres upon construction. It will restore marshes degraded by hurricanes Rita, Gustav and Ike and prevent Freshwater Bayou from continuing to enlarge and further erode interior marshes. Sediment will be delivered via pipeline to the site from either the Gulf of Mexico or the Freshwater Bayou Canal. The newly created marsh will protect against storm surge, wave energy and flooding. It will also foster nutrient transport, vegetation growth and soil accretion, helping set the marsh on a path to rebuilding rather than washing away.

13. Golden Triangle Marsh Creation

This marsh creation project is located near the confluence of two major navigation and shipping channels — the Mississippi River Gulf Outlet (MRGO) and the Gulf Intracoastal Waterway. Dominated by brackish marsh, this area was badly damaged by saltwater intrusion and erosion following the dredging of the MRGO. This project will use sediment from nearby Lake Borgne to create and restore marsh. The restored marsh will help buffer the recently constructed surge barrier, protecting some of the most populated areas of New Orleans, and will eventually provide important estuarine habitat for Lake Borgne.

14. Large-scale Barataria Marsh Creation

This marsh creation project is located in Barataria Bay near Lafitte. Historically, only a limited hydrological connection existed between the fresher upper basin and the saltier lower basin. Canal networks, erosion and subsidence have severely degraded the natural barriers between the upper and lower basin, exposing freshwater wetlands to saltwater intrusion and increased wave energy. This project will continue to build on its components that are already in place or under construction to strengthen the Barataria Landbridge, such as Bayou Dupont Marsh Creation project, the Long-Distance Sediment Pipeline project, the Northwest Turtle Bay Marsh Creation project and the Barataria Basin Landbridge Shoreline Protection project. Sediment conveyed from the river through a pipeline will be used to build new marsh, nourish existing marsh in the area, help restore historic salinities in the upper basin and provide benefits to the nearby community of Lafitte, by buffering storm surge and tidal flooding.

15. New Orleans East Landbridge Restoration

This large-scale marsh creation project is located in eastern New Orleans on a landbridge separating Lake Pontchartrain from Lake Borgne, which is the major control on the potential flow of hurricane surge into Lake Pontchartrain. The exposure to wave energy and storm surge has resulted in rapid retreat of the shoreline and the expansion of ponds and lakes within the marsh. The New Orleans East Landbridge Restoration project will create and restore marsh via a sediment conveyance pipeline. The project area includes the Fort Pike State Historic Site, U.S. Highway 90 and the Bayou Sauvage National Wildlife Refuge, the largest urban refuge in the nation, which provides significant estuarine habitat. The New Orleans East Landbridge is identified by the Corps as a critical landscape feature that serves as a crucial line of defense from storm surge for nearly 1.5 million people in eight parishes, including the cities of New Orleans, Laplace, Madisonville, Mandeville and Slidell.

Ridge Restoration

16. Breton Ridge Restoration: Bayou Terre aux Boeuf & Bayou la Loutre

Breton Ridge Restoration includes the restoration of two historic ridges on either side of the Mississippi River Gulf Outlet (MRGO).

Bayou Terre aux Boeufs stretches from Delacroix to Black Bay and has historically helped buffer storm surges for St. Bernard and Plaquemines parish communities and provided critical habitat for migratory birds and other wildlife. Severe erosion around the ridge and adjacent marsh has resulted in a loss and narrowing of the ridge. Subsidence of the ridge and saltwater intrusion has killed most of the trees on the ridge. This restoration will raise the ridge to an elevation of five feet to provide coastal upland habitat, restore natural hydrology, and provide wave and storm surge attenuation.

Bayou la Loutre begins in Yscloskey and extends into the southeastern Biloxi marshes. Bayou la Loutre ridge is actually two parallel natural levees flanking old Bayou la Loutre (Otter Bayou), which is part of the structural underpinning of the Biloxi marshes. Construction of the MRGO breached the ridges, dramatically altering the hydrology of the area and leading to saltwater intrusion and extensive wetland loss. The rock dam built across the MRGO in 2009 helped restore the hydrology but not the actual, previously lost marsh or ridge habitat. The ridge has suffered from subsidence, saltwater intrusion and canal breaches. The project will use dredged sediment, likely from Bayou la Loutre, to reestablish the ridge. This will add elevation to the ridge and help improve hydrology, provide storm surge protection, decrease saltwater intrusion and provide important resting habitat for migratory birds.

17. Terrebonne Ridge Restoration: Mauvais Bois & Bayou DuLarge

This project will restore the historic Mauvais Bois and Bayou DuLarge Ridges located in Terrebonne Parish near Lake Mechant and Caillou Lake. The project will restore and construct maritime forest in the lower Terrebonne marshes by using dredged sediment to increase the elevation of the relict ridges. Both ridges will help restore historic hydrologic patterns and reduce saltwater intrusion. They will also buffer storm surge and wind energy for inland communities. Two diversions, Atchafalaya River Diversion and Increase Atchafalaya Flow to Terrebonne, will work synergistically with these ridges to restore natural ecosystem processes in the area, including patterns of freshwater flows, salinities and land building.

Priority Programs

Beyond specific projects outlined as recommended priorities, CPRA is also advancing its new restoration programs – barrier islands and oyster reef restoration – that we also support as essential tools in the restoration toolkit. Although there are not specific barrier island or oyster reef restoration projects identified in the 2017 Coastal Master Plan, our coalition views the restoration of these habitats as vital pieces of a comprehensive coastal restoration program. We will continue to advocate that restoration funds be strategically invested in these programs and any related projects.

Barrier Island program components currently supported include:

18. Barataria Pass to Sandy Point Restoration

19. Belle Pass to Caminada Pass Restoration

20. Timbalier Islands Restoration

21. Isles Dernieres Restoration

Oyster Reef program component currently supported includes:

22. Biloxi Marsh Oyster Reef Restoration

PHOTO CREDITS

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Cover	Aerial view of the east bank of the Mississippi River, downriver from Fort. St. Phillip where a new delta is emerging. Credit: Richie Blink.
2	A sport fishing boat along the rim of Barataria Bay. Credit: Richie Blink.
4	Dr. Erik Johnson leads a group of volunteers in installing protective fencing for beach nesting birds in Cameron Parish. Credit: Emily Falgoust.
6	Coalition staff and volunteers participate in an Earth Day tree planting. Credit: Samantha Carter.
7	Wetlands in Empire, LA. Credit: Helen Rose Patterson.
8	New land built by the Caernarvon diversion. Credit: Helen Rose Patterson.
10	Estelle Robichaux at the Caminada Pass Barrier Island Restoration site. Credit: Liz Van Cleve.
11	Brown Pelicans on a Louisiana barrier island. Credit: Lauren Bourg.
13	Aerial view of healthy Louisiana wetlands. Credit: Alisha Renfro.
14	Volunteers helping to restore the coast. Credit: Kelly Messer, CRCL.
15	Bald Cypress along the rim of Lake Maurepas. Credit: Richie Blink.
16	Cypress trees in Louisiana swamp. Credit: Richie Blink.
17	Alligator in Louisiana swamp. Credit: Ryan Rastegar.
18	Bald cypress killed by saltwater intrusion near Venice, Louisiana. Credit: Richie Blink.
19	Top: Laughing gulls near the Bohemia Spillway. Credit: Shannon Cunniff, EDF. Bottom: Dr. Theryn Henkel displays new land forming in the Caernarvon Diversion influence area. Credit: Jacques Hebert.
20	Jean Lafitte National Historical Park and Preserve, Barataria Preserve. Credit: Alisha Renfro.
21	Coalition staff explore Maurepas Swamp. Credit: Samantha Carter.
22	Louisiana shrimp boat. Credit: Tim Carruthers, IAN.
23	Camp in Maurepas Swamp. Credit: Kelly Wagner, National Wildlife Federation.
24	Roseate Spoonbill. Credit: William Chitty, National Audubon Society.
25	Chenier au Tigre, Vermillion Parish. Credit: Erik Johnson.
26	Top: Dead mangrove trees on Cat Island as a result of the BP oil spill. Credit: Lauren Bourg. Bottom: Oysters bagged as part of CRCL's Oyster Shell Recycling Program in Buras, LA. Credit: Emily Falgoust.
27	Airboat through the Caernarvon diversion outfall area. Credit: Samantha Carter.
30	Left: Aerial view of a barge on the Mississippi River. Credit: Ryan Rastegar. Right: Timmy Vincent, Manager of Audubon's Rainey Sanctuary. Credit: National Audubon Society.
31	Top: Coalition staff participate in CRCL's Oyster Shell Recycling Program. Credit: Emily Falgoust. Middle: Staff scientist Alisha Renfro leads a field trip through the Barataria Reserve. Credit: Helen Rose Patterson. Bottom: John Lopez briefing our partners before a boat tour through the Golden Triangle. Credit: Amanda Moore.
32	House on an eroding Louisiana barrier island. Credit: CPRA.
39	Destrehan, Louisiana. Credit: Jacques Hebert.

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