



2023

Louisiana's Comprehensive **Master Plan** for a Sustainable Coast

4TH EDITION

Effective May 25, 2023

State of Louisiana
The Honorable John Bel Edwards





committed to **our coast**

Cover Photo: Mississippi River Delta near Phoenix, 2020 (CPRA)



**COASTAL PROTECTION AND RESTORATION
AUTHORITY OF LOUISIANA**

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2023

Louisiana's Comprehensive **Master Plan** for a Sustainable Coast

4TH EDITION
Effective May 25, 2023

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APRIL 2023

Dear Members of the Louisiana Legislature,

I am proud to submit for your consideration and approval, Louisiana’s fourth comprehensive Coastal Master Plan. This plan represents both the evolution of a process that began eighteen years ago in the aftermath of Hurricanes Katrina and Rita, and something that, thanks to its ability to incorporate new data and new analyses, is entirely remarkable and new.

In 2005, the danger a degrading coast posed for our communities was all too real, yet our ability to respond to the enormity of the challenge was very much an aspiration. Today, we can celebrate the fact that the projects in this 2023 Coastal Master Plan are explicitly designed to build on the successes we have realized in the intervening years. Successes that include 358 miles of levee improvement, 60 miles of barrier island and headland restoration, the benefits of projects covering 82 square miles of our coastal habitats—a level of progress that would have been almost unthinkable when the coastal program first began.

Of course, not all of the changes along our coast have been positive. Persistent natural processes and the accumulating impacts of human actions are still working against us; the oiling that once spread across at least 450 miles of our shore took its toll; and too many of our communities are trying to rebuild after a new generation of destructive milestones brought by Hurricanes Laura, Delta, and Ida.

Despite these changes and challenges, Louisiana’s approach to the land loss crisis remains constant. The Coastal Master Plan is still built on the most scientific and up-to-date understanding of the problem and a wide-open call for solutions. We continue to evaluate

and select future projects based on rigorous modeling, and we call on leading experts from different disciplines, stakeholder groups, and the public to guide and inform our decision-making.

This “lead with the science” approach paired with our aggressive implementation record has been the key to our success. While it brings hard truths and startling maps, it also opens the door for honest discussions about what can be done, leads us to construct only the most effective projects, and spawns new efforts to build resilience that reach beyond the Coastal Protection and Restoration Authority and the coast. While the coast of the future may not be the coast of today, this 2023 Coastal Master Plan contains 77 projects that can preserve, protect, and restore the vibrancy and the characteristics of the coast we call home and depend on. It also proudly continues a legacy of nonpartisan commitment to one of the most important issues we face, a legacy that the John Bel Edwards administration inherited from Governors Foster, Blanco, and Jindal, and one we must demand carries on through future governors.

Sincerely,



Kyle R. “Chip” Kline, Jr.
Governor’s Executive Assistant for Coastal Activities
Chairman of the Coastal Protection and Restoration Authority Board

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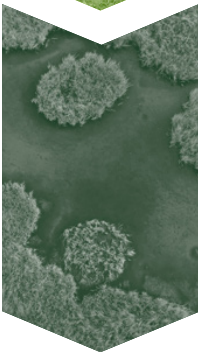
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CHAPTER 1

INTRODUCTION

Louisiana’s 2023 Coastal Master Plan updates the state’s living plan to preserve our rich history, culture, ecosystems, and natural resources that are threatened by ongoing land loss and flood risk. By building on past progress, evaluating our current situation, and preparing to adapt for the future, the master plan works to protect our treasured resources and reduce land loss and flood risk.

INTRODUCTION

UNDERSTAND

PREDICT

EVALUATE

TAKE ACTION

REGIONAL
APPROACH

BEYOND
THE MASTER
PLAN

Image: CPRA Staff in Lake Saint Catherine, 2021 (CPRA)

COMMITTED TO OUR COAST

PURPOSE AND OPPORTUNITY

Fifty years from now, Louisiana’s coast will look very different. The state continues its commitment to implement restoration and risk reduction projects that will result in a vibrant and more sustainable coast for residents and visitors to enjoy. We recognize the challenges of natural and human-made change to the coastal environment and are proactively working to address them through this updated master plan. The implementation of large-scale projects represents a commitment to the people of Louisiana, to our cultural heritage, and to maintaining a viable working coast.

When thinking about the future, people in coastal Louisiana have many questions. What might the future coast look like? How will hurricanes impact coastal communities in the future? Will future generations get a chance to enjoy the communities, landscapes, and natural resources of our coast? Through a rigorous evaluation effort, the 2023 Coastal Master Plan provides insight into these questions. The master plan presents projections of the future coastal landscape and how factors like climate change and subsidence may impact where and how coastal communities can thrive. But it does not stop there – master plan analyses provide a vision for a better, more productive future for our coast by proposing a robust suite of restoration and risk reduction projects to benefit every region.

The 2023 Coastal Master Plan and appendices provide information about land loss, storm surge-based flood risk, and associated challenges facing south Louisiana, explanations of how the plan was developed, and in-depth discussion of proposed

projects to address those challenges. Taken together, the many parts of the master plan provide ideas for a better future and offer ways to enhance the connection between our coast and all who depend on it.

The 2023 Coastal Master Plan is the fourth such plan developed by the State of Louisiana to articulate a clear statement of priorities to achieve comprehensive coastal restoration and risk reduction goals. The Louisiana Coastal Protection and Restoration Authority (CPRA) is tasked with updating the master plan every six years. Once approved by the Louisiana Legislature, this plan becomes the guiding document for the state’s coastal activities and provides a path forward for billions of dollars of investment in the design, implementation, and operation of large-scale restoration and risk reduction solutions.

CPRA was formed following the devastating hurricanes of 2005. The first Louisiana Coastal Master Plan was released in 2007. It has since been updated in 2012, 2017, and now 2023. The 2012 plan represented a significant advancement in the plan framework, utilizing predictive models to prioritize investments, which was built upon in the 2017 plan. The 2023 plan has again built on that framework while improving evaluation tools, incorporating the best available science, and adapting the process to better utilize local knowledge.

Much has changed over the last 18 years since CPRA was formed. Additional hurricanes have ravaged our coast. We experienced the Deepwater Horizon Oil Spill – one of the worst environmental disasters in the history of our country. New funding sources became available, and CPRA and its partners developed, designed, and constructed the state’s largest and most ambitious restoration and risk reduction projects.



Image: White Lake Wetlands Conservation Area, 2021 (Louisiana Sea Grant College Program)

There is uncertainty in what the future holds, but work to date demonstrates that the state is invested in the future of our coast. This plan is the blueprint for where we go from here: the goal is a sustainable coast where people can continue to live, work, and enjoy the things that make coastal Louisiana economically, ecologically, and culturally unique and valuable.

Building this resilient coast is a much larger endeavor than the projects CPRA implements. It is dependent on the decisions of individual citizens, communities, local governments, and businesses, as well as fellow state and federal agencies. In addition to prioritizing restoration and risk reduction projects, the 2023 Coastal Master Plan illustrates how the coast will change in terms of landscape, natural resources, and future hurricane risk. It also illustrates how people and communities may experience that change so they can make informed decisions.

LOUISIANA’S BOUNTIFUL COAST

With a population of more than two million people, coastal Louisiana is home to a rich diversity of people, communities, and cultural traditions. It is also home to a variety of industries, ecosystems, and natural resources which feed and nourish its people and the nation’s economy. Louisianans have a deep and abiding love for their coast, and their rich cultural heritage is closely connected to the land and water. This connection between the land, water, and people is as diverse and productive as the people themselves. Louisianans include members of multi-generational fishing families that dock in Plaquemines Parish; duck hunters setting out at dawn amongst the freshwater marshes in Cameron Parish; Indigenous peoples whose traditions and histories inform their daily lives on the coast; and new residents who have begun to experience and appreciate the natural beauty and bounty of our coast. For each of these residents, and the millions of visitors to the state each year, maintaining a healthy and productive coast is of critical importance.

STRATEGIC PLANNING

THE ROLE OF THE 2023 COASTAL MASTER PLAN

Previous master plans have set an ambitious path to respond to the loss of our coastal land and threats from storm surge-based flooding. The 2023 Coastal Master Plan continues the state’s mission by identifying a long-term program of project planning, design, construction, monitoring, and operations and maintenance, as well as adaptive management of the coastal program and landscape.

Louisiana’s coastal program is guided by an ongoing master planning process that allows for progress to be made in advancing projects before the funding to build them is available. By laying out a vision for which projects the state prioritizes for investment, the master plan fosters efficient and effective progress such that when funds become available from any source, action can be taken quickly to implement projects. The plan is sufficiently specific about what needs to be done, and where, to provide a foundation for action. It provides a level of confidence about where funds will go and what outcomes are expected, while not being overly prescriptive on project details so their designs can be tailored to on-the-ground conditions when the time is right. This process bridges the gap between the current conditions in coastal Louisiana and future changes, while providing a path forward to support the lives, livelihoods, and culture of our coastal citizens and communities.

A SIX-YEAR UPDATE CYCLE

Every master plan cycle begins by reviewing feedback on the previous master plan process and incorporating recommended improvements. Additionally, collaboration among CPRA staff, advisory groups, expert partners and contractors, and dialogue with

stakeholders across coastal Louisiana is a major component of the plan development process. Goals are identified, timelines are determined, tasks are outlined, and appropriate technical partners are engaged to undertake the work of updating the plan. We work with experts to translate up-to-date data and scientific information into a modeling framework that addresses the physical and ecological dynamics of the coastal landscape and changes in predicted damages from storm surge-based flooding.

In parallel, advisory groups are established and a broad network of coastal experts, landowners, scientists, community leaders, local officials and stakeholders are asked to provide insight and guidance during the development process. By doing this, we identify challenges, understand what Louisianans value, and develop projects that address the coastal crisis. Advisory group members provide input on topics ranging from technical updates and scientific understanding to regional and local priorities and effective communication strategies.

An extensive model improvement effort was one of the first steps in the development process of the 2023 Coastal Master Plan, the results of which are detailed in the following section. These models were used to predict changes in the landscape and storm surge damages over a 50-year period and identify future challenges across the coast.

PROJECT SELECTION PROCESS

Louisiana residents are facing enormous changes. Because people are making decisions about their families, their jobs, and their futures, they need the opportunity to provide input and feedback on plans for the future of the coast. A list of candidate projects

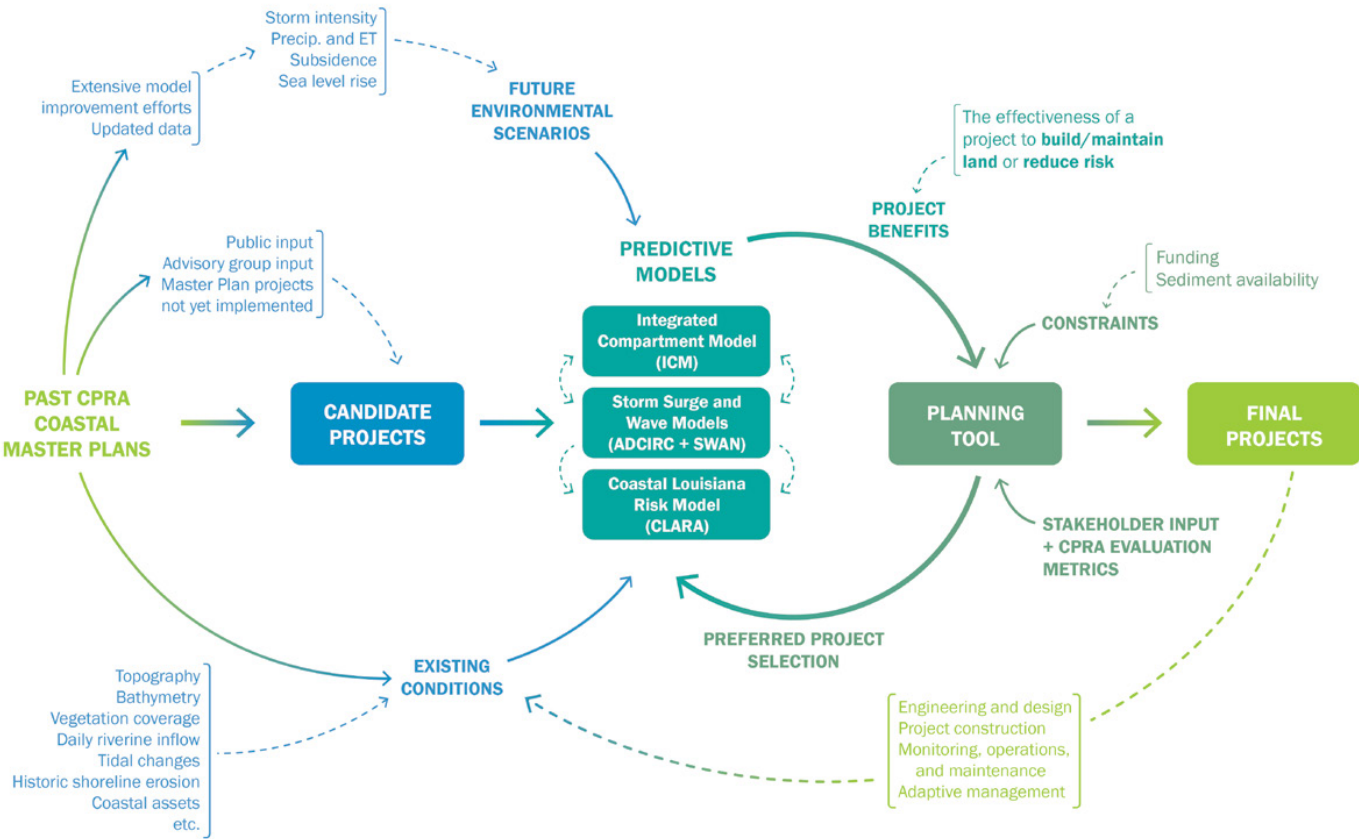


Figure 1.1: The 2023 Coastal Master Plan Development Process.

was developed to address future land loss and storm surge-based flood damages. Project concepts were solicited from the public and members of advisory groups to address key coastal concerns. Projects included in previous master plans that have not yet been implemented were also added to the list. All of these candidate projects were then modeled, and model outputs were used to evaluate project performance in reducing land loss, reducing storm surge-based flood risk, and other impacts on important coastal metrics (such as navigation, habitats, and support of resource-based industries and workers).

We modeled 50 years of a future with each project and compared that to the predictions without the project in place to understand the project’s impacts (positive or negative). Then, a computer-based decision support software system, called the Planning Tool, was used to identify groups of robust projects that are predicted to have beneficial impacts under a variety of future conditions. More information on the Planning Tool can be found in Chapter 4 - Evaluate.

Throughout the project selection process, members of the public and advisory groups were kept informed and regularly asked to provide feedback and guidance. As each step of the process was completed, methods and outputs were documented, and modeling results underwent a quality assurance protocol to ensure decisions were made based on accurate and reliable data. Information was communicated to advisory groups, stakeholders, local and state officials, and other interested parties at several points during plan development, followed by an extensive outreach effort that presented the plan to Louisianans. Ultimately, the 2023 Coastal Master Plan is presented to the CPRA Board and the Louisiana Legislature for consideration and, upon approval, becomes the official guidance for the state’s coastal program. This process, along with feasibility studies and engineering and design work, allows the state to be more responsive to funding as it is identified by having projects on hand that have already been evaluated and are well developed. This leads to project implementation that is both efficient and effective.

A PLAN TO ACHIEVE

GOALS, OBJECTIVES, AND PRINCIPLES

The master plan serves as a guide for the state’s restoration and risk reduction efforts. This is accomplished by identifying robust projects that meet the goals of the plan by reducing land loss and limiting storm surge-based flood risk across the coast both today and into the future. However, those are not the only concerns of coastal Louisiana residents and the master plan has been developed with people in mind. To better meet the needs of Louisianans,

the master plan refines the vision of our future coast by identifying objectives and principles. Here, we present objectives and principles which have been identified to help support the master plan’s goals and provide clarity about what Louisianans value. Together, these goals, objectives, and principles reflect years of coastal planning experience and serve as guidelines for developing and implementing a comprehensive 2023 Coastal Master Plan.

PLAN GOALS

LAND LOSS REDUCTION

Candidate projects are evaluated based upon how much land they create and maintain over 50 years, as compared to the projected landscape without the projects.

STORM SURGE RISK REDUCTION

Candidate projects are evaluated based on how well they reduce expected annual damage in dollars and in terms of structure damages, from storm surge-based flooding as compared to the projected damage without the projects.

PLAN OBJECTIVES

FLOOD PROTECTION

Reduce economic losses from storm surge-based flooding to residential, public, industrial, and commercial infrastructure.

NATURAL PROCESSES

Promote a sustainable coastal ecosystem by harnessing the natural processes of the system.

COASTAL HABITATS

Provide habitats suitable to support an array of commercial and recreational activities coastwide.

CULTURAL HERITAGE

Sustain the unique cultural heritage of coastal Louisiana by protecting historic properties and traditional living cultures and their ties and relationships to the natural environment.

WORKING COAST

Promote a viable working coast to support regionally and nationally important businesses and industries.

PRINCIPLES

Urgent Need to Take Action. In order to have the best future outcomes, we must plan, design, and implement projects now to address increasing land loss and storm surge-based flood risk in the future.

A Systems Approach. The master plan was developed using a systems approach to risk reduction and restoration, whereby projects that are effective under a range of future conditions were selected.

Planning for the Future. The master plan is charged with providing a sustainable long-term solution for coastal protection and restoration. Projects were evaluated and prioritized based on their effects over the next 50 years. Beyond 50 years, uncertainties about environmental conditions such as sea level rise, project costs, and other factors become too great for the evaluation results to be reliable.

Clear Expectations. We cannot recreate the coast of the 20th century or even retain the coast of today. Instead, we must plan to help shape a new landscape that will continue to support viable natural and human communities into the future.

Acknowledging Residual Risk. Risk reduction measures and restored coastal habitats cannot eliminate all storm surge-based flooding risks. Some degree of residual risk is inevitable.

Collective Responsibility. The state, through the master plan and with its partners, develops the common vision for our coast. Achieving a sustainable coast, however, is a collective endeavor that requires stakeholder input and feedback, and coordinated action from our state, federal, and local government partners, and various other stakeholders including non-governmental organizations (NGOs), business, industry, and academic and research institutions.

Providing for Transitions. Louisiana’s coastal crisis has and is displacing people, infrastructure, businesses, and entire communities. Sensitivity and fairness must be shown to those whose homes, lands, livelihoods, and ways of life may be affected by master plan projects or by continued land loss and flooding.

Participatory Process. The master plan was developed with the participation of the many diverse interests that live, work, play, and own property in coastal Louisiana, along with national interests that have a stake in coastal Louisiana’s landscape.

Accounting for Uncertainties. Planning for the next 50 years means acknowledging a certain level of financial, environmental, and scientific uncertainty. We do know, however, that land loss and increased flood risk will continue, and the risk of doing nothing is far greater than the risk of acting with incomplete knowledge.

Adapting to Changing Circumstances. The master plan is updated every six years with model and process improvements, including the integration of newly available data, to respond to changing economic, social, environmental, and climatic conditions in Louisiana’s dynamic coastal communities.

Efficient Use of Resources. The master plan was developed in a way that acknowledges the need for efficient use of resources, such as funding and sediment. The plan’s analysis seeks to capitalize on synergies among projects, resolve overlaps and conflicts, and promote sound management of resources.

Sediment for Restoration. At present, limited supplies of, or access to, renewable sediment resources constrain the restoration efforts we can undertake. We consider both natural processes and dredging options to meet our needs, and focus on introducing sediment from outside the system.

Regulatory Effects. Revisions to some laws and regulations may be needed to help the state’s coastal program better achieve its goals, and cooperation is needed from local, state, and federal partners.

Role of Private Landowners, Business, and Industry. Close working relationships with private landowners are essential, not only for their support, but to gain knowledge about private coastal lands. Since Louisiana is also a working coast, partnerships with businesses and industries are also important for the success of the coastal program.

LEADING UP TO 2023

A TIMELINE OF PROGRESS

The information shown here represents just some of the notable events and key achievements of Louisiana's coastal program since 2005. Project implementation metrics are also presented to track accomplishments over time.

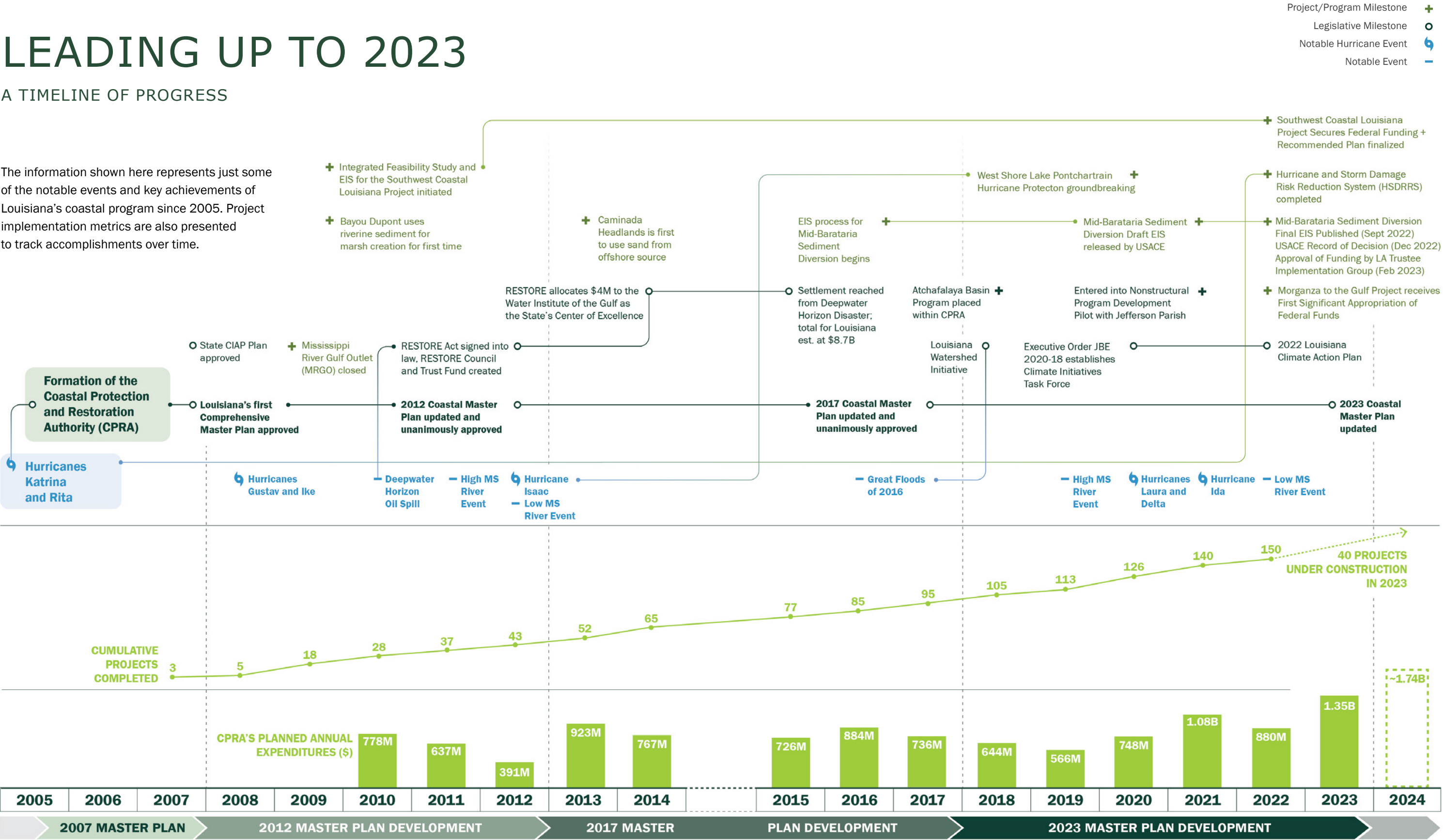
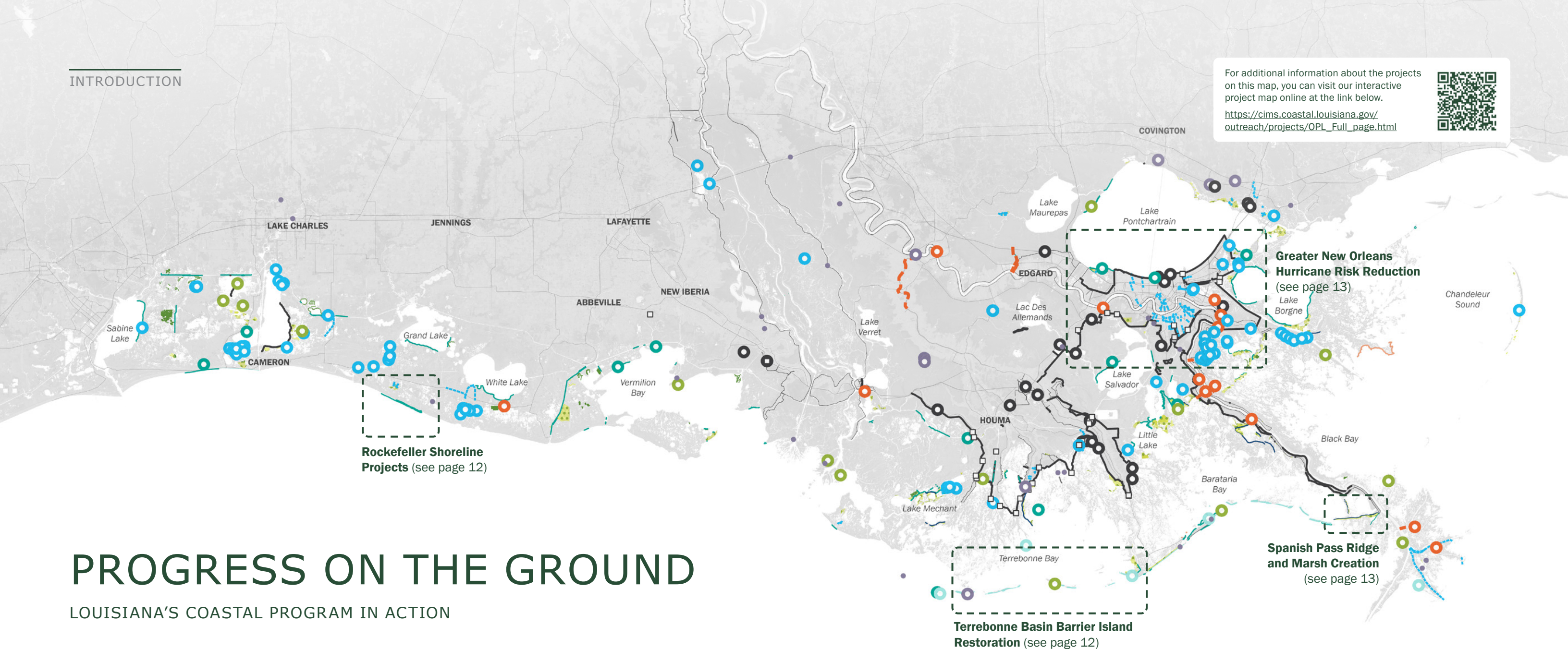


Figure 1.2: Timeline of Master Plan Efforts Leading up to 2023 and Other Notable Events.



PROGRESS ON THE GROUND

LOUISIANA’S COASTAL PROGRAM IN ACTION

CPRA is an implementation agency – we do not just plan projects, we build them. For decades, the state and our partners have moved projects forward from conception to construction, securing \$21.4 billion in pursuit of coastal restoration and risk reduction efforts since 2007. Over that time, CPRA has completed more than 140 projects to benefit coastal Louisiana. Since 2007, these efforts have totaled:

- 55,807 acres benefited (87.2 sq mi)
- 193 million cubic yards of sediment placed
- 369 mi of improved levees
- 71.6 mi of restored barrier islands

Louisiana is committed to mobilizing dollars quickly and efficiently through the master plan process and to leveraging advanced science and technology and the dedication of people working to implement the master plan.

The following spread provides more details on some example projects highlighted in the coastwide map shown above.

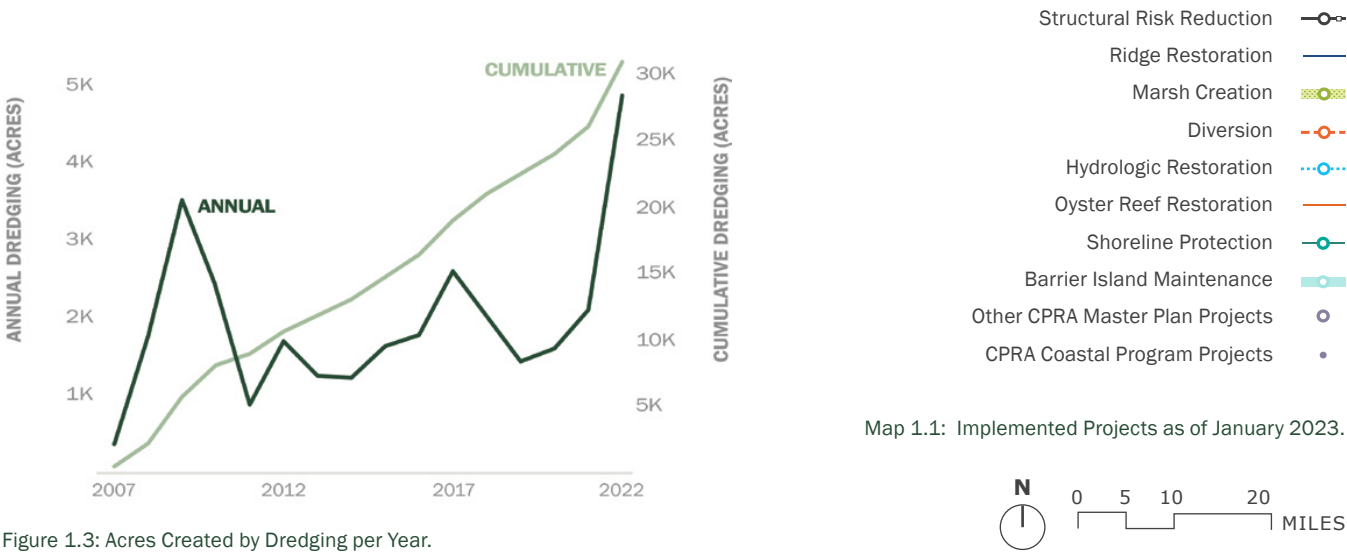


Figure 1.3: Acres Created by Dredging per Year.

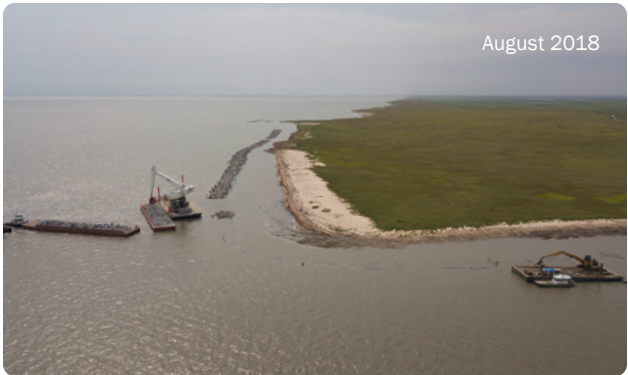
Map 1.1: Implemented Projects as of January 2023.

INTRODUCTION

ROCKEFELLER SHORELINE PROJECTS

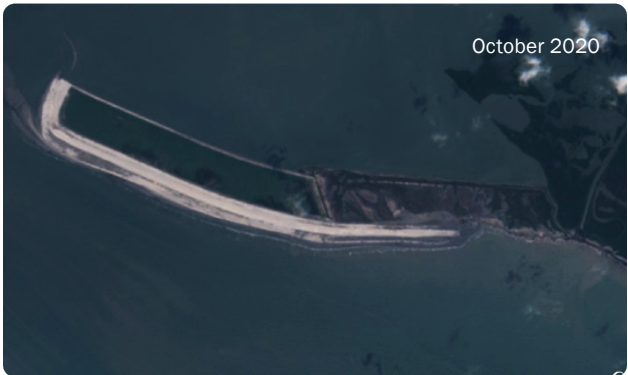
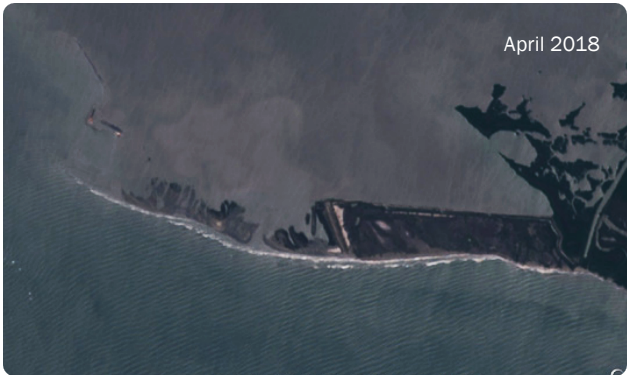
The Rockefeller Shoreline projects, three in all, together represent over 5 mi of foreshore breakwaters. They protect reaches of the Gulf shoreline that have been eroding at some of the highest rates in Louisiana.

Due to soft substrates this project involved the development of novel techniques for the placement of breakwaters, including testing of different approaches. Lightweight aggregate in the core of the breakwaters reduces their weight, while providing the necessary structure to reduce wave erosion.



TERREBONNE BASIN BARRIER ISLAND RESTORATION

The Terrebonne Basin Barrier Island and Beach Nourishment project includes the engineering, design, and construction of approximately 1,100 acres of beach, dune, and marsh habitat within the Terrebonne Basin barrier shoreline system. It uses dredged material from Ship Shoal, and includes restoration of beach, dune and marsh habitat on West Belle Headland, Timbalier Island, and Trinity Island.



GREATER NEW ORLEANS HURRICANE RISK REDUCTION

The Hurricane and Storm Risk Reduction System (HSDRRS) project includes the construction and improvement of 133 mi of perimeter risk reduction features, such as levees, floodwalls, floodgates, and pump stations to reduce risk for an event with a 1% annual exceedance probability. It also includes about 70 mi of interior risk reduction features such as large-scale pump stations. It is among the most advanced storm surge risk reduction systems in the world.



SPANISH PASS RIDGE AND MARSH CREATION

The Barataria Basin Ridge and Marsh Creation Project, Spanish Pass Increment project involves dredging sediment from the Mississippi River to restore 132 acres of earthen ridge and 1,538 acres of marsh along Spanish Pass in Plaquemines Parish, a natural historic river distributary west of Venice, Louisiana.



THIS UPDATE OF THE MASTER PLAN

The master plan serves as a long-term, comprehensive guide to restoration and risk reduction investments by the State of Louisiana and is undertaken in parallel with other efforts to address more acute challenges in the coastal zone. In the past six years, several events and initiatives have influenced the conversations and actions around issues of environmental and community change across the coast.

SINCE THE 2017 COASTAL MASTER PLAN

The state and its partners have remained hard at work since the adoption of the 2017 Coastal Master Plan to address challenges across the coast. Thousands of Louisiana residents were negatively affected and/or displaced as a result of Hurricanes Laura and Delta in 2020, and Ida in 2021 among others, and state and federal assistance related to these events is ongoing. The Louisiana Office of Community Development’s resettlement of Isle de Jean Charles has begun to see the first residents move to their new homes near Schriever, Louisiana. The Chitimacha Tribe of the Central Coast was awarded \$5 million as part of the U.S. Bureau of Indian Affairs’ greatly expanded efforts to assist tribes severely affected by climate-related environmental threats.

Permits for the Mid-Barataria Sediment Diversion were approved by the U.S. Army Corps of Engineers (USACE) and the project received necessary funding to start construction. The HSDRRS was completed and handed off to the state and levee boards. The West Shore Lake Pontchartrain Risk Reduction project was funded and construction has started. In addition, Governor John Bel Edwards’ administration

appointed Louisiana’s first Chief Resilience Officer and encourages state agencies to incorporate long-term coastal change projections into their planning and operations. Governor Edwards also established the Climate Initiatives Task Force, which released a plan to guide the state’s pursuit of carbon neutrality by 2050. In 2018, in response to the statewide flood events of 2016, the state launched the Louisiana Watershed Initiative, a watershed-based approach to reducing flood risk in Louisiana. It is designed to coordinate and align various state and federal programs, and coordinate policies and decision-making among local jurisdictions within a watershed.

WHAT’S NEW IN 2023

Building on the capabilities and advancements of previous plans, the 2023 Coastal Master Plan includes efforts to improve project development and evaluation; incorporate the best available science to refine tools and analyses; collaborate with federal, state, and local governments, academia, and NGO partners; and effectively engage stakeholders.

Following two public solicitations for new project ideas, CPRA worked with Regional Workgroups (RWs) to refine project concepts and identify areas of need that were not represented among the initial proposals. Ultimately, 131 candidate projects were evaluated. Projects were developed with a focus on addressing regional-scale challenges and integrating restoration techniques to amplify benefits. A new robust project selection process was used to identify projects that perform well under a range of possible future conditions to address climate and other uncertainties in the decision-making process. Improvements to predictive models include updates to inputs and assumptions, such as the vegetative response to



Image: Pass A Loutre, 2020 (CPRA)

stressors and ensuring environmental scenario values vary consistently with potential climate change pathways and sea level rise. Risk modeling now incorporates updated and higher resolution coastal assets data, population change, and community demographics information. The development of new risk metrics allows us to better understand and illustrate who is currently most vulnerable to flood risk and how different communities may experience future flood risk. Nonstructural risk reduction strategies are considered coastwide to better support funding and implementation opportunities provided by multiple agencies and programs.

To facilitate effective communication of the results, the 2023 Coastal Master Plan makes more results from the analyses accessible through the Master Plan Data Viewer.

These improvements work together to create a plan that is both realistic and practical, links risk reduction and restoration projects, and focuses on a message of transition and adaptation for coastal Louisiana residents.

FOCUS ON THE COAST

The 2023 Coastal Master Plan presents a vision for the coast and illustrates the benefits of continued investment and implementation of projects.

- The plan relies on a variety of restoration project types that harness natural processes and use available dredge material to create and maintain land over time.
- The plan looks to both structural and nonstructural risk reduction projects to provide storm surge-based flood risk reduction to communities across the coast and provides information on the residual risk faced over the next 50 years.
- The plan provides tremendous economic development opportunities for Louisiana and its citizens. Our investment in coastal research has spurred the growth of this and related fields.
- The ecosystem benefits provided by the plan will support commercial and recreational fisheries and wildlife across the coast and provide additional benefits to our communities.
- The plan provides a blueprint for action that is consistent with and supportive of other efforts at the local, state, and federal level and provides information to support the work of other agencies.



CHAPTER 2

UNDERSTAND

To understand how best to restore and protect Louisiana’s coast, we must recognize its value as a natural, economic, and cultural resource.

The state has a rich history of connection between its landscape and communities as well as decades of scientific study of land loss and storm impacts. Bringing this knowledge together means better planning for the future of our coast.

INTRODUCTION

UNDERSTAND

PREDICT

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Image: Grand Isle, 2016 (CPRA)

A PART OF THE SOLUTION

PLANNING AND COOPERATION

Coastal resilience is more than restoration and protection. State agencies, parishes, municipalities, levee districts, federal partners, businesses, and individuals must work together in support of a comprehensive approach to enhance the resiliency of our communities, livelihoods, culture, and coastal environment.

The 2023 Coastal Master Plan serves as the guiding document for the state’s investments in coastal restoration and risk reduction. While updating each master plan is complex and takes six years to complete, plan development is only one part of CPRA’s work.

The master plan process develops and evaluates project concepts to generate regionally significant impacts over decades that complement local and parish-level efforts, and that help respond to specific events, like hurricanes or oil spills. The master plan process allows the state to be prepared when restoration or risk reduction funding becomes available by evaluating project concepts and advancing promising ideas.

Once funds are identified and incorporated into CPRA’s Integrated Ecosystem Restoration & Hurricane Protection in Coastal Louisiana: Fiscal Year Annual Plan (annual plan), projects can efficiently move forward. They are analyzed in more detail during the feasibility process through which CPRA, the state, and our partners refine our understanding of how a project is expected to perform and what it will take in terms of funding, timelines, permitting, etc. to construct and operate.

From there, projects can move forward to engineering and design.

The next stage, once funds and permits are in hand, is construction. Depending on the project type and size, this can take several years, and hundreds of local jobs may be created during the construction phase.

Following construction, CPRA or its partners are responsible for project operation, maintenance, and monitoring. This improves project outcomes and provides data and information necessary to inform future planning efforts and adaptively manage the state’s coast with respect to ongoing challenges.

CPRA is both a planning and an implementation agency, which ensures consistency between the master plan and CPRA’s other charges.

EXPANDED COORDINATION

In addition to the work of CPRA, the State of Louisiana leverages local government initiatives, the efforts of other state agencies, federal studies and funding, and the work of NGO and community-based organizations to expand the reach of our coastal program.

Through state and local partnerships, large-scale risk reduction projects, such as the Morganza to the Gulf project, have been pursued incrementally.

The Governor’s Adaptive Governance Initiative (AGI) has promoted information sharing among state agencies and their assessment of

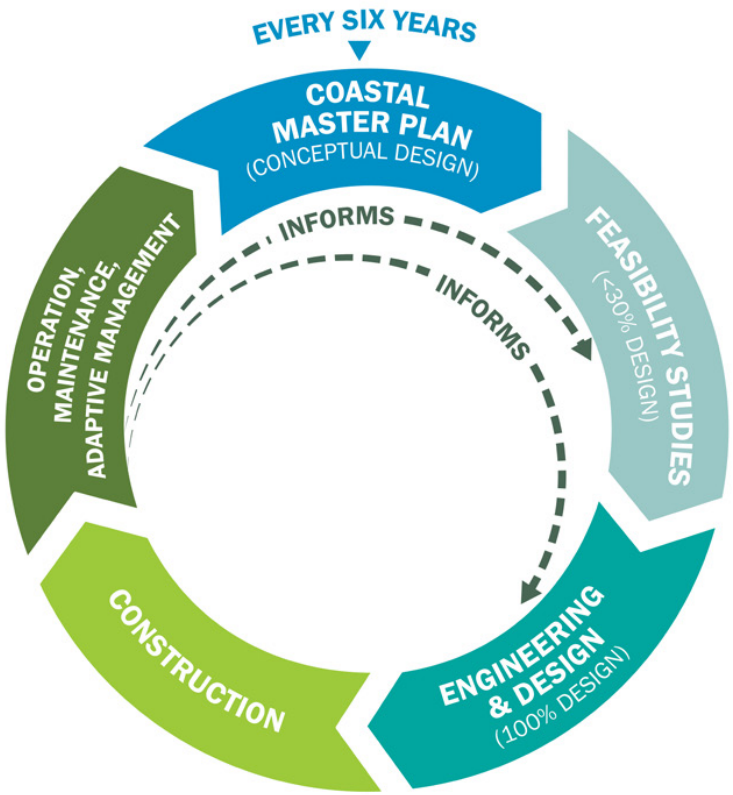


Figure 2.1: Six-Year Cycle to Update the Master Plan.

vulnerabilities, identification of adaptation actions, and pursuit of measures to make our coastal communities more resilient. CPRA supports the agencies in their efforts to consider environmental change projections from the master plan in their long-term planning and decision-making.

In addition to state and local partners, CPRA also works directly with USACE to monitor and maintain levees and coordinates with the Federal Emergency Management Agency (FEMA) and other federal partners during and in the aftermath of damaging storms.

The state’s pursuit of these endeavors is anchored in a commitment to the people and places that make up coastal Louisiana. While restoration and risk reduction planning is essential for managing the coast and providing consistent, long-term investment in our communities and ecosystems, it cannot meet every need.

Resilience and the future of coastal Louisiana rely on identifying goals, cultivating a shared vision, and continuing to adapt to changing conditions. The state, through updates to the master plan and each of the efforts above, supports Louisianans in understanding how the coast will change in the future allowing them to prepare accordingly.

Adaptive management is a structured, iterative process of incorporating new information to improve decision-making over time and it is foundational to CPRA’s work. As CPRA and its partners continue to plan, design, implement, and monitor large scale restoration and risk reduction projects, the lessons learned are incorporated into each step of the process. Updating the master plan every six years helps ensure adaptive management and allows CPRA to incorporate the best available science and to reassess the tools and processes used to develop the plan.

THE VALUE OF OUR COAST

A trip to coastal Louisiana makes clear what a valuable resource it is. It boasts extensive swamps filled with Spanish moss-draped cypress trees and miles of coastal marshes. Alligators float on the water’s surface, between the fish swimming below and the birds flying above. This landscape supports a thriving ecosystem and is home to a diverse group of people and their rich cultures. Many make their living on the Louisiana coast – fishing, hunting, and working in industry. Louisiana’s working coast benefits the U.S. economy and Louisiana-made products can be found throughout the world.



Image: Atchafalaya Basin, 2018 (Louisiana Sea Grant College Program)

Image: Fort Pike, 2021 (CPRA)

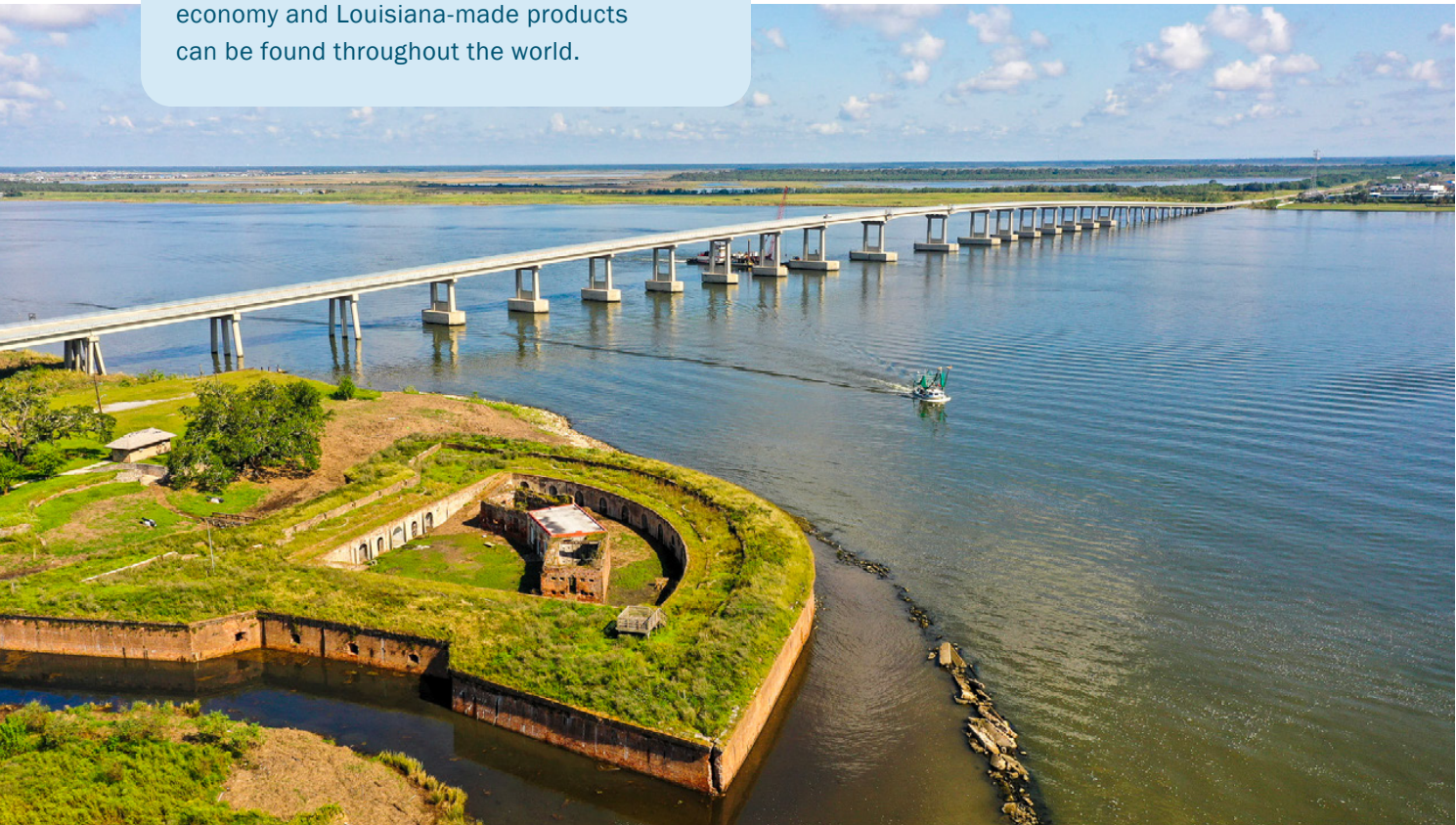


Image: Pier Fishing at Pointe-aux-Chênes, 2015 (Louisiana Department of Wildlife and Fisheries [LDWF])

The landscape is for leisure too. Recreational fishing, hunting, birding, and boating in coastal Louisiana are unparalleled. Locals and people from all around the world come to enjoy the beautiful and bountiful landscape.



Image: Pointe-aux-Chênes, 2020 (CPRA)

These experiences, skills, and enjoyments have been passed down for generations. Implementing the 2023 Coastal Master Plan is critical to a vibrant future coast for generations to come.

A HISTORY OF CHANGE

DYNAMIC LANDSCAPES AND COMMUNITIES

The landscapes and communities of Louisiana have changed immensely over time – from the early Indigenous settlements to our present-day rural and urban populations and industries – and will continue to do so in the future.

Much of the land that makes up coastal Louisiana was formed from sediment that washed down the Mississippi River and was distributed over thousands of years as the river changed course and left behind enormous deltas with vast areas of coastal wetlands. As one delta was built and others degraded, the diversity of the ecosystems—from swamps to salt marshes to barrier islands—emerged. To the west, sediments moved along the coast as the Mississippi changed course, and periodic deposition and erosion led to chenier ridges across the wetland plain.

These underlying formations created a vast complex of wetlands interspersed with protected lakes and bayous that provided essential navigable waterways during pre-colonial and post-industrial periods. The fertile lands, made of rich sediments from overflowing rivers and bayous, first made this region desirable to early native and settler populations.

Louisiana’s population, culture, and economy have evolved over time. The original inhabitants of this land were the Indigenous peoples that lived in the area for thousands of years before the arrival of Spanish and French settlers in the 16th and 17th centuries. The population expanded and diversified with the arrival of thousands of enslaved people transported from West and Central African nations. The 18th century saw the arrival of Acadians from present day Nova Scotia who, when they were expelled by the

British, chose to settle in Louisiana. Descendants of these groups, including the geographically unique Creole population, have continued to make their home in Louisiana alongside more recently arrived residents, including members of Louisiana’s large Vietnamese and Latin American communities.

During and after World War II, Louisiana’s significant economic development was associated with the petrochemical industry and increased drilling for oil and natural gas, both inshore and in the Gulf of Mexico. This energy development completely transformed the state’s economy and its landscape. As the oil and gas industry expanded, thousands of miles of canals were cut through Louisiana’s coastal wetlands, unintentionally contributing to and exacerbating land loss. Chemical production, leveraging the state’s readily available hydrocarbons, sulfur, salt, and water resources, boomed between 1947 and 1957 when the first big move to offshore petroleum production was made. After the war, the rise of global economic markets led to rapid industrialization in Louisiana including oil refineries, petrochemical plants, foundries, food production, fishing, timber, transportation equipment, and electronic equipment. Today, chemical, petroleum, and coal products remain Louisiana’s leading industrial sectors, providing approximately 30% of all industrial activity in the state. These industries are located predominantly along the Mississippi River between Baton Rouge and New Orleans, and near Lake Charles, where they are served by deep water navigation channels.

While petrochemical production is still important, the agricultural foundation of rural Louisiana remains strong. Louisiana farmers produce a variety of commodities, including sugarcane, soybeans, rice, feed grains,

cotton, strawberries, hay, and pecans. Louisiana is also the nation’s second largest seafood supplier and the seafood industry is a major employer across the coast. From shrimp to oysters and crabs to crawfish, Louisiana seafood remains an iconic product for the state.

Many of these coastal industries and businesses rely on workers living in coastal communities that have been increasingly impacted by damage from hurricanes in recent decades. Repeated flooding, frequent and unpredictable evacuations, and challenges with obtaining affordable insurance are all factors that have contributed to many residents’ decisions to move. The residents of south Louisiana have always moved with the changing coast and will continue to do so as they weather these challenges. However, moving away from the coast today is a different proposition than it was 100 or even 50 years ago. The way we currently live and work in coastal Louisiana means most of us move houses or jobs relatively infrequently and have strong ties to our local communities. Long-term, gradual changes to the coastal landscape and increased flooding risks, along with the more acute impacts of hurricanes such as Katrina, Rita, Ike, Gustav, Laura, Delta, and Ida have led some coastal residents to move north. People are moving to areas that might not be ready for them. Increases in traffic, needs for road improvements, and a lack of affordable housing are all problems that expanding communities and their new arrivals face. Understanding the challenges that come with a changing

coast is important so individuals and communities can plan and adapt. The 2023 Coastal Master Plan presents a detailed picture of what the future may hold and a plan for transition through continued investment in coastal restoration and risk reduction projects.

ENVIRONMENTAL AND CLIMATE CHANGE

Unfortunately, over the past century, the State of Louisiana has experienced changes to its landscape and the environment that pose significant challenges to the lives and livelihoods of many Louisianans. Since 1932, more than 2,000 square miles of Louisiana’s coast, and the benefits they provide, have been lost. Both natural processes – such as hurricanes, erosion, subsidence, sea level rise – and human-made challenges – like the cutting of canals, oil spills, and building levees on the Mississippi River – impact coastal wetlands and barrier islands and undermine their ability to replenish naturally.

These issues are exacerbated by the impacts of climate change, which contributes to increasing rates of sea level rise and more intense hurricanes. Climate change will increase flooding in coastal communities, as tides get higher and roads flood more frequently. Drainage becomes more difficult as water levels rise, flooding fields and yards and causing excessive inundation of previously vibrant wetlands. The remaining wetlands and communities of coastal Louisiana are especially vulnerable, and additional land loss and increased flooding risk are inevitable over the coming decades.



Image: Map of the Alluvial Region of the Louisiana Coastal Plain, 1861 (Library of Congress)

PREPARING FOR THE FUTURE

Change is inevitable for Louisiana’s coast. The state’s landscape will look different in 50 years regardless of the environmental conditions we face. It is important that we prepare for the future in order to protect our way of life. Although the future is uncertain, predictions of climate change are constantly improving and can provide significant insight for how we should adapt to oncoming change in order to retain our culture and traditions. The master plan looks at a range of potential future environmental conditions to best be prepared for what the future brings. The plan looks forward to the next 50 years in order to identify a path forward. This allows us to make timely progress toward the future and be proactive. As the plan is implemented, we evaluate at every step and are able to adapt to the way the future unfolds.



Image: Elevated Camps along Bayou Decade, 2021 (CPRA)



Image: Bridge Repair Post Hurricane Ida, Lafitte, 2021 (CPRA)



Implementing projects to restore wetlands and reduce flood risk are part of how we prepare for the future, but they cannot fully address the impacts that a changing coast will have on residents and communities. Through the state’s Adaptive Governance Initiative, CPRA will continue to coordinate with fellow state agencies to help them consider coastal change as they manage programs that support coastal communities and resources—ranging from access to key services to supporting cultural preservation.

For more information on the state’s Adaptive Governance Initiative, see **Chapter 7: Beyond the Master Plan.**

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Image: Hurricane Laura Damage in Cameron Parish, 2020 (Louisiana Sea Grant College Program)



The master plan and the information produced are not just to support state-led efforts but also to help individuals and communities understand how they may experience coastal change to help them make the best decisions they can.

Image: Waterfowl Youth Hunting weekend in Atchafalaya Delta WMA (LDWF)



Image: Mississippi River Port, 2019 (CPRA)

A PEOPLE-FOCUSED PROCESS

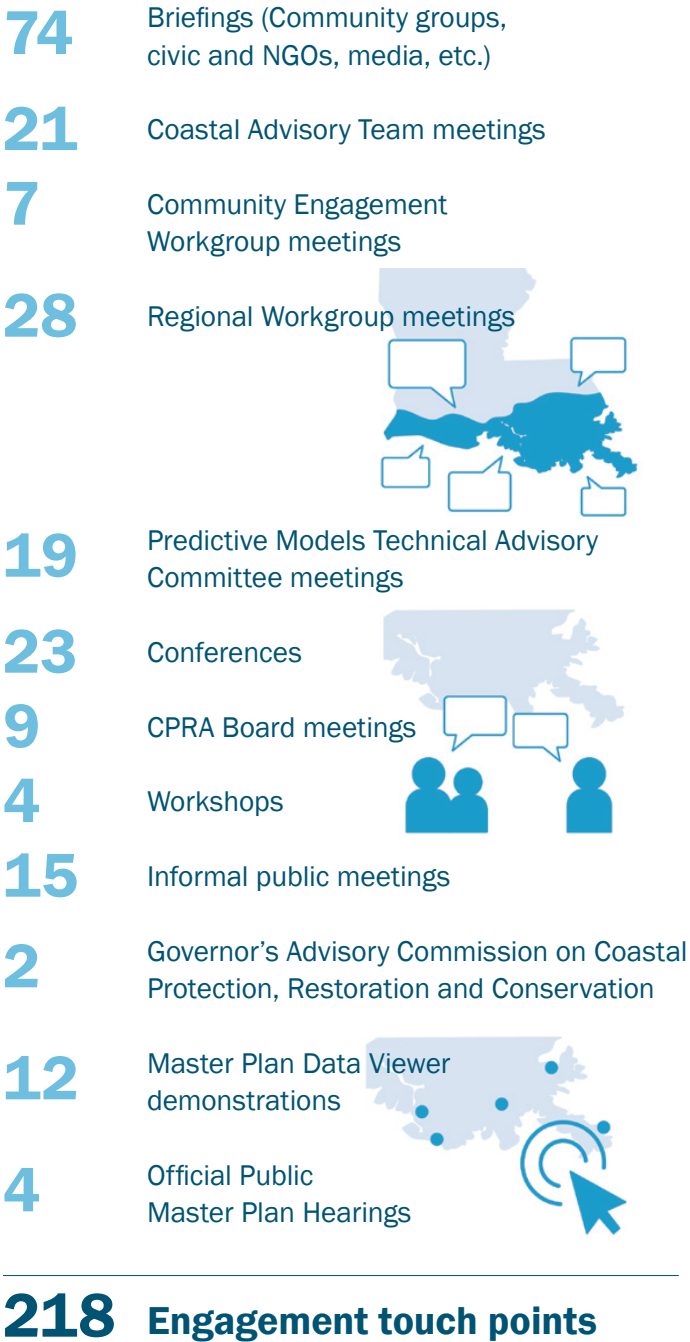
STAKEHOLDER INPUT

The 2023 Coastal Master Plan was developed through years of discussion, engagement, and input from the people of Louisiana.

From the very first master plan, interaction with a broad array of local stakeholders, communities, and technical experts has been crucial to defining the goals of the state’s coastal program and developing solutions to address land loss and storm surge-based flooding.

Engagement with the master plan process takes many forms. In 2018, several advisory groups were established to bring experts from across the state into the plan and project development process. The insights and participation of our Coastal Advisory Team (CAT), five Regional Workgroups (RW), and Community Engagement Workgroup (CEW) helped to focus efforts on meaningful advancements, refine project concepts to address critical regional issues, and understand the hopes and concerns of individuals and communities coastwide. One result of this was the development of new project concepts by local experts with on-the-ground experience and knowledge of conditions.

Throughout plan development, CPRA staff had conversations with a variety of groups and individuals, including fishers, students, landowners, business and industry representatives, NGOs, parish officials, elected leaders, and tribal leaders. Discussions focused on the future of our coast and actions we can take now to achieve a more resilient future. These conversations occurred in many places, including classrooms, civic centers, ports, council chambers, banquet rooms, and boat launches. The figure to the right provides a summary of these efforts for the 2023 Coastal Master Plan.



More than **200** hours of engagement
118 Technical Partners
from **31** Institutions / Organizations
113 Advisory Group members
from **85** Organizations



Images: Engagement Efforts (CPRA)

THE ROLE OF SCIENCE

USING WHAT WE KNOW

While we do not know exactly how the coast will change in coming decades, the fact is that the coast will certainly be different than it is today, just as it is different now than in the past. The master plan’s intent is not to halt or reverse that change. Rather we use advanced tools to predict a range of possible future coastal conditions. These predictions provide a basis for a plan that moves toward more desirable and sustainable outcomes for Louisiana residents, businesses, and our natural coastal resources.

To ensure the 2023 Coastal Master Plan is built on the best possible scientific foundation, the State of Louisiana brought together local, national, and international experts to refine data, improve predictive models, and design comparative analyses. Through this process and by building on experience from previous master plans, we believe that the 2023 Coastal Master Plan is the most advanced coastal plan of its kind anywhere in the world.

PREDICTIVE MODELS

The master plan uses predictive modeling tools that consider landscape change, storm surge and waves, and flood-related damages to coastal Louisiana structures and assets to understand what the future holds under a range of environmental conditions. These models are also used to evaluate the potential benefits of restoration and risk reduction projects and identify projects that best reduce land loss and storm surge-based flood damages through the 50-year planning time frame. CPRA partnered with multiple entities to use advanced and high performance computer systems to run these models.

THE LANDSCAPE MODEL (ICM)

The landscape of coastal Louisiana is represented using the ICM which predicts coastal hydrology, wetland morphology, vegetation dynamics, and the suitability of habitats to support an array of fish and wildlife. The ICM builds on the version used for the 2017 Coastal Master Plan, but recent improvements include refined resolution in key areas and the incorporation of additional processes.

The State of Louisiana’s Coastwide Reference Monitoring System (CRMS) is a large network of more than 300 wetland-based observation stations that, since 2006, have collected data about wetland elevation, water levels, salinity, vegetation, and land change. In the 2023 Coastal Master Plan, data from CRMS stations has been used to refine how wetland vegetation in the ICM responds to changes in salinity and inundation stress. CRMS data, along with data and information from other CPRA-funded studies, were also used to improve the evaluation of subsidence (i.e., sinking of the ground) across the coast.

Future environmental change is an important driver of the predictive models used to inform master plan development and decision-making. During plan development, the most recent available global climate model outputs were leveraged to develop environmental scenarios that use climate-related variables, such as sea level rise rates and temperature changes, to represent plausible future conditions.

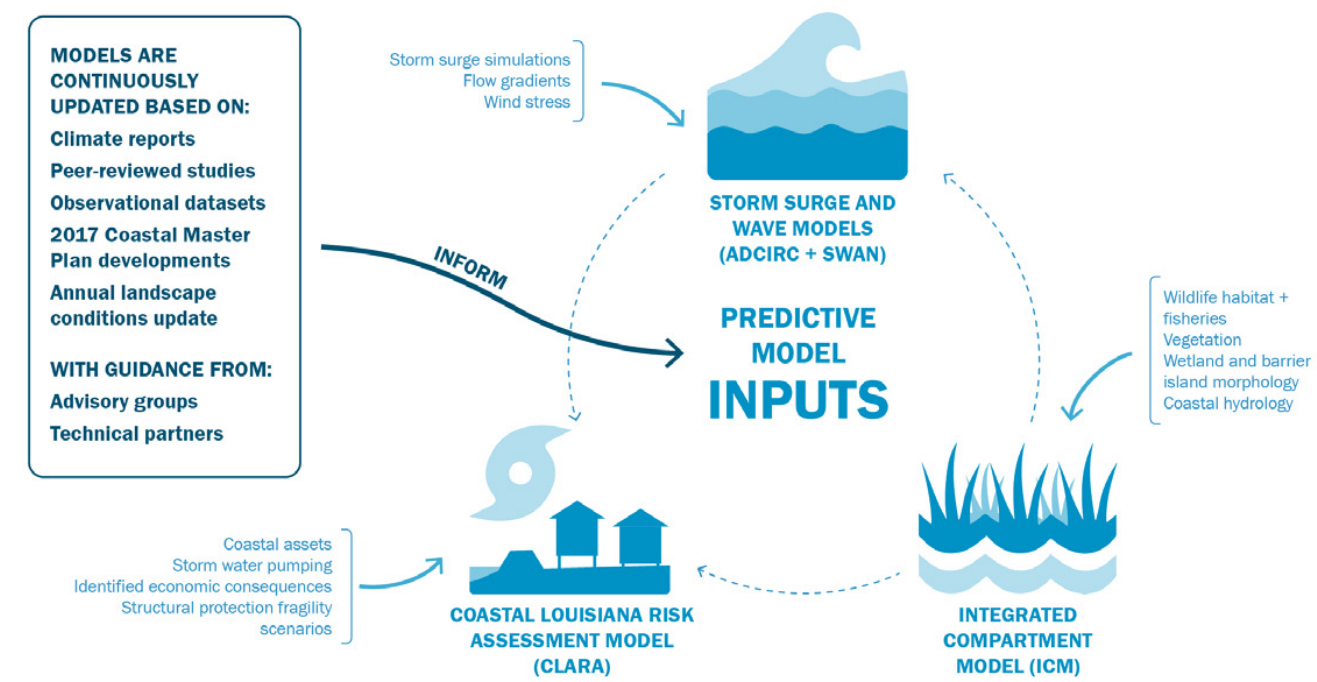


Figure 2.2: Predictive Model Inputs.

STORM SURGE AND WAVE MODELS (ADCIRC+SWAN)

Risk to coastal communities from hurricanes and other tropical events will continue into the future. Storm surge and wave models (ADCIRC+SWAN) are used to model storms and provide water level inputs to the risk assessment model.

Synthetic storms with varying characteristics, such as wind speed and central pressure, are used to test the impacts of a range of plausible events.

Working with the USACE Engineer Research and Development Center, an updated set of storms was used to model hurricanes and tropical storms, including more extreme and less intense events than were previously available, to predict associated storm surge and wave heights across the coast.

COASTAL LOUISIANA RISK ASSESSMENT (CLARA) MODEL

The CLARA model is designed to estimate flood depths and direct economic damages from hurricanes and other tropical events. CLARA is used to estimate risk under a range of assumptions about future environmental and economic conditions and with different combinations of structural and nonstructural risk reduction projects in place. The CLARA framework considers uncertainty related to future storms and their effects, as well as the physical landscape.

For the 2023 Coastal Master Plan, multiple detailed asset inventories were combined to characterize residential, commercial, industrial, and public structures across the coast to improve economic damage estimates. Additionally, through work with scholars at Purdue University, artificial intelligence was utilized to produce more accurate first floor elevations (which is used in damage estimates) than in any previous plan.

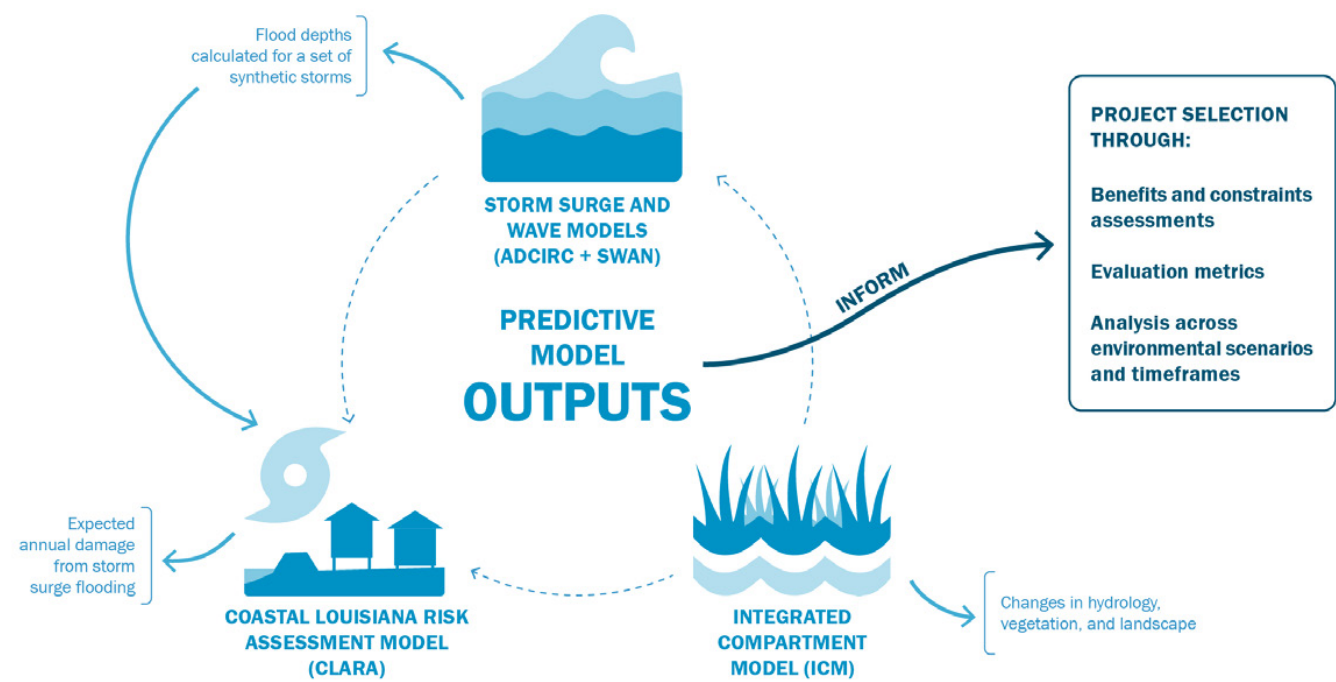


Figure 2.3: Predictive Model Outputs.

An economic measure of damages, known as expected annual damage in dollars (EADD), is an annualized estimate of storm surge damage. EADD includes damage to structures, their contents, and other direct losses incurred during the recovery period after a storm event, such as lost wages, costs associated with evacuation and temporary displacement, and other considerations. Another metric, expected annual structural damage (EASD) is an annualized estimate of structural damage. EASD is reported in ‘structure equivalents’ and represents an aggregate risk to structures, with damage to each structure expressed as a proportion of its replacement cost. Using EASD to represent flood damages ensures that the project selection process will not be more heavily weighted toward reducing damages in affluent communities at the expense of communities with lower property values. The incorporation of EASD in the 2023 Coastal Master Plan was an important step in providing an equitable and balanced risk reduction project portfolio.

>>> WANT TO KNOW MORE?

The following appendices provide additional information on model improvements, inputs, and other aspects of the predictive models used in developing the 2023 Coastal Master Plan.

- > **Appendix C: Use of Predictive Models in the 2023 Coastal Master Plan** provides an overview of all the predictive models and their uses in the 2023 Coastal Master Plan development process.
- > **Appendix D: Overview of Improvements to Landscape Modeling (ICM) for 2023** provides an overview of the ICM landscape model and how it functions, as well as details on improvements to individual model components.
- > **Appendix E: Overview of Improvements to Risk Modeling (ADCIRC+SWAN, CLARA) for 2023** provides an overview of two risk-related models focused on storm surge and waves (ADCIRC+SWAN), and risk assessment (CLARA).

FREQUENTLY ASKED QUESTIONS

Why is the master plan important to Louisianans?
The master plan provides a way for Louisiana leaders, residents, and businesses to understand what may happen in the future to their neighborhood, their favorite fishing areas, and how much flooding may occur in future storms. This allows them to prepare for, rather than react to, the changing coast. By knowing which projects are planned and how they can improve future conditions, individuals and communities can support these efforts, inform others, and work with local, state, and federal officials to expedite project implementation.

How can I get involved in the master plan process?
By reading the plan you are already engaged! The CPRA Board meets monthly to share updates on progress and allow individuals time for public comments. You can also sign up for master plan updates (email us at masterplan@la.gov) and follow our social media to stay informed of recent advancements and upcoming events. Providing your thoughts and comments about coastal change and how it impacts you, gives the state important context for when and where action is needed.

If new data is incorporated into the master plan models and it changes the results from the last plan, does that mean that the previous models were wrong? How do we know this plan is right? The master plan models are neither right nor wrong. Their job is to tell us how our current understanding of how the coast works will play out in the future as conditions change. The regular updates to the state’s coastal master plan allow us to ensure that the plan is based on what we know now, and leverage new developments in

understanding the coast. The updates to the models have been related to processes or data sets that we identified as major uncertainties in the previous plan. We have confidence in the plan as we test the models against data, and we use them to select a set of projects that will perform well under a range of assumptions about future conditions.

In this plan, restoration and risk reduction projects were selected based on their performance across multiple future conditions, which means they should provide benefits no matter how conditions change.

Coastal Louisiana has changed throughout history – why do we need a whole plan to deal with future changes? Coastal Louisiana is a very dynamic system and, over time, people have changed how they live to adjust to those changes, sometimes moving across the coast seasonally to harvest wildlife or catch shrimp. People have strong ties to their communities and those communities are one of the great strengths of coastal Louisiana. This plan aims to allow us to continue to live, work, and play in as many places as possible and ensure that Louisianans can continue to make a living in coast-dependent industries like ports, energy, and commercial fishing. Anticipating future change, and preparing for it with restoration and risk reduction projects, supports both our unique cultural heritage and the contribution of coastal residents critical to state, regional, and national economies.

>>> HAVE MORE QUESTIONS?

Visit us online at coastal.la.gov or contact us directly at masterplan@la.gov.

The background of the entire page is a photograph of a coastal landscape. It features large, mature trees with thick trunks and dense foliage, some of which have Spanish moss hanging from their branches. The trees are situated along a sandy beach that meets the water. The water is a calm, light blue color. The sky is a pale, hazy blue. The overall tone of the image is serene and natural.

CHAPTER 3

PREDICT

To predict potential future changes to coastal Louisiana over the next 50 years, we use predictive models to get an idea of how the landscape and storm surge-based flood damages might change with and without projects. Using an environmental scenario approach enables project performance to be tested against a range of future uncertainties.

INTRODUCTION

UNDERSTAND

PREDICT

EVALUATE

TAKE ACTION

REGIONAL
APPROACH

BEYOND
THE MASTER
PLAN

Image: Fontainebleau State Park, 2020 (Louisiana Office of Tourism)

PLANNING WITH MODELS

USING PREDICTIVE MODELING TO MAKE INFORMED DECISIONS

Since the 2007 Coastal Master Plan, the state has clearly articulated goals and objectives around reducing land loss, reducing storm surge-based flood risk, and realizing a future coast that supports how Louisianans live, work, and play. Each subsequent master plan used the most up-to-date information to predict how the coast may look in the future due to climate change and other environmental changes.

A combination of observations and scientific projections indicate that rising sea level, more intense hurricanes, and other environmental stressors will have major impacts on coastal systems, but exactly when, where, and how remains uncertain. In the face of this uncertainty, knowing how to adapt to a range of potential futures and achieve the goals of the state’s coastal program requires the use of predictive models to inform decision-making.

Predictive models can be used to understand potential future conditions and to test the impact of different strategies in meeting our goals. For example, the ICM was specifically developed to support the master plan process. It represents the landscape of coastal Louisiana and the physical and ecological processes, and feedbacks that drive coastal change. This model uses established and newly developed understandings of coastal dynamics to predict change on the landscape. The interaction between storms, waves, and the landscape are represented in two other models, ADCIRC and SWAN, which predict changes in storm surge flooding. These predictive models, when supplied with boundary conditions and inputs, produce outputs that reflect the complexity of coastal processes and how they change over time.

Boundary conditions are external inputs to the models that vary over time, such as water levels, river flows, or

wind speeds. They are based on historical conditions or predictions of future conditions. Data about elevation, water levels, vegetation, and other aspects of the landscape serve as a starting point, or initial conditions, for the 50-year predictions of landscape change in the ICM. The storm surge and risk assessment models are also informed by the boundary conditions imposed on the ICM as well as information about existing structures and infrastructure across the coast.

The future is uncertain with regard to climate-related environmental conditions and, therefore, assumptions about how climate will change must be made to make landscape- and storm damage-related predictions. We know that sea level rise and subsidence, along with precipitation, temperature, tributary flows, and hurricane intensity are key environmental drivers that influence our coastal landscape. We also know that there is uncertainty in how these variables may change over time. To make informed decisions, the master plan employs a scenario approach to define a range of plausible future environmental conditions.

SCENARIOS AND DRIVERS

For the 2023 Coastal Master Plan, we defined two scenarios, referred to as the “lower” and “higher” scenarios, to drive change within the ICM and ADCIRC+SWAN for use in project selection. Analyses from the 2017 Coastal Master Plan showed that two variables, subsidence and sea level rise, had the greatest impact on model outputs; therefore, development of scenarios for this plan began with choosing values for these two model inputs. Sea level rise rates were selected based on climate change modeling from external sources such as the National Oceanic and Atmospheric Administration (NOAA) sea level guidance and the Intergovernmental Panel on Climate Change (IPCC). Subsidence rates were determined through analysis of shallow and deep subsidence rates

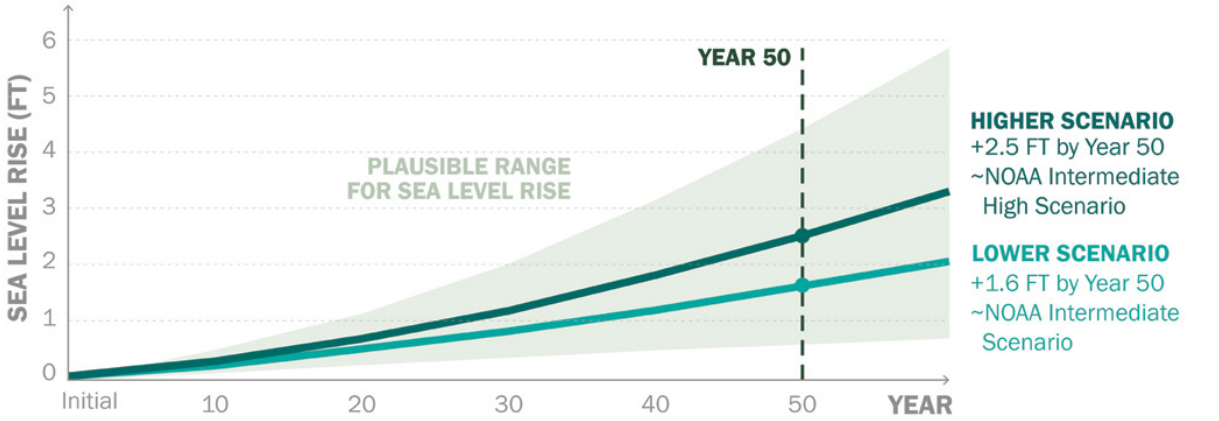


Figure 3.1: Sea Level Rise Curves for Project Selection and Range of Plausible Curves.

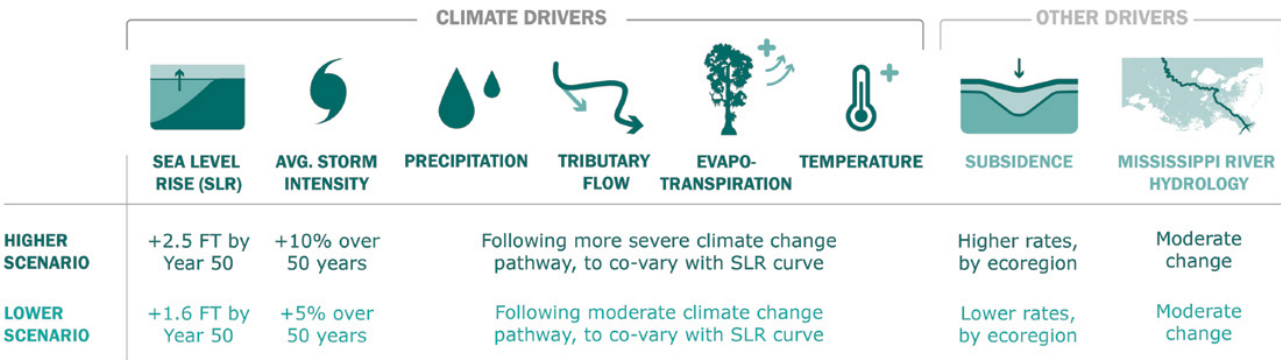


Figure 3.2: Environmental Drivers for the Higher and Lower Scenarios.

derived from CRMS and global positioning system (GPS) elevation data, with a greater rate of shallow subsidence applied in the higher scenario than in the lower. Overall, the lower scenario represents more moderate future conditions, while the higher scenario represents more severe conditions with greater sea level rise and shallow subsidence, leading to increased land loss and flood depths compared to the lower scenario.

Once sea level rates were selected for the two scenarios, values for the other scenario variables were derived from related global climate model outputs. When considered together, the model outputs of the two scenarios delineate a range of possible future landscapes and damage profiles that can be used to inform decision-making. While the use of this scenario approach does not make the future more certain, it does provide a better understanding of what may come and, thereby, increases confidence in the master plan being well-suited for whatever the future holds. Additional scenario values

are used in the prediction of storm surge-based flood damage in CLARA. The analysis does not necessarily assume that all storm surge protection levees hold when storm flooding occurs. Rather, CLARA uses two fragility (i.e., infrastructure performance) scenarios: 1) a no fragility scenario, where levees hold, and 2) a fragility scenario that uses assumptions developed by USACE in post-Katrina studies regarding when and where levee breaches could occur. Similarly, whether interior drainage pumps continue to operate during a storm to remove rainfall from poldered areas is also dependent on a variety of unpredictable factors. Therefore, CLARA uses three pumping scenarios: 1) drainage pumps are fully operational, 2) pumps operate at 50% capacity, or 3) no pumping.

>>> Additional details on scenario values can be found in **Appendix B: Scenario Development & Future Conditions.**

THE CURRENT OUTLOOK

THE FUTURE DEPENDS ON WHERE YOU START

When modeling the possible futures of coastal Louisiana, outcomes are significantly impacted by the chosen starting point. As part of the master plan development process, the starting landscape was updated from the one used in the 2017 Coastal Master Plan. This landscape update reflected changes in surface elevation, land/water distribution, and vegetation cover and was adjusted to include new restoration or levee projects that were recently constructed.

It is important that the initial landscape conditions used in the modeling represent the on the ground conditions as much as possible so that there is confidence that model outputs reasonably reflect landscape responses to candidate restoration and risk reduction projects.

FUTURE WITHOUT CURRENTLY FUNDED PROJECTS (FWOCFP)

As part of the 2023 Coastal Master Plan development, the ICM was run for 50 years under a condition referred to as “Future Without Currently Funded Projects (FWOCFP).” For these model runs, the only restoration or risk reduction projects modeled on the landscape are those that have already been constructed. Some of these projects are included in the existing conditions coastwide digital elevation model (DEM), which captures the location and elevation of these projects along with the rest of the landscape features.

The characteristics of other projects or features that were constructed after data were collected for the DEM were imposed on the model based

on engineering design documents, conversations with local landowners, institutions like levee boards, and others who have knowledge of their community and these features.

These model runs serve to demonstrate the possible future of coastal Louisiana if all future planned restoration and risk reduction efforts were halted and the coastal program only continued to operate existing projects. Given that funding for future projects is not guaranteed and that unforeseen circumstances could complicate the process of implementing projects that are already funded, comparing these model runs to those with projects that have funding but are not yet constructed can provide insight into the long-term effects of ongoing investments in the coastal program.

The 2023 Coastal Master Plan, however, does not assume this FWOCFP landscape to be the starting point. The next section provides additional detail about what is included in the master plan’s starting landscape or “Future Without Action (FWOA).”

FUTURE WITHOUT ACTION (FWOA)

The FWOA condition in the 2023 Coastal Master Plan serves as the baseline for predicting changes to the landscape and storm surge-based risk into the future. The initial landscape represented in the ICM and passed to the ADCIRC+SWAN and CLARA models reflects a snapshot in time while the coastal program continues its activities. Thus, a decision must be made about how to include the effects of ongoing work in the modeling.

To start, completed projects and existing landscape features are included in the DEM, as for FWOCFP.



Image: Operations at West Belle Headland after Hurricane Ida, 2021 (CPRA)

Then, additional projects and features are included based upon expectations around progress in implementing those projects. This includes projects that have undergone significant advancements in engineering and design, those that have availability of funding for construction, and those for which construction permits are currently being obtained.

Some of the projects included in FWOA are very large and are expected to have significant impacts on the future landscape following implementation. Of particular note are several projects that were included in the 2017 Coastal Master Plan and have been successful in advancing toward construction since that time.

For the first time, two large-scale sediment diversions off of the Mississippi River — the Mid-Barataria and Mid-Breton Sediment Diversions — are included in FWOA. These projects, when implemented, will divert sediment and water from the river when flows are favorable to transport sediment and deliver it to

the Barataria and Breton basins, respectively. The two mid-basin sediment diversions are anticipated to reconnect the adjacent basins to the Mississippi River as a source of sediment to nourish and maintain existing wetlands and to create coastal wetlands over time, in much the same way as southeast Louisiana was originally built by the Mississippi River before levee construction (see Chapter 2 for more details about the history of coastal Louisiana’s landscape).

Analysis from the 2017 Coastal Master Plan and subsequent engineering and design studies suggests that the Mid-Barataria Sediment Diversion has the potential to build 21 sq mi of new land over a 50-year period. In September 2022, USACE issued the final environmental impact statement (EIS) for this project. Federal and state permits and permissions for construction are under review as of December 2022. The Mid-Breton Sediment Diversion project is currently in advanced stages of design, and it is anticipated that initial construction could commence upon permit approval.

Another project that is assumed to be on the landscape in FWOA is the River Reintroduction Into Maurepas Swamp. This project includes a gated diversion structure in Reserve, Louisiana, and a conveyance channel crossing Highway 61 and Interstate 10 to allow a maximum of 2,000 cubic feet per second (cfs) of water from the Mississippi River to restore natural swamp hydrology and reduce salinity levels in the Maurepas Basin. Design of the River Reintroduction Into Maurepas Swamp project is nearly complete and construction is expected to begin in 2023. This diversion project was selected as a mitigation feature for the West Shore Lake Pontchartrain levee project, which is a large-scale structural risk reduction project currently under construction which is building over 18 mi of levee and floodwalls on the east bank in the river parishes of St. James, St. John the Baptist, and St. Charles. The integrated risk reduction and restoration project features

from these two projects marks an important step forward in recognizing the value in mitigating wetland impacts directly adjacent to projects; this will increase the resiliency of the West Shore Lake Pontchartrain Risk Reduction project and is an on-the-ground example of the master plan’s emphasis on both reducing coastal flood risk and restoring coastal habitats.

The impact of these projects can be seen in output maps for FWOA model runs (see maps 3.1-3.4) showing land creation that helps to strengthen wetlands in both basins. It is important to note that because these projects are in FWOA their benefits are not attributed to the 2023 Coastal Master Plan. Those benefits, however, are an important part of Louisiana’s coastal program and are the result of targeted, significant investment in large-scale restoration projects.

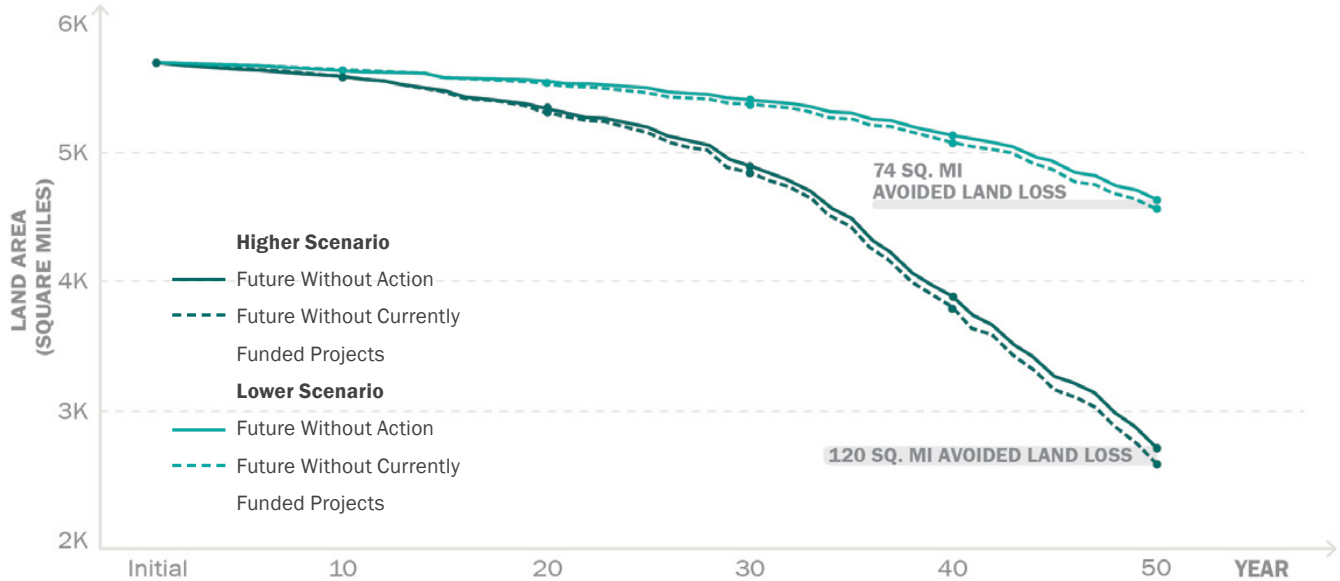


Figure 3.3: Land Area Over 50 Years, FWA and FWOCFP, Higher and Lower Scenario.

FUTURE WITHOUT ACTION OUTCOMES

Even with these projects assumed to be on the ground, the FWOA landscape realizes significant land loss and increases to storm surge-based flood depths over the 50-year model prediction. Under the lower scenario, 1,100 sq mi of land are lost at Year 50; an equivalent amount of loss occurs by Year 34 under the higher scenario, with up to 3,000 sq mi lost at Year 50 under those more severe environmental conditions.

This land loss impacts not only the landscape configuration and ecology but also results in changes to storm surge and waves and, thus, flood-related damages. Without additional project implementation, flood damages could increase by up to \$19 billion annually, with 17,000 additional structures damaged due to significant increases in flood depths. These possible futures without action reveal the challenges that the 2023 Coastal Master Plan was developed to address.

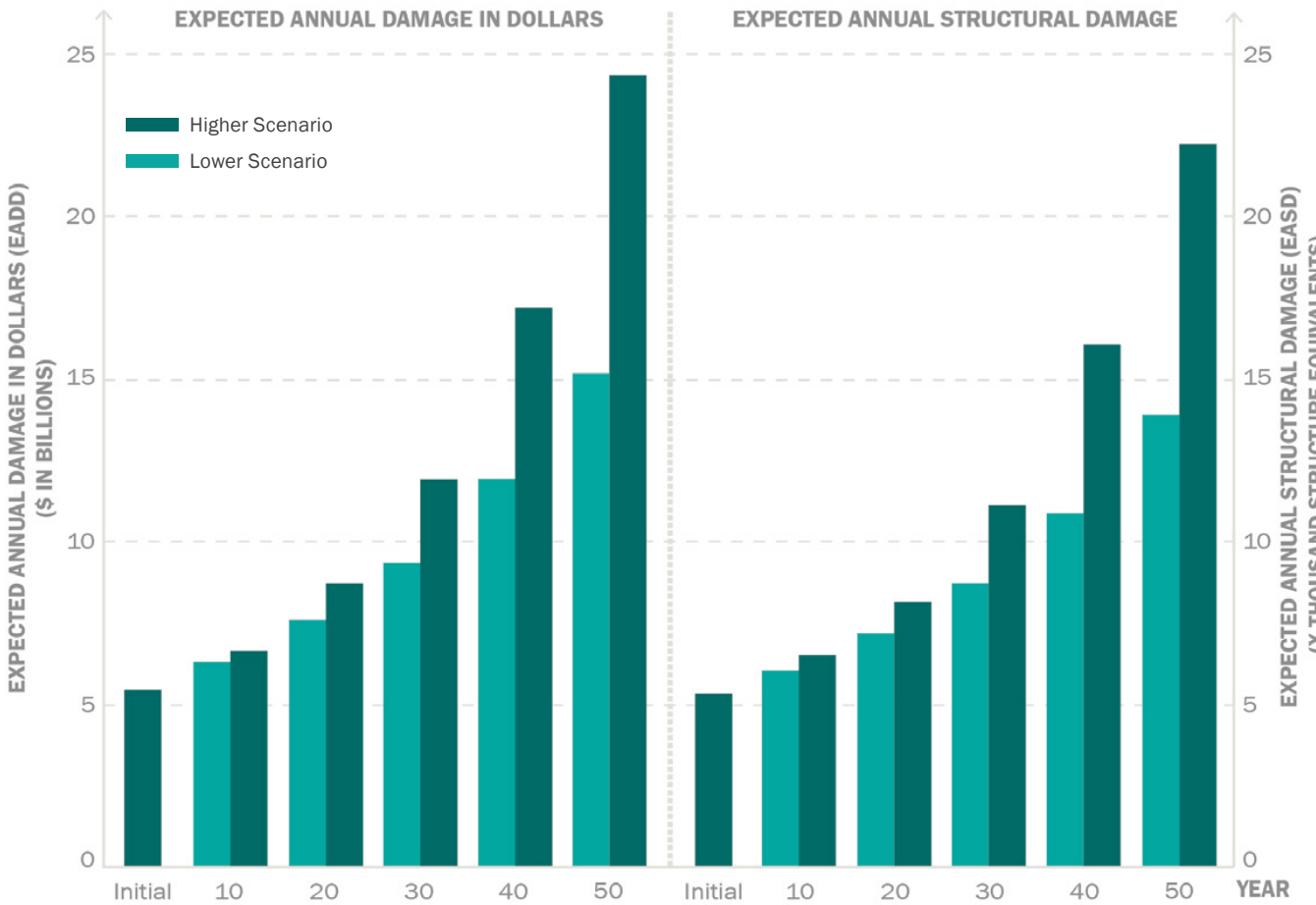
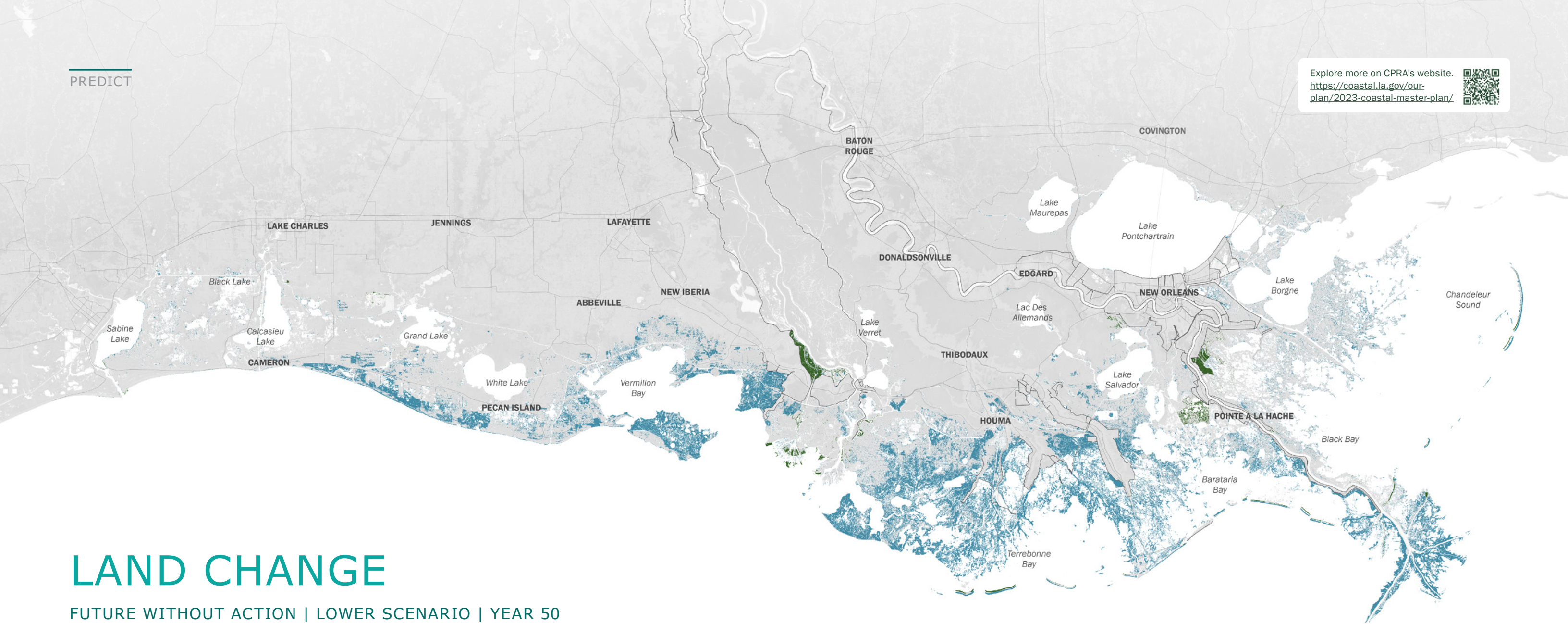


Figure 3.4: Expected Annual Damage in Dollars (EADD) and Expected Annual Structural Damage (EASD), Over 50 Years, Future Without Action, Higher and Lower Scenario.



LAND CHANGE

FUTURE WITHOUT ACTION | LOWER SCENARIO | YEAR 50

Because Louisiana’s coast is a dynamic system that will continue to be impacted by a changing climate, environmental conditions 50 years in the future will be different from those experienced today. Predictions of the FWOA landscape define the scale of the land loss challenge in coming decades and serve as a baseline against which candidate projects can be compared to determine their potential benefit.

Land change projections for the master plan’s lower environmental scenario, one of two scenarios used for project selection, are shown above. Under this environmental scenario, coastal Louisiana would experience moderate

climate change impacts, including sea level rise of 1.6 ft over 50 years. Without the 2023 Coastal Master Plan projects, the lower scenario ICM outputs predict 1,100 sq mi of land lost in that same time period. Much of the projected loss is concentrated in lower basins and on marsh edges.

>>> Go to **Chapter 5: Take Action** to read about how CPRA addresses these anticipated challenges through protection and restoration projects.

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