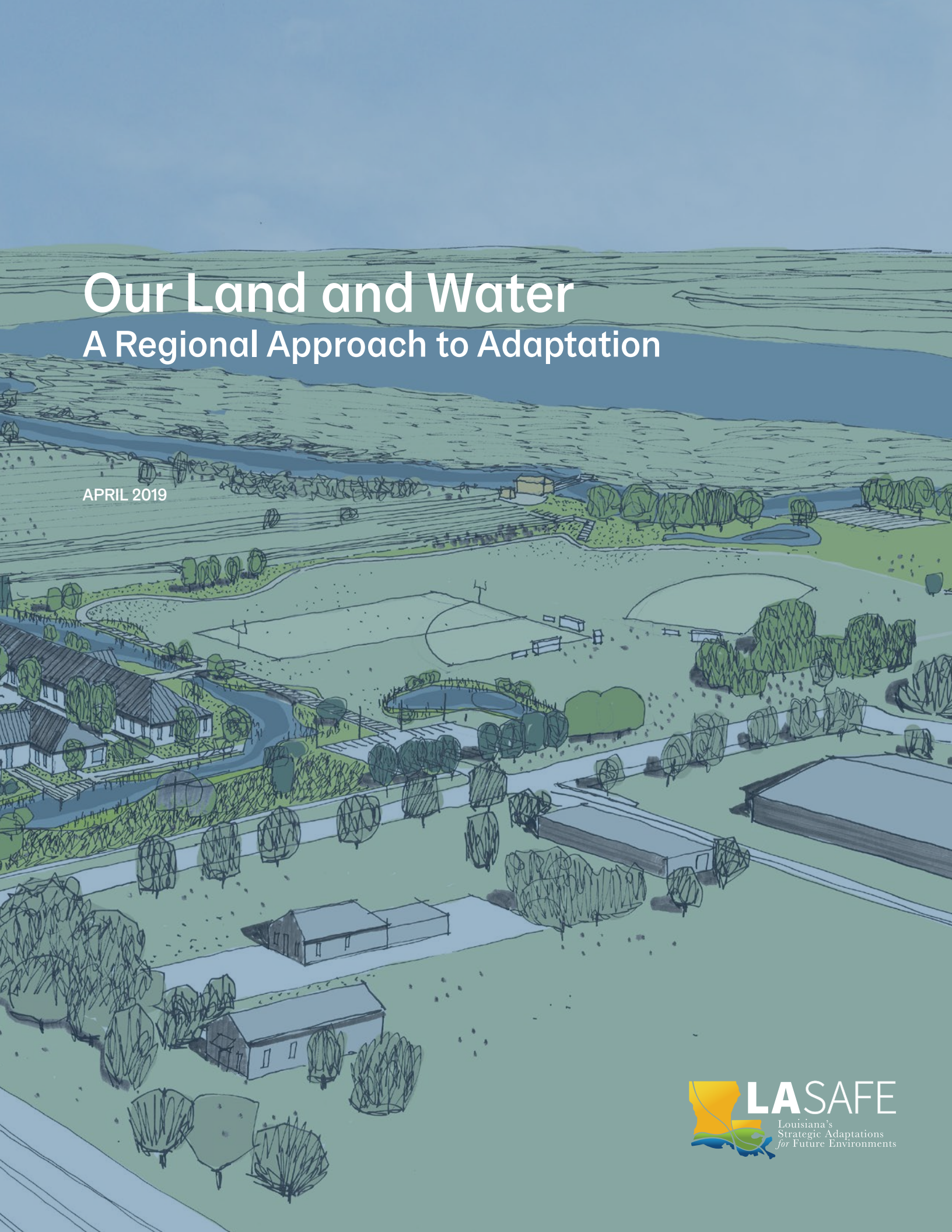
Our Land and Water

A Regional Approach to Adaptation

APRIL 2019



LASAFE
Louisiana's
Strategic Adaptations
for Future Environments

During the next 50 years, Louisiana is projected to lose more land and wetlands along its coast than it can rebuild, even if restoration efforts are completed as currently planned. With less wetland buffer, the state's coastal regions face increased storm surge and flood risk that will impact families and communities in ways large and small, acute and chronic.

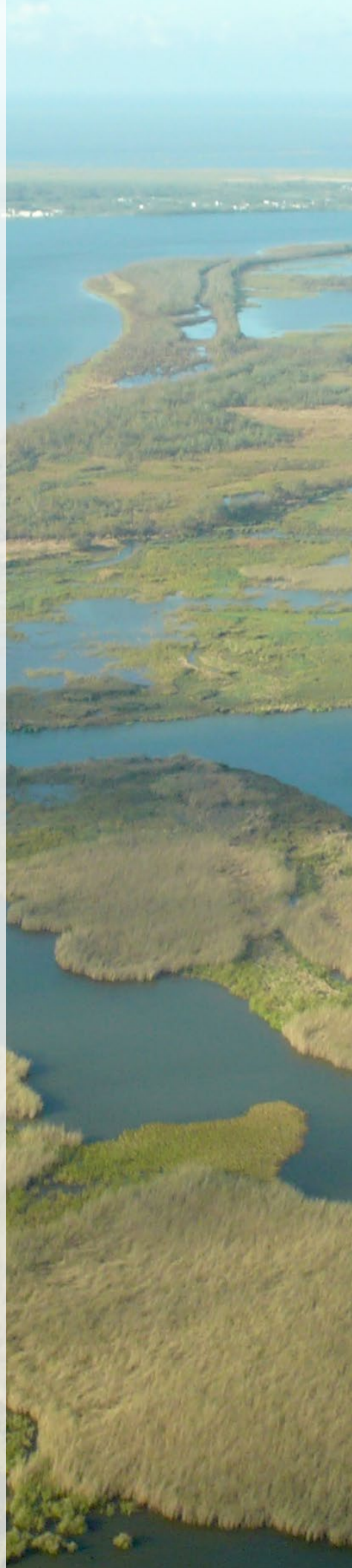


Figure 01. Louisiana's Wetlands
The region was made out of the muddy waters and soft soils of southeast Louisiana's bayous, swamps, marshes, and estuaries.

Project Team

Led by the Louisiana Office of Community Development (OCD) and the Foundation for Louisiana (FFL), the multidisciplinary Louisiana's Strategic Adaptations for Future Environments (LA SAFE) team developed strategies in concert with an extensive community engagement campaign to provide an integrated approach in the development of an adaptation strategy for coastal Louisiana.

Funder

U.S. Department of Housing and Urban Development (HUD)

Partners

Louisiana Office of Community Development Disaster Recovery Unit, Lead Partner

Foundation for Louisiana, Partner

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Other Partners

Franklin Associates, JCW, NOVAC, Coastal Communities Consulting, Greater New Orleans, Inc., Coalition to Restore Coastal Louisiana, Restore or Retreat, Restore the Mississippi River Delta, National Wildlife Federation, Environmental Defense Fund, Lake Pontchartrain Basin Foundation, Gulf Restoration Network, Bayou Interfaith Shared Community Organizing, Lower 9th Ward Center for Sustainable Engagement & Development, Zion Travelers Cooperative Center

Table of Contents

Louisiana's coast is a working coast. It supplies 90% of the nation's outer continental oil and gas, handles 20% of the nation's annual waterborne commerce, and produces 26% (by weight) of the continental U.S. commercial fisheries landings. Five hundred million tons of cargo pass through the state's deep-draft ports and navigation channels, ranking first in the U.S. in total shipping tonnage.

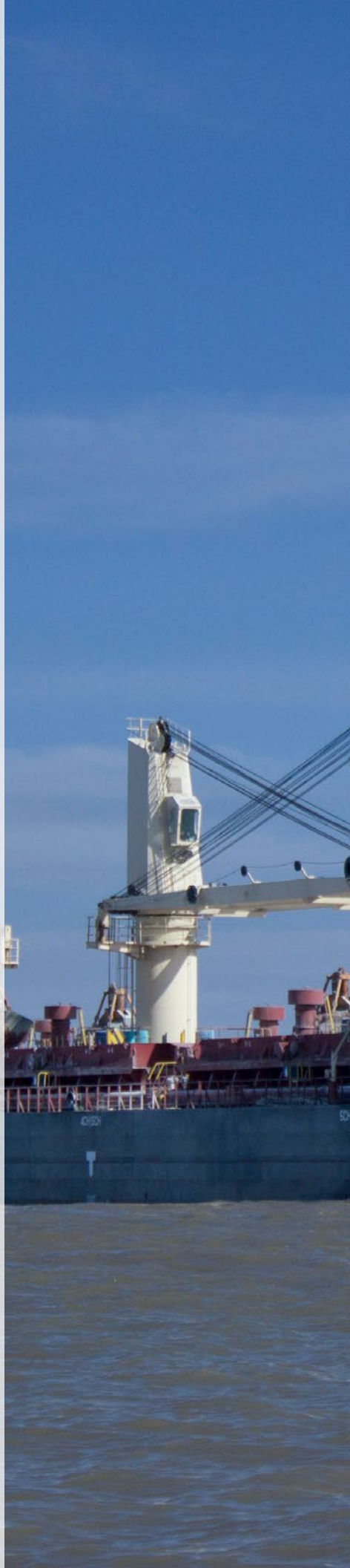


Figure 02. Strategic Location
The region's proximity to the mouth of the Mississippi River makes it vital to the nation's economy.

Executive Summary

Since Hurricane Katrina's landfall in August 2005, each of Louisiana's 64 parishes has been included in a federal major disaster declaration as a result of a named tropical event. Moreover, the Great Floods of 2016—two rainfall events six months apart affecting wide swaths of the state—caused severe flash and riverine floods and led to major disaster declarations in 56 parishes. These events have left an indelible mark on Louisiana's history.

Louisiana is the most flood-prone state in the U.S., and its flood risks extend to all three types of flooding—coastal (surge and tidal), fluvial (riverine), and pluvial (intense rain causing surface flooding).

Statistics paint a grim picture. According to the Coastal Protection and Restoration Authority (CPRA), more than 1,900 square miles have been lost in Louisiana since the 1930s, and an additional 4,120 square miles could be lost over the next 50 years. The state's coastal condition directly correlates with its disaster risk—specifically vulnerability from severe tropical events and their accompanying catastrophic surge floods.

Louisiana is in the midst of an existential crisis. Its response to this crisis can either lead to a prosperous renaissance or to a continued and sustained cycle of disaster and recovery.

The Coastal Master Plan—a $50 billion, 50-year coastal restoration and flood risk reduction effort—is the cornerstone of Louisiana's response. However, even with the plan's full implementation, it is likely the state will experience a net loss of land—and be faced with the increased coastal flood risk that comes from less land—over the next 50 years. **In some communities, conditions are likely to get worse before they get better. For some, relocation will be the only viable option.**

While structural interventions like levees, pumps, and floodgates are vital to mitigate flood risk, complete protection is impossible. Adaptation is necessary, and as a comprehensive approach adaptation includes structural risk reduction systems and ecological restoration efforts. **Adaptation must also include a large-scale rethinking of where and how development takes place in the future—and also where and how it does not.**

Louisiana's Strategic Adaptations for Future Environments (LA SAFE) provides a holistic approach to flood risk of all types as well as the myriad of human, economic, and environmental impacts experienced following past floods and those anticipated in the future. To develop aspirational—yet realistic—visions of tomorrow's communities, LA SAFE led a grassroots effort across six-parishes to gather information and ideas while harnessing the experience and ingenuity of local citizens. It includes an extensive planning process of more than 70 outreach and engagement events, more than $41 million in project investments designed by residents and stakeholders, and seven strategy documents highlighting takeaways and recommended actions.

While takeaways and recommendations vary in each parish, a few prevailing themes emerged throughout.

Louisiana is already experiencing a migratory shift as a result of its flood risk. The state's lowest-lying communities are currently losing population while higher-ground areas—those naturally better protected from coastal floods—are gaining population. Additionally, as these disaster-vulnerable communities—and many others like them—have declined in population, most have experienced parallel declines in median household incomes and increases in poverty rates. In short, those who move are often those with the financial means and social networks to do so, while in many cases, lower-income populations—those most vulnerable to severe impacts when disasters occur—remain behind and in locations more prone to significant flood risks. This effect carries consequences including contracting tax bases and fewer available resources for social services and infrastructure investments.

Land is a shrinking commodity in Louisiana. As Louisiana considers long-term mitigation of flood impacts, land use strategies should be a vital component. The state cannot afford continuing development practices exacerbating its exposure to flood risk. Likewise, with each passing flood, it cannot continue to rebuild in place and in replication of what previously existed. Strategic land use must not only consider those low-lying and higher-risk communities, but it also must consider locations naturally less likely to flood—those communities poised to become "receiver communities" as populations continue to move away from risk.

Floods have impacts beyond property damages. Long-term adaptation must include plans for new, resilient, and affordable housing stock. As coastal lands disappear, supply chains and transportation patterns will be disrupted, resulting in necessary adjustments being made to the network. Private property and water use rights will become more contentious issues. Coastal parishes relying on immovable natural resources and infrastructure for their economic benefits may increasingly become commuter parishes, impacting social networks, local culture, and demand for goods and services. Louisiana's changing environment impacts every aspect and function of its society, which the state's adaptation plans must address.

Education, economic diversification, and smart-growth principles are part of a solution. Most Louisiana citizens are aware they live in an especially flood-prone state. However, awareness should not be confused with education. Louisiana's educational system includes curriculum on its rich history and culture. There is no consistent curriculum outlining Louisiana's coastal condition or broader flood risk profile. More alarmingly, there is no effort educating the public on the relative benefits—and limitations—of risk reduction and restoration efforts or of ways to more effectively manage water and its many benefits.

Through education, Louisiana's citizens can develop a better understanding of what happens in areas susceptible to severe, repetitive disaster events and how lower-income, often underserved, populations are disproportionately impacted by these events. Its citizens can learn how diverse, robust economies provide natural disaster resilience and how smart-growth principles offer opportunities to maximize land uses in the state's upland, less flood-prone places. Coalitions can be built and motivated to a scale appropriate to the existential crisis at hand.

A future with increased risk will force relocation for some, but offer new opportunities for others. Isle de Jean Charles, an island community in southeastern Terrebonne Parish—outside of the Morganza to the Gulf structural risk reduction system, is one such community. While much of the current island has eroded away—forcing its resettlement, the Isle de Jean Charles community now has the opportunity to be reborn in a new upland location. Many additional communities, while not candidates for resettlement, will be forced to contemplate existence with a reduced population and contracted economy, and perhaps a smaller land footprint. Meanwhile, receiver communities will experience growth both rapid and gradual as populations continue to flee more flood-prone areas for those naturally higher—and drier.

Both scenarios present obvious challenges. However, both scenarios also offer the promise of opportunity. Through this set of seven adaptation strategies, LA SAFE is Louisiana's first effort in what will be a generations-long process to take what has been a historical hardship—catastrophic flood risk—and use it as a catalyst to develop a vision for a new Louisiana in which disaster risk reduction, economic growth, equity, education, and innovation are not just ideals, but hallmarks defining Louisiana's place in the global effort to combat the consequences of climate change.

Recommendations at a Glance

LA SAFE addresses community resilience holistically—**integrating risk planning with planning for stormwater management, housing, transportation, economic development, education, recreation, and culture**. LA SAFE recommends the following goals and strategies, including specific action items needed to implement the strategies over a 50-year time frame.

The below recommendations are the result of an extensive community visioning and input effort. LA SAFE's outreach and engagement campaign encompassed 71 individual public meetings across five rounds of events in each of the six LA SAFE parishes. These efforts are further detailed in **Chapter 2: LA SAFE Process**.

Manage Flooding and Subsidence

Institutionalize considerations of future flood risk in daily operations and programs within state agencies

A: Develop a means for statewide oversight and coordination of regional adaptation initiatives. Connect with neighboring states and complementary programs.
B: Require state agencies to assess flood risks to their physical assets based on best available data, including Coastal Master Plan projections, and to prioritize allocation of resources with this in mind. Continue to monitor as projections evolve and the Coastal Master Plan is updated.
C: Require state agencies to include current and future land loss and population movement in their program evaluations and updates.

Align public funding and project prioritization to promote green infrastructure and stormwater management

A: Develop watershed-based stormwater policies across jurisdictional boundaries.
B: Require that all publicly funded capital projects in the state capture and store at least 1.25 inches of rainfall in the first hour of a rain event.
C: Develop or adopt existing safety guidelines for graywater use.
D: Incorporate stormwater management functions in recreational areas.

Incentivize the incorporation of stormwater management features and green infrastructure in private development

A: Encourage local governments to develop green infrastructure programs.
B: Provide incentives for investment in stormwater best practices on private property.
C: Promote the use of shared detention areas adjacent to property owners.
D: Provide outreach, education, and technical assistance for best management practices in stormwater management and green infrastructure as well as updates on the current status of local stormwater management systems.

Plan for Safe and Affordable Development

Encourage elevation of homes based on current and future flood risk

A: Require all new development or substantial rehabilitations of existing properties be built to two feet above the base flood elevation for a 100-year flood or to the 500-year floodplain.
B: Develop equitable financial incentives and education to assist with home elevations and ensure elevation support for all residents.
C: Include weatherization programs and wind fortification, extreme heat, and seismic upgrades with home elevations to address multiple risk factors.
D: Develop an education and marketing program to encourage pier-and-beam construction.

Plan for future development based on risk typologies with mixed-use residential growth in low-risk areas

A: Create small area plans to accommodate future development in low-risk areas.
B: Develop zoning incentives to attract mixed-use development in low-risk areas.
C: Create an optional buyout program for full-time residents in high-risk areas.
D: Ensure demolition at the end of life of commercial developments in high-risk areas, upon long-term vacancy.

Identify ways to address insurance affordability

A: Analyze the feasibility for Louisiana to leave the NFIP and develop its own flood insurance program.
B: Provide support and incentives to communities in the floodplain for participation in FEMA's Community Rating System (CRS).

Improve Mobility throughout the Region

Promote well-connected, multimodal transportation options within parishes and across the region—including water transportation—to better connect existing communities to emerging and growing sectors, industries, and job opportunities

A: Require the use of Base Flood Elevation (BFE) and CPRA 50-year flood risk projections when planning future transportation routes.
B: Model the impacts of new transportation projects on hydrological processes.
C: Improve connectivity between transportation routes and natural destinations.
D: Prevent future loss of purchasing power to help pay for the backlog of maintenance.
E: Prioritize multimodal transportation options and improve access within and among communities.
F: Update and improve Louisiana's Complete Streets Policy.
G: Implement any recommendations that DOTD has not yet adopted.

Protect and elevate key supply chain and evacuation routes

A: Identify and improve key transportation and evacuation routes vulnerable to current or future flooding and other weather events.
B: Incorporate existing transportation assets into evacuation plans.

Diversify Educational and Employment Opportunities to Strengthen the Regional Economy

Increase coastal education for students of all ages

A: Introduce a statewide curriculum about the state's coastal landscapes for pre-K – 12 students. Once implemented, expand the curriculum to include instruction about Louisiana's regional land and water ecosystems.
B: Expand weekend and summer camp opportunities for coastal education.

Expand skills training in coastal careers

A: Develop a coastal specialization pathway for high school students who seek either Jump Start or TOPS diplomas.
B: Match education with skill needs of local employers.
C: Support apprentice-based model for coastal careers.
D: Build Louisiana's expertise in coastal and stormwater management.
E: Offer retraining programs in emerging coastal careers such as adaptation, mitigation and recovery, wetlands protection, and aquaculture.

Grow and diversify the economy

A: Promote Louisiana expertise in coastal restoration and adaptation.
B: Support and foster emerging economies.

Support Louisiana seafood and fishers

A: Understand how environmental changes will affect Louisiana fisheries.
B: Assist the fishing industry to adapt and distribute locally.
C: Provide technical assistance and loans to help commercial fishers diversify their businesses during commercial off-seasons.
D: Increase fisheries certification.
E: Develop and promote the Louisiana seafood label.
F: Create a marketing and branding training program for fishers.
G: Provide research and assistance for adopting sustainable fisheries.

Support Healthy Communities, Regional Culture, and Recreational Access to Nature

Increase access to nature for recreational use and ecotourism

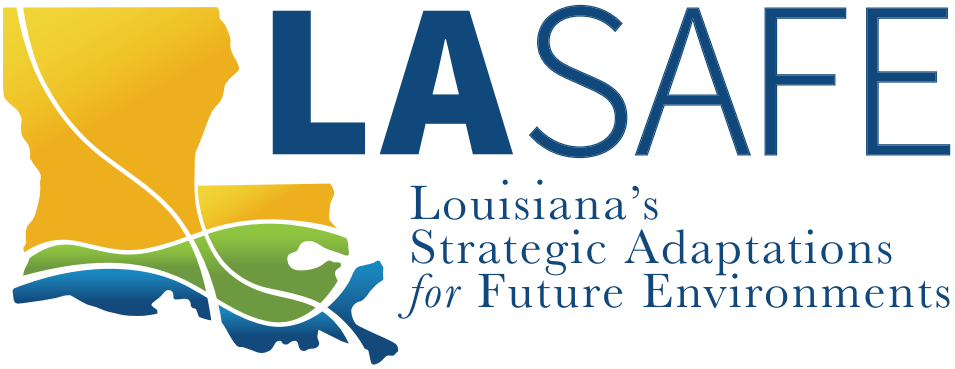
A: Support businesses that provide recreational services.
B: Promote ecotourism opportunities at the state level.
C: Expand access to outdoor recreational opportunities for Louisiana youth.

Preserve and support Louisiana's culture and heritage

A: Host cultural events and programs in conveniently located, accessible places.
B: Expand the state's Percent for Art program.
C: Capture the culture and history of high flood risk areas.
D: Promote local tourism.
E: Invest in and use existing and new marketing tools to promote Louisiana.

Encourage development that is informed by an understanding of the relationship between public health and the built environment

A: Use municipal ordinances and incentives to incorporate public health objectives and strategies into new developments.
B: Provide a state best practices guideline for minimizing negative health impacts of development.
C: Address mental health issues associated with living in areas of risk uncertainty.



LA SAFE MISSION

Working together for community resilience, economic prosperity, and a better quality of life for everyone in Louisiana.

LA SAFE GOALS

1. **To generate parish-wide, community-driven adaptation strategies focused on opportunities for residents and stakeholders to proactively adapt and prepare for anticipated environmental changes over the next 10, 25, and 50 years.**

2. **To implement a catalytic project in each of the six parishes that demonstrates adaptive development practices that conform to current and future flood risks. Furthermore, LA SAFE is intended to identify and support development of resilience-building projects and practices that can serve as models for the entire region.**

3. **To create a statewide adaptation model that enhances long-term sustainability and resilience for all Louisiana parishes.**

LA SAFE is a comprehensive strategy for community **adaptation** and **resilience**, concepts that may have different meanings to different people. For the purposes of this strategy, the following definitions will be used.

Adaptation

the process of modifying behavior to suit changing environmental conditions.

Resilience

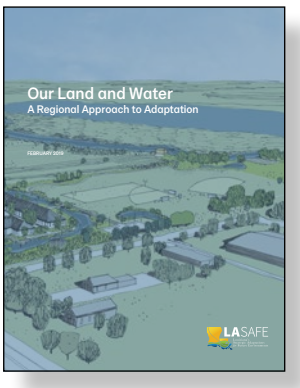
the capacity of individuals, communities, and systems to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience.

Document Organization

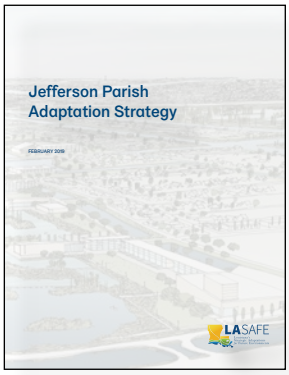
LA SAFE provides a regional strategy and six individual parish strategies. The regional plan describes regional-scale challenges and corresponding program and policy recommendations. Each parish strategy provides more detailed recommendations and includes six project proposals applicable to that specific parish. Within each parish, one or two projects—chosen from the six projects described in its individual plan—are funded for implementation by LA SAFE. These projects and programs were developed and selected in concert with the engagement process, based on qualitative and quantitative community benefit, leverage funding, community preference, and parish benefit through the National Flood Insurance Program's Community Rating System (CRS).

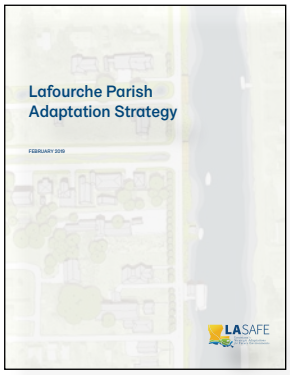
The strategies are designed to be read independently or together. The regional strategy complements each parish document. What is common across all the documents are low, moderate, and high risk typologies (see Chapter 2: LA SAFE Process, pages 52 – 55), five planning categories (see Chapter 1: Introduction, page 29), and one consistent hierarchy of strategy recommendations (see Chapter 4: Vision and Strategies, pages 98 – 99).

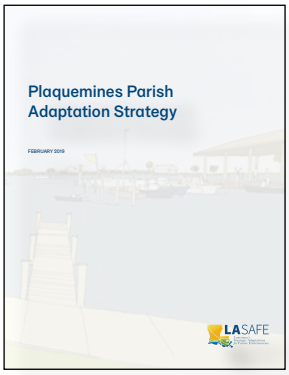
Regional Strategy

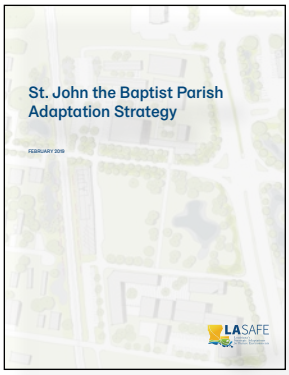


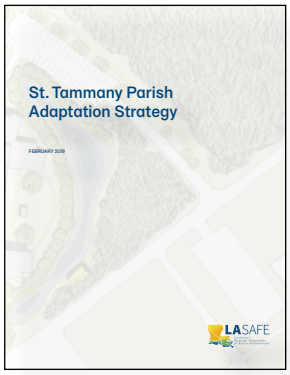
Parish Strategies











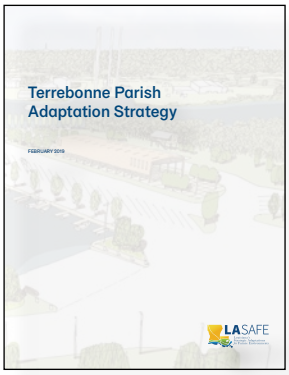


Figure 03. Wildlife
The brown pelican, Louisiana's state bird, has recovered from near extinction and thrives in the state's coastal areas today.
Photo Credit: Louisiana Department of Wildlife and Fisheries

"We are dependent on the coast. Our culture is completely driven by the natural resources more than anywhere else in the country, from where we eat, where we live, where we build our houses."

—Lafourche Parish Resident

Regional Adaptation Strategy Goals

LA SAFE employs strategies to plan for and implement safer, stronger, and smarter development. LA SAFE remains flexible in its policies and recommendations. As techniques and technologies to mitigate risk improve and updated information becomes available, LA SAFE adapts to integrate new data and options. The program also acknowledges the needs of individual communities and proposes what is best for those areas. For example, LA SAFE does not suggest every community located in a high-risk area must move, one in a moderate-risk area must take drastic fortifying action, or one in low-risk area grow in population or economic activity. The program does, however, advocate for Louisiana's proactive effort to develop effective strategies to address multiple risk types, when and where it is prudent to do so. LA SAFE recognizes our state's unique opportunity to become an innovative leader in risk-oriented community development, which can be transferred and developed throughout the world.

The goal of this regional adaptation strategy is to establish a framework for preparing Louisiana's coastal areas to **adapt to 50-year projections** of land loss. This strategy is intended to—

- Establish a framework for working across multiple jurisdictions;
- Provide examples of regional coordination; and
- Build sustainable, vibrant communities that combine LA SAFE's adaptation measures with **Louisiana's Comprehensive Master Plan for a Sustainable Coast** (Coastal Master Plan) structural projects by:
    - Managing water by watershed,
    - Developing connected, walkable communities on higher ground,
    - Creating regional transportation options for all types of users,
    - Establishing regional economic development programs, and
    - Providing shared recreational and cultural opportunities.

This regional adaptation strategy provides an overview of the LA SAFE program and the process and products of the LA SAFE effort in the six parishes. It addresses **current regional coordination** entities and efforts, highlights **big trends** that became apparent during the LA SAFE process, and explores options for **regional governance strategies**. The strategy also provides **goals and strategies** to achieve the LA SAFE vision. Additional information on the background, research, analysis, planning process, and stakeholder engagement involved in the LA SAFE initiative can be found in the following chapters as well as in the six LA SAFE Parish Adaptation Strategies.

All images in this strategy are credited to the LA SAFE team, unless otherwise noted.

The value of Louisiana's coastal zone can be neither fully stated nor accurately measured. Our coastal region offers so much economic and cultural value that losing it would degrade both Louisiana's and the nation's economy and culture.

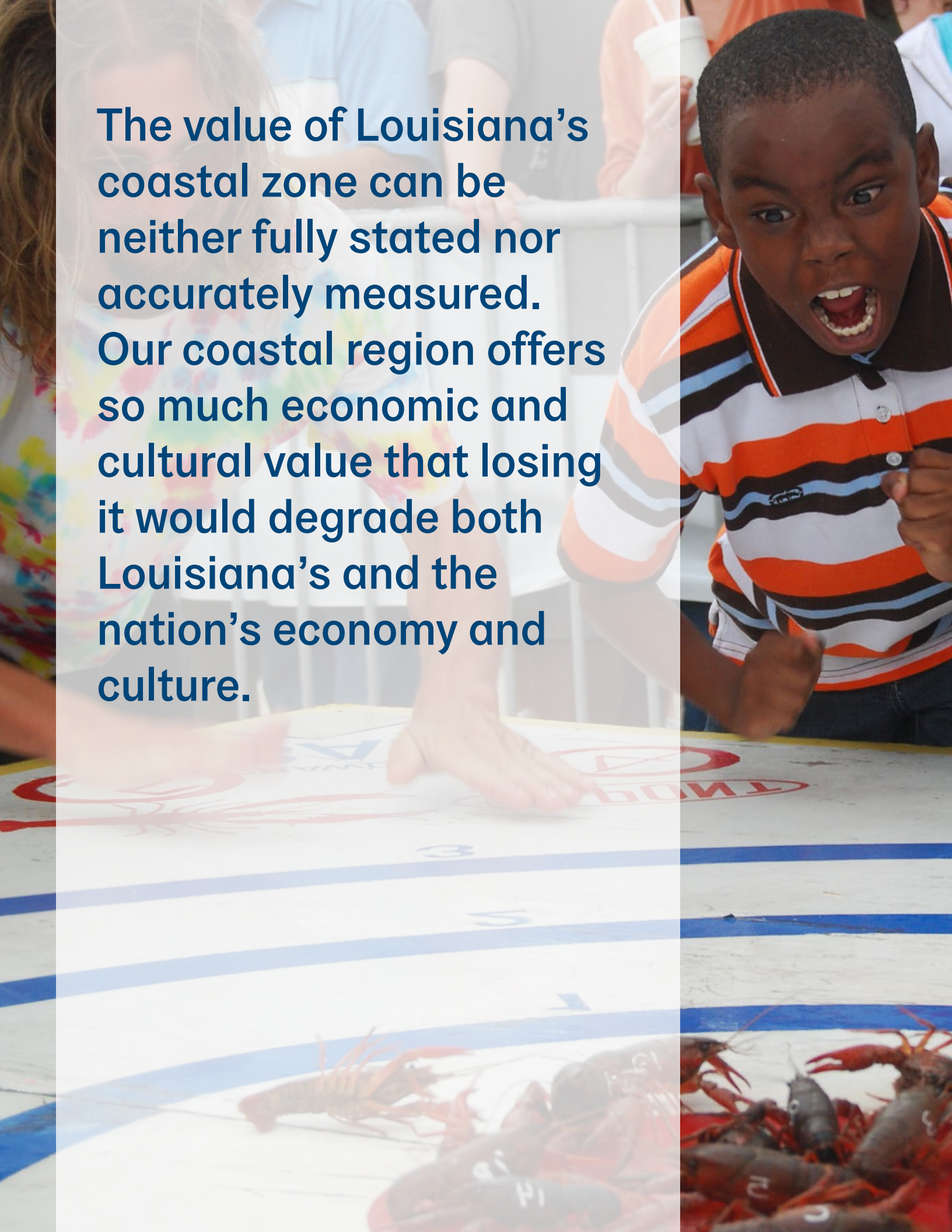


Figure 04. Cultural Identity
Coastal Louisiana's people, food, music, language, and architecture contribute to residents' sense of identity and attract visitors from all around the world.
Photo Credit: Louisiana Office of Tourism

Figure 05. Coastal Environment
Louisiana's coastal wetlands—which are vital to the region's economy, ecology, and culture and essential as a natural defense from storm events—face risks such as storm surge, saltwater intrusion, and sea level rise.

1 Introduction

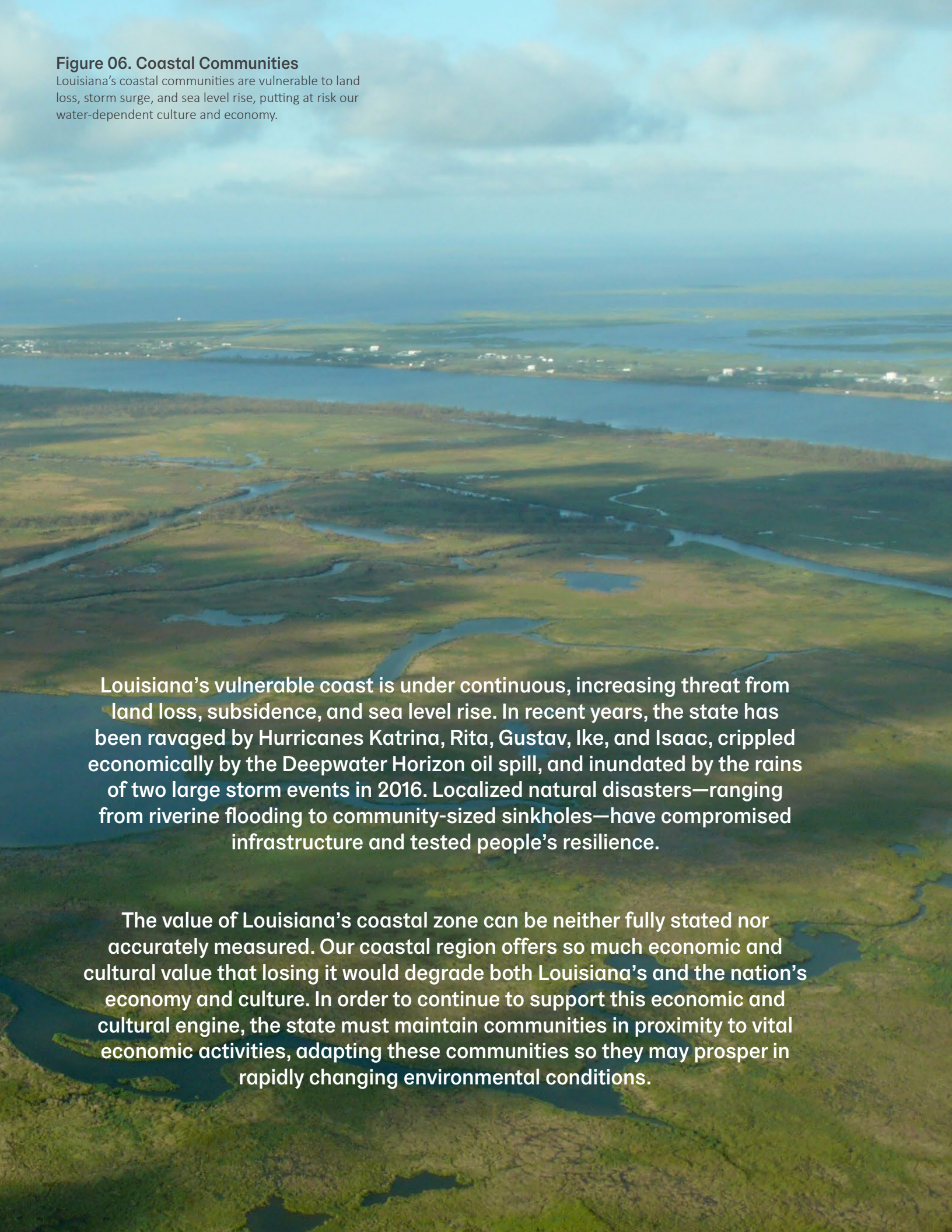


Figure 06. Coastal Communities
Louisiana's coastal communities are vulnerable to land loss, storm surge, and sea level rise, putting at risk our water-dependent culture and economy.

Louisiana's vulnerable coast is under continuous, increasing threat from land loss, subsidence, and sea level rise. In recent years, the state has been ravaged by Hurricanes Katrina, Rita, Gustav, Ike, and Isaac, crippled economically by the Deepwater Horizon oil spill, and inundated by the rains of two large storm events in 2016. Localized natural disasters—ranging from riverine flooding to community-sized sinkholes—have compromised infrastructure and tested people's resilience.

The value of Louisiana's coastal zone can be neither fully stated nor accurately measured. Our coastal region offers so much economic and cultural value that losing it would degrade both Louisiana's and the nation's economy and culture. In order to continue to support this economic and cultural engine, the state must maintain communities in proximity to vital economic activities, adapting these communities so they may prosper in rapidly changing environmental conditions.

After the devastation of Hurricanes Katrina and Rita in 2005, the Louisiana Legislature created the Coastal Protection and Restoration Authority (CPRA). CPRA is the single state entity that addresses our changing coastal landscape. The organization focuses on restorative and protective efforts to preserve the state's coastline. In 2007, Louisiana's Comprehensive Master Plan for a Sustainable Coast, called the Coastal Master Plan, was released. Revisions followed in 2012 and 2017, and future updates are to be completed every six years. The Coastal Master Plan looks 50 years into coastal Louisiana's future and applies science and engineering expertise to define what is realistically achievable.[1,2,3] This science-driven projection of potential risk presents Louisiana a unique opportunity to plan for future conditions under many environmental scenarios, some more optimistic and some less optimistic.

According to the 2017 Coastal Master Plan, expected annual damages under current conditions are approximately $2.7 billion coast wide. In 50 years, with no further action, expected annual damages could reach $6.7 billion under the best-case environmental scenario and as high as $19.9 billion per year under the worst-case environmental scenario.[4] Regardless of the scenario, two facts are indisputable.

First, full implementation of the 2017 Coastal Master Plan would lead to a reduction—but not an elimination—of the projected increase in future surge flood risk. Second, while the Coastal Master Plan relies on proven scientific methodology to curb, and in some cases reverse, environmental degradation—namely land loss—it can do so neither instantaneously nor completely. Even under an ideal scenario, in which Coastal Master Plan projects are adopted and implemented in their entirety, Louisiana will have succeeded in building or maintaining 802 square miles of land but is still projected to have a further net loss of 1,452 square miles of land.[5,6] Determining how to best maintain or grow economies and improve ecologies with this degree of land-to-water shift is a planning priority.

Sponsored by the U.S. Department of Housing and Urban Development (HUD) and the Rockefeller Foundation, the National Disaster Resilience Competition (NDRC) announced funding for LA SAFE—Louisiana's Strategic Adaptations for Future Environments—in 2016 and awarded it in 2017.

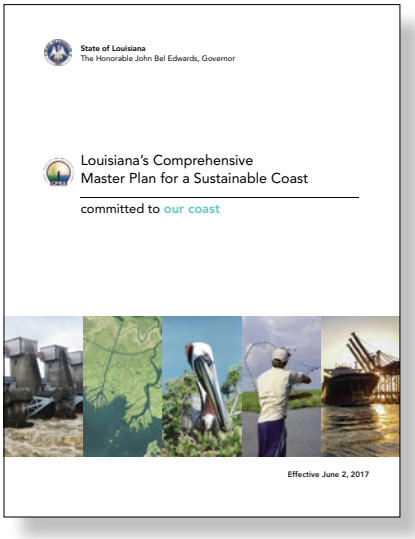


Figure 07. The Coastal Master Plan
Louisiana's Comprehensive Master Plan for a Sustainable Coast, updated in 2017 and called the Coastal Master Plan, sets forth an ambitious path to create a more sustainable coastal Louisiana landscape.
Image Credit: CPRA, 2017 Coastal Master Plan

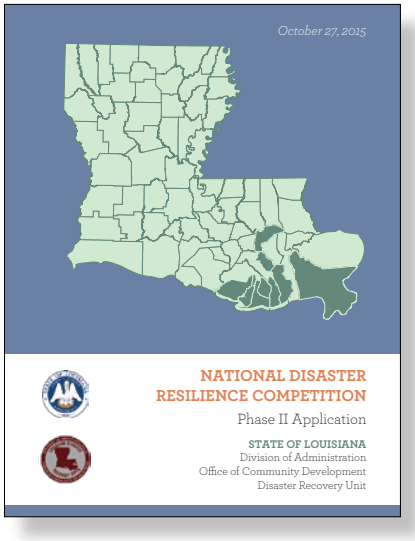
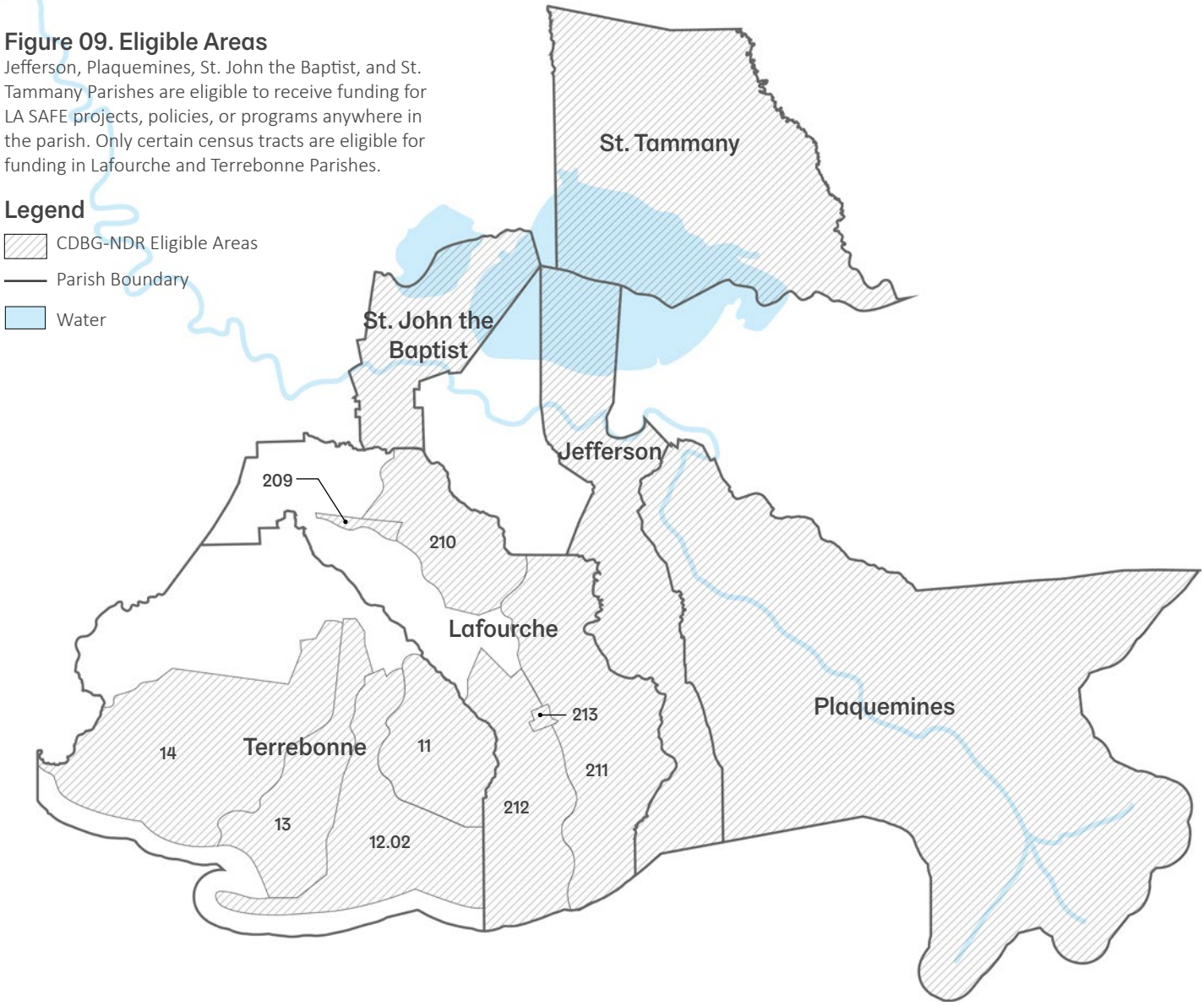


Figure 08. State of Louisiana NDRC
The State of Louisiana's application to NDRC in 2015 resulted in funding for LA SAFE.

The LA SAFE program supports an inclusive public process to identify adaptation strategies and provides funding for at least one catalytic project in each parish.

Figure 09. Eligible Areas

Jefferson, Plaquemines, St. John the Baptist, and St. Tammany Parishes are eligible to receive funding for LA SAFE projects, policies, or programs anywhere in the parish. Only certain census tracts are eligible for funding in Lafourche and Terrebonne Parishes.



The LA SAFE planning process focused on six parishes heavily impacted by Hurricane Isaac in 2012: Terrebonne, Plaquemines, Lafourche, St. John the Baptist, Jefferson, and St. Tammany—as well as the region as a whole. Four of the LA SAFE parishes (St. John the Baptist, St. Tammany, Plaquemines, and Jefferson) are eligible to receive investments anywhere in the parish because they meet the HUD's Community Development Block Grant–National Disaster Resilience (CDBG–NDR) requirements. In Terrebonne and Lafourche Parishes, only certain census tracts meet those requirements (Census Tracts 11, 12.02, 13, and 14 in Terrebonne Parish and Census Tracts 209, 210, 211, 212, and 213 in Lafourche Parish). To receive funding, a locale must meet threshold requirements in the three categories of "most impacted," "most distressed," and having "unmet recovery needs as a result of a qualifying disaster."

Ongoing efforts, such as the 2017 Coastal Master Plan, strive to reduce risk to populations from storm surge flooding through significant **large-scale structural risk reduction projects**, such as restoration projects like barrier islands, hydrologic restoration projects, and oyster reefs and structural protections like earthen levees, concrete walls, floodgates, and pumps. However, LA SAFE recognizes that the environmental challenges facing the region cannot be solved by

engineering alone. LA SAFE begins to address ways to strengthen Louisiana's resilience in dealing with inevitable changes to the land and water. The risk reduction projects championed by the U.S. Army Corps of Engineers (USACE) and CPRA are critical, but communities must also adapt their development patterns to address inevitable changes. LA SAFE's approach combines the world-class science behind the Coastal Master Plan with the community-building planning and policy techniques Louisiana has honed during its post-Katrina recovery effort. While the Coastal Master Plan centers on techniques to reverse negative environmental trends, LA SAFE—through its people-driven approach—strives to help our communities retain and build upon their cultural and social uniqueness. The intent is to preserve our way of life while remaining mindful of and attentive to future risks.

Through policies, programs, and projects, LA SAFE offers a set of community-driven strategies designed to provide a holistic approach to reducing long-term risk and increasing Louisiana's ability to prepare for and recover from disasters and other disruptions. The adaptation recommendations in this strategy and in LA SAFE's six parish strategies integrate **stormwater management**, **housing and development**, **transportation**, **education, economy, and jobs**, and **culture and recreation (including social/public services)** to provide community benefits that improve quality of life while mitigating flood risk.

In addition, the parish adaptation strategies were organized into three risk areas with parish-specific, long-term visions established for each risk area. Risk typologies include—

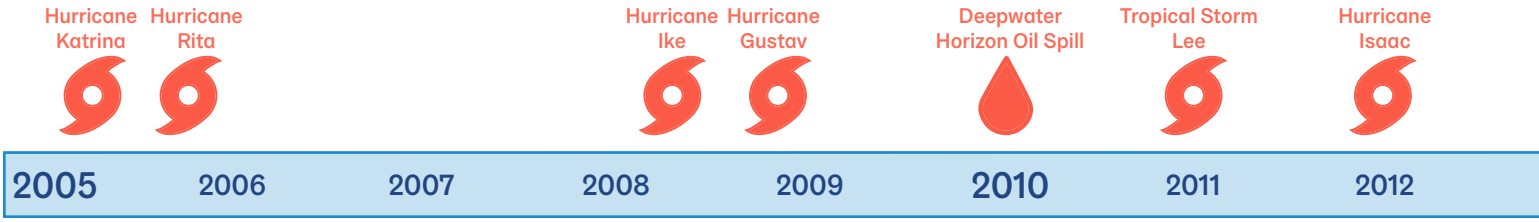
- **Low-risk areas, which are areas that have minimal projected storm surge flood risk and are outside the current 100-year floodplain*;**
- **Moderate-risk areas, which have between zero and six feet projected storm surge flood depths or are within the current 100-year floodplain*; and**
- **High-risk areas, which have greater than six feet projected storm surge flood depths 50 years into the future.**

Throughout the LA SAFE process, stakeholders recognized that thinking and cooperating regionally is instrumental to adapt to increasing risk and to create a resilient and vibrant coast in support of the state and the nation. Parish residents discussed the impact of land use decisions on the region, the need to coordinate transportation and economic development efforts for the betterment of all residents, and the impacts of water management actions on adjacent parishes, especially along bayous and rivers. They expressed their shared concerns about their ability to live on the coast, to retain their young people, to maintain their businesses and attract workers, and to provide amenities to enhance everyone's quality of life.

While catalyzed from funding awarded to the state after Hurricane Isaac in 2012, the LA SAFE Regional Adaptation Strategy situates within the history and trajectories of work following the Hurricane Katrina's devastation. Summaries of many of those efforts are included in this strategy.

**A 100-year flood is a flood event that has a 1% probability of occurring in any given year.*

Timeline of Planning Since Hurricane Katrina



Coastal Protection and Restoration Authority
CPRA forms in response to Hurricane Katrina to create and update a Coastal Master Plan every five years.

Coastal Protection and Restoration

Coastal Master Plan, 2007
Statewide consolidation of protection and restoration projects.

Coastal Master Plan, 2012
Prioritized projects based on a $50B budget.

Disaster Response

$13.4B Katrina recovery

$1.09B Gustav and Ike recovery

OCD-DRU: Disaster Recovery and Community Development
OCD-DRU manages federal Community Development Block Grants from HUD to **recover** and **prepare** for disaster events.

Community Preparedness

Comprehensive Resiliency Pilot Program
HUD and OCD-DRU fund the Comprehensive Resiliency Pilot Program (CRPP) for the development of 30 resilience projects around the state, including the Greater New Orleans Urban Water Plan.

Dutch Dialogues
Waggonner & Ball works with Dutch planners and designers to rethink urban water management in New Orleans.

Urban Water Plan
Comprehensive water management plan for St. Bernard Parish and the east banks of Orleans and Jefferson Parishes.

LA Speaks
CPEX forms and develops Louisiana Speaks Regional Plan with involvement from over 27,000 residents.

Figure 10. Timeline of Planning Since Hurricane Katrina

Louisiana Speaks Regional Plan

Louisiana Speaks, completed in 2007, was the long-term planning initiative of the Louisiana Recovery Authority (LRA), following the devastation of Hurricanes Katrina and Rita.[7] Combining local, state, and federal efforts with the work of experts, stakeholders, and citizens, Louisiana Speaks strived for a sustainable, long-term vision for South Louisiana, stewarding recovery and growth over the next 50 years. Tens of thousands of Louisianians participated in the Louisiana Speaks Regional Plan process, providing guidance for the plan's strategies and actions.

The Louisiana Speaks Regional Plan embodied three vision goals: **Recover Sustainably, Grow Smarter, and Think Regionally**. The plan was the result of 18 months of work that included 35 parishes, covered 25,000 square miles, and involved 27,000 citizens. At the plan's heart lies a desire to preserve and enhance the distinctive cultures and quality of life of Louisiana. It builds a framework in which planning at the state, regional, and local governments are coordinated to create stronger communities supported by a restored coast and a resilient

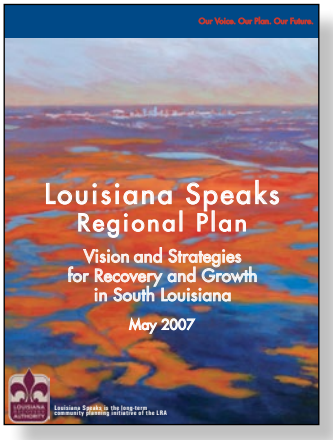
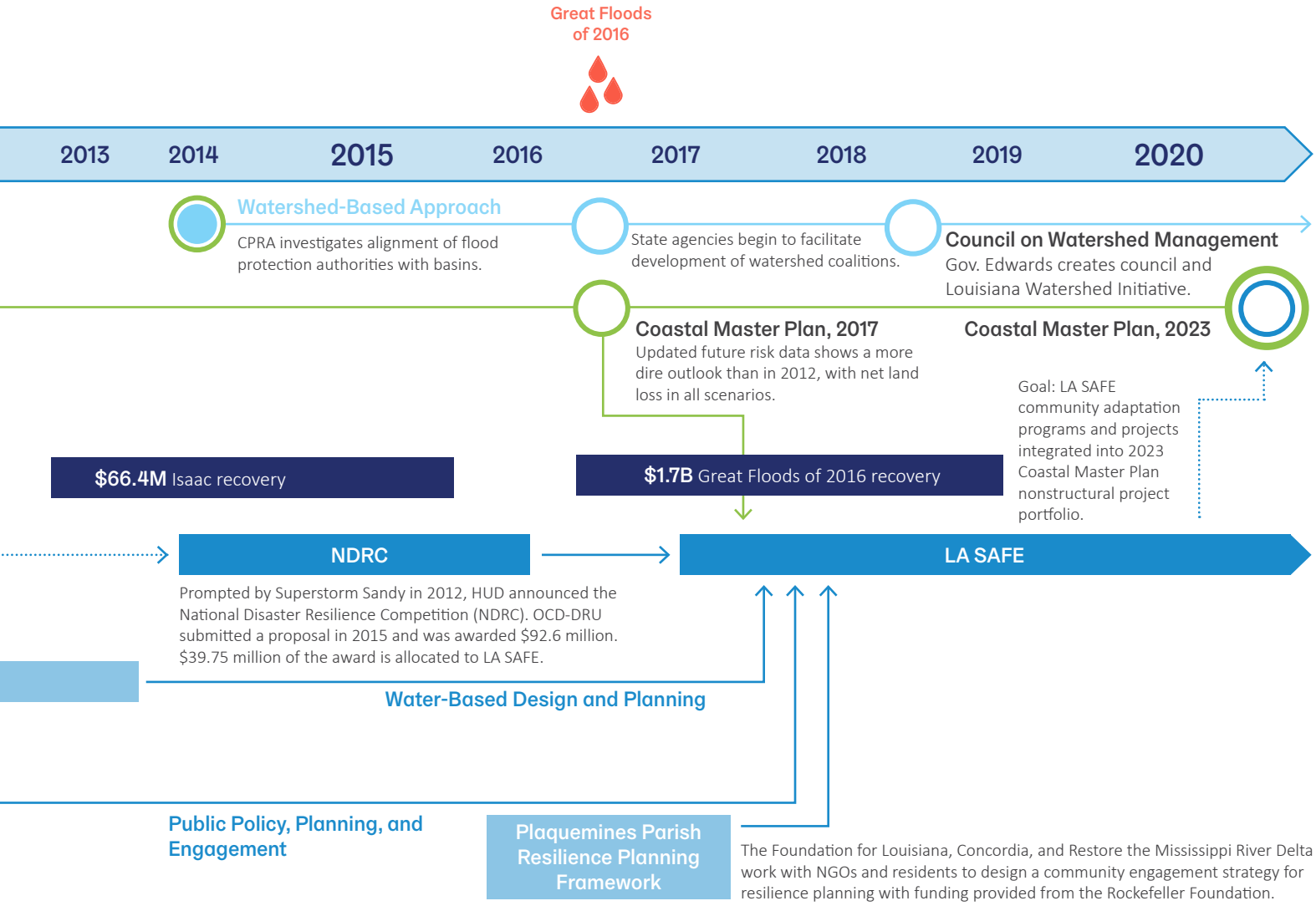


Figure 11. Louisiana Speaks Regional Plan
The plan provided a sustainable, long-term vision for 35 parishes in Louisiana.
Image Credit: Center for Planning Excellence



economy. A top priority of the plan was extending this framework to central and north Louisiana.

Dutch Dialogues

In 2008, with support from the Royal Netherlands Embassy and other Dutch agencies and institutions, the architecture firm Waggonner & Ball began the Dutch Dialogues. These dialogues "engaged Dutch engineers, urban designers, landscape architects, city planners, and soils/hydrology experts and their Louisiana counterparts."[8] The information exchange and design-driven workshops provided Louisiana designers and planners with new ideas for how best to manage water, particularly in urban environments inside a levee system. The Dutch Dialogues provided conceptual underpinnings to the Greater New Orleans Urban Water Plan, released in August 2013.

Figure 12. Dutch Dialogues
A series of design workshops were held to study stormwater management.
Photo Credit: Dutch Dialogues

Comprehensive Resiliency Pilot Program and the Urban Water Plan

In 2010, the Louisiana Office of Community Development Disaster Recovery Unit (OCD-DRU) provided 29 grants totaling $8,848,888 to government and nongovernment organizations to develop planning solutions to resilience problems. The largest of these grants went to Greater New Orleans, Inc. (GNO, Inc.) to develop the Greater New Orleans Urban Water Plan, a comprehensive water management plan for St. Bernard Parish and the east banks of Jefferson and Orleans Parishes. Waggonner & Ball led the team of national and international experts to develop the plan and stimulate community input. Involved are strategies to manage stormwater, control subsidence, reduce flood risk, and induce reinvestment. The City of New Orleans was awarded $141 million in funding through the National Disaster Resilience Competition (NDRC), including funds to construct one of these projects, the Mirabeau Water Garden.

Figure 13. Mirabeau Water Garden
Currently in design, the project is a functional as well as educational model of a stormwater park.
Image Credit: Waggonner & Ball

Plaquemines Parish Resilience Planning Framework

In 2015, the Rockefeller Foundation provided seed funding to the Foundation for Louisiana for the development of a planning framework that would be a template for engaging coastal residents with information related to future flood risk. To involve Plaquemines Parish residents in establishing an approach for a larger-scale, community-based resilience planning effort, the Foundation for Louisiana worked with several organizations and nonprofits including Concordia, an architecture and engagement firm, and the Restore the Mississippi Delta coalition, a group of five nonprofits who lead restoration efforts and community outreach.

Figure 14. Community Engagement
Parish residents participate at a meeting in Plaquemines Parish.
Photo Credit: Plaquemines Parish Resilience Planning Framework

"Hurricane Harvey brought a good example of what poor planning brings; Houston showed a picture of 30 years ago and now—green space vs. concrete. Areas with concrete all flooded. Cities like Gretna are built out, houses on almost every lot. We have made mistakes. All cities have made mistakes in planning. The real challenge is how to change what we have done wrong."

—Jefferson Parish Resident

Coastal Master Plan

The Coastal Master Plan has a specific mandate to reduce risk and to regenerate land over time. The LA SAFE policy framework is intended to complement the Coastal Master Plan through implementation of adaptation strategies that support the Coastal Master Plan recommendations.

The Coastal Master Plan's goals are to maximize land preservation and reduce flood risk. To accomplish this, the plan focuses on large-scale engineering projects. If the plan is fully funded and all proposed restoration and protection projects are completed, these efforts will slow land loss and reduce risk relative to a future without action, but despite these measures, risk will continue to increase and land will continue to be lost across the region.

Within the Coastal Master Plan is a program category called "nonstructural," which recommends strategies intended to help communities adapt to the risks they will face in the future. Some examples include floodproofing businesses in low-risk areas, elevating homes in medium-risk areas, and voluntary home acquisitions in the highest-risk areas. Because LA SAFE'S policy framework is meant to complement the Coastal Master Plan, LA SAFE expands upon the nonstructural category with a set of community adaptation and resilience-building strategies designed to reduce vulnerability to risk in the future. When towns and communities are able to adapt to living with water, they will be less vulnerable to catastrophic loss.

Figure 15. CPRA Projects
LA SAFE complements the Coastal Master Plan, expanding on the nonstructural projects category. Above, a project in the restoration project category in progress.

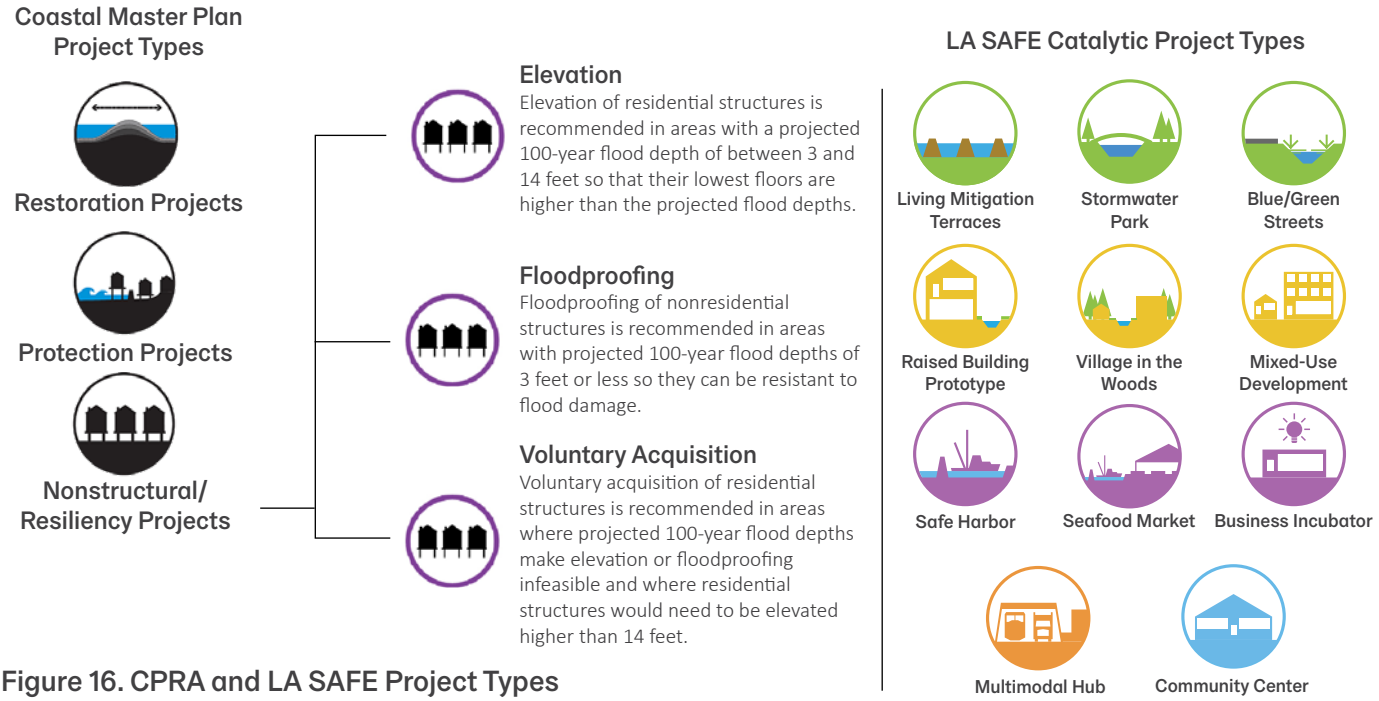


Figure 16. CPRA and LA SAFE Project Types
Source: Coastal Master Plan

LA SAFE Background and Mission

LA SAFE must contend with two basic facts—the state's land mass is physically shrinking, and Louisiana's coastal population is shifting.

According to the U.S. Geological Survey, Louisiana currently loses more than 16 square miles of land per year due to coastal erosion.[9] Even under a best-case scenario, the state will continue to experience net land loss during the next 50 years.[10] Louisiana's land area will neither return to a past state nor retain its current condition. Shifting ecologies means that any land that builds up may be in different areas than it is now. These changes present challenges but also opportunities for Louisiana.

Over the years—to address our vulnerabilities as well as protect our people and economic assets—Louisiana and several local communities have implemented risk-reduction projects including levee systems, stormwater capacity initiatives, and green infrastructure. As technology in these fields advances over time, we have every expectation projects like this will become more efficient and more cost effective. At the same time, the coastal zone will always be vulnerable to significant environmental changes. We must accept that some areas of Louisiana cannot be preserved as is and that some residents will have less land and more water, potentially impacting their livelihoods and communities. LA SAFE strives to help the people and the ecologies they depend on adapt and thrive in the midst of these uncertainties.

When population shifts occur, migration patterns are typically the result of one of two forces. In one circumstance, people move elsewhere for the promise of a better quality of life—usually in the form of economic opportunity, outward social mobility, or a combination of both. In another circumstance, people leave their locales because their communities have declined in some way. This could be a matter of jobs being eliminated or less abundant than they were in the past. Another situation might involve catastrophic events, including the loss of a major employer or natural disasters such as hurricanes or floods. Chronic deteriorating conditions, such as land loss and sea level rise, have a similar effect on migration patterns. Regardless of the reason they're moving, people are drawn to and want to stay in places that are safe and bountiful.

LA SAFE is a response to the challenges that our land and people will face in the coming decades. Herein, we contemplate a three-pronged approach for the future of our coastal parishes. First, strengthen our economic assets and maintain a community development footprint to service those assets. Second, in areas where minimal risk is projected, responsibly plan thoughtful, high-quality community development in our high-ground territories. Third, acknowledge that some places will become uninhabitable, requiring resettlement. This transition must be handled with respect and compassion for those displaced communities.

In all approaches, we continue to value the cultures, economies, and ecologies unique to each place and consider ways to integrate those in LA SAFE.

Approach

To create this regional strategy, the LA SAFE team conducted a year-long planning effort that incorporated a broad coalition of expertise including planners, community leaders, stakeholder groups, elected officials, philanthropies, nongovernmental organizations (NGOs), and nearly 3,000 coastal residents. In doing so, LA SAFE aligned three general perspectives.

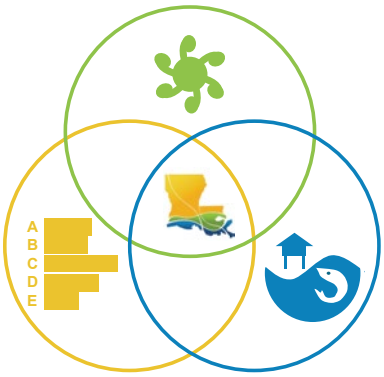


Figure 17. LA SAFE Approach

Community Vision

LA SAFE recognizes the community as a critical partner in developing these plans. During five rounds of community meetings in each parish, residents and stakeholders reviewed data and made recommendations for addressing their communities' current and future challenges. Residents actively shaped this plan and participated in demonstration project development and selection.

Best Planning Practices

LA SAFE engaged planners, designers, sociologists, scientists, parish officials, and other local experts to collaborate on implementable solutions that address the current and future environmental conditions and the community vision. LA SAFE researched innovative planning and design precedents from around the world that mitigate risk at the community scale.

Current and Future Environmental Conditions

All LA SAFE recommendations aim to minimize risk and maximize benefits that align with the best current understanding of future conditions. This information is principally organized around future flood risk but also incorporates soil composition, ecologies, water salinity, transportation patterns, development density, past population shifts, and other socioeconomic trends to understand the networks and relationships that are stressed by increasing flood risk.

Planning Categories

LA SAFE strategies are organized into five planning categories, which emerged during the engagement process, to address the far-reaching impacts of increasing flood risk. LA SAFE takes a commonsense approach to connecting stormwater management systems, build-out patterns, transportation networks, economic development, and cultural preservation so that they complement one another and become more capable of adapting to anticipated future risks.

Figure 18. LA SAFE Planning Categories

Endnotes

1. “History,” Coastal Protection and Restoration Authority, accessed September 19, 2018. http://coastal.la.gov/about/history/.

2. Coastal Protection and Restoration Authority, *Louisiana’s Comprehensive Plan for a Sustainable Coast: committed to our coast*, March 2012, https://issuu.com/coastalmasterplan/docs/coastal_master_plan-v2.

3. Coastal Protection and Restoration Authority, *Louisiana’s Comprehensive Plan for a Sustainable Coast: committed to our coast*, April 2017, http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Book_CFinal-with-Effective-Date-06092017.pdf.

4. Coastal Protection and Restoration Authority, *Louisiana’s Comprehensive Plan for a Sustainable Coast*.

5. Coastal Protection and Restoration Authority, *Louisiana’s Comprehensive Plan for a Sustainable Coast*.

6. Per the 2017 Coastal Master Plan’s Medium Environmental Scenario, with no additional action, Louisiana is projected to lose 2,254 square miles of land. With full implementation of the 2017 Coastal Mater Plan, Louisiana is projected to build or maintain 802 square miles of land. Therefore, the net loss is projected to be 1,452 square miles of land.

7. Louisiana Recovery Authority, *Louisiana Speaks Regional Plan: Vision and Strategies for Recovery and Growth in South Louisiana,* May 2007, https://www.cpex.org/s/Louisiana-Speaks-Regional-Plan-final-booklet.pdf.

8. Judith Nemes, “New Orleans architects look to the Netherlands for ideas on living with water.” U.S. Green Building Council. Accessed July 23, 2018. http://plus.usgbc.org/dutch-dialogues/.

9. B. R. Couvillion, H. Beck, D. Schoolmaster, and M. Fischer. “Land area change in coastal Louisiana 1932 to 2016: US Geological Survey Scientific Investigations Map 3381.” Pamphlet (2017). https://doi.org/10.3133/sim3381.

10. Coastal Protection and Restoration Authority, *Louisiana’s Comprehensive Plan for a Sustainable Coast: committed to our coast*, April 2017, http://coastal.la.gov/wp-content/uploads/2017/04/2017-Coastal-Master-Plan_Web-Book_CFinal-with-Effective-Date-06092017.pdf.

2 LA SAFE Process

Figure 19. Community Benefits
Lafreniere Park in Jefferson Parish provides a recreational and ecological refuge on the parish's urban east bank.

In an effort to plan for our state's robust, sustainable future, addressing growing flood risk will be a primary concern for Louisiana communities. Climate scientists agree that warming temperatures are likely to result in more frequent flooding that occurs with increased intensity.[1] On the coast, these impacts will be compounded by the effects of development activities, especially those that accelerate erosion and subsidence.

Over the years, Louisiana residents have responded to flood risk in various ways: first, by settling on higher ground along the rivers and bayous, then by building levees, and eventually by restoring wetlands. **During the next 50 years, Louisiana is projected to lose more land along its coast than it can rebuild, even if restoration efforts are completed as currently planned.**[2] As land in the delta continues to subside and erode, sea level rise is expected to accelerate.[3] In turn, salinity impacts wetlands, changes ecologies, and disrupts economies. With less wetland buffer, the state's coastal regions face increased storm surge and flood risk that will impact families and communities in ways large and small, acute and chronic.

Increasing flood risk is already causing socioeconomic and demographic repercussions. Due to the combined effects of man-made and natural land loss and sea level rise, people are moving from flood-prone areas to higher ground seeking safety.[4] In the lower-risk areas where people are moving, tax bases are growing, but existing infrastructure may be overburdened. Communities in areas most at risk are losing population, facing declining median household incomes and declining tax bases. These trends are likely to continue as risk increases.

Fifty years from now, high-ground, low-risk areas will be even more scarce, and coastal areas, our economic engine, will be at even greater risk. How parishes and municipalities develop these areas will influence the region's population capacity, cost of living, economic opportunities, ecologies, and quality of life. Planning for the future of these areas where our working coast is located is as important as planning for low-risk areas where populations are expected to grow. **Planning at a regional level is imperative to each parish's success.**

LA SAFE's holistic approach to planning for a future with increased land loss and flood risk looked beyond immediate threats to lives and property to the many community impacts that stem from increasing risk. **To complete this planning process, LA SAFE used three general sources of knowledge: community vision, planning and design best practice, and scientific data,** including the current and future environmental conditions projected by the Federal Emergency Management Agency (FEMA) and the Coastal Protection and Restoration Authority (CPRA). All LA SAFE planning recommendations are designed to align with the most current scientific understanding of future flood risk, land loss, and demographic trends.

Figure 20. Gaining Water
Coastal Louisiana is losing land but gaining water that is shallow and resource-laden.

Figure 21. Opportunity
The region is uniquely posed to become a leader in adaptation measures and to retain a unique relationship to water.

Figure 22. Round 1 Meetings
At Round 1, residents comment on sticky notes on changes and challenges they have observed in their parish.

Figure 25. Round 3 Meetings
Residents choose strategies they like and dislike in the LA SAFE planning categories.

Figure 27. Round 5 Meetings
Results from the catalytic project polling process are revealed.

Figure 23. Round 2 Meetings
During Round 2, residents indicate issues and opportunities on a map.

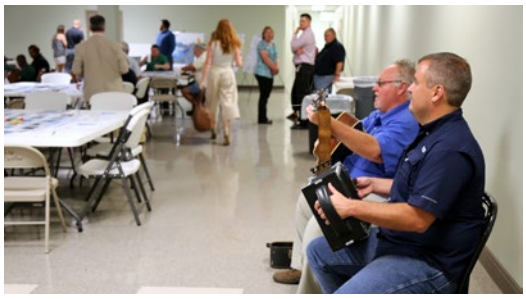


Figure 24. Round 2 Meetings
In several parishes, Round 2 meetings featured local musicians and craftspeople.

Figure 26. Round 4 Meetings
The LA SAFE team presents potential projects to parish officials during Round 4.

Community Visioning and Input

In order to develop community-driven plans and projects, LA SAFE drew heavily on community input and vision. LA SAFE engaged residents across the coast through five rounds of community meetings. **During these meetings, LA SAFE sought to understand residents' perspectives on the impacts of increasing risk and the possible solutions.** Round 1 of meetings, residents described their experiences of changes already taking place and the impacts of those changes on their lives, including increasing insurance costs, decreasing home values, loss of local businesses, and shifts in population. In Round 2, they reviewed projected environmental conditions and programs, policies, and projects that would benefit their communities, then described their visions for the future based on those factors. In Round 3, residents participated in a survey to convey their preferences regarding vision proposals and strategies. They worked together to rank components of each vision, selecting potential projects and programs that they could see working in their parish. In Round 4, residents and parish leaders discussed potential catalytic projects and what would be needed for those projects to be successfully implemented. In Round 5, residents reviewed six options and selected the project or program they most wanted to see implemented in their parish. This input accounted for a substantial portion of the final selection criteria. This eight-month engagement process aligned resident goals with future conditions and provided insight into the impacts of increasing risk on people and their community as well as the problems that need to be addressed.

MARCH – APRIL 2017

Round 1 → Identify Challenges and Priorities

6 Meetings
509 Parish-wide Attendees

MAY – JUNE 2017

Round 2 → Locate Areas of Opportunity and Propose Strategies

21 Meetings
551 Community Attendees

JULY – AUGUST 2017

Round 3 → Evaluate Community Vision and Strategies across Risk Zones

8 Meetings
387 Parish-wide Attendees

OCTOBER 2017

Round 4 → Further Define Strategies and Identify Potential Partners

29 Meetings
340+ Parish Officials, Parish-wide Attendees

DECEMBER 2017

Round 5 → Evaluate Six Final Demonstration Proposals

7 Meetings
531 Parish-wide Attendees
517 Online Poll Participants

TOTAL
71 Meetings
2,318+ Meeting Attendees
517 Online Poll Participants

Planning and Design Best Practices

Best planning and design practices were another critical component of LA SAFE. **The LA SAFE team brought their expertise in many fields, including policy, planning, architecture, stormwater management design, communication, and sociology. With this knowledge, the team provided insight to align future conditions and the community vision with proposed policy, programs, and projects that will effectively achieve residents' goals.** Planning and design experts developed a coalition among LA SAFE lead team members and created a significant knowledge base. Contributors included educational, governmental, and nonprofit institutions, grassroots community connections, and many local partners, who assisted in testing concepts and providing valuable feedback throughout the process.

Figure 28. LA SAFE Process
The LA SAFE team used planning best practices and community feedback to develop 50-year visions and strategies.

Scientific Understanding

The Coastal Master Plan models storm surge risk over the next 50 years using scenarios of sea level rise, land loss, and implementation of restoration and protection projects. Its focus is on the reduction of storm surge risk and impacts through the restoration of wetlands as well as the construction of diversions, levees, and locks. The Coastal Master Plan supports the development of adaptation strategies through the LA SAFE process by providing storm surge risk data. This data was combined with FEMA DFIRM 100-year floodplain data to include precipitation flood risk. LA SAFE is building long-term community goals around the recommendations of the Coastal Master Plan.

Those involved in the LA SAFE process developed a greater understanding of Louisiana's deep ties to land and water through the merging of science, engineering, and quality of life considerations.

Climate Change and Relative Sea Level Rise

With climate change, sea levels are expected to rise in the Gulf of Mexico and waterways in coastal Louisiana. Recently, storms that have affected the region have also increased in frequency and intensity. Relative sea level rise, which is rising waters combined with subsidence, poses a double threat to coastal Louisiana. Increasing water levels bring higher high tides, and subsidence results in sinking land. This accelerated risk means that flooding will reach higher levels of elevation at a faster rate.

Based on data through 2014, CPRA estimates that the sea level will rise between 1.41 feet and 2.72 feet by 2067. Coastal Louisiana's relative sea level rise ranges between two feet to over six feet depending on the subsidence rate of a given area.*

Intense rain has also occurred more frequently than in the past. During the 2016 Louisiana floods, rainfall rates of up to two to three inches an hour were reported in deluged areas, where overall rainfall totals exceeded possibly two feet and higher in some places. What was once a "100-year storm" might, in reality, now occur every decade. Crucial to resilient adaptation is helping the community shift to prepare for more regular and intense rain events.

Rising seas and increasing storms will also impact ecosystems. Coastal Louisiana has a range of different zones, from aquatic to coastal edge and shoreline as well as upland, urban, and developed. Over time, this could mean the loss of native species that provide valuable ecosystems.

**Note that sea level rise projections will continue to evolve, and monitoring the latest scenarios and updating projected impacts will be required.*

"I'll say this, I've been living here for 30 years. When the storms used to come through, we'd get a couple of inches, but now it seems that every storm keeps bringing more and more water."

—Terrebonne Parish Resident

ENVIRONMENTAL DRIVERS AND VALUES USED IN SCENARIOS

SCENARIO	PRECIP	ET	SEA LEVEL RISE	SUBSIDENCE	STORM FREQUENCY	AVG STORM INTENSITY
2017 COASTAL MASTER PLAN						
LOW	>HISTORICAL	<HISTORICAL	1.41′	20% OF RANGE	-28%	+10.0%
MEDIUM	>HISTORICAL	HISTORICAL	2.07′	20% OF RANGE	-14%	+12.5%
HIGH	HISTORICAL	HISTORICAL	2.72′	50% OF RANGE	0%	+15.0%

Figure 29. CPRA Data in the LA SAFE Process

CPRA modeled three scenarios of land loss and storm surge projections—low, medium, and high. **LA SAFE used CPRA's medium scenario** in developing maps to show projections of land loss and storm surge as well as risk zones. For more information on CPRA's modeling data, see the 2017 Coastal Master Plan Appendix C, Attachment C3-25, Storm Surge and Risk Assessment.
Precip = precipitation. ET = evapotranspiration.
Image Credit: CPRA, 2017 Coastal Master Plan

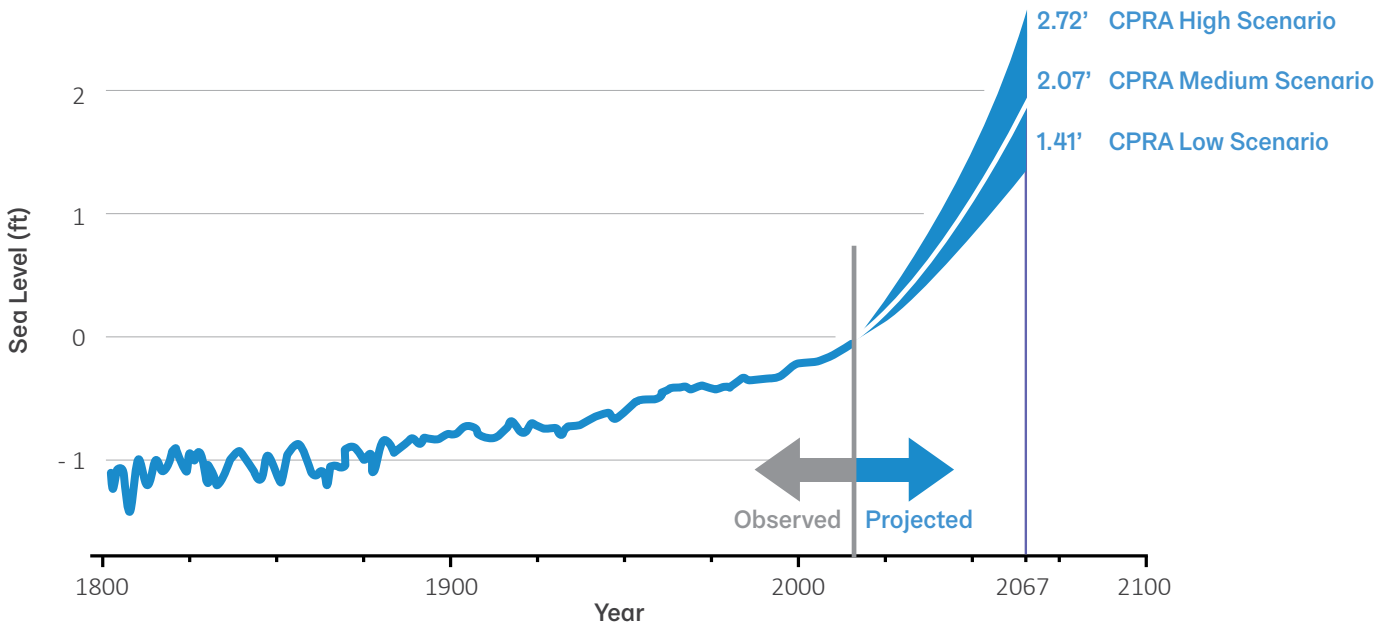
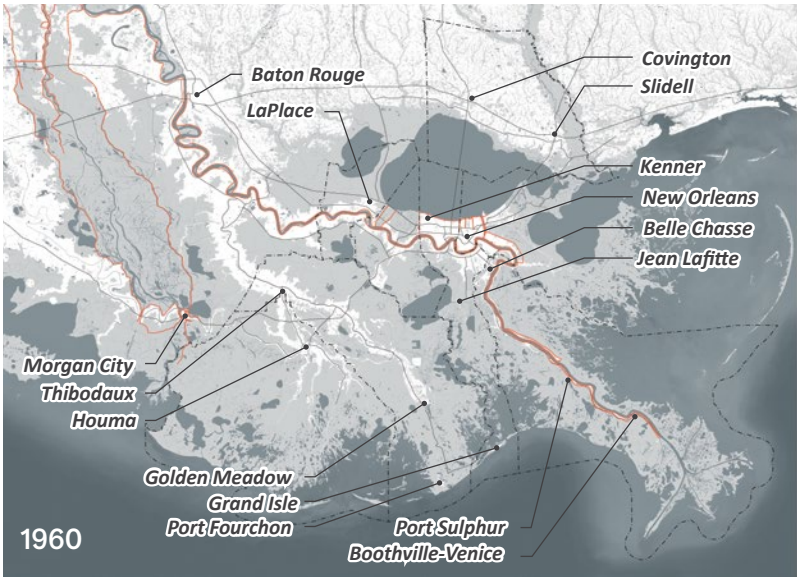
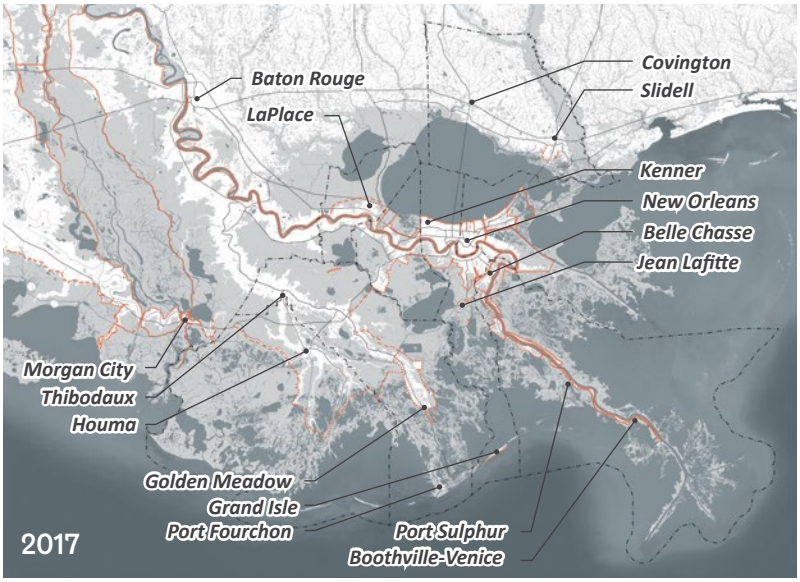
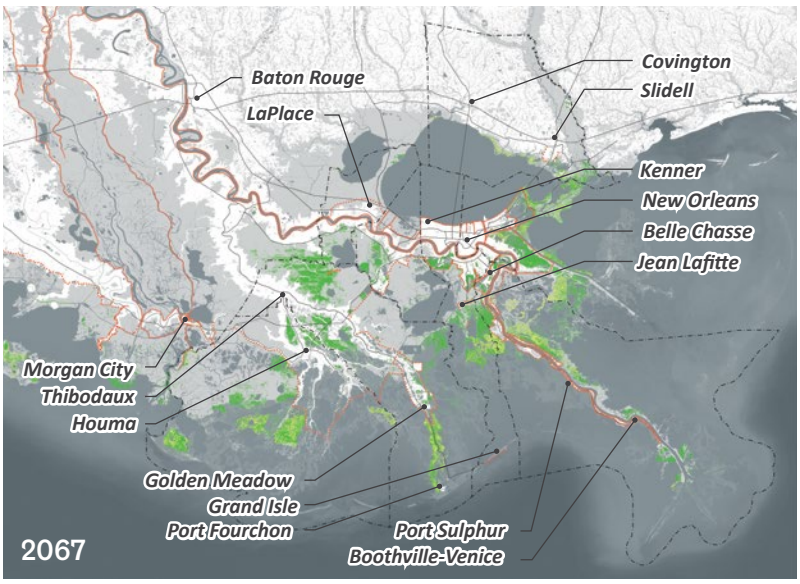


Figure 30. Sea Level Rise—Observed and Projected Levels

Sources: Observed Sea Level Rise: IPCC, "Climate Change 2013: The Physical Science Basis. Projections of sea level rise;" Projected Sea Level Rise: CPRA, 2017 Coastal Master Plan







Land Loss

Coastal Louisiana was built over thousands of years by sediment depositing from the Mississippi River and connecting distributaries. Annual flooding brought sediment that was then deposited throughout the region as waterways overflowed their banks and discharged into marshes and estuaries. This sediment slowed the effects of coastal erosion. However, when levees were constructed along the lower Mississippi River Basin to mitigate river flooding, they choked off the sediment supply and stopped the natural land-building process.

In addition to building levees, other human activities have also contributed to subsidence and erosion. Man-made causes of subsidence and erosion include oil and gas extraction, groundwater pumping, and marsh channelization. Extraction and pumping remove fluids and gases from the ground, leaving empty space into which the surrounding soil falls, causing subsidence.[5,6] The creation of navigation channels and canals through marshes has accelerated erosion rates by increasing the area of marsh exposed to wave action and saltwater.

N

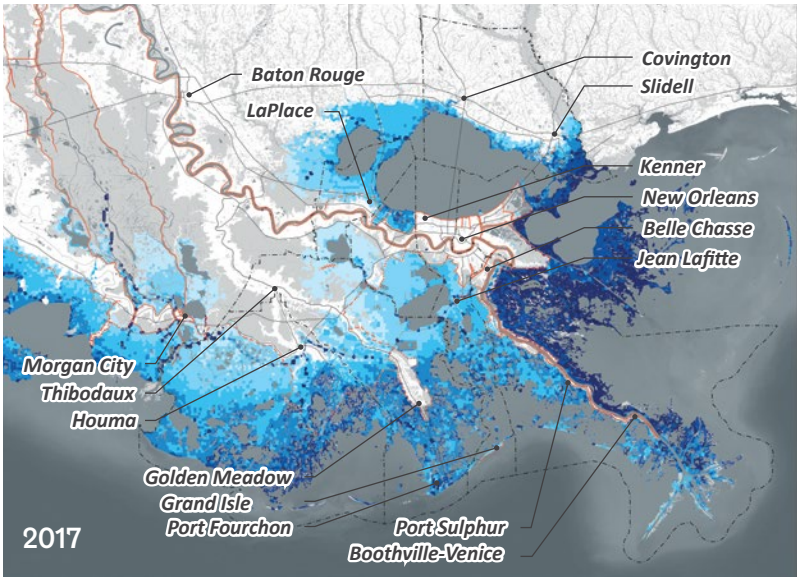
MAP 01. LAND LOSS SERIES

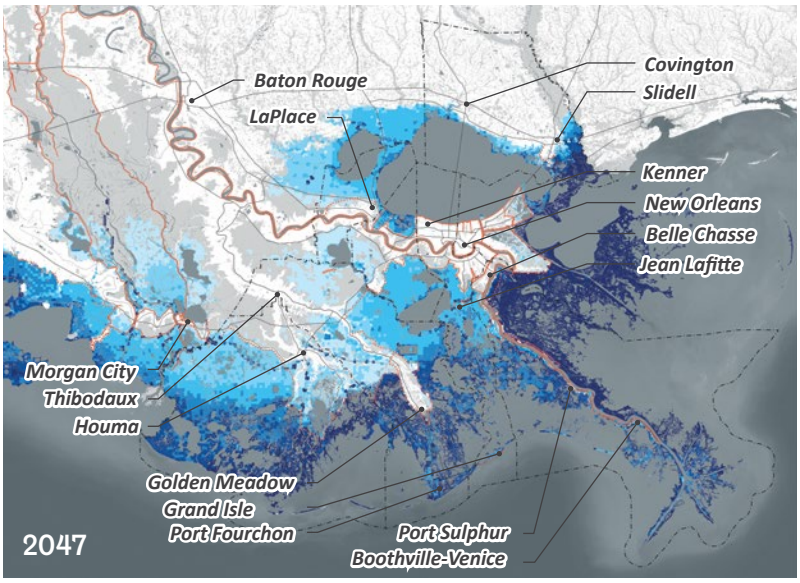
Land change along the Louisiana coast from 50 years ago to today and CPRA's predicted land loss, gained, and maintained under the Medium Environmental Scenario over the next 30 years as an outcome of implementing 2017 Coastal Master Plan projects.

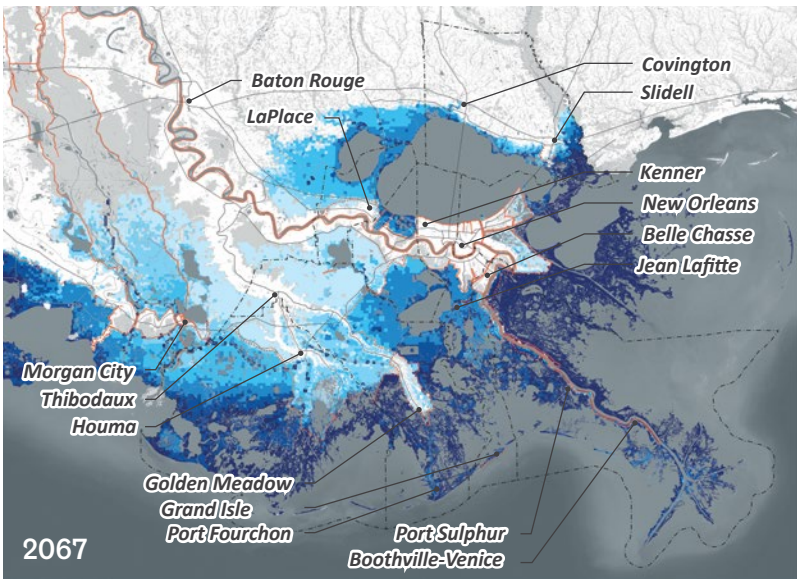
Sources: CPRA Land Loss Modeling Data 2017 for a Medium Scenario; for all basemap data, see References

Legend

- Land Lost/Open Water
- Land Maintained
- Land Gained
- Wetlands
- Land
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

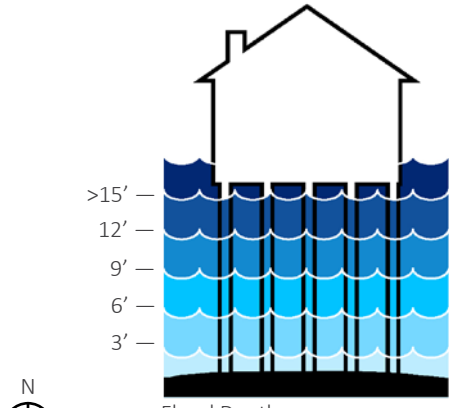






Storm Surge

Storm surge is an increase in water height caused by strong winds, often associated with a hurricane that produces vertical circulation below the water surface and elevates the water height. When a storm approaches land and encounters shallower water, the water piles up to a greater height. Combined with sea level rise, the impacts of storm surge are felt farther inland, affecting communities that were once protected by surrounding wetlands. The flood risk projections at left are based on CPRA's Medium Environmental Scenario, which projects 2.07 feet of sea level rise and full implementation of the 2017 Coastal Master Plan. Predictions indicate that even with full implementation of the Coastal Master Plan's projects, flooding risk from storm surge remains a threat to coastal Louisiana.



MAP 02. FLOOD RISK SERIES

Flood depths today, 10, and 25 years from now under the Medium Environmental Scenario as an outcome of implementing the 2017 Coastal Master Plan projects.

Sources: CPRA Flood Risk Medium Scenario Modeling Data, 2017; for all basemap data, see References

Legend

- Water
- Wetlands
- Land
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

Water and Land in Louisiana

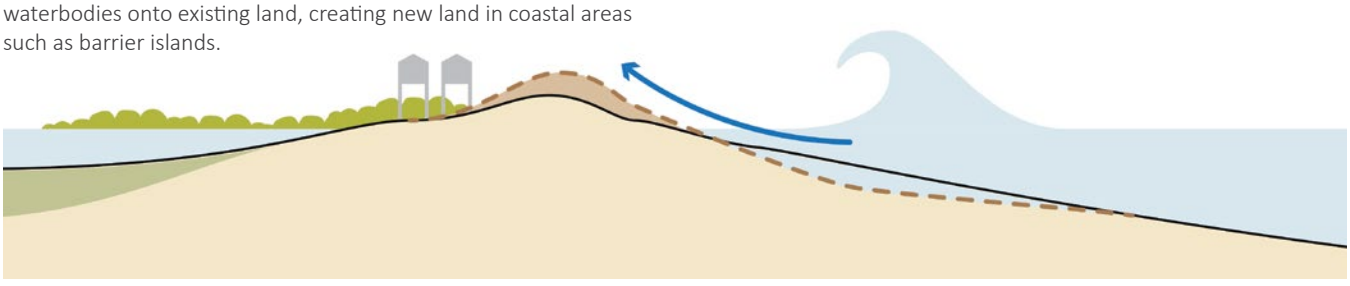
Waterfront communities should see waterways as part of their **cultural and ecological heritage, and future that provide public spaces to be adapted**—as public spaces to be adapted through conservation efforts that improve water quality, water flow, biodiversity, and resilience of landscapes.

The abundance of water, wetlands, and waterways in the Mississippi River Delta is a distinct regional advantage. Over three centuries, however, the region has reshaped itself with an approach to drainage and flood mitigation that pushes its water assets out of sight and out of mind. Long-term resilience requires adapting this approach and existing water management systems. Understanding how water flows through and across the region begins with understanding the shape of land, how that land was formed over time, the types of soils throughout the landscape, and how human activities have altered the landscape.

Water knows no boundaries. Collaborations across neighborhood, cultural, and political boundaries and developing solutions at all scales—from individual properties to regional networks—are prerequisites for building a stronger future. In the long-term vision, stormwater, surface water, and groundwater are managed together as resources with which to enhance public spaces, revitalize neighborhoods, strengthen habitats, and provide opportunities for economic growth. In finding the means to thrive in a place of economic and cultural importance—but also one of weak soils and ecological instability—coastal Louisiana can become a world leader in climate-adaptive design and water resource management. Waterways and waterbodies provide shipping routes, recreation, transportation, aquaculture, education, and research.

Understanding the region's geology, hydrology, and ecology is the next step. A new approach to water—the region's most abundant natural resource—is the foundation for building a safe, prosperous, and beautiful future on the Mississippi River Delta.

Figure 31. Land Gain
The Mississippi River Delta is constantly changing, losing and gaining land. Storm surge can push sediment from the bottom of waterbodies onto existing land, creating new land in coastal areas such as barrier islands.



Shallow Subsidence

Shallow subsidence is the sinking of the ground that damages buildings, streets, and other infrastructure, and it makes the challenge of pumping stormwater out of the region more difficult. Subsidence is a result of dry soils, largely caused by current drainage practices that pump water out rather than maintaining a consistent water table.

The increased flood risk and infrastructure damage caused by subsidence across the region add millions of public dollars every year in preventable expenses.[7] Subsidence also drastically raises the cost and frequency of repairs to levees, canals, and floodwalls that have been compromised by degradation or lowered elevations.

There is an opportunity to address our water risks by expanding water management roles to include subsidence control. Stormwater management best practices hold water in the landscape as long as possible, so that pumping is a last resort. Water storage in ponds, canals, rain gardens, and bioswales maintain higher groundwater levels, allowing organic soils to remain stable.

The graphic below indicates how development patterns over time can lead to land subsidence. Uncontrolled development in low-lying areas with organic soils necessitates pumping practices which, in turn, cause soils that need water to remain stable to dry out and sink.

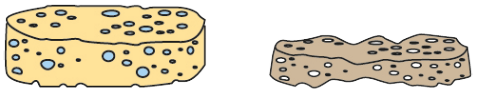
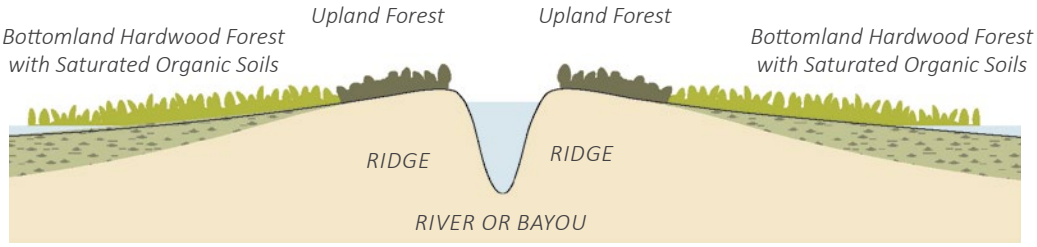
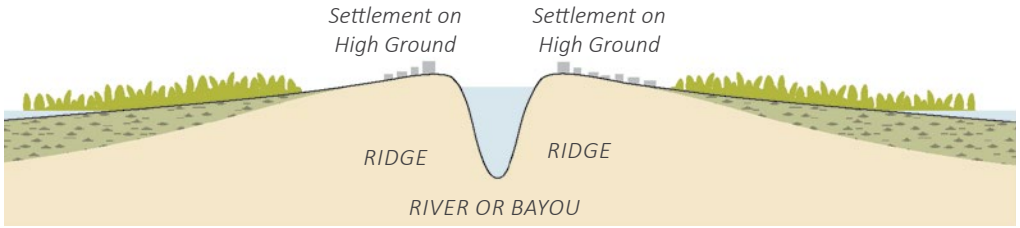


Figure 32. Delta Soils
Delta soils are like a sponge. Organic soils are only stable when they are full of water. When they dry out, they shrink.



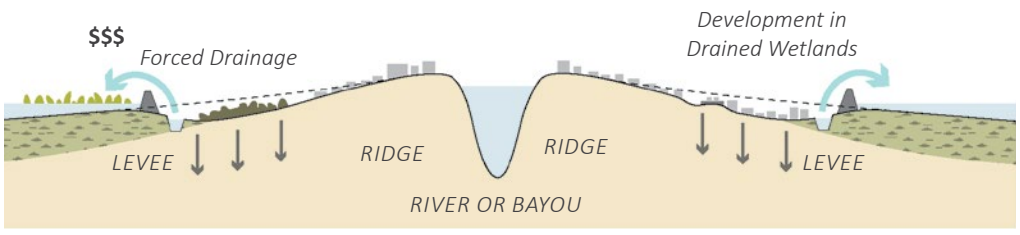
Natural waterways form naturally high ridges.

Pre-European Settlement—Natural Condition



Early development was on the highest ground adjacent to natural bayous and waterways.

Early Development



Modern technologies have allowed development in low-lying wetlands. Water is pumped out, lowering the groundwater level and protection that natural wetlands afford.

Current Condition—Drain and Pump

Figure 33. Shallow Subsidence Landscape Sections

Geology

The Mississippi River Delta is in constant flux, a place of flowing water, tidal fluctuation, and shifting soils. Integrated resilient planning requires a deeper understanding of how different layered systems interact. Soils and water are the basis for planning and designing infrastructural networks, which help to shape the urban fabric and human activity. Policies and human activities change the shape of the land and the flow of water and nutrients across the landscape. These interactions are visible throughout coastal Louisiana. Prior decisions regarding these systems both support and constrain future action.

Resilient design requires an understanding of both natural and man-made infrastructure systems and how they interact with one another. Resilient planning for the future requires a **ground-up approach** that considers (1) the region's soils, water, and biodiversity, (2) existing infrastructure networks, and (3) the urban fabric. Local **unique geology** must be considered in future development.

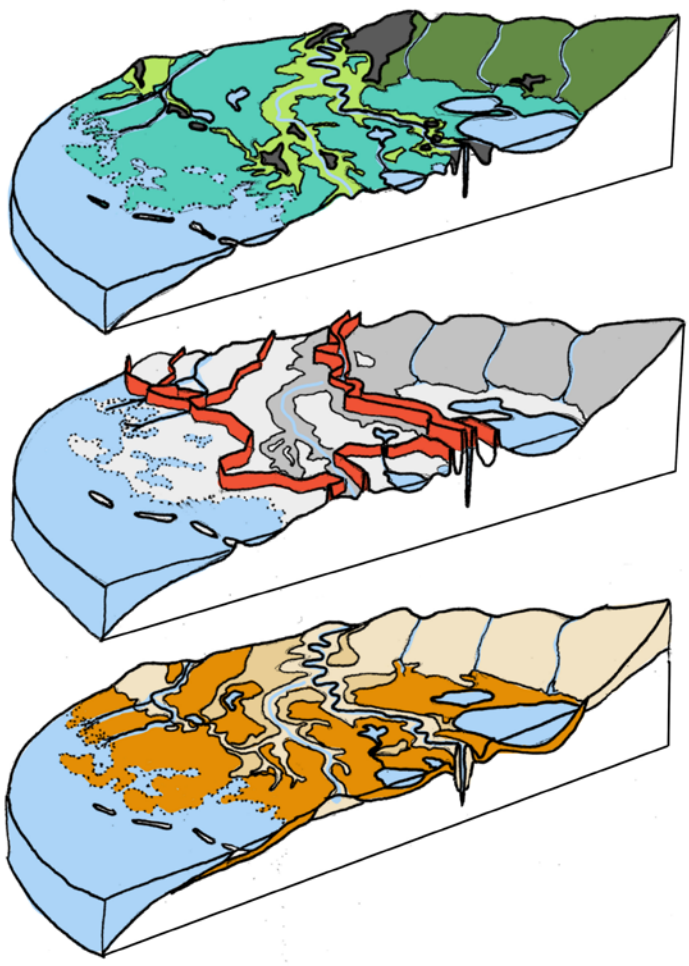


Figure 34. Approaching Water from the Ground Up
Principles for water management, regional planning, and urban design should be developed out of a process that considers (1) the region's soils, water, and biodiversity, (2) existing infrastructure networks, and (3) the urban fabric.

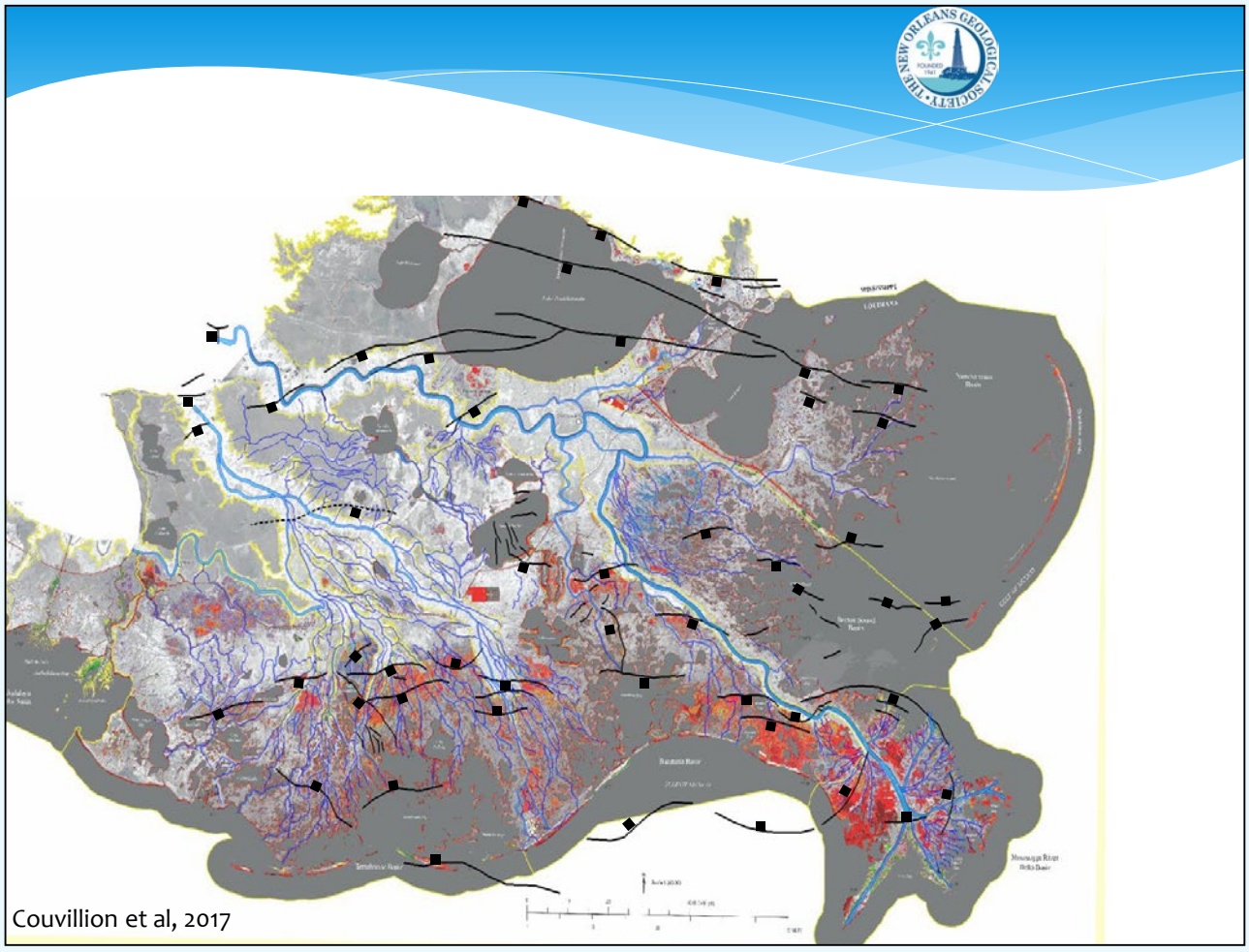


Figure 35. New Orleans Geological Survey (NOGS) Surface Fault Map
The map shows NOGS surface faults overlaid on the USGS Land Area Change Map. The squares indicate the downthrown direction of each fault. These interpretations of faults are a continually evolving work in progress. New interpretations are constantly being done, and new data will be acquired in the future. The fault traces represent reasonable estimates of where faults are likely to cross the land surface, but they are always subject to change. Large blank areas on the map do not indicate the absence of faults; they more often indicate the lack of any interpretation in that area.
Sources: New Orleans Geological Survey surface faults; USGS Land Area Change Map[8]

The Gulf of Mexico's Floor

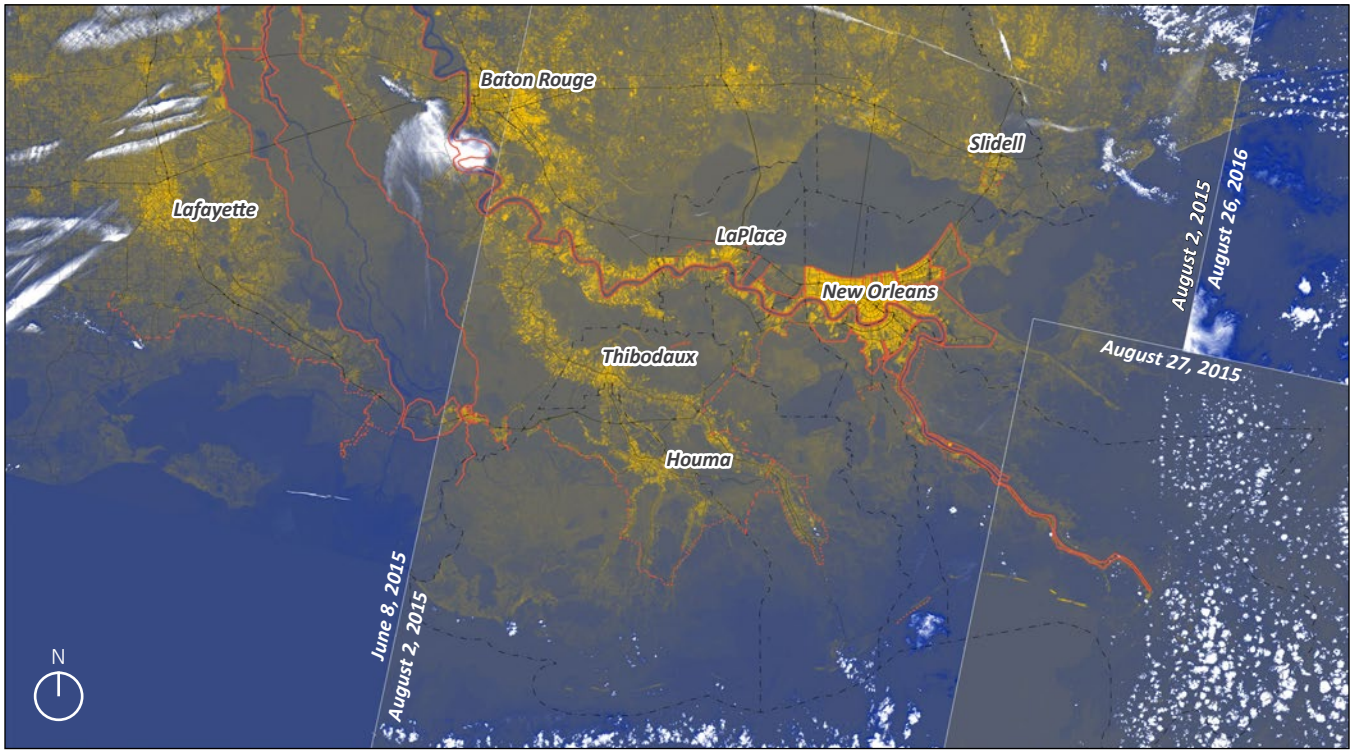
Understanding fault slip movement in the region is critical when planning future investments. Slow slip activity along active fault traces is linked to coastal subsidence. Submergence of lowlands occurs as a result of soil compaction and consolidation, sea level rise, and faulting, which in turn leads to saltwater intrusion and erosion. Fault events have also been found to change the terrain's slope and elevation as well as hydrology, water quality, and distribution of water and plants.[9] An understanding of the location of known fault lines and their potential impact on development and infrastructure can allow for more strategic future investment.

Climate

Land temperatures during Louisiana's summers are reaching 120°F. The concentration of the **highest temperatures directly corresponds to more urbanized areas**. This heat island effect occurs in metropolitan areas where the built environment creates a warmer temperature than its surroundings. A contributing factor to higher temperatures in coastal Louisiana is the loss of trees and other vegetation due to disaster events, such as hurricanes. The **Gulf of Mexico follows this warming trend** brought on by changes in the oceanic climate. Rising land and sea temperatures can lead to drought, crop failure, low livestock productivity, vegetation loss or disease, aquatic food chain disruption, and harmful algae or bacteria in coastal water.[10] As the Gulf warms, the composition of the coastal ecology begins to change. Tropical black mangroves have replaced salt marsh plants in areas along the northern gulf coast. This and other "tropicalizations" can affect the relationship the ecosystem has to fisheries and flood mitigation.[11]

Changing Climate and Healthcare

Natural disaster events—such as hurricanes, extreme rainfalls, or heat waves—are increasing in frequency and intensity due to rising temperatures. These disasters change the "social and environmental determinants of health—clean air, safe drinking water, sufficient food, and secure shelter."[12] The increasing frequency of water-related disaster events, such as hurricanes or flooding, leaves people without homes, healthcare facilities, food sources, and clean water. A long-term vision for healthy environments is crucial as people move inland due to disasters and rising seas, and the risk for mental illness and vector-borne diseases increases. Coastal Louisiana faces rising seas and disaster events, and the population movement is trending inland. These issues of well-being for physical and mental health deserve further exploration.



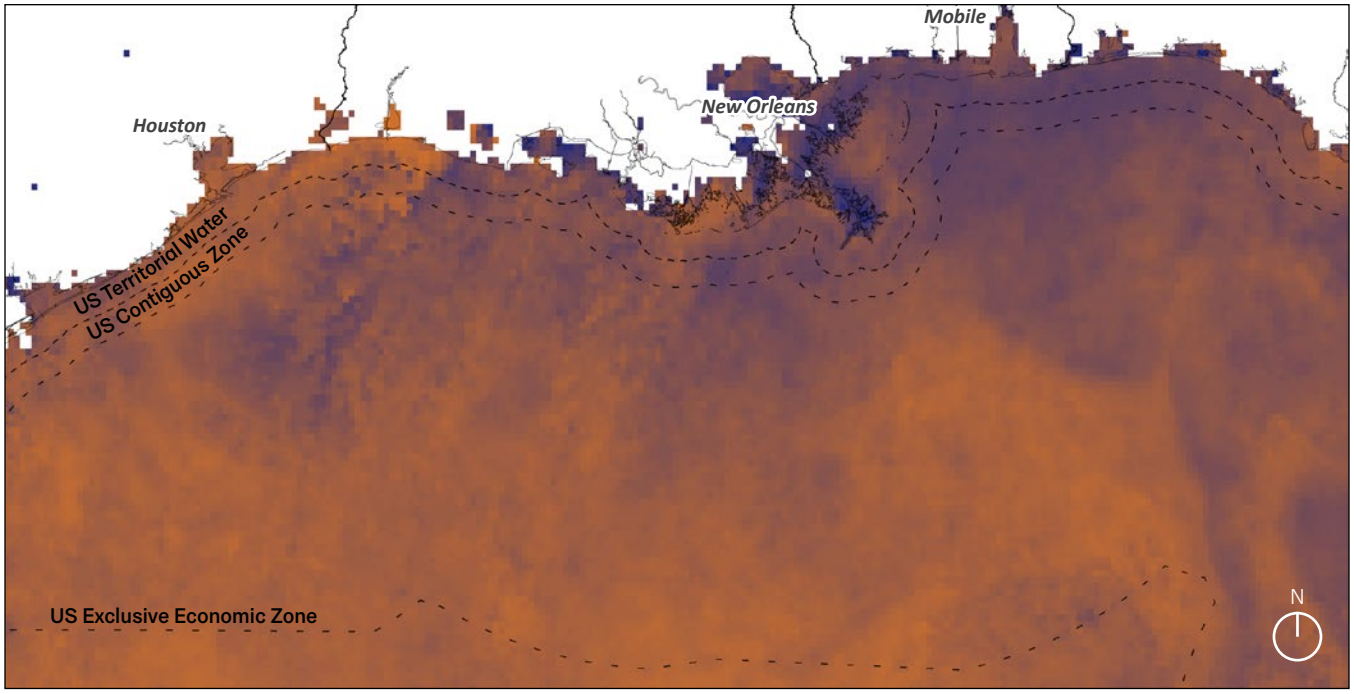
MAP 03. SUMMER LAND SURFACE TEMPERATURE

This map shows land surface temperature from the peak of summer in 2015 and 2016. The temperature data was derived from infrared and vegetation data contained within Landsat satellite imagery. The Landsat images are tiled together and were captured on similarly hot summer days with little to no cloud cover. From the land surface temperature calculation, the "urban island heat effect" becomes apparent. Densely populated areas, especially with little or no vegetation, are noticeably hotter than their surroundings.[13]

Sources: U.S. Geological Survey; for all basemap data, see References

Legend

- 120° F
- >75° F
- Cloud Cover
- Roads
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary



MAP 04. SEA SURFACE TEMPERATURE

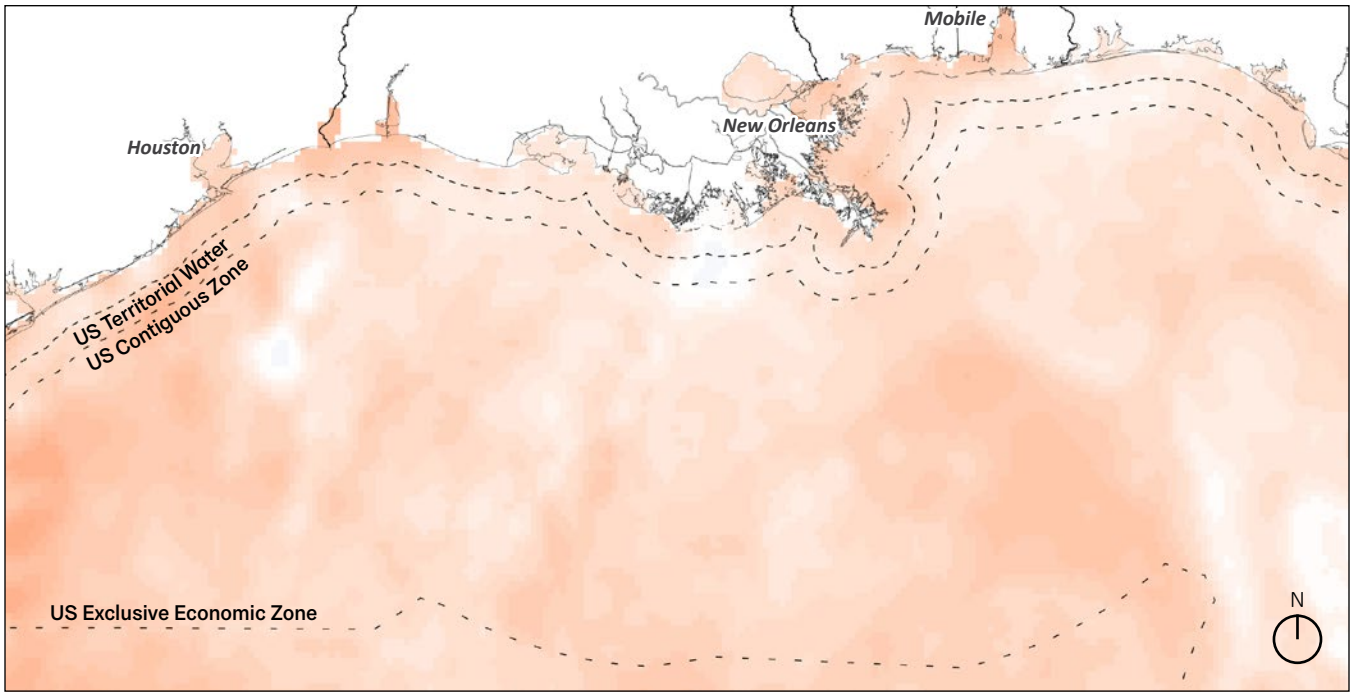
This map shows sea surface temperature from September 9, 2018, taken from the Geostationary Operational Environmental Satellite system (GOES). The Louisiana coast, especially around the mouth of the Mississippi River, has a localized difference in temperature throughout the year.[14]

Legend

87°F

83°F

Sources: National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite Data and Information Service (NESDIS), Office of Satellite and Product Operations (OSPO), 2018; Flanders Marine Institute, Maritime Boundaries Geodatabase, 2018



MAP 05. SEA SURFACE TEMPERATURE ANOMALY

This map shows the temperature "anomalies" on September 9, 2018. Anomalies are calculated as difference between the day's temperature and the maximum monthly mean. This calculation is done by NOAA using data from the Advanced Very High Resolution Radiometer (AVHHR) satellite. Most of the Gulf is warmer than the mean on this day. This is the general trend for the Gulf.[15,16]

Legend

-0.5°F

+2.25°F

Sources: National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite Data and Information Service (NESDIS), Office of Satellite and Product Operations (OSPO) Coral Reef Watch, 2018; Flanders Marine Institute, Maritime Boundaries Geodatabase, 2018

Figure 36. Freshwater Habitat
Crawfish farming in coastal Louisiana.

Ecology

"[A] harmonious combination of brackish water, shallow depths, and high levels of nutrients forms an ideal environment for microscopic marine organisms, which in turn forms the base of the marine food chain by fostering healthy populations of fish, amphibians, and shellfish. In an estuary, every species plays its part. Louisiana's estuaries, fed by the nutrient-rich Mississippi and Atchafalaya Rivers, make up the seventh largest estuary in the world."
—LouisianaSeafood.com

The value of the region's shallow waters cannot be understated. Freshwater, brackish, and saltwater swamps and marshes are home to many species of aquatic life.

Figure 37. Saltwater Habitat
Oysters thrive in the warm saltwater of the Gulf.
Photo Credit: Historic Plaquemines Parish/James and Alora Cosse Madere

The delta is constant state of give and take. While salinity levels in the region's waterbodies are in constant flux due to tidal cycles, land loss projections show a future with more saltwater. As storm surge, sea level rise, and subsidence push saltwater farther inland, fragile freshwater habitats are at stake.

As natural systems migrate upland, adaptation measures must include development of the delta to allow migration of these ecosystems, including managing freshwater within risk reduction systems to encourage biodiversity.

"By November the water off Louisiana's coast is a veritable soup of trillions of trillions of microscopic shrimp larvae...if all the larvae of just three successive generations...were to survive to adulthood and reproduce, the resulting shrimp would be equal to the volume of the sun in less than two years."
—Mike Tidwell, *Bayou Farewell*

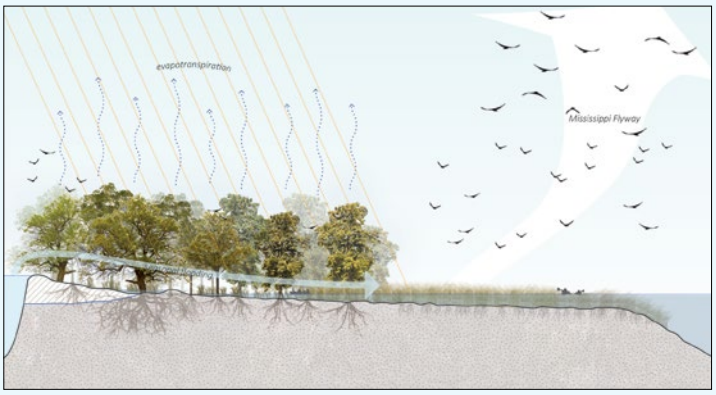


Figure 38. Shrinking Wetlands and Migratory Birds
Louisiana's wetlands provide a winter habitat and spring feeding ground for migratory birds. A smaller wetland environment means fewer food sources for birds before they migrate north to breeding grounds.

Wetland Loss and the Mississippi Flyway

According to the U.S. Fish and Wildlife Service's annual "Trends on Duck Breeding Populations," duck populations are down 13% from reported estimates between 2017 and 2018. In addition to a shrinking winter wetland habitat and stopover feeding grounds in Louisiana's coastal region, the prairie breeding grounds experienced a dryer season. This change in duck populations reflects a change in weather patterns from Louisiana up through the Dakotas.[17]

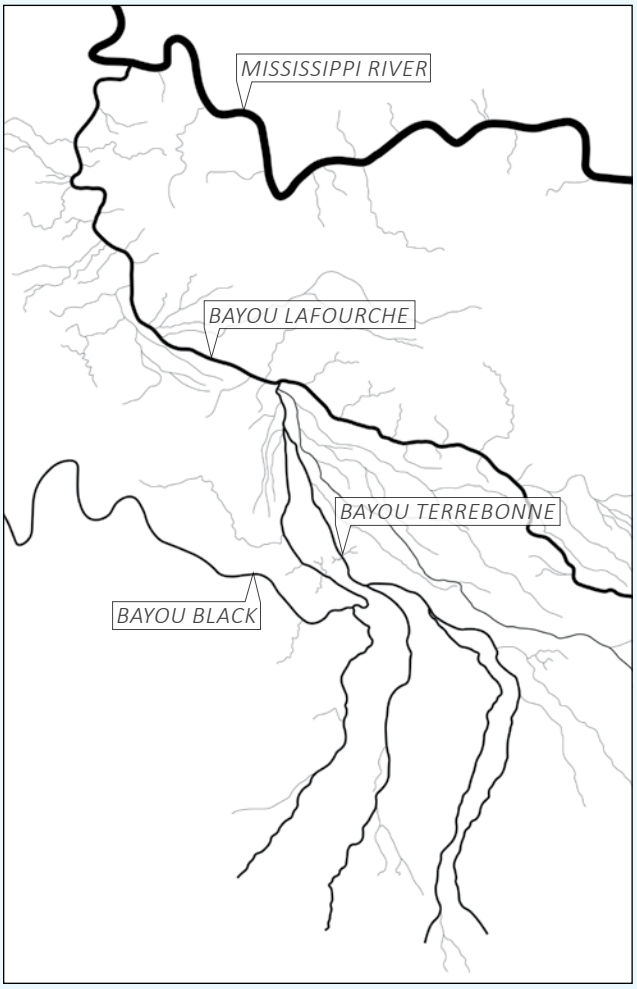


Figure 39. Historic Hydrology

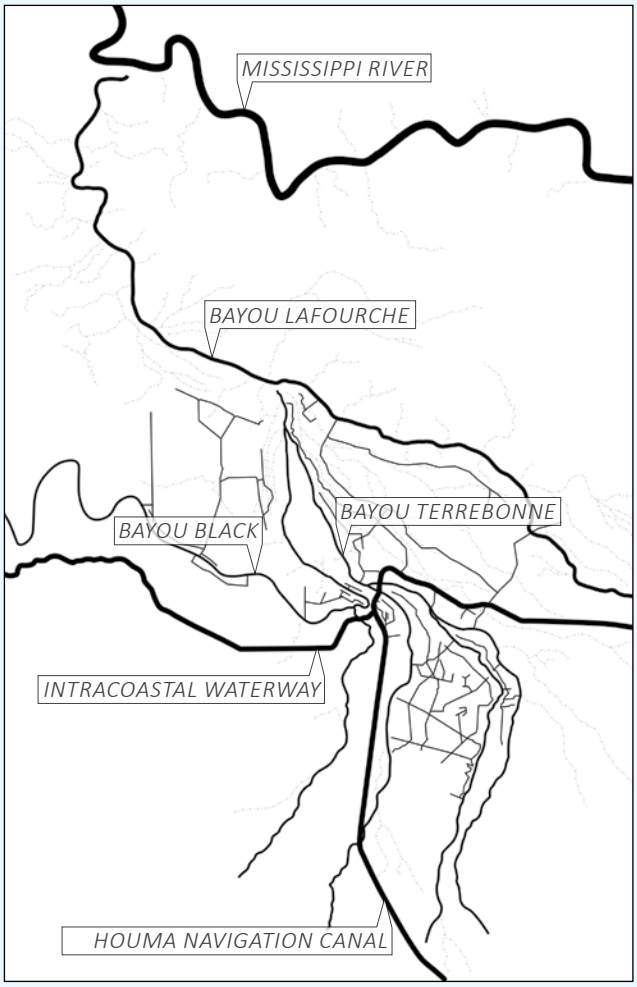


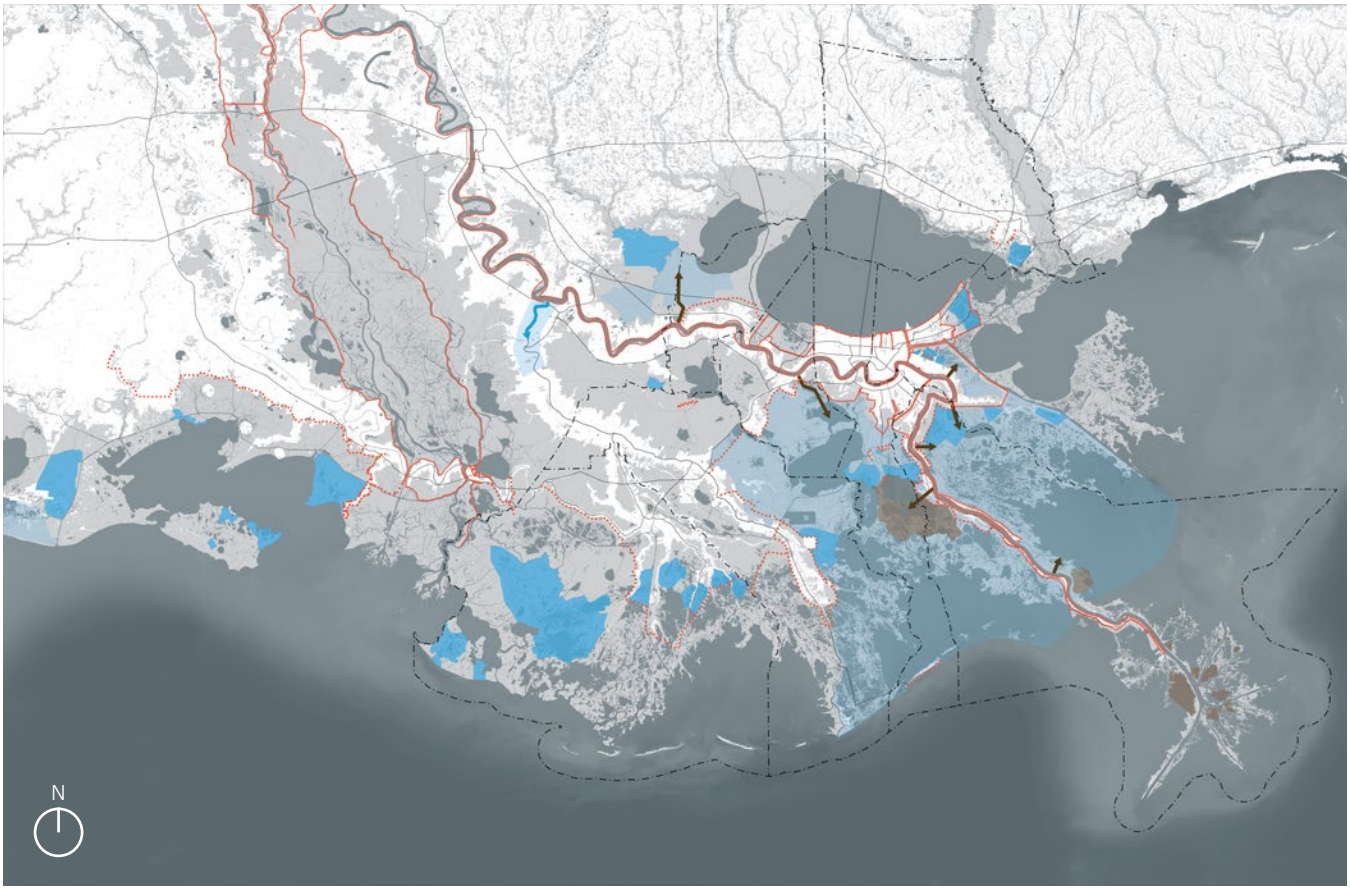
Figure 40. Current Hydrology

Impaired Hydrology

Bayou Lafourche and the bayous of Terrebonne Parish were distributaries of the Mississippi River. As the Mississippi River was leveed, Bayou Lafourche was disconnected from the river, and the flow to it and its distributaries stopped. Sediment can no longer deposit along these waterways to build land and wetlands, resulting in impaired hydrology and ecological instability. Low-lying habitations along and even atop bayous and canals further impair functional and restoration of flows and floodplains.

New and repaired connections among local waterways, lakes, and wetlands will reestablish some of the flows of water that are vital to the health of delta ecosystems. Change is a constant in the delta. Designing systems for dynamic conditions, diverse uses, economic development, and environmental restoration maximizes the value of water infrastructure investments.

Figure 41. Mississippi River Control Structure
The control structure in Donaldsonville disconnected the flow of the Mississippi River into Bayou Lafourche.



MAP 06. CPRA PROPOSED DIVERSION PROJECTS

The map shows the 2017 Coastal Master Plan's planned diversion projects.

Sources: CPRA 2017 Coastal Master Plan; for all basemap data, see References

Legend

- CPRA Proposed Diversion
- CPRA Proposed Sediment Diversion
- CPRA Proposed Hydrologic Restoration
- CPRA Proposed Diversion Influence Area
- Roads
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

Changing Salinity Levels

As part of the 2017 Coastal Master Plan, CPRA is planning diversion projects to divert sediment and freshwater from the Mississippi River into adjacent estuarine marshes in an effort to rebuild or maintain land. Building and maintaining land in the adjacent basins provides long-term benefits, serving as natural buffers from storm surge risk. However, these diversions could pose an economic disruption for the fishing industry. As river water is diverted into saltwater marshes, it brings the sediments, nutrients, and freshwater, which will in turn change the salinity levels. Saltwater species, such as shrimp, rely on the Gulf temperatures, salinity, and oxygen levels to breed and feed. Aquatic animals adapt to changing salinity, changing their behaviors and habitats,[18] which will in turn require adaptation measures for the fishing industry.

Wetland Restoration

The Environmental Defense Fund is working with Quantified Ventures and CPRA to design the first ever **Environmental Impact Bond** (EIB) to finance coastal restoration projects in the Coastal Master Plan. The team identified and evaluated projects' suitability and produced a feasibility study of the most applicable projects for a pilot EIB. Goals of the EIB feasibility study include (1)beginning restoration projects sooner to avoid higher costs, (2) sharing project risks, and (3) attracting additional funders.

Shrimping with Diversions

The Coalition to Restore Coastal Louisiana conducted a community-based study to further understand the fishing community's understanding of how diversions will affect the shrimping industry. A series of meetings were held in five fishing communities, Venice, Jean Lafitte, Meraux, Buras and Metairie (Bucktown), in 2017. Of the 50 participants surveyed, 90% were very concerned with the effect diversions would have on the white shrimp catch, and 68% were concerned about the brown shrimp catch. **Participants expressed three adaptation categories: (1) catch more shrimp, (2) sell shrimp for more money, and (3) find alternative income.**

Fishers shared concerns about these three adaptation strategies. In order to catch more shrimp, boats and equipment would need to be upgraded, with improved gear and expanded storage. To get more shrimp, fishers would need to work longer hours and more days. In order to sell their catch for more profit, participants voiced concerns about low imported shrimp prices and difficulties with raising prices on locally caught shrimp. A direct market approach would, in turn, mean additional effort on the part of the shrimper, requiring more time, permits, transport, etc. Additionally, any time spent selling shrimp is lost time catching shrimp. Of the participants, those who fish part-time expressed less concern with the third adaptation measure: finding alternative income. For full-time shrimpers, the benefit of switching means of income could also mean fishing new fisheries, jobs in other sectors, relocating, or going back to school. Changes to quality of life was a common concern among part-time and full-time shrimpers.

To learn more: https://crcl.org/resources

Adaption Strategies for Oyster Harvesting

In 2014, the Coalition to Restore Coastal Louisiana conducted a similar study to assess vulnerabilities and risks to oyster harvesting and suggest adaption methods. The study found that oyster habitats suffered during the back-to-back disasters of Hurricanes Katrina and Rita and the Deepwater Horizon oil spill. In the years following the oil spill, the majority of harvests came from privately owned oyster leases rather than public leases, suggesting these public grounds environments had not recovered. Habitats will be lost as wetlands are lost, and those remaining will be harmed as sediment diversion introduces more freshwater into the area.

The report suggests six adaptation strategies to deal with these risks:

- Replace the current volume-based measurement system with a weight-based measurement system to improve accuracy in determining catch quantity.
- Upgrade from a self-reported paper system to an electronic system to report harvest data (harvest location, duration of trip, quantity, and price paid).
- Allow supplemental seed bedding on privately owned leases as an alternative to long, costly trips to gather oyster seed from public land to use on private leases.
- Increase management of public oyster grounds to regulate practices and prevent overfishing.
- Support research to improve the safety of oyster consumption and prevent bacteria-carrying oysters from reaching consumers.
- Market and brand Louisiana specialty oysters.

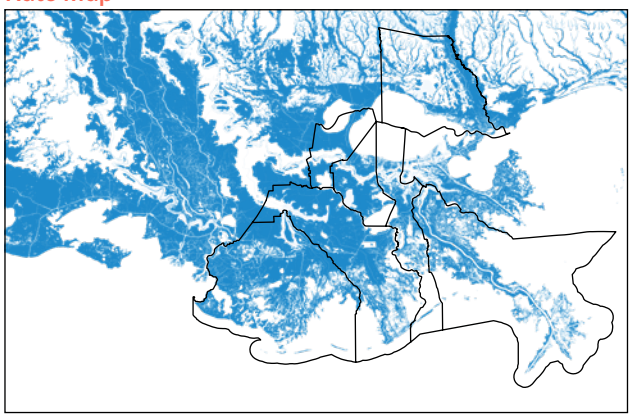
To learn more: http://www.daturesearch.com/wp-content/uploads/Datu-Oyster-Report_Final__5_21_15.pdf

LA SAFE Risk Zone Maps

LA SAFE's adaptation strategies are organized into three risk zones. These zones are categorized as low risk, moderate risk, and high risk based on NFIP DFIRM floodplain data combined with CPRA Medium Environmental Scenario storm surge data.

NFIP DFIRM

National Flood Insurance Program Standard Digital Flood Insurance Rate Map

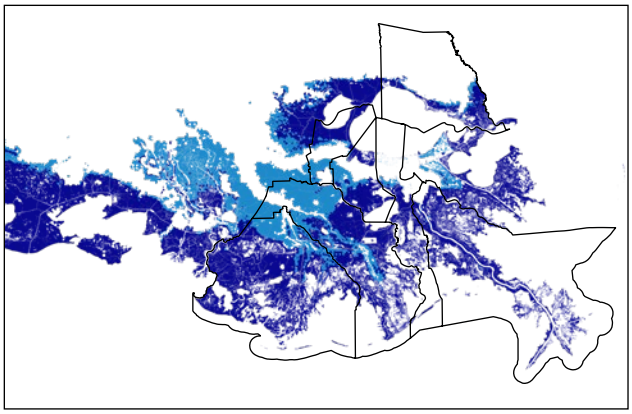


The map shows areas within levees and in a 100-year floodplain as a moderate-risk zone, as these zones flood during intense rainfall.

+

CPRA

Coastal Protection and Restoration Authority



The map shows projected 2067 flood risk from storm surge for a medium scenario or a 100-year storm.

CPRA modeling includes precipitation, evapotranspiration, sea level rise, subsidence, storm frequency, and average storm intensity.

Within the 100-year flood zone

>0 – 6' of projected storm surge flood depths

>6'of projected storm surge flood depths

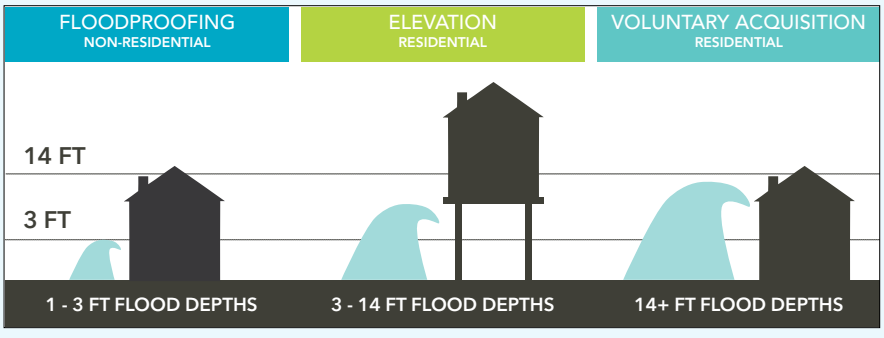


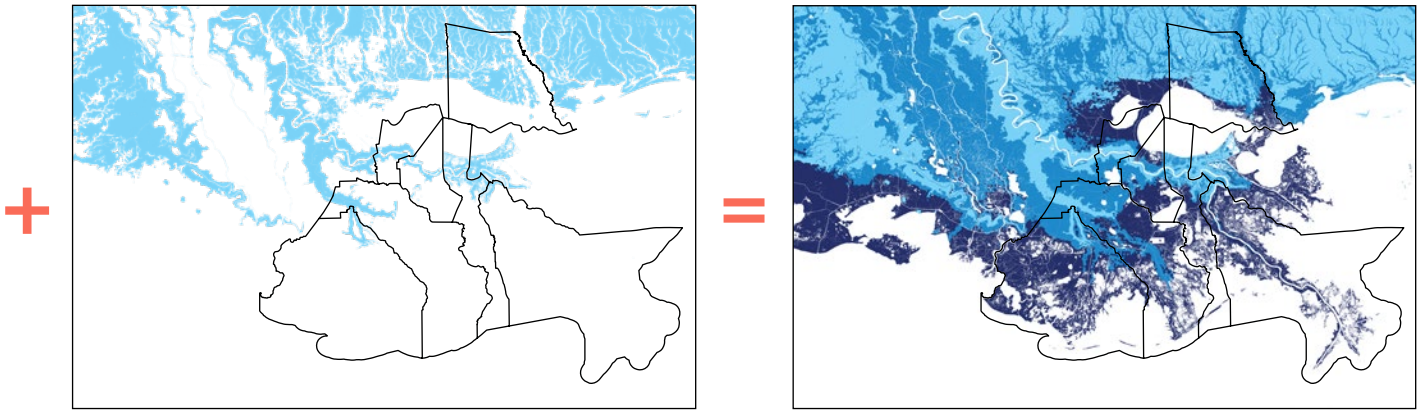
Figure 42. What is 'nonstructural mitigation'?

CPRA includes a **nonstructural project type** and associated flood depths. Structures in an area projected to have less than three feet of flood depth can be mitigated. Structures projected to have between three and 14 feet of flood depth should be elevated. In areas where structures would need to be elevated 14 feet, voluntary acquisition is considered.

Image Credit: CPRA, 2017 Coastal Master Plan

LA SAFE

Louisiana's Strategic Adaptations for Future Environments



The map shows areas outside of the 100-year flood plain and 2067 flood risk from storm surge.

The map combines the DFIRM and the CPRA modeling as well as areas outside of these modeled areas to create the risk zones.

Areas outside of the NFIP DFIRM and the CPRA storm surge modeling

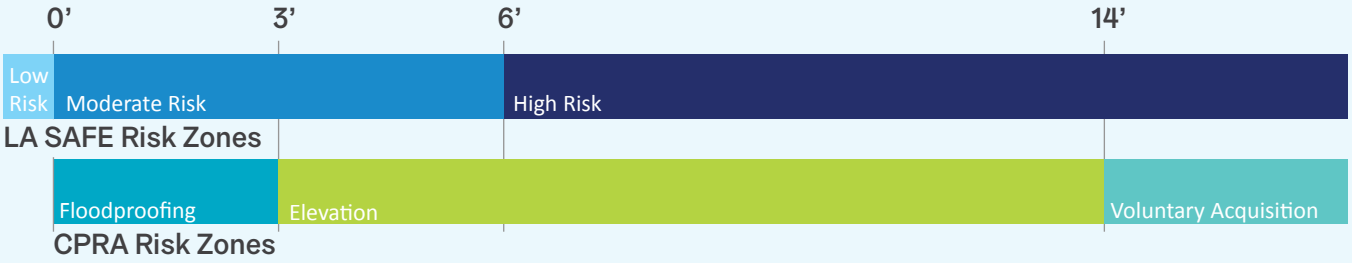
Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

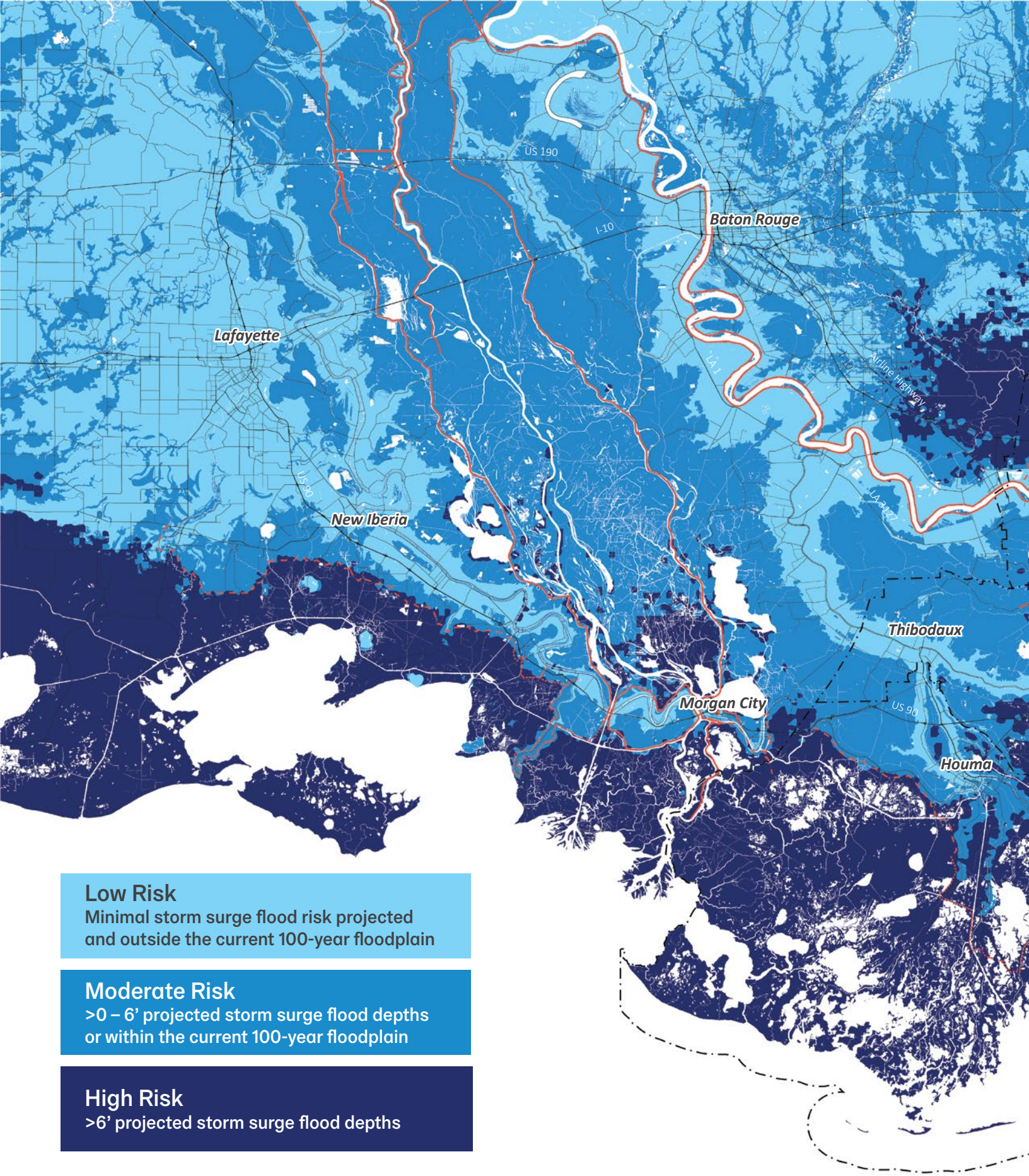
Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

High Risk
>6' projected storm surge flood depths

Figure 43. What do the flood depths mean?

LA SAFE focuses on nonstructural adaptation strategies. To define risk zones, LA SAFE uses CPRA data for flooding from storm surge combined with FEMA's National Flood Insurance Program (NFIP) data in order to plan for areas both within and outside of levee systems.



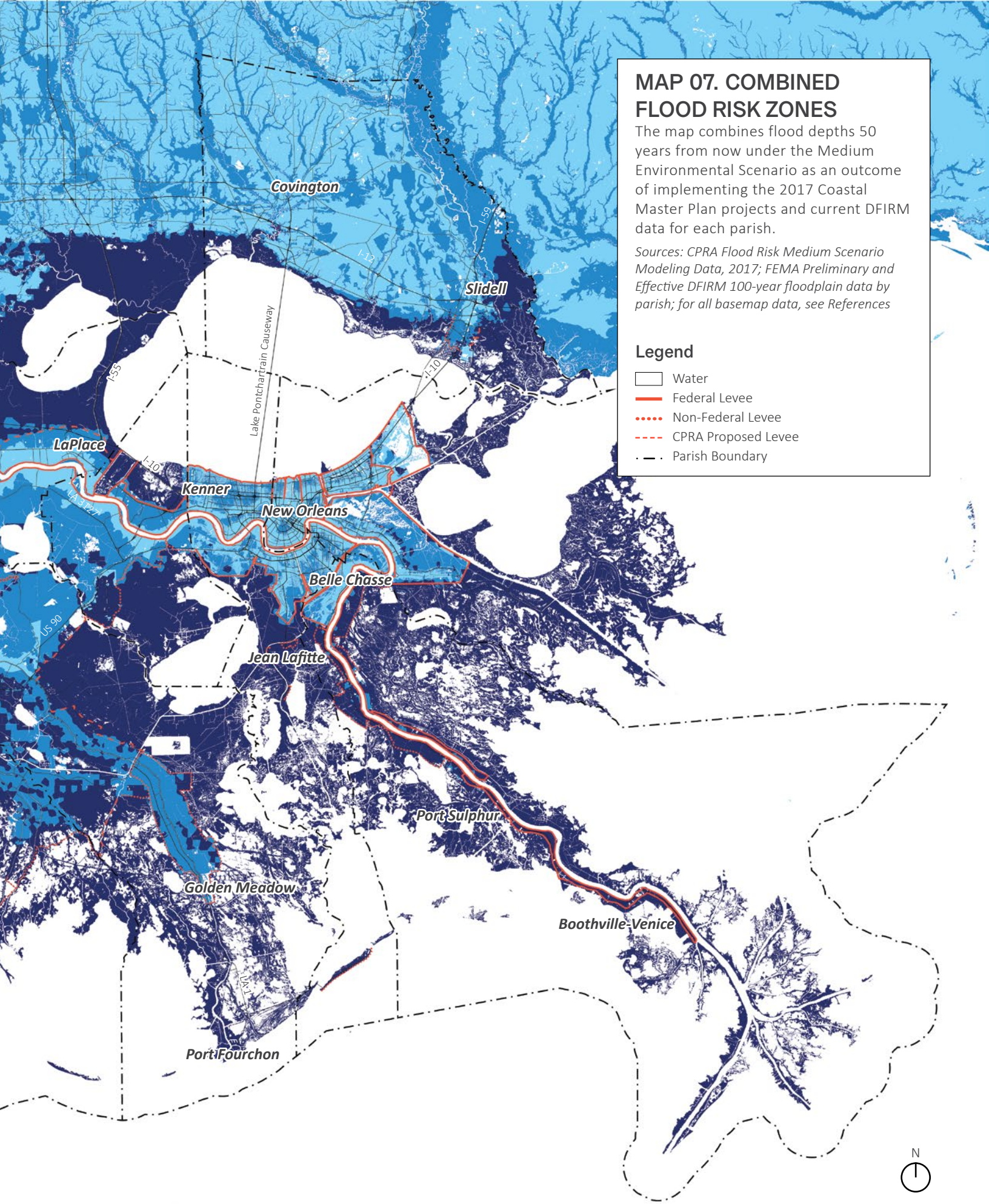


Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

High Risk
>6' projected storm surge flood depths

LA SAFE Flood Risk Zones



MAP 07. COMBINED FLOOD RISK ZONES

The map combines flood depths 50 years from now under the Medium Environmental Scenario as an outcome of implementing the 2017 Coastal Master Plan projects and current DFIRM data for each parish.

Sources: CPRA Flood Risk Medium Scenario Modeling Data, 2017; FEMA Preliminary and Effective DFIRM 100-year floodplain data by parish; for all basemap data, see References

Legend

- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

Public Evaluation of Risk and Adaptation Needs

Residents described a wide range of impacts that environmental changes have had on their lives.

High Risk

Residents who live in high-risk areas described struggles with increasing insurance costs, decreasing home values, loss of local businesses and jobs, and neighbors moving away. Residents reported that their disposable income has decreased and, with it, opportunities to participate in cultural events like fishing rodeos or local festivals. They worry that the culture and sense of place will fray as neighbors move north and environmental and economic conditions deteriorate. In some cases, these issues are compounded by trauma and loss from past storm events, impacting mental and physical health.

Moderate Risk

Residents in these areas expressed a desire to support their communities into the future, but are experiencing similar challenges of flooding, increased insurance costs, and decreased property values. Some residents in moderate-risk areas have seen neighbors move away, and expressed desire to do the same but are unable to sell their homes. Residents described decreasing opportunities as permanent residents, services, and amenities move north. Whether in schools or other educational programs, residents hope to see youth learn about the changing coastal landscape and local history. Residents have seen an increase in tourism and related activities, and suggested capitalizing on this industry by providing recreational and educational amenities for visitors.

Low Risk

In low-risk areas, residents are concerned about a different set of issues. Low-risk areas face new challenges as they receive influxes of population moving in from higher-risk areas. Residents in low-risk areas raised concerns over the effects of rapid population growth on infrastructure that they fear cannot support such increased demand. They described issues such as worsening traffic and sprawl into flood-prone areas. Residents want to see steps taken to manage growth over the long term and take into account the impacts that new development will have on stormwater management, traffic, and their communities' aesthetic and cultural character. While across the coast, residents are already adapting to increasing risk and population shifts, they want to see leaders take more decisive action to solve problems that cross borders, such as a coordinated regional stormwater management strategy and development of walkable communities with transportation and recreation systems that encourage active, healthy lifestyles.

> **"As far as what we can look into the future, the most resounding component is protecting and preserving assets. Smart growth and planned development, not just development. We would like to see developments that are done purposefully. We want quality, not just stuff."**
>
> **—St. Tammany Parish Resident**

Figure 44. Property for Sale
A lot for sale in lower Terrebonne Parish. Shifts in population and economic activity can result in economic and social hardships for those who are relocating as well as the communities that they left behind.

Figure 45. Building in a Floodplain
Newer developments in the 100-year floodplain in LaPlace in St. John the Baptist Parish experienced damage and standing water during Hurricane Isaac. *Photo Credit: FEMA/Patsy Lynch*

Figure 46. Traffic Congestion
I-12, one of the main vehicular arteries connecting St. Tammany Parish to Baton Rouge, is frequently congested as development and populations expand. *Photo Credit: formulanone/Flickr/ShareAlike 2.0 Generic*

Endnotes

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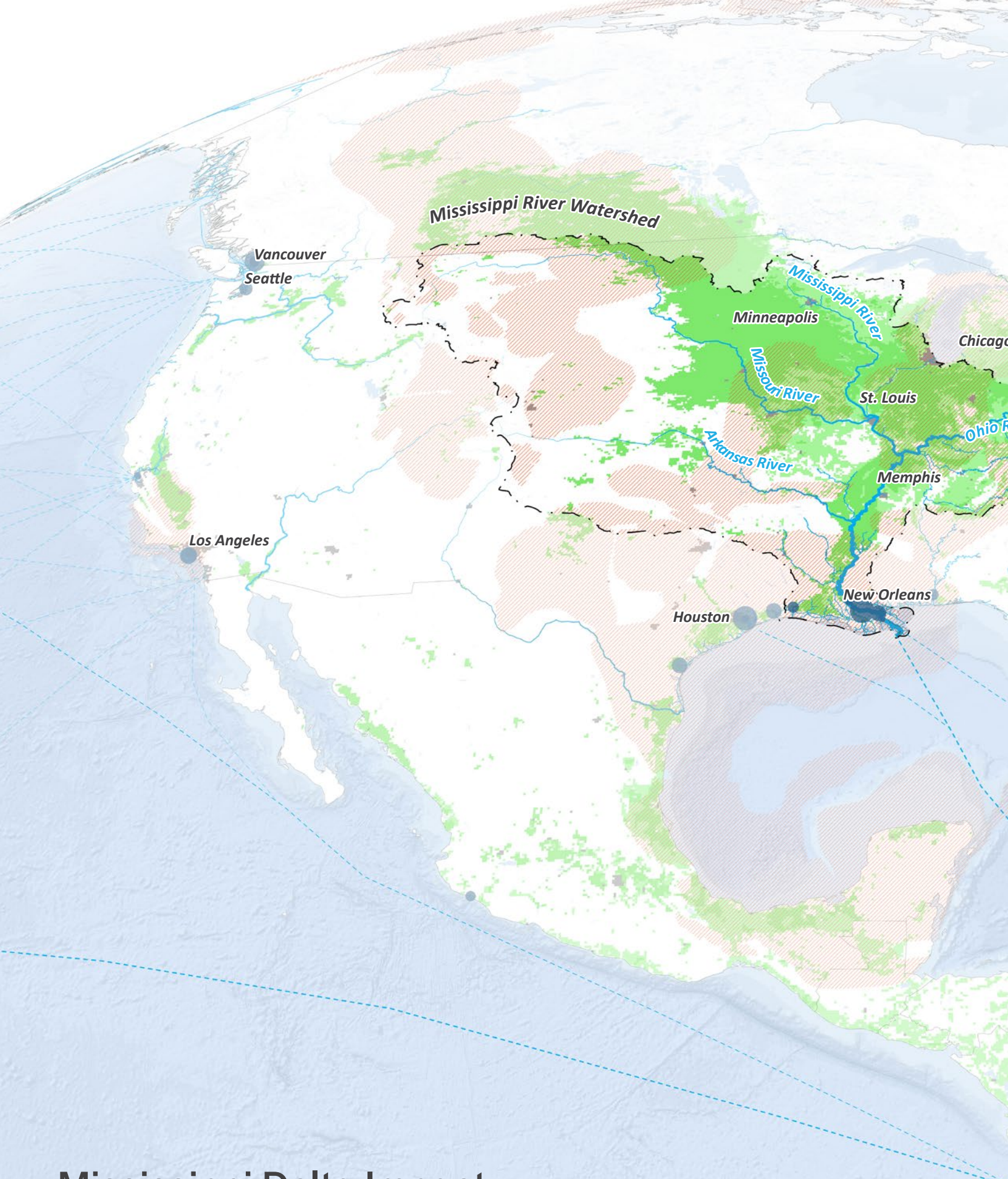
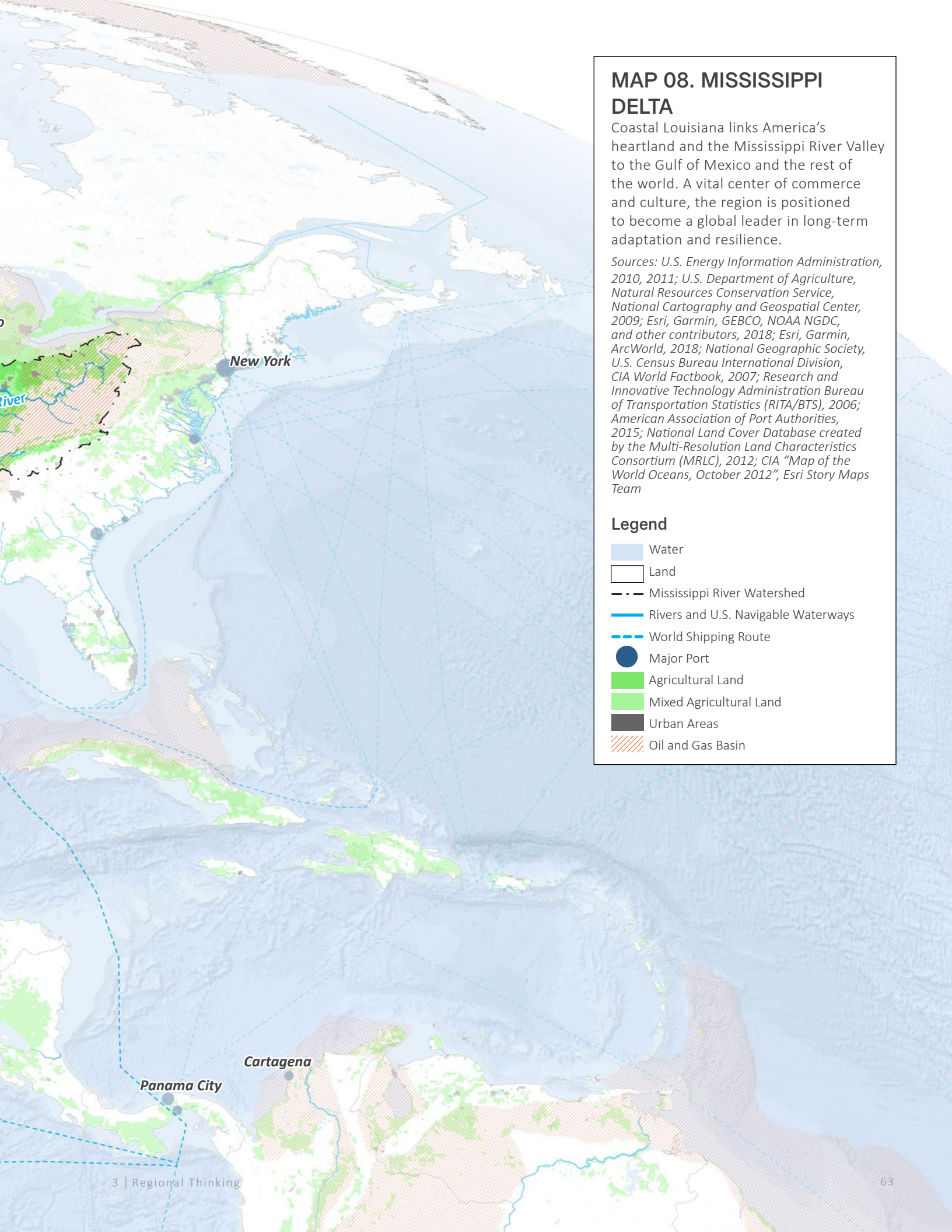
Figure 47. Mississippi River
The Mississippi River serves as the supply chain of vital resources to the nation and beyond. This photo was taken a few days after Hurricane Isaac passed through Plaquemines Parish.

3 Regional Thinking



Mississippi Delta Impact



MAP 08. MISSISSIPPI DELTA

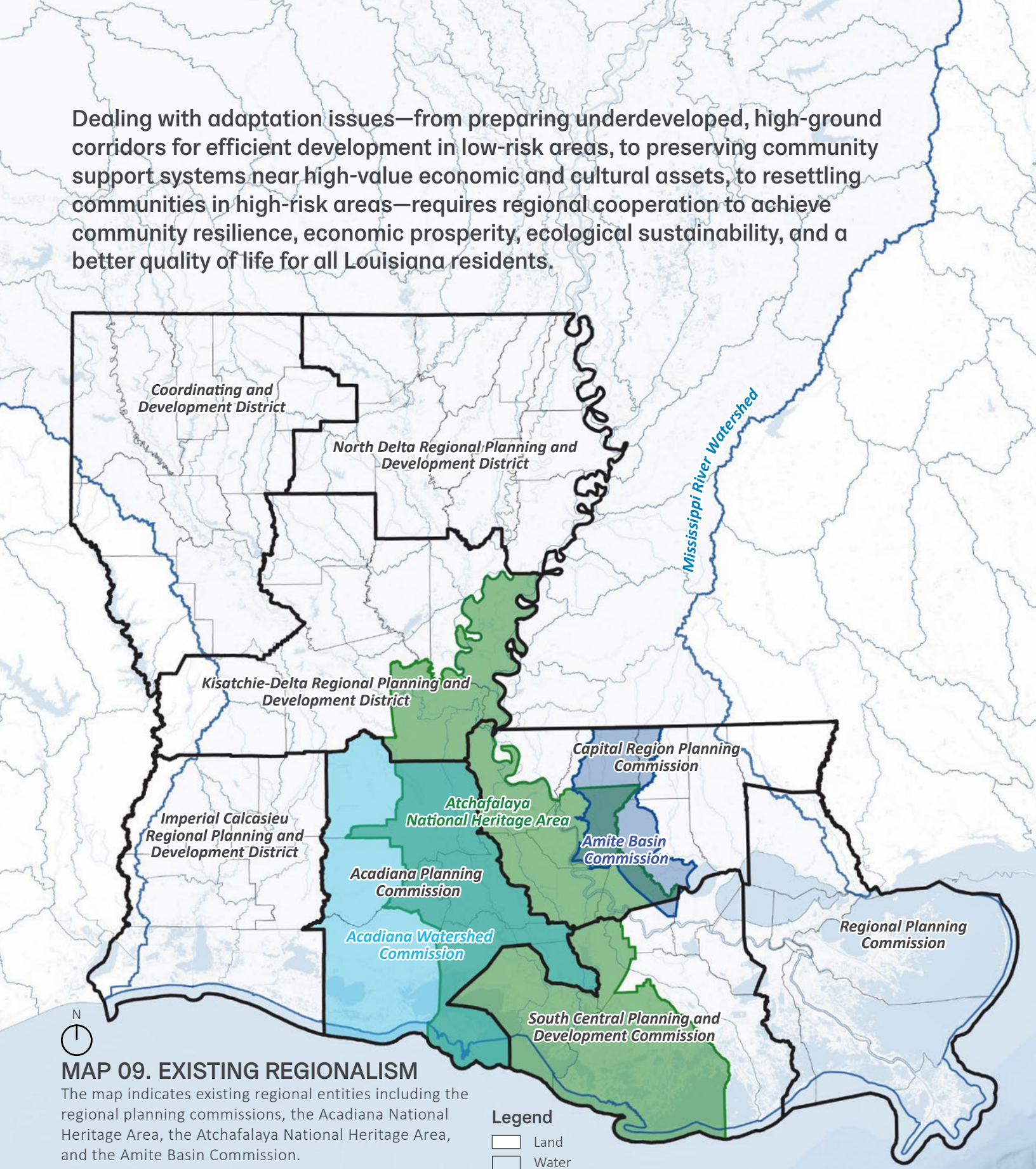
Coastal Louisiana links America's heartland and the Mississippi River Valley to the Gulf of Mexico and the rest of the world. A vital center of commerce and culture, the region is positioned to become a global leader in long-term adaptation and resilience.

Sources: U.S. Energy Information Administration, 2010, 2011; U.S. Department of Agriculture, Natural Resources Conservation Service, National Cartography and Geospatial Center, 2009; Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, 2018; Esri, Garmin, ArcWorld, 2018; National Geographic Society, U.S. Census Bureau International Division, CIA World Factbook, 2007; Research and Innovative Technology Administration Bureau of Transportation Statistics (RITA/BTS), 2006; American Association of Port Authorities, 2015; National Land Cover Database created by the Multi-Resolution Land Characteristics Consortium (MRLC), 2012; CIA "Map of the World Oceans, October 2012", Esri Story Maps Team

Legend

- Water
- Land
- Mississippi River Watershed
- Rivers and U.S. Navigable Waterways
- World Shipping Route
- Major Port
- Agricultural Land
- Mixed Agricultural Land
- Urban Areas
- Oil and Gas Basin

Dealing with adaptation issues—from preparing underdeveloped, high-ground corridors for efficient development in low-risk areas, to preserving community support systems near high-value economic and cultural assets, to resettling communities in high-risk areas—requires regional cooperation to achieve community resilience, economic prosperity, ecological sustainability, and a better quality of life for all Louisiana residents.



MAP 09. EXISTING REGIONALISM

The map indicates existing regional entities including the regional planning commissions, the Acadiana National Heritage Area, the Atchafalaya National Heritage Area, and the Amite Basin Commission.

Sources: U.S. Department of Agriculture, Natural Resources Conservation Service, National Cartography and Geospatial Center, 2009; Louisiana Department of Transportation, Louisiana State University Department of Geography and Anthropology, 2000; Esri, Garmin, GEBCO, NOAA NGDC, and other contributors, 2018

Existing Regionalism and Regional Problem-Solving in Louisiana

Louisiana has a long track record of collaboration, especially when responding to natural disasters and complex issues needing coordinated responses. In many cases, Louisiana already has the structures in place to make and implement effective regional progress in land use, transportation, economic development, disaster recovery, and other functions. The regional planning commissions provide planning and transportation coordination and budgeting. These structures should be further strengthened and built upon to ensure that coastal adaptation decisions and implementation advance the economic well-being and quality of life of all residents, regardless of jurisdictional boundaries. These goals will be fully recognized if multi-jurisdictional agencies and organizations collaborate, share research and data, and coinvest funding. Examples of regional initiatives, past and present, include, but are not limited to—

- Governor's Council on Watershed Management
- Louisiana Regional Planning Commissions
- Acadiana Watershed Commission
- Amite River Basin Drainage and Water Conservation District
- Atchafalaya National Heritage Area
- Louisiana Super Region Rail Authority (CONNECT)

Governor's Council on Watershed Management

In May 2018, through Executive Order JBE 2018-16, Governor John Bel Edwards created the Council on Watershed Management comprised of the Office of Community Development (OCD), Coastal Protection and Restoration Authority (CPRA), Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), Louisiana Department of Transportation and Development (DOTD), and the Louisiana Department of Wildlife and Fisheries (LDWF).

The order also established the Louisiana Watershed Initiative to develop and implement a **watershed-based statewide floodplain management program** to mitigate future risks associated with frequent flooding and severe weather events that could impact the state. The program is intended to increase community and regional resilience to flooding by managing, mitigating, and adapting to future flood risk at regional and state levels. The initiative's goal is to position Louisiana to be a national leader in watershed-based floodplain management through the cooperation of communities, local and state governments, federal agencies, institutions of higher education, and private and nonprofit organizations. Working together, the collaborative group will align actions and objectives to make Louisiana safer and more resilient through coordinated land use, policy, and infrastructure decisions. The Initiative is currently investigating how regions may work in collaboration to manage water and mitigate future flood risk, and will be collecting input via regional steering committees as part of their 2019 Engagement Strategy.

Reference: http://gov.louisiana.gov/assets/docs/Watershed-Initiative-Vision-White-Paper-8-15-18-(2)-.pdf

Louisiana Regional Planning Commissions

Louisiana has eight legislatively-established **regional planning commissions**. Each commission has a governing board of five to nine members from the parishes and municipalities within its region. The regional commissions conduct planning studies and prepare regional development and transportation plans for their respective areas. In addition, the commissions work closely with parish and local governments to coordinate planning activities of federal, state, and other local agencies within the area. To **conduct planning, transportation, and infrastructure projects**, the commissions receive funds, grants, and services from the federal government or its agencies; from departments, agencies, and instrumentalities of state, parish, municipal, or local governments; or from private and civic sources. The commissions hold hearings—both public and private—and sponsor public forums to obtain input on projects and expenditures of project funds.

Reference: http://www.lapdd.org/

Acadiana Watershed Commission

After the 2016 Louisiana floods, Acadiana leaders voluntarily launched and organized a regional initiative to find **solutions to better manage their regional watersheds**. Housed in the Acadiana Planning Commission, the initiative works to build local capacities that integrate long-term, science-based decision-making to address drainage and flooding issues. The cooperative regional watershed initiative works with the University of Louisiana—Lafayette, the Louisiana Governor's Office of Homeland Security and Emergency Preparedness, the Louisiana Office of Community Development (OCD), FEMA, USACE, and the U.S. Economic Development Administration. Serving as the pilot project in FEMA's watershed research, the initiative will support the Acadiana region's $25 million mitigation allotment; the primary criteria for project selection was that it would provide regional watershed solutions.

Reference: http://planacadiana.org/

Amite River Basin Drainage and Water Conservation District

This district is commonly referred to as the Amite Basin Commission. Its jurisdiction covers most of the Amite River Basin, which includes several local municipalities and portions of seven parishes—East Baton Rouge, Ascension, Livingston, St. Helena, St. James, East Feliciana, and Iberville. In 1981, the Louisiana Legislature created the commission to plan, implement, and finance basin-wide drainage and flood control measures within the basin. The 13-member commission meets monthly and consists of residents from all seven parishes.

The commission's primary mission is **flood mitigation**, which integrates a holistic approach to the role of the Amite Basin and Comite Diversion. Principal management strategies include comprehensive watershed planning, National Flood Insurance Program (NFIP) participation, floodplain conservation, flood preparedness, flood risk reduction, repetitive flood loss reduction, flood response and recovery, public outreach, and education. Ongoing projects include the Amite River Floodplain Management Plan in support of the Comite River Diversion Canal Project and community action plans for the following municipalities: East Baton Rouge, Ascension, and Livingston Parishes; the Cities of Zachary, Baker, Denham Springs, and Central; the Town of Port Vincent; and the Village of French Settlement.

Reference: http://www.amitebasin.org/

Atchafalaya National Heritage Area

The Atchafalaya National Heritage Area consists of 14 parishes: Ascension, Assumption, Avoyelles, Concordia, East Baton Rouge, Iberia, Iberville, Lafayette, Pointe Coupee, St. Landry, St. Martin, St. Mary, Terrebonne, and West Baton Rouge. In 1997, the Louisiana Legislature selected several parishes to be part of the Atchafalaya Trace Heritage Area. Through the National Heritage Areas Act of 2006,[1] Congress designated the same region as the Atchafalaya National Heritage Area. The act established a geographic heritage area and local coordinating authority responsible for developing and implementing a management plan of the entire site. The Atchafalaya Trace Commission is the area's local managing entity. The 14-member commission consists of a representative member from each parish and meets every other month.

The Atchafalaya Trace Commission incorporates a management plan that centers on a cooperative method to **understand, conserve, and promote the natural, scenic, cultural, historic, and recreational resources of the heritage area**. Program areas include outdoor recreation, culture and history, education and tools, and water heritage. The commission has a 15-year strategic **management plan**, with **ongoing projects** including the Water Heritage Trail, river and flood control using locks and dams, and conservation the Atchafalaya Basin as the nation's largest river swamp.

Reference: http://www.atchafalaya.org/

Louisiana Super Regional Rail Authority (CONNECT)

In 2011, CONNECT was formed by a broad coalition of philanthropic organizations and nonprofit institutions to advocate for the development of a **regional, multimodal transportation network along the I-10 corridor** between Baton Rouge and New Orleans. The effort focused on providing people with more access to affordable homes, job centers, and equitable economic opportunity.

The coalition was instrumental in passing legislation that created the Louisiana Super Region Rail Authority—a multi-parish entity empowered to negotiate, fund, finance, construct, and operate intercity passenger rail to serve the region. As of 2014, seven parishes along the rail corridor have designated representatives and come together as members of the Rail Authority: New Orleans, East Baton Rouge, Ascension, Jefferson, St. Charles, St. John the Baptist, and St. James. The Louisiana Super Region Rail Authority also includes a designee from the Southern Rail Commission, a multi-state body formed to support an interstate passenger rail system.

Reference: http://www.lsrra.org/

Regional Opportunities

The LA SAFE process involved four main premises. First, Louisiana is **shifting from land to water** at an alarming rate. Second, **residents are moving homes and businesses** to areas of higher ground. Third, **some communities are threatened** and are facing relocation. Fourth, recreational and cultural assets and the ecologies to support them are more important than ever to retain the **sense of place** and **quality of life** enjoyed by Louisiana's many cultures. These issues, along with others discussed within this strategy, are the overarching trends that need to be addressed in planning for Louisiana's long-term future.

Figure 48. Gaining Water
Louisiana's coastal region is losing land and gaining water, prompting the need for adaptation measures for a resilient future.

Figure 49. Shifting Population
Areas of higher ground, such as Covington on the northshore of Lake Pontchartrain, are receiver communities for people moving homes and businesses.
Photo Credit: St. Tammany Parish Flickr

Figure 50. Preserving Culture
Louisiana's cultures and traditions are uniquely tied to our landscape. These areas present educational and recreational opportunities to teach Louisiana's youth and visitors about coastal Louisiana's environment, history, heritage, and adaptation.

Louisiana has a unique opportunity to become a world leader in adaptation, identifying and maximizing opportunities as the region gains more water. Louisiana can lead the way in positioning its landscape, infrastructure, development, and education to adapt.

Living in a Smaller, More Sustainable Delta

Our coastal areas are losing land at an alarming rate. However, our coastline is gaining water, which has long provided an economy and livelihood for Louisianians. As land mass decreases and open water increases, the state's boundary line is poised to remain at its current coordinates—three miles off of the 1975 coastline. It is not only critical to maximize the state's economic potential in a smaller, more sustainable delta but also to fully activate the value of newly-created open water.

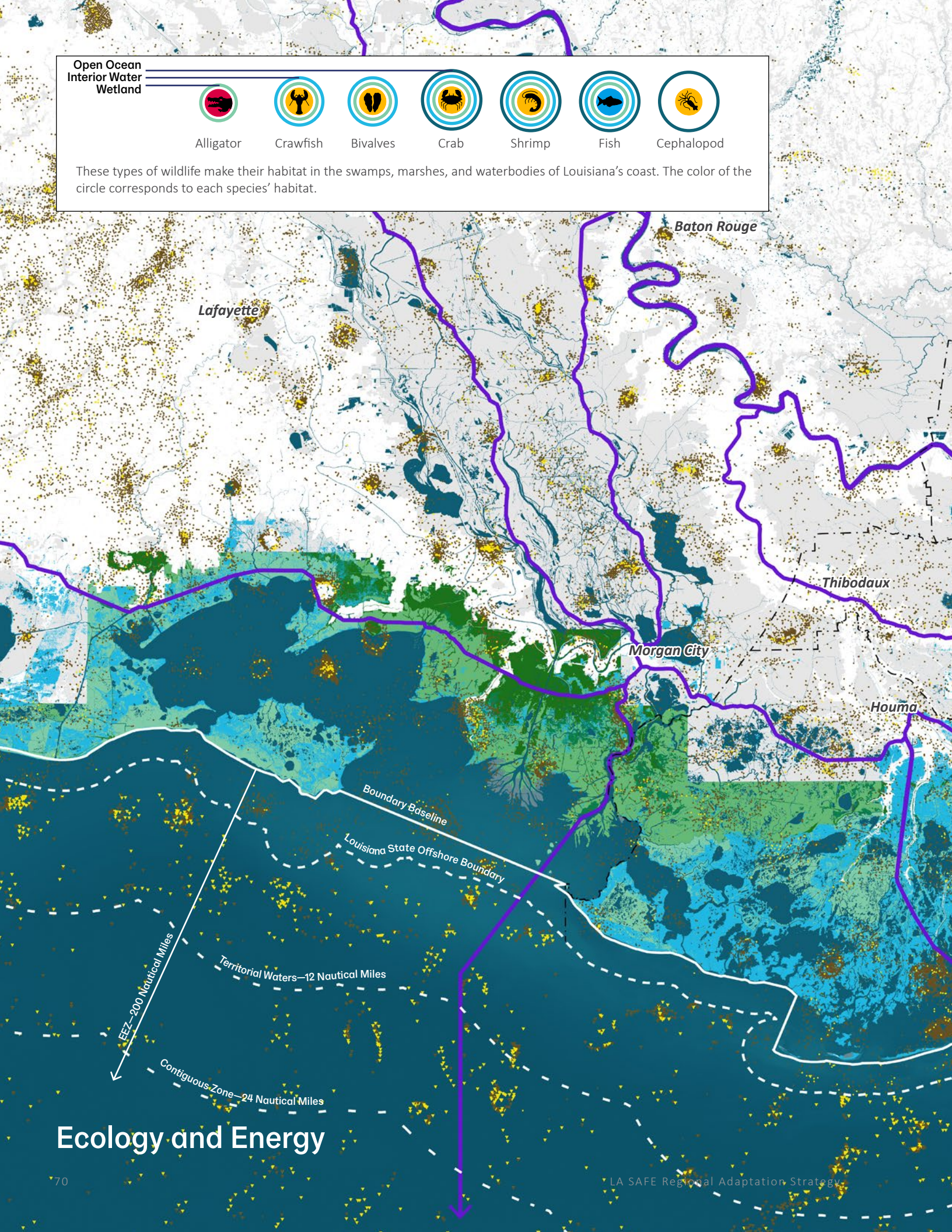
Determining Louisiana's Gulfward Boundary in Light of the Receding Coast

In United States v. Louisiana, 422 U.S. 13 (1975), a special master was appointed by the Supreme Court to determine the baseline from which Louisiana's coastline would be measured for purposes of its gulfward boundary pursuant to the Submerged Lands Act. In that case, the baseline of Louisiana's coast is defined in Exhibit A by a set of coordinates. The case did not address whether the baseline would be affected by fluctuations in the coast (i.e. changes that occur as the coast recedes closer inland). Concerning the state's gulfward boundary, in 2011 the Louisiana Legislature passed Act No. 336, which amended and reenacted LA Rev Stat § 49:1 and enacted LA Rev Stat § 49:3.1. These statutes indicate that the legislature recognized the potential problem inherent in measuring Louisiana's gulfward boundary from the state's coast (i.e., as the coast recedes, so too might the state's gulfward boundary).

Louisiana Revised Statutes § 49:1 defines **Louisiana's coastline as "the line of ordinary low water along that portion of the coast which is in direct contact with the open sea."** The statute continues that the coastline "shall be not less than the baseline defined by the coordinates set forth in *United States v. Louisiana*, 422 U.S. 13 (1975), Exhibit 'A'" and declares that "[u]nder no circumstances shall the coastline of Louisiana be nearer inland than the baseline established by" those coordinates. Additionally, LA Rev Stat § 49:3.1 indicates that, even as the coast recedes, the baseline should not change. That statute provides that "[i]n light of the continuing effects of coastal erosion, subsidence, and land loss, the coastline of Louisiana should be recognized as consisting of at least and not less than that coastline defined by the coordinates set forth in *United States v. Louisiana*, 422 U.S. 13 (1975), Exhibit 'A'." Thus, these statutes merely iterate the baseline established by the Supreme Court and provide that, **even as the coast recedes, Louisiana's gulfward boundary remains unchanged** and is located three miles from the coordinates in United States v. Louisiana, 422 U.S. 13.

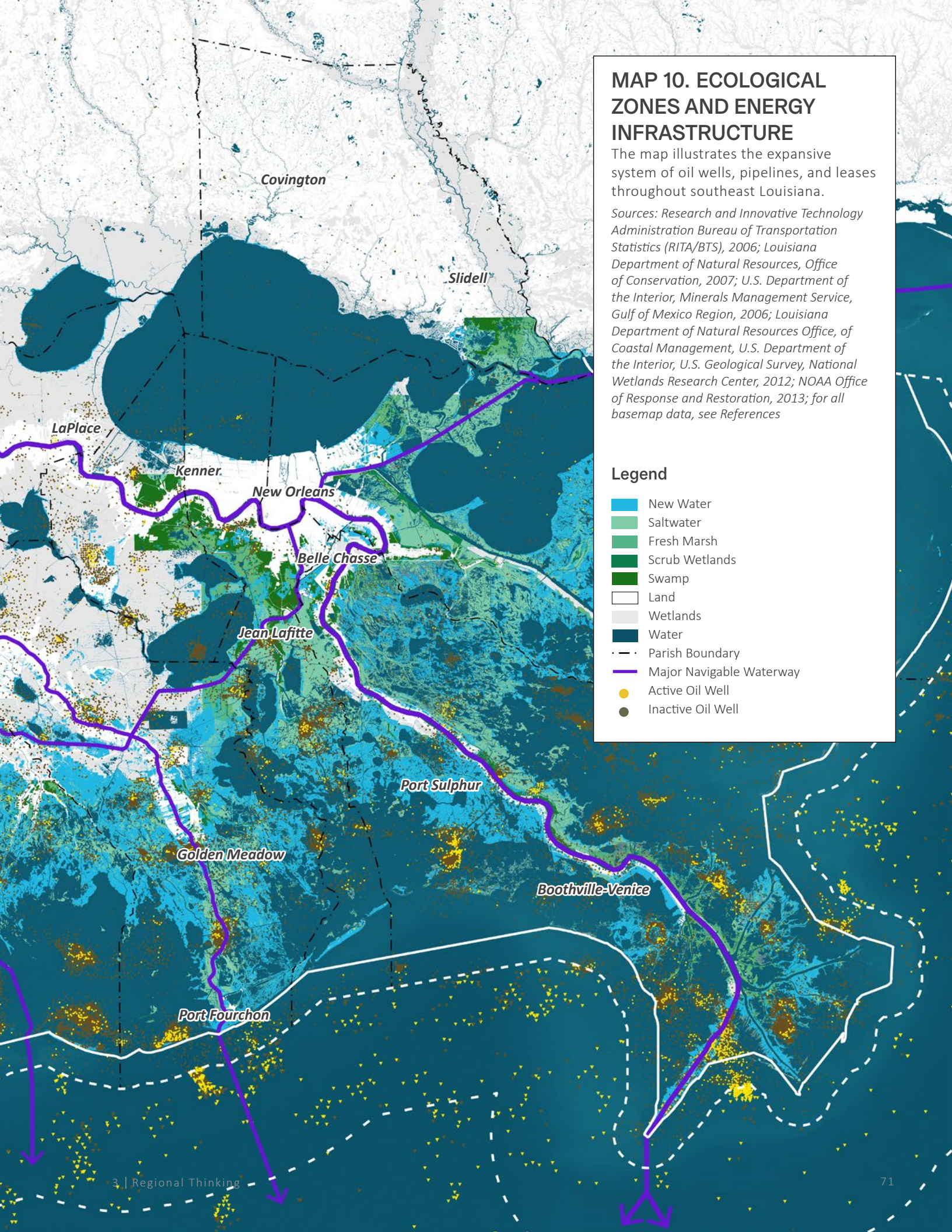
Because the issue of the changing coast affecting the baseline was not addressed in United States v. Louisiana, there appears to be no federal preemption issue with the state declaring that the coordinates for defining the coast will remain the same even as the land recedes.

—"Finding the Means: Financing Community Adaptation in a Changing Coast," an issue paper of the Tulane Institute on Water Resources Law and Policy scheduled for publication in Fall 2018



These types of wildlife make their habitat in the swamps, marshes, and waterbodies of Louisiana's coast. The color of the circle corresponds to each species' habitat.

Ecology and Energy



MAP 10. ECOLOGICAL ZONES AND ENERGY INFRASTRUCTURE

The map illustrates the expansive system of oil wells, pipelines, and leases throughout southeast Louisiana.

Sources: Research and Innovative Technology Administration Bureau of Transportation Statistics (RITA/BTS), 2006; Louisiana Department of Natural Resources, Office of Conservation, 2007; U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Region, 2006; Louisiana Department of Natural Resources Office, of Coastal Management, U.S. Department of the Interior, U.S. Geological Survey, National Wetlands Research Center, 2012; NOAA Office of Response and Restoration, 2013; for all basemap data, see References

Legend

- New Water
- Saltwater
- Fresh Marsh
- Scrub Wetlands
- Swamp
- Land
- Wetlands
- Water
- Parish Boundary
- Major Navigable Waterway
- Active Oil Well
- Inactive Oil Well

Sustainable Economy—Ecology and Energy

Living in a smaller, more sustainable delta includes a shift in thinking about the future of our economy. Oil and gas and fisheries are two of Louisiana's primary economies, and they occupy the same waters. As the coastline shifts from land to water, Louisianians can build economic opportunities in these sectors.

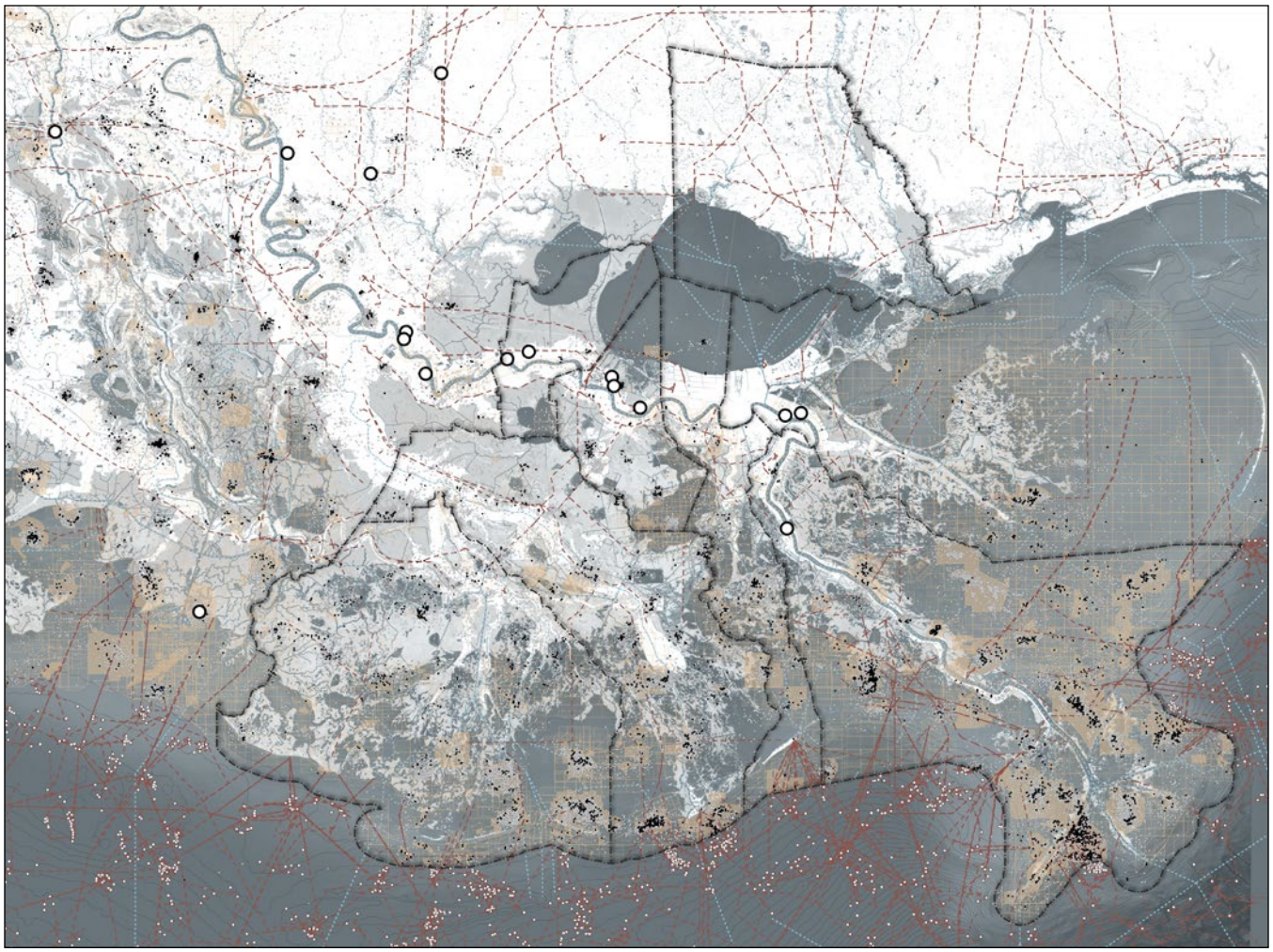
Offshore oil platforms dot the coast and Louisiana's deeper waters. As these structures are decommissioned, opportunities to dismantle or repurpose these structures can spur growth in new job sectors. Louisianians have a unique opportunity to lead the nation in creating business opportunities to dismantle and recycle the materials. Alternatively, these existing structures, whether in their current locations or a relocation, can house a multitude of new programs, such as ecotourism destinations.

Fisheries have long provided jobs and livelihoods for the people of Louisiana's coast. Studies have shown that aquatic life thrives around these structures, which can spur ecotourism opportunities for sea life observation and sportfishing.

This overlap of the ecology and energy sectors also presents an unique opportunity for Louisiana to lead the way in education and job training for emerging industries.

Figure 51. Shrimp and Petroleum Festival

Though the festival's name celebrates two very different sectors, the seafood and oil and gas industries have thrived for decades in the same waters of coastal Louisiana. The Shrimp and Petroleum Festival is held annually in Morgan City. First celebrated as Blessing of the Fleet in 1937, "petroleum" was incorporated into the festival's name in 1967. "The festival recognizes the working men and women of both the seafood and "petroleum" industries, which are the economic lifeblood of the area... The festival also emphasizes the unique way in which these two seemingly different industries work hand-in-hand culturally and environmentally in our area." (www.shrimpandpetroleum.org)[2]



MAP 11. OIL AND GAS INFRASTRUCTURE

The map illustrates the expansive system of oil wells, pipelines, leases, and refineries throughout southeast Louisiana.

Sources: Louisiana Recovery Authority, 2007; Louisiana Department of Natural Resources, Office of Conservation, 2007; U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico Region, 2006; USGS, National Wetlands Research Center, 1999; Louisiana Department of Natural Resources, Office of Mineral Resources, 2000; U.S. Census TIGER/Line, 2010, USGS National Hydrography Dataset, NOAA, Atlas: The Louisiana Statewide GIS, Esri, TomTom, Tele Atlas North America, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/ Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Water
- Wetlands
- Parish Boundaries
- Navigation Waterways
- Refineries
- Pipelines
- Active Leases
- Inactive Leases
- Active Wells
- Inactive Wells
- Offshore Platforms

Aquatic Life and Oil Platforms

The Gulf of Mexico is dotted with decommissioned oil and gas infrastructure. Beneath the water, these structures have become homes to thriving aquatic life. Studies of these structures off the coast of southern California found that coral and other aquatic life were created around the rig rather than migrating from other parts of the ocean. These structures, with their abundance of sea life, have become opportunities for ecotourism off of the coast of Louisiana as well.

To learn more: https://www.nytimes.com/2016/03/08/science/marine-life-thrives-in-unlikely-place-offshore-oil-rigs.html

Figure 52. Coral Reef

Photo Credit: U.S. Bureau of Ocean Energy Management/Wikimedia Commons

Protecting and Servicing State and National Assets

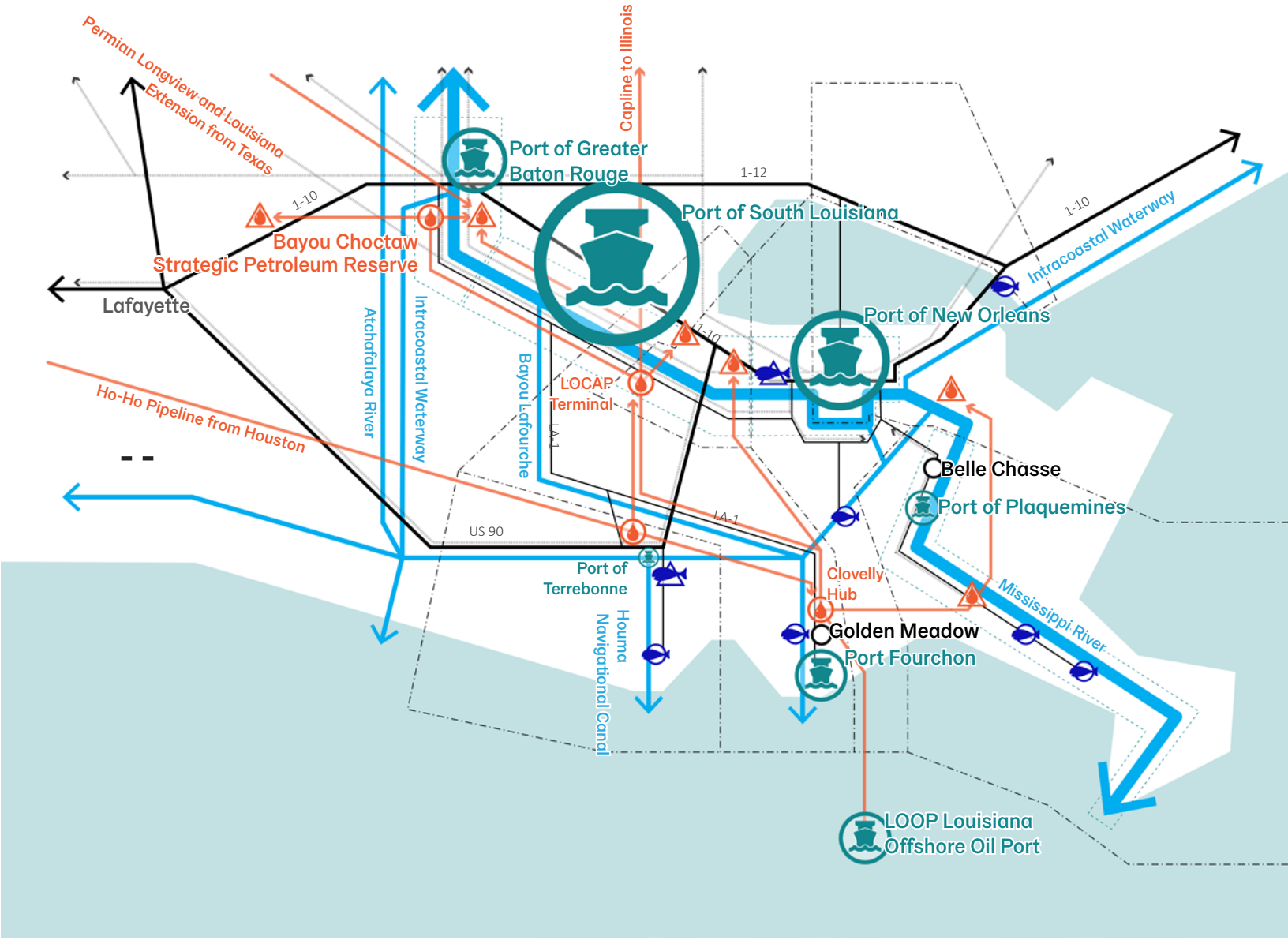
Louisiana's coast is a working coast. Louisiana's offshore waters **supply 90% of the nation's outer continental oil** and **70% of the nation's natural gas**, **handle 20% of the nation's annual waterborne commerce**, and **produce 26%—by weight—of the continental U.S. commercial fisheries landings**.[3,4,5] Five hundred million tons of cargo pass through the state's deep-draft ports and navigation channels, **ranking first in the U.S. in total shipping tonnage**.[6] The nation's largest individual port by tonnage, the Port of South Louisiana, is headquartered in St. John the Baptist Parish. The Port of Terrebonne has ranked in the top five each of the last five years in U.S. Customs vessel entries while supporting 3,000 direct jobs and an additional 5,000 supplementary jobs.[7]

Additionally, Port Fourchon in Lafourche Parish is host to the Louisiana Offshore Oil Port (LOOP). **LOOP is the only port in the U.S. capable of unloading Ultra Large Crude Carriers (ULCCs) or Very Large Crude Carriers (VLCCs) delivering oil to the U.S. from abroad.** During the past 30 years, LOOP has transported more than 11 billion barrels of oil to Port Fourchon and on to the nation. Activity at Port Fourchon accounts for **one in every 6.2 jobs** created in Louisiana, and a three-week disruption in port services would lead to a 16.6% spike in U.S. gasoline prices and an 11.4% increase in natural gas prices. Such a disruption would cost the U.S. economy $11.2 billion in sales, $3.1 billion in earnings, and more than 65,000 jobs.[8]

Most importantly, **Louisiana's coastal zone is home to more than two million people**. Many of these residents have called the coastal zone home for multiple generations, cultivating a unique way of life and a unique bond with the land itself. According to CPRA, "[s]hould land loss continue unabated, the nation would face costs of approximately $40 billion just to handle the retreat of communities inland."[9]

Golden Meadow, Belle Chasse, and Similarly Situated Communities as Service Hubs

As Louisiana's land area shrinks, deliberate actions will be required to ensure that transportation networks and supply chains to the state's assets are maintained. Goods and services must be conveniently located in stable communities to support ports, industry, fishing, and other important assets. Located on higher, safer ground, Golden Meadow and Belle Chasse can facilitate and **provide services** to residents and businesses farther south as well as **ensure that long-term supply chains and transportation networks are viable for high-risk areas**, such as the Plaquemines Port, Port Fourchon, and Grand Isle. It is also essential to **maintain access from hubs** such as Golden Meadow to the region's major assets. An example is the reconstruction and expansion of LA 1, a major highway initiative **connecting Port Fourchon with other parts of the region**. Completing LA 1 will have an impact on the future trucking system through Lafourche Parish and surrounding parishes. To ensure the region's sustainability, the LA 1 Coalition, the Louisiana Department of Transportation and Development (DOTD), and regional, state, and national planning agencies must secure the funding to complete this and similar projects.



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MAP 12. REGIONAL RESOURCE FLOWS

The landscape of southeastern coastal Louisiana provides a number of economic drivers—such as navigation, oil and gas, and seafood industries.

Sources: RITA/BTS and NTAD, 2006; USGS National Wetlands Research Center, 1999; Louisiana Department of Natural Resources, Office of Conservation, 2007; U.S. Department of the Interior, Minerals Management Service, 2006; Louisiana Speaks Regional Plan and Louisiana Recovery Authority, 2007; for all basemap data, see References

Legend

- Land
- Water
- Major Road
- Major Railroad

- Major Port
- Major Navigable Waterway
- Oil and Gas Terminal
- Refinery
- Oil and Gas Flow
- Seafood Distribution Center
- Seafood Processing
- Fishing Flow
- Service Hub

Planning for Shifting Populations

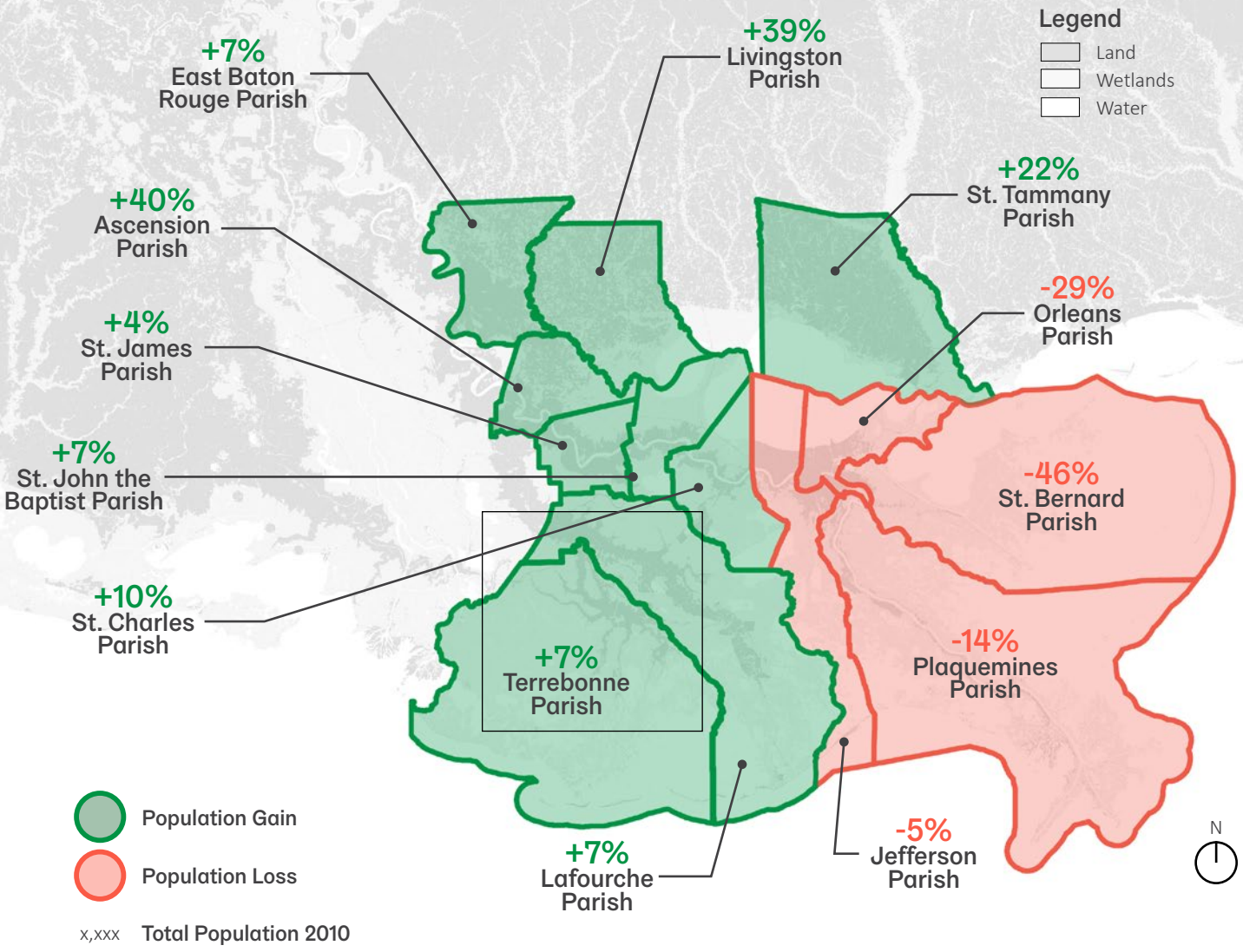
Louisiana has experienced significant population shifts resulting from catastrophic events and acute and chronic deterioration. For example, in Plaquemines Parish, an area heavily impacted by Hurricane Katrina in 2005, total population declined 14%, from 26,757 to 23,042, between 2000 and 2010.[10,11] However, Belle Chasse—Plaquemines Parish's largest municipality and an area within the U.S. Army Corps of Engineers-designed Hurricane and Storm Damage Risk Reduction System (HSDRRS)—grew 28%, from 9,848 to 12,679, over the same period. Generally, this pattern was replicated throughout southeastern Louisiana from 2000 to 2010. Areas heavily impacted by Katrina declined in population, like St. Bernard (-46%), Orleans (-29%), Plaquemines (-14%), and Jefferson (-5%), while higher-ground "receiver" parishes gained population, like Ascension (40%), Livingston (39%), St. Tammany (22%), St. Charles (10%), East Baton Rouge (7%), St. John the Baptist (7%), and St. James (4%). Two outliers to this trend, Lafourche and Terrebonne Parishes, were both heavily impacted by Katrina but also experienced population increases of 7% each.[12,13]

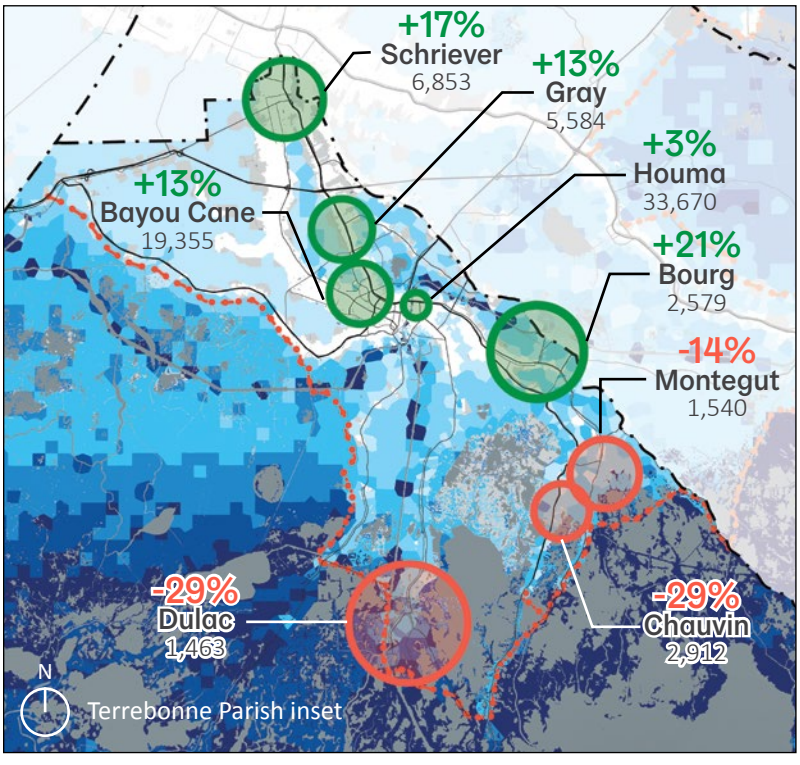
However, even within these outliers, the trend remains apparent. In Lafourche and Terrebonne Parishes, coastal places like Dulac (-40%), Montegut (-14%), and Chauvin (-9%) significantly lost population, while areas farther upland like Chackbay (29%), Schriever (17%), and Bayou Cane (14%) experienced substantial gains.[14,15]

History of Migration

Louisianians have a centuries-long history of migrating inland as a result of risk or disaster. Louisiana's barrier islands were once home to large populations, but today are largely uninhabited, with the exception of Grand Isle. The Hurricane of 1893 hit the coast of Louisiana, without warning, the night of Oct. 1. The marsh and barrier island communities of Cheniere Caminada, Grand Isle, Oyster Bayou, and Fifi Island were devastated. Located on the barrier island, the fishing village of Cheniere Caminada was destroyed, and most of the town's 1,500 residents perished. Cheniere Caminada was abandoned after the hurricane, and survivors moved inland to Cut Off, Golden Meadow, Grand Isle, Lafitte, Leeville, Marrero, and Westwego. A frequent visitor to Louisiana's barrier islands, **Kate Chopin set her novel *The Awakening* on the Gulf Coast.** This work was published shortly after the hurricane and preserves the island's legacy through literature.[16]

Figure 53. Nicholas Curole House
Newly built by Nicholas Curole on Cheniere Caminada, the house flooded during the Hurricane of 1893. The building was dismantled and moved 15 miles up Bayou Lafourche to Cut Off, where it still stands today. Since its relocation, the house has never flooded.
Photo Credit: South Lafourche Levee District/Windell Curole

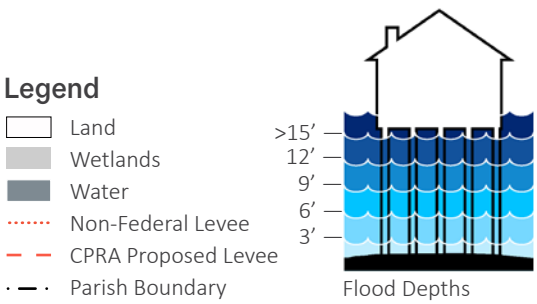




MAP 13. POPULATION CHANGES 2000 – 2010

Between 2000 and 2010, upper parishes had a population increase while coastal parishes experienced a population decrease. The exception is Terrebonne and Lafourche Parishes, which each had a 7% population increase.

Sources: Data prepared by ESRI, sourced from U.S. Census Bureau, Census 2000 Summary File 1 and Census 2010 Summary File 1; CPRA Flood Risk Medium Scenario Modeling Data, 2017; for all basemap data, see References



Over the past decades, **high-risk areas have lost population** while **low-risk areas behind structural protection or on higher ground have gained population**. These population shifts generate economic and social ripple effects throughout the region. As people move away from high-risk areas, home values in those areas depreciate further. The tax base declines due to the reduction in population and property values. With fewer public funds, local governments are forced to either raise taxes on those who remain, cut services, or go into debt. This problem is made worse by the evidence that as people move away, the median income declines. This data suggests that people with more means are moving to safer ground, leaving poorer neighbors behind. For example, during the LA SAFE engagement process, some residents expressed how difficult it is to leave because their homes have lost significant value and they can't afford to sell them.

Many of the areas identified as high-risk in the six parishes are rural. Access to mental and physical healthcare, healthy food, social services for children and the elderly, and even education become scarcer as it costs more to deliver such services to smaller, remote populations. The erosion of population and the subsequent difficulties to access and pay for the cost of transportation to reach services and amenities further degrades the opportunities that exist in rural communities.

Areas identified as low flood risk have potential for a higher risk from air- and water-related pollution. Petrochemical and chemical manufacturing industries transformed the physical landscape of southeast Louisiana. Peaking in the 1960s, refineries and upstream industries replaced agricultural plantations along the Mississippi River, contributing to water and air pollution for towns and neighborhoods nearby.

Given these event- and risk-influenced migrations, Louisiana must prepare underdeveloped, high-ground corridors for development in anticipation of future population and economic growth. LA SAFE envisions a larger-scale strategy geared toward **parish-level and regional planning and engagement designed to incentivize smart, structured, and contextual development**.

Figure 54. High Flood Risk

As people move away from areas of high flood risk, businesses and infrastructure struggle as the tax base declines.

Figure 55. Low Flood Risk

As large industries replace agriculture on higher ground, communities are at risk of air and water pollution.

Shifting Population and the Continuation of Cultures

For many Louisianians, culture and sense of place are tied to the landscape. Each newcomer to the area brought cultural traditions and methods of harvesting from the water and its surrounding environment, and these cultures were able to both thrive and survive due to the isolation of these places within Louisiana's watery landscape. A loss of wetlands could mean a loss of these cultures.[17] As the landscape shifts to more water and people move away from lower-lying places, these unique traditions should be preserved. We want to infuse, rather than lose, this unique cultural tie to the landscape.

"It's probably the most unique area of its type in the US...It's [the loss of wetlands] something that really alarms me because it's not only an ecological disaster; it's a cultural disaster. There's a whole culture, a very fine culture, that's inter-related and intertwined with the environment. We waited too long [to start saving it]. Some things have been irrevocably lost. I'm hopeful; but skeptical."

—Judge Stanwood Duval, a coastal Louisiana native, 2002, in *Burley and Jenkins, 2004*[18]

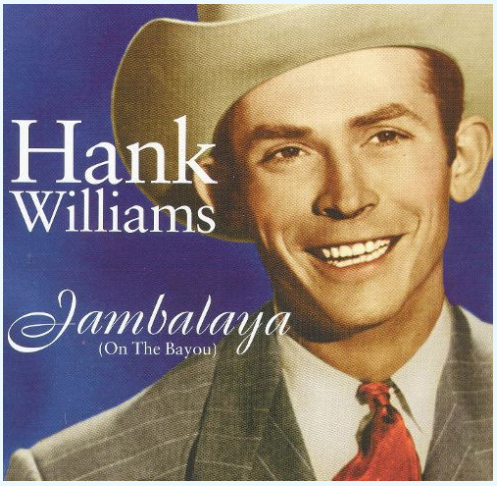


Figure 56. Jambalaya
Photo Credit: discogs.com

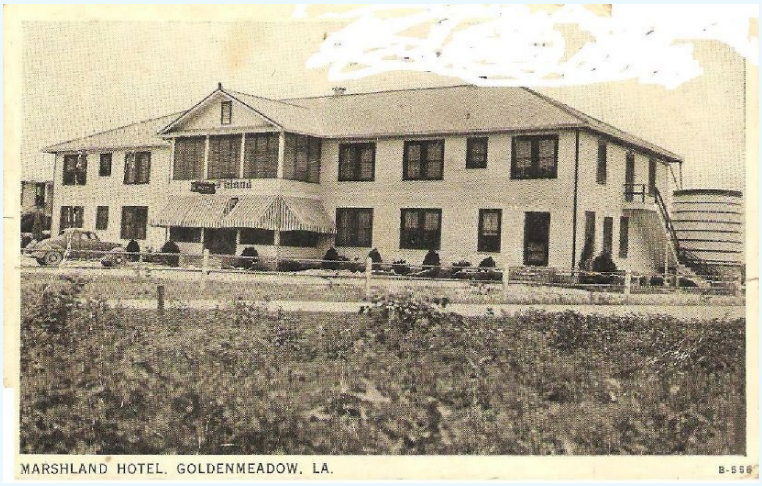
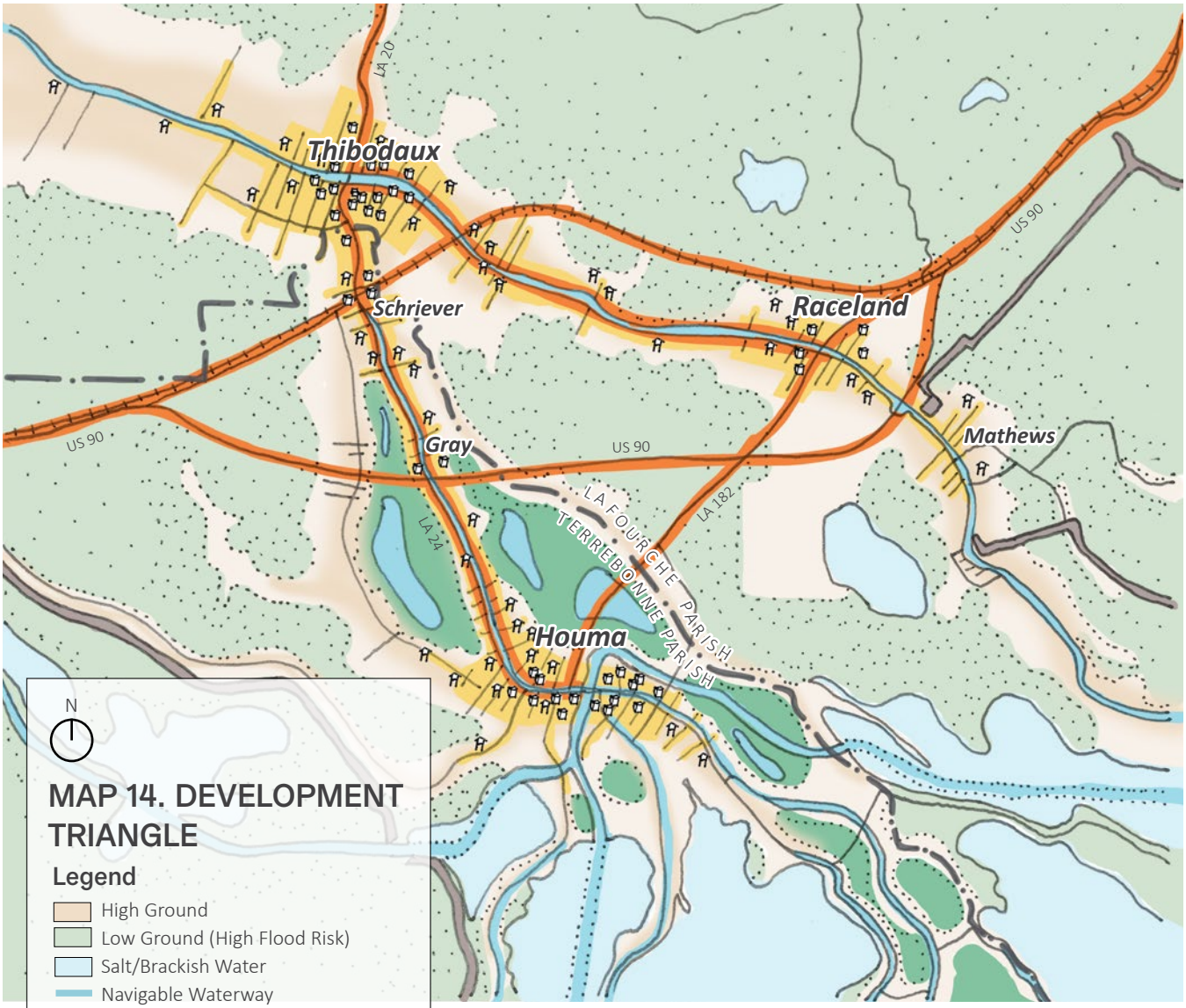


Figure 57. Marshland Hotel
Photo Credit: Lafourche Parish Public Library

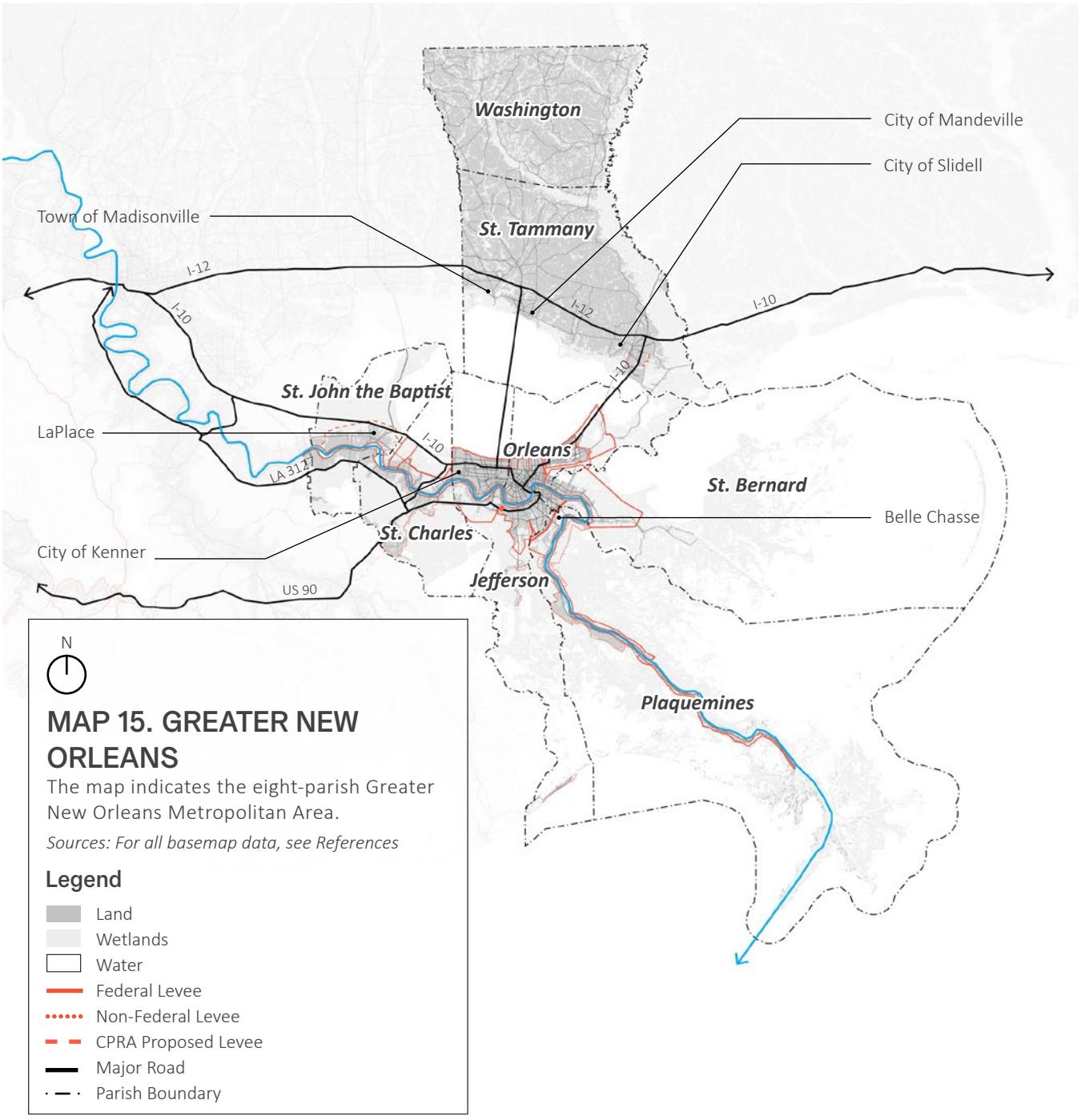
Louisiana's Influence—Oral Traditions Preserving Culture

Louisiana's culture has long both fascinated and influenced the nation. The song "Jambalaya (on the Bayou)" provides a glimpse into this national influence. Inspired by the tune of a Cajun song, "Grand Texas," Hank Williams wrote the lyrics for "Jambalaya" in 1952 while listening to the jukebox at the Marshland Hotel in Golden Meadow on Bayou Lafourche. His song rose to a national number one hit, spurred numerous cover versions, and still raises the spirits of listeners in Louisiana and around the world.



The Houma-Thibodaux-Raceland Development Triangle

As an example, the Lafourche and Terrebonne Parish plans identified the corridors linking Houma, Thibodaux, and Raceland/Mathews as **potential development centers**. These three communities are home to almost a third of the two parishes' population, providing for many the service, shopping, healthcare, and governmental needs of the region. As people seek to move to areas of higher ground in lower-risk areas, the corridors in the Houma-Thibodaux-Raceland triangle are ideal to become **receiver communities**. Houma and Thibodaux already have **historic centers with cultural amenities and walkable grids** that are attractive to the Millennial population. New development opportunities along the corridors should retain the cultural and historic characteristics of these locations while also incorporating best practices in water management, energy conservation, transportation, recreation, and environmental protection. Shared policies and development direction to coordinate such growth should be created through a small area/corridor plan that is a collaborative effort among Lafourche and Terrebonne Parishes and the cities of Thibodaux, Raceland, and Houma. This small area/corridor plan could also contribute corridor development best practice ideas to Louisiana, which has several large transportation/evacuation projects in this area. Whether on a regional or statewide level, the intent is to secure supply chains and vital cooridors facilitating emergency evacuation and providing for the safe, efficient movement of goods.



MAP 15. GREATER NEW ORLEANS

The map indicates the eight-parish Greater New Orleans Metropolitan Area.

Sources: For all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Major Road
- Parish Boundary

Greater New Orleans Metropolitan Area

Just as there is tremendous potential for coordinated, sustainable new growth in the Houma-Thibodaux-Raceland triangle, the New Orleans metropolitan area provides a second example for collaborative growth and support. While New Orleans is often seen as a somewhat isolated community, there is a need to **build collaborations with neighboring parishes** and municipalities to **coordinate and strengthen housing, support services, transportation, economic opportunities, land use, and cultural enrichment**. The eight-parish metropolitan area includes the City of Mandeville, the Town of Madisonville, and the City of Slidell. These communities have quantities of high-ground access by two corridors to the Lake Pontchartrain Causeway, allowing for new growth that connects New Orleans and economic centers to the north and south.

Collaborative Educational Institutions

As some current coastal industries grow and other jobs transition into ones that focus on adaptation and coastal management issues, Louisiana will continue to face a shortfall of qualified workers, which includes people in specialized trades to those in management. Educators—working closely with employers, workers, and job seekers—will need to build coalitions with other educational institutions to expand curriculum offerings, maximize the skills locally available for Louisiana's future jobs, and build the state's intellectual capital.

Examples of initiatives that benefit from continued and expanded collaboration to create a robust job education system are Nicholls State University in Lafourche Parish, Fletcher Technical Community College in Terrebonne Parish, and Northshore Technical Community College in St. Tammany Parish. Nicholls State University offers degrees and certification in a range of areas including **education, culinary arts, petroleum services, marine biology, health sciences, and management**. Fletcher Technical Community College has a Workforce Solutions Division, which supports initiatives that address local workforce needs and provides advanced, flexible, and applicable education and training for Louisiana's business and industry. Also at Fletcher Technical Community College, programs include a **global technician training program supporting the oil and gas industry, the Louisiana Contractors Accreditation Institute, and medical and health-related courses**. The Northshore Technical Community College offers a STEM (science, technology, engineering, and mathematics) program with focuses in **biological sciences, maritime industry, information technology, and business**.

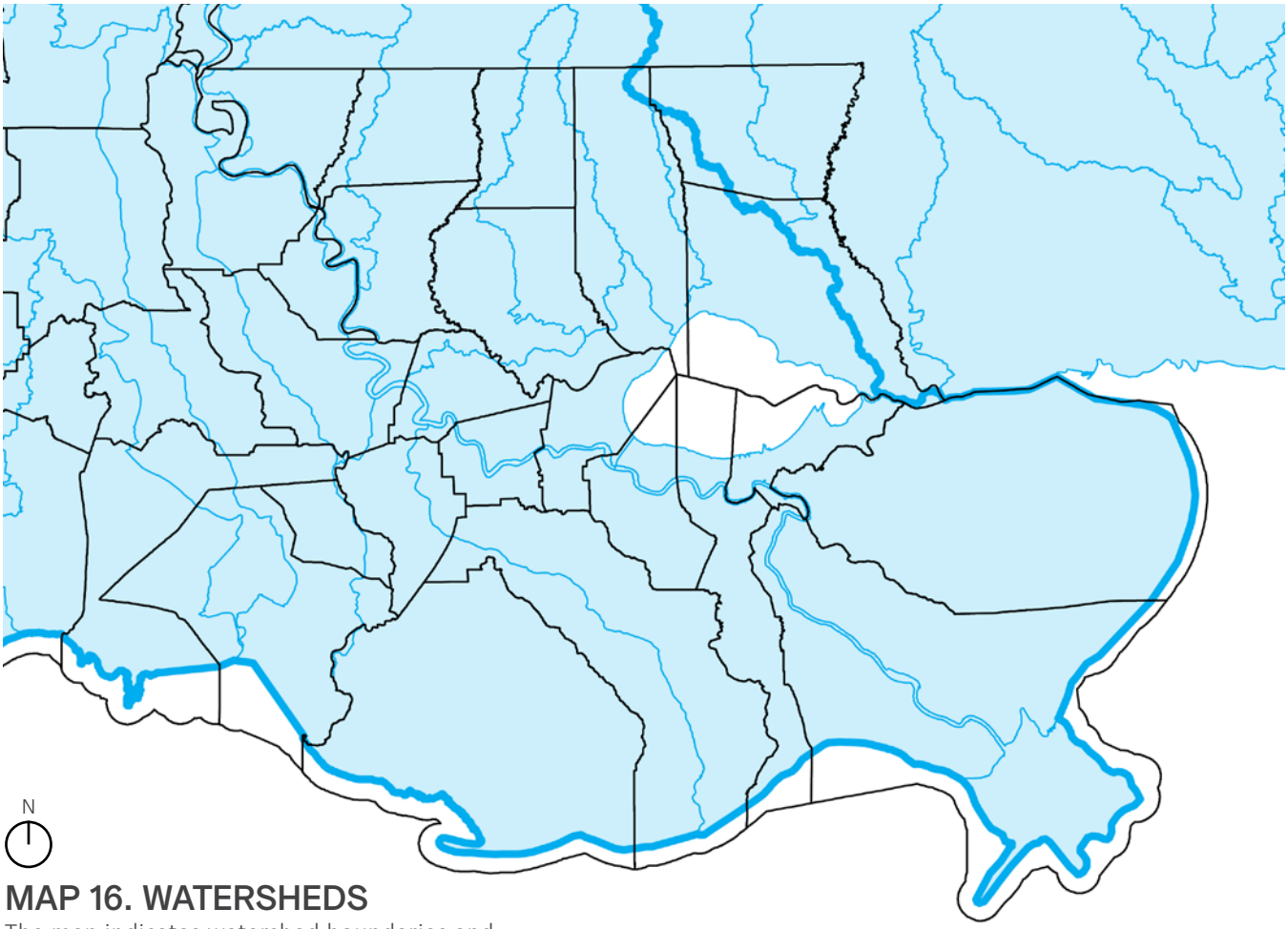
Coordinating these and other resources throughout the region with industry, workers, and chambers of commerce will ensure that Louisiana builds on its existing local talent to produce the skilled workers needed for our future job growth.

Figure 58. Culinary Arts
The John Folse Culinary Institute offers degrees with concentrations in Culinary Operations, Patisserie, Service, Business Administration, Culinary Journalism, and Public Relations, among others.
Photo Credit: Louisiana's Cajun Bayou

Chef John Folse Culinary Institute at Nicholls State University

John Folse brought the regional culinary traditions to the rest of the world. After opening Lafitte's Landing in Donaldsonville, he continued sharing Cajun and Creole cuisine worldwide with Japan, Beijing, Hong Kong, Paris, Moscow, and beyond. Recognizing his contributions, the Louisiana Legislature named him "Louisiana's Culinary Ambassador."

He opened the **Chef John Folse Culinary Institute at Nicholls State University** in 1995, which is dedicated to the preservation of Louisiana's culinary and cultural heritage. The institute offers Louisiana's only four-year culinary education degree.



MAP 16. WATERSHEDS

The map indicates watershed boundaries and jurisdictional boundaries.

Sources: U.S. Department of Agriculture, Natural Resources Conservation Service, National Cartography and Geospatial Center, 2009; Louisiana Department of Transportation, Louisiana State University Department of Geography and Anthropology, 2000; for all basemap data, see References

Legend

- Mississippi River Watershed
- Regional Watershed
- Parish Boundary

Managing Watersheds across Jurisdictions

In community discussions throughout the LA SAFE process, we heard from residents and officials about the difficulties they've had in managing stormwater because of some efforts taken to handle water in upstream and adjacent parishes and communities. For example, one homeowner described how small levees—"potato levees"—built by an adjacent parish now inhibited drainage and resulted in a decline of wetlands behind their property. People from all six LA SAFE parishes shared similar stories.

These reflections underscored how important it is for communities to work together across jurisdictional boundaries. When parishes and communities consider watersheds as a whole, stakeholders are better able to develop an **integrated, holistic approach** to **improve and protect water resources** and **create coordinated flood management programs**.

Regional and National Expert Review

Global Transformation Roundtable

LA SAFE sought expert guidance to plan and coordinate their process. With support from the Rockefeller Foundation and the Walton Family Foundation, LA SAFE team members met with local and national experts during the Global Transformation Roundtable. Over two days in July 2017, LA SAFE met with 12 thought leaders in the resilience field and more than a dozen local practitioners working for governments and NGOs. The participants identified some challenges LA SAFE must take into consideration, particularly during the implementation stage. These include—

- Developing an overall strategy for continued engagement with state agencies, local governments, and residents to educate decision makers and stakeholders about the benefits of resilience planning;
- Implementing a transparent methodology for project and program prioritization so that residents can see the impact of their participation; and
- Identifying additional financing resources to help pay for both CPRA's Coastal Master Plan and LA SAFE projects and programs.

100 Resilient Cities

A second convening was held in Buras, LA in March 2017. This event hosted 44 local, national, and international leaders in the resilience field and connected LA SAFE with three of the Rockefeller Foundation's 100 Resilient Cities. Residents and leaders from organizations throughout Louisiana and across sectors discussed the social and economic implications of future resilience efforts.

Education

Additionally, the LA SAFE team consulted with experts in education, workforce development, and fisheries management over the course of 2017. To develop the education and workforce development recommendations in the regional section, the LA SAFE team worked with GNO, Inc. to convene a meeting with K – 12 Career Technical Education (CTE) coordinators, community colleges, four-year colleges, and business groups. This evolved into an ongoing working group convened by GNO, Inc. to create a coastal/water management pathway for both career- and university-bound students, akin to the preengineering Jump Start pathway the state introduced in 2017. This working group also provided insights into the types of programs and projects that could help build coastal and water management literacy in schools and among those entering the workforce.

Fisheries

The LA SAFE team also consulted with entities working closely in the fishing industry in Louisiana, including the Louisiana Seafood Promotion and Marketing Board, Louisiana Sea Grant, and Coastal Communities Consulting during 2017 and 2018.

LA SAFE acknowledges that connections among regional and national experts are still to be made.

Regional Strategy Framework

The LA SAFE process raised a number of important issues regarding the need for regionalism as well as the challenges a successful regional strategy will have to address. Achieving this regional vision will require individuals and entities to think and act differently.

Upstream and Downstream Impacts

Leaders and decision makers should understand upstream and downstream impacts of local and regional development decisions. Further, they should be willing to coordinate and compromise in support of a healthy regional dynamic that ultimately benefits all players, but that may require some short-term sacrifices.

Climate Change Projections

Local leaders should plan for and act upon information available about how land loss and climate change will impact our communities over time. This means providing support for planned retreats from areas that are becoming unsustainable and investing in growth centers and corridors that can offer safe, affordable housing, economic opportunity, and a sense of place that helps build community.

Social and Cultural Needs

At all scales, leaders and officials should be prepared to address the complex social and cultural needs of populations that are shifting due to circumstances related to land loss and increased flood risk. The need for community identity and cultural continuity amidst these often dramatic changes calls for creative strategies for preserving, cultivating, and celebrating these assets even as community members move throughout the region.

Equitable Change

Equity is another critical consideration for regional planning. An effective regional approach should take into consideration the dynamics of shifting populations within the context of land loss and other environmental changes, which often result in those who are most vulnerable being left behind in areas that no longer provide access to adequate infrastructure, services, or social networks. Investments made using a regional framework should address these dynamics and be directed towards areas of greatest need. Just as the Louisiana Office of Community Development adheres to HUD's requirements for investing in areas in which at least 51% of the population is low- to moderate-income, a regional plan should call for other public entities to prioritize and coordinate investments in areas of greatest need.

Smaller Delta

In the coming decades, a smaller delta is inevitable, and a more compact, sustainable development footprint will be necessary. Because of this, it is important to make strategic decisions using a much longer planning horizon. With the research and modeling underway, we are able to envision a 20- to 50-year future—and we should begin planning for that longer-range future. Decision makers on the federal, state, regional, and local levels should make intentional strategic decisions that consider the limited amount of land available for development, the consolidation of development patterns, and needed services and locations of development to support Louisiana's diverse assets.

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Figure 59. Mandeville Shoreline
The Northshore's shoreline provides recreational, agricultural, aquaculture, and economic opportunities.
Photo Credit: St. Tammany Parish Flickr

4 Vision and Strategies

50-Year Vision

LA SAFE proposes a 50-year vision for the region that aligns with current and future flood risk profiles, community-developed visions, and best planning practices. **This vision addresses comprehensive community resilience and identifies the most promising opportunities for coastal communities to remain viable and vibrant.**

Land loss, subsidence, and sea level rise combine to create an environment subject to an abnormally high degree of flood risk. As a result, the very fabric of the region—a tapestry of communities, traditions, industries, and environments—is under threat. The impacts of flood risk go far beyond damage to buildings and property. They extend to mental and physical health and well-being; social services delivery; investment and economic development; and individual financial considerations, especially those related to homeownership and flood insurance. LA SAFE understands the need to think through adaptation opportunities for all aspects of community life as they relate to current and future flood risk.

LA SAFE identifies these opportunities at three levels of flood risk—low, moderate, and high—and addresses community resilience holistically—integrating risk planning with planning for education, culture, economic development, housing, transportation, stormwater management, and recreation.

This chapter presents a vision for the region organized by five planning categories and three flood risk typologies. Some strategies are applicable to all risk levels, while others are not. The following vision describes goals and strategies on the regional scale and at each risk-level typology.

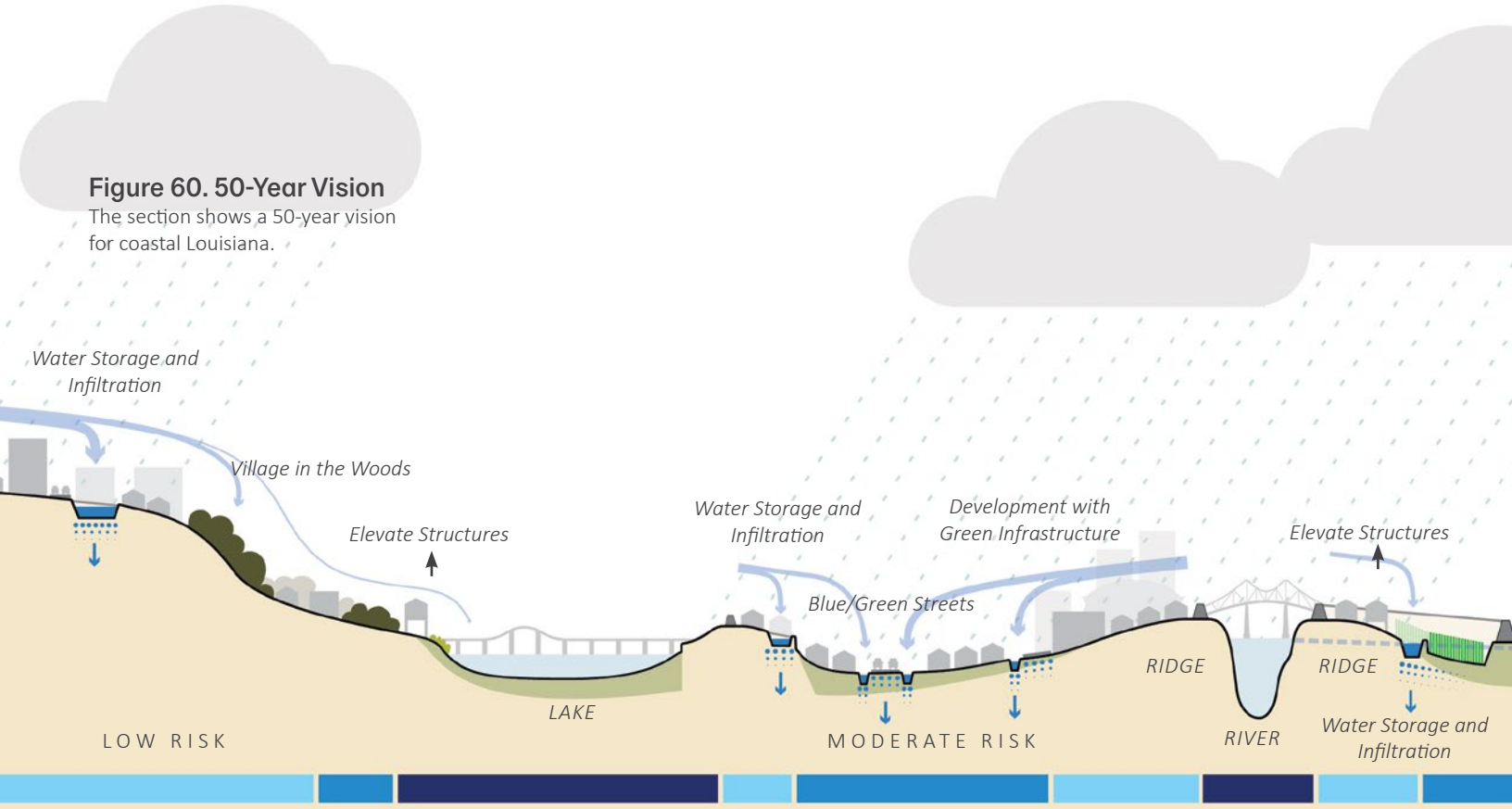


Figure 60. 50-Year Vision
The section shows a 50-year vision for coastal Louisiana.

Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

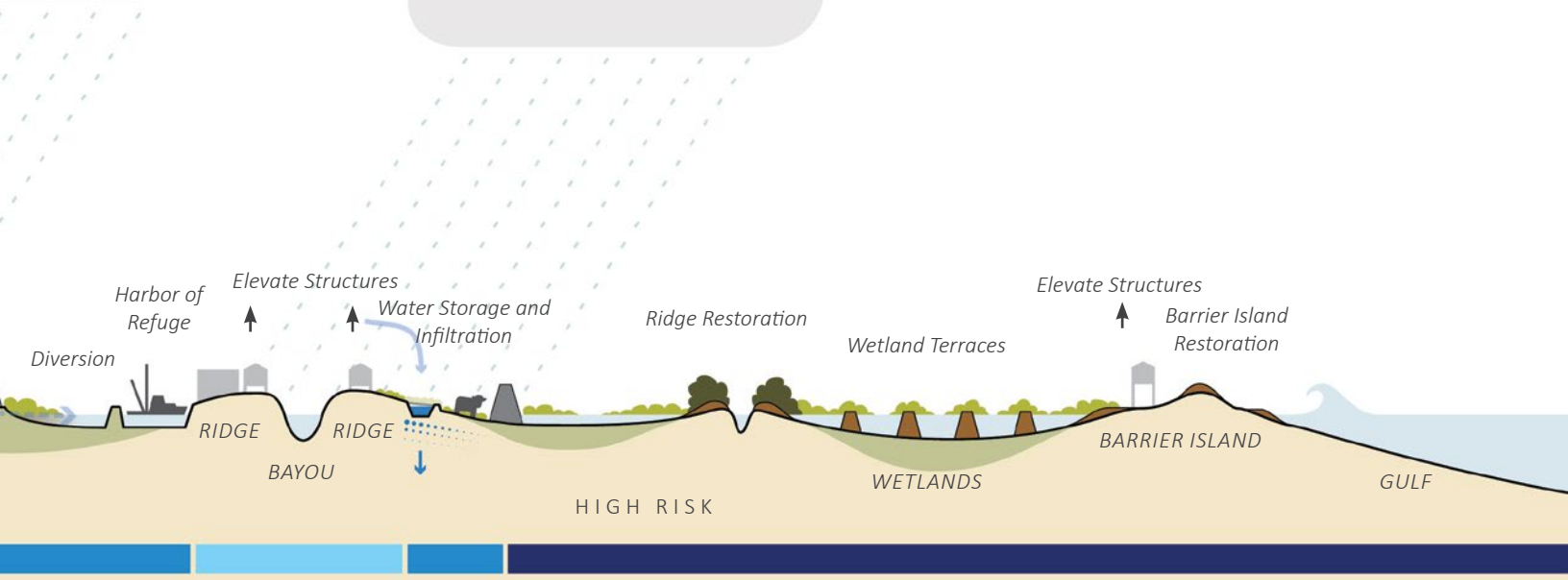
In low-risk areas, LA SAFE recommends prioritizing sustainable, long-term growth strategies. These areas are best suited to receive more residents and continue to grow as individuals in high- and moderate-risk areas seek higher ground. LA SAFE recommends that low-risk areas prepare for multimodal and mixed-use development patterns that can accommodate larger populations affordably and safely. Land with a lower future risk profile is limited, and higher density development in these areas should be considered to incentivize long-term population growth and commercial activity while maintaining and improving ecological health.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Many coastal workers live and work in moderate-risk areas. They depend on safe and affordable housing options, reliable transportation and evacuation routes, and access to basic services. Moderate-risk areas can continue to support communities and the coastal economy through strategies that harden and protect existing assets. Elevated housing, protected transportation routes, harbors of refuge, and resilient supply chains can work together to enable residents to continue thriving in moderate-risk areas.

High Risk
>6' projected storm surge flood depths

Much of Louisiana's working coast, the economic lifeblood of the region, is in high-risk areas. The state must support and maintain its working coast while adopting strategies to minimize threats to lives and infrastructure. Commercial fishing, oil and gas extraction, and navigation industries all depend on safe access to the coast and infrastructure adapted to high-risk conditions. As residential populations move away from these areas due to mounting risks and costs, these areas have the potential to transition into recreational and ecotourism destinations and support new economic opportunities.



Planning Context

Natural Environment

Southeast Louisiana has a dynamic and complex geography, economy, and culture. The region developed in close relationship with the Mississippi River, wetland ecosystems, and the Gulf of Mexico. These natural resources support trade, the seafood industry, and energy production, all of which have influenced development patterns and protection strategies over the past centuries. Many of these development decisions resulted in unintended consequences that have increased risk and vulnerability for the region's current and future populations.

"On either side of the bayou, in various lakes and inlets fringed with grass, long-hulled oyster boats can be seen working these lonely backcountry wetlands, harvesting from rich beds which produce more oysters than any other state in America: ten million pounds of oyster meat per year."

—Mike Tidwell, *Bayou Farewell*

Built Environment

In southeast Louisiana, the banks of rivers and bayous have always been the highest ground and the safest land to settle. Existing development patterns along these waterways reflect this historic pattern. Alluvial soils along the lower Mississippi River provided a rich landscape for agriculture, leading to the arpent system of plantations. This system provided landowners with parcels of long, narrow agricultural fields perpendicular to navigable waterways and with frontage access to the water. These arpent lots, which can be as narrow as 300 feet and over 11,000 feet in length, can be seen in the development patterns of present-day road networks and towns.

The region has a long history of adapting to flood risk. American Indian tribes lived in the region on high ground on the natural levees of rivers and bayous. These high grounds were then settled by Europeans in the 1700 and 1800's. The yearly floods deposited the coarsest soils here, which provided high, firm ground for permanent settlement. Control of the river for transportation, trade, and defense also drove initial settlement and development in New Orleans. Prior to the advent of levees, floodwalls, and pumping systems, residents lived more densely along the river banks, surrounded by a wetland environment, requiring the local population to adapt and live with water. The annual floods necessitated elevating structures and maintaining water ditches alongside roads.

Figure 61. Terrebonne Parish's Bayous
Terrebonne Parish's many bayous provide both a source of livelihood and tourist destinations.

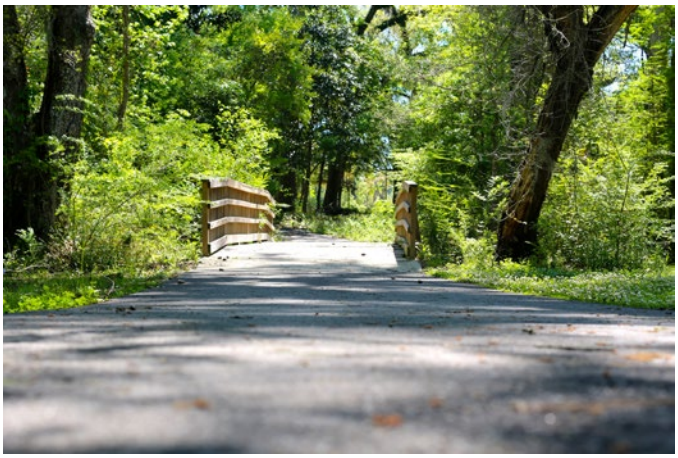


Figure 62. Tammany Trace
St. Tammany Parish's Tammany Trace runs through the Northshore's hardwood forests and hills.
Photo Credit: St. Tammany Parish Flickr

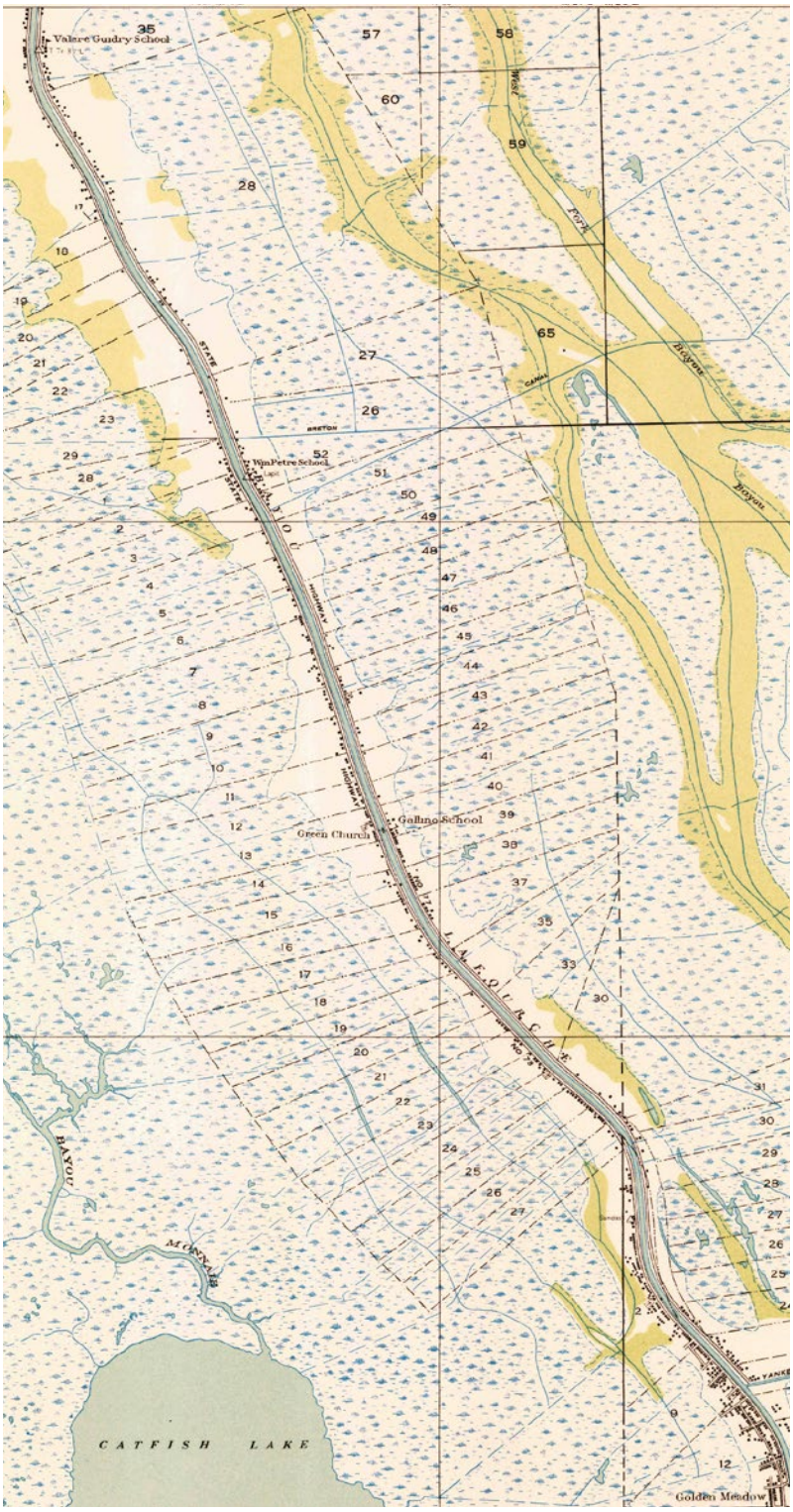


Figure 63. South Bayou Lafourche, 1935
Historically, people settled on the highest ground, the natural ridges adjacent to waterways. The arpent system along these waterways allowed everyone access to water. An example of this pattern of narrow frontages can be seen along Bayou Lafourche, creating the longest "Main Street in America" to the Gulf of Mexico.
Map Credit: USGS

Figure 64. San Malo, early 20th century
The community of San Malo was built entirely above the floodplain on stilts.
Image Credit: The Historic New Orleans Collection

Figure 65. Early Raised Structures, Lacombe, LA, 1890
American Indians built their structures with thatch roofs supported by posts that anchored into the ground, with space below for water and air to flow. These structures influenced early settlers' raised houses.
Image Credit: Louisiana State Museum

Figure 66. Historic Building Methods
Historic building methods, such as elevated or floating homes, adapted to flood risk. These types of construction are still relevant today.

Transportation System

The development of Louisiana has been linked to transportation since its earliest history. Waterways brought the first explorers and colonists, and they remain important to the state's modern shipping industry. Building on American Indian footpaths and trails, new pathways emerged to create migration and shipping routes that now connect among our nationwide roadway network. As the regional population and economy expanded, railroads eased travel and commerce, giving Louisiana more expedient connections to destinations and markets beyond the state's boundaries. In urban areas, streetcars became an important means of passenger conveyance, evolving from steam to horse to electric power. Today, waterways and rail remain important to industrial and logistical development. The national, state, and parish roadway systems, often located in areas of higher ground, provide access to existing and new development as well as serve as critical evacuation routes during storm events.

Figure 67. Access and Evacuation
Tunnels and underpasses in this low-lying region often flood, such as the tunnel in Belle Chasse pictured above .

Figure 68. Connecting the Region
The Lake Pontchartrain Causeway, above, connects the Northshore to Jefferson Parish and aided in the growth of St. Tammany Parish.

Figure 69. East and West Banks
Several bridges span the Mississippi River throughout the region, providing vehicular access across the river.

Figure 70. Intracoastal Waterway
The Intracoastal Waterway connects Texas to Florida and intersects through many Louisiana towns, such as Larose, at right. *Photo Credit: Cpt. Hayes YouTube*

Economies

The economy and environment of coastal Louisiana are not only connected but deeply interdependent. The confluence of these two forces has long shaped the movement of populations, capital, goods, and services across the region, the country, and the world. South Louisiana is home to industries including energy, trade, advanced manufacturing, maritime and petrochemical production, water management, seafood, tourism, and healthcare. Many of these industries will be negatively impacted by increasing risk, perhaps none more than the fishing industry. Some, however, like the burgeoning water management sector, can develop strategies that can be exported to other coastal areas around the world. Because Louisiana is one of the earliest places to be impacted by the effects of sea level rise, the state has an opportunity to become the water management capital of the country.

Figure 71. Fishing
The seafood industry is one of the leading sources of income and major employers throughout the region.

Figure 72. Energy
The oil and gas industry is one of the primary economic drivers in the region.

Figure 73. Navigation
The prominence of the navigation industry is directly tied to the region's proximity to the mouth of the Mississippi River.

Heritage and Culture

Southeast Louisiana is culturally rich. Its food, music, and festivals distinguish the region as a unique combination of cultures adapted to a hot, humid climate. However, the culture of these six parishes is not a single entity. The region is made up of many different people, with different values, temperaments, occupations, educational attainment, ethnicities, traditions, and experiences. In popular culture, South Louisiana is simplified as a blend of French, Afro-Caribbean, African, Spanish, and French-Canadian (Cajun) influences. That leaves out or smooths over the complex relationships among these groups, American Indians, and successive waves of immigrants throughout the past three centuries. As increasing flood risk displaces populations and frays social support networks, cultural attitudes and narratives will play a role in forming the character and identity of growing communities. Residents across the coast expressed pride, joy, and love for their culture and traditions and shared their worry and sadness regarding how increased risks and population movement can disrupt their way of life. Many residents with Cajun heritage are concerned that their Cajun French language is disappearing with each generation, which may be exacerbated by future environmental challenges. Others see technology playing a role that connects the youth around the world while distracting them from the immediate environment around them. They worry that people are becoming disconnected from the place they inhabit and the customs that have sustained them for generations.

Figure 74. Markets
Seafood and farmers' markets, such as the one pictured above in Covington, provide consumers access to locally grown produce.
Photo Credit: St. Tammany Parish Flickr

Figure 75. Festivals
Regional festivals provide cultural connections through local food, music, dancing, and crafts. Above, a team competes in the Gumbo Cook-Off at Andouille Festival in LaPlace.
Photo Credit: St. John the Baptist Parish

Race and Ethnicity

Identities built around heritage and race have been powerful forces during the past four centuries in the region and are still manifest today in the demographic geography. During the 1700s, early European settlers enslaved some American Indian people,[1] and by 1795, almost 20,000 enslaved people from Africa were used for labor on Louisiana farms and plantations.[2] The 1850 U.S. Census, which collected data for "whites," "free colored," and "slaves," reveals that more than half of the population in Plaquemines, St. John the Baptist, and Terrebonne Parishes were enslaved people—64.7%, 62%, and 56%, respectively. In these parishes, 30%, 35.3%, and 42.8% of the population, respectively, was white. In Lafourche and St. Tammany Parishes, the enslaved populations were 45.8% and 37.1%, and the white populations were 53.9% and 57%. Jefferson Parish had an enslaved population of 24.7% and a white population of 71.9%. The remaining residents in these parishes were free people of color; St. Tammany had the largest population of free people of color at 5.6%.[3]

During and after the post-colonial period, a person's race typically determined one's socioeconomic status, available opportunities, and narratives of their own lived experiences and history. Beginning with the region's 18th century colonization, followed by 150 years of chattel enslavement, to 80 years of Jim Crow laws, to a disproportionate six-fold increase in black prisoner population since the late 1970s—the effects of institutionalized and systemic racism and white supremacy are still with us.

One economic consequence is that white Louisianians earn nearly double the income of black Louisianians. Factors contributing to this difference for black residents include barriers to accumulating intergenerational wealth and asset building, reduced access to education and training opportunities, and outright racial discrimination. This economic disparity is reinforced by the geography of risk. Safe, high-ground areas have more expensive real estate. Unsafe areas are less expensive, but a larger proportion of housing expenses goes toward both homeowner's insurance and flood insurance, which means families with lower incomes in flood-prone areas are less able to build equity in their homes. In this way, geography becomes a contributing factor to economic and racial inequality. This is perhaps most evident in New Orleans during and after Hurricane Katrina. The areas that flooded had predominantly black residents—with the exception of the Lakeview neighborhood—while the high-ground, expensive, "sliver by the river" houses were occupied by predominantly white residents.

St. John the Baptist Parish, the only parish with a majority black population among the LA SAFE parishes, has the state's highest cancer risk due to the heavy chemical industries located there. In Plaquemines Parish, the east bank has a majority black population, and it is one of the highest-risk flood zones in the region. In Terrebonne Parish, the Isle de Jean Charles community is resettling to higher ground, relocating from a home that was once an American Indian refuge from persecution in decades past.

Throughout the 20th and 21st centuries, the region's population has become more racially and ethnically diverse, driven by an increase in Hispanic/Latino and Asian populations. According to U.S. Census data estimates for 2017, more than one quarter of the populations in Jefferson, Plaquemines, Terrebonne, and Lafourche Parishes are from minority groups. Residents living in Jefferson Parish are 27.6% black, 14.9% Hispanic/Latino, and 4.3% Asian; this parish has the largest population of Hispanic/Latino and Asian American residents in the region.[4] In Plaquemines Parish, 21% of residents are black, 7.4% Hispanic/Latino, 4.2% Asian, and 1.8% American Indian.[5] Terrebonne Parish's residents are 19.1% black, 6% American Indian, 5.2% Hispanic/Latino, and 1.2% Asian.[6] In Lafourche Parish, residents are 13.6% black, 4.5% Hispanic/Latino, 3% American Indian, and 1% Asian.[7] The majority of St. John the Baptist residents—56.9%—are black, and 6.5% are Hispanic/Latino.[8] The least racially and ethnically diverse parish is St. Tammany; 12.2% of the residents are black, 5.8% Hispanic/Latino, and 1.5% Asian.[9]

During and after the Vietnam War and the fall of the Khmer Rouge regime in Cambodia, many people immigrated to Louisiana. These immigrants and their descendants make up a large proportion of the growing Asian community in coastal Louisiana. Many of these residents are part of the fishing industry in Plaquemines Parish.

As residents move away from high-risk areas, the geographies of race and risk may change. LA SAFE strategies encourage all development to be on safe, high ground and to provide the density necessary, so no one is forced to live in unsafe, unhealthy areas. Despite the dire circumstances, as residents move away from risk, there is opportunity to build housing and create services for them that will rectify the social, economic, and geographic inequality they faced previously.

Adaptation Goals and Strategies

This section includes background on each goal followed by a description of the strategies used to achieve the goal and specific actions needed to implement the strategies. Goals and strategies were generated from the previously described public engagement activities (see Chapter 2: LA SAFE Process).

Goal 1: Manage Flooding and Subsidence

Implement water management strategies that are based on natural systems and address all scales—regional, parish, and community programs as well as initiatives targeted to individual property owners.

Strategy 1: Institutionalize considerations of future flood risk in daily operations and programs within state agencies

Strategy 2: Align public funding and project prioritization to promote green infrastructure and stormwater management

Strategy 3: Incentivize the incorporation of stormwater management features and green infrastructure in private development

Goal 2: Plan for Safe and Affordable Development

Retrofit existing and create new safe, inclusive, and sustainable communities.

Strategy 1: Encourage elevation of homes based on current and future flood risk

Strategy 2: Plan for future development based on risk typologies with mixed-use residential growth in low-risk areas

Strategy 3: Identify ways to address insurance affordability

Goal 3: Improve Mobility throughout the Region

Support a resilient transportation system that includes multiple modes of transportation and promotes the creation of walkable communities.

Strategy 1: Promote well-connected, multimodal transportation options

Strategy 2: Protect and elevate key supply chain and evacuation routes

Goal 4: Diversify Educational and Employment Opportunities to Strengthen the Regional Economy

Integrate risk and adaptation practices into all levels of government and educational systems. Build a robust economy that diversifies the parish's economic base, supports residents' entrepreneurial spirit, and trains and retains parish workers in emerging industries.

Strategy 1: Increase coastal education for students of all ages

Strategy 2: Expand skills training in coastal careers

Strategy 3: Grow and diversify the economy

Strategy 4: Support Louisiana seafood and fishers

Goal 5: Support Healthy Communities, Regional Culture, and Recreational Access to Nature

Retain the region's culture and values as growth and development occurs. Incorporate diverse recreation opportunities to promote a healthy environment that allows residents to experience the region's natural beauty while maintaining a healthy, active lifestyle.

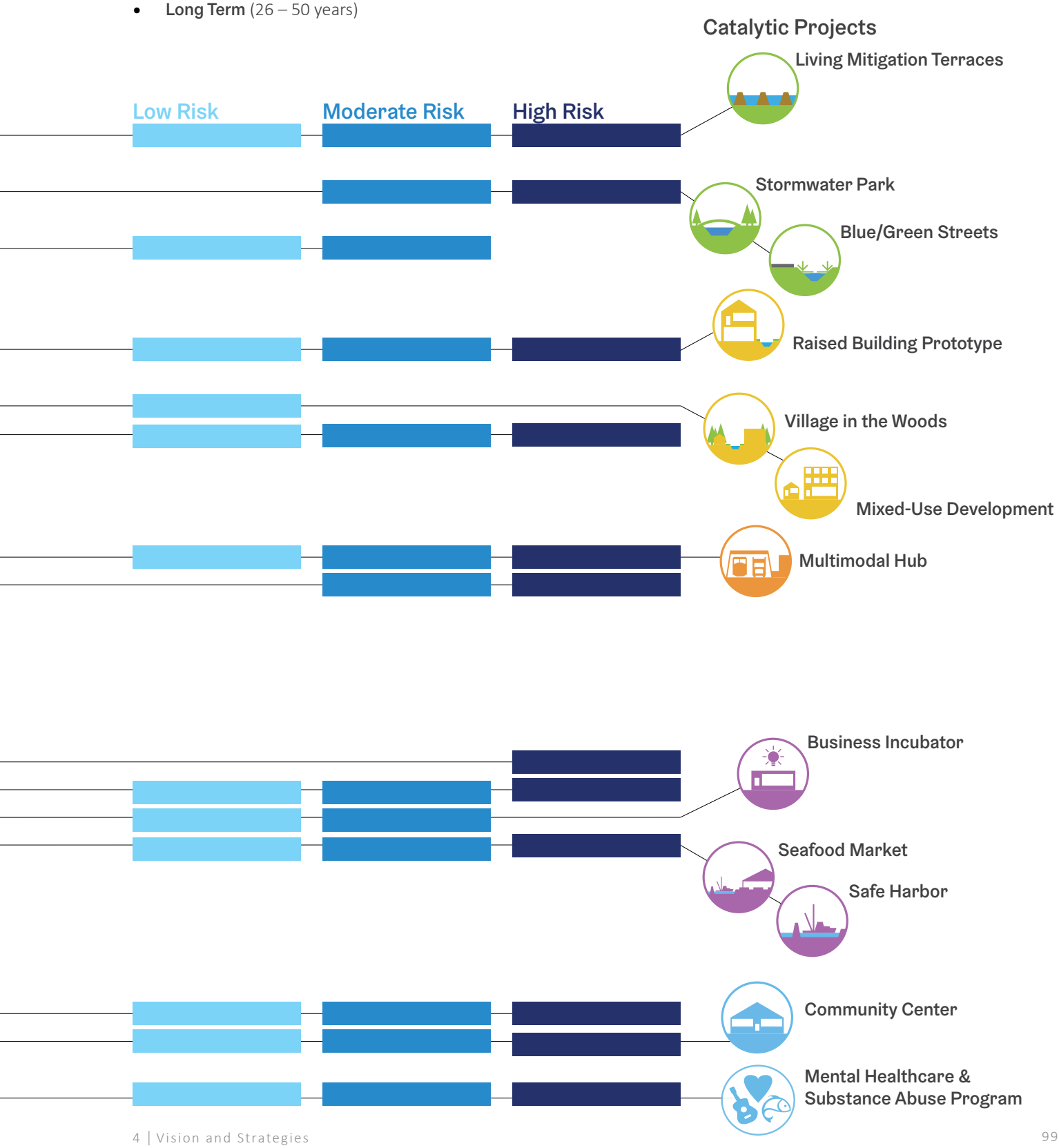
Strategy 1: Increase access to nature for recreational use and ecotourism

Strategy 2: Preserve and support Louisiana's culture and heritage

Strategy 3: Encourage development that is informed by an understanding of the relationship between public health and the built environment

These strategies and actions are recommended for completion over the next 50 years.

- **Near Term** (1 – 10 years)
- **Medium Term** (11 – 25 years)
- **Long Term** (26 – 50 years)



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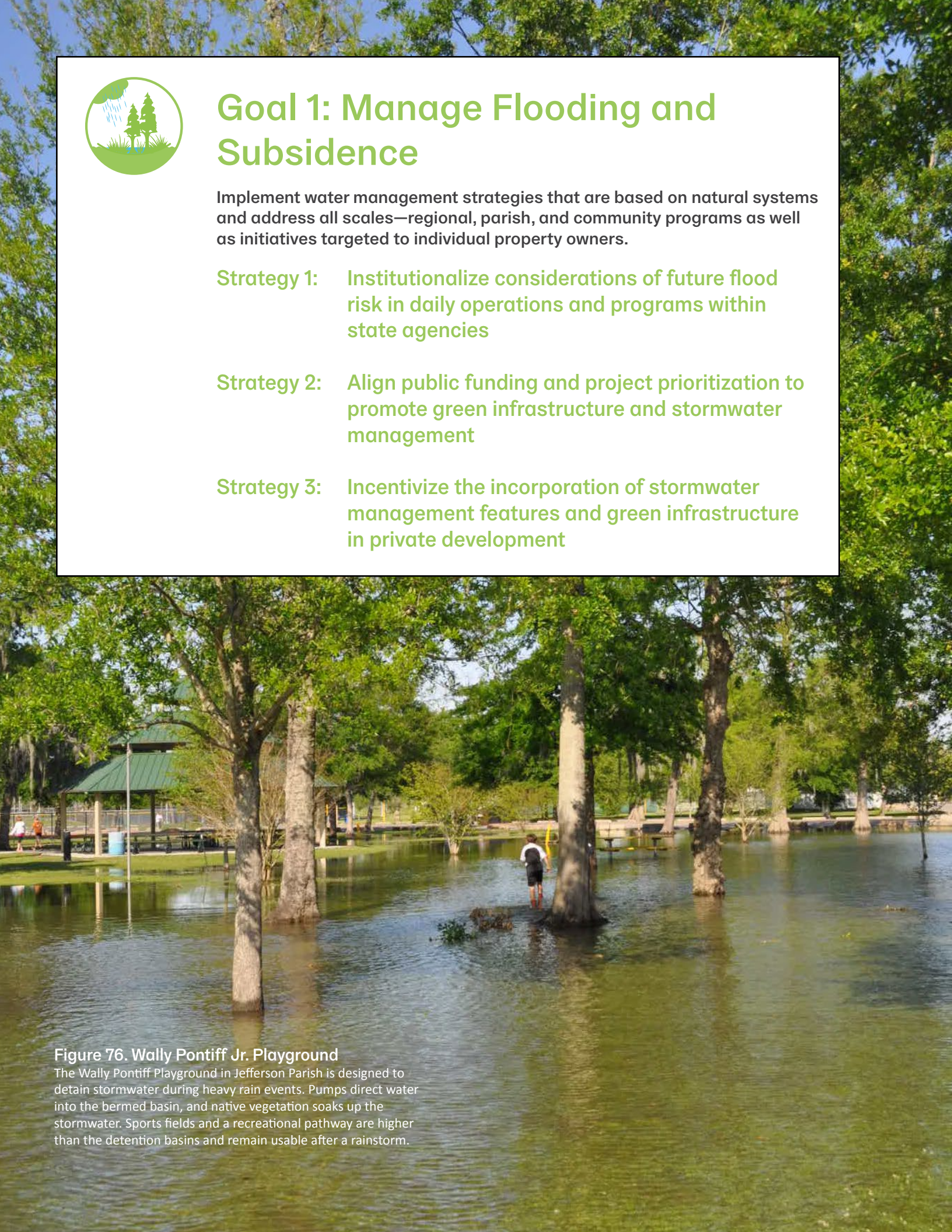


Figure 76. Wally Pontiff Jr. Playground
The Wally Pontiff Playground in Jefferson Parish is designed to detain stormwater during heavy rain events. Pumps direct water into the bermed basin, and native vegetation soaks up the stormwater. Sports fields and a recreational pathway are higher than the detention basins and remain usable after a rainstorm.

Stormwater Management

As stormwater is a concern for residents throughout Louisiana, LA SAFE recommends strategies that increase the amount of water retained in the ground to slow shallow subsidence and reduce flooding. It also recommends that regional authorities be oriented around watersheds rather than parish boundaries. To do so, LA SAFE recommends that parishes increase stormwater retention areas, increase green space and vegetation, create on-site stormwater management requirements for new developments, and incentivize retrofits to reduce existing impermeable surfaces. Parishes should also coordinate their long-term water management plans and activities so that all pumping and drainage systems are optimized for the region as a whole. Finally, LA SAFE recommends that stormwater management considerations be integrated into building development, transportation design, and recreational planning. Ensuring that these types of projects manage stormwater effectively will relieve pumping systems and reduce flood risk, deliver aesthetic enhancements that improve quality of life, help revitalize corridors, and attract new residents and businesses.

Figure 77. Current Condition—Drain and Pump
Modern technologies have allowed development in low-lying wetlands. Water is pumped out, lowering the groundwater level and the protection that natural wetlands afford.

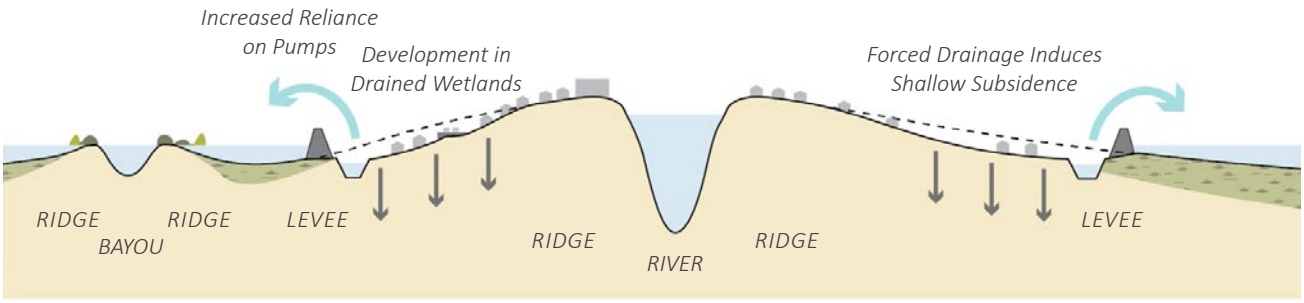
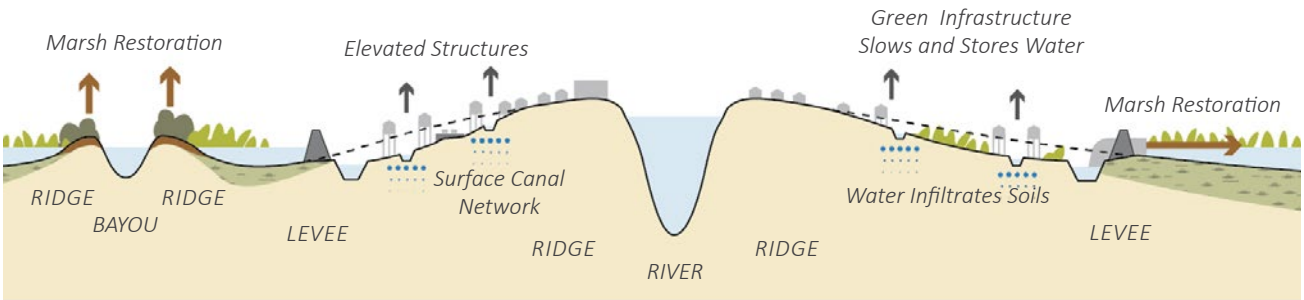


Figure 78. 50-Year Vision—Slow, Store, Drain if Necessary
The natural hydrology is emulated with green infrastructure. The raised water table mitigates subsidence and elevated structures reduce risk.



Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Implementation in Low-Risk Areas

In many low-risk areas with urban or suburban land use patterns, flooding problems are caused in part by an overabundance of impervious surfaces such as concrete and asphalt. With too little water-absorbing green space and vegetation, impervious surfaces direct excess water into forced drainage systems that can back up or fail, causing street flooding. As more residents move into low-risk areas and further reduce green space, flooding problems in these areas may increase. Parishes and municipalities can **incorporate green streets and bioswales** in public right of ways, **enhance parks and green spaces** with stormwater retention features, and **require or incentivize on-site stormwater management** for new developments. Such incentives could come in the form of tax incentives, regulations, or public-private partnerships based on Pay for Success models, in which a government agency commits funds to pay for a specific outcome that is achieved within a given timeframe.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Implementation in Moderate-Risk Areas

Suburban moderate-risk areas can benefit from **increased permeable surfaces** to slow subsidence and reduce flooding. In more rural areas that have plenty of green space but a high water table, **larger retention basins** can drain stormwater from nearby homes and businesses. These stormwater areas can also serve as **large recreational parks and nature preserves** with boardwalks and trails. In these areas, **maintenance of bioswales, ditches, and culverts** should be prioritized to ensure water is moving as it should. **Planting cypress trees and other water-absorbing vegetation** can reduce flooding and storm surge.

High Risk
>6' projected storm surge flood depths

Implementation in High-Risk Areas

In higher-risk, more rural environments, especially those outside of structural protection systems, parishes can plan **large-scale water retention areas**. These areas could double as **nature preserves and ecotourism destinations**. Bike paths, walking trails, and educational features can enhance these water retention areas to make them assets that enhance quality of life for nearby communities. **Increasing retention areas and returning abandoned and unproductive development areas to a natural condition** can help protect lower-risk areas from storm surge and drain stormwater more quickly.

Strategy 1: Institutionalize considerations of future flood risk in daily operations and programs within state agencies

As Louisiana's coastline and flood risk are changing, state agencies should plan for and anticipate the impact these changes will have on their programs, services, assets, and facilities.

Action A: Develop a means for statewide oversight and coordination of regional adaptation initiatives. Connect with neighboring states and complementary programs.

Statewide **oversight and coordination of regional adaptation initiatives** should include all aspects of disaster preparedness and recovery across state agencies, specifically flood risk mitigation and adaptation activities between disaster events.
Example: http://opr.ca.gov/planning/icarp/
Time Frame: Near Term

Action B: Require state agencies to assess flood risks to their physical assets based on the most recent Coastal Master Plan's 50-year projections and to prioritize allocation of resources with this in mind. Continue to monitor as projections evolve and the Coastal Master Plan is updated.

The state should conduct an **inventory** of state-owned and dependent (and planned) physical assets and a **vulnerability assessment** of flood risks to these assets based on the Coastal Master Plan's 50-year projections.

Updates to the Coastal Master Plan, or to CPRA's programs and policies, should **include risk reduction plans for these assets**. When resources are allocated, state agencies need to evaluate whether these investments are consistent with the Coastal Master Plan.

The expected lifetime of state agency's physical assets and their programs should consider current and future land loss, flood risk, and population changes. Through that lens, **prioritize resource allocation** to provide adequate public service that meets the needs of Louisiana residents.
Example: http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/CT_D4_Technical_Report_VerAI.pdf
Time Frame: Medium Term

Action C: Require state agencies to include current and future land loss and population movement in their program evaluations and updates.

As part of their regular evaluation cycles, state agencies should **analyze the impact of land loss and population movement** to their public services.
References: https://oig.denali.gov/
Time Frame: Medium Term

Strategy 2: Align public funding and project prioritization to promote green infrastructure and stormwater management

Using vegetation to filter and absorb water and to increase cooling in areas with heat island effects, green infrastructure—combined with its recreational potential—is becoming essential to stormwater and runoff water quality management. Although green infrastructure is not yet a required part of Louisiana's public projects, with increased flood risk, state agencies should develop and prioritize such multi-benefit projects to provide public service and meet stormwater management needs.

Action A: Develop watershed-based stormwater policies across jurisdictional boundaries.

Building on Executive Order JBE 2018-16, regional planning commissions should **develop watershed-based stormwater policies across jurisdictional lines** and **allow for the formation of stormwater utilities** that can create fee-based services to help pay for flood risk reduction projects.

Example: https://www.cranstonri.com/pdf/UNB%20Draft%20Regional%20Stormwater%20Utility%20Feasibility%20Study%204-3-14.pdf

Time Frame: Medium Term

Action B: Require that all publicly funded capital projects in the state capture and store at least 1.25 inches of rainfall in the first hour of a rain event.

As rainfall is predicted to intensify, developed areas will be at increased risk from flash flooding and back river flooding due to overwhelmed drainage systems. To reduce runoff, **publicly funded projects should capture and store at least 1.25 inches of rainfall in the first hour of a rain event**. To ensure consistency at all jurisdictional levels, local governments should adopt stricter stormwater retention requirements for publicly funded projects.

Example: https://library.municode.com/la/new_orleans/codes/code_of_ordinances?nodeId=PTIICO_CH26BUBUREHOST_ARTIINGE_S26-15SAME

Time Frame: Near Term

Action C: Develop or adopt existing safety guidelines for graywater use.

Develop or adopt safety guidelines for appropriate and safe graywater use, and **encourage the use of captured stormwater** for irrigation and other applicable purposes where non-potable water is sufficient to use. The use of graywater can be promoted through the **implementation of a stormwater utility fee**.

Example: https://legacy.azdeq.gov/environ/water/permits/download/graybro.pdf

Time Frame: Near Term

Action D: Incorporate stormwater management functions in recreation areas.

Design new and retrofitted recreation areas with ample drainage and storage space, and use those recreation areas as a secondary tier of risk reduction against neighborhood flooding. To do so, determine risk through hydrological modeling and assign detention targets accordingly.

Example: https://buffalobayou.org/visit/destination/buffalo-bayou-park/

Time Frame: Near Term

Strategy 3: Incentivize the incorporation of stormwater management features and green infrastructure in private development

To reduce the demand on the drainage system, regions should work together to consistently encourage the use of green infrastructure in all development as a means to handle stormwater runoff and control erosion. To promote green infrastructure practices and/or provide information to those required to incorporate them, the state should offer an information source, updated regularly, that highlights best practices.

Action A: Encourage local governments to develop green infrastructure programs.

To reduce the significant amounts of runoff generated by private properties and more effectively manage stormwater at the local level, **incentivize private property owners to reduce their properties' impervious surfaces and increase stormwater retention capacity**. Grant programs and stormwater utility fee reductions allow local governments to increase private participation in stormwater management and green infrastructure implementation.

Example: https://www.epa.gov/green-infrastructure/policy-guides#Municipal%20Handbook

Time Frame: Medium Term

Action B: Provide incentives for investment in stormwater management best practices on private property.

Align green infrastructure incentives for watersheds across jurisdictions to reduce impervious hard surfaces and require integration of green infrastructure techniques into site design. Provide a model for **establishing a maximum impervious surface** for developments. **Tie incentives to acquisition of grants/ other funding opportunities** and benchmark to monitor the use of green infrastructure over time. **Update ordinances to reduce parking requirements, to require property owners to manage stormwater on site and reduce runoff from their property and to increase erosion controls** during and after site development.

Example: http://www.georgetownclimate.org/adaptation/toolkits/green-infrastructure-toolkit/incentive-based-tools.html

Time Frame: Near Term

Figure 79. Park Space
Trails and park space are designed to accommodate floodwaters in the event the bayou overflows.

Buffalo Bayou Park

Houston's Buffalo Bayou Master Plan was published in response to a 1986 mayoral initiative. It called for a solution that integrated recreation, environmental quality, urban development, and economic benefit. That same year, the nonprofit Buffalo Bayou Partnership was established to oversee and raise funds for the implementation of the plan. The updated Buffalo Bayou and Beyond Master Plan was released in 2002. Among the notable projects, the 1.4 mile-long Buffalo Bayou Promenade connects the central business and arts districts and includes trails, kayaking, sculptures, and special event spaces. The area is designed to accommodate floodwaters when the bayou overflows its banks.

Strategy 3 continued

Action C: Promote the use of shared detention areas to adjacent property owners.

For one acre and larger developments, **increase the applicable stormwater detention volume** to allow adjacent development to channel stormwater runoff into this closed system. Work with developers/adjacent property owners to identify opportunities to **leverage detention areas** to serve larger areas. In addition, **regularly inspect commonly held detention areas** to ensure clear channels into the detention and retention areas.

Example: http://www.cedar-rapids.org/local_government/departments_g_-_v/public_works/regional_detention_basin_project_-_18th_street_sw.php

Time Frame: Medium Term

Action D: Provide outreach, education, and technical assistance for best practices in stormwater management and green infrastructure as well as updates on the current status of local stormwater management systems.

Provide educational events/materials on the benefits of green infrastructure at the state/regional level for a consistent watershed message. Use educational forums to make the public and development community aware of best practices and available incentives.

Example: https://www.ricecreek.org/?SEC=A630EEFF-5862-4993-8D7B-4B95870921B4

Time Frame: Medium Term

"[The borrow pits have retention capacity]...everything here is flat, so everything is forced drainage. [W]e can develop a protocol where you pump [the water] down...I think it would be a multi-use [area] where it could be a recreational park with wet and dry ponds. You can grade it because you have thousands of acres of land here... You can incorporate it into the fabric where people can enjoy it. Charge admission so you can maintain it, or [levy] recreational taxes."

—Plaquemines Parish Official

Case Study: Germantown Education Pond

Located in the suburbs of Memphis, the Rotary Club of Germantown and the Germantown Parks and Recreation Department found a strategic location for a youth education pond to teach kids how to fish. Located at the Germantown Greenway's trailhead with a nearby parking lot, the former four-acre borrow pit had been used as a fishing pond for several years, but the banks were too steep to be safe for children. The education pond project included a platform so that children could walk out to cast lines. The borrow pit itself is part of Germantown's drainage system. Located in a floodplain, the pond receives surface flow from the surrounding neighborhood. When water levels are too high, an outlet flows into the nearby Wolf River.

Case Study: Southeast Florida Regional Climate Change Compact

The Southeast Florida Regional Climate Change Compact is a collaborative effort among counties in southeast Florida to foster resilience at a regional scale. The compact is guided by a regional plan containing recommendations, guidelines for implementation, and best practices for local entities to take actions that reduce vulnerabilities, prioritize efforts, and integrate policy initiatives in a coordinated manner. The regional plan includes policies, actions, and recommendations to generate public engagement and to encourage sustainable practices regarding greenhouse gas emissions, public health, transportation, water management, and other issues.

Water management intends to "[a]dvance... strategies and infrastructure improvements..., in parallel with existing water conservation efforts, to mitigate the potential adverse impacts of climate change and sea level rise on water supplies, water and wastewater infrastructure, and water management systems, inclusive of regional canal networks, pumps, control structures, and operations."

For example, the City of Riviera Beach, FL developed a Stormwater Master Plan that included stakeholder input from the larger region, neighboring counties, and neighboring municipalities. The study considered the contributing areas that drain into existing water management systems including areas that are outside the city's corporate boundary, such as a portion of the Town of Mangonia Park.

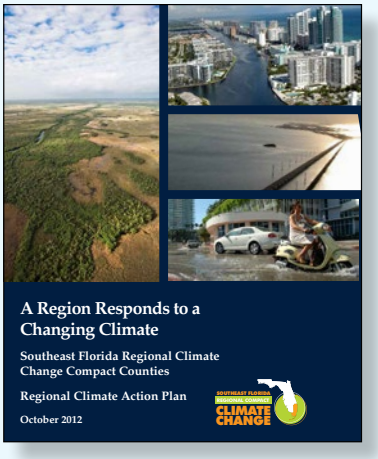


Figure 80. Regional Climate Action Plan
"The Regional Climate Action Plan that integrates climate adaptation and mitigation measures for the region. The plan identifies vulnerabilities, prioritized actions and integrated policy initiatives to create a clear—though challenging—path forward for their region."
Source: Southeast Florida Fact Sheet, Institute for Sustainable Communities
Image Credit: Southeast Florida Regional Climate Change Compact

Figure 81. Mississippi River
The Mississippi River Cities and Towns Initiative brings together mayors from the Mississippi River's towns and cities to protect and support the cultures, economies, and ecosystems of the river corridor.

Mississippi River Coalition and Investment Fund

Established in 2012, the Mississippi River Cities and Towns Initiative (MRCTI) "promotes economic and environmental security and stability along the Mississippi River Corridor."[10] The coalition comprises mayors from cities and towns along the Mississippi River. MRCTI promotes the protection and restoration of the Mississippi River corridor's natural systems to support culture, economies, and ecosystems.

To learn more: https://www.mrcti.org/

In September 2018, Mayor Lionel Johnson Jr. of St. Gabriel, LA announced the formation of the **Mississippi River Investment Fund** at the Global Climate Action Summit. A **$4 billion investment** aims to plan for and **implement climate adaption work** along the Mississippi River in Louisiana.

Goal 2: Plan for Safe and Affordable Development

Retrofit existing and create new safe, inclusive, and sustainable communities.

Strategy 1: Encourage elevation of homes based on current and future flood risk

Strategy 2: Plan future development based on risk typologies with mixed-use residential growth in low-risk areas

Strategy 3: Identify ways to address insurance affordability

Figure 82. Main Street
Thibodaux Main Street, Inc. is working to create an example of centralized services and amenities in downtown Thibodaux, concentrating cultural, social, professional, and retail in a walkable area.
Photo Credit: Thibodaux Main Street, Inc.

Housing and Development

Residents across the coast identified safe, affordable housing as a top concern. As flood insurance costs rise, safety and affordability may compete. With increased flooding, most existing development in moderate- and high-risk areas will be increasingly unaffordable and/or unsafe. In turn, demand for housing in low-risk areas will likely rise. Rising insurance costs in high-risk areas will push residents out or leave more uninsured. To address these issues, and to increase safe and affordable housing options, new development should be concentrated in low-risk areas and existing low- and moderate-risk areas should be retrofitted to manage flood concerns.

LA SAFE recommends that all future developments be elevated above Base Flood Elevation (BFE) and be designed to be resilient against increasingly powerful storms. The BFE is the calculated anticipated flood level for a given area. Locating the lowest floor of the building above the BFE minimizes risk of property loss, reduces costs associated with displacement, and results in lower flood insurance premiums. Insurance savings increase with additional freeboard, which is an increased height above BFE to provide more flood safety.

As flood risk increases, many buildings will need to be elevated. LA SAFE encourages pier-and-beam new construction techniques as the cost of elevating pier-and-beam buildings is far less than their slab-on-grade counterparts. When floods do occur, pier-and-beam buildings can accommodate stormwater beneath them, allowing water to absorb into the ground, reducing flood levels. This provides risk reduction benefits to neighbors as well as individual building owners.

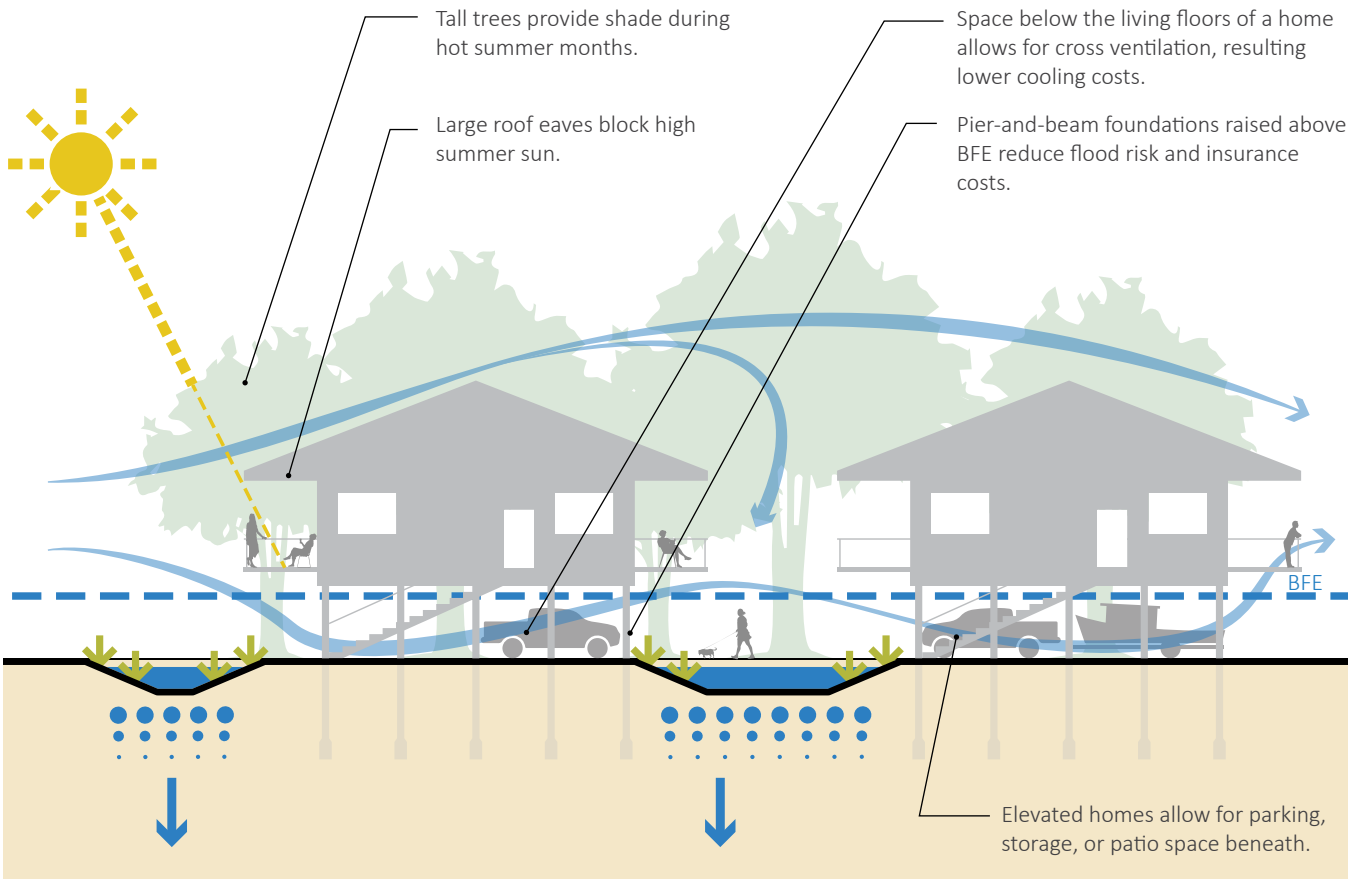


Figure 83. Proposed Vision—Housing and Development

Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Implementation in Low-Risk Areas

LA SAFE recommends **increasing density in low-risk areas** by investing in and incentivizing multifamily housing and mixed-use development that incorporates commercial and recreational options alongside housing. These types of "live, work, play" environments provide multiple benefits that support LA SAFE's goals and residents' vision for high-ground areas. Mixed-use developments typically have a greater variety of housing unit sizes and price points and help reduce travel distances—and traffic—among homes, jobs, retail, and services. Paired with sidewalks and bike lanes, these areas can be pedestrian and bicycle-friendly. Public spaces and town squares in such areas are ideal for community events like farmers' markets and outdoor concert series as well as for small businesses. Mixed-use neighborhoods are denser than conventional suburbs, and they should be **paired with ample water-retaining green space** to manage stormwater and double as a recreational amenity in walking distance to homes and businesses. They should also be well-integrated into a regional transportation plan. If planned well, higher-density, mixed-use development can facilitate long-term sustainable growth with a high quality of life that is both safe and affordable.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Implementation in Moderate-Risk Areas

In moderate-risk areas, LA SAFE recommends strategies that will **protect and retrofit existing assets to maintain current levels of population and economic activity**. Homes and businesses can be elevated above future flood levels. Parishes can plan to consolidate and cluster essential public and commercial resources in relatively safe and accessible areas. These clusters can serve as community hubs that provide key services in nearby areas, including healthy food, medical care, and support services for industries based in high-risk areas. These nodes of development should be planned in concert with transportation planning.

High Risk
>6' projected storm surge flood depths

Implementation in High-Risk Areas

LA SAFE recommends **high-risk areas transition away from permanent residential development and toward other development more compatible with a high degree of flood risk**. LA SAFE endorses programs such as voluntary acquisitions to help homeowners who want to move to a safer locations. Although high-risk areas are not well-suited for future residential uses, LA SAFE recommends these areas rightsize to continue to support industrial use, the coastal economy, and ecotourism. As rising insurance rates make it less affordable to live in these environments, homeowners may be able to capitalize on elevated homes by making them available for short-term rentals, attracting visitors to these areas. LA SAFE recommends land use policies that encourage the transition to an ecotourism-, recreation-, and destination-based economy. Oil and gas, maritime transportation, water management, alternative energy, and fish and seafood industries will all have assets in high-risk areas that, along with the infrastructure needed to support them, should be designed in accordance with greater future flood risk.

Strategy 1: Encourage elevation of homes based on current and future flood risk

Home elevation occurs through open or fill foundations. Open foundations, when left unenclosed or with appropriately designed breakaway walls, allow flood waters to flow beneath the structure and encourage onsite percolation. These types of foundations better protect property and contribute toward reduced flood levels. Comparatively, fill displaces water to lower site areas, likely increases runoff impacts and does little to capture water on site. To be most effective, elevations and open foundations should be designed in accordance projected flood levels and flooding types: storm surge, riverine, or surface flooding.

Action A: Require all new development or substantial rehabilitations of existing properties be built to two feet above the base flood elevation for a 100-year flood or to the 500-year floodplain.

Amend local floodplain regulations and building code requirements to require that new development or substantial rehabilitations of existing properties be **built to a minimum of two feet above the base flood elevation for a 100-year flood or to the 500-year floodplain**, whichever is higher. There may be areas where even greater freeboard is desired due to the type of flooding and anticipated future conditions. Avoid allowing exemptions in rebuilding efforts as these negatively impact flood ratings and reinforce patterns that reintroduce risk of loss.

Example: http://www.eng.hctx.net/Consultants/Floodplain-Management/Floodplain-Information

Time Frame: Medium Term

Action B: Develop equitable financial incentives and education to assist with home elevations and ensure elevation support for all residents.

Provide financial incentives and assistance to cover elevation expenses for equitable flood protection solutions. Costs associated with retrofits for improved flood protection may discourage some homeowners from protecting from flood losses, placing those least likely to afford recovery in a more vulnerable position.

Example: https://www.fema.gov/flood-mitigation-assistance-grant-program

Time Frame: Medium Term

Action C: Include weatherization programs and wind fortification, extreme heat, and seismic upgrades with home elevations to address multiple risk factors.

Coordinate across multiple risk factors to provide a holistic approach that serves to further minimize loss of life and property. Addressing flooding without considering potential damage due to wind, heat, seismic, and other risks still leaves a property susceptible to losses during a hurricane or other disasters.

Example: http://resilience.abag.ca.gov/wp-content/documents/housing/Final%20Report/StrongerHousingSaferCommunities_TechnicalReport.pdf

Time Frame: Medium Term

Action D: Develop an education and marketing program to encourage pier-and-beam construction.

Outline the benefits of pier-and-beam construction to dispel myths about its quality while educating homeowners, builders, and local governments about safe design and development to protect against flood losses.

Example: https://www.fema.gov/media-library-data/20130726-1707-25045-4311/chapter6.pdf

Time Frame: Medium Term

Case Study: Shifting St. John the Baptist Parish's Population Center to Higher Ground

Located approximately 30 minutes west of New Orleans, St. John the Baptist Parish has undeveloped high ground along the Mississippi River's east and west banks, an area that is an obvious location to project future economic and population growth. Additionally, the parish is poised to become an ideal "receiver" community for populations migrating away from coastal areas. Still, despite its advantages, the parish has its own threats and vulnerabilities—notably exacerbated during Hurricane Isaac—that are barriers to the parish realizing its full development potential. Specifically, growth has sprawled outside of high-ground areas, which are at greater flood risk, and the parish is at risk from floodwaters from Lake Pontchartrain. Efforts to respond to these issues, described below, are replicable in other parishes across the state.

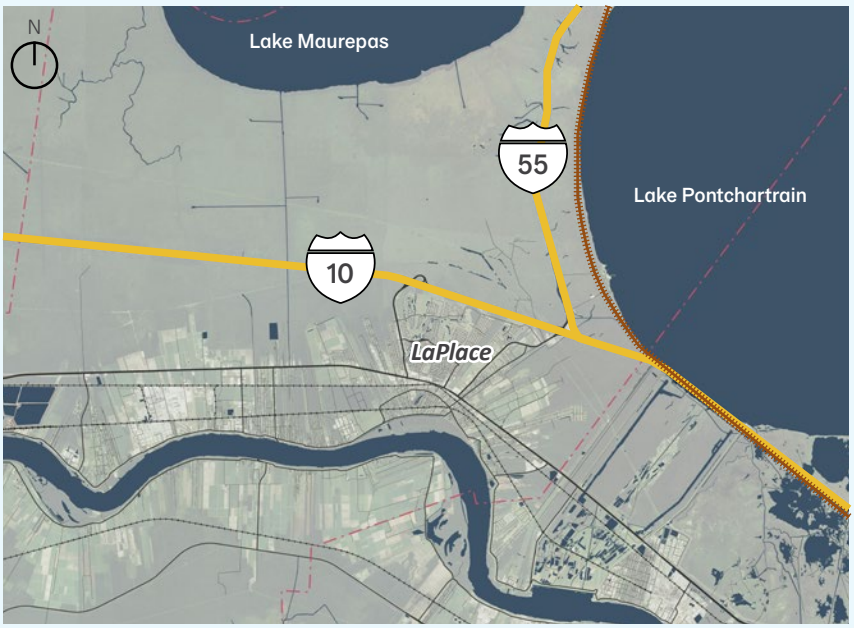


Figure 84. Set the Edge

Interstates 10 and 55 converge in St. John the Baptist Parish in LaPlace. During Hurricane Isaac, water from Lake Pontchartrain encroached from the east and flooded that area. This condition was exacerbated by ongoing coastal erosion affecting the lake's western edge. LaPlace itself, a major rail line along Lake Pontchartrain, and I-10 to I-55 are more vulnerable as the shoreline erodes This shoreline must be reinforced as part of any comprehensive growth strategy.

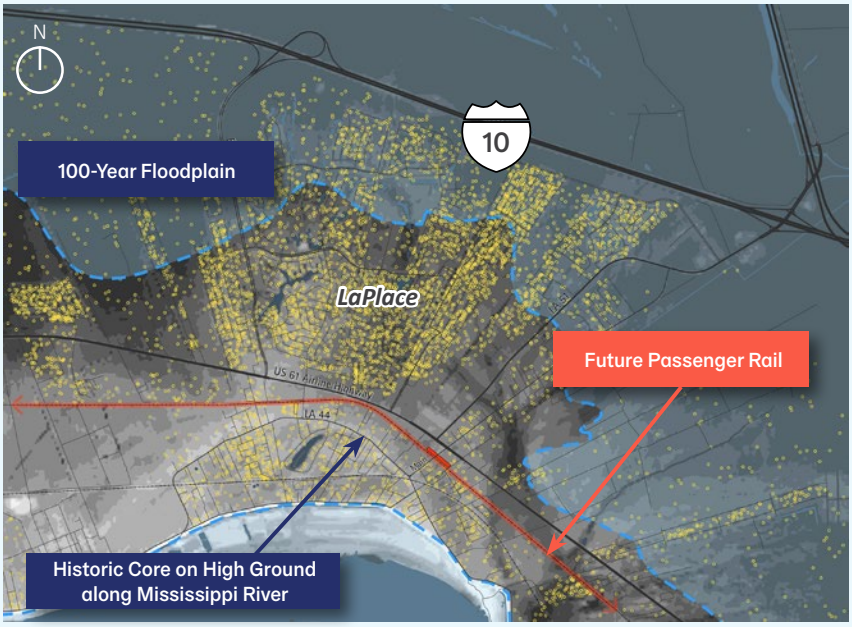


Figure 85. Move the Centroid

Long term, St. John the Baptist Parish must maximize its high-ground land along the Mississippi River on the east and west banks. Currently, a critical mass of the parish's population is located in LaPlace, the eastern-most community on the river's east bank. Over time, LaPlace has sprawled from the high-ground riverbank northward to I-10 and into the floodplain. The majority of instances of residential flooding during Hurricane Isaac occurred within the floodplain. Therefore, it is logical to create growth corridors in LaPlace that hug the river's edge, drawing the community's population center back toward the river and high ground. In the coming decades, such a growth strategy would extend along the river's east and west banks, orienting development outside of the floodplain.

Strategy 2: Plan future development based on risk typologies with mixed-use residential growth in low-risk areas

Managing growth and change within the region will require approaches that are tailored based upon level of risk. Population centers are increasingly locating on higher ground, and these areas must be prepared to accommodate growth in an orderly manner. Areas of higher risk must be managed in a way to reduce future losses and restore environmental defenses against flooding.

Action A: Create small area plans to accommodate future development in low-risk areas.

Develop small area plans to ensure that low-risk areas are prepared to meet growth challenges as shifting populations move to higher ground. This process evaluates development potential, defines an array of potential land uses based upon citizen input and visioning, and identifies necessary infrastructure investments to support and encourage desired growth. From a regional perspective, coordinated small area plans also address regional transportation, housing, and economic needs and align capital investment and infrastructure development.

Example: https://www.denvergov.org/content/denvergov/en/community-planning-and-development/planning-and-design/how-we-plan/small-area-plans.html

Time Frame: Medium Term

Small Area Plans

"A small area plan is any plan that addresses the issues of a portion of the city. Small area plans can cover three different geographic scales—neighborhood, corridor, and district regardless of the size of the area. Small area plans cover a specific geography that often has a cohesive set of characteristics."[11]

The City and County's of Denver's Department of Community Planning and Development launched the **Neighborhood Planning Initiative**, a long-term project to ensure a small area plans are developed for all of Denver's neighborhoods. The Neighborhood Planning Initiative Strategic Plan, providing an overview of the initiative's strategy and approach, process, and planning areas. The portal also offers access to a library of both completed and in-progress small area plans, searchable by geographic area.

Action B: Develop zoning incentives to attract mixed-used development in low-risk areas.

Develop incentives to encourage a desired product or development pattern that may not be delivered by the market otherwise. Zoning incentives, such as parking reductions and density bonuses, may encourage high-density, mixed-use development in low-risk areas. Evaluation of the barriers to achieving desired mixed-use development is a necessary step in outlining effective incentives. These generally need to be combined with appropriate standards to ensure that the desired overall development pattern and character will be achieved.

Example: https://www.portlandoregon.gov/bps/article/588148

Time Frame: Medium Term

Figure 86. Home and Landscape Resource Center
LaHouse is a demonstration home and site for resilient building techniques and landscaping ideas.
Photo Credit: LSU AgCenter

Figure 87. Expert Advice
Open to the public on weekdays and one Saturday each season, the home offers educational exhibits with experts on hand to answer questions.
Photo Credit: LSU AgCenter

Case Study: LaHouse Home and Landscape Resource Center

LaHouse is "a research-based showcase of solutions to shape your future with homes that offer more comfort, durability, value, convenience, environmental quality, safety and better health with less energy, water, pollution, waste, damage and loss."[12] The resource center is located in Baton Rouge on the Louisiana State University campus. An extension of the LSU AgCenter, the house and site are designed as a showcase of resilient design, construction, and landscaping techniques. Exhibits, cutaway reveals, educational features, and signage provide a comprehensive demonstration of a safe, sustainable, and healthy home in Louisiana's hot, humid, and wet climate. Designing a home in Louisiana's coastal area also means designing for hurricanes and fluvial and pluvial flooding. The home demonstrates hazard resistance design measures for hurricane resistance up to 130 mph winds.

The resource center is open on weekdays and one Saturday each season. The Saturday open houses focus on seasonal topics, such as cold weather comfort; keeping the home warm, dry, and free of insects; resilient solutions to flooding and wind resistance; and healthy indoor air quality and universal design.

To learn more: http://www.lsuagcenter.com/topics/family_home/home/lahouse

Strategy 2 Continued

Action C: Create an optional buyout program for full-time residents in high-risk areas.

For full-time residents in high-risk areas outside of structural protection, **develop a funding structure and an optional buyout program** that provides an adequate amount of money to buy a home of similar size and in good condition in a low-risk area. This program should be paired with restrictions on future development in eligible high-risk geography.

Example: https://www.hcfcd.org/hurricane-harvey/home-buyout-program/latest-updates-about-home-buyouts/

Time Frame: Medium Term

Action D: Ensure demolition at the end of life of commercial developments, in high-risk areas, upon long-term vacancy.

Require bonding of new commercial developments in high-risk areas to ensure demolition at the end of their useful life or upon long-term vacancy.

Example: http://news.msu.edu/media/documents/2013/06/d3872863-e60d-429b-9350-ffecc0f3bc63.pdf

Time Frame: Medium Term

Strategy 3: Identify ways to address insurance affordability

Rising flood insurance rates contribute to increased housing costs. As a strategy to provide affordable housing while guiding residential development to low-risk areas, actions that contribute to lower risks and premiums also result in the development of a safer, more resilient housing stock.

Action A: Analyze the feasibility for Louisiana to leave the NFIP and develop its own flood insurance program.

Conduct a feasibility analysis for Louisiana to leave the NFIP and develop its own flood insurance program that requires mandatory insurance for homeowners throughout the state, creating a separate risk pool.

Example: https://www.insurancejournal.com/blogs/right-street/2018/03/18/483689.htm

Time Frame: Medium Term

Action B: Provide support and incentives to communities in the floodplain for participation in FEMA's Community Rating System (CRS).

To help communities participate in CRS, **provide local capacity building and technical assistance, prioritize funding for local mitigation and projects that improve a community's CRS rating, and provide education and outreach on the potential economic benefits of higher CRS ratings** for home and business owners.

Example: https://www.edf.org/sites/default/files/documents/Cunniff_Shore%20and%20Beach_Spring%202018.pdf

Time Frame: Medium Term

Parish Policies for Additional CRS Credit

The "CRS credit" references provide additional FEMA information and resources for each initiative.

Regulatory floodplain data

(May require additional language in a community's floodplain management regulations, building code, or other ordinance.)

- **Flood of record:** The highest flood of record is used to determine the extent of the regulatory floodplain. The regulatory flood elevation is where there is no BFE shown on the Flood Insurance Rate Map (FIRM) or where the flood of record is higher than the BFE. (CRS credit: Activity 410 (Floodplain Mapping), NS New Study)
- **Best available data:** Where there is no BFE shown on the FIRM, the BFEs in another acceptable study are adopted for regulatory purposes. (410, NS New Study)
- **No available flood data:** Where there is no BFE shown on the FIRM and there is no available flood study, the BFE must be calculated by either the permit applicant or the community before a permit is issued for a new building or substantial improvement. (410, NS New Study)

Building protection

(May require additional language in a community's floodplain management regulations, building code or other ordinance.)

- **Building Code Effectiveness Grading Schedule (BCEGS):** The community invites the Property Insurance Association of Louisiana to conduct a Building Code Effectiveness Grading Schedule (BCEGS) evaluation to identify where its building code program should be improved. The community sets a goal to improve one class within two years. (430, BC Building Code)
- **Subdivision set-asides:** New subdivisions and other large developments that are both in and outside the floodplain are required to have all parcels with buildable sites on the higher ground outside the floodplain. (420, OSI Open Space Incentives)
- **Non-conversion agreements:** An applicant for a permit for a building elevated on walls must sign an agreement that the area below the flood protection elevation will not be improved or converted to a use contrary to the building's originally approved design. The agreement authorizes the Floodplain Administrator to periodically inspect the area. The parish is currently working to implement this. (430, ENL Enclosure Limits)
- **Substantial improvement tracking:** Improvements and repairs to existing buildings are tracked for five years or more. If during that time, the total improvements exceed 50% of the value of the building, the building must be brought up to the flood protection standards for a new building. (430, CSI Cumulative Substantial Improvements)
- **Critical facilities:** To the extent possible, new critical facilities are located outside the limits of the base floodplain. If they are in the base floodplain, they will be protected from damage and loss of access to the 500-year flood level or the base flood elevation plus three feet, whichever is higher. (430, PCF Protection of Critical Facilities)

Other floodplain development standards

(May require additional language in a community's floodplain management regulations, building code, or other ordinance.)

- **Filling restrictions:** In order to maintain the floodplain's capacity to store flood waters in riverine areas, any filling added to the floodplain must have an equal amount of fill material removed from it and deposited in an area that will not adversely affect that or any other floodplain. (430, DL1 Development Limitations)
- **No adverse impact:** In riverine areas where the FIRM does not have a floodway mapped, if a development will cause any increase in flood heights, the developer must document that the increase is acceptable to the affected property owners. This may require the developer to purchase a flowage easement or otherwise pay the affected owners for the adverse impact created by the development. (430, OHS Other Higher Standards)
- **Hazardous materials:** Hazardous materials are prohibited from the regulatory floodplain. This does not apply to small quantities of these materials kept for normal household use or to the continued operations of existing facilities. (430, DL3 Development Limitations)

Stormwater management

(May require additional language in a community's floodplain management regulations, building code or other ordinance.)

- **Manage the 100-year storm:** Retention/detention basins in new developments must be designed and sized to ensure that stormwater runoff leaving the property is no greater than it was under pre-development conditions. (450, DS Design Storm)
- **Low-impact development:** The measures used to manage stormwater runoff and drainage are required to use or mimic natural processes that result in the infiltration, evapotranspiration, or other measures to protect water quality and associated aquatic habitat and to minimize adverse impacts downstream. (450, LID Low Impact Development)

Loss reduction measures

(May require additional language in a community's floodplain management regulations, building code, or other ordinance.)

- **Property protection measures:** Buildings are elevated, flood proofed, or otherwise retrofitted to protect against flood damage. The protection standard is the same as for new construction, preferably with several feet of freeboard above the BFE. (Activity 530 (Flood Protection))
- **Acquisition:** Where retrofitting measures are not effective or feasible due to an extreme flood hazard or the buildings' conditions, the buildings are purchased and the sites are cleared. The properties are kept as open space or other use compatible with the hazard. (Activity 520 (Acquisition and Relocation))
- **Drainage maintenance:** Local streams, canals, ditches, and retention/detention basins are periodically inspected for obstructions to flow or loss of storage. When problems are found, they are quickly remediated so the channels and basins can continue to operate to their full capacities. (Activity 540 (Drainage System Maintenance))
- **Repetitive loss plans:** Each of the community's repetitive loss areas is examined, and a list of site-specific loss reduction measures are developed. The parish is currently working on an analysis of five repetitive loss areas. (510, RLAA Repetitive Loss Area Analysis)

—**UNO-CHART**, 2018

Goal 3: Improve Mobility throughout the Region

Support a resilient transportation system that includes multiple modes of transportation and promotes the creation of walkable communities.

Strategy 1: Promote well-connected, multimodal transportation options within parishes and across the region—including water transportation—to better connect existing communities to emerging and growing sectors, industries, and job opportunities

Strategy 2: Protect and support key supply chain and evacuation routes

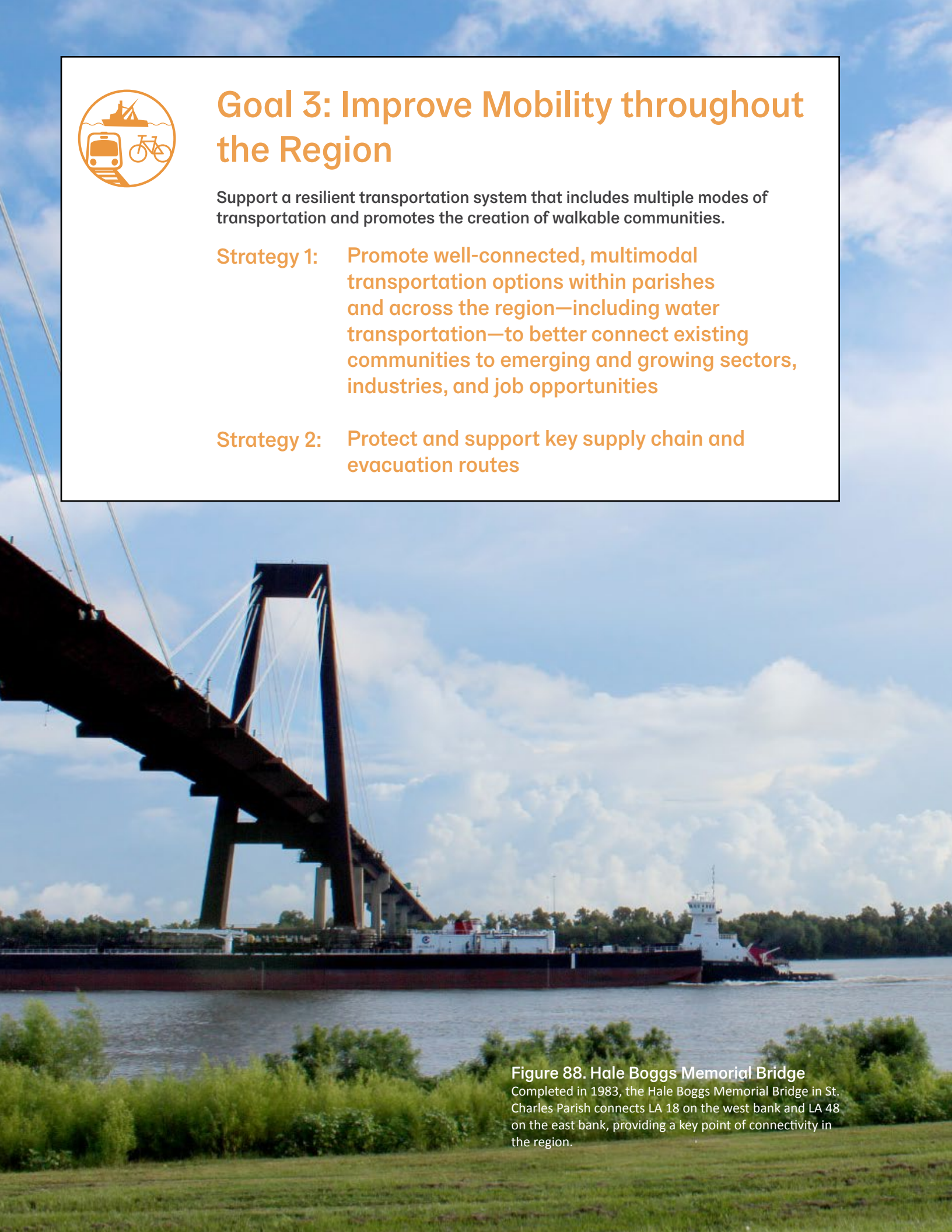


Figure 88. Hale Boggs Memorial Bridge
Completed in 1983, the Hale Boggs Memorial Bridge in St. Charles Parish connects LA 18 on the west bank and LA 48 on the east bank, providing a key point of connectivity in the region.

Transportation

Transportation connects workers to their jobs, residents to retail and services, coastal goods to communities, and people to the cultural and recreational resources that southeast Louisiana offers. LA SAFE promotes enhancing and reinforcing transportation networks that service the supply chain of coastal industries and that serve as evacuation routes during disasters. It also recommends improving access to targeted developments in low-risk areas. Residents across the coast identified the need for local and regional transportation improvements centered on an integrated, multimodal transit system. DOTD should be involved in monitoring all routes for the impacts of subsidence.

In the short term, enhanced bus transportation across parish lines could better connect workers and jobs. Similarly, high-occupancy vehicle (HOV) lanes and park-and-ride bus services could help reduce traffic.

As alternate forms of transportation—such as rideshare applications like Uber—gain a stronger foothold in the region, local, parish, and regional planners should prepare for continued innovation in this field and consider the potential implications for development. If rideshare applications continue to grow in popularity and young people continue to delay car ownership, demand for parking spaces may decline, creating opportunities for additional stormwater management features and/or implementation of Complete Streets facilities.

In the long term, high-speed rail transportation through low-risk growth corridors would support the region, reduce traffic, and benefit residents and the economy. Water-based transportation could be a component of multimodal transit in the region. Canals and waterways are assets that can be retrofitted for personal transportation and recreational activity. Although in past years, ferries have been shut down due to low ridership, with increased development in low-risk/high-ground areas along waterways, the value and economic viability of ferries or other water-based transit may increase.

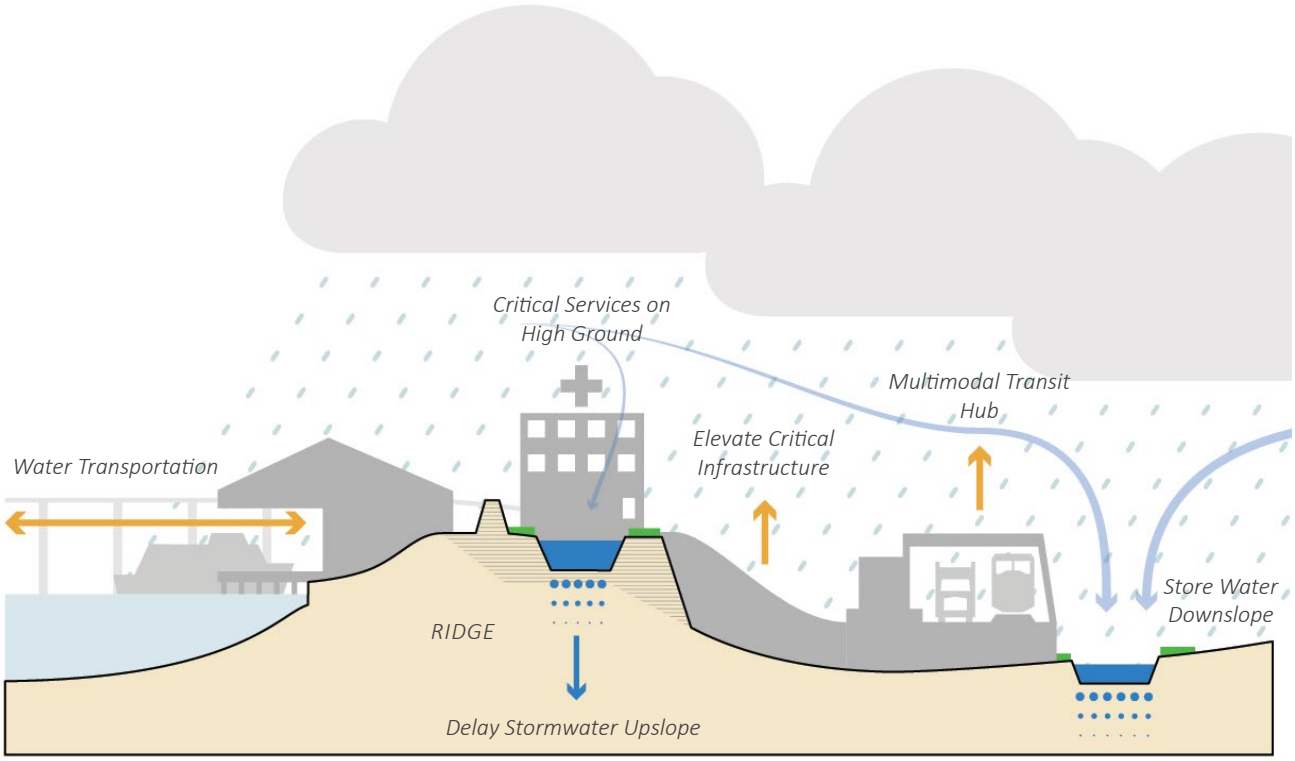


Figure 89. Proposed Vision—Transportation and Infrastructure

Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Implementation in Low-Risk Areas

Complete Streets—streets designed to accommodate walking, biking, and public transit—are a high priority for residents across the region. Complete Streets encourage multiple modes of transit and invigorate commercial corridors with foot traffic that supports retail stores and other small businesses. **Complete Streets planning should focus on network development** and, therefore, should be done in concert with planning for regional bus and rail service, as well as with housing and economic development planning. LA SAFE recommends that **Complete Street projects also integrate stormwater management features such as bioswales and street trees and address ecological health.**

Improving public transportation in low-risk areas can improve mobility and reduce traffic and strain on infrastructure. Parishes should consider **improving bus stops, designating HOV lanes, and integrating more technology into the system**. Bus stops and phone apps can monitor and update expected arrival times. Riders can pay upon entry to covered wait stations, increasing boarding efficiency and quality of service. Buses can communicate with traffic signals to give priority to buses. Interparish bus routes can strengthen the regional economy and help encourage development along low-risk corridors. In the long term, **high-speed rail service through low-risk areas will provide a backbone to transit-oriented development**, integrating with Complete Streets and walkable neighborhoods that are well connected to the regional economy.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Implementation in Moderate-Risk Areas

Moderate-risk areas will need to maintain safe and direct links to coastal industries. The region should **ensure that roads and bridges are adequately elevated and well-lit to ensure safe travel**, especially along evacuation routes. These areas are well-suited to anchor future water transportation needs with protected harbors, boat docks and launches, and infrastructure to accommodate ferry service or water transit where viable. Boat harbors can become transportation nodes in moderate-risk areas, supporting nearby commercial activity, farmers' and seafood markets, and elevated housing. Bus routes that connect from low-risk areas through these nodes of water transportation can strengthen transit connectivity through the region, allowing residents to combine water transit and public transit to get where they need to go.

High Risk
>6' projected storm surge flood depths

Implementation in High-Risk Areas

Transportation and supply chain connectivity to high-risk areas maintain the viability and resilience of Louisiana's working coast. Transportation infrastructure also plays a lifesaving role during evacuations and disaster recovery. Several major infrastructure investments are in planning or construction stages now, including the I-49 corridor and an elevated LA 1 highway to Port Fourchon. LA SAFE endorses these efforts and encourages parishes to **consider how their long-term transportation needs will be affected by further environmental change and advances in transportation technology**. Although residents may move away from these areas to higher ground, workers will still need to be connected to their jobs along the coast, making transportation infrastructure developments like elevated highways and rail especially valuable. The need for water transportation in high-risk areas may increase. Public docks and safe harbors will play an increasing role supporting commercial and recreational purposes. Parishes should also consider **investing in emergency response boats for evacuation and recovery activities**.

Strategy 1: Promote well-connected, multimodal transportation options within parishes and across the region—including water transportation—to better connect existing communities to emerging and growing sectors, industries, and job opportunities

As a consequence of a dispersed development pattern, the nature of the road network in rural areas focuses primarily on accommodating automobile traffic with primary routes limited to a few rural highways. As development patterns shift and new areas experience growth or densify, existing road infrastructure may no longer match demand. Adjustments to road systems to accommodate additional types of transportation and provide more route options are necessary in order to handle increased traffic and diversified modes of transportation to reduce congestion. Doing so will support economic activity through access to jobs and industry, improve equity by accommodating households without access to cars, and increase livability and environmental performance.

Action A: Require the use of Base Flood Elevation (BFE) and CPRA 50-year flood risk projections when planning future transportation routes.

Funding transportation infrastructure is a long-term investment. If future conditions are not fully considered during the planning and design process, access into, out of, and within the region could be jeopardized—not only during weather events but also as a result of anticipated climate change. To create a more resilient transportation system and region as a whole, it is essential to **use BFE and CPRA 50-year flood risk projections as a required benchmark in the planning and design process for future transportation routes as well as in the prioritization of retrofits and upgrades to existing routes** to ensure long-term viability.

Example: http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/FR3_CA_Climate_Change_Adaptation_Guide_2013-02-26_.pdf

Time Frame: Long Term

Action B: Model the impacts of new transportation projects on hydrological processes.

Analysis for a well-planned transportation system in flood areas with such as coastal Louisiana, DOTD must **model the impacts of new transportation projects on hydrological processes and mitigate flood risk in the surrounding areas**. Additionally, DOTD must **evaluate and understand how investment in projects impacts economic activity, development opportunities, and environmental factors such as air quality, water quality, and overall quality of life**.

Example: http://library.rpa.org/pdf/RPA-4RP-Executive-Summary.pdf

Time Frame: Medium Term

Figure 90. Executive Summary
Image Credit: Regional Plan Association

New York-New Jersey-Connecticut Transportation

The **Fourth Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area** identifies transportation as a major challenge and area of opportunity. While vital to the quality of life for people who live and work in this region, a lack of improvements and investments has resulted in congestion and daily travel disruptions. The plan puts forth the goal to **create a dynamic, customer-oriented transportation network** through the following strategies: (1) create a fully integrated, regional transit system, (2) rebuild the subway system, (3) adapt streets and highways for a technology-driven future, and (4) create world-class airports and seaports.

Strategy 1 continued

Action C: Improve connectivity between transportation routes and natural destinations.

Natural amenities throughout coastal Louisiana are not only a defining element behind the region's culture and sense of place but are also economic engines, supporting tourism, industry, and aquaculture. Through the use of Complete Streets, public transit, water transportation, and greenways, **increasing connectivity to parks, open space, and natural areas contributes to the community's appreciation for the area's environmental beauty and its economic vitality** into the future. In complement, caring for the area's natural ecology assures that these amenities continue to act as assets and work as ecological systems.

Example: https://www.riverkeeper.org/campaigns/restore-nyc-waterways/flushing-waterways-vision-plan/

Time Frame: Long Term

Flushing Waterways Vision Plan, 2018

"Together, Riverkeeper and the Guardians of Flushing Bay launched this vision process in 2016 in order to help put to paper the energy and momentum building around the clean water future of northern Queens... With all of the pollution presently discharging into these waterways each year, and all of the uncertainty around access and investments in the waterfront, there is, and always has been, a community of people fighting for this community resource and a place to play, learn, fish, and paddle.

[W]e see waterways teeming with aquatic life, active recreational communities, clean water stewards, and committed educators. We see a waterway with great potential. This Vision Plan is a community-driven catalog of these efforts already underway. It is also a record of the pollution, access, and investment barriers facing the Waterways, and a plan for how to overcome those barriers."[13]

Action D: Prevent future loss of purchasing power to help pay for the backlog of maintenance.

Develop innovative approaches to financing development, maintenance, and operations of infrastructure to address funding challenges. Alternatives such as indexing the state fuel tax to the consumer price index can help revenues to keep pace with maintenance costs. In order to help pay for the backlog of necessary projects, particularly on key evacuation routes, and expand funding options for multimodal transportation, additional funding strategies must be considered. Diversified funding streams can assist in offsetting any reductions in fuel tax revenue due to increases in vehicle fuel efficiency, use of alternative energy sources, or reductions in travel behavior.

Example: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB733

Time Frame: Long Term

Strategy 1 continued

Action E: Prioritize multimodal transportation and access to community assets.

Anticipating shifting development patterns and changes in community preference, the region should proactively **plan for transportation alternatives to cars**. Supporting walkable and bikeable communities that are connected to amenities, shopping, and services allow residents opportunities for physical activity built into their daily lives. Improving transit options can also better connect residents to amenities throughout the region. Transportation projects that promote multimodal transportation, access to public and commercial facilities, and environmental and economic benefits should be prioritized for funding.

Example: http://www.virginiadot.org/vtrc/main/online_reports/pdf/05-cr14.pdf

Time Frame: Long Term

Action F: Update and improve Louisiana's Complete Streets Policy.

Louisiana's Complete Street Policy, adopted in 2010 and generally regarded as leading edge, now integrates stormwater conveyance. It should also **include stormwater capture and retention**. These green streets—right-of-ways that use stormwater management techniques to reduce pollutants and the amount of water conveyed into the storm sewer system—have the cumulative benefit of reducing the burden upon existing drainage systems and improving overall stormwater discharge water quality. Throughout the region, these types of improvements can reduce flood risks and improve environmental quality.

Example: https://nacto.org/case-study/pinehurst-green-grid-seattle/

Time Frame: Long Term

Pinehurst Green Grid, Seattle

Seattle's Pinehurst neighborhood drainage system drains into Thorton Creek, a natural salmon-bearing creek. The neighborhood streets lacked formal rights-of-way, curbs, drainage infrastructure, and sidewalks. With the green grid project, the street was clearly delineated into a clear right-of-ways, with a sidewalk on one side of the street and linear bioretention cells on the other side. The street's green infrastructure is able to manage runoff volume up to a two-year storm event, or 1.68 inches of rain in 24 hours.

Figure 91. 20th Ave.
Image Credit: Google Maps Street View

Figure 92. 23rd Ave.
Image Credit: Google Maps Street View

Strategy 1 continued

Action G: Implement any recommendations that DOTD has not yet adopted.

Review DOTD implementation status with the Complete Streets Work Group final report and determine how to best move forward with remaining recommendations.

Reference: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Complete_Streets/Complete%20Streets%20Legislative%20Reports/Complete%20Streets%20Legislative%20Update%20Final.pdf

Time Frame: Long Term

Louisiana Complete Streets

"In 2009, The Louisiana Department of Transportation and Development convened a Complete Streets Work Group in fulfillment of the request of the state legislature. This process resulted in the adoption of a Complete Streets Policy for DOTD and the development of a final report, including recommendations for future actions."[14] The Complete Streets policy aims to "create a comprehensive, integrated, connected transportation network for Louisiana that **balances access, mobility and safety** needs of motorists, transit users, bicyclists, and pedestrians of **all ages and abilities**, which includes users of wheelchairs and mobility aids. It ensures a fully integrated transportation system, by planning, funding, designing, constructing, managing, and maintaining a multi-modal network that **achieves and sustains sustainability, while safely accommodating pedestrians, bicyclists, and transit users**."[15]

The 2017 Update released three goals as part of the Performance Measure Report:

"Goal 1: Safely and efficiently accommodate all road users (motorists and non-motorists such as, but not limited to, pedestrians, transit users & bicyclists of all ages and abilities).

Goal 2: Create a network that balances integration of context sensitivity, access and mobility for all road users.

Goal 3: Provide leadership and establish exceptional partnerships with local public agencies on implementation of Louisiana's Complete Streets policy."

Several plans have been developed for local areas within the LA SAFE region.

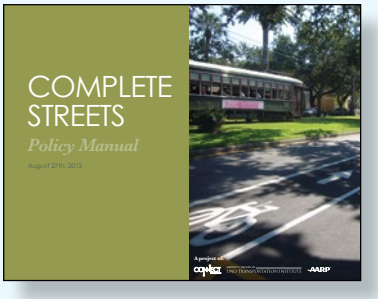


Figure 93. Policy Manual
https://www.cpex.org/complete-streets-manual/

Figure 94. Jefferson Parish
http://www.jeffparish.net/modules/showdocument.aspx?documentid=11505

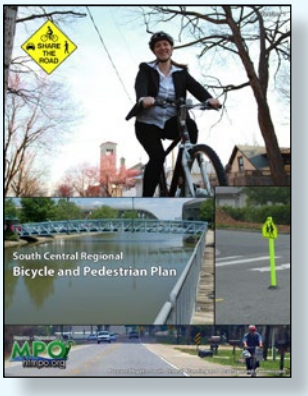


Figure 95. South Central Region
http://www.htmpo.org/docs/20130426_bikes_v1.pdf

Strategy 2: Protect and elevate key supply chain and evacuation routes

The transportation system serves many important functions, including access to supplies that support the daily life of residents, a means of logistical operations for commerce and industry, and in times of disaster, safety lines for evacuation. If not properly protected against disaster and anticipated land loss over time, loss of these routes is not only an economic hardship but also can be a matter of life and death. Damage from weather events to significant transportation corridors and facilities can extend the timeline of a disaster beyond a weather event itself by isolating communities from needed supplies and assistance until access can be restored. Flooding can inundate roads and make them impassable. Wave action and debris can damage bridge supports, impugning their structural integrity and making them unsafe to use.

In the long run, subsidence and sea level rise will take their toll on transportation infrastructure and the region's cut-off areas over time. This slow degradation of our infrastructure, due to the impacts of land loss and subsidence, requires that measures are taken now to ensure that key infrastructure doesn't erode as the coast erodes. Holistically analyzing the transportation system's ability to perform during adverse conditions and taking steps to protect it accordingly can maintain the continuity of economic activity and support the health and safety of residents.

Action A: Identify and improve key transportation and evacuation routes vulnerable to current or future flooding and other weather events.

Define and map critical transportation corridors and facilities—including rail, road, and air—and evaluate their vulnerability to disaster and long-term changes due to subsidence and sea level rise. Consider BFE and the Coastal Master Plan's 50-year projections in order to fully identify routes and facilities vulnerable to current or future flooding. Conduct additional analyses to determine vulnerabilities due to age, condition, or design that might result in loss of access or function during a disaster or changing climate conditions. Develop a plan to determine necessary improvements to harden these susceptible facilities against risk and prioritize their retrofit in the Louisiana Statewide Transportation Plan. Additionally, consider impacts from lack of access to fuel and other needed logistics that support transportation and identify alternatives to them, in the event access to these supplies are jeopardized.

Example: http://www.virginiadot.org/vtrc/main/online_reports/pdf/05-cr14.pdf

Time Frame: Long Term

Action B: Incorporate existing transportation assets into evacuation plans.

Develop evacuation plans that outline how to wholly leverage existing assets in times of disaster and identify methods to deploy these assets when needed in order to ensure that residents can efficiently and safely get to protected areas. This same exercise is necessary when accounting for climate change conditions that will further jeopardize evacuation routes over time. At a regional level, this will require not only coordinating with local jurisdictions but also coordinating a regional response that makes use of existing transportation assets such as parish ferries and train captains, who serve as first responders in case of emergencies.

Example: http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf

Time Frame: Long Term

Figure 96. Highway to Port Fourchon
LA 1 from Golden Meadow to Leeville is still subject to flooding and erosion.

Figure 97. Partially Elevated
Currently, the portion of LA 1 connecting Leeville to Port Fourchon is raised.

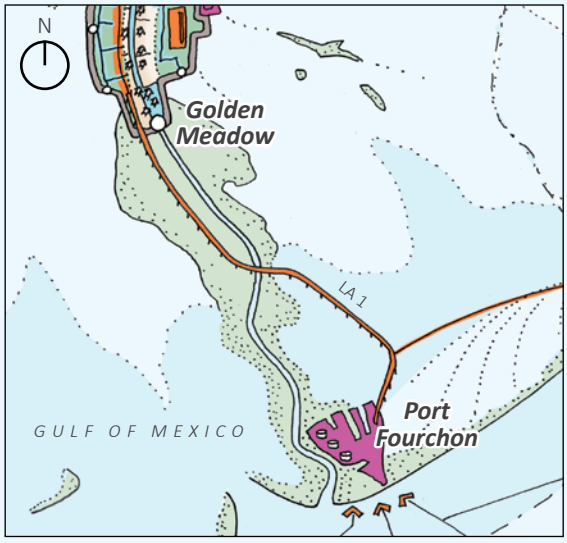


Figure 98. Golden Meadow as Launch Point
Golden Meadow can serve as a service hub for Port Fourchon.

Case Study: LA 1

Louisiana Highway 1, a thoroughfare connecting Port Fourchon to inland areas and cross-country transportation corridors, regularly experiences closures during high tides and has remained underwater for days following previous storm events. Tropical storms, hurricanes, and other tidal events pose increased risk to the two-lane, at-grade LA 1 from Leeville to Golden Meadow, impacting commerce and hurricane evacuation. LA 1 supports 18% of the United States' total oil and gas supply. It is the only land route to Port Fourchon, the hub of Gulf of Mexico energy production, and the Louisiana Offshore Oil Port, which off-loads supertankers and transmits oil by pipeline to refineries across America and facilitates the exportation of U.S. oil and gas.[16]

Recognizing that the LA 1 system is extremely significant to the nation's energy supply and to the billions of dollars generated in Outer Continental Shelf (OCS) revenues, the U.S. Congress named this critical energy infrastructure to the federal list of "High Priority Corridors" in 2001. This designation puts LA 1 in an impressive class of only 84 such highways in the nation. Among these corridors, LA 1 is the sole highway designated as such for its role as "critical energy infrastructure."

In 2011, the U.S. Department of Homeland Security authored the Louisiana Highway 1/Port Fourchon Study, which assessed the national consequences of disruptions to LA 1. **The study concluded that a 90-day closure of 7.1 miles along existing, at-grade LA 1 could result in up to a $7.8 billion loss in American gross domestic product.** A concurrent 90-day closure of Port Fourchon as a result of the loss of this highway access would significantly reduce domestic oil and gas supplies for 10 years following the closure.

This compelling study verifies how crucial it is—for the state and nation—to have a continuous, secure elevated highway from Golden Meadow to the energy hub of Port Fourchon. In short, Louisiana constantly balances its economic and cultural interests with clear and present risks. It is an unavoidable arrangement that requires thoughtful, strategic interventions to maintain a vital connection between residential corridors—the human element—and hubs of commerce and industry.

Goal 4: Diversify Educational and Employment Opportunities to Strengthen the Regional Economy

Integrate risk and adaptation practices into all levels of government and educational systems. Build a robust economy that diversifies the parish's economic base, supports residents' entrepreneurial spirit, and trains and retains parish workers in emerging industries.

Strategy 1: Increase coastal education for students of all ages

Strategy 2: Expand skills training in coastal careers

Strategy 3: Grow and diversify the economy

Strategy 4: Support Louisiana seafood and fishers

Figure 99. Louisiana Seafood
Strategies to diversify economic opportunities for those who work in the seafood industry could include promoting activities that connect producers with consumers, ensuring transportation and access to commercial fishing vessels, and developing off-season employment and training opportunities.

Education, Economy, and Jobs

Residents identified the need to align education at all levels with local economic opportunities. LA SAFE focuses on coastal education, job training, economic diversification, and support for Louisiana seafood as four key areas for economic growth.

Coastal Education—Many residents want their children to learn more about the region's unique environment and culture. Residents spoke about a desire to see **school curricula, after-school programs, and summer camps** provide hands-on opportunities across the coast to learn about the environmental challenges ahead. Educating youth about the complexity of Louisiana's coastal challenge can better prepare future generations to make smart development decisions, encouraging them to get involved in the coastal restoration field, which is part of the multi-billion dollar water management sector projected to grow by 23% over the next 10 years in the region.[17] Residents also suggested that schools should **educate students about Louisiana's history, culture, and traditions and its individual parishes**. Many residents are worried that as risk continues to strain communities and separate neighbors, youth will lose touch with their cultural heritage and sense of place.

Economic Diversification—Residents want to see the region's economy grow and diversify. **Louisiana is a coastal laboratory with an opportunity to develop approaches, techniques, and solutions applicable around the world.** The coastal management sector, which has demonstrated significant growth in the last decade, has the potential to become an even greater driving economic asset for the state and its residents. LA SAFE recommends that the region capitalize on the opportunity to become a **world leader in coastal adaptation and water management** while simultaneously working to improve its ecosystems. In addition, energy, healthcare, digital media, and advanced manufacturing are all growing sectors in the region that can support well-paying jobs in the future.

Job Training—Residents identified access to jobs and job training as the most important factors for retaining youth in their parishes and prioritized job training above all other economic strategies. One of their goals is to **build potential workers' technical skills and connect them with existing employer needs**. High school curricula, after-school programs, community colleges, vocational-technical schools, and local industry and employers all have a role to play in preparing students for careers. **Partnerships among educational institutions and industries** can help students receive the training and skills they need to be successful and provide internships to continue building those skills. Research has demonstrated that upward social mobility is strongly correlated with early intervention and support during K – 12 education and higher teen labor force participation rates. Educational opportunities that complement early internship opportunities in high-demand industries could significantly increase the economic prospects for Louisiana youth.

Figure 100. Educational Programs
Ripple Effect field trip to UNO's Coastal Education Research Facility. Students studied blue crab behavior, explored the estuary in canoes, and recorded observations of organisms caught in dip nets.
Photo Credit: Ripple Effect Water Literacy Project

> **"Our kids are passionate about living here and being involved in contributing to the parish's future."**
> **—Terrebonne Parish Resident**

Support Louisiana Seafood—LA SAFE supports adaptation measures that will preserve and promote the seafood industry as it adapts to increased risk. For example, the industry can benefit from new harbor infrastructure investment to prepare for greater storm surge and from vessel upgrades to prepare for longer trips.

Louisiana also has the potential to **increase the value of its catch** by earning fisheries certifications that will distinguish Louisiana catch from unsustainably harvested and lower-quality products from overseas. There are several models for **raising market demand for high-quality products**, which include—

- Building upon the work of the Louisiana Seafood Promotion and Marketing Board to develop effective advertising campaigns to raise awareness of the quality and sustainability of Louisiana seafood;
- Lobbying the federal government for stricter regulations on imports from overfished stocks as well as from countries with abusive labor practices, catch with known contaminants, lower quality yields, and/or harmful hormones;
- Promoting seafood and farmers' markets and other forms of direct sales;
- Providing technical assistance and training to increase product quality and increase ex-vessel value for fishery products;
- Coordinating with processing facilities and businesses to increase availability and visibility of local products in restaurants and stores; and
- Caring for fisheries in order to maintain quality and species diversity.

Increasing demand for Louisiana seafood throughout the state and country has the potential to bolster the seafood industry and bring more revenue to the region. What coastal change will look like in the future has a high degree of uncertainty, and the impact of coastal change on fisheries is dependent not only on the timing and extent of the change but also how and when the state implements components of the Coastal Master Plan. Nonetheless, Louisiana can begin preparing for changes today by promoting Louisiana seafood, providing technical assistance to deliver high-quality products, and increasing the focus on the management of ecosystems, thus increasing the overall value of Louisiana's fisheries.

> **"First, you have to support the commercial fishermen. We can't keep allowing the state to import seafood from everywhere else."**
>
> **—Jefferson Parish Resident**

Case Study: Successful LA Creel Survey

The Louisiana Department of Wildlife and Fisheries launched the **Louisiana Recreational Creel Survey** (LA Creel) to provide weekly estimates of recreational fish harvests. LA Creel aims to provide precise data to manage Louisiana's recreational fisheries. In 2018, LA Creel proved successful in projecting the length of harvest time for fishers to reach the self-imposed 734,000-pound red snapper quota. Through weekly data analysis, LA Creel projected the quota would be reached by 11:59 p.m. on August 12, allowing for a 60-day season. When numbers from the final weekend of the season were gathered, LA Creel's team recorded the red snapper recreational final catch at 737,229 pounds.[18,19]

Figure 101. Redfish Harvest
Redfish thrive in the marshes and coastal waters southeast Louisiana.
Photo Credit: Louisiana Sea Grant/Flickr/CC 2.0 Generic

Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Implementation in Low-Risk Areas

In low-risk areas with expanding residential populations, **businesses compatible with residential areas should be encouraged**, while toxic or heavy industrial uses should be discouraged. Low-risk areas are prime for more **economic diversification**. Many residents want to see a focus on healthcare, creative industries, alternative energy, information technologies, and other high-paying jobs. Residents also recommended more support for business incubators and entrepreneurs to spur new small business growth. In denser, mixed-use areas, small businesses, retail, restaurants, and other neighborhood businesses should be encouraged to **attract residents and improve quality of life**.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Implementation in Moderate-Risk Areas

Moderate-risk areas will **support existing residential use and the coastal economy**. In these areas, seafood processing centers, job training for coastal industries, and coastal education centers will bridge the economies of high-risk areas and low-risk areas. Fishers expressed demand for physical improvements to harbors and docks, including services on site like boat security and surveillance, public markets, stores, and places to eat. As potential centers for community gathering, LA SAFE encourages more economic activity to **service and benefit from the commercial fishing activities in and around harbors**. These areas **can become vibrant economic nodes within moderate-risk areas, anchoring towns and communities**.

High Risk
>6' projected storm surge flood depths

Implementation in High-Risk Areas

High-risk areas will continue to **support existing industries and have the potential to support new ones**. Residents prioritized alternative energy and coastal restoration as the two most promising sectors in which to pursue new jobs and opportunities. Louisiana can support offshore wind power generation and build on investments in the water management sector. Louisiana can become a **global leader in water management**, exporting this expertise to coastal communities around the world facing similar issues.

Drawing from the $8.7 billion BP settlement for the 2010 Deepwater Horizon oil spill, Louisiana will spend hundreds of millions of dollars on coastal restoration and protection over the next 15 years, and most of this work will be focused on southeast Louisiana. **Formalizing and commercializing the expertise residents have and will develop around water management, ecological repair and stabilization, and coastal restoration will enable small businesses to tap growing markets in other coastal areas**.

Strategy 1: Increase coastal education for students of all ages

Louisiana's coastal landscape is changing, and several research, restoration, and protection efforts are underway. To provide a pipeline for future researchers and workers, learning opportunities about and interaction with the dynamic coastal environment are needed.

Action A: Introduce a statewide curriculum about the state's coastal landscapes for pre-K – 12 students. Once implemented, expand the curriculum to include instruction about Louisiana's regional land and water ecosystems.

The coastal ecosystem has contributed significantly to the riches of the state's culture, history, and economy. By developing a curriculum that focuses on these assets, this knowledge can be maintained and expanded both geographically and generationally, while also establishing baseline knowledge necessary to make informed decisions and support coastal-relevant initiatives. To achieve this, the state should **work with educators, nonprofits, higher education institutions, and others to design a framework for curriculum development that outlines coastal education learning expectations by grade level**.

Example: http://coastal.la.gov/resources/educational-resources/

Time Frame: Long Term

Action B: Expand weekend and summer camp opportunities for coastal education.

Work with nonprofit and philanthropic partners to **expand weekend or summer camp opportunities for coastal education and combined culture and history camps**, particularly among low- and middle-income students.

Example: http://gcrl.usm.edu/mec/camps.and.field.programs.php

Time Frame: Long Term

Senior Education

Since 2011, under LA Rev Stat § 17:1807—through Acts 1990, No. 824, §1, eff. July 24, 1990, effective July 24, 1990 and Acts 1995, No. 307, §1—**Louisiana offers tuition exemption and a 50% reduction in textbook costs to people aged 55 and older**.

"A. Any person age fifty-five years or over who registers for one or more courses of instruction at a public college or university in this state and who is a resident of this state shall be exempt from the payment of tuition and other registration fees and shall receive a fifty percent reduction in the cost of textbooks, reference books, manuals, and other aids to instruction which are required by any course in which such student is enrolled when purchased from a public college or university operated bookstore.

B. Any funds lost to any public college or university as a result of this Section shall be reimbursed to the college or university by the state.

C. The tuition exemption and reduction in textbook costs provided in this Section shall be provided only if and to the extent that there are sufficient funds appropriated by the legislature to reimburse the public college or university granting them."

To learn more: http://legis.la.gov/legis/Law.aspx?d=79985

Strategy 2: Expand skills training in coastal careers

The current economies of the delta areas are primarily related to the seafood and oil and gas industries, which have steadily declined in the last decades and remain volatile to global markets. As industries evolve, so must skills training. To ensure that skill sets correspond to locally available workforce needs, skill training opportunities should be expanded.

Action A: Develop a coastal specialization pathway for high school students who seek either Jump Start or TOPS diplomas.

- **Develop a Jump Start pathway** modeled after the pre-engineering pathway, where students seeking a Jump Start or a TOPS diploma can take supplemental courses to earn a "coastal specialization certificate," which prepares students for success in coastal vocational careers or college degrees related to coastal management and restoration.
- **Develop a "Coastal 101" course** that can also serve as a science elective. The course would include an overview of the coastal landscape, information about careers in coastal management/coastal restoration, and a deep exploration of the coast's geology and ecology. This could be a junior-year high school course and offered for dual enrollment for college credit.
- **Develop additional electives focused on coastal issues.** These could include topics such as coastal engineering, the economics of the working coast, and coastal Louisiana's history and culture. Funding would go towards identifying the most beneficial elective courses and developing curricula for them.

Example: https://coast.noaa.gov/estuaries/curriculum/

Time Frame: Long Term

Estuaries 101

NOAA's National Estuarine Research Reserves system offers resources "to help educators bring estuarine science into the classroom."[20] The portal offers lessons that include hands-on learning, experiments, fieldwork, and data exploration. The lessons are adaptable for any age group and include resources and tools required for the lesson. Lessons focus on real estuary systems across the country. Twenty-seven lessons are offered, including "Migrating Mangroves and Marshes," "Oil Spill—The Rest of the Story," "An Ode to the Oyster," "Estuary Food Pyramid," "Port to Port," and "Sharks in the Estuary."

Action B: Match education with skill needs of local employers.

To avoid a disconnect between the skill sets available among employees and needed skill sets sought by employers, **enhance coordination among K – 12 education, community colleges, four-year universities, and industry**.

Example: http://www.ihep.org/guidebook/workforcealignment/chapter/two

Time Frame: Long Term

Strategy 2 continued

Action C: Support apprenticeship-based model for coastal careers.

Many of the skills needed to work in coastal careers may not require a four-year degree but instead technical knowledge and/or experience. To foster coastal careers, the state should **explore developing an apprenticeship-based model to train and educate its future workforce**. Such a model has proven efficient and effective in numerous sectors, including automobile maintenance and repair as well as the food industry.

Example: http://ngicp.org/

Time Frame: Long Term

Action D: Build Louisiana's expertise in coastal and stormwater management.

Use a combination of regulations, financial incentives, technical assistance, outreach, and education to **build Louisiana's expertise in coastal and stormwater management**. Building this expertise will also increase the state's ability to assist other states and countries with similar issues and position itself as a leader in coastal restoration and protection as well as flood risk reduction.

Example: https://www.coastal.ca.gov/whoweare.html

Time Frame: Long Term

Action E: Offer retraining programs in emerging coastal careers such as adaptation, mitigation and recovery, wetlands protection, and aquaculture.

As the environment changes, many natural resource-based economies will need to adapt. To assist with transitioning workers, the state and local governments should **explore retraining programs that target impacted economies** and their workers.

Example: https://www.thesolarfoundation.org/workforce-development/solar-training-network/

Time Frame: Long Term

"A full 95 percent of all the fish and shellfish caught commercially in Louisiana depend on the wetlands as a nursery and/or source of food at some point in their life cycles. 'Take away the marsh and you fatally disrupt the life cycle of all those species—shrimp, crabs, oysters, fish. That's not only an ecological disaster. It's a billion-dollar fishing industry gone. A *billion* dollars—with untold families wiped out.'"

—Mike Tidwell, *Bayou Farewell*

Strategy 3: Grow and diversify the economy

Currently, the delta-area economies are tied to the seafood and oil and gas industries, both of which are volatile. To decrease economic vulnerability to global market and environmental changes, the local economies should be diversified.

Action A: Promote Louisiana expertise in coastal restoration and adaption.

Louisiana is one of the few states that has an agency entirely dedicated to protecting and restoring its coast. The Coastal Protection and Restoration Authority (CPRA) developed and continuously updates its Louisiana Comprehensive Master Plan for a Sustainable Coast, typically referred to as the Coastal Master Plan.[21] Through its planning and implementation of restoration and protection projects, CPRA has developed a significant amount of expertise, which could be **marketed and promoted nationally and globally**.

Example: https://www.oxfamamerica.org/static/media/files/rebuilding-our-economy-restoring-our-environment.pdf

Time Frame: Long Term

Action B: Support and foster emerging economies.

There are several emerging economies that show promise of contributing significantly to the local economy and its diversification. Sectors include renewable energy, research and development, technology, and healthcare. These and other **emerging economies should be supported by providing access to low-interest capital and fostering a network that enables collaboration** across sectors and economies to ensure that Louisiana continues to thrive economically.

Example: https://www.nyserda.ny.gov/Partners-and-Investors/Clean-Energy-Startups

Time Frame: Long Term

New York State Energy Research and Development Authority (NYSERDA)

"NYSERDA offers objective information and analysis, innovative programs, technical expertise, and support to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce reliance on fossil fuels. A public benefit corporation, NYSERDA has been advancing energy solutions and working to protect the environment since 1975."[22]

NYSERDA provides a listing of resources to help clean energy start-ups get off the ground. NYSERDA offers a searchable database to help potential partners find programs or assistance, allowing one to search programs as a partner, financial supporter, or innovator. Additionally, StartupGPS.org offers additional, free-of-charge resources to help start-ups, offering a Pathfinder survey to help guide entreprenurial efforts as well as a library of resources to help those who know which path they'd like to pursue.

Strategy 4: Support Louisiana seafood and fishers

The seafood industry is not only a major economy in Louisiana but also a cultural and historic asset of the state. Louisiana ranks second-highest in commercial fishing landing in the U.S. and contributes 21% of commercial fishing landings by weight in the continental U.S.[23] The seafood industry is important locally and nationally and must be supported.

Action A: Understand how environmental changes will affect Louisiana fisheries.

More than two-thirds of commercial fin and shellfish species depend on wetlands for spawning, nursery habitat, and feeding. These species also make up the majority of Louisiana's commercial seafood. As wetland habitats change, species that depend on them will, too, and this will subsequently impact the seafood industry. Understanding how changing environmental conditions and proposed coastal restoration projects will affect the habitats that Louisiana fisheries depend on is important. The state should **evaluate and communicate this knowledge and work with affected fisheries to develop strategies, economic opportunities, and support adaptation of fisheries**.

Example: https://www.fisheries.noaa.gov/insight/climate

Time Frame: Long Term

Action B: Assist the fishing industry to adapt and distribute locally.

Louisiana's fishing industry will need technical assistance and financial resources to respond and adapt to the changing environmental conditions and habitat changes. Furthermore, as local seafood is marketed, the fishing industry must ensure product quality standards and expectations are met and distribution to local markets is uninterrupted. The state should **provide the fishing industry with technical assistance and flexible loan programs to help ensure product quality and market distribution**.

Example: https://www.alaskaseafood.org/about/

Time Frame: Long Term

Action C: Provide technical assistance and loans to help commercial fishers diversify their businesses during the commercial off-seasons.

For many fishers, fishing is a seasonal occupation. During the off-season periods, there is an increasing **need to diversify their businesses**—beyond working for the oil and gas industry, which, historically, has been an option. To assist, technical assistance and loans should be made available.

Example: https://www.commerce.alaska.gov/web/ded/fin/loanprograms/commercialfishingloanprogram.aspx

Time Frame: Long Term

Action D: Increase fisheries certification.

In an effort to assist local fisheries, the state should support national and targeted advertising campaigns and events by coordinating with the Louisiana Seafood Promotion and Marketing Board. This coordination should aim to **continue the development of fisheries certification**, which will raise Louisiana seafood's market value.

Example: https://www.alaskaseafood.org/rfm-certification/

Time Frame: Long Term

Strategy 4 continued

Action E: Develop and promote the Louisiana seafood label.

Once certified, a label specifically for Louisiana seafood, such as the Louisiana Wild Seafood Certification program, could be further developed. A marketing campaign that **promotes the certification/label** would be a way to increase desirability and may prompt further investment in promoting Louisiana seafood globally.
Example: https://www.alaskaseafood.org/retail/marketing-tools/power-of-the-brand/
Time Frame: Long Term

Alaska Seafood

"The Alaska Seafood Marketing Institute is a marketing organization with the mission of increasing the economic value of the Alaska seafood resource... ASMI is a public-private partnership between the State of Alaska and the Alaska seafood industry established to foster economic development of a renewable natural resource. ASMI is playing a key role in the repositioning of Alaska's seafood industry as a competitive market-driven food production industry. Its work to boost the value of Alaska's seafood product portfolio is accomplished through partnerships with retail grocers, foodservice distributors, restaurant chains, foodservice operators, universities, culinary schools, and the media. It conducts consumer campaigns, public relations and advertising activities, and aligns with industry efforts for maximum effectiveness. ASMI also functions as a brand manager of the Alaska Seafood family of brands."[24]

The Alaska Responsible Fisheries Management (RFM) Program certifies fisheries that are responsibly managed per (1) Fisheries Standard and (2) Chain of Custody Standard.

Action F: Create a marketing and branding training program for fishers.

To maintain and increase the profitability and success of Louisiana's seafood industry, a training program could be established that **teaches fishers how to use the labeling and branding to sell their product at a premium rate**.
Example: http://www.futureoffish.org/sites/default/files/docs/resources/TNC.SeafoodSupplyChainReport.V10.Web_.pdf
Time Frame: Long Term

Action G: Provide research and assistance for adopting sustainable fisheries.

The Mississippi Delta is noted for its productivity, especially its fish and shellfish productivity. However, to continue to meet demands and adapt to a changing environment, sustainable fisheries and aquaculture practices should be expanded in Louisiana and complemented with additional research and technical assistance for adopting sustainable practices.
Example: http://www.seafoodwatch.org/
Time Frame: Long Term

"75% of the U.S. commercial catch comes from estuaries. 35% of estuary marshes in the continuous U.S. are in Louisiana."
—LouisianaSeafood.com

Case Study: New Harmony High School

New Harmony High School is a charter school that will break new ground in teaching Louisiana students about the state's ecology and natural systems. The curriculum will help students understand the interconnectedness of the people, land, air, and water, which will empower them to holistically plan for coastal Louisiana's future resiliency. Awarded a $10 million grant in 2016 from XQ: The Super School Project, the school was founded through a collaboration among leaders from Big Picture Learning, New Orleans-based architecture firm Concordia, Restore the Mississippi River Delta, and other partners including designers, philanthropists, and teachers.

In Fall 2018, New Harmony High will welcome its first class of students who will be equipped with the knowledge and skills to engage in local projects, scientific research, and community initiatives that address current ecological concerns and meet statewide education standards. The school's environmentally focused curriculum was developed with the goal of getting young people behind the issues of coastal restoration, coastal preservation, and Louisiana's economic and ecological sustainability. By placing students in real-world settings—such as on a barge—they will have hands-on opportunities in Louisiana's coastal communities, on shorelines, and in wetlands while being immersed in the topics they are studying. Upon graduation, students will both understand the transforming environment in which they live and be prepared for college and coastal careers.

For more information, see https://newharmonyhigh.org/

Figure 102. School on a Barge
Concept for a floating school on a barge on the Mississippi River.
Image Credit: Concordia

Goal 5: Support Healthy Communities, Regional Culture, and Recreational Access to Nature

Retain the region's culture and values as growth and development occurs. Incorporate diverse recreation opportunities to promote a healthy environment that allows residents to experience the region's natural beauty while maintaining a healthy, active lifestyle.

Strategy 1: Increase access to nature for recreational use and ecotourism

Strategy 2: Preserve and support Louisiana's culture and heritage

Strategy 3: Encourage development that is informed by an understanding of the relationship between public health and the built environment

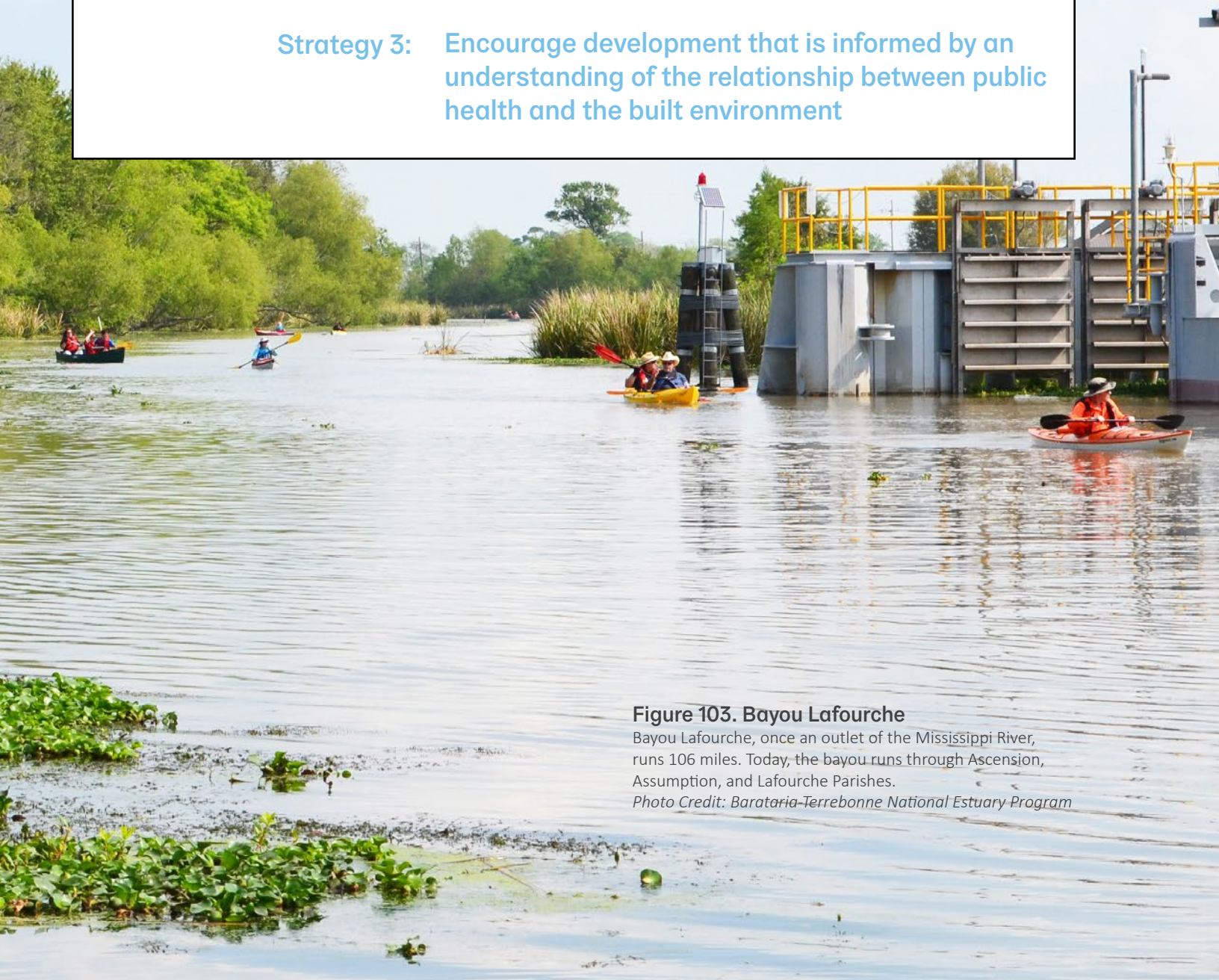


Figure 103. Bayou Lafourche
Bayou Lafourche, once an outlet of the Mississippi River, runs 106 miles. Today, the bayou runs through Ascension, Assumption, and Lafourche Parishes.
Photo Credit: Barataria-Terrebonne National Estuary Program

Culture and Recreation

Southeast Louisiana's culture is treasured. The region's people, food, music, language, and architecture embody a unique history. They contribute to the identity and sense of place for many residents and attract appreciative visitors from around the world. These assets reflect residents' relationship to the environment and each other, expressed through recreational activities like hunting, fishing, boating, cooking, dancing, art, sports, and enjoying a cool breeze on the front porch.

As populations shift and a new generation grows up in a technologically connected world, many residents worry that without action, Louisiana's culture and traditions will dissipate. Residents proposed after-school programs, farmers' and seafood markets, greater access to water and nature, and other recreational and youth programs as ways to preserve and pass on traditions to the next generation.

Parishes and municipalities can create more access to water and outdoor resources for residents through bike and nature trail connectivity and boat launches. Creating or building on existing cultural events can increase the value of public spaces. Colocating cultural assets and programs near schools, businesses, natural assets, and transit will also increase their accessibility and economic impact.

"Louisiana is a part of me. The culture is one thing that you don't want to give up. The way of life."

—Jefferson Parish Resident

"We live in a place that still practices our history. We somehow hold on to our historical traditions."

—Plaquemines Parish Resident

Figure 104. Grand Caillou Elementary
As services and amenities move north to higher ground, vacated buildings and sites become opportunities for community spaces, such as a stormwater management park, cultural center, or recreational destination.

Figure 105. Adaptive Reuse Potential
One of the catalytic projects, the Grand Caillou Elementary property is envisioned as an educational and cultural center with green infrastructure, a boat dock and market pavilions, sports fields, and wetland trails.

Low Risk
Minimal storm surge flood risk projected and outside the current 100-year floodplain

Implementation in Low-Risk Areas

In low-risk areas, cultural districts can contribute to vibrant growth. Façade renewal programs and main street revitalization projects that **integrate historic and cultural elements create a sense of place** that supports cultural destinations, businesses, and redevelopment. Cultural districts with tax exemptions for cultural producers—such as artists, galleries, musicians, chefs, museums, and heritage centers—will attract cultural capital and younger residents, who tend to favor denser downtown living. Cultural districts are highly compatible with Complete Streets and mixed-use development. Investing in culture will support downtown development in historic, high-ground areas. Murals and other public art can help tell the story of coastal Louisiana's environment and culture and contribute to placemaking in these districts.

Moderate Risk
>0 – 6' projected storm surge flood depths or within the current 100-year floodplain

Implementation in Moderate-Risk Areas

Both moderate- and high-risk areas are home to unique coastal environments, music, food, language, and cultural character. These assets have the potential to attract tourism and generate wealth. Moderate-risk areas can **support economic activity rooted in the environment and culture that can reinforce residents' goals to preserve and pass down culture to future generations**. Moderate-risk areas are home to many historic buildings and sites that should be protected and preserved. These areas can support camps and education centers that connect youth with both the culture and environment of the region. Fishing piers and boat launches can attract visitors to these areas and promote water-based recreation.

High Risk
>6' projected storm surge flood depths

Implementation in High-Risk Areas

High-risk areas include the region's most beautiful natural assets. Even with fewer residents, these areas have the potential to grow as **recreational and nature destinations** with greater access for boating, hunting, and fishing. Existing elevated structures can be retrofitted to serve ecotourism businesses and short-term rentals. There are many historic sites in high-risk areas that can host yearly events and seasonal tours. Public amenities such as boat launches and walking and biking trails can support this transition and **provide greater access to Louisiana's Sportsman's Paradise**. Programs and camps that **connect youth to nature** can provide educational and cultural benefits.

Strategy 1: Increase access to nature for recreational use and ecotourism

Louisiana is the Sportsman's Paradise with an abundance of natural areas ideal for recreational uses and ecotourism such as fishing, hunting, and observing. Expanding access to these natural areas can promote local economies as well as increase awareness of, and education about, Louisiana's culture, environment, and at-risk delta ecosystem.

Action A: Support businesses that provide recreational services.

Promote areas outside structural protection systems as a sportsman's paradise, and support businesses that operate in these areas providing hunting, fishing, or other forms of recreational services, such as charter boat services and hunting guides. In addition, support outdoor sport and recreational activities like bait shops, food sales, and sports supplies.

Example: https://www.floridasee.org/

Time Frame: Long Term

Florida Society for Ethical Ecotourism (Florida SEE)

The organization's website states that "the Florida Society for Ethical Ecotourism is a nonprofit educational organization established in 2000. It is a state-wide Certification/Recognition Program which maintains a professional code of ecotourism ethics in order to encourage an awareness of and stewardship for Florida's natural and cultural history."

"Florida SEE is dedicated to maintaining a professional code of ecotourism ethics in order to **encourage an awareness and stewardship of Florida's natural and cultural heritage** by:

1. Endorsing compliance with federal, state, and local laws regarding the protection of natural resources and customer safety.
2. Providing environmental education and awareness which encourage behaviors that contribute to the sustainability of Florida's natural ecosystems and resources.
3. Promoting professionalism and integrity within the ecotourism industry by providing and maintaining a certification/recognition program for ecotour providers."[25]

Action B: Promote ecotourism opportunities at the state level.

To further develop and grow the ecotourism industry, the Louisiana Office of Culture, Recreation, and Tourism (CRT) should **create a program that promotes coastal ecotourism**. Similar to the Atchafalaya National Heritage Area program, this program could coordinate local recreational, cultural, and educational efforts for residents and visitors.

Example: http://www.atchafalaya.org/index.php

Time Frame: Long Term

Action C: Expand access to outdoor recreational opportunities for Louisiana youth.

Partner with academia, nonprofits, or philanthropic organizations to **expand access to outdoor recreational opportunities for Louisiana youth**.

Example: https://www.sierraclub.org/atlantic/nyc-ico

Time Frame: Long Term

Strategy 2: Preserve and support Louisiana's culture and heritage

Coastal Louisiana's distinct culture is deeply rooted in strong connections to the land, swamps, and waterways that comprise the region. As increasing flood risk and sea level rise force populations to higher ground and effectively erase the landscape, people are concerned that this distinct culture will vanish as well. Proactive steps to continue traditions and celebrate history will keep the culture alive.

Action A: Host cultural events and programs in conveniently located, accessible places.

Increase accessibility to, and awareness of, cultural events and programs to increase participation, benefit the local economy, and maintain and expand knowledge about the area's culture. By colocating cultural events and programs near existing transportation corridors and community centers, they are more accessible to a wider range of people.

Example: https://www.nycgo.com/things-to-do/arts-culture

Time Frame: Long Term

Action B: Expand the state's Percent for Art Program.

To further preserve and support Cajun, Creole, and other local cultures and history, **Louisiana's Percent for Art program should be expanded**. In addition to funding visual arts, the program should be allowed to include capital expenditures, such as building or maintaining a recreational space. Cultural assets like this could be used for festivals, music performances, or traditional cooking demonstrations.

Example: https://www.pps.org/article/artfunding

Time Frame: Long Term

Action C: Capture the culture and history of high flood risk areas.

Create a division within the CRT's State Historic Preservation Office (SHPO) that would **preserve and transfer the cultures and practices of migrating communities as well as document and honor culturally and historically important locations** in areas subject to high flood risk.

Example: https://scholars.unh.edu/cgi/viewcontent.cgi?article=1340&context=carsey

Time Frame: Long Term

Sea Level Rise, Climate Change, and Coastal New Hampshire's Precarious Cultural Heritage

Coastal New Hampshire faces sea level rise and rising temperatures, placing some of its cultural and historical sites at risk of inundation, resulting in economic implications for the area's tourism industry. Climate Solutions New England, a partnership with the University of New Hampshire, measured six scenarios of sea level rise and emission patterns. Known prehistoric and historic cultural site locations in Strafford and Rockingham Counties were mapped in comparison to these sea level rise results, revealing a number of sites are at risk from inundation. In the highest sea level rise prediction and high-emission pattern scenario, 14% of historic sites will be affected, and many face complete inundation. As many as 80 known cemeteries are at risk. These sites, if lost, could also negatively impact the region's tourism economy. One solution is to relocate sites farther from the coastline and potential risk. The study suggests that the tourism industry relies on authenticity. For example, people are willing to pay more to visit a site in its original setting. Tourists would be less likely to visit a building that has been relocated from its original site.[26]

Action D: Promote local tourism.

Numerous efforts have been underway locally to promote staycations—vacations taken close to one's home—such as the Visit St. Martin Parish marketing campaign aimed at Louisiana residents. CRT should expand its work with local communities and parishes and **promote staycation campaigns**.

Example: https://www.adweek.com/creativity/lyft-encourages-new-yorkers-to-take-a-staycation-and-explore-the-local-sights/

Time Frame: Long Term

Action E: Invest in and utilize existing and new tools to discover Louisiana.

Apps, augmented reality, and other new technologies can help visitors discover Louisiana's culture and history in an interactive way. Multilingual tour guides, websites, and maps can make it easier for visitors to navigate and explore Louisiana.

Historically, French was spoken for generations in this area, and some people still speak Cajun French. This aspect of the culture can be combined with historic and cultural education and tourism to provide a multidimensional experience to visitors, many of whom come from French-speaking countries.

Example: https://www.nycgo.com/articles/best-nyc-smartphone-apps

Time Frame: Long Term

NYC: The Official Guide

NYC: The Official Guide provides a list of smartphone apps that are designed around New York City's transporation, attractions, dining, arts and culture, and beyond. A sampling of apps available include—

iTrans NYC Subway

"In a rush? This app finds the fastest route between any two New York City subway stations, taking into account current schedules and service changes. iTrans NYC Subway provides users with detailed maps and walking directions, and even works off-line."

Downtown NYC

"This is the official app of the Downtown Culture Pass, which offers discounts to Lower Manhattan cultural attractions as well as for the odd event and dining experience. Visit Wall Street, Century 21, the South Street Seaport and other popular destinations."

Broadway.org

"With this app, you can browse current and future Broadway productions, as well as see show info, curtain times and ticket prices. Users can also find hotels and restaurants in the Theatre District."[27]

Strategy 3: Encourage development that is informed by an understanding of the relationship between public health and the built environment

Many Louisianians struggle with diabetes, cancer, heart disease, asthma, and mental illness. The prevalence of these and other chronic diseases is related to factors such as nutrition, physical activity, social networks, and access to clean air and water—all of which are heavily influenced by the built environment in which one lives. To create communities that support a culture of health and make it easier to engage in healthy behaviors, buildings, infrastructure, and public spaces must be developed in ways that encourage physical activity and social interaction, maintain or improve air and water quality, provide frequent exposure to nature, and facilitate access to healthy food and health services.

Action A: Use municipal ordinances and incentives to incorporate public health objectives and strategies into new developments.

Use municipal ordinances and incentives to encourage new developments to follow healthy design principles, such as creating access to green spaces and natural areas, and to generally consider a range of health impacts associated with development decisions in the interests of reducing health disparities and optimizing health outcomes.

Example: https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.highlight/abstract/817

Time Frame: Medium Term

Action B: Provide a state best practices guideline for minimizing negative health impacts of development.

Similar to the state's Complete Streets Policy, Louisiana should formally **adopt a policy to provide information about best practices for minimizing negative health impacts of development and optimizing opportunities to benefit public health outcomes**. Active live/work/play options include access to green space and natural light, availability of multimodal transportation, and design that encourages social interaction.

Example: https://americas.uli.org/research/centers-initiatives/building-healthy-places-initiative/

Time Frame: Medium Term

Action C: Address mental health issues associated with living in areas of risk and uncertainty.

In addition to physical health impacts and financial impacts associated with living in moderate- and high-risk areas, mental health professionals are seeing an **increased need for mental health services for coastal residents**. Throughout the LA SAFE process, leaders and residents expressed a need for additional mental health services for people living with mental health challenges exacerbated by living in high risk areas. Cambodian and Vietnamese participants indicated that addressing mental health challenges are a high concern.

Example: https://www1.nyc.gov/site/doh/health/neighborhood-health/tcny-neighborhood-initiative.page

Time Frame: Medium Term

Figure 106. August 2016 Flood
The U.S. Coast Guard rescues Baton Rouge residents following the flood in August 2016.
Photo Credit: U.S. Department of Agriculture Flickr/Public Domain

Case Study: "Resilient Baton Rouge"—Addressing Mental Health Challenges Associated with Living with Risk

Developed in response to the 2016 floods that devastated the Greater Baton Rouge area, Resilient Baton Rouge seeks to address post-disaster mental health (also known as behavioral health) needs that far outstrip the community's capacity to provide services. With support from the Robert Wood Johnson Foundation and the Baton Rouge Area Foundation, Resilient Baton Rouge was designed to support recovery after major flooding by building local capacity to implement an expanded model of care for adults that is reflective of local priorities and connected to local recovery assets.

The program is led by both community members and academic experts along with representatives providing guidance from the Community and Patient Powered Research Network—a participatory collaborative dedicated to "implementing community-engaged, culturally tailored interventions focused on improving behavioral health." The program provides "funding, training, tools and a workspace for collaborators to focus on disaster-related complications through a partnership of community members, health services providers, community organizations, government, and academic participants that can encourage and support improved mental health services for disaster-impacted communities."[28]

In addition to learning more about the short- and long-term mental health needs that emerge after disaster, Resilient Baton Rouge is building upon successful models of community-based networks responding to mental health challenges that have been implemented in South Louisiana post-Katrina and elsewhere throughout the country. By hosting trainings, convening work groups and advisory councils, making grants, forming multi-sector partnerships, and publishing tool kits, Resilient Baton Rouge was successful in expanding local mental health service delivery and increasing local expertise on post-disaster behavioral health needs and best practices for meeting those needs. Resilient Baton Rouge was also able to contribute lessons learned to ongoing efforts at the national level to collaborate on issues of mental health, risk, and resilience.[29]

Figure 107. Isle de Jean Charles
Once nestled in the coastal Louisiana marshes, the island today is a narrow strip of land encompassed by levees.
Photo Credit: CSRS

Regional Case Study

Relocation of the Coastal Community of Isle de Jean Charles

A primary goal of LA SAFE is to establish a framework for preparing Louisiana's coastal areas to adapt to 50-year projections of land loss, projections that paint a bleak picture for the habitability of some coastal communities. A 2014 Tulane Institute on Water Resources Law & Policy issue paper calculated that up to 86% of at-risk families will benefit from Coastal Master Plan projects.[30] The remaining 14% will remain vulnerable and will see their risk increase over time. As controversial as resettlement is, as painful as the process can be for already vulnerable people, it is a necessary component to any comprehensive adaptation policy framework in Louisiana.

The U.S. Department of Housing and Urban Development awarded $48.3 million to the Louisiana's Office of Community Development-Disaster Recovery Unit (OCD-DRU) to resettle the Isle de Jean Charles residents as an entire community. Located on a narrow island within Terrebonne Parish's southern-most bayous, the Isle de Jean Charles community has been a historically significant landmark for nearly 200 years. This island is home to members of the Band of Biloxi-Chitimacha-Choctaw Tribe and the United Houma Nations Tribe, whose ancestors fled to the island after the 1830 Indian Removal Act policies forced them from their native land. Within the past 60 years, 98% of the community's land has been lost to frequent floods, subsidence, and rising sea levels. The residents must soon move to higher, safer ground.

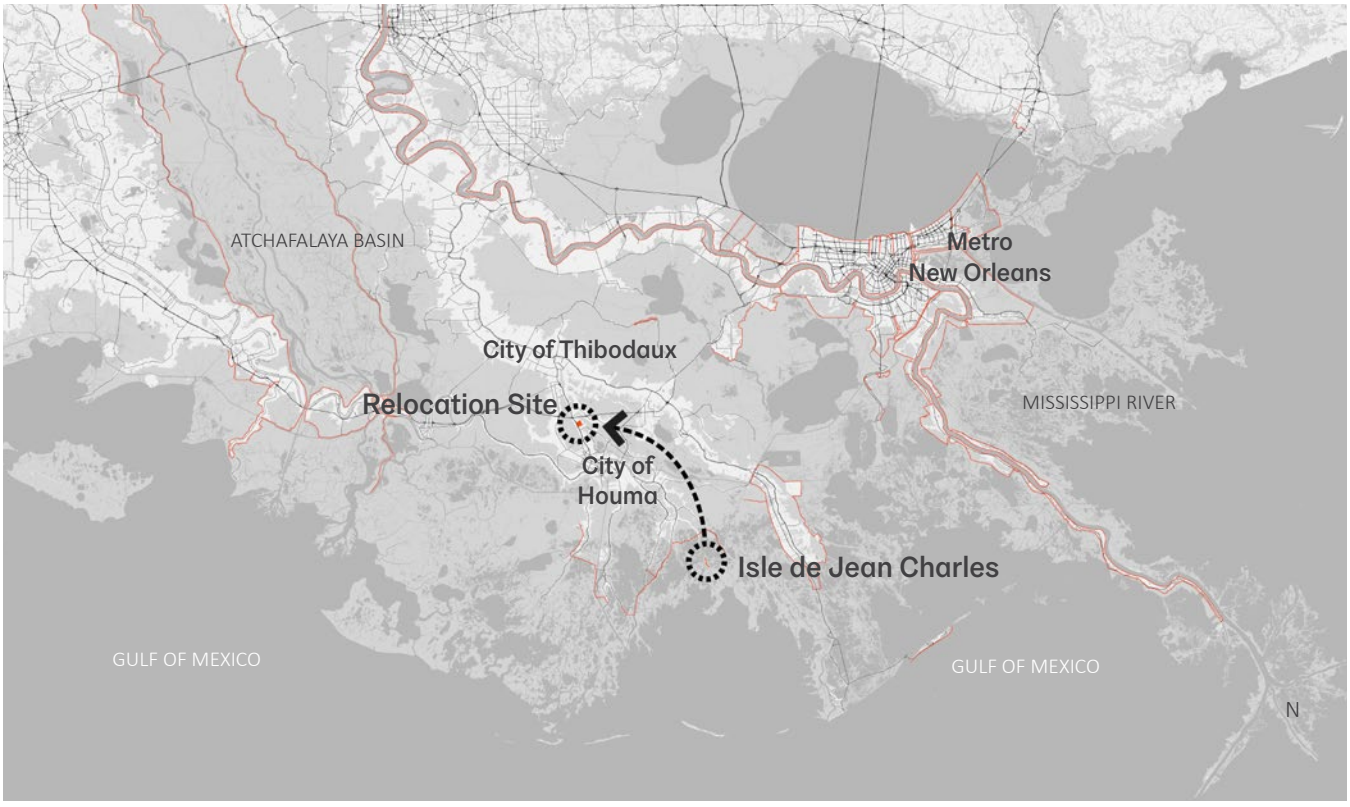


Figure 108. Site Relocation within Mississippi Delta Context
Sources: For all basemap data, see References

Figure 109. Island Homes

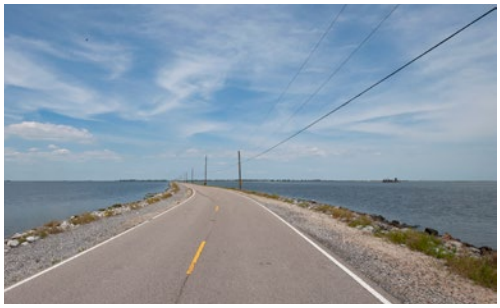
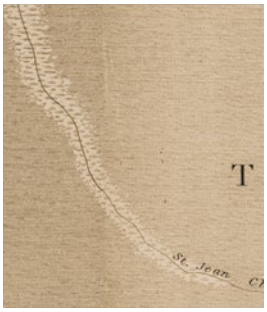


Figure 110. Island Road

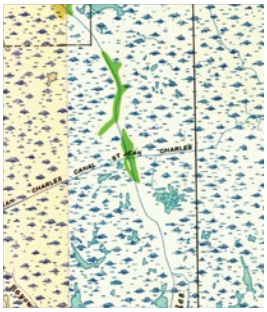
Figure 111. Island Marina

Figure 112. Island Timeline

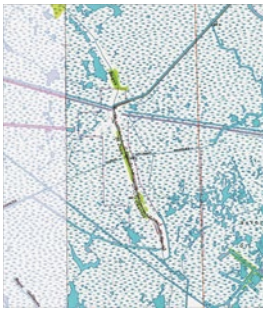
The aerials show a timeline of wetland loss leaving Isle de Jean Charles vulnerable to storm surge and rising sea levels.
Map Credits: USGS Historical Topographic Map Explorer



1892 – 1894
Distributary bayou ridge in a field of wetlands.



1939 – 1941
First canals are dredged for navigation.



1979 – 1980
Continued dredging of canals for oil and gas extraction and pipelines. First indication of canal encircling island.

1994 – 1998
Extensive wetland loss. Continued dredging of canals.

2018
Extreme wetland loss. Island surrounded by levees.

OCD-DRU is developing and implementing a geographically achievable, economically feasible, and culturally respectful resettlement strategy. The strategy recognizes that the challenges of resettlement do not end with a physical move to a new location. To be successful, the resettlement must protect the island's culture and support future generations. As such, the approach includes close collaboration with residents—as well as local, state, and federal stakeholders—in order to achieve an outcome that serves the island's residents and provides a replicable, scalable resettlement model for Louisiana and the nation.

The envisioned outcome is a systems-based approach to community-led planning and group migration. It is a small-scale, targeted strategy for culturally sensitive, at-risk communities and special needs groups, including the disabled, the elderly, disaffected minority groups, and very low-income populations. It is intended to capture, transfer, and nurture the community's socio-cultural value. While the community's deep connection to the rhythms and bounty of the island is irreplaceable, the approach works to sustain social and cultural bonds and provide opportunities for residents to sustain their self-sufficient lifestyles.

The physical separation from one's land cannot be minimized. However, in the process of losing this connection, principled planning can help the people preserve their culture, traditions, and sense of community. We must make every effort to ensure this vital bond remains strong for future generations.

Figure 113. Oak Trees at Site Entry
Oak trees at the residents' entry point to the site will be preserved.

Figure 114. Saint Louis Bayou
The bayou, flanked by natural wetlands, runs through the middle of the site.

Figure 115. Bayou Terrebonne/LA 24
The site is easily accessible from LA 24.

Figure 116. Draft Relocation Site Plan, September 2018

1	Residences	5	Market Space	9	Retail	13	Pasture
2	Bayou Blue Community Park	6	Festival Grounds	10	Wetlands Nursery	14	Reforestation
3	Community Center and Ballfields	7	Trail Network	11	Light Industry	15	Protected Wetlands
4	Constructed Fishing Pond	8	Assisted Living	12	Storage	16	Solar Field

LA SAFE Adaptation Strategies in the Isle de Jean Charles Relocation

As an exemplar of the LA SAFE Regional Adaptation Strategy, the Isle de Jean Charles project integrates the following adaptation strategies in support of the larger regional targets.

The new site and all development are wholly located within a low-risk zone.

Goal 1: Manage Flooding and Subsidence

Implement water management strategies that are based on natural systems and address all scales—regional, parish, and community programs as well as initiatives targeted to individual property owners.

The **entire property is designed to produce zero net runoff for a 10-year storm** and includes no subsurface drainage. Residential areas feature regrading to bioswales, which collect water to recharge Bayou Blue. A new lake and forebay **add storage capacity** and **improve water quality** within the parish drainage system. Shallow subsidence is mitigated by holding water on site, infiltrating where soils are most conducive, and avoiding buried drain pipes that could draw down the water table. Existing wetlands on site—a stabilizing element of the delta landscape—will be protected and improved.

On-Site Rainwater Capture

Integrated Stormwater Management

Expanded On-Site Water Storage Capacity

Goal 2: Plan for Safe and Affordable Development

Retrofit existing and create new safe, inclusive, and sustainable communities.

All new development is concentrated along high ground: the Bayou Terrebonne and Bayou Blue ridges. All buildings are sited above the 100-year floodplain, and **all houses are raised above the 500-year datum**. Recreation amenities woven throughout the community support healthy lifestyles and help sustain property values over time. All structures include **wind-resistant reinforcement**. **Passive solar shading** is embedded in the orientation of lots and homes by minimizing exposure to hot southwest sun. The site landscape strategy aids solar shading, facilities cool prevailing breezes, and encourages runoff infiltration. House types preference cross ventilation with openings on two opposite sides of nearly every room. The use of **durable materials** and **vernacular styles**, proven over time in this climate, helps reduce maintenance burdens. Solar energy is generated on site with a commercial-scale array and distributed arrays on individual homes.

On-Site Energy Generation

Passive Solar Shading and Natural Ventilation

Mixed-Use Housing and Commercial Development with Adjoining Industrial and Cultural/ Recreational Sites

Raised Building Prototype with Siting on Highest Ground, Increased BFE

Reduced Flood Risk Due to Avoidance of Floodplain

Goal 3: Improve Mobility throughout the Region

Support a resilient transportation system that includes multiple modes of transportation and promotes the creation of walkable communities.

The Isle de Jean Charles new community site is located along LA 24, a growing corridor, between Thibodaux and Houma, two growing regional centers. The highway provides an **evacuation route** and a **direct link to the island**. Public-facing development is clustered around **two regional bus stops along LA 24**. Balancing the community's strong desire for privacy with the need for intermodal connections, an **extensive network of trails**—for pedestrians, bicylces, and small electric vehicles—crisscrosses the site. The regional Amtrak station is located just over two miles by

Multimodal Link with nearby Amtrak, Site-Specific Bus Stops

Proximity to Evacuation Route

Goal 4: Diversify Educational and Employment Opportunities to Strengthen the Regional Economy

Integrate risk and adaptation practices into all levels of government and educational systems. Build a robust economy that diversifies the parish's economic base, supports residents' entrepreneurial spirit, and trains and retains parish workers in emerging industries.

Retail on site is tailored to residents' needs, including a **market hall** and **community kitchen**, plus ground lease options for community-compatible regional commerce. Planned future phase opportunities on site include light manufacturing, workshops, makerspaces, and assembly of prefabricated building components; **program collaborations** with Nicholls State University in Thibodaux, including plant nursery and orchard operations; and **skilled employment on site** through an assisted living facility.

Farmers' and Seafood Market, Community Kitchen and Garden

Modularized Fabrication Site

Goal 5: Support Healthy Communities, Regional Culture, and Recreational Access to Nature

Retain the region's culture and values as growth and development occurs. Incorporate diverse recreation opportunities to promote a healthy environment that allows residents to experience the region's natural beauty while maintaining a healthy, active lifestyle.

A trail network through the Green Heart—an existing wetland area on the site—gives residents **access to natural landscapes**. The trails also link a string of parks, playgrounds, and orchards interspersed between residential clusters along Bayou Blue. A **new lake and forebay** connected to the wetlands will be stocked by the Louisiana Department of Wildlife and Fisheries. **Playing fields and open meadows** will host organized and informal sports. A **festival ground** with covered pavilions and utility hook-ups will be able to host a variety of tribal and regional events. Throughout the site, iconic native plantings and tribally significant species reference the island landscape.

Stocked Lake for Fishing

Green Heart Trail Network

Community Center, Festival Ground, Sports Fields, Playgrounds

Figure 117. Residential Site Plan, September 2018
The residential area is planned on a man-made ridge adjacent to existing Bayou Blue, which will be expanded to hold excess stormwater as well as provide a recreational amenity for residents. An alternating pattern of residential plots and community parks forms a "petal" pattern.

Figure 118. Enlarged Petal Plan, August 2018
At left, the "petals" alternate to provide multiple types of lot adjacencies. Some lots are bayou facing, while others face forest, community parks, or prairie conditions. Within each petal, houses and landscaping are arranged to afford each residence privacy.

Figure 120. Engagement
Island residents have been involved throughout the design process, providing critical direction for the design team. Above, the design team presents a model that shows the "petal" arrangement of residential sites around the bayou.

Figure 119. Relocation Site Rendering, January 2019

Residential Prototypes

The design team is developing **four prototypical residential designs**, each **with flexible design components** that can be adapted for each family's needs. Each design can be altered for the number of bedrooms, outdoor living spaces (such as screened porches, covered patios, and sheds for protected storage), building cladding (such as metal siding or hardy panels), and landscape elements.

A set of **Architectural Design Guidelines** provides a set of criteria for the prototypes, intended to provide a basis of design as each prototype is uniquely adapted for each family. These guidelines provide recommendations for site strategy; water management techniques; exterior cladding; floorplan adaptability; mechanical, electrical, and plumbing considerations; and future additions or renovations.

Figure 121. Prototype House Elevation, August 2018

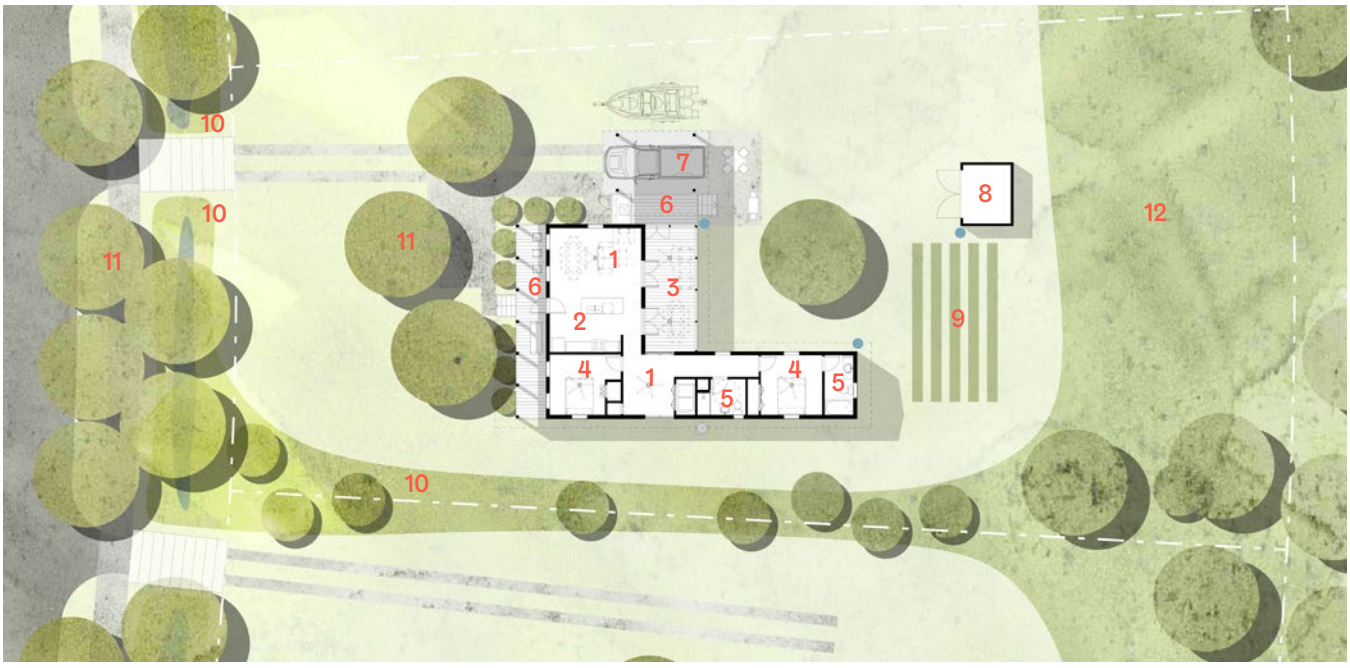


Figure 122. Prototype Site Plan, August 2018
Each residence will be placed on its site to maximize passive cooling. Landscaping shields the exterior walls from hot summer sun. The scheme above features two bedrooms and several covered exterior spaces, which could be adapted for more bedrooms or more interior space. Landscaping elements are unique to each site, providing both shade and privacy.

Legend

1 Living	4 Bedroom	7 Covered Carport	10 Bioswale
2 Kitchen	5 Bathroom	8 Storage Shed	11 Trees for Shade and Privacy
3 Screened Porch	6 Covered Porch	9 Vegetable Garden	12 Access to Reforested Area

Figure 123. Site Rendering, January 2019
The residential neighborhood maximizes the natural surroundings, providing each house a connection to land and water.

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5 Realizing the Vision

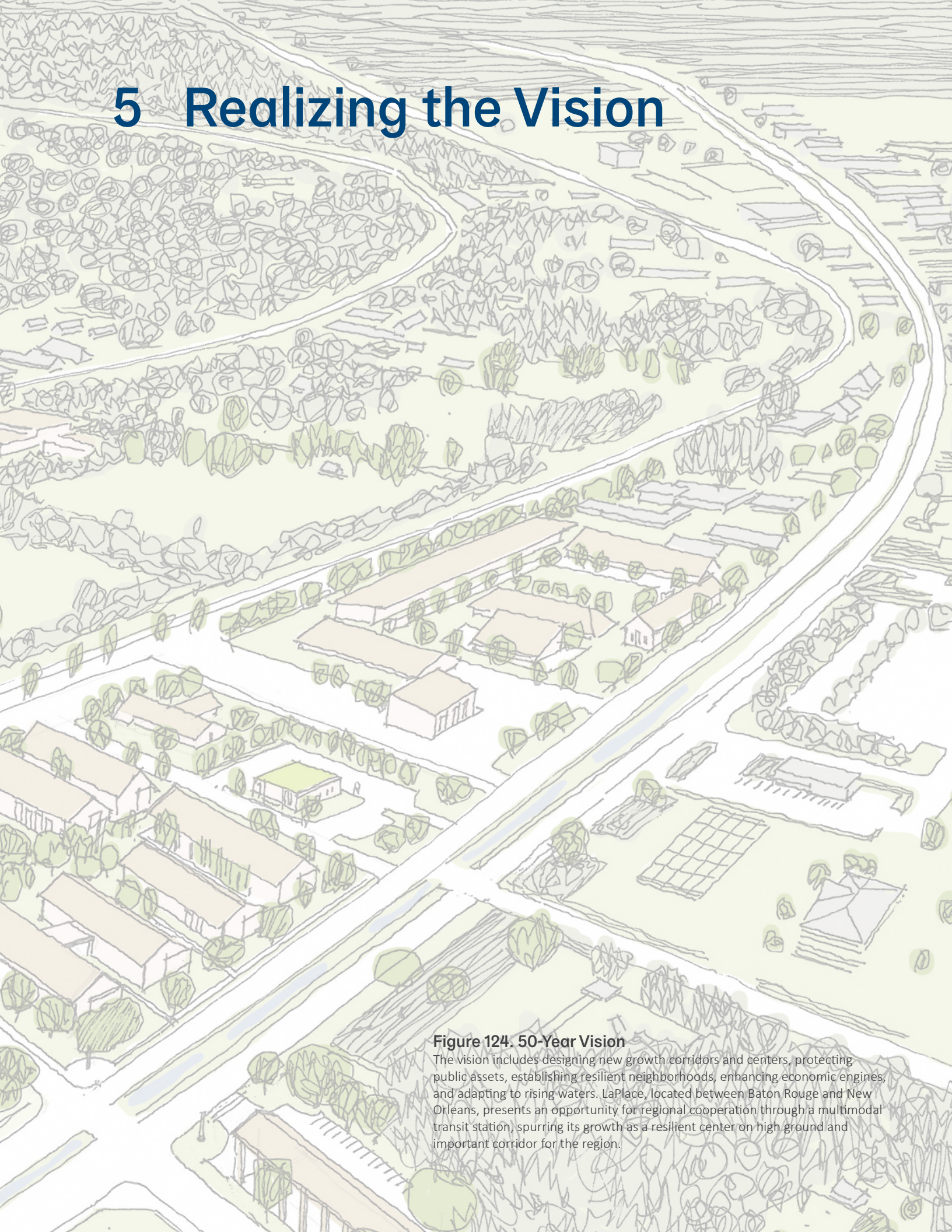


Figure 124. 50-Year Vision
The vision includes designing new growth corridors and centers, protecting public assets, establishing resilient neighborhoods, enhancing economic engines, and adapting to rising waters. LaPlace, located between Baton Rouge and New Orleans, presents an opportunity for regional cooperation through a multimodal transit station, spurring its growth as a resilient center on high ground and important corridor for the region.

Call to Action

Our time is now. Our current experience tells us so.

Louisiana has much to offer in response to the risks and vulnerabilities that we collectively face. Our state's myriad assets and resources form the economic and cultural anchors that create the place that so many rely on for our income, our education, and our long-term future. These create attractions for visitors who help to fuel local economies and set the basis for historic and new industries to call Louisiana home. To maintain and build on these assets, Louisianians need a future vision that acknowledges the changes to come and the opportunities and challenges that accompany those.

The LA SAFE Regional Adaptation Strategy begins the process.

Many of Louisiana's resources will experience increasing challenges as sea level rise and subsidence meet an increasingly warm region. Compounded with shifts in economic trends and changes in industries reliant on ecosystems, the state will experience significant change, as it has over its 300-year history. These changes, while perhaps unwelcome initially, offer opportunities to reflect on the pathways available for improving economies, reinvigorating ecosystems, and supporting cultures.

Louisianians must acknowledge that all aspects of our decisions—from housing to transportation to economic development—are influenced by the risks and are open to new opportunities. Although many of our historic decisions have increased risks, especially flood risk, we are poised to challenge norms. Through our collaborative partnerships, our innovation, our tenacity, and our commitment to this place that we lovingly call home, we can introduce constructive change. These adaptations can simultaneously address our vulnerabilities and open doors to new possibilities for our youth, who will undoubtedly look to us for guidance now and require explanations in times to come.

It won't be easy to make these changes, but Louisianians are strong people who are committed to this place we call home.

It will require leadership, political will, an informed public, and financial resources. Without this shared willingness and strength, Louisiana will lose significant portions of its economic, cultural, and historic assets and increase vulnerabilities among all its populations. But Louisianians are innovators in many ways, from pirogues to pralines, from zydeco to shrimp boats, from biosciences to ecological restorations. Our culture, in fact our settlement, is a creative act, every single day. We know how to think this way because it's in our bones.

The LA SAFE Regional Strategy offers an initial reference of how we might make creative leaps, how we respect who we are while positioning ourselves for who we can become. We have this thinking within us and are now in a place where we have to make hard decisions that will have a major impact on Louisianians' lives.

We can do this.

Next Steps

The LA SAFE Regional Adaptation Strategy sets the stage for a further collaborative effort to link the investments being made through state and local programs and the recommended actions identified herein. For each recommended action, it is important to understand where related programs might be further expanded or tweaked to allow for greater impact across the various activities.

Through this careful interweaving of goals, strategies, and actions, the OCD will leverage good work across the state with the potential for additional transformative change stemming from the engagements that LA SAFE brought to so many communities. In doing so, it advocates for collective understanding, which in turn leads to collective action.

Transparency of this effort to Louisianians further expands dialogues while inviting citizen-awareness campaigns and encouraging engagement in the actions across the state.

To that end, the LA SAFE Regional Adaptation Strategy is an initial step in establishing a 50-year vision—a publicly shared one—that encourages a broadening of the dialogue and the investment linkages to serve the greater good of Louisianians.

Recommendations at a Glance

LA SAFE addresses community resilience holistically—**integrating risk planning with planning for stormwater management, housing, transportation, economic development, education, recreation, and culture**. LA SAFE recommends the following goals and strategies, including specific action items needed to implement the strategies over a 50-year time frame.

The below recommendations followed an extensive community visioning and input effort. LA SAFE's outreach and engagement campaign encompassed 71 individual public meetings across five rounds of events in each of the six LA SAFE parishes. These efforts are further detailed in **Chapter 2: LA SAFE Process**.

Manage Flooding and Subsidence

Institutionalize considerations of future flood risk in daily operations and programs within state agencies

A: Develop a means for statewide oversight and coordination of regional adaptation initiatives. Connect with neighboring states and complementary programs.
B: Require state agencies to assess flood risks to their physical assets based on best available data, including Coastal Master Plan projections, and to prioritize allocation of resources with this in mind. Continue to monitor as projections evolve and the Coastal Master Plan is updated.
C: Require state agencies to include current and future land loss and population movement in their program evaluations and updates.

Align public funding and project prioritization to promote green infrastructure and stormwater management

A: Develop watershed-based stormwater policies across jurisdictional boundaries.
B: Require that all publicly funded capital projects in the state capture and store at least 1.25 inches of rainfall in the first hour of a rain event.
C: Develop or adopt existing safety guidelines for graywater use.
D: Incorporate stormwater management functions in recreational areas.

Incentivize the incorporation of stormwater management features and green infrastructure in private development

A: Encourage local governments to develop green infrastructure programs.
B: Provide incentives for investment in stormwater best practices on private property.
C: Promote the use of shared detention areas adjacent to property owners.
D: Provide outreach, education, and technical assistance for best management practices in stormwater management and green infrastructure as well as updates on the current status of local stormwater management systems.

Plan for Safe and Affordable Development

Encourage elevation of homes based on current and future flood risk

A: Require all new development or substantial rehabilitations of existing properties be built to two feet above the base flood elevation for a 100-year flood or to the 500-year floodplain.
B: Develop equitable financial incentives and education to assist with home elevations and ensure elevation support for all residents.
C: Include weatherization programs and wind fortification, extreme heat, and seismic upgrades with home elevations to address multiple risk factors.
D: Develop an education and marketing program to encourage pier-and-beam construction.

Plan for future development based on risk typologies with mixed-use residential growth in low-risk areas

A: Create small area plans to accommodate future development in low-risk areas.
B: Develop zoning incentives to attract mixed-use development in low-risk areas.
C: Create an optional buyout program for full-time residents in high-risk areas.
D: Ensure demolition at the end of life of commercial developments in high-risk areas, upon long-term vacancy.

Identify ways to address insurance affordability

A: Analyze the feasibility for Louisiana to leave the NFIP and develop its own flood insurance program.
B: Provide support and incentives to communities in the floodplain for participation in FEMA's Community Rating System (CRS).

Improve Mobility throughout the Region

Promote well-connected, multimodal transportation options within parishes and across the region—including water transportation—to better connect existing communities to emerging and growing sectors, industries, and job opportunities

A: Require the use of Base Flood Elevation (BFE) and CPRA 50-year flood risk projections when planning future transportation routes.
B: Model the impacts of new transportation projects on hydrological processes.
C: Improve connectivity between transportation routes and natural destinations.
D: Prevent future loss of purchasing power to help pay for the backlog of maintenance.
E: Prioritize multimodal transportation options and improve access within and among communities.
F: Update and improve Louisiana's Complete Streets Policy.
G: Implement any recommendations that DOTD has not yet adopted.

Protect and elevate key supply chain and evacuation routes

A: Identify and improve key transportation and evacuation routes vulnerable to current or future flooding and other weather events.
B: Incorporate existing transportation assets into evacuation plans.

Diversify Educational and Employment Opportunities to Strengthen the Regional Economy

Increase coastal education for students of all ages

A: Introduce a statewide curriculum about the state's coastal landscapes for pre-K – 12 students. Once implemented, expand the curriculum to include instruction about Louisiana's regional land and water ecosystems.
B: Expand weekend and summer camp opportunities for coastal education.

Expand skills training in coastal careers

A: Develop a coastal specialization pathway for high school students who seek either Jump Start or TOPS diplomas.
B: Match education with skill needs of local employers.
C: Support apprentice-based model for coastal careers.
D: Build Louisiana's expertise in coastal and stormwater management.
E: Offer retraining programs in emerging coastal careers such as adaptation, mitigation and recovery, wetlands protection, and aquaculture.

Grow and diversify the economy

A: Promote Louisiana expertise in coastal restoration and adaptation.
B: Support and foster emerging economies.

Support Louisiana seafood and fishers

A: Understand how environmental changes will affect Louisiana fisheries.
B: Assist the fishing industry to adapt and distribute locally.
C: Provide technical assistance and loans to help commercial fishers diversify their businesses during commercial off-seasons.
D: Increase fisheries certification.
E: Develop and promote the Louisiana seafood label.
F: Create a marketing and branding training program for fishers.
G: Provide research and assistance for adopting sustainable fisheries.

Support Healthy Communities, Regional Culture, and Recreational Access to Nature

Increase access to nature for recreational use and ecotourism

A: Support businesses that provide recreational services.
B: Promote ecotourism opportunities at the state level.
C: Expand access to outdoor recreational opportunities for Louisiana youth.

Preserve and support Louisiana's culture and heritage

A: Host cultural events and programs in conveniently located, accessible places.
B: Expand the state's Percent for Art program.
C: Capture the culture and history of high flood risk areas.
D: Promote local tourism.
E: Invest in and use existing and new marketing tools to promote Louisiana.

Encourage development that is informed by an understanding of the relationship between public health and the built environment

A: Use municipal ordinances and incentives to incorporate public health objectives and strategies into new developments.
B: Provide a state best practices guideline for minimizing negative health impacts of development.
C: Address mental health issues associated with living in areas of risk uncertainty.

Figure 125.Regional Wetlands
Water is both a driver of the economy and a source of recreation in coastal Louisiana. A kayaker takes advantage of a wetland area in lower Plaquemines Parish.

Appendices

Appendices

Appendix A: LA SAFE Process Evaluation Report

The LA SAFE program supported an inclusive public process to identify adaptation strategies to enhance the resilience of coastal Louisiana. This public process involved the six parishes most impacted by Hurricane Isaac in 2012: Jefferson, Lafourche, Plaquemines, St. John the Baptist, St. Tammany, and Terrebonne. Throughout the planning and implementation process, UNO-CHART conducted an evaluation in an iterative manner that allowed for continual feedback. The evaluation was a mixed methods process that included both qualitative and quantitative measures, involving both process and outcome measures. In this process analysis, the evaluation team reviewed team meeting notes, current plans for the six parishes, and ethnographic notes and survey results from the community meetings, in order to document and assess the LA SAFE planning process.

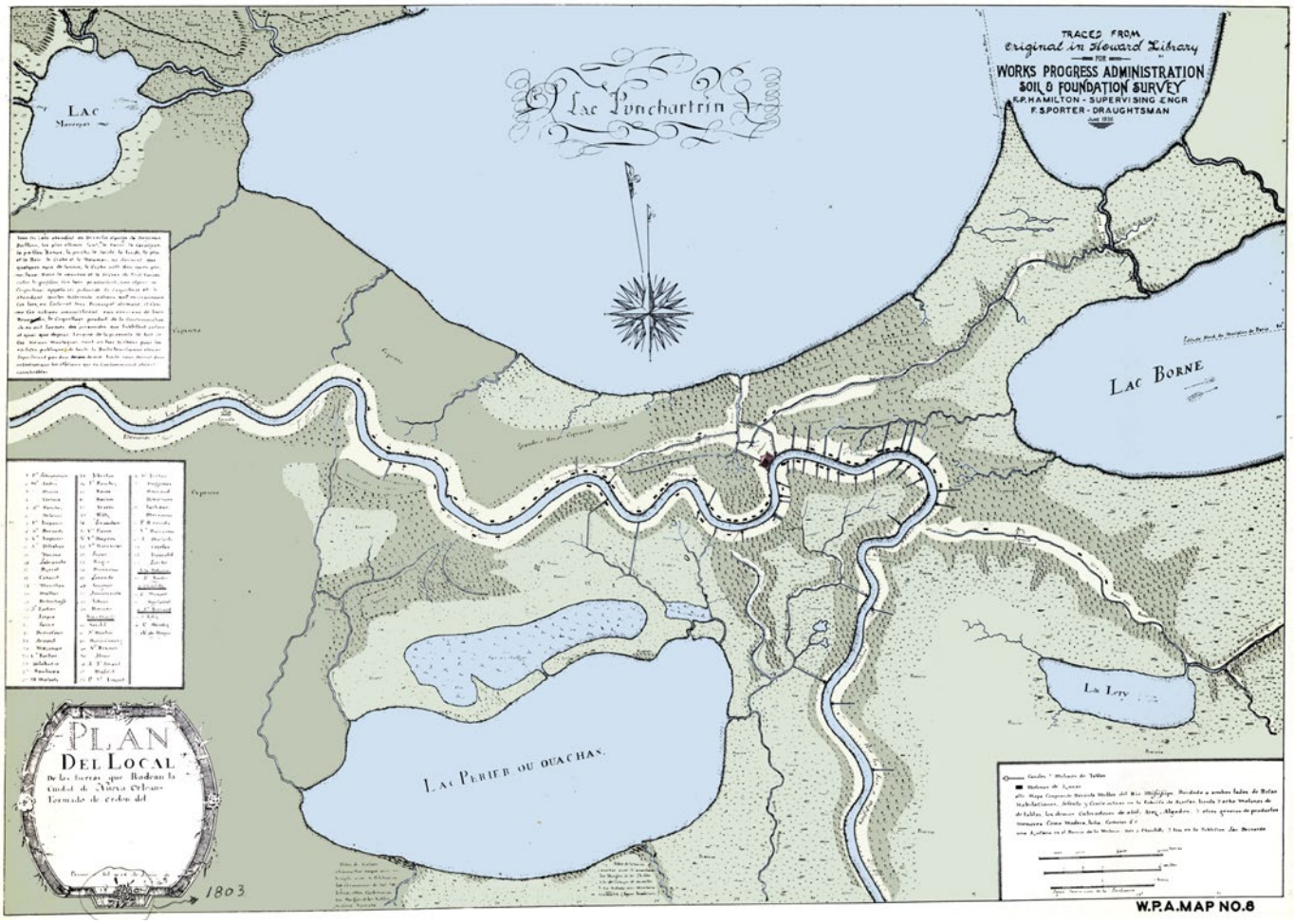
The report is available for download.

Appendix B: Community Rating System (CRS) Reports

As part of LA SAFE's comprehensive planning efforts, UNO-CHART assessed the participation of LA SAFE parishes in the National Flood Insurance Program (NFIP) Community Rating System (CRS), in order to make recommendations to improve participation in the program. Reports for each parish provide current CRS ratings, summaries of CRS activities, and recommendations for short- and long-term goals related to the implementation of the program. Parish floodplain managers and CRS coordinators provided information on each community's CRS activities through in-person meetings and digital communication. FEMA and Insurance Services Office (ISO) also provided data for the reports.

These six parish reports are available for download.

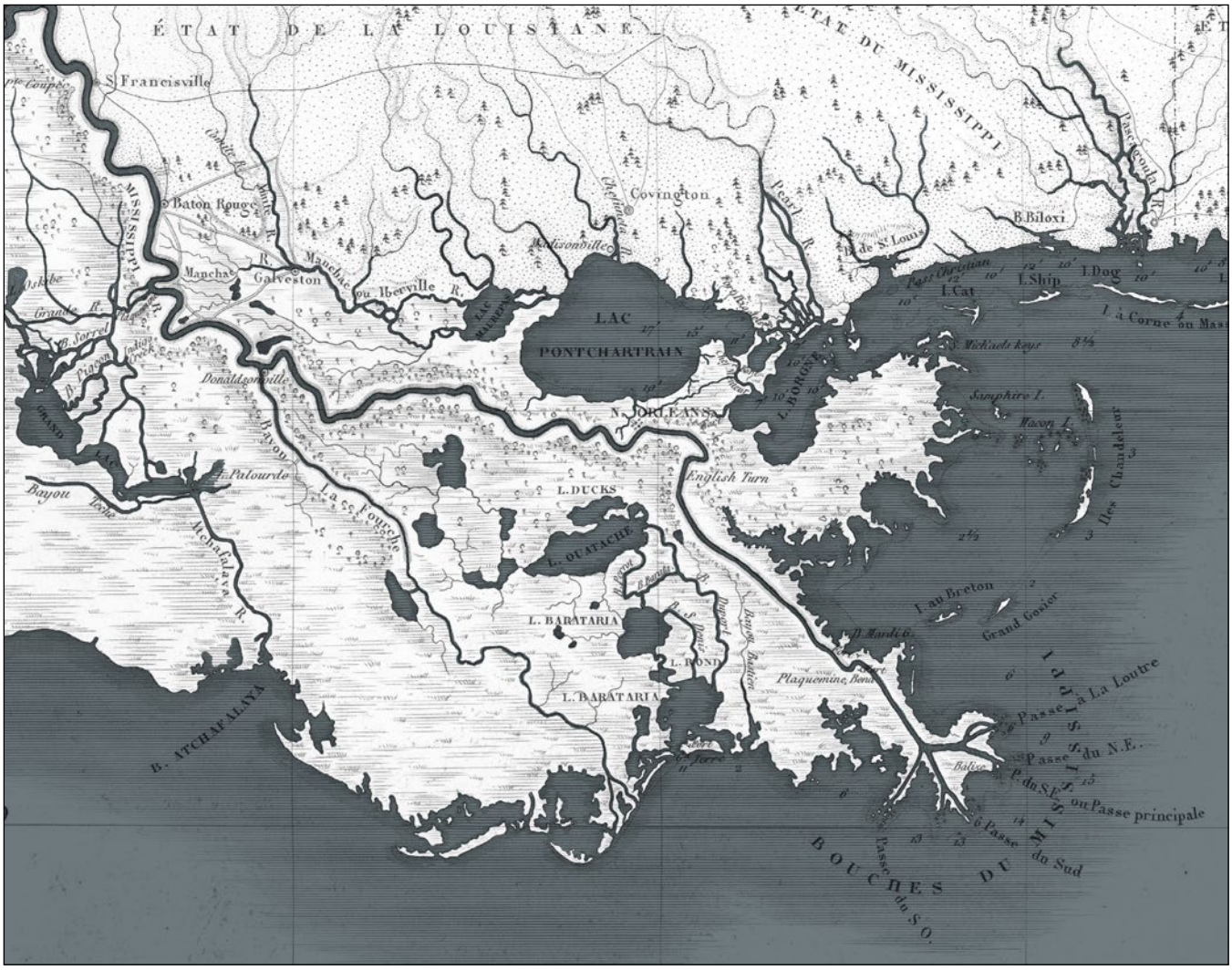
Map Atlas



MAP 17. LOUISIANA, 1803

Drawn in 1803 and traced by the Works Progress Administration (WPA), the map indicates the higher ground along the Mississippi River and ridges along the bayous.

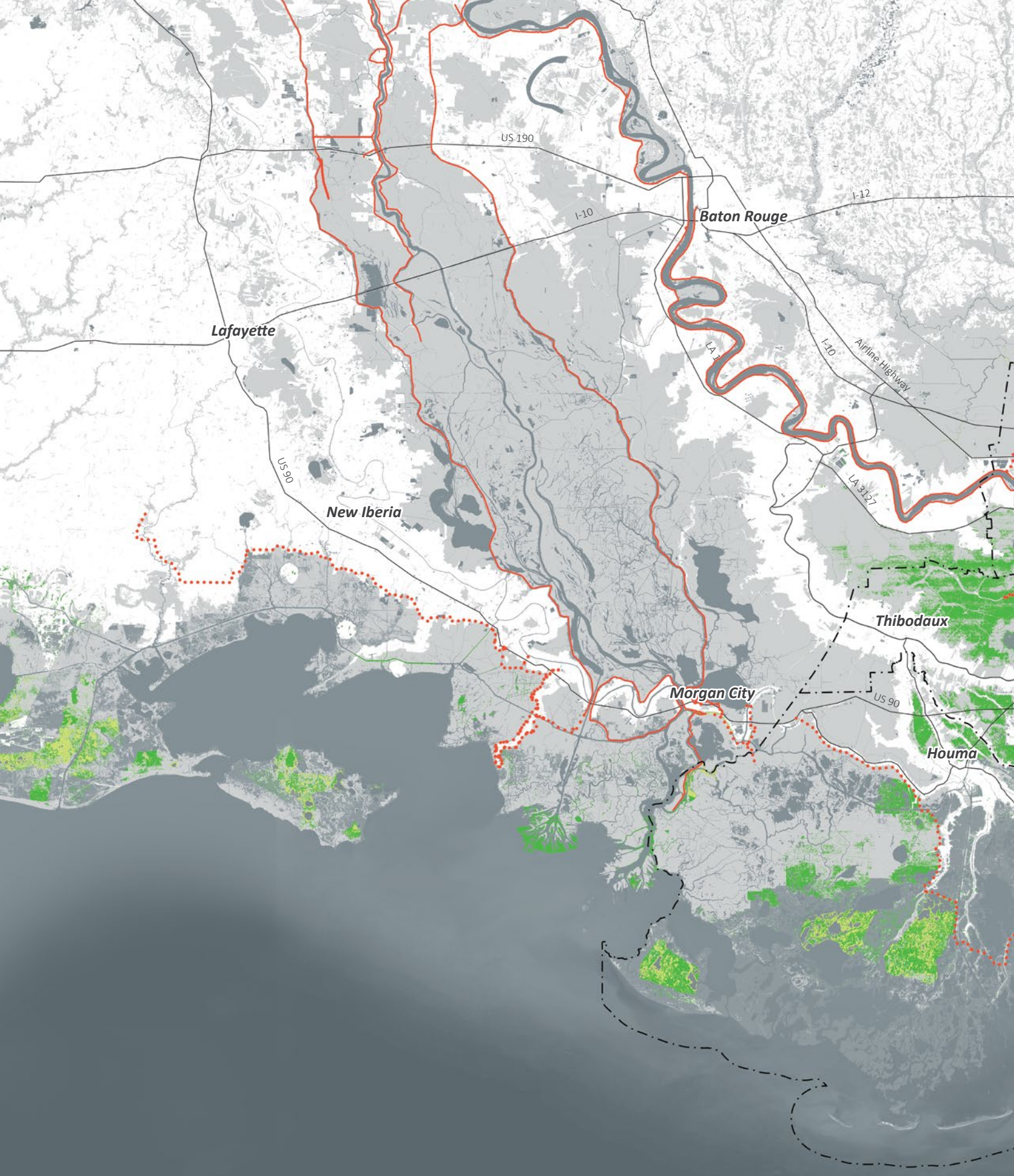
Map Credit: (original) Plan Del Local De las tierras que Rodean la Ciudad de Nueva Orleans, created by Carlos Laveau Trudeau, 1803, The Historic New Orleans Collection; traced by WPA, 1936; coloration by Waggonner & Ball



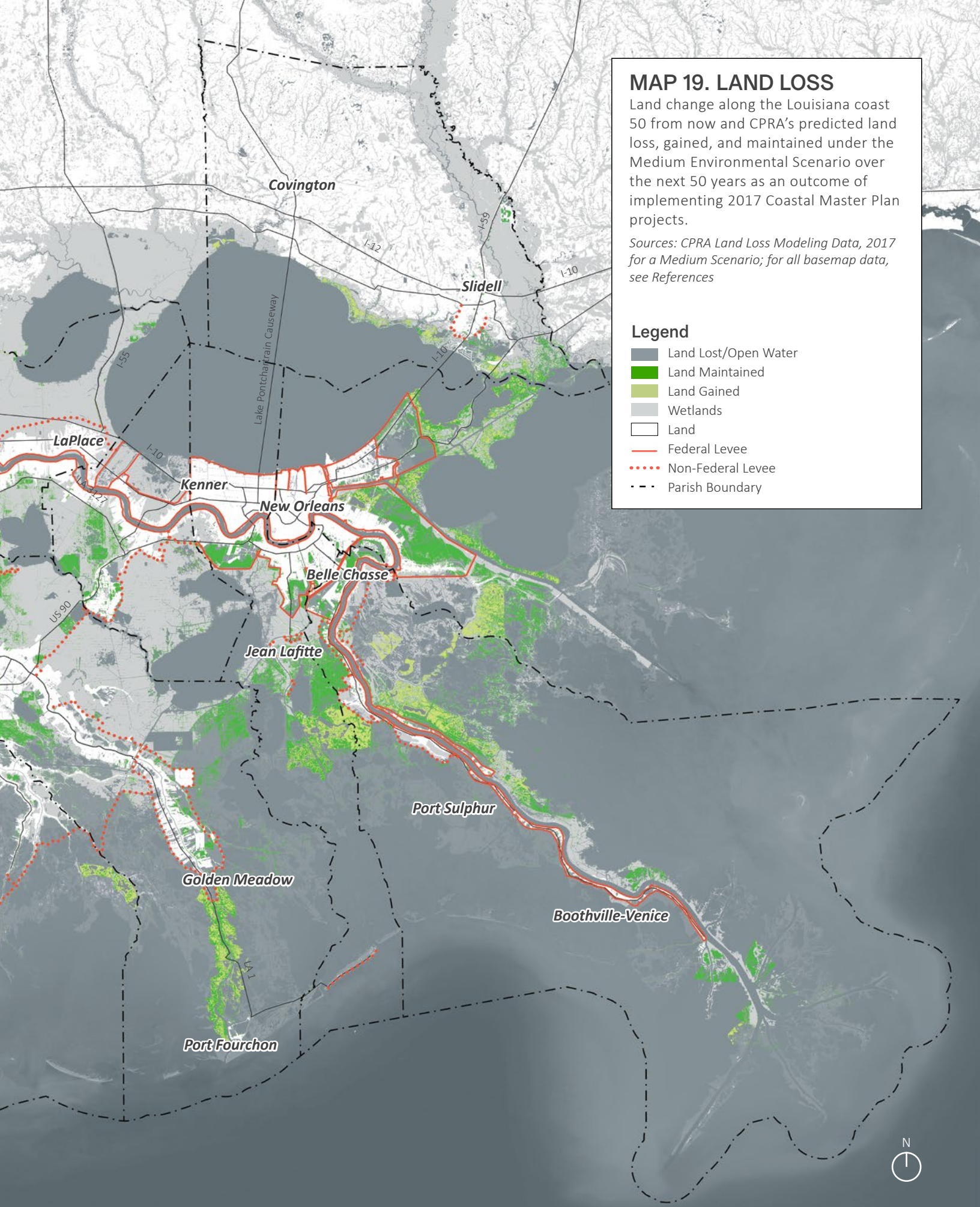
MAP 18. LOUISIANA, 1820s

Map of Louisiana circa 1820 shows the extent of the region's wetlands and shoreline condition.

Source: David Rumsey Map Collection, 1820; coloration by Waggonner & Ball



2067 Predicted Land Loss



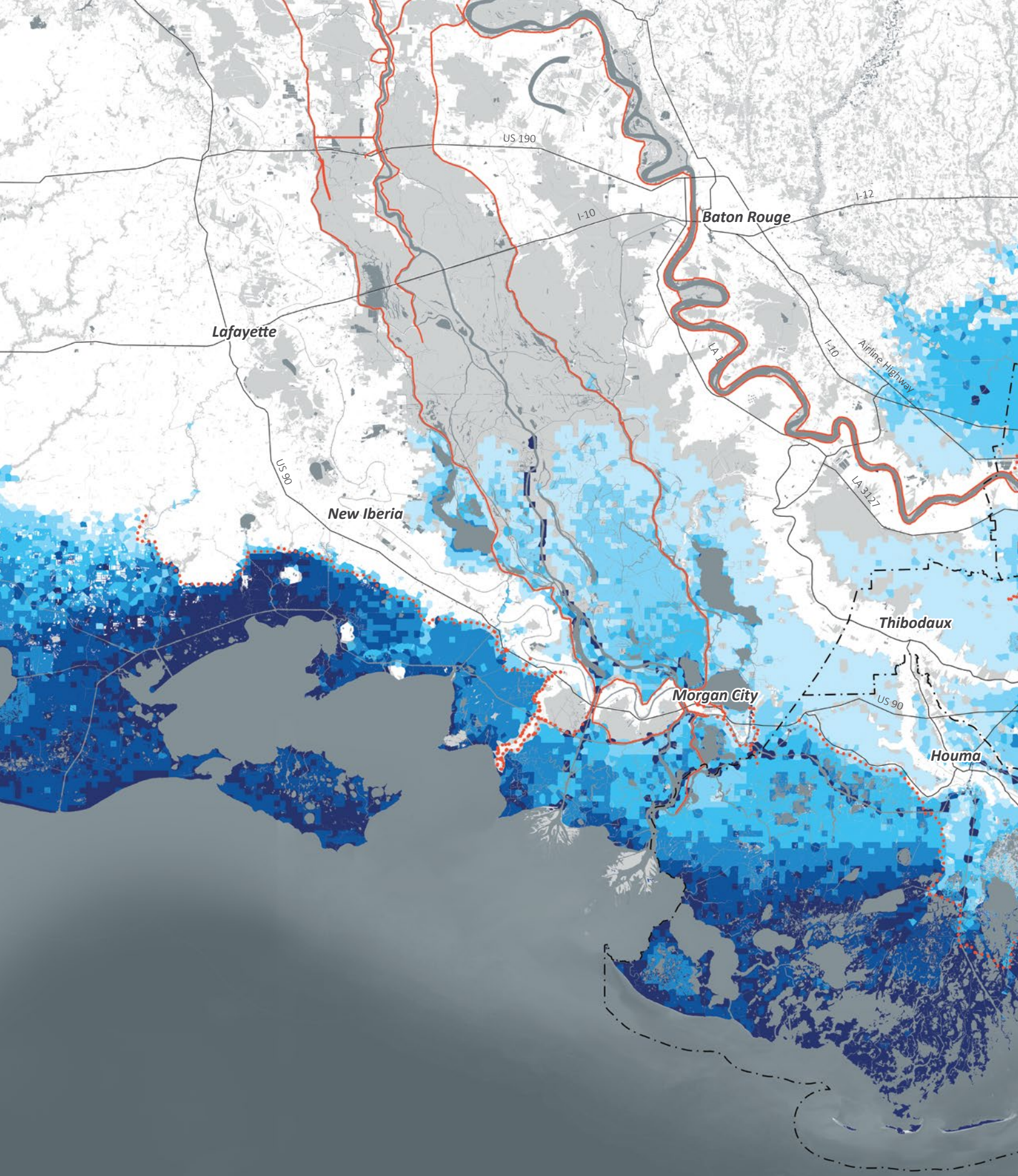
MAP 19. LAND LOSS

Land change along the Louisiana coast 50 from now and CPRA's predicted land loss, gained, and maintained under the Medium Environmental Scenario over the next 50 years as an outcome of implementing 2017 Coastal Master Plan projects.

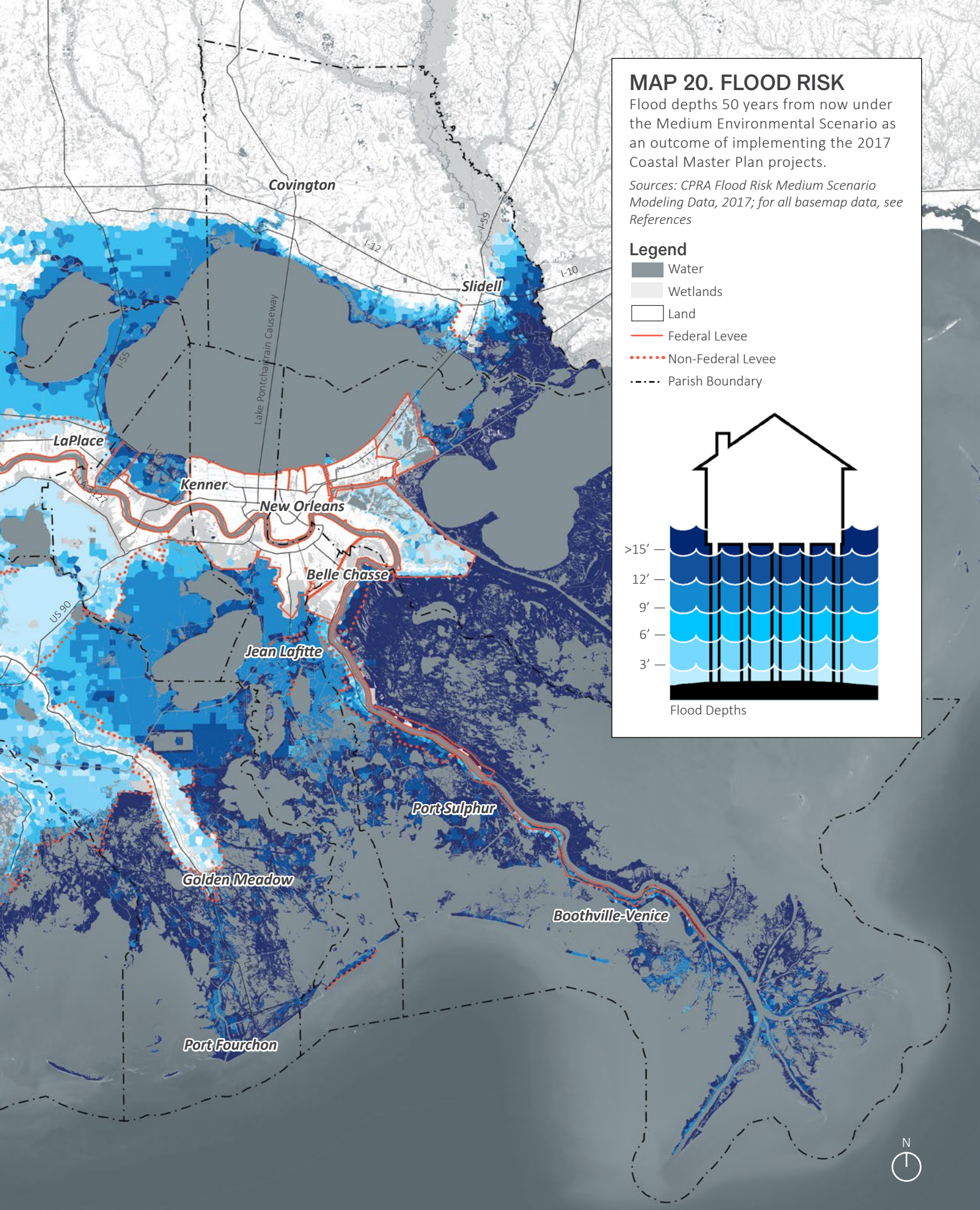
Sources: CPRA Land Loss Modeling Data, 2017 for a Medium Scenario; for all basemap data, see References

Legend

- Land Lost/Open Water
- Land Maintained
- Land Gained
- Wetlands
- Land
- Federal Levee
- Non-Federal Levee
- Parish Boundary



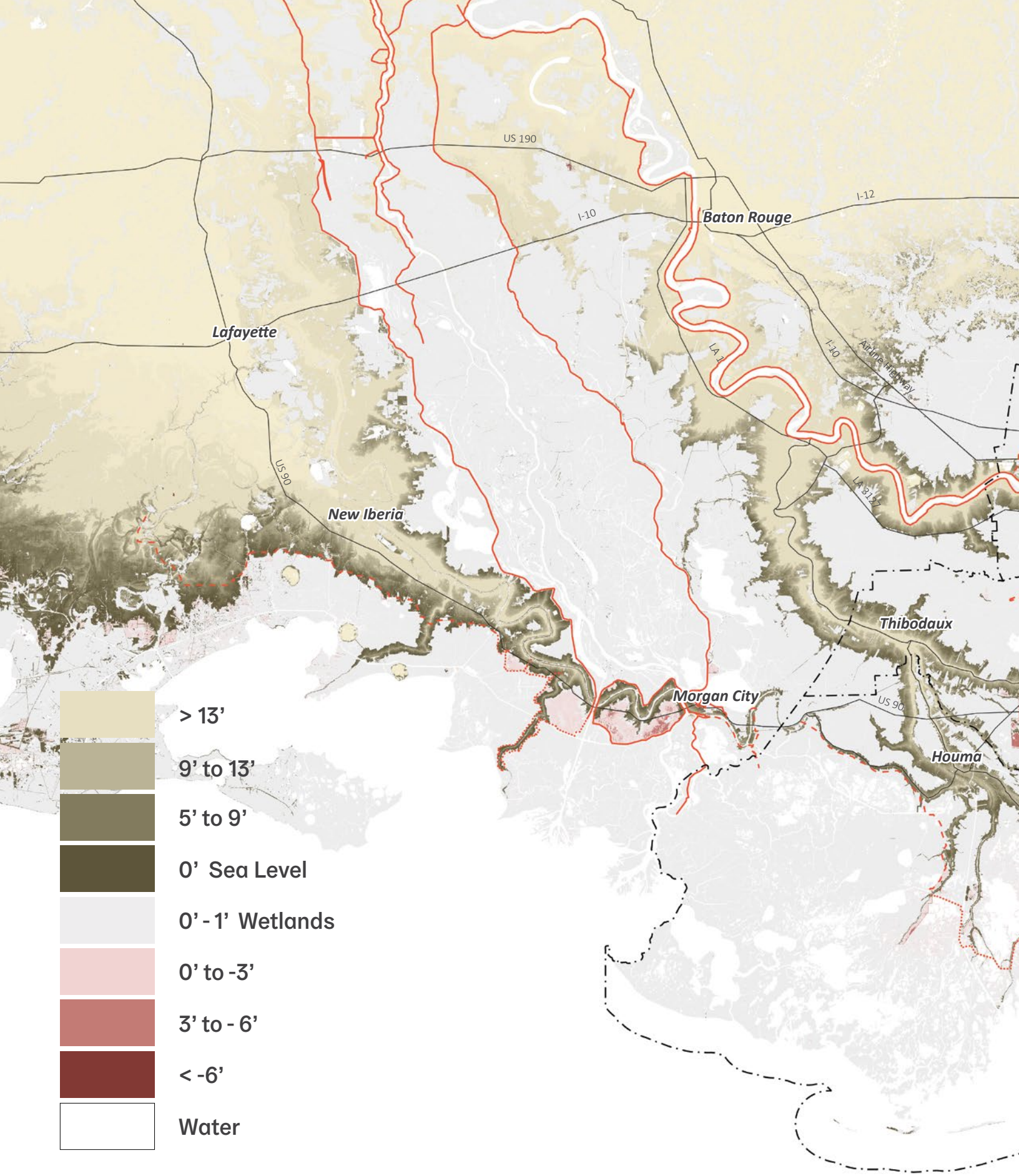
2067 Predicted Storm Surge Flood Risk



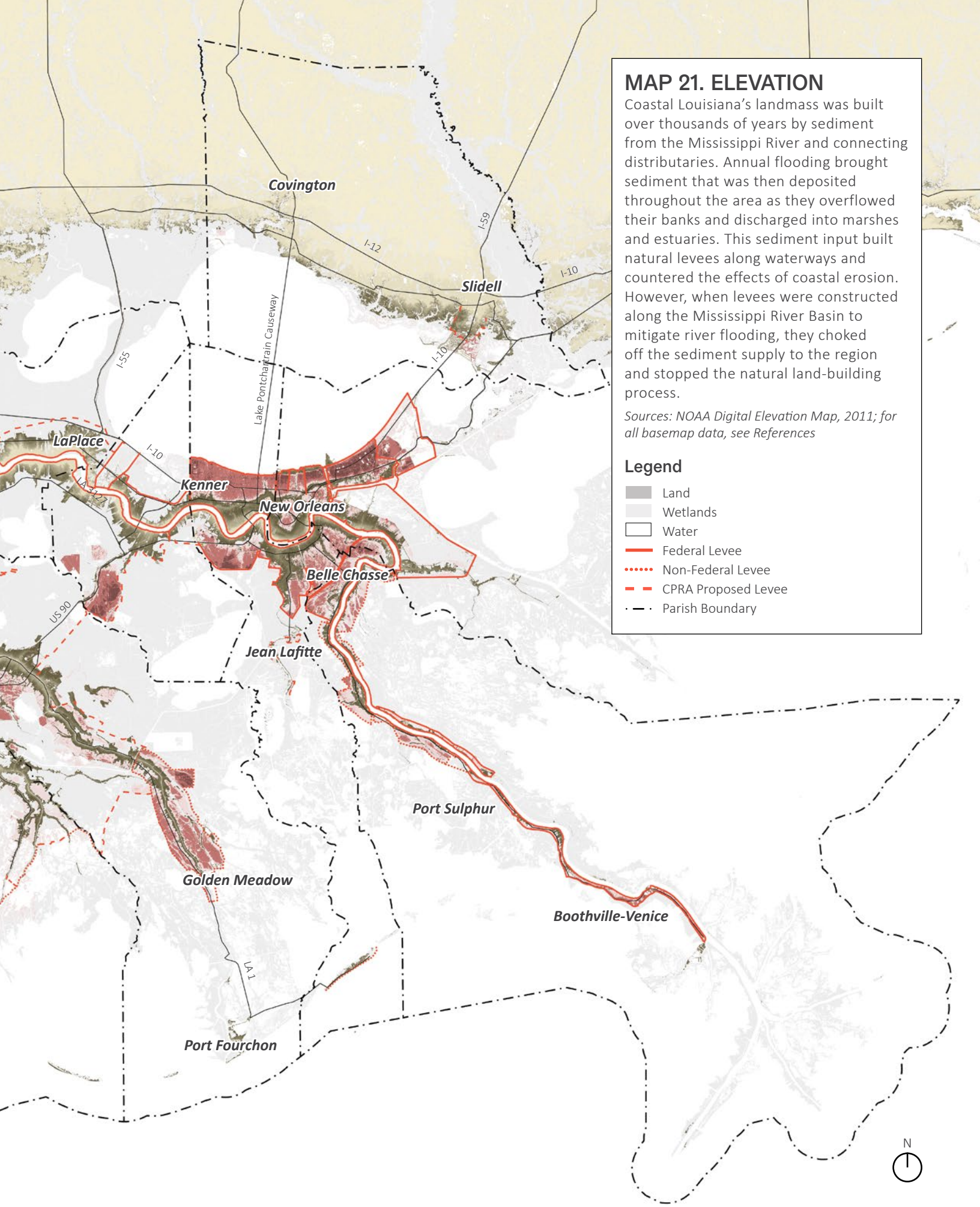
MAP 20. FLOOD RISK

Flood depths 50 years from now under the Medium Environmental Scenario as an outcome of implementing the 2017 Coastal Master Plan projects.

Sources: CPRA Flood Risk Medium Scenario Modeling Data, 2017; for all basemap data, see References


US 190
I-10
Baton Rouge
I-12
Lafayette
LA 1
I-10
Airline Highway
US 90
New Iberia
LA 3127
Thibodaux
Morgan City
US 90
Houma
> 13’
9’ to 13’
5’ to 9’
0’ Sea Level
0’ - 1’ Wetlands
0’ to -3’
3’ to - 6’
< -6’
Water

Elevation



MAP 21. ELEVATION

Coastal Louisiana's landmass was built over thousands of years by sediment from the Mississippi River and connecting distributaries. Annual flooding brought sediment that was then deposited throughout the area as they overflowed their banks and discharged into marshes and estuaries. This sediment input built natural levees along waterways and countered the effects of coastal erosion. However, when levees were constructed along the Mississippi River Basin to mitigate river flooding, they choked off the sediment supply to the region and stopped the natural land-building process.

Sources: NOAA Digital Elevation Map, 2011; for all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

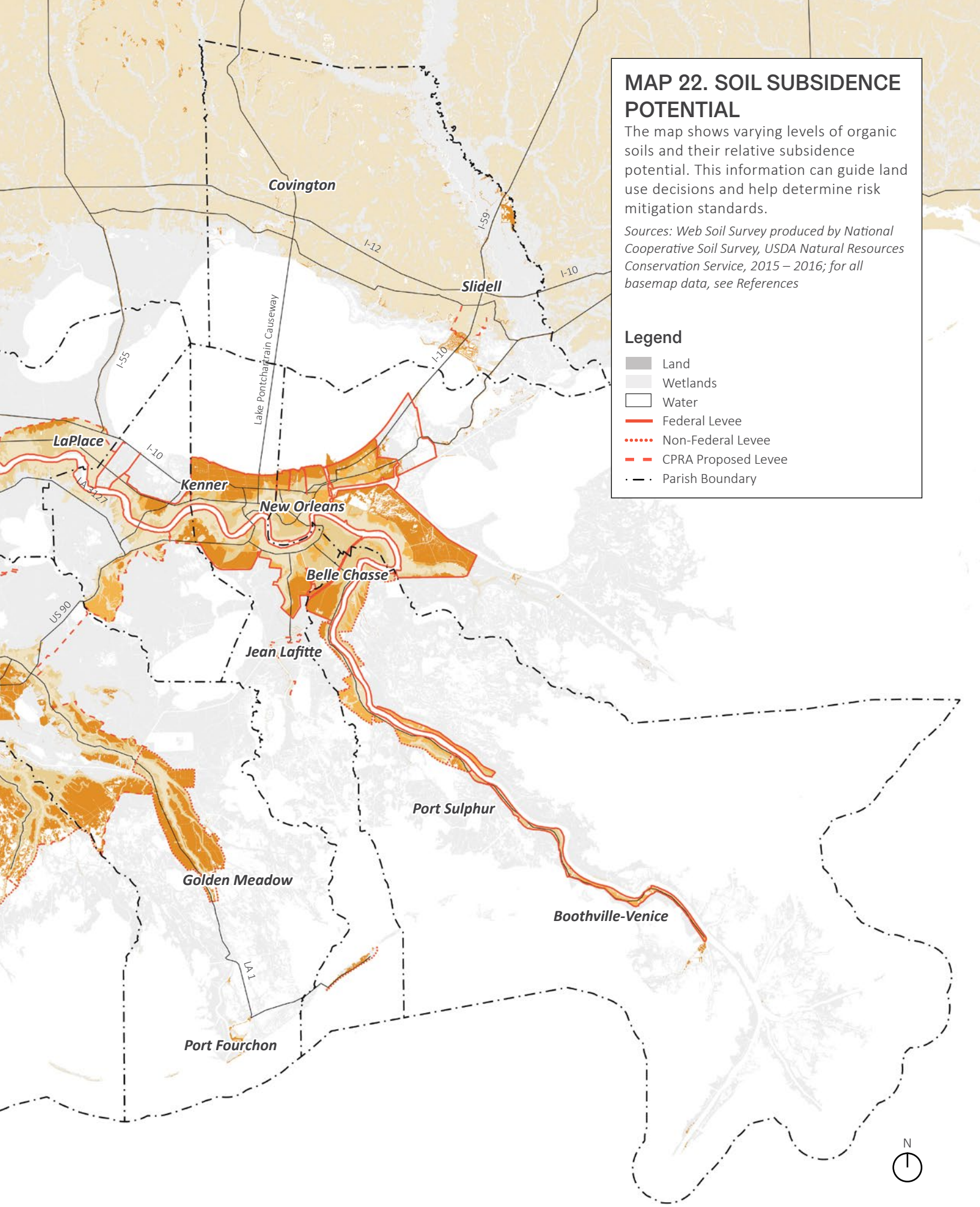
Delta soils are like a sponge. Organic soils are only stable when they are full of water. When they dry out, they shrink.

Highly Organic Soils
High Subsidence Potential

High Plasticity Silt and Clay Soils
Shrink and Swell Potential

Low Plasticity Silt and Clay Soils
Lower Shrink and Swell Potential

Soil Subsidence Potential



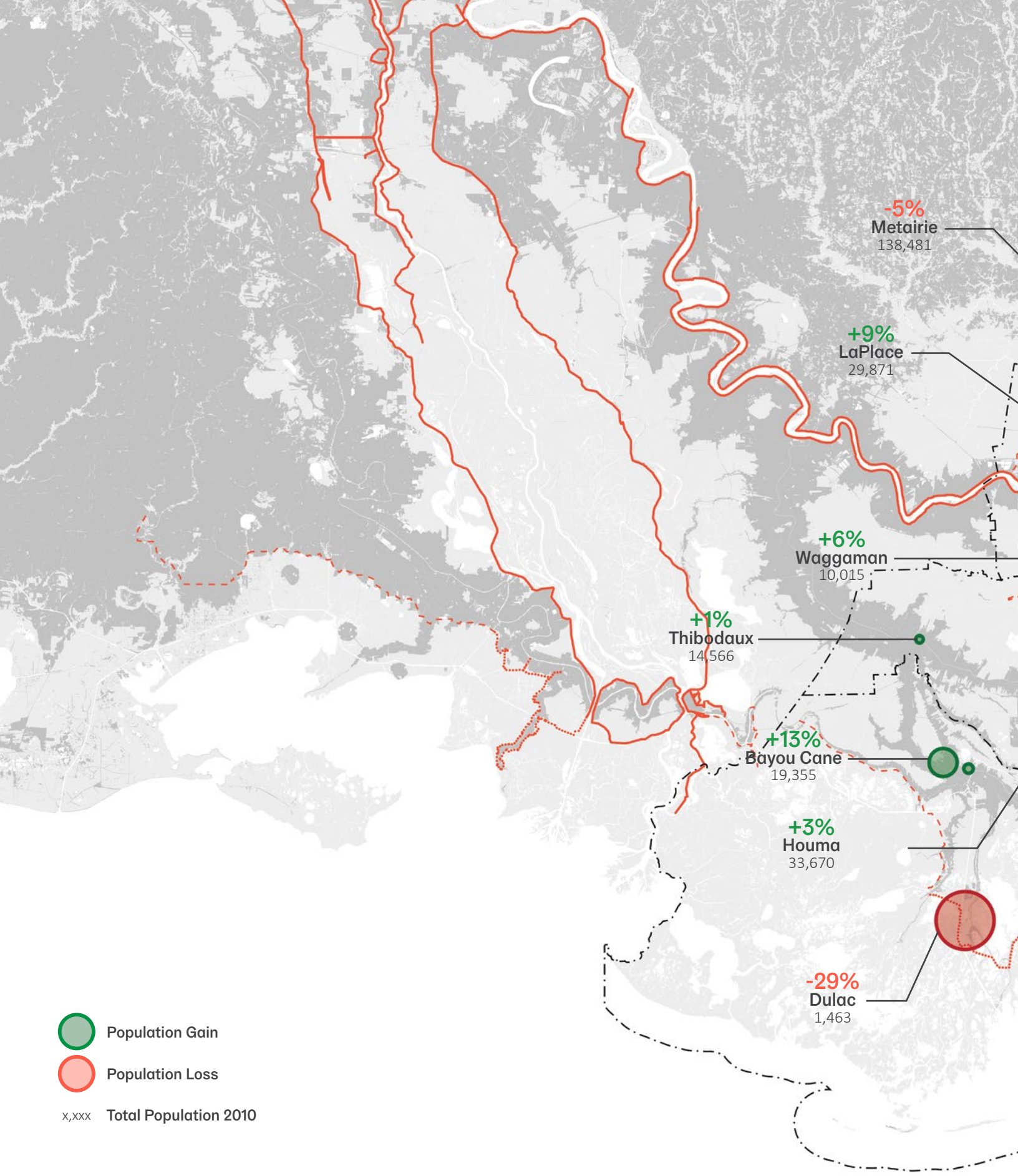
MAP 22. SOIL SUBSIDENCE POTENTIAL

The map shows varying levels of organic soils and their relative subsidence potential. This information can guide land use decisions and help determine risk mitigation standards.

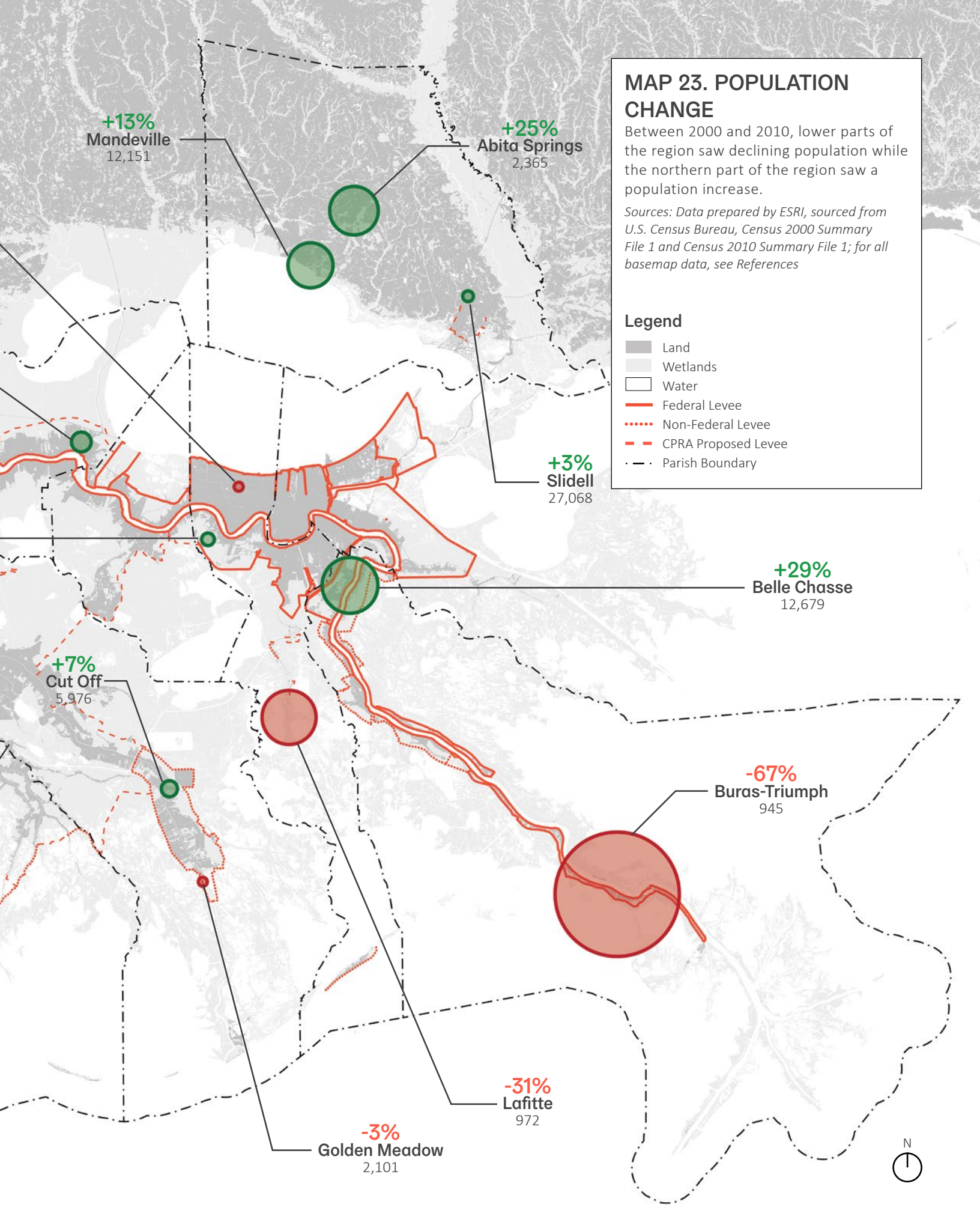
Sources: Web Soil Survey produced by National Cooperative Soil Survey, USDA Natural Resources Conservation Service, 2015 – 2016; for all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary



Population Change 2000 – 2010



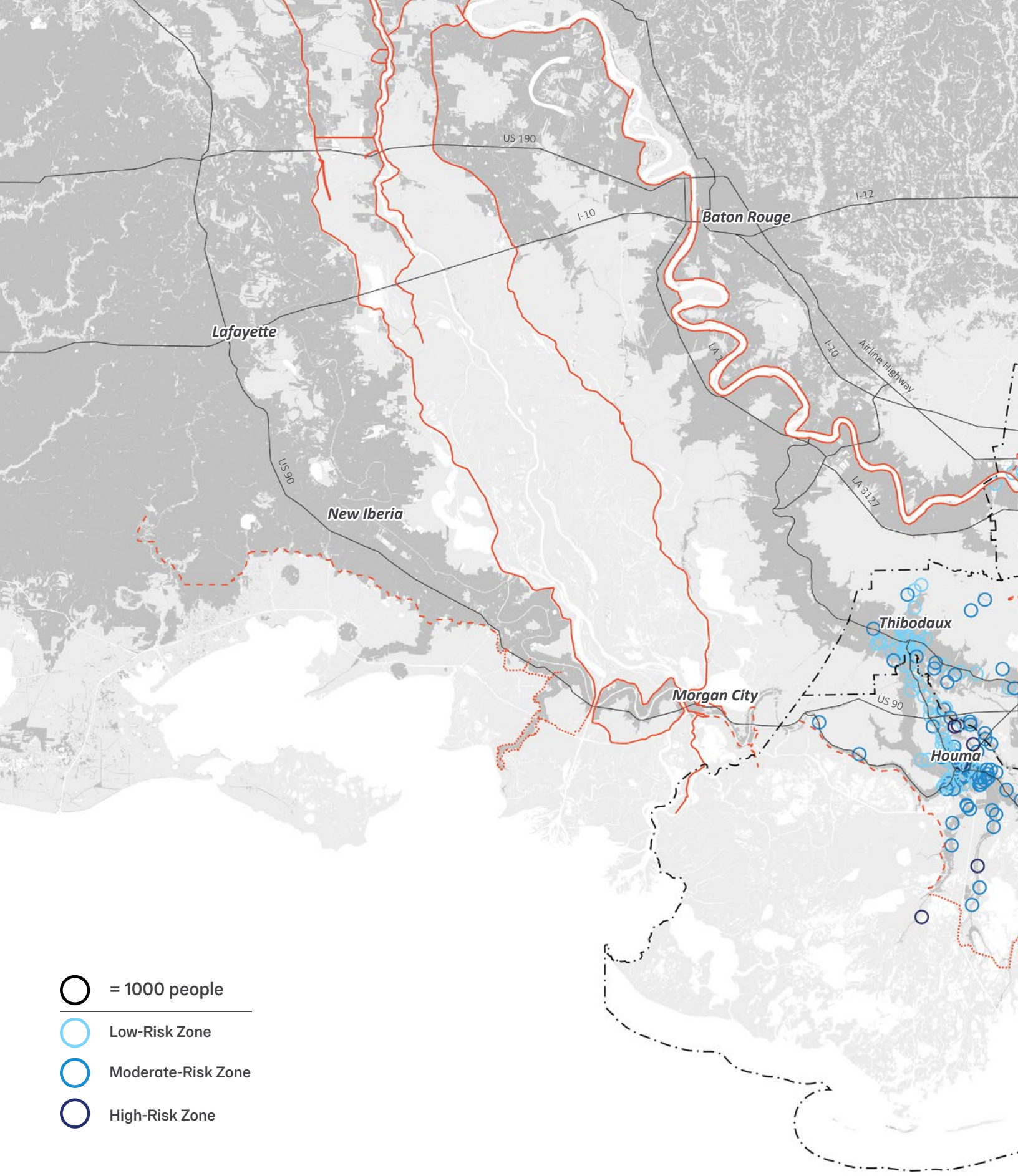
MAP 23. POPULATION CHANGE

Between 2000 and 2010, lower parts of the region saw declining population while the northern part of the region saw a population increase.

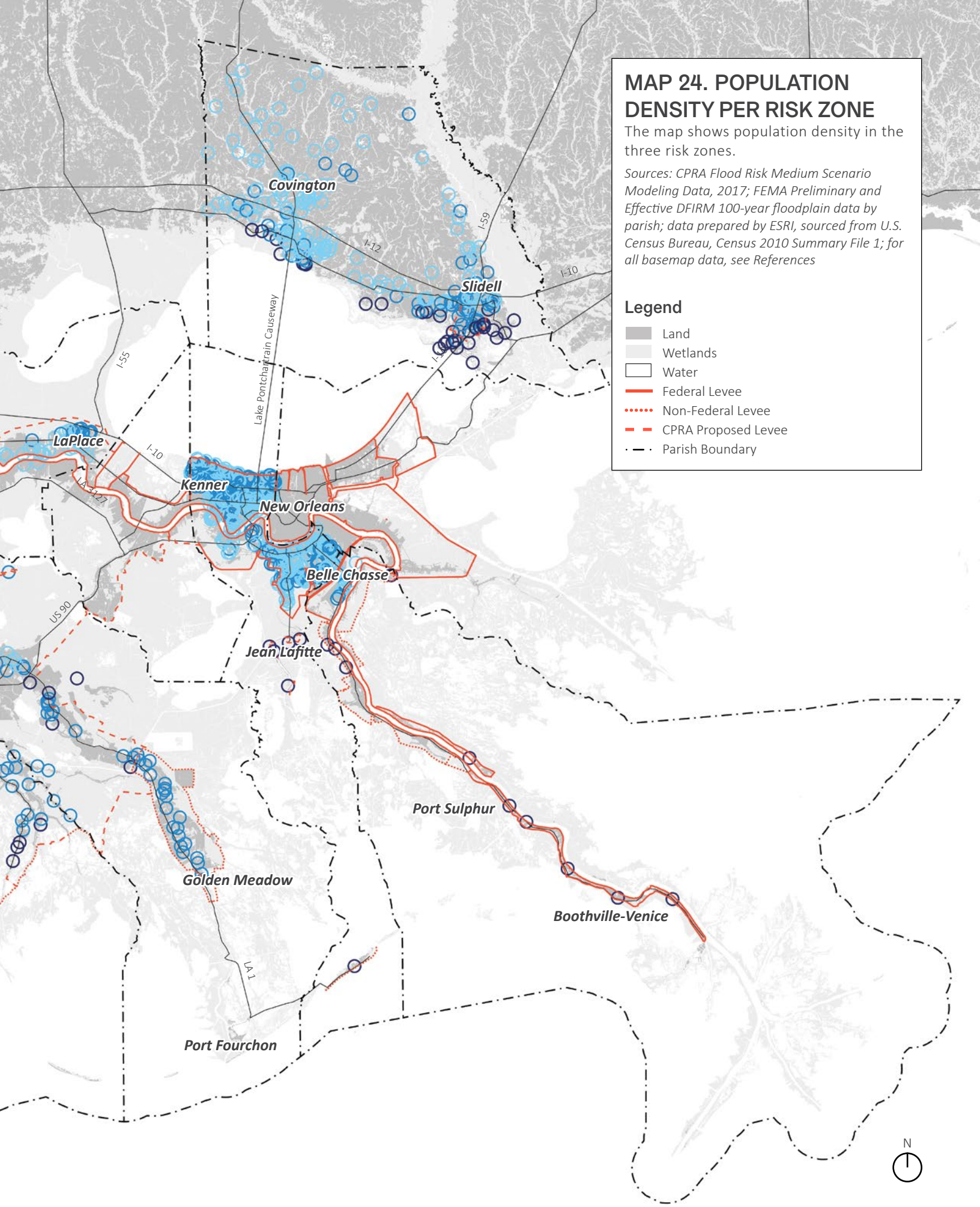
Sources: Data prepared by ESRI, sourced from U.S. Census Bureau, Census 2000 Summary File 1 and Census 2010 Summary File 1; for all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary



Population Density Per Risk Zone



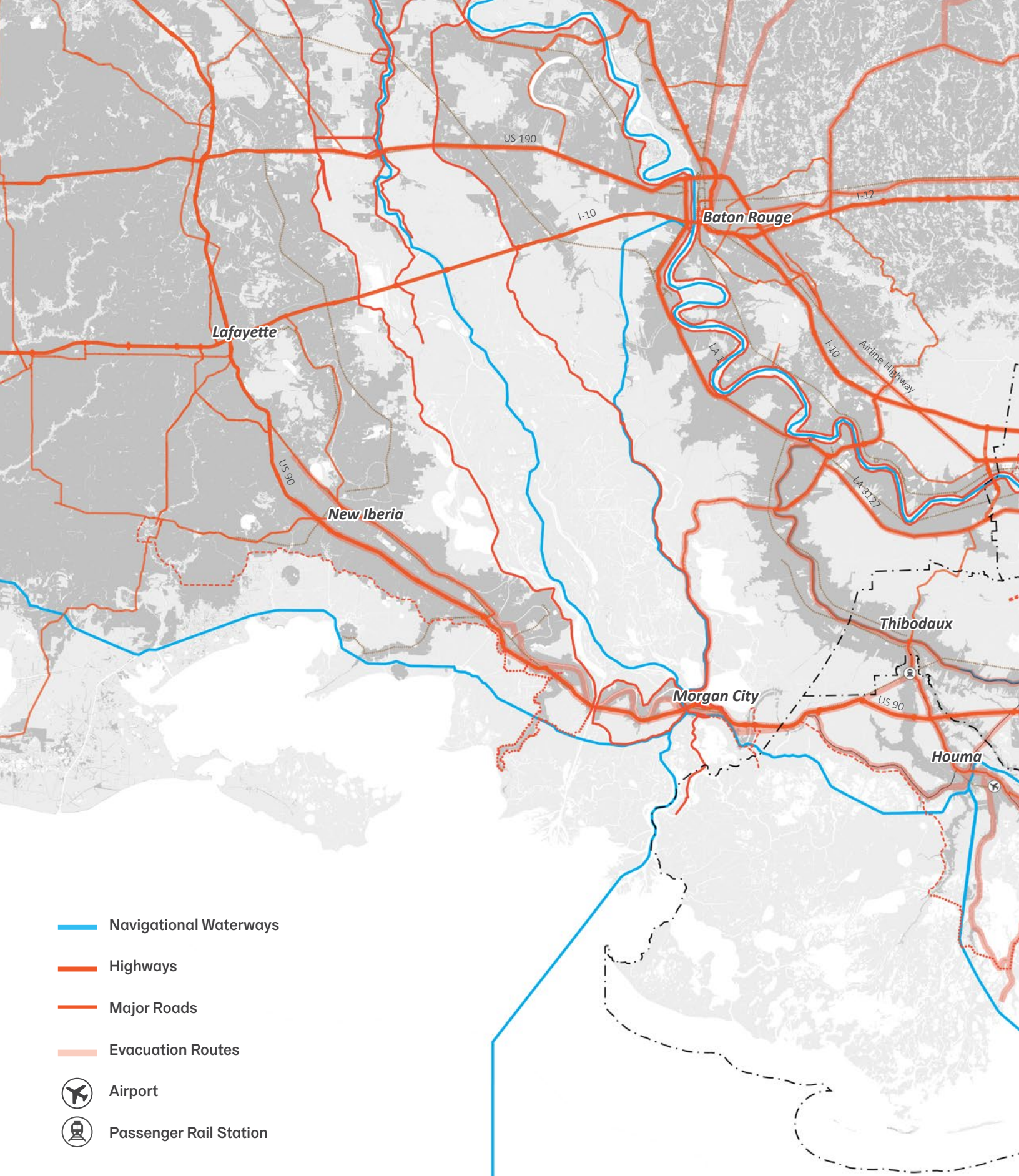
MAP 24. POPULATION DENSITY PER RISK ZONE

The map shows population density in the three risk zones.

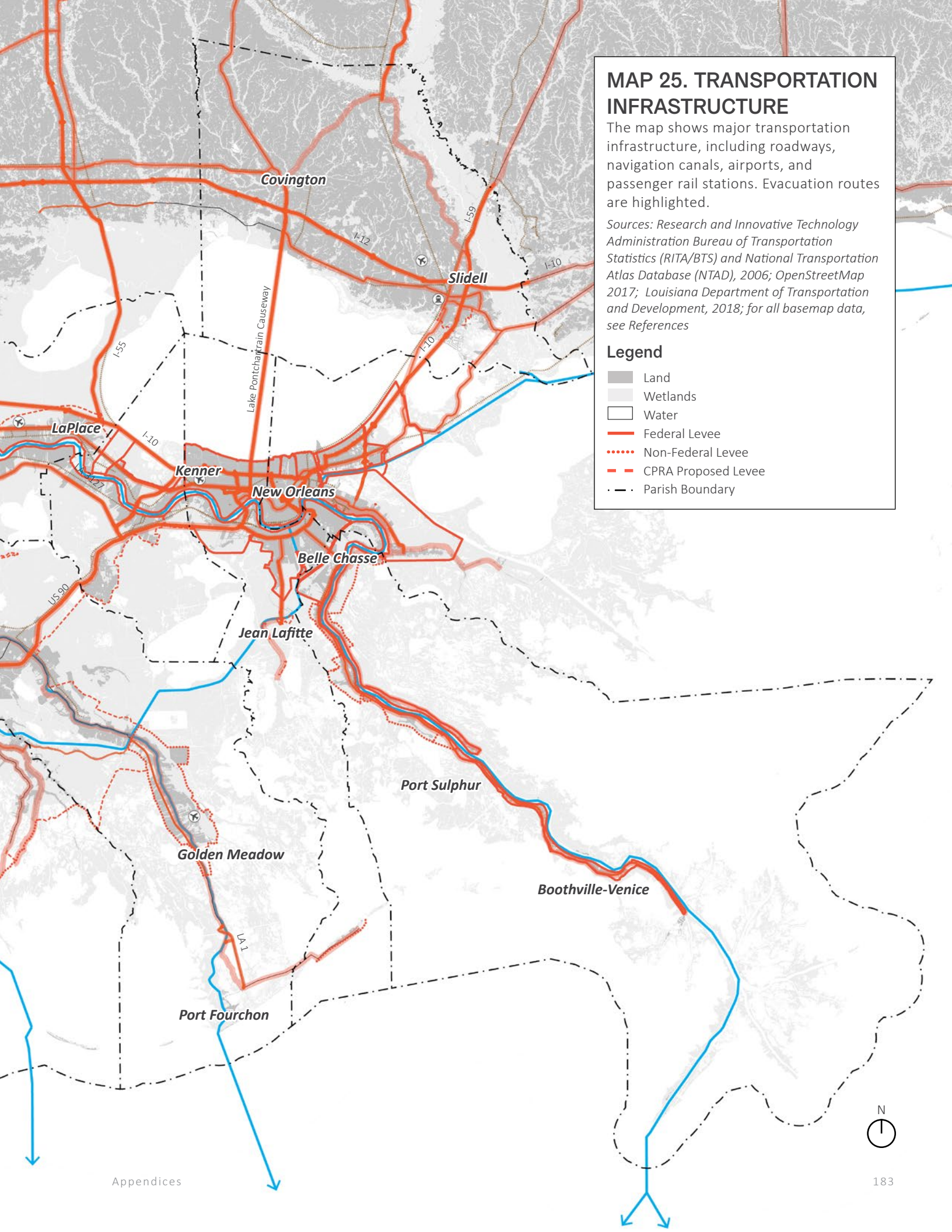
Sources: CPRA Flood Risk Medium Scenario Modeling Data, 2017; FEMA Preliminary and Effective DFIRM 100-year floodplain data by parish; data prepared by ESRI, sourced from U.S. Census Bureau, Census 2010 Summary File 1; for all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary



Transportation



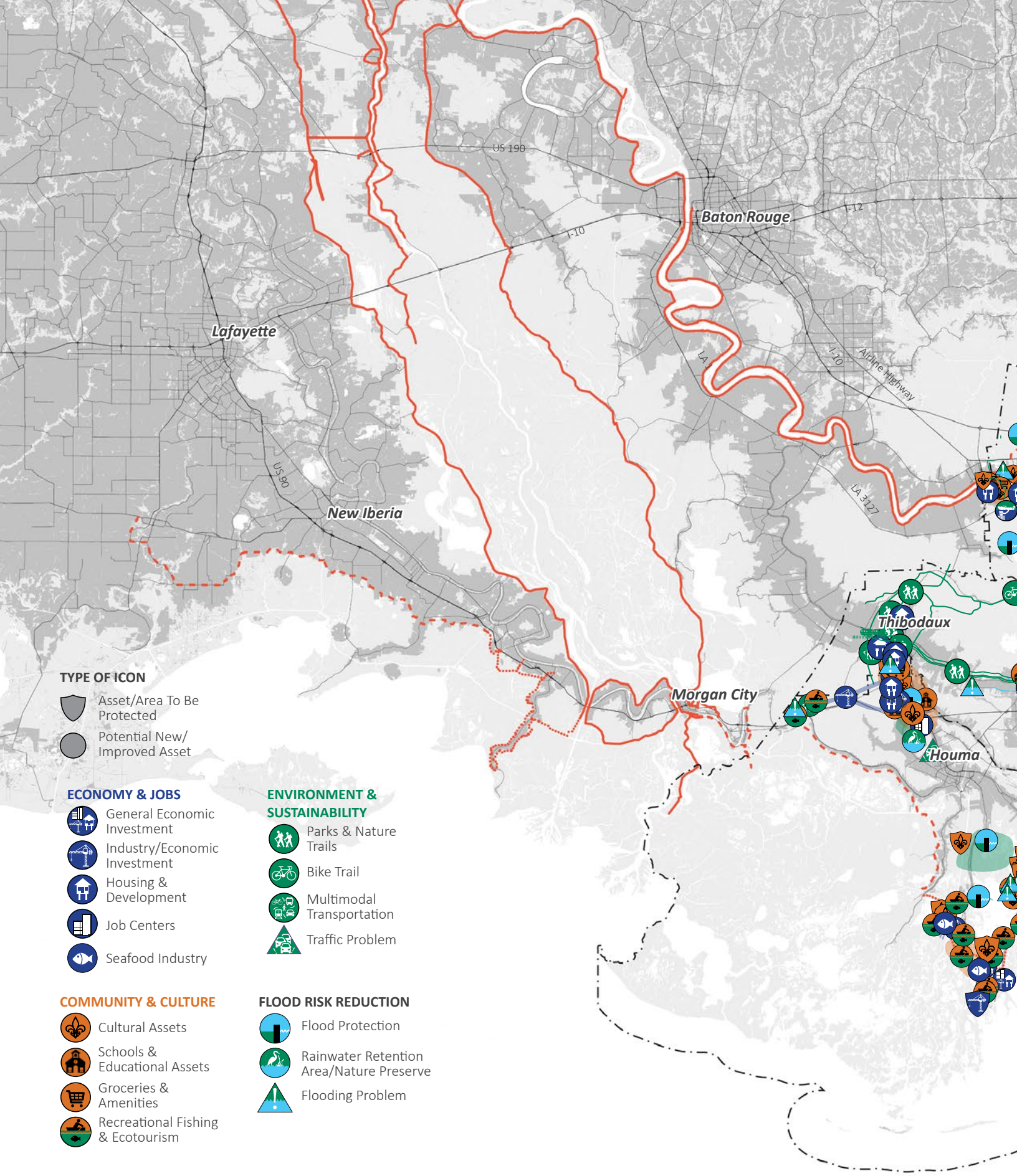
MAP 25. TRANSPORTATION INFRASTRUCTURE

The map shows major transportation infrastructure, including roadways, navigation canals, airports, and passenger rail stations. Evacuation routes are highlighted.

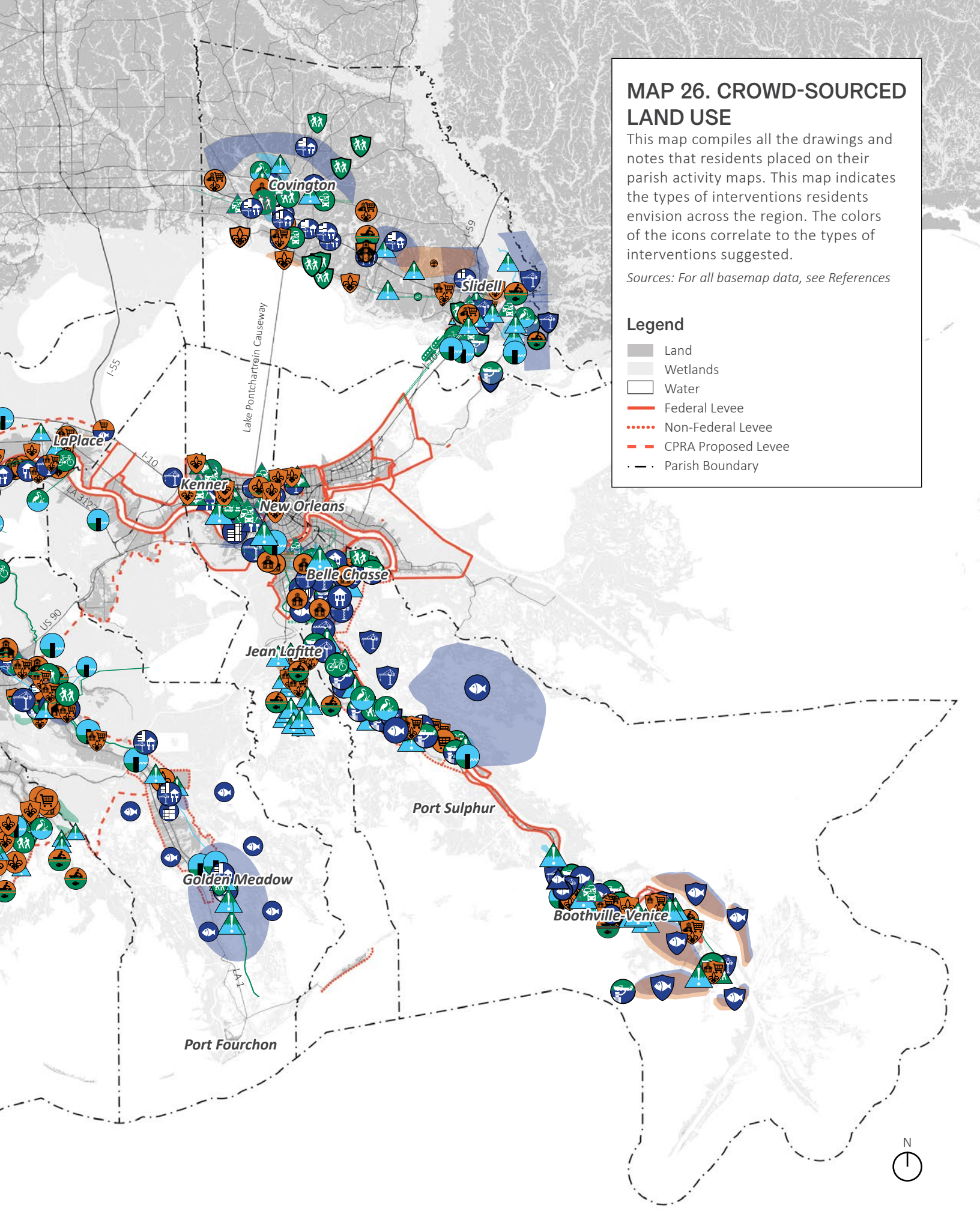
Sources: Research and Innovative Technology Administration Bureau of Transportation Statistics (RITA/BTS) and National Transportation Atlas Database (NTAD), 2006; OpenStreetMap 2017; Louisiana Department of Transportation and Development, 2018; for all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary



Crowd-Sourced Land Use



MAP 26. CROWD-SOURCED LAND USE

This map compiles all the drawings and notes that residents placed on their parish activity maps. This map indicates the types of interventions residents envision across the region. The colors of the icons correlate to the types of interventions suggested.

Sources: For all basemap data, see References

Legend

- Land
- Wetlands
- Water
- Federal Levee
- Non-Federal Levee
- CPRA Proposed Levee
- Parish Boundary

List of Abbreviations

BFE	Base Flood Elevation
BMP	Best Management Practice
CPRA	Coastal Protection and Restoration Authority
CRS	Community Rating System
DFIRM	Digital Flood Insurance Rate Map
DOTD	Louisiana Department of Transportation and Development
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
HUD	U.S. Department of Housing and Urban Development
ICC	Increased Cost of Compliance
ISO	Insurance Services Office
LDWF	Louisiana Department of Wildlife and Fisheries
MLOD	Multiple Lines of Defense
NDRC	National Disaster Resilience Competition
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NOGS	New Orleans Geological Survey
OCD-DRU	Louisiana Office of Community Development-Disaster Recovery Unit
RLAA	Repetitive Loss Area Analysis
RL	Repetitive Loss
SLR	Sea Level Rise
SFHA	Special Flood Hazard Area
SRL	Severe Repetitive Loss
UNO-CHART	University of New Orleans' Center for Hazards Assessment, Response and Technology
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

Glossary

1% Chance Flood
the flood having a 1% chance of being equaled or exceeded in any given year, is known as the "100-year" or "1% chance" flood.

10-Year Storm
an event that has a 10% chance of occuring or being exceeded in any given year. Also known as a T10 storm, where the "T10" refers to the return period.

100-Year Flood
the flood that has 1% chance of being equaled or exceeded each year. The effective risk for the 100-year flood is 26% over a 30 year mortgage.

100-Year Storm
an event that has a 1% chance of occuring or being exceeded in any given year. The U.S. Army Corps of Engineers' levees and floodwalls are meant to protect against this level of storm. Also known as a T100 storm, where the "T100" refers to the return period.

Adaptation
the process of modifying behavior to suit changing environmental conditions.

Asset
things such as buildings and infrastructure, natural features, cultural artifacts and traditions, knowledge, social bonds, systems, and networks—whether tangible or intangible—that are deemed to be of value to an individual, organization, or community.

Base Flood
a statistical concept used to ensure that all properties subject to the National Flood Insurance Program (NFIP) are protected to the same degree ("1% chance" or "100-year") against flooding. The National Flood Insurance Program and other agencies use the base flood to require flood insurance and regulate development.

Base Flood Elevation (BFE)
the elevation of the crest of the base flood or a 100-year flood. The BFE is an elevation set by the Federal Emergency Management Agency (FEMA) that measures the elevation to which floodwater is anticipated to rise during a base flood. To receive FEMA funds in the case of storm damage, FEMA requires the lowest floor of the building to be at or above BFE.

Bayou
a slow-moving creek or swampy body of water, which may be brackish (mixed fresh- and saltwater) and home to a rich diversity of wildlife. Bayous are often associated with the southeastern part of the United States and can be found throughout coastal Louisiana.

Berm
a raised barrier dividing space, which may be used to prevent flooding or erosion. Berms can be incorporated into landscape designs to create detention and retention basins.

Best Management Practice (BMP)
a method or technique that consistently yields outcomes superior to those achieved by other means and generally agreed upon by a community of experts to be the most effective means of delivering a particular outcome.

Bioswale
a linear depression in the landscape constructed to slow and filter stormwater with vegetation and soil media. Bioswales can remove silts, pollutants, and pathogens and reduce the quantity of runoff from a site.

Bottomland Hardwood Forest
a wetland ecosystem found throughout the Gulf Coast states, typically in flood plains alongside rivers or streams that periodically flood. Gum, oak, and cypress are common tree species, along with other plants that can survive periodic flooding or standing water for much of the year.

Brackish Water
a mix of freshwater and seawater found in places like estuaries and deltas, such as Lake Pontchartrain.

Canal
a man-made channel for water, often built as connections to larger bodies of water. Throughout coastal Louisiana, canals both convey and store stormwater.

Community Rating System (CRS)
a voluntary program that recognizes NFIP participating communities that go above and beyond the minimum requirements for floodplain management. Policyholders in participating communities are rewarded with reduced insurance premiums. CRS communities receive various credits for the floodplain management activities they implement. The more credit earned, the better the class ranking of that community. The CRS has 10 classes; a Class 10 ranking has no flood insurance premium reduction, whereas a Class 1 carries the maximum discount.

Complete Streets
streets designed and operated to allow all types of users—including but not limited to pedestrians, bicyclists, motorists, and transit users of all ages and physical abilities—to safely use and traverse the right-of-way.

Delta
a flat low-lying plain that sometimes forms at the mouth of a river, emptying water and sediment into another body of water, such as an ocean or lake. The LA SAFE region is situated on the Mississippi River Delta.

Detention
the holding of stormwater temporarily in a swale, detention basin, or other features. Detention reduces peak discharge by allowing the slower and more controlled release of runoff and does not allow for the permanent pooling of water.

Digital Flood Insurance Base Map (DFIRM)
a map prepared by a digital GIS system that reflects a community's flood hazards. All new maps are based upon this digital platform and communities may use these maps instead of paper maps for regulatory purposes.

Drainage Canal
an artificial channel built to drain an area with no natural outlet for runoff. In leveed areas, aboveground and underground drainage canals move runoff to and from drainage pump stations.

Elevation
the altitude of a place above or below sea level.

Environmental Degradation
the deterioration of the environment through depletion of resources such as air, water, and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution.

Estuary
a partially-enclosed body of water where freshwater from rivers and streams flows into the ocean, mixing with seawater and forming brackish water. Estuaries such as Lake Pontchartrain are rich habitats influenced by tides but protected from the direct impact of ocean waves and winds by surrounding land, wetlands, and barriers islands.

Flood
the temporary condition of inundation of what is usually dry land. It can be caused by an overflow of inland or tidal waters or the rapid accumulation of runoff in drainage ditches or inland waterways. Flash floods are floods that subside in fewer than six hours.

Flood Insurance Rate Map (FIRM)
is the official map which identifies flood hazard areas and flood risk zones in the community.

Floodgate
a structure that can be opened or closed in order to adjust the flow of water through a sluice or canal or prevent the flow of water as part of a levee and floodwall system.

Floodplain
an area of typically flat land that is susceptible to inundation by water from any source. Floodplains are typically fertile agricultural areas as a result of nutrient-rich sediments deposited by floodwaters.

Floodwall
a vertical barrier, usually made of concrete, constructed to contain floodwaters from a river, lake, or sea to prevent flooding in urbanized areas. They are usually in densely developed areas where building levees is not feasible or atop levees in order to increase the level of safety provided by the levee.

Fluvial
of or relating to rivers and streams and the flooding, erosion, and soil deposition associated with these waterways.

Freeboard
a factor of safety usually expressed in feet above Base Flood Elevation (BFE) for purposes of floodplain management.

Geographic Information Systems (GIS)
integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information in the form of maps, globes, reports, and charts.

Geology, Hydrogeology
the study of groundwater, including its flow and its physical and chemical interactions with soils and surface water.

Green Infrastructure
an approach to stormwater management that utilizes natural processes, soils, and vegetation to filter and reduce runoff. In contrast to gray infrastructure, green infrastructure can provide additional benefits such as improved air quality and streetscapes.

Groundwater
water held in underground permeable rock or soil layers. When these layers hold enough water to be usefully extracted for human use, it is called an aquifer.

Hazard
any substance, phenomenon, or situation that has the potential to cause disruption or damage to people, their property, their services, and/or their environment.

Hazard Mitigation
any sustained action taken to reduce or eliminate long-term risk to life and property from hazard events (floods, fires, earthquakes, etc.), such as elevation or floodproofing.

Hydrology
the study of the distribution, flow, and quality of water. This includes the water cycle, water resources, and watershed sustainability. The term hydrologic refers to the movement of water among land areas, waterways, water bodies, and the atmosphere.

Impervious Surface
a material or area that cannot be penetrated by water. This includes most rooftops and structures like roads, sidewalks, and parking lots that are paved with concrete, asphalt, or stone. Impervious surfaces prevent rainfall from infiltrating into the ground and recharging groundwater as well as accelerate runoff.

Increased Cost of Compliance (ICC)
a $30,000 rider on flood insurance policies for policy holders located in the special flood hazard area that can be used to bring the structure into compliance in the event that it is substantially damaged by a flood.

Infiltration
the passage of water into below-ground soil layers. The velocity at which this occurs is called the infiltration rate, which is dependent on the composition of surface soil layers. Infiltration replenishes groundwater and raises the water table.

Infrastructure
the foundational systems and installations necessary to maintain and enhance basic social, economic, governmental, economic, and military functions. These include drinking water systems, drainage systems, sewers, hurricane defenses, schools, transportation networks, electrical grids, and telecommunications networks.

Inundation
flooding, the overwhelming of an area by floodwaters.

Levee
a linear earthen ridge that divides areas hydrologically and can be used to protect inhabited areas from flooding. Coastal Louisiana has both naturally occurring levees and man-made levees. Many natural levees have been reinforced with additional soil, rock, concrete, and/or grass. Levees are also known as dikes.

Louisiana Coastal Master Plan
a framework created by the state's Coastal Protection and Restoration Authority (CPRA) focused on protecting and restoring the state's deteriorating coastline. Threats to many of Louisiana's coastal assets led to the passing of Louisiana Legislature Act 8 in 2006, which created the CPRA and required it to develop a coastal master plan every five years. The latest edition was adopted by the state legislature in 2017.

Marsh
wetlands that are frequently inundated with water and characterized by soft-stemmed vegetation adapted to saturated soil conditions. Nutrients are typically abundant, allowing plant and animal life to thrive in these areas. Marshes help reduce flood damage by slowing and storing flood water. As water moves slowly through a marsh, sediments and other pollutants settle to the marsh floor. Municipalities are now building urban wetlands to harness these natural processes in cleaning stormwater and wastewater.

Multiple Lines of Defense (MLOD)
a core concept of both the Louisiana Coastal Master Plan and the Best Practices Manual for Development in Coastal Louisiana, developed by the Lake Pontchartrain Basin Foundation. MLOD describes the importance of naturally-occurring and man-made features in protecting inhabited areas from the direct impact of hurricanes in southeast Louisiana. Man-made features include levees, flood gates, pump stations, elevated structures, highways that serve as ridges, and hurricane evacuation routes. Natural features external to perimeter levees include offshore shelves, barrier islands, sounds, marsh land bridges, and natural ridges. The Greater New Orleans Urban Water Plan introduces urban water management to the MLOD concept as a means of addressing risks associated with rainfall in order a achieve a higher factor of safety overall.

National Flood Insurance Program (NFIP)
FEMA's flood insurance coverage and floodplain management system.

Old River Control Structure
a floodgate system in a branch of the Mississippi River in central Louisiana that regulates the flow of water leaving the Mississippi into the Atchafalaya River, thereby preventing the Mississippi River from changing course.

Oxidation
the decomposition and compaction of organic matter that occurs in the presence of oxygen. Oxidation is a primary cause of subsidence in coastal Louisiana in areas where highly organic soils with lowered water tables are exposed to oxygen.

Pervious Paving
a material for walkways, roadways, and parking lots that allows stormwater to be absorbed by the ground where it falls, reducing runoff into the drainage system.

Pump, Pumping
the mechanical removal of water from an area. This is how stormwater has been traditionally managed in the leveed areas of coastal Louisiana, but it is also the primary cause of subsidence in the region.

Rain Garden
a shallow, excavated basin that collects and cleans storm water runoff on a small scale. Soil layers and plantings are designed for infiltration and the removal of pollutants.

Repetitive Loss Area Analysis (RLAA)
an approach that identifies repetitive loss areas, evaluates mitigation approaches, and determines the most appropriate alternatives to reduce future losses.

Repetitive Loss (RL) Property
an NFIP-insured property where two or more claim payments of more than $1,000 each have been paid within a 10-year period since 1978.

Resilience
the capacity of individuals, communities, and systems to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience.

Retention
the holding of stormwater permanently in basins, ponds, and cisterns. Retention basins allow stormwater to infiltrate the ground and for the collected stormwater to be repurposed for other uses such as irrigation.

Retrofit
a measure taken to adapt existing infrastructure to operate more efficiently and effectively, without having to completely rebuild existing systems.

Risk
exposure to the possibility of experiencing negative consequences that may arise when hazards interact with vulnerable people, property, areas, or environments.

Runoff (Surface Runoff)
stormwater flowing from rooftops, streets, and other surfaces that neither infiltrates into the ground nor evaporates, but instead collects and must be drained away in order to prevent flooding.

Sea Level Rise (SLR)
most simply defined as an increase in the mean sea level, caused by changes in air temperatures that are linked to global climate change. Sea level rise poses a growing risk to low-lying coastal communities. With land subsiding at high rates as well, coastal Louisiana is experiencing some of the highest rates of sea level rise in the world.

Severe Repetitive Loss (SRL) Property
A residential repetitive loss property that within a 10-year period has had either four or more NFIP claim payments, more than ten days apart, of more than $5,000 each and the cumulative amount of claims exceeds $20,000, or within a 10-year period two separate claims (building payments only) more than ten days apart, that cumulatively exceed the building's market value.

Slow, Store, Drain
a new approach to stormwater management fundamental to LA SAFE: slow water as it hits the ground, create spaces in the city to store water and use it as a resource, and drain using pumps only as a last resort to prevent flooding.

Soil Organic Content, Soil Organic Matter
component of a soil layer comprised of plant and animal residues at different stages of decomposition, cells and tissues of microorganisms, and living organisms along with the organic residues that they produce. Soil organic content is a critical measure of a soil's ecological function, quality, and stability.

Special Flood Hazard Area (SFHA)
the base floodplain delineated on a Flood Insurance Rate Map that a community must regulate under the requirements of the National Flood Insurance Program. The SFHA is mapped as a Zone A or AE (see definition). In coastal situations, Zone V (see definition) is also a part of the SFHA. The SFHA is included in a community's regulatory floodplain.

Stormwater Management
techniques, methods, or policies that control planning, maintenance, and regulation of stormwater (rainfall). Stormwater management is critical in precipitation-rich coastal Louisiana in order to prevent flooding and reduce subsidence.

Subsidence
the sinking of land relative to sea level. In the Greater New Orleans area, the primary cause of subsidence is the excessive pumping of groundwater. As groundwater is removed, the soil from which it is drawn compresses and highly organic soil layers are able to oxidize. Subsidence damages buildings, streets, and other infrastructure, and its effects are irreversible.

Substantial Improvement
the repair, reconstruction, or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the improvement or repair is started.

Swamp
a shallow body of water and wetland habitat, typically dominated by woody vegetation such as cypresses. Swamps have highly organic soils that provide a nutrient-rich environment for the growth of a variety of water-tolerant species of flora and fauna.

Topography
the position and elevation of natural and artificial features in an area, and also the study of the surface shape and features of an area. Topographic maps and models provide graphic representations of features that appear on the Earth's surface, including infrastructure and development, waterways and water bodies, relief (mountains, valleys, slopes, depressions), and vegetation.

Vulnerability
constraints of an economic, social, physical, or geographic nature that increase exposure to risk and/or reduce the ability to prepare for and cope with the impacts of disasters and disruptions.

Water Literacy
an understanding of how water impacts and functions in a given landscape—where water is coming from, how it is used, how it is stored, and what risks and opportunities are associated with water. Water literacy is an important aspect of a sustainable water future for coastal Louisiana.

Water Quality
a measure of how suitable water is for a particular type of use (such as drinking and bathing) based on physical, chemical, and biological characteristics such as temperature, turbidity, mineral content, and bacteria presence.

Water Table
the boundary between water-saturated soils and unsaturated soils. Typically, deeper soil layers are saturated with water while those closer to the surface are drier.

Watershed
a land area, and distinct hydrological entity, where all water drains to the same point.

Weir
a barrier that alters the flow of waterways to prevent flooding, to store water, or for navigation purposes, while allowing the steady flow of water over the top of the structure.

Wetlands
ecosystems that are saturated with water, including bottomland hardwood forests, swamps, marshes, and bayous. The presence of water drives the nature of soil development as well as characteristic plant and animal communities living in and above the soil. Wetlands are natural storm buffers that store and filter runoff. They are also habitats that support hundreds of thousands of species of plants and animals as well as myriad fishing, hunting, agriculture, and recreational uses. Much of coastal Louisiana's natural ecosystems are comprised of wetlands.

Zone A
The Special Flood Hazard Area (except coastal V Zones) shown on a community's Flood Insurance Rate Map. There are seven types of Zone A's:

A: SFHA where no base flood elevation is provided.
A#: Numbered A Zones (e.g., A7 or A14), SFHA where an older FIRM shows a base flood elevation in relation to a national datum.
AE: SFHA where base flood elevations are provided. AE-Zone delineations are used on newer FIRMs instead of A# Zones.
AO: SFHA with sheet flow, ponding, or shallow flooding. Base flood depths (feet above grade) are provided.
AH: Shallow flooding SFHA. Base flood elevations in relation to a national datum are provided.
AR: A temporary designation for an area where a flood control system that no longer provides protection from the base flood is expected to be improved, so it will provide protection to the base flood again in the future. This zone is considered part of the Special Flood Hazard Area or "regulatory floodplain", but properties in this zone do not receive the "in SFHA" CRS premium discount.
A99: A mapped floodplain that will be protected by a federal flood protection system where construction has reached specified statutory milestones. This zone is considered part of the Special Flood Hazard Area or "regulatory floodplain", but properties in this zone do not receive the "in SFHA" CRS premium discount.

Zone B

Area of moderate flood hazard, usually depicted on older Flood Insurance Rate Maps as between the limits of the base and 500-year floods of the primary source of flooding. B Zones may have local, shallow flooding problems. B Zones are also used to designate areas protected by levees and base floodplains of little hazard, such as those with average depths of less than one foot.

Zone C

Area of minimal flood hazard, usually depicted on older Flood Insurance Rate Maps as above the 500-year flood level of the primary source of flooding. C Zones may have local, shallow flooding problems that do not meet the criteria to be mapped as a Special Flood Hazard Area, especially ponding and local drainage problems.

Zone D

Area of undetermined but possible flood hazard.

Zone V

The Special Flood Hazard Area subject to coastal high hazard flooding. There are three types of V Zones: V, V#, and VE, and they correspond to the Zone A designations.

Zone X

Newer Flood Insurance Rate Maps show Zones B and C (see above) as Zone X. The shaded Zone X corresponds to a Zone B, and the unshaded Zone X corresponds to a Zone C.

List of Figures

Chapter 1. Introduction

Chapter 2. LA SAFE Process

Chapter 3. Regional Thinking

Chapter 4. Vision and Strategies

Chapter 5. Realizing the Vision

Appendices

List of Maps

References

Unless otherwise noted, all photos and drawings were produced by the LA SAFE project team.

Additional Map Sources

These additional sources were used to create the maps throughout the Regional Adaptation Strategy—

Atlas: The Louisiana Statewide GIS, accessed 2017

CPRA 2017 Coastal Master Plan: Structural Projects, 2017

OpenStreetMap, accessed 2017

National Land Cover Database created by the Multi-Resolution Land Characteristics (MRLC) Consortium, 2011

USACE Louisiana Geographic Information Center, 2006

USGS National Hydrology Dataset, accessed 2017

FEMA Effective DFIRM 100-year floodplain data for Jefferson Parish, 2018

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FEMA Preliminary DFIRM 100-year floodplain data for Plaquemines Parish, 2012

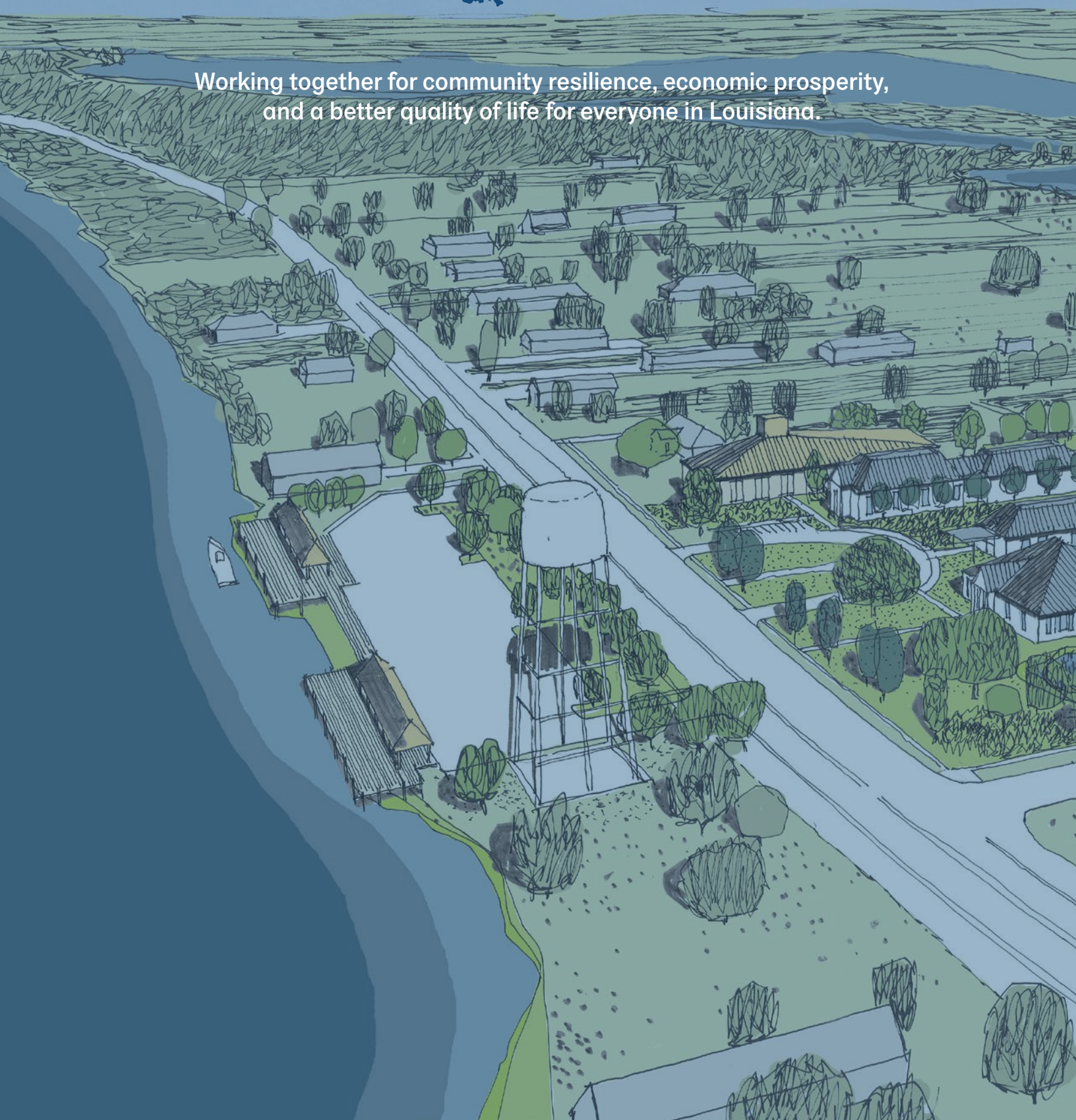
FEMA Effective DFIRM 100-year floodplain data for St. John the Baptist Parish, 2010

FEMA Preliminary 100-year floodplain data for St. Tammany Parish, 2008

FEMA Preliminary 100-year floodplain data for Terrebonne Parish, 2008

LASAFE

Louisiana's Strategic Adaptations *for* Future Environments



Working together for community resilience, economic prosperity, and a better quality of life for everyone in Louisiana.