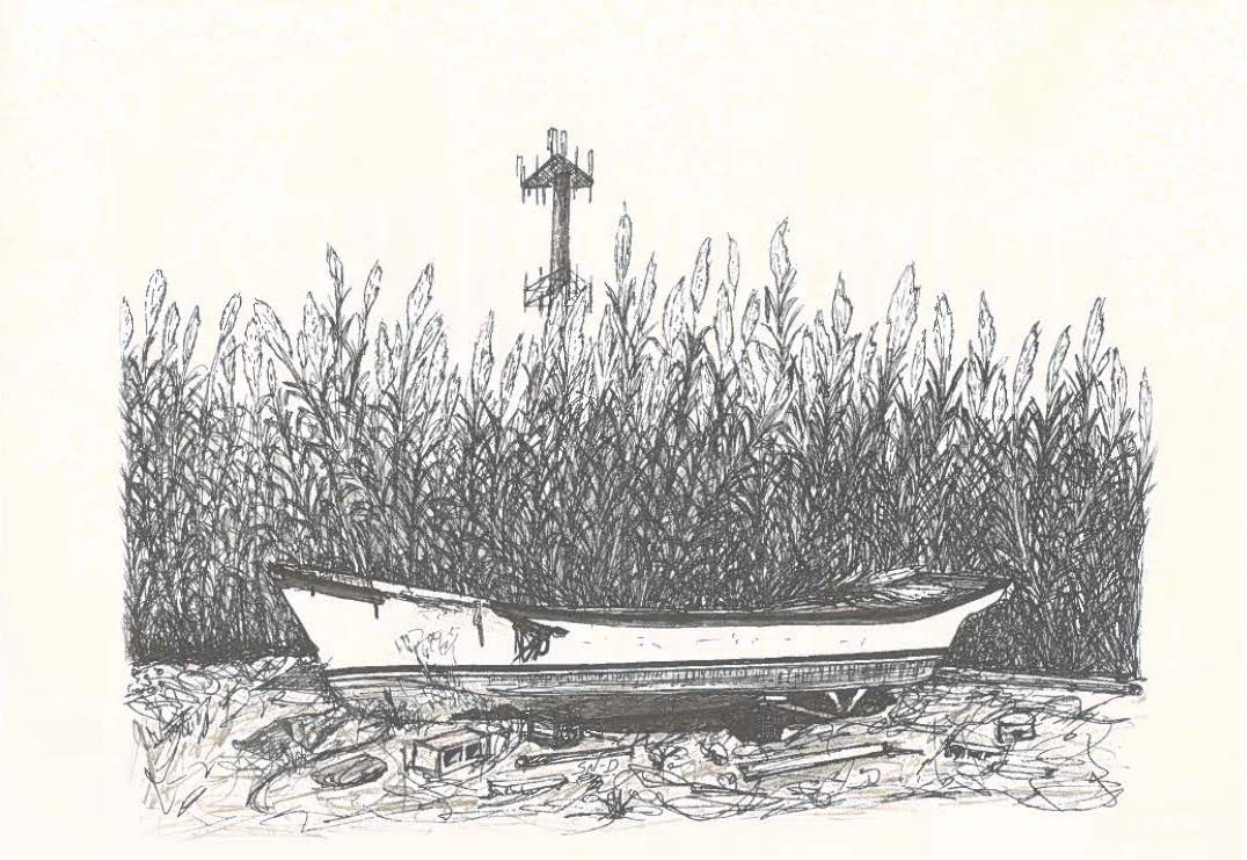
FINDING THE MEANS:

INVESTMENT AND ADAPTATION IN VULNERABLE COMMUNITIES

An Issue Paper of the Tulane Institute on Water Resources Law & Policy and The Water Institute of the Gulf

July 19, 2019



Lafitte Skiff and Roseau Cane, New Orleans East, 2009 by Susan Norris-Davis

Tulane Institute on Water Resources Law & Policy

THE WATER INSTITUTE OF THE GULF™

FINDING THE MEANS:

INVESTMENT AND ADAPATION IN VULNERABLE COMMUNITIES

An Issue Paper of the Tulane Institute on Water Resources Law & Policy and The Water Institute of the Gulf[1]

July 19, 2019

INTRODUCTION

It is no secret that coastal communities face mounting pressures to their safety and sustainability. Rising seas, repetitive flooding, subsidence, and aging infrastructure are just some of the things pushing communities toward tipping points beyond which they become victims of change rather than managers of change. Despite that fact, there is a mismatch between the level of discussion and the allocation of resources, authorities, and political capital, as well as uncertainty as to where responsibilities for adaption fall. That is certainly true in coastal Louisiana, which is the immediate subject of this paper, but it is not just a Louisiana problem. Similarly, this is not a problem that discriminates between urban, suburban, and rural areas. To be sure, the risk factors and options will vary from community to community but there are common threads tying them together that deserve closer attention, especially because it is at the local level that community viability is determined. Despite that, much—perhaps most—of the planning and programming for coastal change has presumed a level of knowledge, resources, and opportunities at the local level that often does not exist. Since much of the planning and discussion so far has been at a much higher and broader level, that is not surprising. But, if managed adaptation is ever going to be successful (however it is defined), the field of play is going to have to get more granule. There are encouraging steps in that direction already. In April 2019, the Louisiana Office of Community Development and the Foundation for Louisiana's Strategic Adaptations for Future Environments (LASAFE) project released a report[2] that looks at the adaptation prospects for six parishes (counties) in southeastern Louisiana more closely than had previously been done. It is

---

[1] Project leads: Mark Davis, Director, Tulane Institute on Water Resources Law and Policy; Scott Hemmerling, Director of Human Dimensions, The Water Institute of the Gulf; Kristen Hilferty, Senior Research Fellow, and Christopher Dalbom, Assistant Director, Tulane Institute on Water Resources Law and Policy. The Institutes and the authors would like to thank The Walton Family Foundation and the Foundation for Louisiana, whose support helped make this paper possible.

[2] *Our Land and Water: A Regional Approach to Adaptation*, LOUISIANA'S STRATEGIC ADAPTATIONS FOR FUTURE ENVIRONMENTS (April 2019) https://s3.amazonaws.com/lasafe/Final+Adaptation+Strategies/Regional+Adaptation+Strategy.pdf.

important to note that the LASAFE report itself was shaped by decades of study and planning that produced a series of ever more refined plans and programs that now frame many of the options the LASAFE communities face. In short, coastal Louisiana is at a point where dynamic and deliberative forces converge. The fundamental issue is whether communities will manage change or be overwhelmed by it. The aim of this paper is to help them do the former.

Because the prospects for community viability turn on multiple factors, this paper is divided into two chapters. The first will focus on some of the broader legal, policy, and financing issues and opportunities that will shape the decisions communities face as they decide if and how to invest for their futures.

The second chapter focuses on the importance of understanding the histories, attitudes, and experiences of specific communities, as well as how decisions are made in those communities and by whom.

By better understanding the "architecture" of how decisions are made and what factors influence them, the hope of the authors is that future discussions and plans concerning the fate of coastal communities will be more comprehensively informed and lead to more effective and equitable decisions and actions.

CHAPTER ONE: INVESTING IN SUSTAINABILITY[3]

I. INVESTMENT IN WATER MANAGEMENT—OVERVIEW

Inconstancy. If one were to sum up America's approach to water infrastructure in one word, inconstancy would be a safe choice. It has been a point of pride and of shame. It has been a federal priority and an afterthought. It has been a public responsibility (usually) and a private one (and sometimes a public one again). We have protected communities against rare but destructive events while leaving them vulnerable to more frequent yet equally destructive events. We have boldly committed to massive projects but refused to maintain them. Through it all, the only common thread has been that, except for navigation projects, the ultimate responsibility for action falls on local governments and their citizens. So do the burdens.

This is the lens through which the paper will look at adapting to climate and coastal change. It is also the lens used by the State of Louisiana's 2017 Comprehensive Master Plan for Coastal Protection, Restoration, and Conservation.

Life in coastal Louisiana has always been challenging. With an economy and culture tied to dynamic and exhaustible natural resources, Louisiana's coastal communities have been a complicated combination of flexibility and vulnerability. Until the middle of the twentieth century, the locus of decision making was largely local and/or private. When levees needed building, homes needed raising, or roads or water infrastructure needed tending, the options and funding were matters of state or local concern. Those were the days before massive federal civil works and regulatory programs. The days before flood and mortgage insurance and days when most of the businesses and employers were locally based. These are not those days.

Today, the long-term stability of the communities in coastal Louisiana rests in multiple hands—federal, state, and local governments, as well as in those of private actors. The number of players is complicated enough, but that complexity is compounded by the fact that there can be

---

[3] Principal authors: Mark Davis, Director, Kristen Hilferty, Senior Research Fellow, and Christopher Dalbom, Assistant Director, Tulane Institute on Water Resources Law and Policy. Special acknowledgements are due to former Tulane Senior Research Fellows Katherine Van Marter and Dean Boyer and our team of research assistants. We would also like to thank those who took the time to review and comment on this paper as it took shape. While much of the credit for any value it may have goes to them, the authors and the Institute remain exclusively responsible for the paper and its contents.

significant differences between the interests, jurisdictions, constraints, and capacities of those players. For example, some actors are motivated by the desire to see climate change addressed as a specific risk factor or opportunity. Others, may be motivated by a desire to see climate change minimized or even denied. Those are facts, but it is also a fact that to keep pace with and maintain current economic viability, South Louisiana needs continued investment at every scale, from individual homeowners to businesses and major lenders. That will require planning and preparation that embraces three objectives:

1. Maintaining existing revenue streams and creditworthiness;
2. Taking full advantage of available water infrastructure finance options; and
3. Working independently and with others to extend and expand financing options.

Investment can be defined broadly as the willingness of individuals and businesses to place resources in a region with the expectation that their value will grow or, at the very least, maintain.[4] Investment depends on confidence, and coastal and climate change threaten to erode investor confidence in a number of ways. This might happen in obvious ways. For example, property owners may shy away from continued investment if they believe a storm, flood, or other catastrophe will wipe out a property's value. Confidence might also erode as local governments lose their ability to maintain necessary infrastructure, such as roads and utilities, and services, such as police and healthcare. Investor confidence could also be shaken by less tangible causes – skyrocketing insurance premiums, for example – that do not alter the physical landscape but change the financial calculus of investment decisions. These factors will also influence commercial and industrial firms, possibly causing some to curtail or even cease operating in a region. Even if homeowners are otherwise willing to invest, the loss of a community pillar such as a major employer, hospital, or economic resource (e.g. fisheries) could tip the balance away from viability for coastal communities. In short, the fate and future of coastal Louisiana depends on more than coastal restoration or business development. Rather, it depends on an entire web of stewardship and investment. At the heart of this analysis are three questions and one truth. The questions are:

1. What actions need to be taken?
2. Who is responsible for taking action?

[4] *Investment*, INVESTOPEDIA, https://www.investopedia.com/terms/i/investment.asp (last visited July 19, 2019).

3. Are the authorities and resources (human, informational, and financial) necessary to support those actions identified and at hand?

These questions and their answers (or lack thereof) are fundamental to identifying and preparing for the spectrum of tipping point decisions facing coastal communities at the governmental, private sector, and individual levels.

The truth is that there is no status quo, other than change. Decisions will be made one way or another. Indeed many have already been presumptively made. The present arc of any number of places is that they will be lost and left to fend for themselves unless some other set of plans and decisions is made. If that is not what we want, then it will take timely affirmative actions and investments to change things. Even then, the time available for action and options changes each day.

With the aforementioned background in mind, this paper will review some of the more important issues, options, and variables relevant to ongoing community viability in the face of coastal change. While this paper will focus on things specifically facing coastal Louisiana, much of it will speak to matters of general relevance to communities facing fundamental threats to their sustainability as a result of rising seas, climate change, and challenges to water availability.

II. COASTS AND TAX BASES

Everything communities do takes resources—not the least of which is money. Schools, roads, police, and fire departments all cost money—money that has to come from somewhere and someone. Adapting to coastal change will be no different in that respect. What does make it different is the fact that the sea level change driving much of the need to adapt is also undermining the very foundation of local governments' capacity to act—their tax base. It does that in two ways.

First, by making vulnerable areas less productive and riskier for investment. This fact underlies most of what will be discussed in this paper.

Second, it does so by turning land into water to the point that ownership can shift from private to public. If and when that happens, entire tracts of property can leave local tax rolls.

The lines between state and federal property and public and private property are both hugely important and poorly understood as years of confused and confusing jurisprudence attest.

As seas rise and land retreats, questions can arise as to just where the line is between what is federal and what is state or local land. That has certainly been an issue in Louisiana where the answer determines who benefits from the mineral wealth beneath the waters.

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.R.S. 49:1 and enacted La.R.S. 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.R.S. 49:3.1 indicates that, even as the coast recedes, the baseline should not change. That statute provides: "[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. Thus far, this issue has not been litigated. If left

unchallenged, as the coast recedes, these statutes could effectively create a larger area of jurisdiction over offshore waters for Louisiana.

Beyond the state and federal boundary lies an even more important question in practical terms. Will submerged lands stay on the tax rolls of local governments? This question turns on the definitions of public things, navigable waters, sea shore and territorial sea under state law.[5] Public things are those things owned by the State or its political subdivisions (e.g. parishes or municipalities) in their capacity as "public persons."[6] Property of this sort must be held and used for public purposes and cannot be transferred into private hands except as may be otherwise allowed by law. Examples of public things cited by the Louisiana Civil Code include the bottoms of navigable water bodies, as well as the territorial sea and the seashore.[7] This is important to the present discussion because public things are not part of local tax bases. As seas rise and lands sink or erode, areas that were once clearly private things can become sufficiently inundated as to become public things. If—when—that happens ownership can shift and so can the benefits and burdens of ownership. Knowing this can happen and planning for the possibility is something that deserves far greater attention since it goes to the very heart of how communities and their residents might plan for their futures.[8] It is highly likely that it will take new legislative and policy initiatives to provide the clarity and authority necessary to allow public and private rights and duties to be aligned in ways that will allow for state and local governments and private property owners to collectively protect their interests and viability. Louisiana has created and is creating options to

[5] This issue is not unique to Louisiana. As a general rule, navigable waters and their beds belong to the state, though there are sufficient exceptions to that rule and differences between the states that draw bright lines. The inundation of coastal lands will likely raise questions about ownership in all coastal states, but the actual impact of submersion on taxable ownership needs to be determined on a state by state basis.

[6] La. Civ. Code Art. 450.

[7] *Id.*

[8] The terms "navigable waters," "seashore," and "territorial sea" sound clear and precise, but in practice they are anything but. These terms are not self-defining, and they also do not indicate of what time they speak. For purposes of what the state initially took ownership of, the definitions refer to the conditions at the time of statehood, which is the year 1812 in Louisiana's case, and the terms are defined by Federal Law. But rivers, streams and coastlines are changeable things: things look different than they did in 1812, and the question of who owns what is mostly a question of state law. In Louisiana, the state has made clear that it claims the waters "of and in all bayous, rivers, streams, lagoons, lakes and bays and the beds thereof" (excepting those not directly owned by any person August 12, 1910). La. R.S. 9:1101.

ameliorate that risk, but those options are neither fully formed nor well understood.[9] Progress on each of those counts will be needed if coastal communities can expect to be attractive places to invest.

III. PUBLIC WATER INFRASTRUCURE FINANCE

There is no shortage of ink and rhetoric devoted to the state of America's infrastructure. Generally, the context is a campaign promise, a major piece of federal legislation, or a report citing the deplorable state of our infrastructure in the hope that it results in campaign promises and major federal legislation. That focus on the national and federal is understandable, but it misses the bigger picture that plays out at the state and local levels. The proper role of the federal government in infrastructure is nearly as old as the Republic as demonstrated by the clash between Henry Clay's expansive American System platform and Andrew Jackson's far more limited view of the federal role in the development of the nation.[10] What has never been disputed is the importance of infrastructure, especially in dealing with water needs and threats, or the pervasive responsibility of state and local governments. That importance is on full display in current federal law and policy.

Federal Water Resources Development Projects

The creation of a federally authorized water resources project is a five step process, in which all steps involve nonfederal participation:

[9] For example, by statute Louisiana has authorized the State to enter into agreements with private landowners in the coastal zone whereby mineral boundaries can be fixed with greater certainty and surface rights transferred to a "qualified conservation organization" subject to various terms and conditions. *See* La. R.S. 41:1702(D). This reflects the additional complicating factor that mineral ownership plays under Louisiana law, which strongly prefers the unitary ownership of surface and subsurface rights. The agreements under that statute can require the acquiring conservation organization to agree to pay taxes or a fee in lieu regardless of their obligations otherwise. Rules to guide the implementation of La. R.S. 41:1702(D) are pending at the time this paper was finalized.

[10] *Classic Senate Speeches: Henry Clay In Defense of the American System*, UNITED STATES SENATE, https://www.senate.gov/artandhistory/history/common/generic/Speeches_ClayAmericanSystem.htm (last visited July 19, 2019).

1. Secure congressional authority to do preliminary (i.e., reconnaissance) study of the problem or opportunity the project would address to see if there is a sufficient federal interest in the project. *This is primarily the job of the nonfederal partner*.

2. Conduct the preliminary study. This will be done by the Army Corps of Engineers *subject to available funding and applicable nonfederal partner cost share.*

3. Conduct feasibility study. If there is a sufficient federal interest to proceed, the Army Corps of Engineers will perform a detailed feasibility study of the project *subject to available funding and applicable nonfederal partner cost share (normally 50%).*

4. Secure congressional authorization of the project based on the feasibility study.

5. Secure construction funding for the project from congressional appropriations (normally this must be done annually) *subject to nonfederal partner cost sharing*.

With the exception of inland navigation projects funded by the Inland Waterways Trust Fund, every class of water infrastructure project eligible for federal support requires some level of nonfederal—almost always state or local government—financial participation for construction and/or operations and maintenance. As shown in a recent Congressional Research Service report, the nonfederal portion is often the lion's share.[11]

Cost Shares for Construction and Operation and Maintenance (O&M)

Project Purpose	**Maximum Federal Share of Construction**	**Maximum Federal Share of O&M**
Navigation		
Harbors and Coastal Channels		
Improvements less than 20 ft. deep	80%[a]	100%[b]

[11] Nicole T. Carter and Anna E. Normand, *Army Corps of Engineers: Water Resource Authorization and Project Delivery Process*, p. 14, CONGRESSIONAL RESEARCH SERVICE, (last updated April 19, 2019), https://fas.org/sgp/crs/natsec/R45185.pdf.

Improvements between 20 ft. and 50 ft. deep	65%[a]	100%[b]
Improvements greater than 50 ft. deep	40%[a]	50%[b]
Inland Waterways	100%[c]	100%
Flood and Storm Damage Reduction		
Inland Flood Control	65%	0%
Coastal Hurricane and Storm Damage Reduction (except Periodic Beach Renourishment)[d]	65% (50%)	0% (0%)
Aquatic Ecosystem Restoration	65%	0%
Multipurpose Project Components		
Hydroelectric Power	0%[e]	0%
Municipal and Industrial Water Supply Storage	0%	0%
Agricultural Water Supply Storage	65%[f]	0%
Recreation at USACE facilities	50%	0%
Aquatic Plant Control	Not Applicable	50%

a. Percentages reflect that nonfederal sponsors pay 10%, 25%, or 50% during construction and 10% over a period not to exceed 30 years.

b. Appropriations from the Harbor Maintenance Trust Fund, which is funded by collections on commercial cargo imports at federally maintained ports, are used for 100% of these costs.

c. Appropriations from the Inland Waterway Trust Fund, which is funded by a fuel tax on vessels engaged in commercial transport on designated waterways, are used for 50% of these costs. For more on this trust fund, see CRS In Focus IF10020, *Inland Waterways Trust Fund*, by Charles V. Stern and Nicole T. Carter.

d. Congressionally authorized beach nourishment components of coastal storm damage reduction projects consist of periodic placement of sand on beaches and dunes; most nourishment activities remain in the construction phase for 50 years.

e. Capital costs initially are federally funded and are repaid by fees collected from power customers.

f. For the 17 western states where reclamation law applies, irrigation costs initially are federally funded, then repaid by nonfederal water users.

These figures can be misleading, suggesting that the federal government will actually pay for a given federally authorized project. However, the federal government need not and may not actually pay because the availability of funds is generally subject to appropriation by Congress. The $98 billion backlog of authorized but unfunded Army Corps of Engineers projects bears witness to that fact.[12]

The requirement that federal construction money be appropriated by Congress was softened somewhat in 2018 by the enactment of Disaster Recovery Reform as part of the FAA Reauthorization Act of 2018, which allows Disaster Assistance Grants under Section 404 of the Stafford Act[13] to be used to fund the federal share of previously approved water resources projects.[14] As a policy and humanitarian matter, this is a very positive development in that it allows better things to come out of bad events. It should not, however, be viewed as a meaningful tool because worthwhile investments should not depend on disasters to be possible.

The picture does not improve appreciably beyond the bounds of the federal civil works program where grant and loan programs offer very useful but limited assistance with certain types of water infrastructure projects.

Loan Programs: These include the Clean Water State Revolving Fund (CWSRF), the Drinking Water State Revolving Fund (DWSRF), and the Water Infrastructure and Innovation Act (WIFIA).

CWSRF and DWSRF are federal programs that encourage states to set up revolving loan funds that can be accessed to fund eligible projects. Louisiana has established both types of funds which allows local governments to gain lower interest debt financing than might otherwise be

[12] *Id.* at 3.
[13] *See* 42 U.S.C. § 5155.
[14] *Id.*

available. Needless to say, because the loans must be repaid with interest, there are limits on how much a given community can afford to tap into these programs.

WIFIA, created in 2014, is a supplemental federal loan program designed to help state and local governments and others fund large water infrastructure projects. It is designed to complement the CWSRF and DWSRF programs but to work separately from them. For communities with 25,000 or fewer people, the minimum project size is $5 million. For larger communities, the minimum is $20 million. In both cases, the most WIFIA can finance is 49% of the project cost, and the total federal share of the project cannot be more than 80%.

Grant Programs: In addition to loan programs, the federal government also offers—or is proposing to offer—significant grants that can expedite water infrastructure projects. These include the Community Development Block Grant (CDBG) program, Disaster Relief Grants, and Water Infrastructure Development Grants.

These loan and grant programs can be hugely beneficial and provide state and local governments with access to much needed capital for water related investments. However, even the most generous loan and grant programs will be difficult for some communities to avail themselves of if they lack the creditworthiness or financial wherewithal to qualify or to afford the price of cost shares and debt service. Even if communities have that capacity today, one of the more dismal aspects of rising seas is that it can rob communities of their future stability and growth potential. For that reason, it will be imperative for communities to expedite their planning and investments and to explore innovative regional and public-private collaborations.

Other Federally Sourced Financial Resources: From time to time events can conspire that lead to the creation of dedicated funding streams that may be used by state and local governments. In Louisiana's case, such funding streams include the Gulf of Mexico Energy Security Act (GOMESA) and the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act).

GOMESA is a revenue sharing concession under which four Gulf States (namely, Louisiana, Texas, Mississippi, and Alabama) share the first $500 million of federal offshore mineral revenue

from the Gulf of Mexico.[15] The states divide the revenues based on a lease area's proximity to each state's coastline.[16] The maximum that the State of Louisiana can receive is $140 million.[17] GOMESA revenues must be deposited in the Coastal Protection and Restoration Trust Fund to be "used only for the purposes of coastal protection, including conservation, coastal restoration, hurricane protection, and infrastructure directly impacted by coastal wetland losses."[18] One potential problem surrounding GOMESA funding is that market forces may threaten to reduce or redirect Louisiana's share of revenue. That is, GOMESA revenues depend upon the continued profitability of offshore oil and gas production. Additionally, political pressure threatens to reduce or redirect Louisiana's share of revenue.

The RESTORE Act diverts 80% of the Clean Water Act penalties from the 2010 BP *Deepwater Horizon* oil spill to the Gulf for restoration work.[19] Funds from the RESTORE Act are divided into five funding streams known as "pots."[20] Pot 1 divides 35% of the RESTORE Act funds evenly among the states.[21] Under pot 3, 30% of the RESTORE Act funds are allocated based on the portion of the state's shoreline that was oiled; coastal population; and distance from the spill. In combination, these two pots will contribute $765 million to Louisiana's coastal restoration.[22]

Even when federal funds have been pledged and apparently secured, they may be less certain than they initially appear. This can lead to questions or reluctance when state and local governments try to use the federal funds to engage private capital as might be the case when a state or local governmental body tries to issue bonds secured by the promise of those funds. For example, efforts by the State of Louisiana to bond out a portion of its future GOMESA revenues have not come to fruition, in part due to the uncertainty of revenues from GOMESA. As GOMESA revenues are tied to future oil and gas leasing and production, the revenues are thus also tied to the

---

[15] Mark Davis and Dean Boyer, *Financing the Future: Financing Options for Coastal Protection and Restoration in Louisiana ("Financing the Future III")*, TULANE INSTITUTE ON WATER RESOURCES LAW & POLICY (Jan. 18, 2017), https://docs.wixstatic.com/ugd/32079b_333bc8956d9d4d56ae8b76253c8270ef.pdf.
[16] *Id.*
[17] *Id.*
[18] La. Const. art. 7, §10.2.
[19] Davis and Boyer, *supra* note 15.
[20] *Id.*
[21] *Id.*
[22] *Id.*

volatility and uncertainty of the oil and gas economy and prices. Similarly, because GOMESA was congressionally created, the risk exists that it could be congressionally modified or even terminated. While some of those risks are undoubtedly low, they are real enough to cause concern.

The RESTORE Act is less likely to be congressionally modified, but it does depend on BP and others to make installment payments as called for in various settlement agreements. Some in the private sector have questioned the commitment or ability of the responsible parties to make those payments into the future. This seems extremely unlikely given the financial condition of the parties and the terms of the settlement agreements. However, in the event of default or bankruptcy, the entire settlement amount accelerates and is immediately due and collectible. That is far more security than most other public and private parties can offer lenders, bond raters, or joint ventures.

The bottom line is that the federal government has become far more entwined with state and local governments in the realms of water infrastructure and hazard mitigation. So much so that it can seem that the federal role is the dominant role. That impression is false, especially when it comes to determining who has the responsibility of acting. Where water resources and hazard management are concerned, the state and local governments bear the ultimate responsibility for action. Federal participation is facilitative, not dispositive.

IV. PROPERTY VALUES, MORTGAGE LENDING & INSURANCE

Property values are the major component of individual wealth for most people in the United States. For average Americans over age 35, home equity makes up roughly 70% of their net worth.[23] With so much at stake, it is understandable that many coastal homeowners have invested considerable resources in protecting individual properties. Despite the risks, the allure of coastal property still holds sway, and there has not, as of yet, been large-scale migration landward or a lack of interest in buying coastal property. One explanation is that perhaps coastal home buyers are shortsighted or do not realize the risk:

> Home buyers tend to think short term, focus on what they can afford and hope that the local infrastructure keeps pace with the rise in sea levels. Home buyers are also

[23] Jim Wang, *Average Net Worth by Age – A Look at American's Wealth & How You Stack Up*, WALLETHACKS, (last updated May 21, 2019), https://wallethacks.com/average-net-worth-by-age-americans/ (last visited July 19, 2019).

> generally on their own as they look at prospective properties and try to size up their risk, as real estate agents vary in what they disclose.[24]

The housing market is starting to wake up to such risks though. Research currently under way shows that middle-income residents are already leaving areas of Miami Beach that suffer from nuisance flooding.[25] From 2006 to 2016, median home prices rose 29.7% across the United States.[26] Over the same period, median home prices in high-risk flood areas have fallen by 4.4%.[27]

The average home buyer might not have access to detailed flood risk disclosures. Mortgage lenders do, however, have the resources to assess climate risks in their lending decisions. Institutional lenders have the power to make decisions that could obviate community resilience efforts. Mayor Jim Cason of Coral Gables, Florida, has laid out the potential tipping points facing coastal communities:

> If property values start to fall…banks could stop writing 30-year mortgages for coastal homes, shrinking the pool of able buyers and sending prices lower still. Those properties make up a quarter of [Coral Gables'] tax base; if that revenue fell, the city would struggle to provide the services that make it such a desirable place to live, causing more sales and another drop in revenue.[28]

Lenders in Australia have already begun to lower their loan-to-valuation ratios in flood risk areas, placing higher upfront costs on the homeowner and making it harder to transfer property.[29] If mortgage lenders begin to incorporate robust climate risk assessment and actively limit their

---

[24] Ian Urbina, *Perils of Climate Change could Swamp Coastal Real Estate*, N.Y. TIMES (Nov. 24, 2016), https://www.nytimes.com/2016/11/24/science/global-warming-coastal-real-estate.html (last visited July 19, 2019).

[25] Erika Bolstad, *High Ground is Becoming Hot Property as Sea Level Rises*, SCIENTIFIC AMERICAN (May 1, 2017), https://www.scientificamerican.com/article/high-ground-is-becoming-hot-property-as-sea-level-rises/ (last visited July 19, 2019).

[26] Urbina, *supra* note 24.

[27] *Id*.

[28] Christopher Flavelle, *The Nightmare Scenario For Florida's Coastal Homeowners*, BLOOMBERG (Apr. 19, 2017, 4:00 PM), https://www.bloomberg.com/news/features/2017-04-19/the-nightmare-scenario-for-florida-s-coastal-homeowners (last visited July 19, 2019).

[29] Kate Mackenzie et al., *There Goes the Neighbourhood: Australian Housing and the Financial Sector 25*, THE CLIMATE INSTITUTE, (May 2016), http://www.climateinstitute.org.au/verve/_resources/TCI-There-goes-the-neighbourhood-FINAL-30052016.pdf.

collateral exposed to climate change, this could trigger a potentially devastating collapse of coastal communities.

If coastal property values decline, the economic ripple effect would not be limited to the coast. A 2016 report from the Federal Home Loan Mortgage Corporation (Freddie Mac) warned that the value of coastal homes, which could be "literally underwater," would cease to exist with no expectation of recovery, making it substantially less likely that borrowers would make mortgage payments than in other circumstances where home value decreases.[30] Thus, because mortgage-backed securities are frequently bundled and resold to institutional investors who hold them as facets of investment portfolios, the value of these investment portfolios could drop precipitously or even disappear entirely. This would lead to economic and social threats that, while gradual, are "likely to be greater in total than those experienced in the housing crisis and Great Recession."[31]

Another important consideration will be how mortgage underwriters approach changes to the security of their investments. Banks could exert influence directly on individual properties by, for example, requiring borrowers to undertake protections. Alternatively, banks could simply cut entire parishes, towns, or latitudes out of their lending portfolios. Where financially feasible, homeowners are investing in protections for their investments, such as raising their homes or building seawalls.[32] However, many property owners in those coastal municipalities most affected by rising sea levels and decreasing property values do not have the disposable income available for these projects. Furthermore, there is limited value to these individual investments "when surrounding areas do not keep pace and flooding or the rise in sea levels swamps nearby roads."[33] Thus, the role of parish and municipal governments in both protecting the value of the citizenry's property values and instilling confidence in mortgage lenders and banks is inherently tied to the governments' ability to learn to live with the rising water.

One way that governments can easily protect the property values of their citizens and assuage the concerns of lenders is through active participation in the Community Rating System (CRS) of

---

[30] *Life's a Beach*, FREDDIE MAC (April 26, 2016), http://www.freddiemac.com/research/insight/20160426_lifes_a_beach.page (last visited July 19, 2019).
[31] *Id.*
[32] Urbina, *supra* note 24.
[33] *Id.*

the National Flood Insurance Program (NFIP).[34] CRS is a voluntary program for communities in good standing with the NFIP that awards points for community activities that lower risk.[35] These points are then transferred into discounts on insurance rates for property owners.[36] Discounts range from 5% to 45%, with increases in increments of 5%.[37] In order to be eligible for the program, the community must maintain FEMA elevation certificates for buildings built after the date of its CRS application.[38] Additionally, if the area is a repetitive loss community, the community must "prepare, adopt, implement, and update a comprehensive flood hazard mitigation plan using a standard planning process."[39] Outside of these mandatory requirements, all other point-eligible programs can be discretionarily implemented.[40]

The savings available through participation in the CRS program are substantial, yet many eligible communities in Louisiana are not participating in the program.[41] Most of these communities are already implementing the policies and programs viable for points under the program. However, government officials have difficulties complying with the administrative aspects of the program, such as documenting programs and policies, due to lack of capacity and funding for a full-time employee position. It is imperative that coastal communities prioritize creating a specified, full-time CRS program position or division within their governmental structure. This could be facilitated through regulations aimed at strengthening or beginning compliance, or through independent initiatives within the agencies and offices best suited to handle these questions.

Should a coastal community actively participate in CRS, thereby lowering insurance rates for its property owners, funds will become available for use on other non-structural projects. A good

---

[34] *National Flood Insurance Program: Community Rating System: A Local Official's Guide to Saving Lives Preventing Property Damage Reducing the Cost of Flood Insurance*, FEMA (2018), https://www.fema.gov/media-library-data/1535126505943-439b296e7778b037d05f698f65c7891b/2018NFIP_CRS_Brochure_June_2018_508OK.pdf.
[35] *Id.*
[36] *Id.*
[37] *Id* at 3.
[38] *Id* at 4.
[39] *Id* at 6.
[40] *See id* at 8.
[41] *Community Rating System Participation State Maps*, FEMA, https://www.fema.gov/media-library/assets/documents/27808 (last visited July 19, 2019).

example of this is home elevation. Though a moderate rise in elevation may just be 1 to 2% of the construction cost of a new home, it is vastly more expensive to elevate an existing home, with an average cost of $160,000 for a seven foot increase in height.[42] By saving homeowners money on their insurance premiums through participation in CRS, property owners are one step closer to affording these types of mitigation efforts. Further, home elevation can lead to greater CRS discounts, completing the circle. These smaller investments, coupled with strong structural protections and active community engagement, can vastly extend community viability and lender confidence.

V. IMPACT INVESTING & COASTAL RESTORATION

Investors have wide discretion when choosing in which companies and communities to invest. As investors consider where to place their finances, they are increasingly looking for businesses and other investments that catalyze not only financial capital, but social capital as well. Specifically, investors are relying on a set of criteria, referred to as environmental, social, and governance (ESG), which are ethical factors that investors consider when determining in which companies and locations to invest.[43] ESG criteria are part of the larger trend of socially responsible investing known as "impact investing." Impact investors look to maximize profits while also supporting socially responsible, environmentally conscious, and ethical businesses. Although they incorporate monetary considerations into investment determinations, they do not value profit over ethics; instead, they strive to create a balance between the two. Further, investors do not follow a specific formula for ESG analysis; rather, different investors may prioritize different factors. Some may focus primarily on the environment and, therefore, would want to look into specifics like a company's contribution to climate change. Others may place more emphasis on the social aspect by examining a company's labor practices and how ethically sound they may be. Additionally, although these investors may have a genuine interest in promoting ethical business practices, they also may be utilizing ESG analysis because it can be inherently more profitable. For example, the

[42] Amanda Kolson Hurley, *The House of the Future is Elevated*, CITYLAB (Dec. 8, 2017), https://www.citylab.com/design/2017/12/the-house-of-the-future-is-elevated/540327/ (last visited July 19, 2019).
[43] *Environmental Social and Governance (ESG) Criteria*, INVESTOPEDIA (updated May 10, 2019), https://www.investopedia.com/terms/e/environmental-social-and-governance-esg-criteria.asp (last visited July 19, 2019).

BP oil spill and the Volkswagen emissions scandal lost these companies, and their investors, large sums of money in fines and punitive settlements.[44]

Impact investing has grown more popular in recent years, and trends have emerged as to what specific factors impact investors assess. According to an August 2017 Callan survey, 37% of plan sponsors[45] incorporate ESG criteria into their investment analysis.[46] Three areas that ESG investors assess have been prioritized recently – climate change, equal pay, and executive compensation.[47] As ESG analysis becomes more prominent in investment practices, environmental concerns are given more weight. Today's environmental factors under consideration by investors go much further than simply analyzing a company's carbon footprint, a common practice under corporate strategies looking to manage for the "triple bottom line."[48] Now, investors are looking more closely at the specifics, such as waste management; water and resource use; energy efficiency; use of renewable energy; and climate change adaptation.[49] In particular, climate change adaptation is an attractive component of ESG management. According to the Asset Owners Disclosure Project, which is a measurement of the top 500 asset owners in the

---

[44] Order and Judgment Granting Final Approval of Economic and Property Damages Settlement and Confirming Certification of the Economic and Property Damages Settlement Class at 1-15, *Bon Secour Fisheries, Inc., et al. v. BP Exploration & Production Inc.*, MDL NO. 2179 (E.D. La. *filed* Dec. 21, 2012).

[45] Plan sponsor refers to "a designated party, usually a company or employer that sets up a healthcare or retirement plan, such as a 401(k), for the benefit of the organization's employees. The responsibilities of the plan sponsor include determining membership parameters, investment choices, and in some cases, providing contribution payments in the form of cash and/or stock." *Plan Sponsor*, INVESTOPEDIA (updated June 17, 2019), https://www.investopedia.com/terms/p/plansponsor.asp (last visited July 19, 2019).

[46] *Callan's 2017 Survey of Institutional Investors Reveals ESG Adoption Trends*, CALLAN (Dec. 14, 2017), https://www.callan.com/press-release-callan-2017-survey-of-institutional-investors-reveals-esg-trends/ (last visited July 19, 2019).

[47] Greg DePersio, *3 Trends to Watch in ESG Investing*, INVESTOPEDIA (updated Jan. 2, 2018), https://www.investopedia.com/articles/investing/030316/3-trends-watch-esg-investing.asp (last visited July 19, 2019).

[48] The "triple bottom line" is a term of art referring to "a company's degree of social responsibility, its economic value, and its environmental impact." *Triple Bottom Line (TBL)*, INVESTOPEDIA (updated May 3, 2019), https://www.investopedia.com/terms/t/triple-bottom-line.asp (last visited July 19, 2019).

[49] George Kell, *The Remarkable Rise of ESG*, FORBES (July 11, 2018, 10:09 AM), https://www.forbes.com/sites/christopherskroupa/2017/06/19/helping-investors-understand-the-importance-of-esg/.

world, nearly one in five asset owners now has a staff dedicated to integrating climate risk into investments, and two in five now incorporate climate change into their policy frameworks.[50]

ESG criteria analysis is crucial to coastal investment because of the serious effects that less-conscious investments can have on fragile coastal environments, both socially and ecologically. While Louisiana's Coastal Master Plan calls for an integrated coastal investment and wetland restoration policy,[51] there is still much to be done to attract private investments in coastal restoration. Currently, such investment is largely centered on community building and workforce development. For example, ExxonMobile has a well-developed ESG investment strategy, with community investments totaling $242 million.[52] While the majority of these investments are directed at "civic and community," Exxon has also invested in higher education, health, the arts and culture, and the environment.[53] In fact, Exxon's 2017 Summary Annual Report discusses corporate sustainability and appears to put a strong focus on the environment, stating the company's support for the Paris Agreement and use of energy efficient technologies.[54] However, investments into education incentives have proved most popular at the company. ExxonMobile has been an active participant in the training and education of Louisiana residents in STEM[55] fields, awarding a $13 million grant to the National Math and Science Initiative in order to expand

[50] Asset Owners Disclosure Project, Global Climate Index 2017, http://aodproject.net/global-climate-index-2017.
[51] Coastal Protection and Restoration Authority of Louisiana, *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (2017).
[52] *See generally Community Engagement: Working with communities*, EXXONMOBIL, https://corporate.exxonmobil.com/Community-engagement/Working-with-communities (last visited July 19, 2019).
[53] *Id.*
[54] *See generally Community Engagement: Working with communities*, EXXONMOBIL, https://corporate.exxonmobil.com/Community-engagement/Working-with-communities (last visited July 19, 2019).
[55] "STEM" stands for Science, Technology, Engineering and Medicine.

Louisiana's STEM program in 2016.[56] This funding helped to spur an increase in qualifying math, science, and English Advance Placement exam scores at schools in the program.[57]

Those who are qualified in the aforementioned fields are particularly ready to engage with water resource management and coastal restoration, a fact that has not gone unnoticed by investors in Louisiana. At the end of 2017, the information technology company DXC Technologies chose New Orleans as the home for its new "Transformation Center."[58] This investment was spurred, at least in part, by a large incentive package from the state, $25 million of which will be dedicated to STEM education in Louisiana's colleges and universities, in return for an agreement by DXC to recruit from the funded schools.[59] Although projected job and impact numbers have proved to be hard to fulfill, Louisiana Economic Development estimates this will create 2,257 indirect jobs for the area and the LSU Economics & Policy Research Group estimates the project will translate to $64.3 million in new state taxes and $868.4 million in new state earnings.[60]

In contrast, there is very limited coastal infrastructure investment by private parties, with much of corporate impact investing focused on business climate improvement rather than project-specific infrastructure development. Coastal infrastructure investment includes two categories, namely gray infrastructure, such as roads and buildings, and green infrastructure, such as wetlands and barrier islands.[61] Of course, both types of investment are essential to combating the impact of

---

[56] *Louisiana Students, Teachers to Benefit from Expansion of National Math Science Initiative's College Readiness Program*, NATIONAL MATH + SCIENCE INITIATIVE (Feb. 25, 2016), http://www.nms.org/News-and-Views/News/Louisiana-Students,-Teachers-to-Benefit-from-Expan.aspx (last visited July 19, 2019).

[57] Charles Lussier, *ExxonMobil-funded program credited with expansion of AP at capital region high schools*, THE ADVOCATE, Jan. 22, 2018 (8:31 PM), https://www.theadvocate.com/baton_rouge/news/education/article_8f7db22c-fef9-11e7-a155-aff10da7491f.html (last visited July 19, 2019).

[58] Katherine Sayre, *DXC Technology is a win 'we will celebrate for a long time to come': Gov. Edwards*, NOLA.COM (Nov. 13, 2017 1:27 AM), https://www.nola.com/business/article_b8ce42b3-2984-5147-892d-bf075c665b2c.html (last visited July 19, 2019).

[59] *Id.*

[60] Caitlin Berni, *Gov. Edwards And Mayor Landrieu Announce DXC Technology To Create 2,000 Jobs in New Orleans*, GREATER NEW ORLEANS, INC. (Nov. 13, 2017), http://gnoinc.org/news/publications/press-release/gov-edwards-and-mayor-landrieu-announce-dxc-technology-to-create-2000-jobs-in-new-orleans/ (last visited July 19, 2019).

[61] Erin McCreless & Michael W. Beck, *Rethinking Our Global Coastal Investment Portfolio*, JOURNAL OF OCEAN AND COASTAL ECONOMICS (2017).

climate change; however, there is currently much more private investment into gray infrastructure, such as roads. This could be problematic where the long-term environmental impact of these developments is not partnered with green infrastructure development by the corresponding governmental entities.[62] With governmental entities lacking the necessary funds, private and non-profit entities have also had to serve as the primary investors in green infrastructure development, with entities like America's Wetland Foundation choosing to invest in pilot projects that build and maintain essential green infrastructure on the coast.[63]

However, with a massive gap between the funds that are available and the actual cost of coastal restoration, there can, and should be, a larger role for private impact investors into coastal infrastructure. Currently, a variety of legal and financial mechanisms are being created that will help support investment into infrastructure and coastal resilience. One method is environmental impact bonds (EIB), a type of green bond. Usually, an outside group coordinates an EIB by aligning and connecting municipalities with investors, and determines the parameters of the bond, such as time frames, expected outcomes, and other key factors.[64] Then, investors provide the capital upfront through the purchase of the EIBs from the issuing municipality.[65] Next, the municipality constructs the project, and the project outcomes are evaluated by an independent third party.[66] Finally, the municipality repays the investors contingent upon the expected outcomes.[67] Key to the success of these bonds is that the return is based on the outcomes of the project. Diego Herrera of the Environmental Defense Fund's Mississippi River Delta restoration team explains it as such: "There would be agreed-upon natural infrastructure performance tiers that may, for example, give investors additional payments if outcomes are better than expected. Likewise, if the

[62] *Id.*
[63] *Gulf Intracoastal Waterway (GIWW) Shoreline Restoration Project*, AMERICA'S WETLAND FOUNDATION, https://www.americaswetland.com/wp-content/uploads/2018/08/010418-AWF-GIWWProjectOverviewREV2.pdf.
[64] *Environmental Impact Bonds*, CHESAPEAKE BAY FOUNDATION, http://www.cbf.org/how-we-save-the-bay/programs-initiatives/environmental-impact-bonds.html (last visited July 19, 2019).
[65] *Id.*
[66] *Id.*
[67] *Id.*

project has lower-than-expected performance, the payor could receive back a portion of the interest investors would otherwise earn."[68]

Environmental impact bonds are already being used for natural infrastructure projects that support water quality. The key example is Washington D.C.'s water utility, who contracted the first ever EIB by selling $25 million in a tax exempt EIB to Goldman Sachs and the Calvert Foundation, using the funds towards a clean water project that manages storm water runoff and river pollution through green infrastructure.[69] This model can be used for coastal restoration purposes as well. A recent example of this is that NatureVest, the conservation-investing unit of the Nature Conservancy, awarded the Environmental Defense Fund (EDF) a Conservation Investment Accelerator Winner.[70] Under this award, EDF will receive a grant and intends to use it to develop an EIB.[71] The EIB will go towards funding a wetland restoration project from the Louisiana Coastal Master Plan.[72] The plan is for the EIB to bring together government, corporate, and non-profit resources to accelerate coastal restoration, with the potential to save the state millions of dollars over the next decade.[73] These opportunities should not be overlooked by public entities as they are trying to fill the space between the finances they have and the finances they need. Impact investing makes up a small part of overall investing currently, about 1% or roughly $77 billion; however, it is expected to grow to as large as $700 billion by 2020.[74] That surge of interest coupled with the savings in time and dollars associated with early action suggest that the time to fully explore these options is now.

As public entities look towards attracting these types of investments in the future, they should begin collecting and providing complete ESG data for investors in municipal bonds and

---

[68] Diego Herrera, *Environmental impact bonds: Next big thing for green investments?*, ENVIRONMENTAL DEFENSE FUND (Jul 14, 2017), https://www.edf.org/blog/2017/07/14/environmental-impact-bonds-next-big-thing-green-investments (last visited July 19, 2019).
[69] *Id.*
[70] *EDF Designing First Ever Environmental Impact Bond for Wetland Restoration*, ENVIRONMENTAL DEFENSE FUND (Oct 3, 2017), https://www.edf.org/media/edf-designing-first-ever-environmental-impact-bond-wetland-restoration (last visited July 19, 2019).
[71] *Id.*
[72] *Id.*
[73] *Id.*
[74] Herrera, *supra* note 68.

infrastructure partnerships. By incorporating environmental data into risk assessments, municipalities allow private investors to apply a holistic approach to investment decisions by evaluating factors such as municipal adherence to regulations; debt incurred due to mitigation activities; and climate-change preparedness.[75] Municipalities can do this by not only keeping adequate records on the aforementioned data, but also by developing the tax base and management systems to support it. Additionally, developing mechanisms on the municipal level for tracking spending on and implementation of infrastructure projects can allow for a more cohesive approach to coastal resiliency, providing potential investors with a roadmap showing how each infrastructure project interacts with the others. This shows investors that their public partner is committed to mitigating the impacts of climate change through the continual promotion of green infrastructure development, thereby minimizing future risks to their investments. Finally, governments should consider their current contracting and procurement regulations, ensuring that they are conducive to attracting impact investors who may not fit into the traditional models of municipal contracting.

VI. CONCLUSION

As the Louisiana coast continues to change due to climate change and other causes, the impacts that investments have on community viability become increasingly important. It is important to understand that the inundation of lands carries not only the risks associated with flooding but also the prospect that it can lead to changes in ownership that can significantly impair local tax bases. The State has created and is creating options to ameliorate that risk but those options are neither fully formed nor well understood. Progress on each of those counts will be needed if coastal communities can expect to be attractive places to invest.

Both outside parties and citizens of these communities make substantial investments in their futures by choosing to remain in coastal Louisiana. The parties that place resources – time, money, and assets – into coastal communities rely on their governmental partners to provide a stable and functional environment where their investments can thrive. Governments can create conditions conducive to investment by prioritizing capacity building in environmental and social factors,

[75] Rob Moore & Robert Fernandez, *How CDP Data Can Inform Investors about Risk and Opportunities in U.S. Municipal Bonds*, CDP (Feb. 18, 2015), https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/001/613/original/White-paper-muni-bonds.pdf?1486720635.

including by making investments of their own through participation in programs such as the Community Rating System. They should also build strong, environmentally engaged portfolios in order to attract investors who place value in environmental, social, and governance criteria when selecting their investments. With a little bit of luck and smart planning, community-led investments can allow the daunting future of coastal communities to become one of hope and growth.

CHAPTER TWO:

FINANCING PROTECTION AND RESTORATION: COMMUNITY PERSPECTIVES[76]

I. RESILIENCE AND COMMUNITY TIPPING POINTS

In recent years, the term resilience has been used by a wide variety of government agencies, industry, consulting firms, international finance organizations, NGOs, community groups, and academics to refer broadly to the ability of a system, community, or society to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events in a timely and efficient manner, including through the preservation and restoration of essential basic structures and functions.[77] Current resilience thought is derived from early studies of social-ecological resilience and refers to systems rather than individual units, due to the term having its origins in ecology, a discipline which is concerned with the study of interaction of organisms and the environments in which they exist.[78] For this reason, it is necessary for researchers to fully understand the complex interactions of the human, natural, and built environments, recognizing that change in any of these environments will result in changes across the entire system. Such an understanding also recognizes the existence of a zone of "stable functioning" within which a system can absorb change while still maintaining its essential functioning.[79] One key component of this systems-based approach to community resilience is an increased focus on how much disturbance a system can absorb before it changes its structure or reaches a critical tipping point—a point at which one more small change results in a large destabilization and transformation of the environment, such that it enters a new state.

Coastal Louisiana can be considered a prototypical social-ecological system, with its culture and economy intricately tied to the region's abundant renewable and nonrenewable natural

---

[76] Principal authors: Scott A. Hemmerling, Director of Human Dimensions, The Water Institute of the Gulf; Monica Barra, Assistant Professor, School of the Earth, Ocean & Environment, University of South Carolina; Raleigh Goodwin, Research Assistant, The Water Institute of the Gulf. The Water Institute and the authors would like to thank The Walton Family Foundation and the Foundation for Louisiana, whose support helped made this make this research possible. We would also like to thank our colleagues with the Tulane Institute for Water Law and Policy for helping guide this research and providing insights throughout. While their input has been invaluable, the authors remain exclusively responsible for the paper and its contents.

[77] National Academy of Sciences, DISASTER RESILIENCE: A NATIONAL IMPERATIVE (Washington D.C.: National Academies Press, 2012).

[78] Crawford S. Holling, *Resilience and Stability of Ecological Systems*, 4 ANNUAL REVIEW OF ECOLOGY AND SYSTEMATICS 1 (1973); Arup International Development, *City Resilience Index: Research Report Volume 1 Desk Study* (2014), https://www.arup.com//media/cri_research_report_vol1.pdf?la=en&hash=FB689DC92AC8906D9524A50F078FB868AFEAED49.

[79] Raven Cretney, *Resilience for Whom? Emerging Critical Geographies of Socio-Ecological Resilience: Resilience of What, for Whom*, 8 *GEOGRAPHY COMPASS* 627 (2014).

resources.[80] Coastal communities, in particular, have proven to be particularly vulnerable to rare but destructive tropical weather events, as well as more frequent yet equally destructive hazards, such as extreme rainfall events and even drought. Other changes impacting Louisiana's social-ecological system have been more subtle but no less impactful when examined over time. Coastal land loss in particular has had a profound impact on coastal communities, both natural and human, though the impacts may be small and imperceptible over the short term.[81]

When combined with Louisiana's high levels of social and economic vulnerability,[82] the cumulative impacts of these environmental hazards can accumulate until they reach a tipping point. As noted above, the tipping point concept is increasingly being applied to assessments of social vulnerability and community resilience. Scientists have begun utilizing this ecological term when addressing the impacts of climate change and seal level rise. They argue that eventually humanity will reach a point at which it would be very difficult, if not impossible, to reverse the effects of climate change and prevent the realization of many catastrophic changes to the planet. The report *Towards a Tipping Point in Responding to Change: Rising Costs, Fewer Options for Arctic and Global Societies* explores the idea of tipping points within broader social systems, expanding the conversation to include tipping points within government and community priorities and spending.[83] For example, as ecological changes like climate change challenge coastal residents, a social tipping point could be the point at which a government is unwilling to finance programs that keep regions habitable despite environmental changes. There could also be a tipping point where communities become willing to abandon their community instead of making the necessary adaptations, which are often difficult or expensive.

In this study, the concept of social tipping points is applied to Louisiana where communities along the coast are subject to a variety of mounting pressures resulting from the aforementioned coastal hazards, including the ongoing coastal land loss crisis. These pressures will largely determine how long these communities remain viable. In response to these pressures, local, state, and federal decision makers have developed a variety of plans and policies that can potentially extend or shorten the lifespan of Louisiana's coastal communities. In previous years, these plans primarily focused on the preservation and restoration of the coast, but today, the idea

[80] Scott A. Hemmerling, A LOUISIANA COASTAL ATLAS: RESOURCES, ECONOMIES, AND DEMOGRAPHICS, (2017).
[81] Brady R Couvillion et al., *Land Area Change in Coastal Louisiana (1932 to 2016)*, 26 (2017), https://pubs.usgs.gov/sim/3381/sim3381_pamphlet.pdf.
[82] Scott A Hemmerling and Ann C Hijuelos, *Coastal Louisiana Social Vulnerability Index (SVI). Version I.* 27 (2016), http://coastal.la.gov/wp-content/uploads/2016/08/Attachment_C4-11.2.pdf.
[83] Henry Huntington, et al., *Towards a Tipping Point in Responding to Change: Rising Costs, Fewer Options for Arctic and Global Societies*, 41 AMBIO 66 (2012); Mark Nuttall, *Tipping Points and the Human World: Living with Change and Thinking about the Future*, 41 AMBIO, 96 (2012); Susan G. Stafford et al., *Now Is the Time for Action: Transitions and Tipping Points in Complex Environmental Systems*, 52 ENVIRONMENT: SCIENCE AND POLICY FOR SUSTAINABLE DEVELOPMENT,38 (2010).

of restoration has been restructured to fit new environmental challenges, such as climate change and sea level rise. While decision makers can attempt to protect what is left of Louisiana's coast, it is no longer considered feasible to restore all of the land that has already been lost. After years of gradual land loss, subsidence, and a decline in the Mississippi River's sediment load, Louisiana has already reached an ecological tipping point. It remains to be seen how close Louisiana's coastal communities are to reaching a social tipping point, beyond which their viability may be in doubt.

II. ADAPTATION AND LOUISIANA'S COASTAL MASTER PLAN

For vulnerable communities along Louisiana's coast, land loss is a daunting and immediate concern. Its obvious direct effect is that as the Gulf of Mexico encroaches, homes and entire communities will need to adapt or be abandoned. In response to this inevitability, Louisiana's Coastal Protection and Restoration Authority (CPRA) outlines a series of structural and nonstructural mitigation measures in the state's Comprehensive Master Plan for a Sustainable Coast (the Coastal Master Plan).[84] According to the Coastal Master Plan, structural protection projects "reduce flood risk by acting as physical barriers" and include projects such as levees, floodwalls, and various water control structures, while nonstructural projects "elevate and floodproof buildings and help property owners prepare for flooding or move out of high risk areas."[85] However, even plans and actions intended to relieve pressures on coastal communities can create new pressures of their own. The Coastal Master Plan, for example, is intended to build land and reduce flood risk for the majority of the state's coastal residents. However, a great deal of the responsibility for carrying out the nonstructural aspects of the Coastal Master Plan and a fair amount of the operations and maintenance for structural protection projects often fall on local governments which are not set up for that and whose capacity will likely get worse without major changes. Because these nonstructural projects are not currently guaranteed funding by the state government, local governments will either have to develop a way to fund the projects on their own or choose to go without these mitigation measures.

Because a tipping point occurs as a result of gradual changes in an environment, it can be difficult to predict before it occurs: What exactly will be the catalyst event that signals the point of no return, or one that is so painful that it's difficult to return? The report entitled *Now Is the Time for Action: Transitions and Tipping Points in Complex Environmental Systems* argues that there must be a greater understanding of tipping points and their effects among policymakers and stakeholders and that "tools must be developed" to facilitate that understanding.[86] A Social Impact Assessment (SIA) can be an integral part of the planning and implementation of a new program that could potentially affect a community and therefore could be useful in the identification of

[84] Coastal Protection and Restoration Authority of Louisiana, *Louisiana's Comprehensive Master Plan for a Sustainable Coast* (2017).
[85] *Id*.
[86] STAFFORD, *supra* note 83.

social tipping points.[87] Among its practitioners, it is often considered good practice to involve community members in the SIA process through structured public participation. The International Association for Impact Assessment (IAIA) asserts that public participation is "essential for good governance" and results in "better projects, better development, . . . and ultimately a more sustainable world."[88] Public participation in SIA helps to refine the project's plan and inform the implementation process. The perspective provided by stakeholders must be considered seriously and applied appropriately.

In keeping with this recommendation, the current project makes use of stakeholder insight to assess the social impact of nonstructural mitigation measures and potential funding streams through a series of semi-structured interviews and qualitative data analysis. The study aims to identify the main social tipping point(s) in the implementation and/or funding process for nonstructural residential programs at which it would become so taxing on the community that residents would choose to move elsewhere. In other words, this study looks at what consequences, if any, paying for or implementing the nonstructural program would have on residents' decision to stay or leave their community. The nonstructural projects of interest for this research primarily include the elevation and voluntary acquisition (i.e., "buyout") of homes in vulnerable areas.

III. SELECTION OF RESEARCH SITES

Stakeholders invited to participate in the project were from one of three coastal parishes: Cameron, Terrebonne, or Plaquemines. Participants from Cameron Parish were from the small towns of Cameron, Creole, and Hackberry. Terrebonne Parish participants were largely from the Houma area, and those interviewed in Plaquemines Parish were mostly located in the Buras-Triumph area. The three parishes are spread strategically along the Louisiana coast—one along the Mississippi River in the southeastern area of the state, one closer to the central coast, and one in the Chenier region of southwest Louisiana. Both Cameron and Plaquemines Parishes provide the insights of more small, rural towns, while the more populous Houma region in Terrebonne Parish represents a mix of both urban and rural living. This variation in population between research sites allows for the exploration of different-sized tax bases. Houma's larger tax base has already allowed Terrebonne Parish to produce funds for the Morganza to the Gulf levee project, while Cameron Parish's small tax base has the parish struggling to pay for basic costs like the wages of its firefighters, let alone the significant burden of funding nonstructural programs. All three parishes are heavily influenced by Louisiana's oil and gas industry, which can benefit parish residents through employment but may not provide a direct contribution to the community's economy due to property tax exemptions at the state level. In 2005, Hurricane Rita devastated

[87] L. Mabon, J. Kita and Z. Xue, *Challenges for Social Impact Assessment in Coastal Regions: A Case Study of the Tomakomai CSS Demonstration Project*, 83 MARINE POLICY 243 (2017).
[88] P. André et al., *Public Participation International Best Practice Principles* (2006), https://www.researchgate.net/publication/322603480_Public_Participation_International_Best_Practice_Principles.

Cameron Parish, and Hurricane Katrina dealt a tremendous blow to communities in Terrebonne and Plaquemines Parishes. The destruction these hurricanes caused—not just to these three parishes, but to multiple parishes near or on the Gulf coast—greatly altered tax bases and local communities through population migration.

The three parishes selected were exceptional in terms of the number of private residences and buildings housing businesses recommended for nonstructural measures, such as elevation and buyout, as well as the total cost of the nonstructural mitigation. All three research sites were well above the median value for number of home elevations and acquisitions suggested by the nonstructural plan as well as the total estimated cost of the recommended nonstructural measures (i.e., floodproofing, elevation, and acquisition). Across all regions mentioned by the Coastal Master Plan, the Houma region of Terrebonne Parish had the highest number of home elevations suggested, the second highest numbers of voluntary acquisitions and floodproofings recommended, and the second highest total cost of the combined recommended nonstructural mitigation measures.[89] In summary, each of the selected parishes may require an above-average amount of nonstructural mitigation. This, combined with the fact that they vary in population size and economic and cultural contexts, makes them ideal for the purposes of the current study. Exploring the feasibility and potential consequences of possible funding streams for these unique or unusually difficult cases could help provide a framework for cases of lesser and equal complexity.

[89] COASTAL PROTECTION AND RESTORATION AUTHORITY OF LOUISIANA, *supra* note 84.

Table 1. Suggested Nonstructural Mitigation Measures in Study Area Communities

Community	Low to Moderate Income Households (%)	Number of Repetitive Loss/Severe Repetitive Loss Properties	Nonstructural Mitigation Measures			
			Number of Structures Recommended for Floodproofing	Number of Structures Recommended for Elevation	Number of Structures Recommended for Voluntary Acquisition	Total Estimated Cost (M)
Median values*	**42**	**92.5**	**3.5**	**106**	**5**	**$63**
Cameron	35	1,225	27	437	114	$127.0
Plaquemines – West Bank	47	95	46	1,331	54	$264.7
Terrebonne – Houma	48	6,265	312	5,307	477	$1,264

*Median values across all "mitigation areas," which are a combination of parishes and select regions within parishes as identified by CPRA. Median values are reported because the data was highly positively skewed; a small number of mitigation areas had values significantly higher than the vast majority of mitigation areas, rendering the mean values misleadingly large. This data was obtained from Attachment E3 of the Coastal Master Plan.[90]

[90] *Id.*

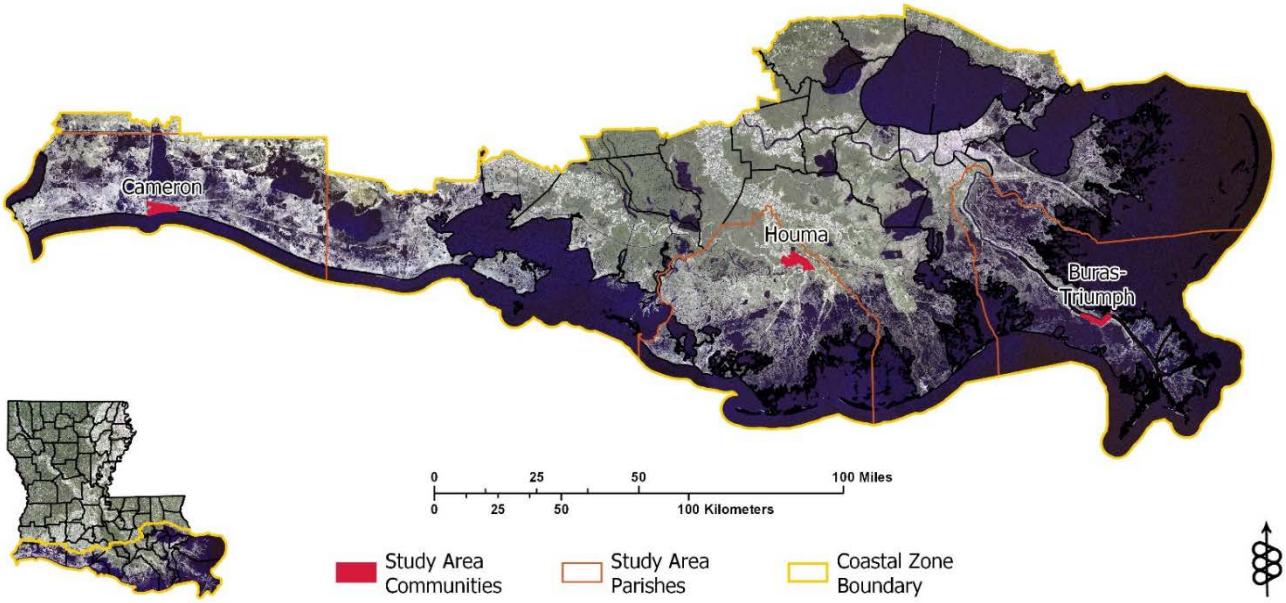


Figure 1. Study Area Communities

Buras-Triumph (Plaquemines Parish): The community of Buras-Triumph (population of 1,342 per 2013-2017 ACS) is located in southeast Louisiana on the west bank of the Mississippi River in south-central Plaquemines Parish. At the county (parish) scale, according to recent estimates by the U.S. Census Bureau (circa 2013-2017 ACS), there were 23,394 people and 8,759 households in Plaquemines Parish. Median household income within Plaquemines Parish was estimated at $49,635 with an annual per capita income of $26,177, well below the nationwide average of $57,652 and $31,177, respectively. The parish has an estimated employment rate of 56.8% in the civilian labor force population older than 16 years. Nearly all of Plaquemines Parish, and by extension the community of Buras-Triumph, is vulnerable to frequent flooding from high intensity storms, riverine high water, and storm surge. Compounding the risk of storm surge related flooding is the significant wetland loss occurring in Plaquemines Parish. Significantly, the parish is converting from land to water faster than any other in Louisiana. The loss of surrounding marshland to erosion played a significant role in the devastation wrought by Hurricane Katrina in 2005. After Katrina, the Buras-Triumph community saw a significant drop in population as many residents chose to relocate instead of rebuild. As evidence of this hurricane-driven relocation, the Buras-Triumph population dropped from 3,358 to 1,161 between the 2000 and 2010 decennial censuses (see Appendix 1A).

Cameron (Cameron Parish): The community of Cameron (population of 222 per 2013-2017 ACS) is located in the southwest region of Louisiana in south-central Cameron Parish. The city serves as the parish seat of Cameron Parish and is part of the Lake Charles Metropolitan Statistical Area (MSA). At the county (parish) scale, according to recent estimates by the U.S. Census Bureau

(circa 2013-2017 ACS), there were 6,806 people and 2,686 households in Cameron Parish. This low population, coupled with the high concentration of oil and gas-related corporations, forces the parish to rely on the oil and gas industry for much of its revenue. Median household income within Cameron Parish was estimated at $60,194 with an annual per capita income of $29,681, on par with the nationwide average of $57,652 and $31,177, respectively. In addition, 12% of residents hold a bachelor's degree or higher, and the parish has an estimated employment rate of 58.2% in the civilian labor force population older than 16 years. The oil and gas industry alone employs more than 1,000 workers in the parish. Cameron Parish is unique among the three parishes studied in that it has no parish sales tax. Flooding due to hurricanes and storm surge are the most common mechanisms of flooding in the community of Cameron. The community has dealt with several devastating hurricanes in its history, including Audrey in 1957, Rita in 2005, and Ike in 2008. Storm surges in excess of 12 feet have destroyed the majority of structures in the community on several occasions. After Hurricane Rita in 2005, the community saw a significant drop in population as many residents chose to relocate instead of rebuilding. The population of the community dropped from 1,965 to 406 between the 2000 and 2010 decennial censuses. Today, all residents of the Cameron community live within the bounds of the 100-year and 500-year floodplains (see Appendix 1B).

Houma (Terrebonne Parish): The community of Houma is located in the Acadiana region of south Louisiana in north-central Terrebonne Parish. The city serves as the parish seat of Terrebonne Parish and is part of the Houma-Bayou Cane-Thibodaux Metropolitan Statistical Area (MSA). At the county (parish) scale, according to recent estimates by the U.S. Census Bureau (circa 2013-2017 ACS), there were 113,067 people and 40,177 households in Terrebonne Parish. In the community of Houma, there were 33,784 people and 12,334 households as of the 2013-2017 ACS. Median household income within Houma was estimated at $43,178 with an annual per capita income of $24,528, well below the nationwide average of $57,652 and $31,177, respectively. The community has an estimated employment rate of 56.5% in the civilian labor force population older than 16 years. The parish has no independent legal ability to raise property or sales tax rates, so revenue flexibility is limited to increases in locally controlled franchise taxes, fees, and charges.[91] Flooding is an issue for many Houma residents as the majority of the city lies at or below sea level. The principal source of flooding in Houma and Terrebonne Parish is rainfall, but hurricanes and associated storm surge are a significant threat during late summer months. The community has dealt with several devastating hurricanes in its history including Andrew in 1992, Katrina in 2005, Gustav in 2008, and Isaac in 2012 (see Appendix 1C).

IV. SUMMARY OF RESEARCH METHODOLOGIES AND DATA COLLECTION

[91] *Fitch Affirms Terrebonne Parish, LA's Bonds at "AA-"; Outlook Stable*, BUSINESS WIRE, https://www.businesswire.com/news/home/20160727006448/en/Fitch-Affirms-Terrebonne-Parish-LAs-Bonds-AA- (last visited July 19, 2019).

Recruitment for participation in this study began in spring 2018. Across the three parishes, researchers used a snowball sampling method* to identify a diverse pool of coastal residents to invite to participate in one-on-one interviews. This began with one or two key contacts and subsequently requesting recommendations for further participants. Phone calls, emails, and in-person meetings were used to recruit an initial list of potential participants. The participant types (i.e. stakeholder groups), developed with team members from the Water Institute, Tulane, and the Foundation for Louisiana, encompassed individuals and representatives from the following groups/sectors (in general):

- Government officials (non-elected)
- Homeowners
- Residents
- Economic development groups
- Cultural organizations
- Local schools/school boards
- Public service sector
- Fisheries
- Religious organizations
- Local business owners
- Community organizations

In each parish, researchers contacted 15-20 potential participants with the goal of securing 8-12 participants for interviews in each parish. Table 2 presents the number of individuals interviewed and participant types for each study location.

*Snowball sampling method is a technique to gather participants for a study requiring subjects that fit certain specifications, making random sampling not an option. For the current study, researchers sought the participation of certain stakeholders. Snowball sampling entails reaching out to a baseline number of participants that the researchers believe will be a good fit for the study. After reaching out, researchers ask the potential participants to list the names and contact information of people they know who they believe would make ideal subjects for the study. This process is repeated, with existing subjects recommending new subjects, until enough participants are acquired.

Table 2. Stakeholders Interviewed

Community	Stakeholder Type	Total Number of Interviewees
Buras-Triumph	Government Official	6
	Government Official and Local Business Owner	
	Resident Homeowner	
	Resident Homeowner	
	Resident Homeowner	
	Resident Homeowner	
Cameron	Government Official	9
	Government Official	
	Government Official	
	Government Official and Economic Development Group	
	Local Business Owner	
	Resident Homeowner	
	Resident Homeowner	
	Resident Homeowner	
	Resident Homeowner	
Houma	Community Organization	9
	Economic Development Group	
	Economic Development Group	
	Education and Cultural Organization	
	Government Official	
	Government Official	
	Religious Organization	
	Resident	
	Resident Homeowner	

Interview times ranged from one to two hours on average. Where possible, multiple interviews were arranged at once to accommodate participants' schedules. All interviews were audio recorded and transcribed by researchers with all identifying information of participants removed for anonymity. Researchers collected over 14 hours of audio which were subsequently transcribed in an abridged manner to be used for coding (see Appendix 3).

All transcripts were coded by members of the research team in order to identify key themes within and across different research sites related to identify tipping points. Key tipping points are described and contextualized in depth in the following pages.

V. KEY TIPPING POINTS IN COASTAL COMMUNITIES

Research was conducted in three coastal parishes across the Louisiana coast: Plaquemines, Terrebonne, and Cameron. The parishes share some similar geographic, economic, and demographic characteristics, yet each one also faces unique challenges in regard to confronting

coastal land loss and CPRA's proposed nonstructural coastal protection program. Because the nonstructural program is not currently funded by CPRA, interviews were conducted within a context of how aspects of the nonstructural program would impact individuals and coastal communities in light of the lack of state funding and how, at either a personal or parish level, residents envisioned paying for the implementation of CPRA's nonstructural program (see Appendix 2).

The following section presents key findings from across research sites, highlighting tipping points that are generalizable to coastal areas and, where appropriate, specific to particular parishes.

Tipping points for the nonstructural program

CPRA currently offers the possibility of three forms of adaptation for coastal residents eligible for their nonstructural program: Floodproofing (for businesses), home elevation, and home buyouts for private residences. With this in mind, researchers discussed the impacts of home elevation, home buyouts, and the potential "do nothing" scenario in order to get a sense of how residents living in these three coastal parishes interpret these options for adaptation. During interviews, participants were asked specifically what particular issues might push them to embrace one option or another for nonstructural adaptation and what obstacles they might encounter as individuals and as a community in the event they need to individually or locally shoulder the burden of funding and organizing aspects of the nonstructural program.

Home elevation: Home elevation is an established mechanism for responding to increasing flood risks across coastal Louisiana. Most home elevations in coastal Louisiana have been heavily subsidized by federal funds, including form the Federal Emergency Management Agency (FEMA) and the U.S. Department of Housing and Urban Development (HUD). The CPRA estimates that approximately 7,694 private residences across the three study parishes will need to be elevated to keep pace with projections of future flood risk. This would be at a total cost of almost $1.2 billion. At the moment though, CPRA does not have the funds to entirely or partially fund home elevations. Given this context, researchers asked residents in the study areas what forces would motivate them to elevate and/or prevent them from elevating their homes.

By far, **economic constraints** were the most frequently noted impediments to individuals living in areas where CPRA recommends home elevation. Residents already living in elevated homes, as well as those not yet in an elevated home, consistently expressed that the possibility of elevating homes is largely dependent upon access to some of kind of cost-sharing program. For almost all residents, the costs of home elevation are estimated to be equal or higher than the value of their homes and property. As such, home elevation is a financial choice on par with purchasing a new home as much as it is a choice about adaptation to predictions of future land loss. Many participants—though not all—reported that elevation would only be financially accessible if the

bulk of the necessary funds were provided. However, home elevation that was entirely financed out of pocket was out of the question for most participants researchers spoke with.

For residents who have elevated, experiences with trying to keep up with **changing base flood elevations** for flood insurance requirements has meant that home elevation is sometimes only a temporary solution to adapting to flood risk. One of the most frequently mentioned concerns from participants who have elevated in the wake of various hurricanes is how the costs of flood insurance change with every storm. Almost all of the participants who currently have elevated homes had financial assistance which enabled them to financially afford elevation costs. Part of their motivation to elevate, beyond protecting their homes and continuing to live in their neighborhoods, was an anticipated financial relief on flood insurance. This, however, often proved to be temporary as base flood elevations and National Flood Insurance Program (NFIP) maps changed. As one resident from Cameron Parish noted, this equates to feeling that they are "penalized because [they]'re below the elevation [set by FEMA/NFIP]," even if they were above the required elevation when they first built or elevated their home.

If finances were not a constraint, many of the participants noted that they would be open to elevating their homes. This motivation emerges from experiences with flooding. For several participants, the notion of the "next flood" was frequently mentioned as the impetus for feeling personally open to elevating their homes (particularly if there is some form of financial assistance). When elevation is possible, a participant from Houma asserted that "it's definitely positive." They continued, "I think there are a lot of people who sleep easier at night, even during hurricane season when a hurricane gets in the Gulf, if their house is elevated a foot, two feet above the [base flood elevation]." In addition to giving residents peace of mind, a participant from Cameron added, "[Elevation] gives those people access to affordable insurance, or more affordable once you get the base flood or above." Thus, not only do residents view elevation as a way to prevent incurring large costs after storms, but it is also a proactive way to minimize the regularly-occurring cost of flood insurance. Another Houma participant told researchers, "If you were to go to [community members] and say, 'We're gonna elevate your house, and we're gonna pay for it,' they'll say, 'Absolutely.' Everyone will be on board."

Despite the overall positive response to the possibility of elevating homes, some participants held nuanced feelings on the subject. A Cameron participant answered that they would "absolutely" consider elevation if most of the funds were subsidized through an elevation program but clarified later in the interview that they "don't want to live in an elevated house" if the house would have to be raised up to fifteen feet in the air, as would potentially be the case based on FEMA flood maps. "I'd rather not… but if it were at three feet above sea level, then yeah." Some participants also noted that they would not feel physically safe or comfortable living in an elevated home, particularly above a certain height. Concern for physical strain, such as walking up a significant number of stairs, and the impacts of wind on homes elevated 15-20 feet in the air were

often mentioned as reasons to stay on the ground. Residents in Plaquemines Parish discussed these drawbacks at length, especially concern for being inside an elevated home during high wind events.

A Houma participant noted that "a lot of people like it also because it gives them space underneath for entertaining … so there are a lot of [positive] things … for the elevation of the home," but that does not negate how "stressful" and "scary" the elevation process is. When asked if they would consider elevating if the funds were provided, that participant replied, "I think I would have to say, 'Take it, and I'll go somewhere else.' … I'm physically fit and so is my [spouse] and my [children], but I don't want my mom climbing stairs like that to come visit us. We'd have to put an elevator in. That's another expense." Regarding mobility issues, however, another participant in Houma did mention that "most of the elevation [they have] seen … paid for by FEMA … include a[n] [elevator]." Still, elevators require maintenance, which creates cost later on, and run the risk of breaking down entirely, rendering elderly residents potentially unable to enter and exit their home until repairs are complete.

When asked if it was difficult to adjust to their new, elevated home, one participant in Cameron replied, "At first, because it sways with the wind. When we first moved in, we'd get headaches, and the washing machine would shake as it worked. And going up and down twenty-something stairs—don't forget nothing downstairs. It ain't fun going back down." Despite those drawbacks in regard to how they feel about their elevated home, they continued, "We love it … When Harvey was coming through, all the yards around were flooding, including mine, but I didn't have to worry because I was up there. We knew we were fine, [and] we got to stay in our house while other people down our road were having to get out." This participant listed several of the concerns other participants had that made them averse to considering elevation, but their family found that the benefits outweighed the costs. However, the members of this family were relatively younger and perhaps not yet forced to consider the implications of an elevated home once they age.

Relocation: In addition to home elevation, CPRA's 2017 nonstructural plan proposes voluntary home acquisition—or a home buyout and relocation—as an option for homes above a 14-foot projected flood risk. For many of the study participants, relocation was not a favored option for dealing with flood risk. Nevertheless, many had already experienced some form of temporary relocation and/or have family and friends who have relocated. A frequent impetus for becoming open to relocation had to do with the **frequency and severity of flooding**. As one participant from Terrebonne Parish noted, the threshold is frequently tied to how often water gets in homes and the capacity of owners to financially and physically deal with repairing damage: "My family – half my family are die-hards. They're gonna stay here until water is in the house. The rest of them moved to higher ground when they got to an age where just couldn't deal with the floods anymore." When relocation does happen, for several coastal communities this is predominately an "up the bayou" decisions: Individuals often opt to stay in the parish if they move, but move to higher

ground. This enables them to maintain ties to family and friends while living in an area with a lower flood risk in the same parish.

For many families, once a financial and physical limitation is met, it becomes more appealing to relocate. This is especially the case for individuals reaching "retirement age." The threshold past which an individual decides to relocate, however, is quite different across communities and even within families. Many individuals remarked that members of their family have already relocated, which can make relocation more appealing. For those that do wish to relocate in the future, a government-subsidized program could prove largely helpful because many residents think it will become increasingly difficult to sell their homes in flood zones as insurance rates rise.

Opportunities for **employment** were also cited as potential reasons individuals might consider relocating. "Some of that out migration could be from economic reasons. That's not to say that those people who live here – they still got family and ties here – they may be moving out because it's expedient; they gotta take care of their families, they gotta get a job." These comments point to the economic factors and the ups and downs of coastal industries—oil and gas, in particular—that also dictate how individuals and families make decisions about whether or not to relocate. The prospect of jobs might persuade individuals to relocate but, as several participants noted, if jobs come back to the coastal region this would be motivation to move back.

Several participants cited the limitations of a buyout program because **no one will want to buy abandoned property**. Several parish workers noted that the parish often ends up having to maintain properties that are left in the wake of a buyout program. These properties, once declared unsuitable for housing, then need to be transferred into other uses that the local parish government may or may not have the resources to maintain. As one parish worker noted, "There's a downside to it in that the property ends up – the parish has to maintain it in perpetuity. It can't be used – it can be a community garden – it can't be built on, and somebody's got to cut the grass. It's been a situation where the parish is like, 'Man, I wish we could sell this to somebody. You wanna make it part of your lot, that's fine, but you can't build on it.' Because the regulations won't allow you to do that. So there have not been in this parish a significant number of buyouts."

Finally, many of the study participants who belonged to tribal communities in particular emphasized that there is no situation under which they would ever consider relocating. This comes from the feeling that living in the bayou is "all they know." "The thing is," one participant explained, "we're close to our families. Twenty, thirty minutes away is too far for a lot of people." Many individuals have opted to rebuild after storms, even with the costs and expectation that they will have to rebuild again. "I don't know what to tell you. Our people are different that way. We're crazy people, we defy the norm in a lot of ways. It depends on what they put a value on, whether or not they'd be willing."

Despite how unpopular relocation is with many coastal residents, one participant is already taking measures to help those that will have to move up from regions that flood frequently in southern Terrebonne Parish. Having purchased much of the property and houses surrounding his or her land, the participant is looking to turn the area into a small receiver community for displaced bayou residents by one day allowing them to rent out the properties as their new homes:

> I'm trying to build a community that welcomes people from down the bayou and has the same feeling of being down the bayou but being in Houma. Because there's a cultural side of it where... when people are forced to move—because they will be forced to move, we kinda know that—they have to go someplace. And is Houma the right place for them to go? I don't know. I hope it is because I hope that means that we're still there... The bayou is in front of my house, so the water is there, and I think that's very important for down the bayou people at least to see, to feel a connection of, 'This looks familiar. I may not be able to catch saltwater fish in here right now.' Maybe by that time they will be catching saltwater fish there. But what is it that you need to have? A sense of neighborhood more than anything.

Actions like these show that relocation, though unpalatable to some, has been accepted as inevitable by many residents of vulnerable coastal parishes. In all three parishes studied, some population migration has already begun to occur, often in the aftermath of a hurricane or significant flooding event. In Plaquemines Parish, participants felt that this relocation has led to a deterioration of the sense of community in the region. For many, without the tight-knit community they grew up in, they feel less incentivized to stay in the area. One participant explained, "You still have people that are leaving. You have people coming back, but we have people that are leaving… It's not the same. There's not a lot of work down here for the men, and the fishing industry is going down, so there's people moving back and people leaving."

A different participant added, "There was a community down here before the storm, and our kids still played…, still walked to the neighbor's house. We did things like that… look out and see where the kids were. Now it's like..." The first participant finished, "There's a lot of strangers." Someone later concluded, "I personally don't think people are coming back."

Do nothing: Many of the same personal and financial burdens noted for home elevation and relocation were emphasized when the "do nothing" scenario was presented to participants. "We'll be here until we absolutely can't anymore," one participant from Terrebonne Parish noted. Often, this belief was born of a mix of expectations of financial hardship. Without resources to elevate or relocate, many residents held fast to staying put and weathering challenges as they come about with the hopes of finding solutions. Two Terrebonne Parish participants thought through the potential consequences if the parish was not able to fund elevations and buyouts and envisioned a scenario that leads to "bankrupts" and "vacated properties":

> But even so, even moving to higher ground, what do you do with the house you're effectively abandoning? If nobody is going to acquire that, who's gonna buy the house? You put it up for sale, you're gonna take an enormous loss on that *if* you can find anybody who wants to buy it for a greatly reduced price. Because, you know, you flood, and the insurance is astronomical … I think ultimately, in a scenario like that, we would have people – elected officials – beating down doors in Congress for relief because that's got to be, with no funding, it's… You might as well just turn off all the lights and leave. The place turns into a ghost town.

Though it seems extreme, one participant in Cameron Parish had worked with families in Texas who had been through a similar experience:

> They weren't required [to have flood insurance], didn't have it. And they flooded. Seven and eight feet of water in their homes – to the roof line. They either took out a second mortgage, or if they were not too far away from the end of the mortgage they had, they just walked away. Start over. If you gotta pay that much money to start over, they just moved. Left it.

In conclusion, social and economic factors – family and social network, flood insurance, the housing market, and jobs – were as likely to drive out migration (or the consideration for out migration) as environmental ones – coastal land loss and the flooding itself. Social networks and connections to place through historical or sentimental value of the land keep people in communities, yet this is also limited by available economic resources and financial capacity to maintain a residence in high flood risk areas.

Tipping points for funding mechanisms for the nonstructural program

The funding mechanisms proposed in the current study would need public support for successful implementation either because they require a vote to pass or because they require action by public officials who are voted into office. However, the majority of participants in the current study believed that increasing taxes, or any other type of financial burden such as fees, would not be well received by fellow residents of their parishes. The attitudes of many participants regarding funding streams harken back to the ideas of Huntington et al. (see footnote 83) and seem to illustrate the viewpoint of residents who live in communities that have already passed a social tipping point in terms of taxation. Past increases in taxes and fees have built over decades, and migration out of the parish—at least partially due to the devastation of past hurricanes and a lack of job opportunities following oil busts—has slowly exacerbated this issue by shrinking the tax base. At some point in this process, participants reached a point at which they became no longer willing or considerably reluctant to accept the imposition of new taxes or fees, even to fund programs meant to greatly benefit the community. Thus, these results may illustrate a financial tipping point already reached by many communities on the coast. Despite the threat of increasing

flood risk, community members are unlikely to support funding mechanisms that place further financial burden on them—even though it is possible these nonstructural mitigations may soon be necessary to maintain the viability of these communities.

Sales and property tax increases: In coastal parishes where the population is particularly low, many participants felt that passing a property tax to fund some form of a nonstructural program would not be supported by residents. They described many of their friends and neighbors as **already feeling overburdened with property taxes**. "A lot of people probably feel like they're taxed to death as it is." Another resident from Cameron Parish, the smallest parish by population in this study stated it bluntly, "If you give most people in this parish the option of paying an extra $150, $200 a year in property taxes to go towards some sort of program, I think they'd rather keep that money and let everybody pay for it themselves." Despite the characterization of others as adamantly against any tax increase, many of our **participants personally were open to an increased sales or property tax to build** to build a fund for nonstructural projects in their respective parishes.

In distinguishing between the two types of taxes in terms of which they would prefer to pay—property or sales—there was no consistent pattern across participants. Some participants preferred an increase in property tax because it is only paid once a year, and they believed a small increase there would not significantly alter their day-to-day budget. Others believed property tax is already too high in their parish and would prefer sales tax because they felt more in control of what they paid due to its dependence on their individual purchases. One participant noted that sales tax is a regressive tax, disproportionately affecting those of lower income or those on a fixed income such as retired residents. Opinions varied even beyond what is detailed in this report; overall, there was no clear consensus.

There was the sense in some parishes, that **property tax increases for new or existing industries**—oil field or natural gas—might be a palatable route for generating funds. Yet, current tax exemption laws that allow new industries to build and develop for a decade before paying property taxes effectively means that access to those possible financial resources is limited.[92]

Reactions to **sales tax** increases varied across parishes. In Cameron Parish, which currently has no sales taxes, several participants indicated that they would be comfortable paying a small sales tax but that overall most parish residents and the parish government are not in favor of increasing sales tax. For a parish that small, as one resident noted, the extent to which a sales tax could generate any revenue, compared to a property, was questionable. "If you look at the sales tax" as one participant explained, "that's gonna fluctuate. We have no retail options in the parish. So if you have no mall or clothing stores, department stores, car dealerships, the larger sales tax

[92] Rebekah Allen, *No Strings Attched: Thanks to Tax Breaks, Cameron Parish Government Struggles amid Industrial Boom*, THE ADVOCATE, Dec. 17, 2017.

generating items are not in this parish." Furthermore, to counterbalance the loss in revenue from a lack of both sales tax and funds from Liquefied Natural Gas (LNG) plants that are tax exempt, the parish has property tax rates that residents believe to already be considerably high. This makes them less open to the idea of an increase in property tax as well.

For any increase in taxes, sales or property, participants consistently raised the question of **trust in public officials to be transparent with how they would allocate that extra revenue** and a shared sense that, if used for programs like home elevation, residents would be upset if they all paid into a fund that only supported certain residents. "Oh, we might not get approved to get our houses elevated but this person over here that doesn't work and pay taxes can have their houses elevated. So it's like, I'm gonna pay these extra taxes, I wanna make sure my house is getting elevated." This was a particularly sticky point in parishes like Plaquemines where the most northern end of the parish rests behind federal 100-year flood protection levees, maintained by the parish government in association with the U.S. Army Corps of Engineers, but the southern half of the parish is not afforded a likewise level of protection. In this circumstance, several participants residing on the southern end of the parish emphasized that residents from the northern end would not approve a tax for elevating homes on the southern end. "Up the road is not gonna pay more for down the road... There's a wall, a divide." Though Plaquemines has a distinct geography compared to other parishes, the sentiment of not wanting to pay into local tax rolls for services not received was shared across parishes. As another participant from Terrebonne Parish noted, "'If I'm over here on the north side of Terrebonne Parish and I'm fine, I'm not gonna want to pay for somebody stupid enough to stay inside [a flood zone].' That's the attitude, okay? I hear this stuff all the time, but it isn't that they're stupid; sometimes there are financial reasons that they can't." Overall, the challenge they point out in using either sales or property tax is accounting for the anticipated **differentiated distribution of those potential funds** if they are used for a home elevation or relocation program.

The aforementioned lack of trust in public officials to run the program stemmed partially from bad experiences with past cost-sharing mitigation programs. Participants in Cameron pointed specifically to issues they had experienced or heard about regarding the Road Home Program following Hurricanes Katrina and Rita. One resident relayed to researchers a story of contractor fraud that occurred using state funds from Road Home Program. The contractor used a portion of the elevation funds for personal expenses, resulting in a failure to elevate some of the homes to which he or she was assigned. The subsequent litigation lasted over a year. "And he paid restitution," the participant explained, "but the restitution was owed to the state! Not to the homeowner because … the payment went directly to the contractor. So those people [whose homes were left unelevated] either did something else in the meantime or relocated." Participants also cited the Road Home Program's poor management of paperwork and documentation. Road Home Program participants would "panic because they [got] a letter saying they'll have to pay their Road Home money back because they haven't provided them the [necessary documentation proving

adherence to program requirements], but they had provided the information *more* than once." Encountering such poor oversight with state and federal programs in the past has made some participants wary to trust how they could expect to benefit from paying tax dollars towards a nonstructural program in the future. This issue compounds with the fact that any new nonstructural program would have no prior record of responsible spending, which multiple Cameron participants saw as a major roadblock to getting any new tax passed. "Voters here tend to overwhelmingly support tax renewals or new taxes when we've seen that those who are spending that tax money have been fiscally responsible, and when they haven't shown that track record, there's not support for that."

Another challenge of using property or sales taxes as a means of developing a nonstructural fund is a dwindling population, and thus tax base. "There is not enough people down here to raise that much money," one participant noted as we discussed increases to sales and property taxes. In this regard, even an openness to increasing taxes might not generate enough funds to cover the estimated costs of implementing the proposed nonstructural plan for each parish.

In addition to questions about increasing taxes, participants were also asked about the potential for funding nonstructural protection through a small quarterly fee that could be attached to a municipal utility bill similar to paying for water or trash collection. Responses to this question, however, were nearly identical to those received from inquiries regarding taxes: Some people expressed a willingness to pay, and others did not. "I don't like bills," one participant said simply. "It's just another form of taxing," said another. One participant in Terrebonne Parish responded, "That you may be able to get away with, but again, that's peanuts." This is an issue with all of the funding mechanisms proposed to participants: Many thought that even if they were to pass, they would not be able to fund the proposed nonstructural projects.

Reallocation of taxes: The reallocation of existing taxes within parish coffers was another topic of conversation for developing a funding mechanism for the nonstructural program. Some participants felt that their parish was already struggling to raise enough money in taxes to pay for existing debts and services and therefore, there are little funds to reallocate. Other participants questioned the legal mechanisms for reallocating taxes—whether or not it would be at the discretion of the parish council or if it would need to go up for a parish-wide vote. Beyond this, certain funds, like those for education or infrastructural maintenance, serve vital purposes in these parishes and cannot be reallocated. General funds were the only existing tax rolls that participants suggested might offer some funding. Even with the possibility of this, though, there was continued concern that there still would not be enough money to cover the costs of funding the nonstructural plan.

In Terrebonne Parish, one participant with a background in economic development noted that a new property tax aimed at starting a nonstructural fund could potentially gain public support, but only if the parish first examined what is currently being taxed and stripping out or cutting down

on unnecessary or wasteful taxing districts. “I know in this parish we have been looking at several things, millages and stuff for different things that could be adjusted. We definitely have things that could be somehow cut back on, but it’s like beating your head against a brick wall… I think they would [support a nonstructural property tax] if we look at other things that need to be fixed first as far as what we’re being taxed on for our property tax.”

Alternative funding mechanism: As illustrated in the three previous sections, most participants either were not willing to entertain the idea of more taxes or fees, claimed they would be willing to pay but that most others would not be, or found the question to be altogether moot because no feasible implementation of those funding sources would produce enough funds to finance the proposed nonstructural programs. However, though not a planned portion of the interviews, several participants shared their ideas for alternative funding mechanisms they believed could help finance nonstructural projects in their parishes.

In Cameron Parish, a large emphasis was placed on the potential usefulness of funding from oil and gas companies in the area. According to participants, the parish has been proactive in the past with creating payment in lieu of taxes agreements (PILOTs) with oil and gas companies to offset, at least in some small way, the loss of revenue created by state-implemented tax exemptions and the lack of sales tax on the parish level. After almost ten years of enjoying tax exemption, more than one LNG plant in the region will be joining the parish tax rolls soon. Both residents and parish officials were optimistic that the new influx of funds would substantially affect the parish’s budget. With help from these oil and gas funds, parish officials have considered the implementation of both structural (e.g., coastal restoration and shoreline protection) and nonstructural (e.g., home elevation) mitigation measures. Officials also discussed potential for a “parish-subsidized insurance program” meant to help parish residents for whom the rising cost of flood insurance is a major barrier to staying in the area by providing financial aid to pay unaffordable insurance premiums.

Interestingly, most Cameron participants—both public officials as well as business owners and residents—were aware of the industrial tax exemptions in place and their implications but did not seem interested in seeking their removal from state law. Instead, as mentioned above, they discussed how to use the funds received from industry property taxes once they were available in the future and spoke enthusiastically about the new plants currently being built. They believe these new plants will further spur economic development, presumably through the jobs they will create both for outsiders—who would then have to move to Cameron—and for those already within the community. These plants will also eventually contribute property tax, which is “the good news,” but “we’re talking ten years from now because they’re tax-free for ten years,” one business owner explained causally to researchers. Further exemplifying the general positive attitude residents have towards these industries, participants told researchers that there is tension between the Cameron community and the Cameron Parish School Board because the school board filed legacy lawsuits, which one participant described as “oil and gas environmental cleanup cases,” against some of the

LNG companies in the area. Once the community learned that the school board won their case, and thus also "got millions of dollars in settlement funds," two newly proposed "school board taxes" failed to pass a vote. "I think [people] were criticizing the schools for suing these oil companies that had been good to the parish for so long," one resident explained. Other participants in Plaquemines worried that if the state were to stop offering tax exemptions, "the first thing [the plants] will say is they'll leave."

One participant in the Terrebonne Parish region was interested in the concept of quarterly fees but, coming from an economic development background, explored a business application as opposed to fees primarily paid by private residents. "[Business owners] always have to pay for a permit to do business in that parish. Why not take a percentage of that or increase it another ten bucks… That may be a steady source of income." The participant pointed out that a home located in the flood zone has to elevate or pay for insurance. "Same thing for business… You're subject to that fee, and that helps even the cost for everybody. So it doesn't have to be for the sake of one business that you're paying that permit fee – it pays for the area that you live in." The participant seemed to be aimed at increasing the resilience of the area by requiring businesses to invest in a pot of money that would be dedicated to preventative nonstructural measures, thus reducing the "clean-up cost" for the region after the next flood event. "There's gotta be residual value for [the business owners]," she added. "… It's more preventative than it is after. That sounds even better than a tax. When you're trying to sell to people, it's a preventative measure you're paying for."

Other participants in Terrebonne Parish provided suggestions for funding mechanisms that they believed would be more palatable in these regions where, as mentioned in sales and property tax section above, residents may be wary to invest tax dollars in a public program from which they may not benefit. As one participant explained, "the knives come out about who's gonna be eligible." Additionally, even if parishes were able to collect money for a grant program through taxes or fees and begin to save it, participants noted that it would "take a long time before we could start making a difference in subsidizing nonstructural projects" simply because the projects are so expensive and the potential recipients often numerous. To bring nonstructural mitigation within financial reach, multiple participants pointed to the possibility of flexible, reasonable loan programs as an alternative to large grants that do not need to be repaid. Specifically, one participant concluded that "it would have to be some sort of revolving loan so that we can keep the money going. Using a revolving loan might allow us to start it soon." In a similar vein, another Terrebonne Parish participant mentioned the possibility of "setting up a no interest or low interest loan fund … or an Individual Development Account (IDA) – where … there's a dollar-for-dollar match [on one's savings], and it can only be used for one purpose."

When the idea of using loans to help homeowners finance their own nonstructural mitigation was brought up to participants in Plaquemines Parish, however, the idea was not popular. "How many people down here can get approved for $100,000?" one participant asked in

disbelief. “Who wants to pay on an elevation loan for twenty years or whatever? Pay that long?” Another participant chimed in, “Especially when I’m gonna pay $30,000 more on a house? My house isn’t worth another $100,000.” Participants in Plaquemines Parish were also less optimistic than Cameron Parish about financial help from the oil and gas industry. “They were tax-free for ten or fifteen years, and as soon as you say we’re gonna raise the taxes on them, the first thing they’ll say is they’ll leave,” one participant predicted. Another added, “We might could go to the oil companies for a certain amount, but it wouldn’t be enough to do what we need to do.”

VI. CONCLUSION

At the conclusion of each interview, participants were asked what they believe residents of the parish need in order to stay in the parish, and what circumstances, if any, could cause residents to leave. This question functions as a last check for tipping points that would prompt out migration from communities, signaling that they are no longer seen as viable by even the most dedicated residents. Reoccurring responses can be categorized as either sociocultural and sentimental in nature or more financial and/or logistical. Sociocultural and sentimental reasons to stay centered around ties to one’s community, family, and coastal property. Financial and logistical tipping points ranged from the availability of jobs and necessary services to flood insurance and future home values.

Sociocultural and sentimental tipping points: Within each community, proximity to the coast and the desire to remain on family land played a large role in motivating residents to stay. “I can drive to where I grew up in thirty minutes, and I go there pretty often,” explained one participant in Cameron Parish. “Keep up the old yard and the home site that was created back in the mid-1800’s, so I sort of feel a tie to that and an obligation to maintain that area.” Some properties along the coast also have value due to mineral rights, and some participants owned or lived on land that had been in the family for up to seven generations, creating an extremely high sentimental value for the property:

> I will inherit six acres of property from my parents. My son already knows that under no circumstances is he to sell those six acres of property. When my parents pass away and I move onto that property, which is part of my plan, I’m not leaving it unless I simply cannot afford to continue to pay to live there – the cost of living there – or if I’m forcibly removed.

Living along the coast is important to residents because it allows them to maintain the tradition of an outdoor lifestyle and, to some extent, living off the land through fishing, farming, and trapping. For older residents especially, there is a deep attachment to the place that they have lived all their lives. “You would be surprised,” a participant elaborated, “but there are some people who live in Plaquemines Parish that have never been out of the parish. That’s a fact… So that’s how strong that people in this area believe in staying home… They’ll figure out a way, even if they have to live on their boat.”

Family was a universally important factor for residents in the choice to remain in their communities. “My family is here; that’s why I’m here,” said one resident plainly. Another participant described family as “entrenched” in the values of parish residents. A tipping point for many participants is simply whether or not their family is still in the region and will remain there for the long term. Some participants expressed a willingness to relocate, but only if or when their remaining family in the area were to leave or pass away (in the case of elderly parents). In contrast, participants whose family was largely still living in the region were less likely to entertain the idea of moving away.

Financial and logistical tipping points: “I think having jobs that our local people can work here is probably the primary thing we would need,” one Cameron participant decided, and a similar sentiment was echoed across all three parishes. The availability of work – either maintaining one’s current job or providing new job opportunities, especially for the parishes’ younger residents – was listed as a necessity to maintain community viability. This was true even in the communities most dedicated to stay, such as coastal tribal communities with significant ties to the land and the traditions they have built there. “I would think the only thing that would make them leave,” one such participant said, “is if they can definitely not making a living shrimping, oystering, crabbing... Them being not able to make a living would be probably the only thing. Because we've seen people’s houses be devastated and … they still rebuilt.”

Another major financial tipping point concerned how living in a flood zone would affect the future value of one’s home and rate of flood insurance. In Plaquemines Parish, where a large number of residents have either moved away or into mobile homes following Hurricane Katrina, one participant told researchers that “if you could get a decent insurance rate, people would build back on the lower end… The insurance is a huge barrier keeping people from actually building.” The rate of flood insurance is “a large reason why people are just moving into mobile homes, not building. And like I said, raising the homes is just not feasible to pay. There’s no help there, and they’re not gonna do it. And to relocate, you can’t sell your home, so they don't have money to relocate either.” In Houma, a participant’s son built a home above base flood elevation about seven or eight years ago, “but now the new [flood] maps came out, and he was so mad! He just sold his house.” This is an example of base flood elevation requirements changing and negatively affecting those who are already elevated. Flood insurance rates can have a negative effect on one’s home value and thus have a significant influence on people’s decisions to stay or leave the region, though some participants estimate that the effect will be generational, as evidenced by the exchange below involving two Terrebonne participants.

> Participant one: “Actually, the people on this side are probably upper middle-class group of people. So what they can afford now, but if you bump it up to that kind of a cost, that's gonna change it. Then you got houses for sale – good luck selling it.

> Who's gonna buy it? Because that's not a big group of people parish-wide who's gonna wanna move to a flood zone."
>
> Participant two: "I think they still will. The kind of folks who live there now can afford increased flood insurance. The problem is their kids, they're not gonna be able to."

The last logistical tipping point, availability of services within the parish, was especially true in the parishes of Cameron and Plaquemines, and it speaks to a greater issue regarding the funding mechanisms for any nonstructural mitigation that would need to be funded by the parish. Following Hurricanes Rita for Cameron and Katrina for Plaquemines, services like schools and businesses such as gas stations and grocery stores left the southern portions of the parishes and either returned very slowly or not at all. This has had a significant impact on the daily lives of residents. Plaquemines Parish participants asserted that it has influenced some of the out migration from the parish, and one Cameron participant believed it would do so there in the future, saying, "I think there are folks that went back [after Hurricane Rita] over part of the parish that may take [a buyout offer] now just because a lot of the services never returned – grocery stores, gas stations."

The same population decline that caused an outflux of businesses also significantly reduced tax bases, which has left parishes like Cameron struggling to cover the costs of basic services such as paying wages to their firefighters. Already operating on a shortage of paid and volunteer firefighters, losing even more due to wage cuts would be harmful to the parish. "Fire rating is gonna go up, and insurance rates go up – to the homeowner. And right now, our rating in that district is like the highest it can be… We had four fires in this community last winter. They all burned to the ground. By the time they get there, if it's half an hour and the wind's blowing, it's over." Parish funds are also needed to maintain infrastructure like pontoon bridges and ferries, which service residents daily on their commutes to work or trips to run errands and apparently break down often. A quality education also needs to be available within communities. In Plaquemines, participants noted that "they kinda waited too long" to complete a new school after Hurricane Katrina; many residents had already left, and some still do leave and send their children to a different high school. In Terrebonne, a participant with an economic background added that a high-quality education needs to be available in these parishes not just to maintain current populations but to bring in new residents as well.

All of these services require tax dollars; they are funded by the communities and need to remain a top priority to keep them functioning effectively. This raises an important issue: if parishes are already struggling to provide standard services to their residents under a reduced tax base, the prospect of them also independently funding parish-wide nonstructural mitigation measures is greatly reduced. The findings of the current study suggest that it would be incredibly difficult for parishes to self-generate funds for nonstructural protection. Even if a fee or tax were

to pass with popular support, a difficult feat in of itself, it appears unlikely that it would be able to generate sufficient funds for decades. Potentially, alternative methods such as loan programs could help coastal residents and communities acclimate to higher flood risks. This could be a topic of future research. The safety of coastal residents remains the ultimate tipping point for these communities. Maintaining viability in coastal communities like those selected in the current study will require a robust protection, restoration, and nonstructural program.

Appendices

APPENDIX I. TIPPING POINTS BACKGROUND: PARISH FACT SHEETS[93]

[93] Principal authors: Harris Bienn, GIS Lead and Scott A. Hemmerling, Director of Human Dimensions, The Water Institute of the Gulf. The Water Institute and the authors would like to thank The Walton Family Foundation and the Foundation for Louisiana, whose support helped make this make this paper possible. Special acknowledgements are due to the research team from the Tulane Institute for Water Law and Policy who provided much of the information included in these fact sheets. While much of the credit goes to them, the authors and the Water Institute remain exclusively responsible for the content of the fact sheets.

Buras-Triumph

COMMUNITY OVERVIEW

October 2018

GEOGRAPHY[94]

The community of Buras-Triumph is located in southeast Louisiana on the west bank of the Mississippi River in south-central Plaquemines Parish. Plaquemines Parish is bordered by Orleans Parish to the north, Jefferson Parish to the west, St. Bernard Parish to the north-northeast, and the Gulf of Mexico to the south. Buras-Triumph was split into the two census designated places (CDP) of Buras and Triumph prior to the conduction of the 2010 decennial census. Adjacent communities include the CDPs of Empire, Port Sulphur, and Point a la Hache to the north and the CDPs of Boothville and Venice to the south. In total, the two CDPs that make up the Buras-Triumph community cover an area of 19.09 square kilometers of which 13.16 square kilometers, 68.9%, is land and 5.93 square kilometers, 31.1%, is water. The community is bordered to the east by the Mississippi River and by degraded wetlands and open water to the west.

TOPOGRAPHY

The community of Buras-Triumph sits at an elevation of 3 feet above sea level with reference to NAVD88 datum. Little to no change in terrain dynamics occurs moving northward from the community along the elevated ground adjacent to Mississippi River. The community resides on the banks of the Mississippi River on natural levees built from sediment deposition occurring from the river's natural flood cycle prior to interruption from the U.S. Army Corps of Engineers.

[94] *DOWNLOAD U.S. CENSUS DATA TABLES & MAPPING FILES*, IPUMS NHGIS, https://www.nhgis.org/ (last visited July 19, 2019).

POPULATION CHARACTERISTICS

The population characteristics for the community of Buras-Triumph reference the 2013-2017 ACS aggregated by place. During the 2013-2017 reporting period, the CDP of Buras had a total population of 877 individuals, of whom 732 identified themselves as White alone, 0 as Black or African American alone, 0 as Native American alone, 115 as Asian alone, 30 as some other race alone, and 0 as two or more races. The population in Buras is split between 97% living in an urban setting and 3% living in a rural setting.[95]

In the same period the CDP of Triumph had a total population of 447 individuals, of whom 374 identified themselves as White alone, 0 as Black or African American alone, 0 as Native American alone, 39 as Asian alone, 0 as some other race alone, and 34 as two or more races. The population in Triumph is split between 95% living in an urban setting and 5% living in a rural setting. The population density of the Buras-Triumph community is 83 people per square kilometer.[1]

At the county (parish) scale, according to recent estimates by the U.S. Census Bureau (circa 2013-2017 ACS), there were 23,394 people and 8,759 households in Plaquemines Parish. The population density as of the 2010 decennial census was 29.5 people per square mile (11.4/km²). The racial makeup of the parish is 69.5% White, 21.0% Black or African American, 1.8% Native American, 4.2% Asian, and 3.2% from two or more races. 7.4% of the population were Hispanic or Latino of any race and 5.4% of the population claims to be foreign born. The median value of owner-occupied housing between 2013 and 2017 was estimated at $165,900 compared to the national average of $193,500. Median household income within Plaquemines Parish was estimated at $49,635 with an annual per capita income of $26,177, well below the nationwide average of $57,652 and $31,177, respectively. The parish has an estimated employment rate of 56.8% in the civilian labor force population older than 16 years. Between 2013 and 2017, the average travel time to work for Plaquemines Parish residents was estimated at 26 minutes.[96]

CLIMATE

The community of Buras-Triumph resides in the subtropical zone of the southern United States with three distinct seasons and year-round moderate temperatures. The annual high temperature is 76.3 degrees Fahrenheit and annual low temperature is 62.4 degrees Fahrenheit during winter months. The average annual temperature in Buras-Triumph is 69.35 degrees Fahrenheit. January is the coolest month of the year with a record low of 10 degrees Fahrenheit occurring in the year 1962. August is the warmest month of the year with a record high of 101 degrees Fahrenheit occurring in the year 1961. The city receives an average of 59.84 inches of rainfall precipitation annually with little to no snowfall. The parish is one of the highest producers of citrus in the State due to its warm climate.[97]

---

[95] *Id*.

[96] *QuickFacts: Plaquemines Parish, Louisiana; United States*, UNITED STATES CENSUS BUREAU, https://www.census.gov/quickfacts/fact/table/cameronparishlouisiana,US/PST045218 last visited July 19, 2019).

[97] U.S. CLIMATE DATA, https://www.usclimatedata.com/ (last visited July 19, 2019).

DEPARTMENTS AND ORGANIZATIONS[98]

Due to the size of the community, Buras-Triumph has limited distinct local governance and primarily relies on services provided by Plaquemines Parish. The parish seat of Plaquemines Parish is located upriver from Buras-Triumph in the unincorporated community of Pointe à la Hache. The departments of the parish government are detailed below.

- Administration
- Animal Control
- Assessor's Office
- Boat Harbors & Shipyards
- Building Rental
- Civil Service
- Civil Service Forms and Documents
- Clerk of Court
- Coastal Zone Management
- Community Action Agency
- Coroner's Office
- Council on Aging
- District Attorney
- Drainage/Pump Stations
- Economic Development/Tourism
- Engineering & Public Works
- Ferry
- Finance
- Fire Departments
- Flood Control & Heavy Equipment
- Geographic Information System
- Health
    - Code Enforcement Services
    - Nursing Services
    - Sanitarian Services
    - WIC Services
- Homeland Security/Emergency Preparedness
- Human Resources
- Information Technology
- Internal Auditor
- Land
- Legal
- Library
- Public Information Officer / Media Contact
- Mosquito Control
- Oil, Gas & Mineral
- Operations
- Parish President/Government
- Permits, Planning & Zoning
- Public Right-of-Way Maintenance (PROWM)
- Public Service
- Purchasing
- Recreation
- Safety
- Sales Tax
- School Board
- Sheriff Office
- Signs
- Solid Waste
- Telecommunications
- Water Works

[98] PLAQUEMINES PARISH GOVERNMENT, http://plaqueminesparish.com/ (last visited July 19, 2019).

TRANSPORTATION

Several transportation routes cross through or are adjacent to the community of Buras-Triumph including, the Mississippi River, a state route and a multitude of abandoned and active pipeline corridors.

Major Motor Vehicle Roadways

- Louisiana State Route 23
- Louisiana State Route 39

Railroads

No active railways exist in the vicinity of Buras Triumph.

Major Pipelines

Natural Gas Pipelines

- Gulf South Pipeline Company
- Louisiana Intrastate Gas Company
- Southern Natural Gas Company
- Tennessee Gas Pipeline
- Texas Eastern Transmission Company
- Transcontinental Gas Pipeline

2017 MASTER PLAN NONSTRUCTURAL PROGRAM[99]

The 2017 Coastal Master Plan (Master Plan) analyzed 54 candidate nonstructural project areas. Selected nonstructural project areas include several nonstructural mitigation measures, defined based on flood depths and type of structure. Each mitigation measure is based on Coastal Protection and Restoration Authority (CPRA) estimates of 100-year flood depths (or 1% annual exceedance probability) with an additional two feet of freeboard for elevation projects. Mitigation measures are defined as:

- Floodproofing of non-residential structures. Recommended in areas inundated to less than three feet.
- Elevation of residential structures. Recommended in areas inundated between 3-14 feet.
- Voluntary Acquisition for residential structures. Recommended in areas inundated above 14 feet.

Table 3 identifies the five nonstructural project areas in Plaquemines Parish and provides estimates as to the number of structures requiring mitigation based on the above criteria.

Table 3: CPRA Nonstructural Protection Mitigation Details for Plaquemines Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Number of Floodproofings	Number of Elevations	Number of Acquisitions
PLA.01N	Plaquemines - West Bank	Selected Period 1	46	1331	54
PLA.02N	Plaquemines - Braithwaite	Selected Period 1	0	184	79

[99] LOUISIANA COASTAL PROTECTION AND RESTORATION AUTHORITY, Nonstructural Risk Reduction Projects, http://coastal.la.gov/our-plan/2017-coastal-master-plan/flood-risk-and-resilience-program/nonstructural-projects/ (last visited July 19, 2019).

PLA.03N	Plaquemines - Grand Bayou	Selected Period 1	0	11	1
PLA.05N	Plaquemines - Phoenix/Pointe A La Hache	Selected Period 1	0	163	24

The 2017 Master Plan included a range of nonstructural projects that effectively reduce economic damages due to storm surge flood risk when coupled with associated structural risk reduction projects. Recommendations presented in the 2017 Master Plan add to nonstructural projects developed for the 2012 Coastal Master Plan by including new mitigation standards and considering additional community characteristics such as low to moderate income (LMI) households.

Table 4 includes a summary of the lone nonstructural project in Cameron Parish, with estimated costs for the three mitigation criteria. These recommendations, provided by CPRA, are intended to provide high-level planning estimates, and do not include recommendations for mitigation of specific structures. Attributes of nonstructural projects will be further revised by coastal parishes during project implementation to identify specific structures to be mitigated, as well as structure counts and costs based on mitigation classification.

Table 4: CPRA Nonstructural Protection Cost Estimates for Plaquemines Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Total Count	Floodproofing Cost	Elevation Cost	Acquisition Cost	Total Cost
PLA.01N	Plaquemines - West Bank	1431	$39.1M	$198.2M	$27.4M	$264.7M
PLA.02N	Plaquemines - Braithwaite	263	$0	$28.7M	$27.5M	$56.2M
PLA.03N	Plaquemines - Grand Bayou	12	$0	$2M	$1M	$3M
PLA.05N	Plaquemines - Phoenix/Pointe A La Hache	187	$0	$24.4M	$13.9M	$38.3M

Due to funding and capacity constraints CPRA's nonstructural protection projects cannot be implemented in the same period. As with restoration and structural risk reduction projects, implementation of nonstructural protection projects is recommended for different periods over the Coastal Master Plan's 50-year planning horizon. Structural and nonstructural risk reduction projects are recommended for two implementation periods, either: years 1-30 or years 31-50. Nonstructural projects vary by mitigation standard, based on implementation period. Projects selected for the first period include mitigation measures designed to attenuate 100-year flood depths occurring at year 10. In certain instances, the selection of a proposed structural protection project necessitated the selection of an associated nonstructural project. Recommendations were made based on whether or a not implementation of a candidate structural protection project resulted in increased flood depths outside of an associated levee system. In this case, nonstructural project in that area would be automatically selected to mitigate induced flooding. **Table 5** identifies the prerequisite structural protection projects and mitigation standards for the five nonstructural project areas in Plaquemines Parish.

Table 5: CPRA Nonstructural Prerequisites and Mitigation Standards for Plaquemines Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Structural Project Prerequisite Mitigation Standard	Mitigation Standard
PLA.01N	Plaquemines - West Bank	Years 1-30	None	Year 10
PLA.02N	Plaquemines - Braithwaite	Years 1-30	None	Year 10
PLA.03N	Plaquemines - Grand Bayou	Years 1-30	None	Year 10
PLA.05N	Plaquemines - Phoenix/Pointe A La Hache	Years 1-30	None	Year 10

During CPRA's nonstructural project development process, several types of data were collected to describe the projects and project benefits. This information was focused on better understanding how candidate nonstructural projects could potentially affect communities that were especially vulnerable to flood risk. Additional data includes:

- Repetitive loss and severe repetitive loss properties (RL/SRL) - total count of RL/SRL properties within the mitigated grid points in the nonstructural project area;
- Low to moderate income households - the average percentage of the low to moderate income households in the project area.

Table 6 identifies the RL/SRL counts and average low to moderate income households for the five nonstructural project areas in Plaquemines Parish.

Table 6: CPRA Nonstructural Protection Repetitive Loss/Severe Repetitive Loss Properties and Average Percentage of Low to Moderate Income (Avg. % LMI) Households in Plaquemines Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	RL/SRL Count	Avg. % LMI
PLA.01N	Plaquemines - West Bank	95	47%
PLA.02N	Plaquemines - Braithwaite	295	42%
PLA.03N	Plaquemines - Grand Bayou	35	66%
PLA.05N	Plaquemines - Phoenix/Pointe A La Hache	35	82%

FLOOD HAZARD IDENTIFICATION

Nearly all of Plaquemines, and by extension the community of Buras-Triumph, is vulnerable to frequent flooding from high intensity storms, riverine high water, and storm surge. Flooding due to hurricanes and storm surge are the most common flooding mechanisms in the community of Buras-Triumph. The community has dealt with several devastating hurricanes in its history including the Cheniere Caminada hurricane in 1893, unnamed Louisiana hurricanes in 1901 and 1915, Betsy in 1965, Camille in 1969, Katrina in 2005, and Isaac in 2012. When Hurricane Katrina made landfall on August 29, 2005, the Buras area experienced the lowest pressure recorded in Louisiana since the nineteenth century. After Katrina, the community saw a significant drop in population as many residents chose to relocate instead of rebuilding.[100] As evidence of this hurricane-driven relocation, the population of the community dropped from 3,358 to 1,161 between the 2000 and 2010 decennial censuses.

Riverine Flooding

Any community located adjacent to the Mississippi River must be concerned with the consequences of riverine flood events. Severe highwater events occurred several times throughout the 20th and 21st centuries, most recently in 2011. The greatest concern associated with riverine flooding is the potential overtopping of community-adjacent protection levees. During the Mississippi River high water event in 2011, naturally occurring erosional process created a new distributary north of Buras-Triumph on the west bank of the river adjacent to Bohemia, Louisiana. The new distributary, named Mardi Gras pass due to its occurrence during the Carnival season, was located within the bounds of the Bohemia Spillway, a flood control project completed in 1926 by the Orleans Levee District to relieve pressure on upstream levees during periods of riverine high water. Still in Plaquemines Parish, north of the Bohemia spillway, is the site of the deliberate 1927 Caernarvon levee breach. Originally occurring as a natural levee break in 1922, portions of the east bank levee were intentionally removed by a series of explosions in an effort to relieve pressure on New Orleans during the Great Flood of 1927. The resulting crevasse was more than a mile wide and deposited up to half a meter of riverine sediment within the 50 square-mile splay. The Bohemia Spillway and Caernarvon crevasse remain contentious issues for many Plaquemines and St. Bernard Parish residents whose livelihoods were disrupted by the flood control efforts.[101]

Channel Migration or Diversion

The potential of channel migration for Plaquemines Parish communities is unknown. As the site is located on the west bank of the Mississippi River south of a noticeable course change there exists a limited potential for erosion induced channel realignment. In curved riverine channels, the maximum flow velocity occurs on the outside edges of the curved channel. This increased velocity results in scour and an overall depth increase along the outside edge. On the inside boundary of the curved channel, flow velocities decrease, and entrained sediment gets deposited. High water events associated with seasonal flooding result in an increase in velocity and overall discharge volume. The Mississippi River in its current configuration exists in a kind of anthropogenic stasis. The course of the river is controlled by USACE and is set based on the

---

[100] David Roth, *Louisiana Hurricane History*, NATIONAL WEATHER SERVICE, https://www.weather.gov/media/lch/events/lahurricanehistory.pdf.

[101] Lopez, et al., *Bohemia Spillway in Southeastern Louisiana: History, General Description, and 2011 Hydrologic Surveys*, LAKE PONTCHARTRAIN BASIN FOUNDATION 1 (2013), https://saveourlake.org/wp-content/uploads/PDF-Documents/our-coast/Bohemia/Bohemia%20Report_March2013.pdf.

channel configuration as it existed in the mid-20th century. The river's course is fixed by hydrologic control features such as levees and discharge metering structures such as weirs and dams. The effects of erosion are reduced as the river is essentially hydrologically isolated from the surrounding floodplain. However, the overall discharge and elevation of the river are increased from this attempted control and the possibility of a channel realignment increases during periods of high water.

Control Structure Failure

Hydrologic control structures in the Lower Mississippi Valley play a significant role in metering flow and controlling discharge through the southern reaches of the Mississippi River. The control structure most relevant to Plaquemines Parish exists north of Baton Rouge at a location known as Old River. The Old River Control Structure meters flow between the Atchafalaya and Mississippi Rivers and maintains volumetric flow to the Mississippi River at a level suitable for navigation and to prevent increases in salinity associated with northward migration of Gulf waters. Failure at the Old River Control Structure would not necessarily result in an increase in hazard downriver as the Atchafalaya is arguably the shorter, steeper route to the Gulf of Mexico. A failure would result in increased volumetric flow down the Atchafalaya and decreased flow down the Mississippi and would likely reduce riverine flood hazard to Plaquemines Parish communities.

Storm Surge Flooding

The highest flooding threat experienced in the community of Buras-Triumph results from storm surge inundation. Storm surge is qualified as the rise in offshore water elevation associated with the shear force imparted by hurricane or tropical depression force winds acting on the water surface. Drivers of storm surge inundation are primarily hurricanes and high intensity storms. Compounding the risk of storm surge related flooding is the significant wetland loss occurring in Plaquemines Parish. Significantly, the parish is converting from land to water faster than any other in Louisiana. The loss of surrounding marshland to erosion played a significant role in the devastation wrought by Hurricane Katrina in 2005. Despite Katrina being lower intensity on the Hurricane Severity Index than either Camille or Betsy, the loss of surrounding marsh lands to erosion and subsidence allowed the storm surge to compromise the levee protection system.[102] More recently during the 2017 Atlantic hurricane season, storm surge driven by the remnants of Hurricane Harvey, by then a tropical storm, opened a 50-foot breach in the marsh-adjacent levee to the Alliance Refinery in Plaquemines Parish.[103]

FLOODING ANALYSIS

This analysis in this section considers flooding potential derived from two data sources: flood insurance studies conducted by the Federal Emergency Management Agency (FEMA) and storm surge inundation modeling conducted by the Coastal Protection and Restoration Authority (CPRA) in fulfillment of the 2017 Master Plan for a Sustainable Coast.

---

[102] National Weather Service, *Service Assessment: Hurricane Katrina August 23-31, 2005,* U.S. DEPARTMENT OF COMMERCE, (2006), https://www.weather.gov/media/publications/assessments/Katrina.pdf.

[103] Sara Sneath, *Harvey storm surge opens 50-foot breach in Plaquemines Parish levee,* NOLA.COM, (Sep. 2, 2017, 2:53 AM), https://www.nola.com/news/environment/article_1272372b-e251-5f55-a02c-4effe23c932f.html.

Flood Zone Analysis[104]

FEMA flood insurance studies rely primarily on elevation and hydrologic modeling to determine flooding potential and flood zones are delineated based on annual flooding probability. Classifications include storm events with a 1-percent annual exceedance probability (100-year flood event) and events with a 0.2-percent annual exceedance probability (500-year flood event). Flood zones falling within the 1-percent annual exceedance probability include zones A, AO, AH, AE, AR, AR/AE, AR/A, V, and VE. Zones in this classification have associated base flood elevations (BFEs) or average depths if the zone code includes two characters (i.e. AE). Zones V and VE indicate a velocity hazard associated with wave action and are most likely to occur on land areas adjacent to a water body with an areal coverage large enough to produce fetch-driven waves. Flood zones falling in the 0.2-percent annual exceedance probability include zones B and X (shaded). No BFEs or average depths are included for these zones. Areas of minimal flood hazard, those outside of the boundaries delineated by the 1-percent and 0.2-percent annual exceedance probability, include zones C and X (unshaded).

Flood probability data was pulled from the National Flood Hazard Layer dataset published by FEMA, available through the federal Open Data program. Included in this dataset is the geographic extent of flooding based on the annual return probability. Boundaries of the community census blocks were overlain on the spatial extent of the 100-year and 500-year flood surfaces, agglomerated based on annual exceedance probability. The areal extent of the flood surface was calculated for each census block and a normalized flooded percentage was tabulated based on the ratio of flooded area to the total area of the census block. The flood zone designations for the community of Buras-Triumph are depicted below by **Figure 2**. All of the Buras-Triumph community resides within the bounds of the 100-year and 500-year floodplains.

Storm Surge Analysis[105]

Several storm surge inundation models have been developed for coastal Louisiana through efforts of CPRA and affiliated agencies. One of these models, called the Integrated Compartment Model (ICM), serves as the design basis for the inundation model used to evaluate storm surge depths across the Gulf Coast. The resultant coastal Louisiana specific model, the one used to evaluate potential inundation for the Buras-Triumph community, is the Coastal Louisiana Risk Assessment (CLARA) model, developed by the RAND Corporation for CPRA. CLARA flooding potentials were spatially joined with dasymetric census block delineations and flooding statistics were developed through zonal analysis. **Figure 3****Figure 4**, **Figure 5** illustrate the average storm surge inundation resulting from a 50-year, 100-year, and 500-year storm under the medium sea-level rise scenario classified by CPRA and RAND. The flooding potentials consider a storm occurring under initial conditions as well as storms occurring 10, 25, and 50 years into the future. The CLARA model does not account for precipitation and ponding of storm water runoff and there exists a potential for a "perfect storm" of flooding mechanisms resulting in significant, catastrophic flooding of the Buras-Triumph community.

---

[104] *National Flood Hazard Layer (NFHL)*, FEMA (last updated July 10, 2019), https://www.fema.gov/national-flood-hazard-layer-nfhl (last visited July 19, 2019).
[105] Jordan R. Fischbach, ET AL., *Coastal Louisiana Risk Assessment Model Technical Description and 2012 Coastal Master Plan Analysis Results*, RAND CORPORATION, https://www.rand.org/pubs/technical_reports/TR1259.html.

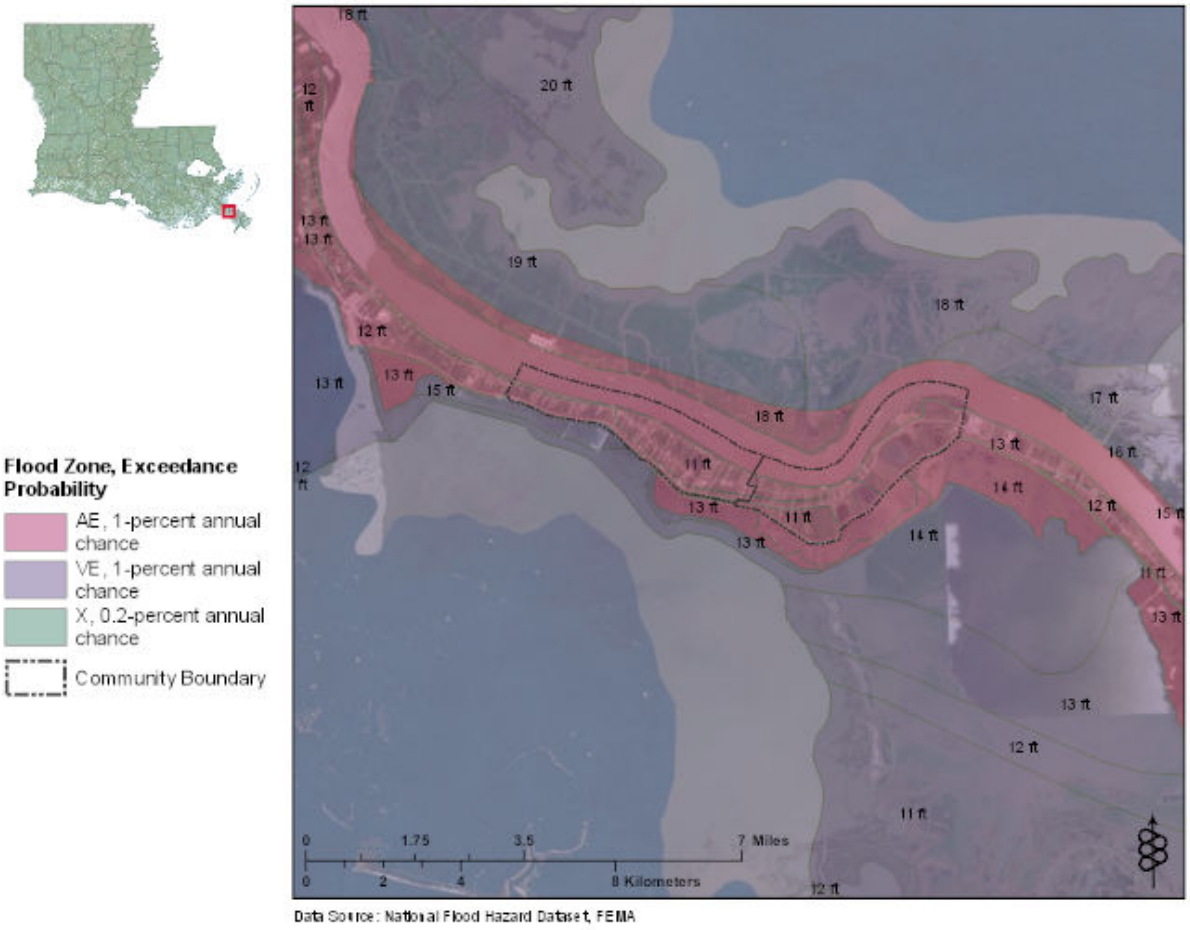


Figure 2: Flood zone detail for the community of Buras-Triumph. Base flood elevations are labeled in available zones.

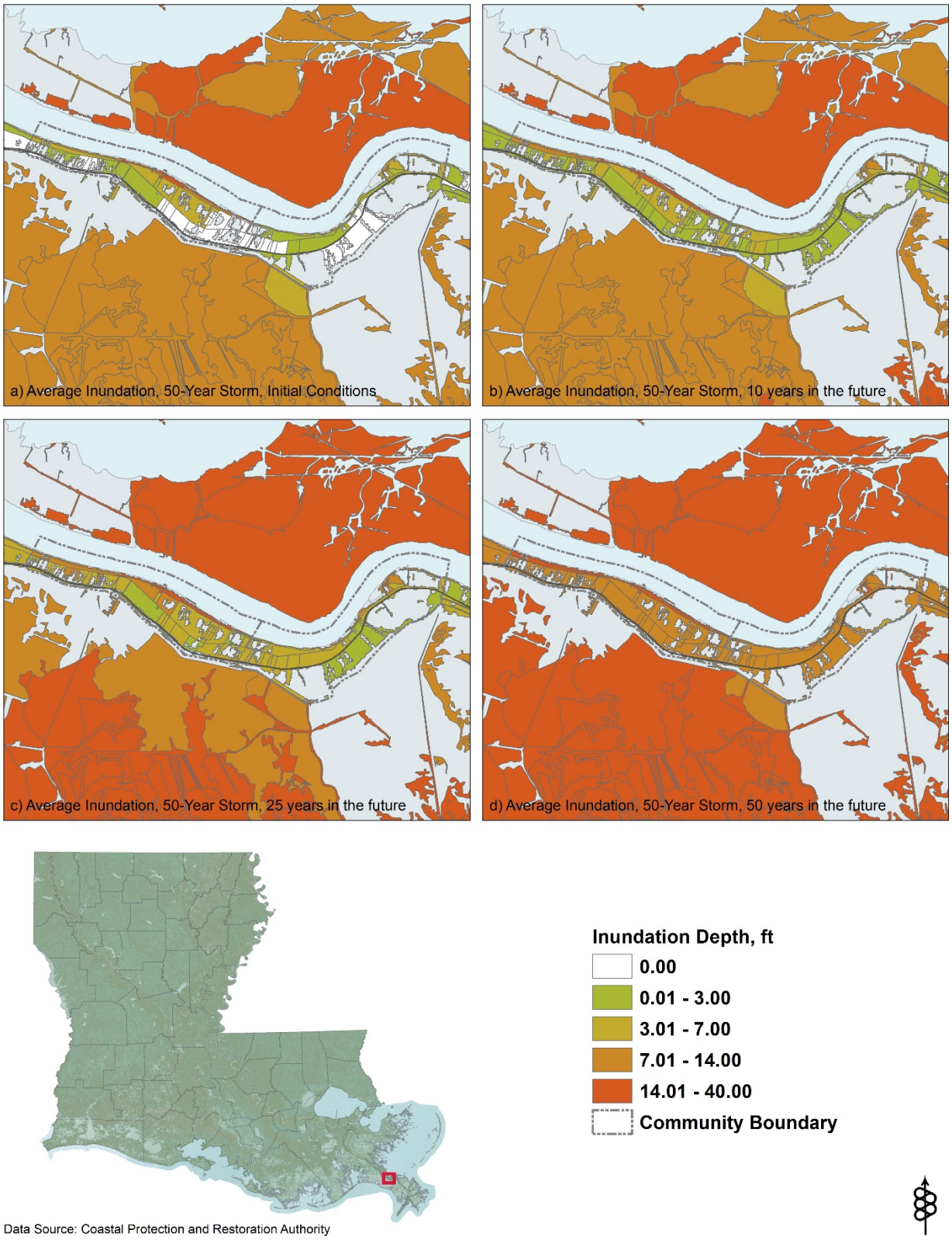


Figure 3: Storm surge inundation forecasts resulting from a 50-year storm occurring under the medium sea-level rise scenario.

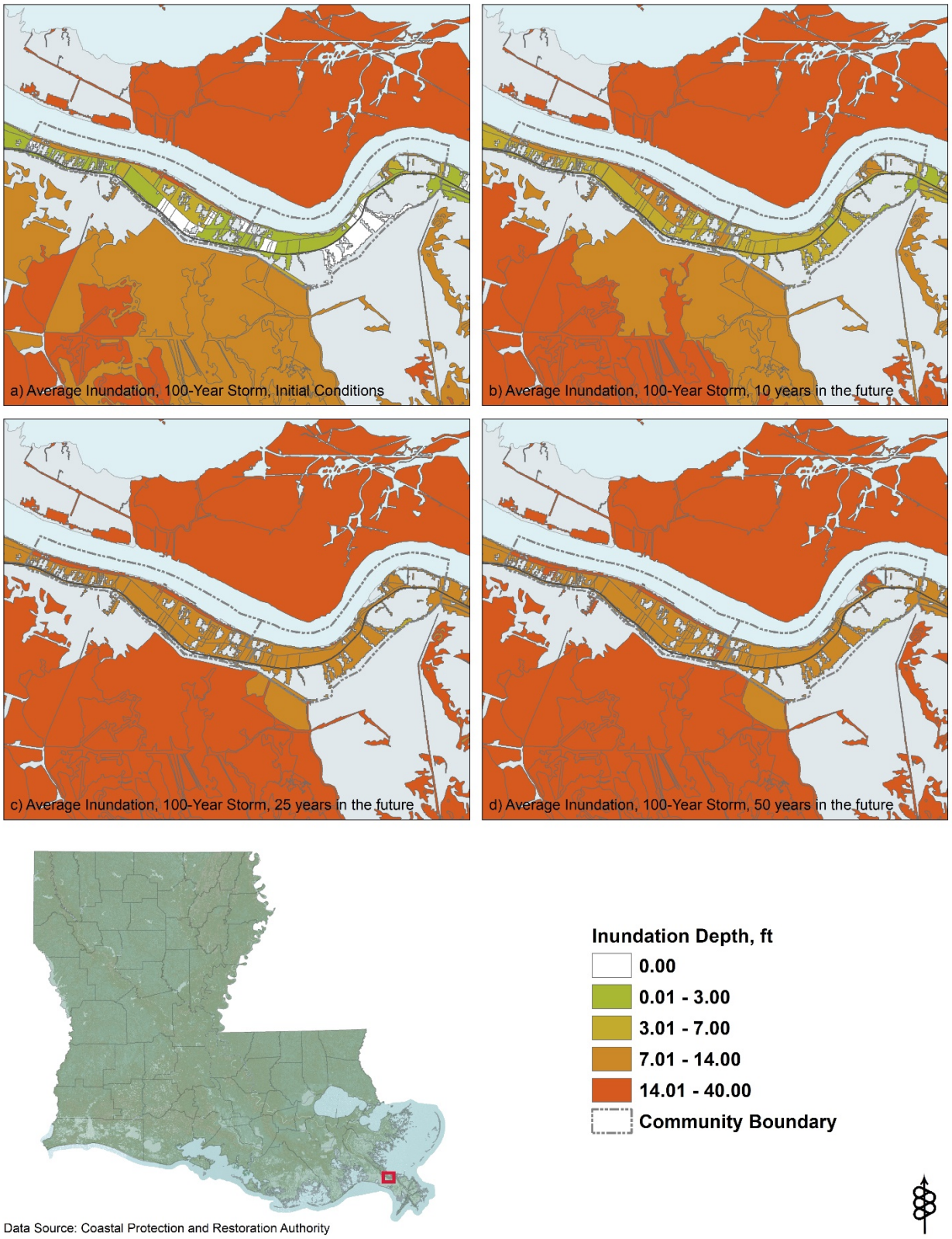


Figure 4: Storm surge inundation forecasts resulting from a 100-year storm occurring under the medium sea-level rise scenario.

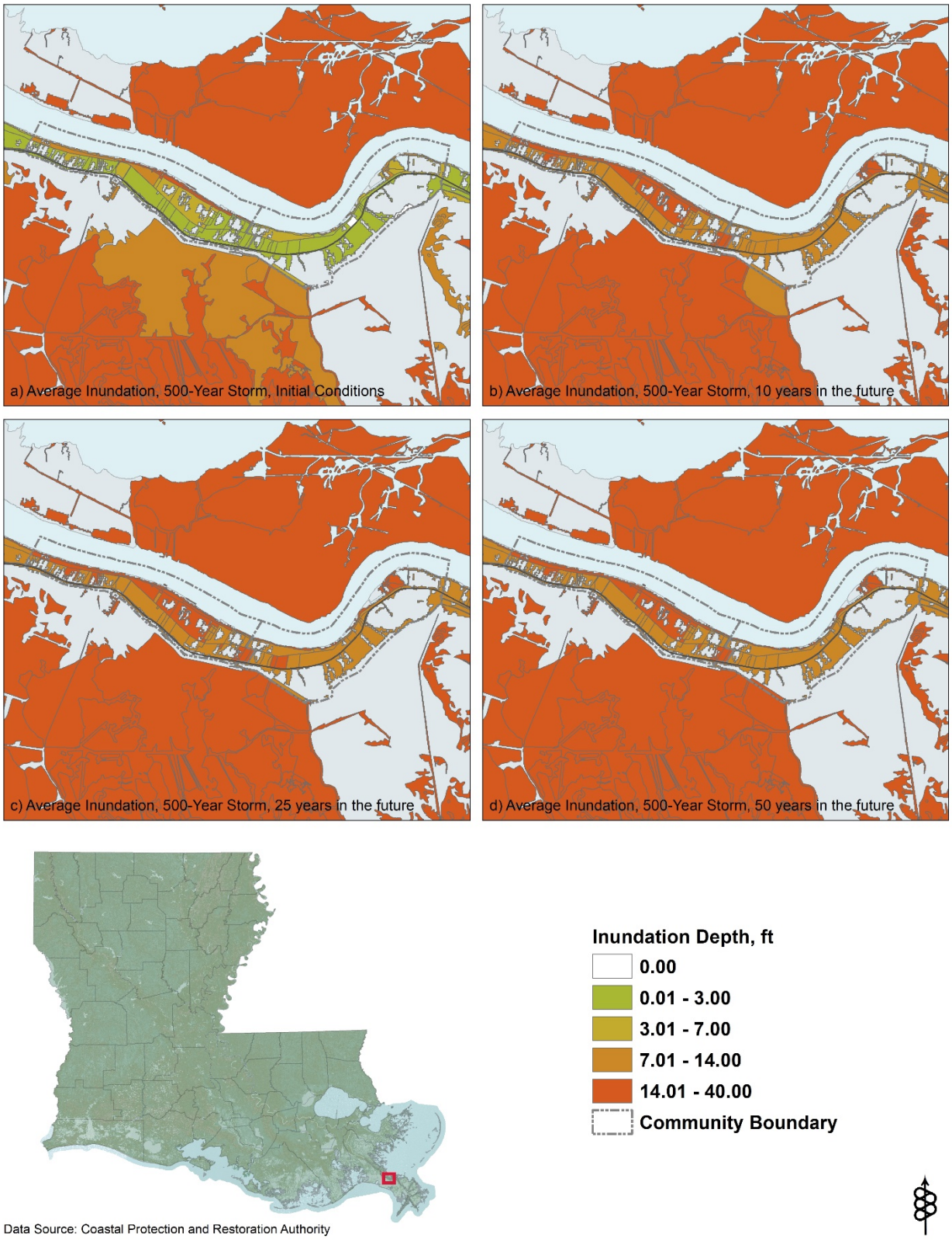


Figure 5: Storm surge inundation forecasts resulting from a 500-year storm occurring under the medium sea-level rise scenario.

TAX INFORMATION

Current Bond Rating[106]

I. **A2 (Moody's)**

Tax Revenues[107]

I. **At a glance:**
   a. **Sales Taxes:** 16.7%
   b. **Ad Valorem Taxes:** 10.84%
   c. **Parish Oil and Gas Royalties:** 10.6%
   d. **Property Taxes:** 15.8% ($15,221,212 in 2016, $3,062 per capita)

Table 7: Severance Tax Details for 2015.[108]

Oil/Condensate	$116,377,066
Gas	3,873,561
Timber/Pulpwood	$31
Minerals	$26,690

Table 8: Louisiana Tax Commission 2015 Annual Report[3].

Agricultural Lands: Class I	327,853
Agricultural Lands: Class II	0
Agricultural Lands: Class III	875,190
Agricultural Lands: Class IV	239,840
Timberlands: Class I	14,540
Timberlands: Class II	0
Timberlands: Class III	0
Timberlands: Class IV	0
Freshwater Marsh	263,213
Brackish Marsh	1,008,573
Salt Water Marsh	680,978

[106] *See generally* MOODY'S, https://www.moodys.com/.
[107] *Primary Government Financial Statements As of and for the Year Ended December 31, 2016 with Supplementary Information Schedules*, PLAQUEMINES PARISH GOVERNMENT, https://www.lla.la.gov/PublicReports.nsf/E277446EB8EB2A8D86258161004CD541/$FILE/000150C6.pdf.
[108] *Annual Report: 2015*, LOUISIANA TAX COMMISSION, https://www.latax.state.la.us/Menu_AnnualReports/UploadedFiles/Annual%20Report%202015.pdf.

All Other Acreage (greater than 3 acres)	19,459,016
Subdivision Lots	37,375,026
All Other Lots	7,140,577
Land Subject to Homestead	3,650,224
Land: All Other	62,619,552
Improvements: Residential Homestead	82,284,684
Improvements: Residential Other	0
Improvements: Commercial or Industrial	30,964,128
Inventories	123,971,381
Machinery and Equipment	145,848,373
Business Furniture and Fixtures	1,405,525
Miscellaneous Personal Property	31,966,333
Credits	0
Leased Equipment	5,533,412
Pipelines	25,510,949
Oil and Gas Surface Equipment	77,894,241
Watercraft	80,292,679
Aircraft	22,654,824
Financial Institutions	3,777,580
Drilling Rigs	3,123,108
Oil and Gas Wells	144,715,261
Public Service Corporations	271,352,580

Major Employers/Asset Holders

I. 2015 Employment Statistics (Table 9)[109]
II. Major Employers (Table 10)[110]

Table 9: Louisiana Workforce Commission 2015 Employment Statistics.

	NAICS Code	Total Units	Average Employment
PLAQUEMINES TOTAL		**822**	**14,379**
Agriculture, forestry, fishing and hunting	11	19	100
Mining	21	47	1,517

[109] *See generally Occupational Wage Data (2015)*, LOUISIANA WORKFORCE COMMISSION: THE DEPARTMENT OF LABOR, http://www.laworks.net/LaborMarketInfo/LMI_WageDataMap2009toPresent.asp?Year=2015 (last visited July 19, 2019).
[110] *See generally Plaquemines Parish*, GREATER NEW ORLEANS, INC., http://gnoinc.org/explore-the-region/plaquemines-parish/ (last visited July 19, 2019).

Utilities	22	4	330
Construction	23	101	1,129
Manufacturing	31-33	52	1,768
Wholesale trade	42	74	897
Retail trade	44-45	61	587
Transportation and warehousing	48-49	106	2,274
Information	51	2	*
Finance and insurance	52	22	90
Real estate and rental and leasing	53	53	627
Professional and technical services	54	72	376
Management of companies and enterprises	55	3	*
Administrative and waste services	56	47	689
Educational services	61	7	1,065
Health care and social assistance	62	26	369
Arts, entertainment, and recreation	71	9	97
Accommodation and food services	72	58	765
Other services, except public administration	81	40	277
Public administration	92	16	1,397

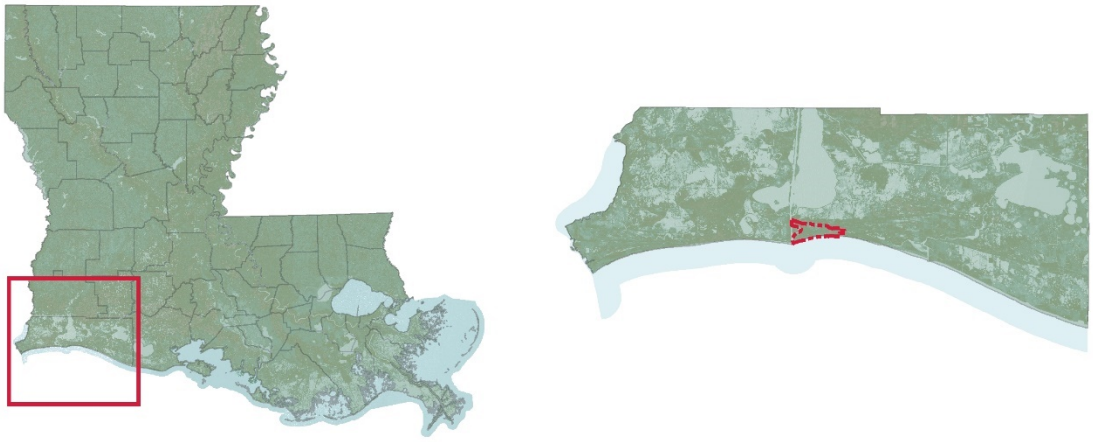
Table 10: Major Employers.

Naval Air Station/Joint Reserve Base	7,000
ConocoPhillips	580
ART Catering	500
CF Bean	400
Epic Divers	400
Chevron	390
Daybrook Fisheries	325
Stolthaven	290
PHI Helicopters	165
Point Eight Power	160

Cameron

COMMUNITY OVERVIEW

October 2018



GEOGRAPHY[111]

The community of Cameron is located in the southwest region of Louisiana in south-central Cameron Parish. The city serves as the parish seat of Cameron Parish and is part of the Lake Charles Metropolitan Statistical Area (MSA). Cameron Parish is bordered by Calcasieu and Jefferson Davis Parishes to the north, Vermilion Parish to the east, and the Gulf of Mexico to the south. The state of Texas lies to the west, the boundary of which is delineated by the north-south flowing Sabine River. Adjacent communities to the north include the census designated places (CDP) of Hackberry, Carlyss, and Prien as well as the cities of Lake Charles, Sulphur and Westlake. The community of Cameron covers a total area of 32.6 square kilometers of which 29.6 square kilometers, 91%, is land and 3.04 square kilometers, 9%, is water. The city is bordered to the west by the Calcasieu Shipping Channel and is separated from Calcasieu Lake by marshland to the north.

TOPOGRAPHY

The West Gulf Coastal Plain region of southern Louisiana is predominately flat with little elevation change. The southernmost gulf-bordering areas are barrier beaches and chenier ridges with up to 20 miles of coastal marsh in the landward direction. Moving northward from the city of Cameron the terrain gradually shifts to rolling hills upon entering the region known as the coastal prairie. The city of Cameron sits at an elevation of 3 feet above sea level with reference to NAVD88 datum.

[111] *DOWNLOAD U.S. CENSUS DATA TABLES & MAPPING FILES*, IPUMS: NHGIS, https://www.nhgis.org/ (last visited July 19, 2019).

POPULATION CHARACTERISTICS

The population characteristics for the town of Cameron reference the 2013-2017 ACS aggregated by place. During the 2013-2017 reporting period, the town of Cameron had a total population of 222 individuals, of whom all identified themselves as White alone. All residents of Cameron CDP live in a rural setting. The population density of the community is 14 people per square kilometer with the highest density in the census blocks located adjacent to the Calcasieu Shipping Channel. [112]

At the county (parish) scale, according to recent estimates by the U.S. Census Bureau (circa 2013-2017 ACS), there were 6,806 people and 2,686 households in Cameron Parish. The population density as of the 2010 decennial census was 5.3 people per square mile (2.05/km²). The racial makeup of the parish is 93.6% White, 3.8% Black or African American, 0.7% Native American, 0.3% Asian, and 1.6% from two or more races. 3.7% of the population were Hispanic or Latino of any race and 4.6% of the population claims to be foreign born. The median value of owner-occupied housing between 2013 and 2017 was estimated at $110,900 compared to the national average of $193,500. Median household income within Cameron Parish was estimated at $60,194 with an annual per capita income of $29,681, on par with nationwide average of $57,652 and $31,177, respectively. The parish has an estimated employment rate of 58.2% in the civilian labor force population older than 16 years. Between 2013 and 2017, the average travel time to work for Plaquemines Parish residents was estimated at 34 minutes.[113]

CLIMATE

The city of Cameron resides in the subtropical zone of the southern United States with three distinct seasons and year-round moderate temperatures. The average high temperature is 76 degrees Fahrenheit and average low temperature is 61 degrees Fahrenheit. The average annual temperature in Cameron is 76 degrees Fahrenheit. January is the coolest month of the year with an average low of 43 degrees Fahrenheit. July and August are the average warmest month of the year with at an average temperature of 90 degrees Fahrenheit. The highest recorded temperature of 106 degrees Fahrenheit occurred in September 2000 with a record low temperature of 11 degrees Fahrenheit occurring in February 1951. The city receives an average of 60.58 inches of rainfall precipitation annually with little to no snowfall.[114]

DEPARTMENTS AND ORGANIZATIONS[115]

Cameron CDP is the designated parish seat of Cameron Parish. The community has no specific organizations or departments and relies on services administered by the Cameron Parish Police Jury. The organization of the parish government is detailed below.

- Departments
  - Administration
  - Office of Emergency Preparedness
- Public Works
  - Facility Management
  - Road and Bridge Maintenance

---

[112] *Id.*

[113] *QuickFacts: Cameron Parish, Louisiana; United States*, UNITED STATES CENSUS BUREAU, https://www.census.gov/quickfacts/fact/table/cameronparishlouisiana,US/PST045218 (last visited July 19, 2019).

[114] U.S. CLIMATE DATA, https://www.usclimatedata.com/.

[115] *See Cameron Parish Elected Officials* and *Departments & Services*, CAMERON PARISH POLICE JURY, https://cameronpj.org/ (last visited July 19, 2019).

        - Garbage Maintenance
        - Animal Control
        - Parks and Recreation
    - Registrar of Voters
    - Permitting
- Boards
    - Ambulance
    - Beachfront Development
    - Cemetery
    - Emergency Communications
    - Fire Department
    - Gravity Drainage
    - Hospital
    - Justice of the Peace
    - Library
    - Mosquito Control
    - Oyster Taskforce
    - Parks and Recreation
    - Waterworks
- Elected Officials
    - Judge Penelope Richard
    - District Attorney Jennifer Jones
    - Clerk of Court Susan Racca
    - Sheriff Ron Johnson
    - Tax Assessor Orson Billings
    - Coroner Susan Dupont

TRANSPORTATION

Several transportation routes cross through or are adjacent to the city of Cameron including state routes and a multitude of abandoned and active pipeline corridors.

Major Motor Vehicle Roadways

- Louisiana State Route 27
- Louisiana State Route 82

Railroads

No active railways exist in the vicinity of Cameron

Major Pipelines

Natural Gas Pipelines

- ANR Pipeline Company
- Bridgeline Holdings Pipeline
- Columbia Gulf Pipeline
- Gulf South Pipeline Company
- Natural Gas Pipeline Company of America
- Tennessee Gas Pipeline
- Transcontinental Gas Pipeline

2017 MASTER PLAN NONSTRUCTURAL PROGRAM[116]

The 2017 Coastal Master Plan (Master Plan) analyzed 54 candidate nonstructural project areas. Selected nonstructural project areas include several nonstructural mitigation measures, defined based on flood depths and type of structure. Each mitigation measure is based on Coastal Protection and Restoration Authority (CPRA) estimates of 100-year flood depths (or 1% annual exceedance probability) with an additional two feet of freeboard for elevation projects. Mitigation measures are defined as:

- Floodproofing of non-residential structures. Recommended in areas inundated to less than three feet.
- Elevation of residential structures. Recommended in areas inundated between 3-14 feet.
- Voluntary Acquisition for residential structures. Recommended in areas inundated above 14 feet.

Table 21 identifies the five nonstructural project areas in Cameron Parish and provides estimates as to the number of structures requiring mitigation based on the above criteria.

Table 11: CPRA Nonstructural Protection Mitigation Details for Cameron Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Number of Floodproofings	Number of Elevations	Number of Acquisitions

[116] *Nonstructural Risk Reduction Projects*, LOUISIANA COASTAL PROTECTION AND RESTORATION AUTHORITY, Nonstructural Risk Reduction Projects, http://coastal.la.gov/our-plan/2017-coastal-master-plan/flood-risk-and-resilience-program/nonstructural-projects/ (last visited July 19, 2019).

CAM.01N	Cameron	Selected Period 1	27	437	114

The 2017 Master Plan included a range of nonstructural projects that effectively reduce economic damages due to storm surge flood risk when coupled with associated structural risk reduction projects. Recommendations presented in the 2017 Master Plan add to nonstructural projects developed for the 2012 Coastal Master Plan by including new mitigation standards and considering additional community characteristics such as low to moderate income (LMI) households.

Table 12 includes a summary of the lone nonstructural project in Cameron Parish, with estimated costs for the three mitigation criteria. These recommendations, provided by CPRA, are intended to provide high-level planning estimates, and do not include recommendations for mitigation of specific structures. Attributes of nonstructural projects will be further revised by coastal parishes during project implementation to identify specific structures to be mitigated, as well as structure counts and costs based on mitigation classification.

Table 12: CPRA Nonstructural Protection Cost Estimates for Cameron Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Total Count	Floodproofing Cost	Elevation Cost	Acquisition Cost	Total Cost
CAM.01N	Cameron	578	$26.2M	$64.2M	$36.5M	$126.9M

Due to funding and capacity constraints CPRA's nonstructural protection projects cannot be implemented in the same period. As with restoration and structural risk reduction projects, implementation of nonstructural protection projects is recommended for different periods over the Coastal Master Plan's 50-year planning horizon. Structural and nonstructural risk reduction projects are recommended for two implementation periods, either: years 1-30 or years 31-50. Nonstructural projects vary by mitigation standard, based on implementation period. Projects selected for the first period include mitigation measures designed to attenuate 100-year flood depths occurring at year 10. In certain instances, the selection of a proposed structural protection project necessitated the selection of an associated nonstructural project. Recommendations were made based on whether or a not implementation of a candidate structural protection project resulted in increased flood depths outside of an associated levee system. In this case, nonstructural project in that area would be automatically selected to mitigate induced flooding. Table 5 identifies the prerequisite structural protection projects and mitigation standards for the five nonstructural project areas in Cameron Parish.

Table 13: CPRA Nonstructural Prerequisites and Mitigation Standards for Cameron Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Structural Project Prerequisite Mitigation Standard	Mitigation Standard
CAM.01N	Cameron	Years 1-30	None	Year 10

During CPRA's nonstructural project development process, several types of data were collected to describe the projects and project benefits. This information was focused on better understanding how candidate

nonstructural projects could potentially affect communities that were especially vulnerable to flood risk. Additional data includes:

- Repetitive loss and severe repetitive loss properties (RL/SRL) - total count of RL/SRL properties within the mitigated grid points in the nonstructural project area;
- Low to moderate income households - the average percentage of the low to moderate income households in the project area.

Table 6 identifies the RL/SRL counts and average low to moderate income households for the five nonstructural project areas in Cameron Parish.

Table 14: CPRA Nonstructural Protection Repetitive Loss/Severe Repetitive Loss Properties and Average Percentage of Low to Moderate Income (Avg. % LMI) Households in Cameron Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	RL/SRL Count	Avg. % LMI
CAM.01N	Cameron	1,225	35%

THREAT HAZARD IDENTIFICATION AND RISK ASSESSMENT SUMMARY

Flooding due to hurricanes and storm surge are the most common mechanisms of flooding in the community of Cameron. The community has dealt with several devastating hurricanes in its history including Audrey in 1957, Rita in 2005, and Ike in 2008. Storm surges in excess of 12 feet have destroyed the majority of structures in the community on several occasions. After Hurricane Rita in 2005, the community saw a significant drop in population as many residents chose to relocate instead of rebuilding.[117] The population of the community dropped from 1,965 to 406 between the 2000 and 2010 decennial censuses.

Riverine Flooding

The community's location adjacent to the Calcasieu Shipping Channel results in a marginal increase in hazard due to riverine flooding. Historic crests recorded at Calcasieu Pass include measurements well above the major flood distinction of 6 feet tide high. Recent major crests occurred at 15 feet on September 24, 2005 and 11.9 feet on September 13, 2008. Both measurements were recorded during major hurricanes, Rita in 2005 and Ike in 2008, and as such are more appropriately attributed to storm surge flooding.[118]

Storm Surge Flooding

The highest flooding threat experienced in the community of Cameron results from storm surge inundation. Storm surge is qualified as the rise in offshore water elevation associated with the shear force imparted by hurricane or tropical depression force winds acting on the water surface. Drivers of storm surge inundation are primarily hurricanes and high intensity storms. Compounding the risk of storm surge related flooding is the significant wetland loss occurring in coastal Louisiana.

---

[117] Roth, *supra* note 100.
[118] *Tide Station (LCH) at Calcasieu Pass*, NATIONAL WEATHER SERVICE, https://water.weather.gov/ahps2/hydrograph.php?wfo=lch&gage=capl1 (last visited July 19, 2019).

FLOODING ANALYSIS

This analysis in this section considers flooding potential derived from two data sources: flood insurance studies conducted by the Federal Emergency Management Agency (FEMA) and storm surge inundation modeling conducted by the Coastal Protection and Restoration Authority (CPRA) in fulfillment of the 2017 Master Plan for a Sustainable Coast.

Flood Zone Analysis[119]

FEMA flood insurance studies rely primarily on elevation and hydrologic modeling to determine flooding potential and flood zones are delineated based on annual flooding probability. Classifications include storm events with a 1-percent annual exceedance probability (100-year flood event) and events with a 0.2-percent annual exceedance probability (500-year flood event). Flood zones falling within the 1-percent annual exceedance probability include zones A, AO, AH, AE, AR, AR/AE, AR/A, V, and VE. Zones in this classification have associated base flood elevations (BFEs) or average depths if the zone code includes two characters (i.e. AE). Zones V and VE indicate a velocity hazard associated with wave action and are most likely to occur on land areas adjacent to a water body with an areal coverage large enough to produce fetch-driven waves. Flood zones falling in the 0.2-percent annual exceedance probability include zones B and X (shaded). No BFEs or average depths are included for these zones. Areas of minimal flood hazard, those outside of the boundaries delineated by the 1-percent and 0.2-percent annual exceedance probability, include zones C and X (unshaded).

Flood probability data was pulled from the National Flood Hazard Layer dataset published by FEMA, available through the federal Open Data program. Included in this dataset is the geographic extent of flooding based on the annual return probability. Boundaries of the community census blocks were overlain on the spatial extent of the 100-year and 500-year flood surfaces, agglomerated based on annual exceedance probability. The areal extent of the flood surface was calculated for each census block and a normalized flooded percentage was tabulated based on the ratio of flooded area to the total area of the census block. The flood zone designations for the community of Cameron are depicted below by **Figure 6**. All of the Cameron community resides within the bounds of the 100-year and 500-year floodplains.

Storm Surge Analysis[120]

Several storm surge inundation models have been developed for coastal Louisiana through efforts of CPRA and affiliated agencies. One of these models, called the Integrated Compartment Model (ICM), serves as the design basis for the inundation model used to evaluate storm surge depths across the Gulf Coast. The resultant coastal Louisiana specific model, the one used to evaluate potential inundation for the Buras-Triumph community, is the Coastal Louisiana Risk Assessment (CLARA) model, developed by the RAND Corporation for CPRA. CLARA flooding potentials were spatially joined with dasymetric census block delineations and flooding statistics were developed through zonal analysis. **Figure 7**, **Figure 8**, and **Figure 9** illustrate the average storm surge inundation resulting from a 50-year, 100-year, and 500-year storm under the medium sea-level rise scenario classified by CPRA and RAND. The flooding potentials consider a

[119] *National Flood Hazard Layer (NFHL)*, FEMA (last updated July 10, 2019), https://www.fema.gov/national-flood-hazard-layer-nfhl (last visited July 19, 2019).
[120] Fischbach ET AL., *supra note* 105.

storm occurring under initial conditions as well as storms occurring 10, 25, and 50 years into the future. The CLARA model does not account for precipitation and ponding of storm water

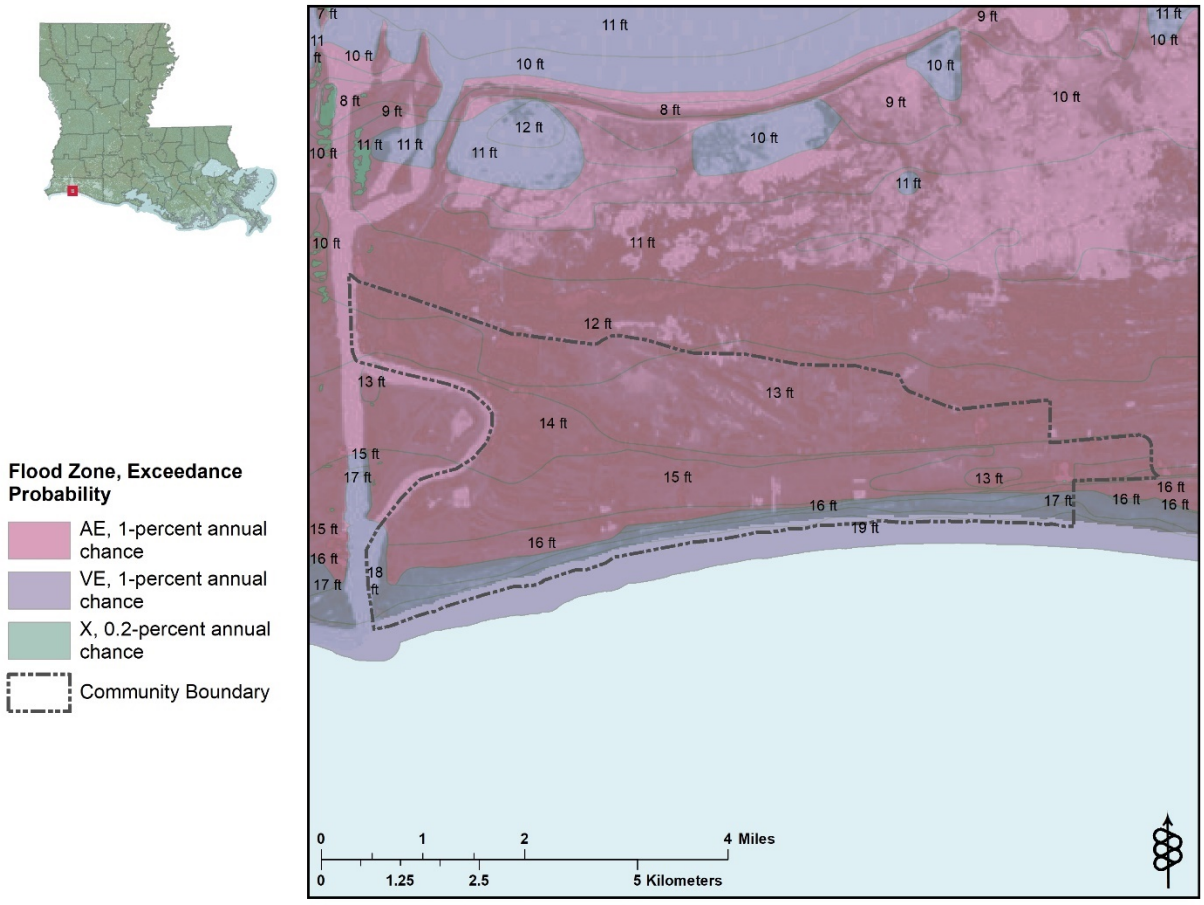


Figure 6: Flood zone detail for the community of Cameron. Base flood elevations are labeled in available zones.

year storm under the medium sea-level rise scenario classified by CPRA and RAND. The flooding potentials consider a storm occurring under initial conditions as well as storms occurring 10, 25, and 50 years into the future. The CLARA model does not account for precipitation and ponding of storm water runoff and there exists a potential for a “perfect storm” of flooding mechanisms resulting in significant, catastrophic flooding of the Cameron community.

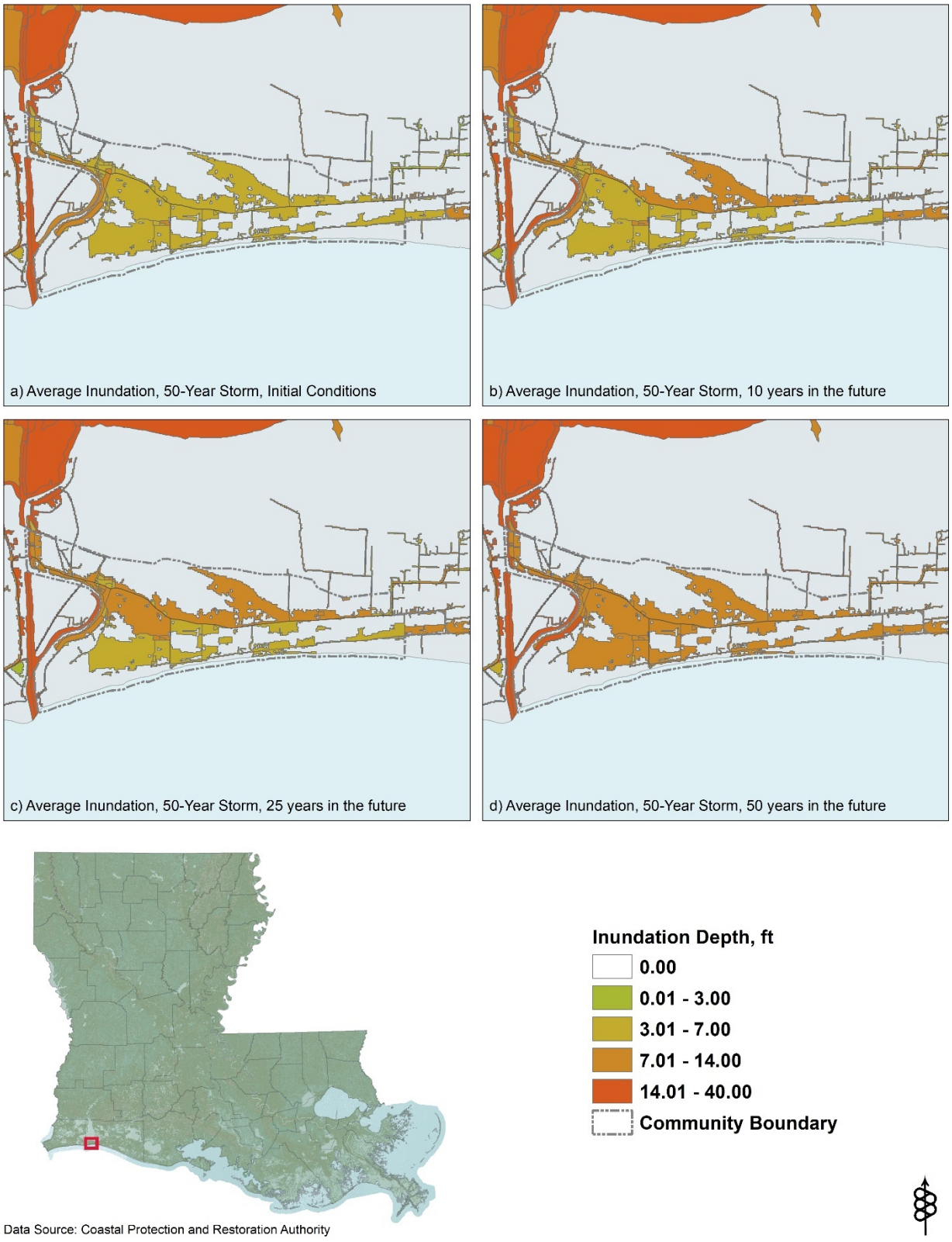


Figure 7: Storm surge inundation forecasts resulting from a 50-year storm occurring under the medium sea-level rise scenario.

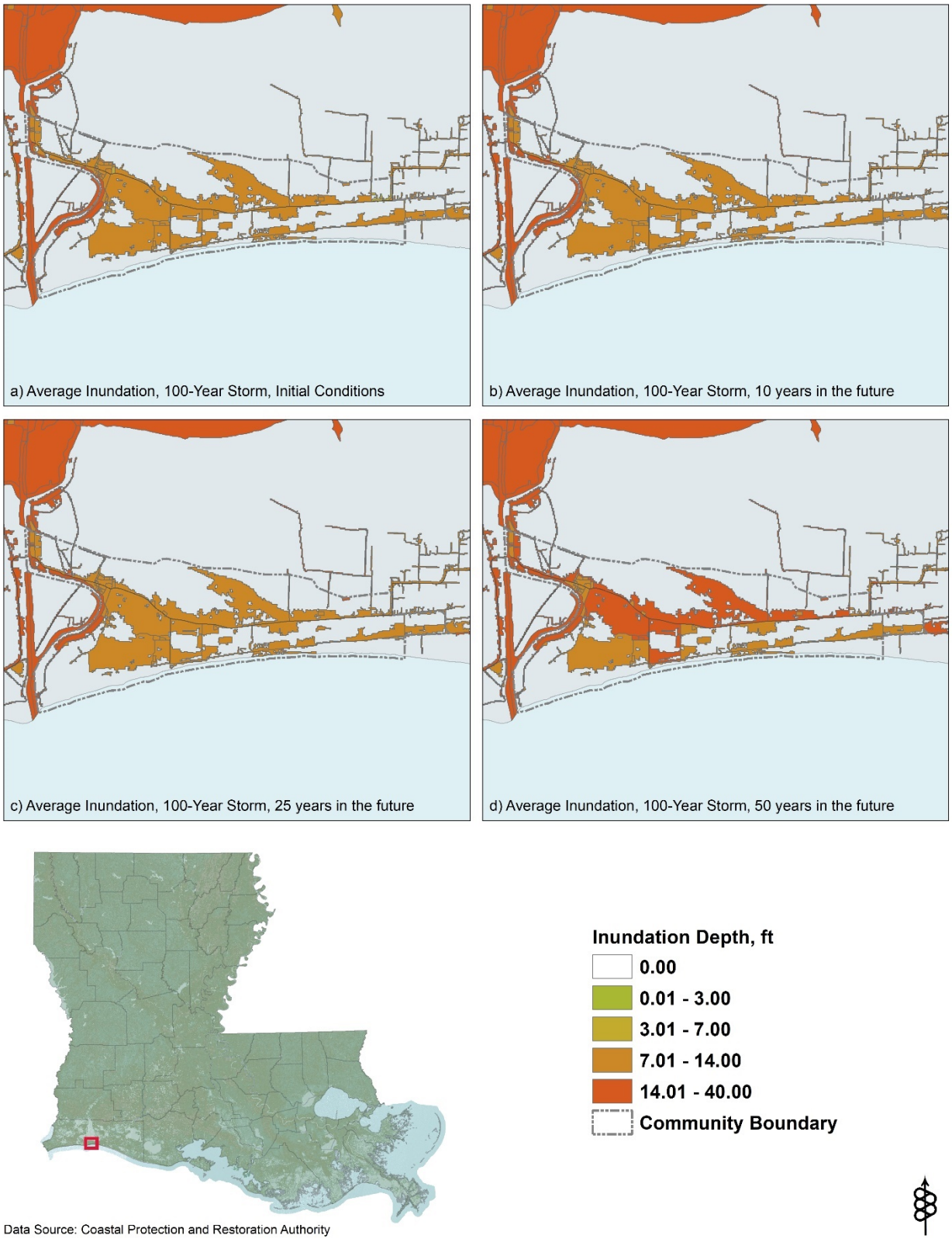


Figure 8: Storm surge inundation forecasts resulting from a 100-year storm occurring under the medium sea-level rise scenario.

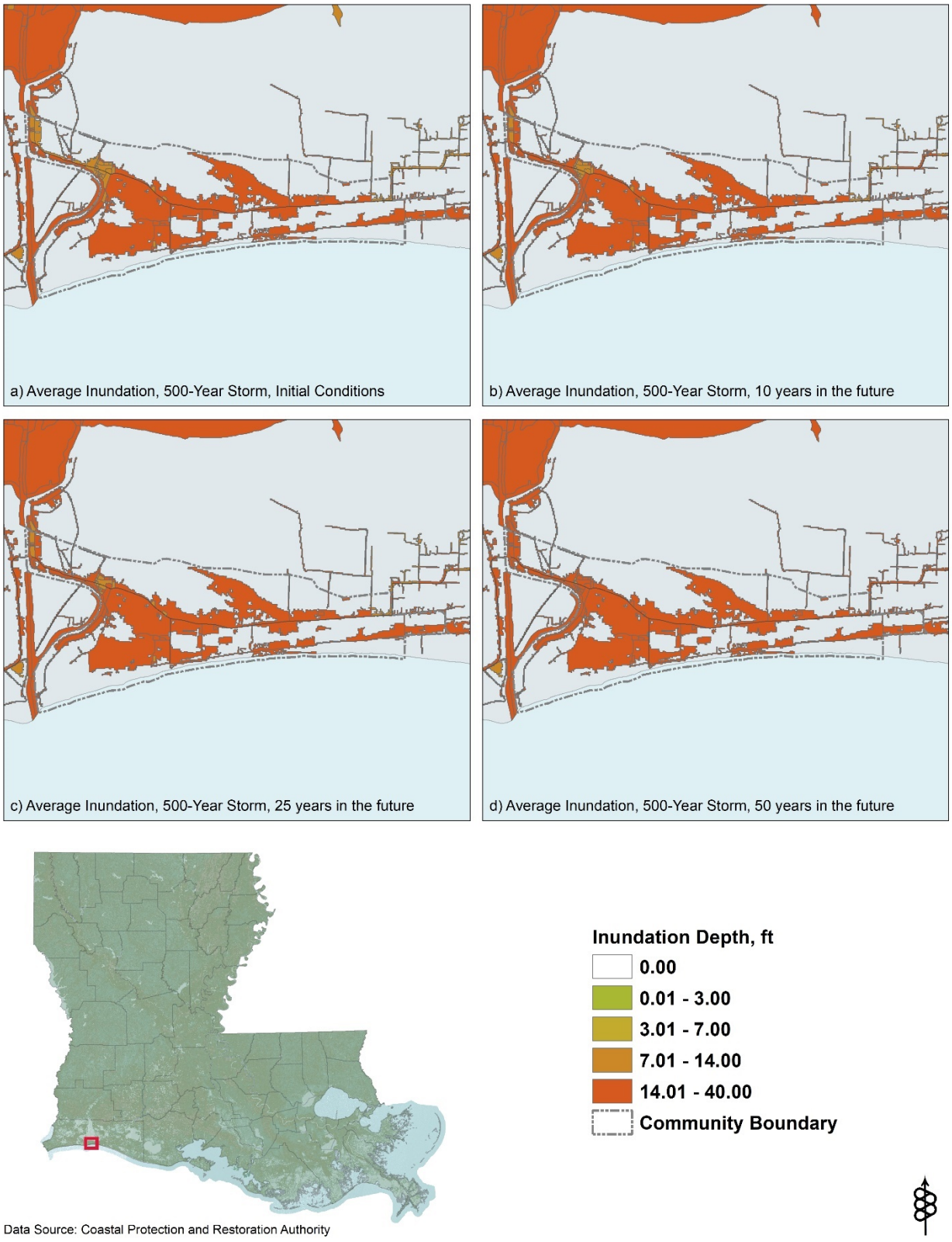


Figure 9: Storm surge inundation forecasts resulting from a 500-year storm occurring under the medium sea-level rise scenario.

TAX INFORMATION

Current Bond Rating and Influential Factors

I. **S&P: BBB+ (**Cameron Parish School District No. 4, La.'s general obligation (GO) debt; 2009) The rating is based on Cameron Parish School Board's very strong financial position and the district's ongoing tax base growth following Hurricane Rita. The outlook is stable. The rating also reflects:

- The school board's stabilizing enrollment trends;
- District's moderately concentrated tax base, centered in oil/gas industry;
- The district's low overall debt burden; &
- The district's full faith and credit tax pledge secures the bonds.[121]

Tax Revenues

I. **At a Glance**[122]:
   a. **Ad Valorem:** 12.39%
   b. **Licenses and Permits:** 5.73%
      i. Other: 23.00%
      ii. Intergovernmental: 57.47%
      iii. Franchise Taxes: 1.11%
   c. **Louisiana Department of Revenue Statistics:** 2014-2015 Property Tax: $37,109,785; per capita: $5,556

Table 15: Cameron Parish Severance Taxes 2015[123]**.**

Tax Collected on all Timber Products	$2,959
Tax Collected of All Other Products	$12,436,099
Oil Tax	$8,860,898
Gas Tax	$3,575,201
Sulfur Tax	-
Salt Tax	-
Salt Brine Tax	-
Sand Tax	-
Stone Tax	-
Lignite Tax	-
Timber Pine Log Tax	$17
Timber Hardwood and Cypress Tax	$2,912

[121] *See generally S&P Global Ratings*, STANDARD & POOR'S, https://www.spratings.com/en_US/home.
[122] *Cameron Parish Policy Jury: Annual Financial Report and Independent Auditors' Reports*: Year Ended December 31, 2015, GRAGSON, CASIDAY & GUILLORY, L.L.P., https://app.lla.state.la.us/PublicReports.nsf/CFA80FF82BE15645862580170073AB17/$FILE/000109AF.pdf.
[123] *Annual Report: 2015*, LOUISIANA TAX COMMISSION, https://www.latax.state.la.us/Menu_AnnualReports/UploadedFiles/Annual%20Report%202015.pdf.

Timber Chip-n-Saw Pine Tax	-
Timber Pulpwood Pine Tax	$13
Timber Pulpwood Hardwood Tax	$15

Table 16: Louisiana Tax Commission 2015 Annual Report[124].

Agricultural Lands: Class I	$0
Agricultural Lands: Class II	$0
Agricultural Lands: Class III	$2,327,067
Agricultural Lands: Class IV	$496,986
Timberlands: Class I	$0
Timberlands: Class II	$0
Timberlands: Class III	$0
Timberlands: Class IV	$0
Freshwater Marsh	$1,453,193
Brackish Marsh	$1,623,900
Salt Water Marsh	$152,540
All Other Acreage (greater than 3 acres)	$1,592,499
Subdivision Lots	$6,230,742
All Other Lots	$733,358
Land Subject to Homestead	$1,511,522
Land: All Other	$13,098,763
Improvements: Residential Homestead	$23,735,109
Improvements: Residential Other	$0
Improvements: Commercial or Industrial	$2,212,268
Inventories	$22,836,423
Machinery and Equipment	$28,903,081
Business Furniture and Fixtures	$599,695
Miscellaneous Personal Property	$8,865,426
Credits	$0
Leased Equipment	$1,038,300
Pipelines	$15,822,964
Oil and Gas Surface Equipment	$10,027,018
Watercraft	$26,311,577
Aircraft	$0
Financial Institutions	$693,810
Drilling Rigs	$2,679,600
Oil and Gas Wells	$57,157,513
Public Service Corporations	$58,147,500

[124] *Id.*

Major Employers/Asset Holders

I. **2015 Employment Statistics Table 17**[125]
II. **Major Employers 2017 - Data from Cameron Parish Port, Harbor & Terminal District (Table 18)**
III. **Cameron Parish Top Tax Payers (Table 19)**
IV. **Public Service Corporations (Table 20)**[126]

Table 17: Louisiana Workforce Commission 2015 Employment Statistics.

	NAICS Code	Total Units	Average Employment
Regional Labor Market Area 5		**6,939**	**124,221**
Agriculture, forestry, fishing and hunting	11	103	719
Mining	21	81	788
Utilities	22	66	869
Construction	23	689	16,426
Manufacturing	31-33	245	12,458
Wholesale trade	42	334	3,330
Retail trade	44-45	1,099	14,088
Transportation and warehousing	48-49	316	3,705
Information	51	70	1,168
Finance and insurance	52	470	2,786
Real estate and rental and leasing	53	300	1,558
Professional and technical services	54	675	4,503
Management of companies and enterprises	55	33	1,017
Administrative and waste services	56	364	5,836
Educational services	61	54	9,744
Health care and social assistance	62	733	17,229
Arts, entertainment, and recreation	71	98	4,078
Accommodation and food services	72	528	15,313

[125] *See generally Occupational Wage Data (2015)*, LOUISIANA WORKFORCE COMMISSION: THE DEPARTMENT OF LABOR, http://www.laworks.net/LaborMarketInfo/LMI_WageDataMap2009toPresent.asp?Year=2015 (last visited July 19, 2019).
[126] *See Annual Report: 2015*, Table 5, LOUISIANA TAX COMMISSION, https://www.latax.state.la.us/Menu_AnnualReports/UploadedFiles/Annual%20Report%202015.pdf.

Other services, except public administration	81	451	2,286
Public administration	92	218	6,307

Table 18: Cameron Parish Major Employers 2017.

Company Name	Company Type	Number of Employees
CCJV (Cameron LNG)	Natural gas distribution	1000
Chicago Bridge & Iron Company	Structural steel erection	400
Cameron Parish School Board	Elementary and secondary schools	350
United States Dept. of Energy Strategic Petroleum Reserves Office	Administration of general economic prog	143
Rural Healthcare Developers of Louisiana, LLC	Psychiatric hospitals	100
DM Petroleum Operations Company	Special warehousing and storage, nec	100
Cameron Parish Police Jury	Police protection	70
Cameron Parish Police Jury	Police protection	70
Brown's Grocery & Market, INC	Grocery stores, nsk	50
Phi, INC	Air transportation, nonscheduled, nsk	50
Cameron Offshore Boat Service, INC	Deep sea passenger trans, excpt ferry	45
Cameron Parish Schools	Elementary and secondary schools	45
Cameron Parish Schools	Elementary and secondary schools	45
Cameron Parish Schools	Elementary and secondary schools	40
ANR Pipeline Company	Natural gas transmission	37
Johnson Bayou Recreation Center	Amusement and recreation, nec, nsk	35
Alpha Seafood Enterprises, INC	Fresh or frozen packaged fish	30
Cameron Parish Schools	Elementary and secondary schools	30
Louisiana Department of Wildlife and Fisheries	Land, mineral,& wildlife conservation, nsk	30
United States Postal Service	Postal service	23
Martin Energy Services, LLC	Petroleum products, nec	21
Louisiana Department of Wildlife and Fisheries	Land, mineral, and wildlife conservation,	21
Halliburton Company	Oil and gas field services, nec, nsk	21
Coastal Environmental Operations, Inc.	Repair services, nec, nsk	20

Moore Land Management, LLC	Lawn and garden services	20

Table 19: Cameron Parish Top Tax Payers.

CCIV (Cameron LNG)	Cameron LNG Headquarters 2925 Briarpark Dr. Suite 1000 Houston, TX 77042[127]
Chicago Bridge & Iron Company	One CB&I Plaza 2103 Research Forest Drive The Woodlands, TX 77380
Cameron Parish School Board	510 Marshall Street, Cameron, LA 70631
United States Dept. of Energy Strategic Petroleum Reserves Office	1000 Independence Ave. SW Washington DC 20585
Rural Healthcare Developers of Louisiana, LLC	5360 W Creole Hwy Cameron, LA 70631
DM Petroleum Operations Company	850 South Clearview Parkway EF-29 New Orleans, LA 70123
Cameron Parish Police Jury	148, Smith Cir, Cameron, LA 70631
Brown's Grocery & Market, INC	620 Main Street Hackberry, LA 70645
Phi, Inc.	PO Box 90808 Lafayette, LA 70509
Cameron Offshore Boat Service, INC	154 Lessburg St Cameron, LA 70631
Cameron Parish Schools	510 Marshall Street, Cameron, LA 70631
ANR Pipeline Company	717 Texas Avenue Houston, TX 77002
Johnson Bayou Recreation Center	135 Berwick Rd, Cameron, LA 70631
Alpha Seafood Enterprises, Inc.	520 Pete Seay Circle Hackberry, LA 70645
Louisiana Department of Wildlife and Fisheries	2000 Quail Dr, Baton Rouge, LA 70808
Martin Energy Services LLC	Three Riverway Suite 400 Houston, TX 77056

[127] *See generally* CAMERON LNG, https://cameronlng.com/.

Halliburton Company	14851 Milner Road Gate 5A Houston, TX 77032
Coastal Environmental Operations, Inc.	5117 US-90, Lake Charles, LA 70615
Moore Land Management LLC	2312 E Burton St, Sulphur, LA 70663

Table 20: Cameron Parish Public Service Corporations (Power Plants).

Utility	Plant Name	City	State	MegaWatt
Agrilectric Power Partners Ltd	Agrilectric Power Partners Ltd	Calcasieu	LA	13.6
Calcasieu Power LLC	Calcasieu Power LLC	Calcasieu	LA	320
CITGO Petroleum Corp	CITGO Refinery Powerhouse	Calcasieu	LA	75
Conoco Inc. - Lake Charles Refinery	Conoco Lake Charles Refinery	Calcasieu	LA	0
Entergy Gulf States Inc.	R S Nelson	Calcasieu	LA	1596.2
Lyondell Chemical Co	Lyondell Chemical Lake Charles	Calcasieu	LA	4.3
Nelson Industrial Steam Co	Nelson Industrial Steam	Calcasieu	LA	0
PPG Industries Inc.	RS Cogen	Calcasieu	LA	493
PPG Industries Inc.	PPG Plant C Caustic	Calcasieu	LA	3.4
PPG Industries Inc.	PPG Riverside	Calcasieu	LA	162
PPG Industries Inc.	PPG Powerhouse A	Calcasieu	LA	52.5
PPG Industries Inc.	PPG Powerhouse C	Calcasieu	LA	357.7
Dynegy Midstream Services	Stingray Facility	Cameron	LA	2.5
Entergy New Orleans Inc.	Michoud	Orleans	LA	959.2
Entergy New Orleans Inc.	A B Paterson	Orleans	LA	148.9
American Sugar Refining Inc.	Domino Sugar Arabi Plant	St Bernard	LA	14
CII Carbon LLC	CII Carbon LLC	St Bernard	LA	46
Enterprise Products Optg LP	Toca Plant	St Bernard	LA	2.8
Mobil Oil Corp-Chalmette	Chalmette Refinery LLC	St Bernard	LA	5.7
Terrebonne Parish Consolidated Govt	Houma	Terrebonne	LA	99.3

Tax and Employment Analysis

Much like St. Bernard Parish, the population of Cameron Parish is the lowest of any governmental entity surveyed. Its population as of the last census was 6,882, with just over 12% holding a bachelor's degree or higher.[128] This low population, coupled with the high concentration of oil and gas-related corporations, forces the parish to rely on the oil and gas industry for much of its revenue. Even though the population is the lowest we have seen thus far, more people here hold at least a college degree than in St. Bernard Parish. This may allow Cameron Parish to outperform St. Bernard Parish in attracting high-quality laborers in the long-term.

Houma

COMMUNITY OVERVIEW

October 2018

GEOGRAPHY[129]

The community of Houma is located in the Acadiana region of south Louisiana in north-central Terrebonne Parish. The city serves as the parish seat of Terrebonne Parish and is part of the Houma-Bayou Cane-Thibodaux Metropolitan Statistical Area (MSA). Terrebonne Parish is bordered Lafourche Parish to the east, Assumption Parish to the north, St. Mary Parish to the west and the Gulf of Mexico to the south.

[128] *QuickFacts: Cameron Parish, Louisiana; United States*, UNITED STATES CENSUS BUREAU, https://www.census.gov/quickfacts/fact/table/cameronparishlouisiana,US/PST045218 (last visited July 19, 2019).

[129] *DOWNLOAD U.S. CENSUS DATA TABLES & MAPPING FILES*, IPUMS: NHGIS, https://www.nhgis.org/ (last visited July 19, 2019).

Adjacent communities to the north include the census designated places (CDP) of Bayou Cane, Gray, and Bayou Blue. Presquille and Bourg exist to the east and the communities of Montegut, Chauvin and Dulac reside to the south. The city covers a total area of 37.7 square kilometers of which 37.4 square kilometers, 99%, is land 0.3 square kilometers, 1%, is water. The generally east-west running Intracoastal Waterway splits the city in half intersecting Bayou Terrebonne at Louisiana State Route 24. Bayou Dularge, Bayou Grand Caillou, Bayou Petit Gaillou, and Bayou Terrebonne all flow southward from Houma toward the Gulf of Mexico

TOPOGRAPHY

The city of Houma sits at an average elevation of 10 feet above sea level with reference to NAVD88 datum. The terrain surrounding the city is predominately flat with naturally occurring bayous and manmade canals throughout. South of the community is predominantly decaying marshland that is split north-south by bayous flowing into the Gulf of Mexico. The topography of these bayou-adjacent areas is heavily influenced by naturally occurring levees built over successive flood cycles which deposited sand and sediment during overbank periods. Areas of highest elevation are located directly adjacent to the bayous and elevation decreases in an outward direction perpendicular to the bayou's flow. Chauvin, Cocodrie, Dulac, and Montegut are several examples of Terrebonne Parish communities built on natural levees. The majority of these water ways are hydrologically isolated from their source feature and no longer experience an annual flood cycle.

POPULATION CHARACTERISTICS

According to recent estimates by the US Census Bureau (circa 2013-2017 ACS), there were 33,784 people and 12,334 households in Houma. The population density as of the 2010 decennial census was 2,339.4 people per square mile (864.6/km²). The racial makeup of the community is 65.1% White, 25.7% Black or African American, 4.5% Native American, 0.7% Asian, and 3.2% from two or more races. 4.4% of the population were Hispanic or Latino of any race and 3.4% of the population claims to be foreign born. The median value of owner-occupied housing between 2013 and 2017 was estimated at $153,000 compared to the national average of $193,500. Median household income within Houma was estimated at $43,178 with an annual per capita income of $24,528, well below the nationwide average of $57,652 and $31,177, respectively. The community has an estimated employment rate of 56.5% in the civilian labor force population older than 16 years. Between 2013 and 2017, the average travel time to work for Houma residents was estimated at 22 minutes.[130]

CLIMATE

The city of Houma resides in the subtropical zone of the southern United States with three distinct seasons and year-round moderate temperatures. The average high temperature is 78.6 degrees Fahrenheit and average low temperature is 60 degrees Fahrenheit. The average annual temperature in Houma is 69.3 degrees Fahrenheit. January is the coolest month of the year with an average low of 44 degrees Fahrenheit. July and August are the average warmest months of the year with at an average temperature of 91 degrees Fahrenheit. The highest recorded temperature of 101 degrees Fahrenheit occurred in June 1930 and August

---

[130] *QuickFacts: Houma city, Louisiana; Cameron Parish, Louisiana*; United States, UNITED STATES CENSUS BUREAU, https://www.census.gov/quickfacts/fact/table/houmacitylouisiana,cameronparishlouisiana,US/PST045218.

2000. The record low temperature of 4 degrees Fahrenheit occurred in December 1960. The city receives an average of 62.18 inches of rainfall precipitation annually with little to no snowfall.[131]

DEPARTMENTS AND ORGANIZATIONS[132]

The city of Houma is the designated parish seat of Terrebonne Parish. The community has no specific organizations or departments and relies on services administered by the Terrebonne Parish Consolidated Government. The organization of the parish government is detailed below.

- Administration
  - Parish Administration
- Civic Center
  - Civic Center
- Coastal Restoration and Preservation
  - Coastal Restoration and Preservation Department
- Finance
  - Finance Department
  - Accounting
  - Customer Service
  - Information Technology
  - Purchasing
  - Warehouse
- Housing and Human Services
  - Housing and Human Services Department
  - Community Development
  - Head Start
  - Human Services
  - Section 8 Housing
- Parish Council
  - Council
  - Council Staff
- Parish President
  - Office of the Parish President
- Personnel Services
  - Human Resources
  - Risk Management
- Planning and Zoning
  - Planning and Zoning Department
  - Auditoriums, Museums, & Main Street
  - Board of Adjustment
  - Downtown Marina
  - Floodplain Management
  - Nuisance Abatement
  - Permits
  - Planning Commission
  - Recovery Assistance & Mitigation Planning
  - Tree Board
  - Zoning
- Public Safety
  - Public Safety Department
  - Houma Fire Department
  - Houma Police Department
  - Juvenile Justice Complex
  - Office of Homeland Security and Emergency Preparedness
- Public Works
  - Public Works Department
  - Engineering
  - Fleet Maintenance
  - Forced Drainage
  - Government Buildings
  - Gravity Drainage
  - Operations
  - Pollution Control
  - Public Transit
  - Roads & Bridges
  - Vegetation & Mosquito Control
- Recreation, Parks & Grounds
  - Recreation Department
- Utilities
  - Utilities Department
  - Animal Shelter
  - Electric Distribution
  - Electric Generation
  - Gas Distribution
  - GIS Mapping

[131] U.S. CLIMATE DATA, https://www.usclimatedata.com/.
[132] TERREBONNE PARISH CONSOLIDATED GOVERNMENT, http://www.tpcg.org/.

- Solid Waste / Landfill
- Other Agencies
  - Assessor
  - City Court
  - City Marshal
  - Clerk of Court
  - Consolidated Waterworks
  - District Attorney
  - Port of Terrebonne
  - Public Library
  - Registrar of Voters
  - Sales & Use Tax
  - School District
  - Sheriff
  - Visitor's Bureau

TRANSPORTATION

Several transportation routes cross through or are adjacent to the city of Houma including state routes, railroads and a multitude of abandoned and active pipeline corridors. The city is served by the Houma-Terrebonne Airport located roughly three miles southeast of the city center.

Major Motor Vehicle Roadways

U.S. Route 90
Louisiana Highway 24
Louisiana Highway 182
Louisiana Highway 311
Louisiana Highway 3040

Railroads

2017 COASTAL MASTER PLAN NONSTRUCTURAL PROGRAM[133]

The 2017 Coastal Master Plan (Master Plan) analyzed 54 candidate nonstructural project areas. Selected nonstructural project areas include several nonstructural mitigation measures, defined based on flood depths and type of structure. Each mitigation measure is based on Coastal Protection and Restoration Authority (CPRA) estimates of 100-year flood depths (or 1% annual exceedance probability) with an additional two feet of freeboard for elevation projects. Mitigation measures are defined as:

- Floodproofing of non-residential structures. Recommended in areas inundated to less than three feet.
- Elevation of residential structures. Recommended in areas inundated between 3-14 feet.
- Voluntary Acquisition for residential structures. Recommended in areas inundated above 14 feet.

Table 21 identifies the two nonstructural project areas in Terrebonne Parish and provides estimates as to the number of structures requiring mitigation based on the above criteria.

[133] *Nonstructural Risk Reduction Projects*, LOUISIANA COASTAL PROTECTION AND RESTORATION AUTHORITY, Nonstructural Risk Reduction Projects, http://coastal.la.gov/our-plan/2017-coastal-master-plan/flood-risk-and-resilience-program/nonstructural-projects/ (last visited July 19, 2019).

Table 21: CPRA Nonstructural Protection Mitigation Details for Terrebonne Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Number of Floodproofings	Number of Elevations	Number of Acquisitions
TER.01N	Terrebonne - Lower	Selected Period 1	1	261	120
TER.02N	Terrebonne - Houma	Selected Period 1	312	5307	477

The 2017 Master Plan included a range of nonstructural projects that effectively reduce economic damages due to storm surge flood risk when coupled with associated structural risk reduction projects. Recommendations presented in the 2017 Master Plan add to nonstructural projects developed for the 2012 Coastal Master Plan by including new mitigation standards and considering additional community characteristics such as low to moderate income (LMI) households.

Table 22 includes a summary of the two nonstructural project areas in Terrebonne Parish, with estimated costs for the three mitigation criteria. These recommendations, provided by CPRA, are intended to provide high-level planning estimates, and do not include recommendations for mitigation of specific structures. Attributes of nonstructural projects will be further revised by coastal parishes during project implementation to identify specific structures to be mitigated, as well as structure counts and costs based on mitigation classification.

Table 22: CPRA Nonstructural Protection Cost Estimates for Terrebonne Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Total Count	Floodproofing Cost	Elevation Cost	Acquisition Cost	Total Cost
TER.01N	Terrebonne - Lower	382	$1M	$40.7M	$46.1M	$87.8M
TER.02N	Terrebonne - Houma	6096	$278.6M	$820.8M	$164.6M	$1,264.0M

Due to funding and capacity constraints CPRA's nonstructural protection projects cannot be implemented in the same period. As with restoration and structural risk reduction projects, implementation of nonstructural protection projects is recommended for different periods over the Coastal Master Plan's 50-year planning horizon. Structural and nonstructural risk reduction projects are recommended for two implementation periods, either: years 1-30 or years 31-50. Nonstructural projects vary by mitigation standard, based on implementation period. Projects selected for the first period include mitigation measures designed to attenuate 100-year flood depths occurring at year 10. In certain instances, the selection of a proposed structural protection project necessitated the selection of an associated nonstructural project. Recommendations were made based on whether or a not implementation of a candidate structural protection project resulted in increased flood depths outside of an associated levee system. In this case, nonstructural project in that area would be automatically selected to mitigate induced flooding. **Table 5** identifies the prerequisite structural protection projects and mitigation standards for the two nonstructural project areas in Terrebonne Parish.

Table 23: CPRA Nonstructural Prerequisites and Mitigation Standards for Terrebonne Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	Implementation Period	Structural Project Prerequisite Mitigation Standard	Mitigation Standard
TER.01N	Terrebonne - Lower	Year 1-30	03a.HP.103 - Morganza to the Gulf	Year 10
TER.02N	Terrebonne - Houma	Year 1-30	None	Year 10

During CPRA's nonstructural project development process, several types of data were collected to describe the projects and project benefits. This information was focused on better understanding how candidate nonstructural projects could potentially affect communities that were especially vulnerable to flood risk. Additional data includes:

- Repetitive loss and severe repetitive loss properties (RL/SRL) - total count of RL/SRL properties within the mitigated grid points in the nonstructural project area;
- Low to moderate income households - the average percentage of the low to moderate income households in the project area.

Table 6 identifies the RL/SRL counts and average low to moderate income households for the two nonstructural project areas in Terrebonne Parish.

Table 24: CPRA Nonstructural Protection Repetitive Loss/Severe Repetitive Loss Properties and Average Percentage of Low to Moderate Income (Avg. % LMI) Households in Terrebonne Parish, LA.

Nonstructural Project ID	Nonstructural Project Name	RL/SRL Count	Avg. % LMI
TER.01N	Terrebonne - Lower	455	61%
TER.02N	Terrebonne - Houma	6,265	48%

THREAT HAZARD IDENTIFICATION AND RISK ASSESSMENT SUMMARY

Flooding is an issue for many Houma residents as the majority of the city lies at or below sea level. The principal source of flooding in Houma and Terrebonne Parish is rainfall, but hurricanes and associated storm surge are a significant threat during late summer months. The community has dealt with several devastating hurricanes in its history including Andrew in 1992, Katrina in 2005, Gustav in 2008, and Isaac in 2012.[134]

[134] Roth, *supra* note 100.

Storm Surge Flooding

The highest flooding threat experienced in the city of Houma results from storm surge inundation. Storm surge is qualified as the rise in offshore water elevation associated with the shear force imparted by hurricane or tropical depression force winds acting on the water surface. Drivers of storm surge inundation are primarily hurricanes and high intensity storms. Compounding the risk of storm surge related flooding is the significant wetland loss occurring in coastal Louisiana.

FLOODING ANALYSIS

This analysis in this section considers flooding potential derived from two data sources: flood insurance studies conducted by the Federal Emergency Management Agency (FEMA) and storm surge inundation modeling conducted by the Coastal Protection and Restoration Authority (CPRA) in fulfillment of the 2017 Master Plan for a Sustainable Coast.

Flood Zone Analysis[135]

FEMA flood insurance studies rely primarily on elevation and hydrologic modeling to determine flooding potential and flood zones are delineated based on annual flooding probability. Classifications include storm events with a 1-percent annual exceedance probability (100-year flood event) and events with a 0.2-percent annual exceedance probability (500-year flood event). Flood zones falling within the 1-percent annual exceedance probability include zones A, AO, AH, AE, AR, AR/AE, AR/A, V, and VE. Zones in this classification have associated base flood elevations (BFEs) or average depths if the zone code includes two characters (i.e. AE). Zones V and VE indicate a velocity hazard associated with wave action and are most likely to occur on land areas adjacent to a water body with an areal coverage large enough to produce fetch-driven waves. Flood zones falling in the 0.2-percent annual exceedance probability include zones B and X (shaded). No BFEs or average depths are included for these zones. Areas of minimal flood hazard, those outside of the boundaries delineated by the 1-percent and 0.2-percent annual exceedance probability, include zones C and X (unshaded).

Flood probability data was pulled from the National Flood Hazard Layer dataset published by FEMA, available through the federal Open Data program. Included in this dataset is the geographic extent of flooding based on the annual return probability. Boundaries of the community census blocks were overlain on the spatial extent of the 100-year and 500-year flood surfaces, agglomerated based on annual exceedance probability.

Storm Surge Analysis[136]

Several storm surge inundation models have been developed for coastal Louisiana through efforts of CPRA and affiliated agencies. One of these models, called the Integrated Compartment Model (ICM), serves as the design basis for the inundation model used to evaluate storm surge depths across the Gulf Coast. The resultant coastal Louisiana specific model, the one used to evaluate potential inundation for the Houma community, is the Coastal Louisiana Risk Assessment (CLARA) model, developed by the RAND Corporation for CPRA. CLARA flooding potentials were spatially joined with dasymetric census block

[135] *National Flood Hazard Layer (NFHL)*, FEMA (last updated July 10, 2019), https://www.fema.gov/national-flood-hazard-layer-nfhl (last visited July 19, 2019).
[136] Fischbach ET AL., *supra* note 105.

delineations and flooding statistics were developed through zonal analysis. **Figure 7**, **Figure 8**, and **Figure 9** illustrate the average storm surge inundation resulting from a 50-year, 100-year, and 500-year storm under the medium sea-level rise scenario classified by CPRA and RAND. The flooding potentials consider a storm occurring under initial conditions as well as storms occurring 10, 25, and 50 years into the future. The CLARA model does not account for precipitation and ponding of storm water runoff and there exists a potential for a "perfect storm" of flooding mechanisms resulting in significant, catastrophic flooding of the Houma community.

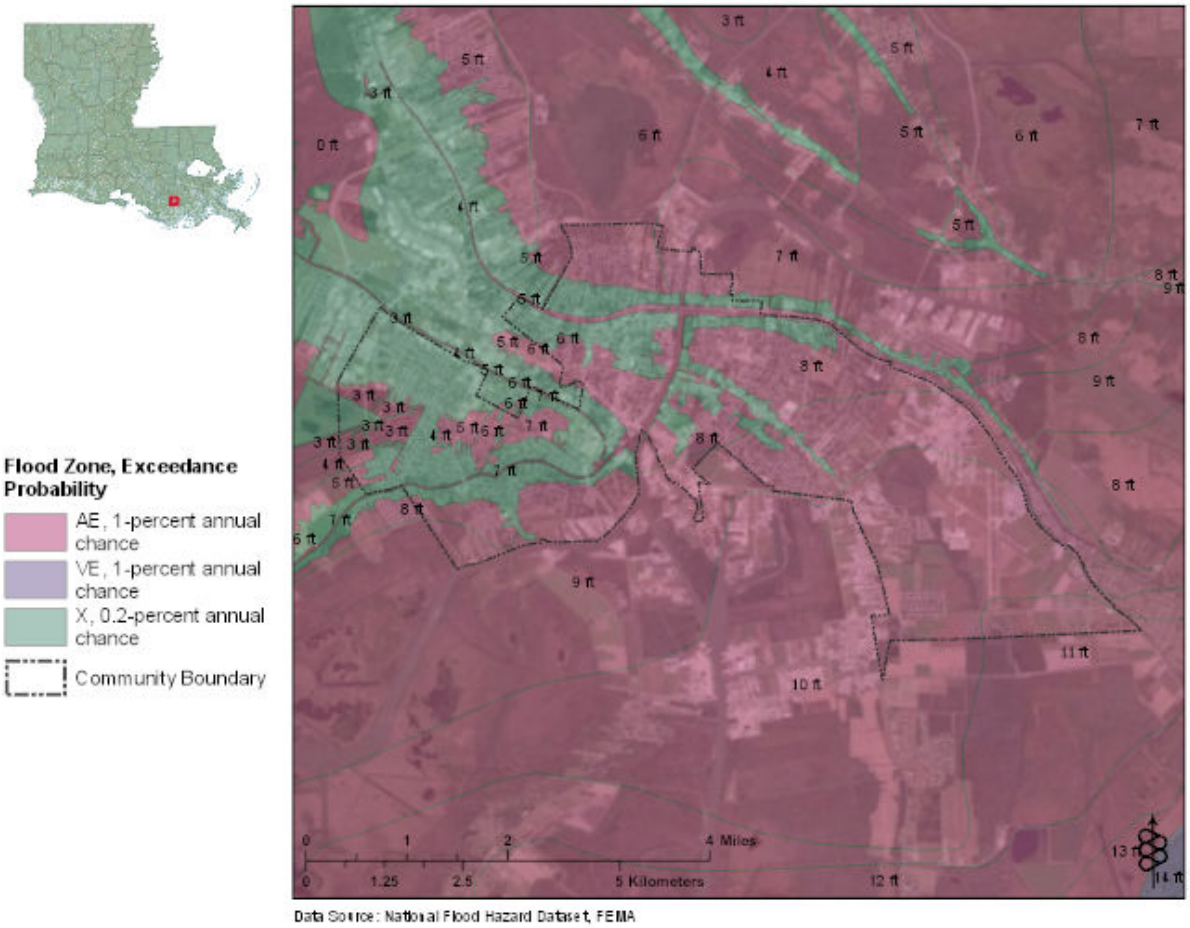


Figure 10: Flood zone detail for the community of Houma. Base flood elevations are labeled in available zones.

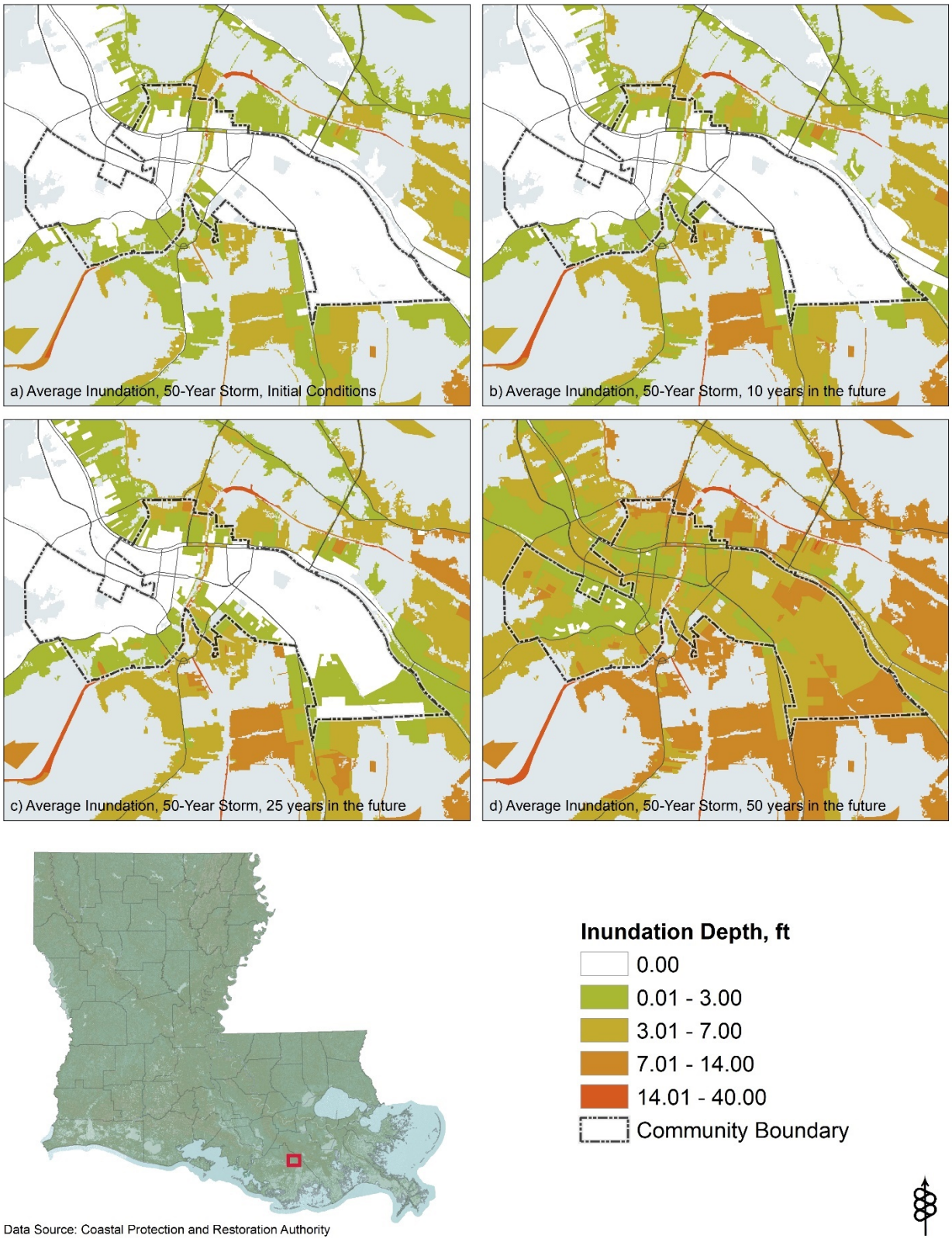


Figure 11: Storm surge inundation forecasts resulting from a 50-year storm occurring under the medium sea-level rise scenario.

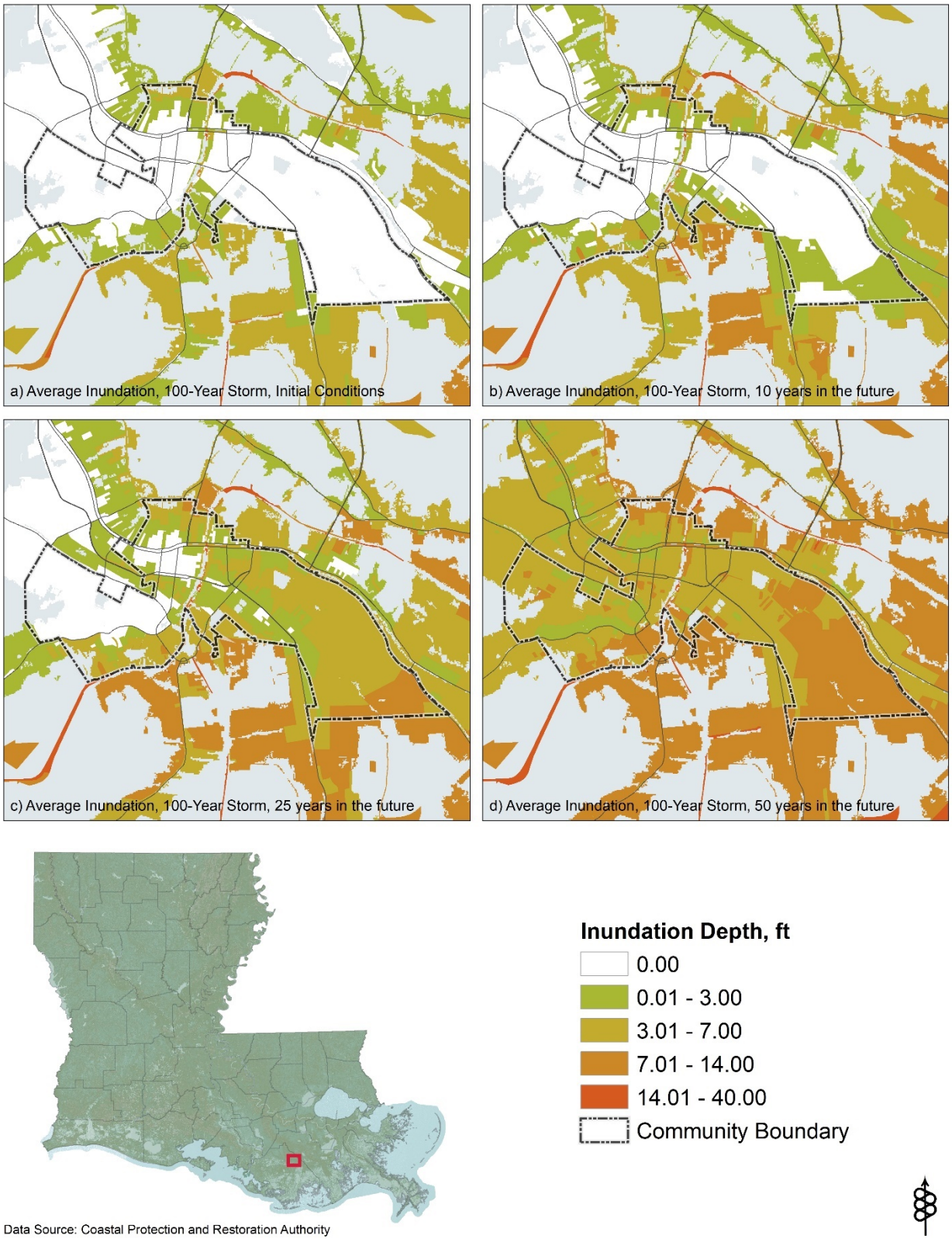


Figure 12: Storm surge inundation forecasts resulting from a 100-year storm occurring under the medium sea-level rise scenario.

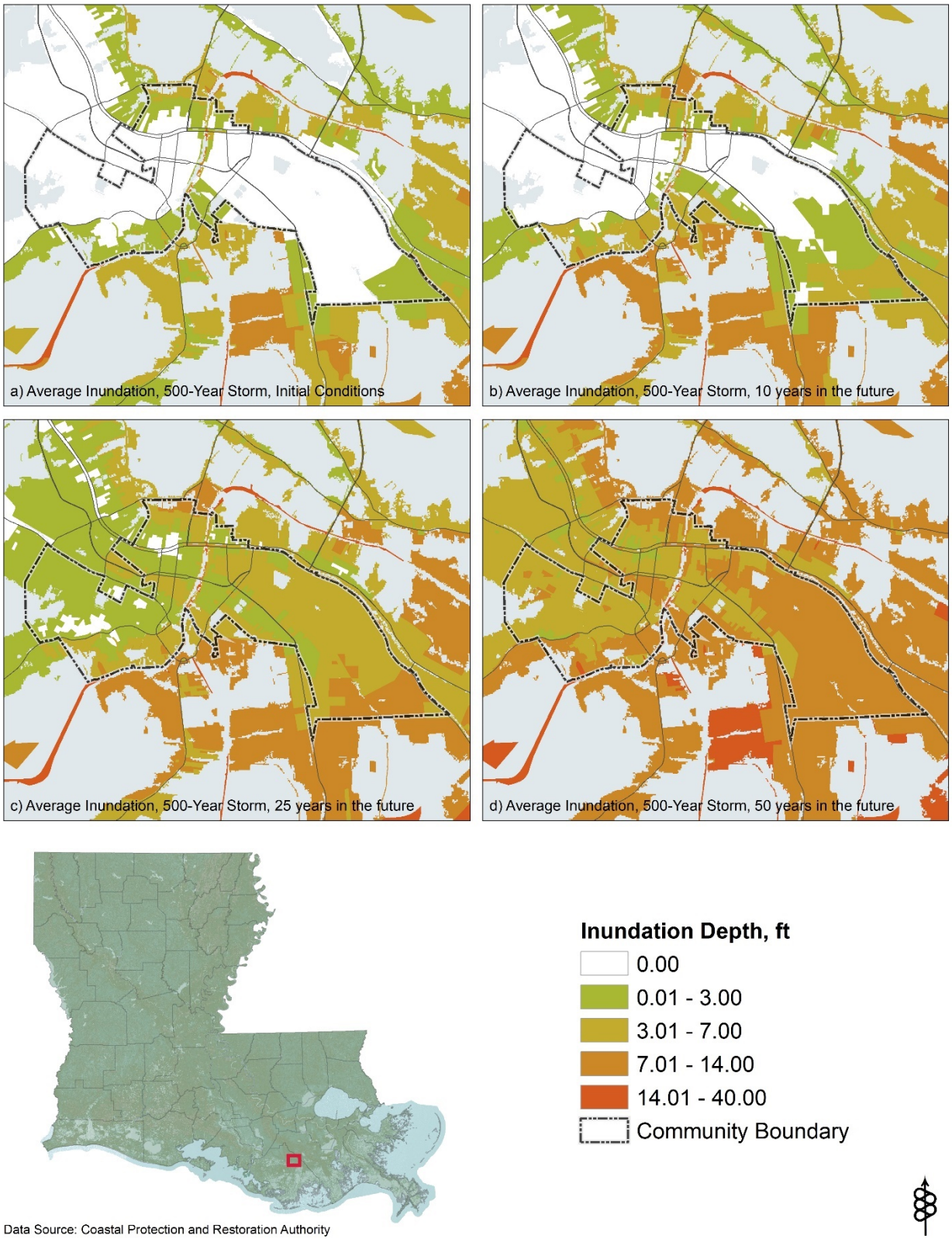


Figure 13: Storm surge inundation forecasts resulting from a 500-year storm occurring under the medium sea-level rise scenario.

Current Bond Rating and Influential Factors

I. Moody's : A3

II. Fitch: AA-

a. "The 'AA-' IDR and GO bond ratings reflect the parish's low debt burden and its strong financial resilience . . . supported by solid spending flexibility and healthy reserves." Fitch: "important offsetting factors to the parish's severely limited revenue flexibility."

b. "The 'AA-' rating on the PIBs [(public improvement bonds)] reflects expectations for a strong coverage cushion during periods of moderate economic decline relative to both MADS [(maximum annual debt service)] and the additional bonds test (ABT) of 2.0 times (x)."[137]

III. Standard and Poor: AA (GO); AA (series 2015 refunding bonds)

a. GO bond rating raised from AA- to AA in 2015 due to improved economic conditions.

b. "The series 2015 bonds are secured by the parish's unlimited ad valorem tax on all taxable property within the parish. The bonds are being issued for the purpose of refunding a portion of the parish's existing GO bonds for interest rate savings."

c. "The existing series 1998B bonds are secured by a pledge of the Terrebonne Parish Consolidated Government that, through an approved ordinance, has obligated itself to budget annually a sum of money sufficient to pay debt service on the aforementioned issuance. The ordinance approving the original issuance also includes a covenant to levy taxes, as per state statutes that govern all parishes, at a rate sufficient to pay debt service on the series 1998B issue. Consequently, we view the security as a full faith and credit pledge of the consolidated government and have not notched the rating . . ."

d. "The rating reflects our opinion of the following factors for the parish:

i. Strong economy, with access to a broad and diverse metropolitan statistical area (MSA);

ii. Strong management, with 'good' financial policies;

iii. Very strong budgetary flexibility, with an available fund balance in fiscal 2013 of 44% of operating expenditures;

iv. Strong budgetary performance, with operating results that were positive in the general fund but negative at the total governmental fund level;

v. Very strong liquidity, with total government available cash of 83.3% of total governmental fund expenditures and 12.1x governmental debt service and access to external liquidity we consider strong;

vi. Strong debt and contingent liability position, with debt service carrying charges of 6.9% and net direct debt that is 76.2% of total governmental fund revenue and low overall net debt less than 3% of market value; and

[137] *Fitch Affirms Terrebonne Parish, LA's Bonds at 'AA-'; Outlook Stable*, BUSINESS WIRE, (July 27, 2016, 3:24 PM), https://www.businesswire.com/news/home/20160727006448/en/Fitch-Affirms-Terrebonne-Parish-LAs-Bonds-AA- (last visited July 19. 2019).

vii. A very strong institutional framework score."[138]

Tax Revenues

I. At a Glance:

- **a.** Sales taxes: about 25% of general fund revenues
- **b.** Mineral royalties: about 10%
- **c.** Property taxes: less than 10%
- **d.** Other sources include a mix of state-shared and local revenues
- **e.** Sales tax receipts declined by 13.5% in 2015 and are expected to decline further
- **f.** Strong revenue growth in 2004-2014 exceeded level of U.S. economic performance due to significant energy sector activity
- **g.** Slowed oil production is expected to produce a more subdued pace of revenue growth, below that of U.S. GDP but at or above the rate of inflation.

II. The parish:

- **a.** has no independent legal ability to raise property or sales tax rates, so revenue flexibility is limited to increases in locally controlled franchise taxes, fees, and charges.
- **b.** council does have the option to carry forward its millage rate following increases in property valuation, generating a higher tax levy.
- **c.** As of 2015, general government items make up the majority of general fund spending (63%), followed by public safety (20.5%). Given the region's rising, but slower population growth, Fitch expects the pace of spending growth to trend with revenues in the absence of policy action.
- **d.** Terrebonne Parish's fixed cost burden is moderately low, with carrying costs for debt service, pensions, and other post-employment benefits equal to 11.4% of governmental fund spending in 2015. Expenditure flexibility is aided by management's strong degree of control over workforce spending, as the parish has no collective bargaining agreements and pay adjustments for all employee classes are determined annually during the budget process.[139]

III. Louisiana Department of Revenue Statistics[140]:

- **a. 2014-2015 Property Tax:** $86,428,714; **Per Capita:** $767
- **b. Severance Taxes 2015 (Table 25)**

LA Tax Commission 2015 Annual Report (

- **c. Table 26**)

---

[138] *See generally S&P Global Ratings*, STANDARD & POOR'S, https://www.spratings.com/en_US/home.

[139] *Fitch Affirms Terrebonne Parish, LA's Bonds at 'AA-'; Outlook Stable*, BUSINESS WIRE, (July 27, 2016, 3:24 PM), https://www.businesswire.com/news/home/20160727006448/en/Fitch-Affirms-Terrebonne-Parish-LAs-Bonds-AA- (last visited July 19. 2019).

[140] *Annual Report: 2015*, LOUISIANA TAX COMMISSION, https://www.latax.state.la.us/Menu_AnnualReports/UploadedFiles/Annual%20Report%202015.pdf.

Table 25: Terrebonne Parish Severance Taxes 2015[4].

Tax Collected on all Timber Products	$1037
Tax Collected of All Other Products	$25,278,708
Oil Tax	$21,027,919
Gas Tax	$4,250,788
Sulfur Tax	-
Salt Tax	-
Salt Brine Tax	-
Sand Tax	-
Stone Tax	-
Lignite Tax	-
Timber Pine Log Tax	-
Timber Hardwood and Cypress Tax	$227
Timber Chip-n-Saw Pine Tax	-
Timber Pulpwood Pine Tax	$22
Timber Pulpwood Hardwood Tax	$787

Table 26: Louisiana Tax Commission 2015 Annual Report[141].

Agricultural Lands: Class I	$634,050
Agricultural Lands: Class II	$118,735
Agricultural Lands: Class III	$72,465
Agricultural Lands: Class IV	$52,775
Timberlands: Class I	$0
Timberlands: Class II	$0
Timberlands: Class III	$0
Timberlands: Class IV	$0
Freshwater Marsh	$0
Brackish Marsh	$682,380
Salt Water Marsh	$3,464,220
All Other Acreage (greater than 3 acres)	$18,307,095
Subdivision Lots	$117,208,375
All Other Lots	$0
Land Subject to Homestead	$59,439,760
Land: All Other	$81,100,335
Improvements: Residential Homestead	$319,756,915
Improvements: Residential Other	$0
Improvements: Commercial or Industrial	$129,273,560
Inventories	$109,476,995
Machinery and Equipment	$93,294,649
Business Furniture and Fixtures	$7,740,736
Miscellaneous Personal Property	$6,667,797

[141] *Id.*

Credits	$307,410
Leased Equipment	$0
Pipelines	$11,704,766
Oil and Gas Surface Equipment	$16,313,946
Watercraft	$42,795,470
Aircraft	$32,772,713
Financial Institutions	$17,416,560
Drilling Rigs	$5,5056,197
Oil and Gas Wells	$65,928,928
Public Service Corporations	$88,125,070

IV. State Mineral Royalties:[142]

a. It has been the practice of Terrebonne Parish to use a portion of State Mineral Royalties for recurring operations and excess funds for non-recurring or special projects. **The Parish received:**

i. $9 million in 2008,

ii. $3.9 million in 2009,

---

[142] *See* LA. CONST. ART. 7, § 4, which states:

> (a) Remittance to parishes. (i) In the first fiscal year of implementation of this Subparagraph, the maximum amount of severance tax on all natural resources other than sulphur, lignite, or timber which is remitted to the parish in which severance or production occurs shall not exceed one million eight hundred fifty thousand dollars. For all subsequent fiscal years, the maximum amount remitted to a parish shall not exceed two million eight hundred fifty thousand dollars. (ii) On July first of each year the maximum amount remitted to the parish in which severance or production occurs, as provided in Item (i) of this subparagraph, shall be increased by an amount equal to the average annual increase in the Consumer Price Index for all urban consumers for the previous calendar year, as published by the United States Department of Labor, which amount shall be as calculated and adopted by the Revenue Estimating Conference. (iii) Of the total amount of severance tax revenues remitted in a fiscal year to a parish governing authority pursuant to the provisions of this Subparagraph, any portion which is in excess of the amount of such tax revenues remitted to that parish in Fiscal Year 2011-2012 shall be known as "excess severance tax". At least fifty percent of the excess severance tax received by a parish governing authority in a fiscal year shall be expended within the parish in the same manner and for the same purposes as monies received by the parish from the Parish Transportation Fund. … (E) Royalties Allocation. One-tenth of the royalties from mineral leases on state-owned land, lake and river beds and other water bottoms belonging to the state or the title to which is in the public for mineral development shall be remitted to the parish governing authority [("PGA")] in which severance or production occurs. [PGA] may fund these into [GO] bonds of the parish in accordance with law.

1. $5.4 million in 2010,
2. $5.94 million in 2011,
3. $4.83 million for the year 2012,
4. $5.58 million for the year 2013,
5. $5.5 million for the year 2014, and
6. $3.2 million in 2015.[143]

Major Employers/Asset Holders

I. **2015 Employment Statistics** (Table 27)[144]
II. **Top Private Sector Employers** (Table 28)[145]
III. **Terrebonne Parish Top Tax Payers 2014** (Table 29) [146]
IV. **Top Public-Sector Employers** (Table 30)

Table 27: Louisiana Workforce Commission 2015 Employment Statistics.

	NAICS Code	Total Units	Average Employment
TERREBONNE TOTAL		**3,279**	**56,635**
Agriculture, forestry, fishing and hunting	11	26	138
Mining	21	99	6,069
Utilities	22	11	211
Construction	23	264	3,318
Manufacturing	31-33	212	6,472
Wholesale trade	42	194	1,886
Retail trade	44-45	487	7,087
Transportation and warehousing	48-49	164	4,036
Information	51	26	403
Finance and insurance	52	199	1,151
Real estate and rental and leasing	53	187	1,688
Professional and technical services	54	352	2,536
Management of companies and enterprises	55	13	303
Administrative and waste services	56	156	2,944

[143] *See Accounting*, TERREBONNE PARISH CONSOLIDATED GOVERNMENT, https://www.tpcg.org/index.php?f=accounting&p=budget (last visited July 19, 2019).
[144] *See generally Occupational Wage Data (2015)*, LOUISIANA WORKFORCE COMMISSION: THE DEPARTMENT OF LABOR, http://www.laworks.net/LaborMarketInfo/LMI_WageDataMap2009toPresent.asp?Year=2015 (last visited July 19, 2019).
[145] *See generally* HOUMA-TERREBONNE CHAMBER OF COMMERCE, https://houmachamber.com/memlogin/membership-directory/ (last visited July 19, 2019).
[146] *Id.*

Educational services	61	34	*
Health care and social assistance	62	310	6,820
Arts, entertainment, and recreation	71	43	458
Accommodation and food services	72	240	5,038
Other services, except public administration	81	191	1,394
Public administration	92	70	1,630

* Data Non-publishable

Table 28: Houma Top Private Sector Employers from 2015

Seacor Marine LLC 7910 Main Street, 2nd Floor Houma, LA 70360	1200
LaShip (Chouest) 367 Dickson Rd Houma, LA 70363	1200
Gulf Island Fabrication 16225 Park Ten Place | Suite 280 Houston, TX 77084	875
Rouses Rouse's Enterprises, LLC d/b/a Rouses Markets P.O. Box 5358 Thibodaux, LA 70302-5358	730
Wal-Mart 702 S.W. 8th St. Bentonville, AK 72716	714
B&D Contracting Inc. 3115 Old Mobile Avenue Pascagoula, MS 39581	634
Performance Energy Services, LLC 250 N American Ct. Houma, LA 70363	600
Chet Morrison Services, LLC 9 Bayou Dularge Rd. Houma, LA 70363	504
Wood Group Production Services 182 Equity Blvd. Houma, LA 70360	464
Weatherford International Ltd 2000 St James Place Houston, TX 77056 USA	414
Superior Labor Services, Inc.	401

8702 E Park Ave. Houma, LA 70363	
Oil State Skagit SMATCO 1180 Mulberry Rd. Houma, LA 70363	400
Dolphin Services, Inc. 400 Thompson Rd. Houma, LA 70363	382
Baywater Drilling 668 S Hollywood Rd. Houma, LA 70360	360
Schlumberger 11490 Westheimer Road Houston, TX 77077	348
Sontheimer Offshore Catering 5450 W Main St. Houma, LA 70360	325
T. Baker Smith 412 South Van Avenue P. O. Box 2266 (70361) Houma, LA 70363	325
Settoon Towing 1073 LA-70 Pierre Part, LA 70339	300
Hutco, Inc. 114 Park Center Street Broussard, LA 7051	298
K&B Industries 2186 Grand Caillou Rd. Houma, LA 70363	275

Table 29: Terrebonne Parish Top Tax Payers

Company	2014 Value ($)	Tax Bill ($)
Hilcorp Energy Company 1111 Travis Street Houston, Texas 77002	38,952,115	3,880,695
PHI PO Box 90808 Lafayette, LA 70509	27,247,665	2,586,809
SCF Marine, Inc. (Seacor) 2200 Eller Drive P.O. Box 13038 Fort Lauderdale, FL 33316	14,191,655	1,412,421
Shell Pipeline Company 777 Walker Street 2 Shell Plaza Houston, TX 77002-5316	13,058,240	1,282,304

Weatherford US 2000 St James Place Houston Texas 77056 USA	11,214,805	1,037,455
Apache Corporation 2000 Post Oak Boulevard, Suite 100 Houston, Texas 77056-4400	10,463,265	1,076,360
Entergy Louisiana, Inc. 4809 Jefferson Hwy Jefferson, LA 70121	9,478,600	891,305
Halliburton Energy Services, Inc. 10200 Bellaire Blvd. Houston, TX 77072	8,602,095	801,356
Transcontinental Gas Pipeline One Williams Center Tulsa, OK 74172	8,295,890	805,771
Hercules Drilling Company 24 Concord Rd Houma, LA 70360	8,058,295	805,771
South Louisiana Electric Co-Op Association 2028 Coteau Road Houma, La 70364	7,690,410	732,942
Bell South Communications 675 West Peachtree Street NE Atlanta, GA 30375	792,760	678,815
Zedeco Pipeline Company PO Box 4525 Houston, TX 77210-4525	7,367,480	664,804
Castex Energy, Inc. 333 Clay St #2000 Houston, TX 77002	6,903,470	693,171
Wal-Mart Louisiana, Inc. 702 S.W. 8th St. Bentonville, AK 72716	6,238,820	592,438
Manson Gulf, LLC 392 Old Bayou Dularge Rd Houma, LA 70363	5,768,990	610,993
Ship Shoal Pipeline Company 919 Milam Suite 2100 Houston, TX 77002	5,595,790	540,242
Oil States Skagit Smatco 1180 Mulberry Rd Houma, LA 70363	5,549,185	466,519
Nabors Offshore Drilling Crown House Second Floor 4 Par-la-Ville Road Hamilton, HM 08 Bermuda PO Box HM3349	5,508,830	515,174

Hamilton, HMPX Bermuda		
Helis Oil and Gas 228 Saint Charles Ave # 902 New Orleans, LA 70130	5,401,620	530,177

Table 30: Terrebonne Parish Top Public-Sector Employers.

Terrebonne Parish School Board 201 Stadium Dr. Houma, LA 70360	2690
Terrebonne General 8166 W Main St. Houma, LA 70360	1285
Chabert Medical Center 1978 Industrial Blvd. Houma, LA 70363	977
Terrebonne Parish Government 8026 W Main St #101 Houma, LA 70360	815

I. Analysis:

Healthcare and government institutions somewhat mitigate private sector concentration in the oil industry. "Oil and gas concentration is evidenced by the parish's top 10 property taxpayers, predominantly petroleum and complementary firms, which constitute over 16% of the tax base. Taxable assessed valuation ("TAV") grew by 20% for the 2017 collection year, reflecting property appreciation since the prior reassessment (2013 collection)."[147] Heavy concentration of firms or employers representing one or two industries in this particular geographic area is concerning. Even though the parish received a strong rating from different bond services, the parish government's tax base is limited. The two major industries concentrated in this area are the oil and gas industry and the shipping industry. If one or both industries suffered a major loss, the tax base would decline. However, the shipping industry may see a boom if LA continues to lose land to sea level rise. Further, high-quality labor is attracted to regions with existing high-quality labor. This means that job growth in an area is determined in large part by that area's present amount of people holding a bachelor's degree, or higher. The percentage of those in Terrebonne Parish holding a bachelor's degree or higher is 13.7 %[148]; for reference, the percentage for Orleans Parish 35.3 %.[149] Those figures are for the period of 2011-2015.

[147] Business Wire, Fitch Affirms Terrebonne Parish, LA's Bonds at "AA-"; Outlook Stable, https://www.businesswire.com/news/home/20160727006448/en/Fitch-Affirms-Terrebonne-Parish-LAs-Bonds-AA- (last visited July 19, 2019).

[148] Allison Plyer, *The Coastal Index: Tracking Development of the water management cluster in Southeast Louisiana*, THE DATA CENTER (June 14, 2017), https://s3.amazonaws.com/gnocdc/reports/TheDataCenter_TheCoastalIndex2017.pdf.

[149] *QuickFacts: Terrebonne Parish, Louisiana; United States*, UNITED STATES CENSUS BUREAU, https://www.census.gov/quickfacts/fact/table/terrebonneparishlouisiana,US/PST045218 (last visited July 19, 2019).

APPENDIX II. INTERVIEW GUIDE

Houma Tipping Points Interviews

Stakeholder Information

1. Name:
2. Address/Zip code:
3. Occupation:
4. Other affiliations/groups you belong to:
5. Homeowner/renter:
6. How long have you lived there?
7. How long do you anticipate living there?
8. If you are from area, how long has your family been here?
9. Do you pay flood insurance? What is the average monthly or annual cost?

Scenarios for nonstructural projects

The 2017 Coastal Master Plan identified 54 candidate nonstructural project areas. Selected nonstructural project areas include several voluntary nonstructural mitigation measures, defined based on flood depths and type of structure. Each mitigation measure is based on estimates of 100-year flood depths with an additional two feet of freeboard for elevation projects. Mitigation measures are defined as:

- Floodproofing of non-residential structures. Recommended in areas inundated to less than three feet.
- Elevation of residential structures. Recommended in areas inundated between 3-14 feet.
- Voluntary Acquisition for residential structures. Recommended in areas inundated above 14 feet.

In the Terrebonne-Houma region, the state estimates the following numbers for nonstructural mitigation and costs:

- 312 structures for floodproofing - $278 million
- 5,307 elevations - $820 million
- 477 voluntary acquisitions – $164 million

Overall, the state estimates total nonstructural protection costs for Terrebonne-Houma to be approximately $1,264 million.

The following scenarios ask what the potential impacts of implementing these voluntary programs might be on you. We'll begin with a scenario in which the program is not implemented at all and then move through each proposed nonstructural program. There are no correct or incorrect outcomes. Instead, we are looking for a range of what you think might happen.

Nonstructural protection project scenarios

Scenario #1: Do nothing

Situation: Projected flood depths from a 100-year flood for the city of Houma range from 0 to 14feet.

Scenario: What would happen to you and your home, business, and/or community if none of the nonstructural programs are implemented? (i.e. nothing is built – no home elevation, no voluntary acquisition)

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Considering these potential impacts as well as your experiences, how would you rate the overall impact of implementing **none** of these programs?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Scenario #2: Home elevation

Situation: Your home is subject to between 3 and 14 feet of projected flood inundation from a 100-year flood, making it eligible for elevation.

Scenario: What impacts would you and your community experience if homes were elevated?

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Under what scenario, if any, would you elevate your home? (i.e. if the parish pays for it, if your family can live there, if it would reduce your flood insurance, etc.)

If you home is already elevated, how has this impacted your life? What were some benefits and challenges?

Considering these potential impacts as well as your experiences, how would you rate the overall impact of home elevation?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Scenario #3: Voluntary acquisitions/Buy-outs

Situation: Your home is subject to over 14 feet of projected flood inundation from a 100-year flood, making it eligible for voluntary acquisition (a buy-out).

Scenario: What would happen to you and your community if a voluntary home acquisition/buyout program was implemented?

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Under what scenario, if any, would you voluntarily sell your home to move to higher ground? (i.e. if the parish pays for it, if your family can live there, if it would reduce your flood insurance, etc.)

Have you, or anyone you know, permanently relocated due to costs associated with increasing flood risk? If so, what has been your/their experience? What were some benefits and challenges?

Considering these potential impacts as well as your experiences, how would you rate the overall impact of voluntary acquisition/buy-outs?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Considering all the various scenarios we just discussed, can you think of any ways the negative impacts could be mitigated?

Funding Scenarios

Terrebonne Parish currently has several parish-level funding mechanisms in place to raise revenue for public services in the parish. These include reallocating existing tax revenue, raising new taxes, and levying fees. In the event that the projected nonstructural program from the state has to be

funded by local parishes, these will be the primary revenue streams to fund these programs alongside partnering with financial institutions to provide low interest loans.

Scenario #4: Tax increase

As of 2017, approximately 35% of parish sales tax goes to drainage, the levee district, public safety, capital projects, and the general fund. Terrebonne Parish uses existing property tax as a means to fund new initiatives. Estimated revenue generated from parish property tax in 2018 is approximately $678,000 annually.

Situation: Terrebonne Parish imposes an **increase** in sales or property tax as a means of generating new parish resources.

Scenario: What would the impact of an increased sales or property tax be on you and your community?

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Considering these potential impacts, how would you rate the overall impact of raising sales or property taxes?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Scenario #5: Reallocation of taxes

Situation: Sales or property tax in Terrebonne parish is reallocated from existing purposes to fund nonstructural projects. In this scenario taxes would not increase, but funds from taxes for other public resources would decrease in order to fund the nonstructural program.

Scenario: What would the impact of a reallocation of sales or property tax be on you and your community?

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Considering these potential impacts, how would you rate the overall impact of reallocating sales or property taxes?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Scenario #6: Fee imposition
Situation: The parish could impose a standard (everyone pays the same), quarterly fee attached to existing municipal services (water and sewage, water, gas) on your utility bill.

Scenario: What would the impact of a standard quarterly fee to fund nonstructural projects affect you and the community?

What are some specific **economic, social, or environmental** impacts?

Positive:

Negative:

Neutral:

Considering these potential impacts, how would you rate the overall impact of a standard fee?

Significantly Negative	Somewhat Negative	Neutral	Somewhat Positive	Significantly Positive

Community Values

Do you know anyone (perhaps yourself included) who moved away voluntarily but eventually chose to return to the community? Please explain.

In general, why do you think people leave or consider leaving the community?

In general, why do you think people stay in or return to the community?

What aspects of your community, if any, do you consider necessary to the community to the point that their loss would result in you and/or others moving away? (i.e., social and cultural aspects, infrastructure, public health and safety, etc.)

APPENDIX III. QUALITATIVE DATA CODING SCHEME

- Home Elevation
  - Housing type and location
  - Out of pocket costs
  - Elevation cost-sharing

    - Flooding
- Relocation
    - Flood insurance
    - Upper vs. lower parish
    - Relocation within the parish
    - Never relocate
    - Forced relocation
    - Family already moved away
    - Rebuilding cost prohibitive
    - Repetitive flooding and home damage
    - Relocation and return
- Property tax
    - Don’t want to fund individual home elevation or mitigation
    - Parish already has a shortage of funds
    - Industry property taxes
    - Property tax already too high
- Sales tax
    - Don’t mind paying
    - Sales tax unpopular
    - Sales tax already too high
- Fees
    - People don’t want fees
    - Challenge for people on fixed incomes
- Reallocation of parish funds
    - Reallocation school board funds
    - Reallocating industrial taxes
- Reasons to stay or go
    - Family
    - Coastal location and recreation
    - Sentimental attachments
    - Economic development potential
    - Jobs
- Lack of trust in implementation process