TERREBONNE PARISH, LOUISIANA

HAZARD MITIGATION PLAN UPDATE 2023

February 16, 2023

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INTRODUCTION

This Hazard Mitigation Plan Update is the fourth such plan in 18 years. The last update development was completed in 2020. The parish has completed the first lift of 70 miles of the Morganza to the Gulf (MTTG) footprint, and dozens of projects to reduce the risk of flooding or wind damage. The levees are not built to the height required to be federally accredited, but provide protection for storms less than the projected 100-year event. The Parish benefited from the flexibility of not only Federal Emergency Management Agency (FEMA) funds, but Community Development Block Grant (CDBG) funds from the U.S. Department of Housing and Urban Development (HUD). The agencies have complementary goals and preferred projects which allowed the Parish to implement many of the priorities that had been identified in previous plans. The levee system and many pump stations and improvements have been built with local taxes over decades. Located directly on the Gulf of Mexico, the projected risks from hurricanes persists as well as relative sea level rise, and subsidence in the forced drainage areas. The focus of this plan is to integrate lessons learned from Hurricane Ida and advanced modeling from FEMA's Hazus risk assessment software to better understand the hazard impacts, and to educate the general public about the community's risks and resilience in the face of future foreseeable events.

Since 2015, Terrebonne Parish implemented or is in the process of implementing 63 projects specifically listed in the Hazard Mitigation Plan Update (HMPU) 2015 and 2020. Advances included a wide spectrum of activities from increased power redundancy, wind risk reduction, local implementation of levees to protect the lower reaches of the Parish, floodgates on every major bayou, the funding of new pump stations and channels, and the design of a lock system to augment the floodgates. A complete list of the HMP accomplishments in the last two years is included in Appendix F. Each project completed or ongoing has resulted in an incremental reduction in risk of damages, mainly focused on the flood and wind hazards. The levee and floodgate systems are complemented by internal forced drainage levees, terraces, and pump stations directing fresh or brackish water into the marshes and lakes as appropriate. Essential government services and buildings have been moved from the special flood hazard area (SFHA) or, if the facility must function in place, many structures have been hardened and supplied with alternative power sources to facilitate continuous function or expedited recovery after an evacuation/event.

Several steps have been taken to revise and streamline the Flood Damage Prevention Ordinance (FDPO) to maximize all areas of the Community Ratings System to maintain flood insurance affordability. While the parish lost a rating class in the restructuring of the 2013 guidance, it has increased the resilience of mobile homes, banned hazardous waste storage in the SFHA, and has identified over 4,000 additional acres that will be dedicated to open space. Additionally, the parish has begun to review the freeboard requirements set by the State to determine how similar requirements may be adopted locally. The Parish also coordinated with the FDPO with regards to

the plumbing code when it is more conservative than the National Flood Insurance Program (NFIP) base flood elevation.

The Process

The process undertaken to update this plan followed the eight (8) steps required in Section 510 of the Community Ratings System Coordinators Manual (September 2013) and other planning guidance to engage the public and thereby reduce risk through engagement.

Through the HMPU process, the Parish HMPU Steering Committee invited members of the public, neighboring parishes, and statewide stakeholders to develop a consensus of priorities. A list of the invited or participating entities is available in Appendix C. While the implementation of the plan is highly dependent on funding sources and storm events, the HMPU will serve as a resource in all Parish planning, response, and recovery activities.

Step 1 - Organize

The Parish has embarked on multiple lines of defense as a strategy to reduce risk through various mechanisms including levees, nonstructural elevation projects, wind hardening projects, and other infrastructure hardening projects. The Parish has increased the focus on the government to provide emergency services, businesses to get back to work timely, and residents to return to safe homes. We have also focused on the promotion of the Multi-jurisdictional Program for Public Information adopted formally in 2015 and updated in 2018.

Recognizing the importance of mitigation to every department and division in the Parish, all were invited to participate in the planning process and committed at least one individual to participate in the process. The planning department was the best represented from the parish government due to the mandate to enforce building codes, land use, floodplain, as well as the subdivision and stormwater management regulations, and to implement the Comprehensive, Hazard Mitigation, and the Long-Term Recovery Plans. The Office of Emergency Preparedness assisted from the beginning offering their feedback, suggestions, and access to the category 5 rated state of the art facility just in front of the new FEMA funded safe room that will support over 200 parish, regional and federal first responders during and after an event. The Utilities Department, the Department of Coastal Restoration and Preservation directors provided feedback as did several divisions of the Public Works Department. The Terrebonne Economic Development Authority and the Assessor's Office also participated and provided background data critical to our community profile.

Step 2 - Involve the Public

Since several plans were being updated at once in the parish, community outreach was conducted in conjunction with these other planning activities. The Steering Committee was comprised of members from the private and public sectors. It was approved by the Council along with the planning process. This year, we had extensive input from the Terrebonne Levee and Conservation District and public safety among others. Names and organizations present at the meetings can be found in Appendix B. This group was established prior to the first meeting with several being involved in the 2020 HMPU process. These members represented a broad spectrum of interests including industries, tribes, nonprofits, academia and public safety. Each brought their perspective and interests to the table providing a range of expertise. As this was the second or even third plan that some participated in creating, the discussion were candid and productive.

The general public was invited to participate through multimedia invitations, some of which are captured in Appendix B relevant to each meeting. The public was invited to four Steering Committee meetings and a standalone public meeting in the evening. Members of the media were invited to observe or participate and the process earned coverage in news print along with the Bayou Black Area Analysis (Houma Courier). The members of the public did participate in those meetings. The Parish emailed interested parties including the press, published each meeting in the newspaper, posted each on the Community Calendar, placed an invitation on the website banner, and hung notices on every bulletin board in the Government Tower. The Parish invited the tribes, hospitals, 9-1-1 service, the North Lafourche Levee District (NLLD), the Council on Aging, and Good Earth Transit to attend the Steering Committee meetings.

The Parish has been included in the LA SAFE listening tours as well as local planning efforts, and elections and therefore may have contended with some meeting exhaustion. The Isle de Jean Charles resettlement process and the efforts of three local tribes to be federally recognized has limited the ability of the tribal members to fully engage, but they have come to meetings and provided input.

As a result of Hurricane Ida, Recovery Plan meetings were held throughout the Parish, with at least one in each geographic community. The Planning Department provided a presentation of the perceived risks, avenues for recovery, and other opportunities for funding or planning. The draft input from the community can be found in Appendix B which captured the concerns and projects submitted by the participants.

Step 3 - Coordinate

In order to prepare for the kickoff of this planning process, the Parish provided copies of a set of relevant plans on the website for all to access and emailed the core documents for all Steering Committee members. This year we included the HMP from Lafourche Parish, the Flood Response Plan from OEP, the LA SAFE Terrebonne Parish Adaptation Strategy, and two sources to support a discussion of the Building Resilient Infrastructure and Communities initiatives sponsored by both the FEMA and the Federal Department of Housing and Urban Development (HUD). The Parish coordinator provided discussion points concerning the recent Hurricane Ida response and impacts including the levee and floodgate system and opportunities to support revisions to subdivision regulations, stormwater regulations, and the flood ordinance. The committee and public were invited to submit other plans that might affect future risk. The deliberations included the review of these earlier plans, studies, and the list of projects completed or not since the last update to reduce risks of hazards.

The content and sufficiency of the plans was discussed during multiple meetings. In reviewing the Goals and Objectives, the Steering Committee updated the goals to be broader and the objectives to include protecting lives.

Step 4 - Assess the Hazard

Due to the long history of natural disasters in Terrebonne Parish, a broad range of hazards were considered in planning, building, regulations, and discussions of future investment. Terrebonne has been steadily building defenses to the storms and was recently impacted by Hurricane Ida so lessons learned were captured in the discussions. More than in past planning efforts, wind and unusual weather headlined many discussions. An advanced Hazus model was implemented for

flood and hurricane hazards which included site level analysis using building footprints, parcel data, and detailed elevation data. The results of these models are provided in Appendix E.

The HAZUS model compiles the inundation maps of all the national presidential disaster declared storms in Terrebonne Parish to estimate the level of risks from the composite flood hazard. Since the new FEMA floodplain maps didn't take into account the 12' levee system, it was important to find models that did reflect the protection provided by these systems. Steering Committee members requested modeling for storms less than the 100-year return period event to get a greater understanding of the most effective actions to reduce the most risk.

All hazards were discussed and then revisited in later meetings. After accepting that the levee, floodgate, pump station and lock systems are maturing reducing the threat of saltwater intrusion, and will be raised towards the 100-year level as funding is available, the Steering Committee elected to focus on other areas where they thought that more progress could be made.

An approach using deterministic and probabilistic analysis was adopted to best represent the flood and hurricane threats. Losses were developed for the probabilistic 100-year event, Hurricane Ida, and Hurricane Ike in Hazus and reported in this document. The Hazus model was developed by the consultant and provided to the parish for future modeling.

Step 5 - Assess the Problem

The planning process provided an opportunity to review the accomplishments of the past, the new or postponed challenges of today and in the future. In some cases, the residual risk requires more of the same approaches. In other cases, the activity itself created a need for more action, whether that would be a change in development practices or education. For example, the parish has increased the forced drainage areas and the pumping capacity such that may if unbalanced exacerbate subsidence which is already present in this deltaic region. Public education was also identified as an area for improvement. The levee and lock system, the pump systems, the new evacuation routes, and the varied design standards are not perceived to be broadly understood by professionals or the public. A broader discussion of gaps in the multiples lines of defense is provided in the risk assessment.

Step 6 - Set Goals

The goals of the Parish remain broad as the threats and risks are great. The interest in public education and a homogenous design standard were captured in the goals without objection by the Steering Committee or the public. A greater level of resolution was supported reflecting a systems-based approach to combined threats that require multi-layered, concurrent responses. While there is some level of predictability in coastal areas, for example, that there will be another hurricane, the trajectory and strength of the event can't be forecasted. Therefore, the goals remained broad and were considered representative of the overarching Parish perception of the risks and risk reduction options. The objectives were updated to recognize the progress in some areas that moved the objective from development or implementation into the public education arena. Other objectives capture areas of interest identified by the subcommittees.

Step 7 - Review Possible Activities

Regardless of the topic, education was central to all activities reviewed. This is particularly true with new climate strategies responding to a greater threat perception by the public. Energy redundancy in the community has expanded from generators to better power lines and transmission to microgrids, and heating and cooling centers are new ideas that led to the potential

use of schools and auditoriums for relief. Ongoing efforts were applauded, but in most instances, increased education was identified as a necessary component of any resulting plan. Several of the newly proposed projects are related to improved outreach regarding preparation for storm season, immediate response, recovery, and general risk management decisions at the government, business, and individual scale. Committee members and business interests stressed the need for increased education and enforcement of existing regulations. The possible activities discussed were broadened this year to include the Building Resilient Infrastructure and Communities (BRIC) program which has replaced the FEMA Predisaster Mitigation (PDM) program. To some degree, this is similar to the whole community approach that the parish has worked to achieve through the multiple layers of defense, but the potential for mitigation funding for equipment for public safety providers, or capacity building in any number of areas was discussed at length. Several entities in response and recovery were interested in communications in particular. The Steering Committee, tribes, and nongovernmental organizations (NGOs), the departments and the general public were encouraged to provide project ideas and link them to the hazard that they would reduce. These were discussed considering the criteria from the STAPLEE Approach and ranked for priority. The costs were considered roughly through the suggested equations in the National Hazard Mitigation Saves 2018 Interim Report.

Section 8 - Draft and Action Plan

The Steering Committee and participants discussed the priorities of the Parish and the feasibility of certain actions throughout the process. In the draft plan, a rough grouping was given allowing a discussion on goals reached through multiple avenues and to stimulate conversation about priorities without the minutiae of competing, discrete projects. The outcome of the priority projects, the approximated cost where available, feasibility, and the responsible party are provided in Appendix F. This process, like all input, was provided in meetings and could be captured through the online web form. This feedback tool could capture up to 8MB of attachments per entry. This enabled people who couldn't attend to provide robust and complete documentation of their suggestions.

The draft action plan was made available for the Steering Committee and the public for review and comments and the later draft presented for adoption by the council. Steering Committee members have volunteered to serve on the maintenance committee and will follow the process set out in Section 5.0 of this HMPU.

1.0 INTRODUCTION AND PARISH BACKGROUND

The information presented in this section provides a synopsis of Terrebonne Parish, Louisiana, including descriptions of its geographic location, land use characteristics, geologic features, and socioeconomic composition. With this context, data provided in subsequent sections may be more easily evaluated.

TERREBONNE PARISH CONSOLIDATED GOVERNMENT

In 1984, Terrebonne Parish instituted a consolidated form of government. At that time, the governmental functions of the City of Houma (the sole municipality in the parish) were consolidated with the governmental functions of Terrebonne Parish. The formal name of the parish's government is the Terrebonne Parish Consolidated Government which is commonly referred to as the "parish." The governing authority consists of an elected parish president who is the chief executive officer, (i.e.) head of the executive branch, and nine elected council members. The council members each represent a single district consisting of relatively equal areas of population. The Terrebonne Parish Council represents the legislative branch of the parish. As stated in its Home Rule Charter and parish code, the Terrebonne Parish Consolidated Government has all the powers, rights, privileges, immunities, and authority heretofore possessed by the City of Houma and Terrebonne Parish under the laws of the state. The parish shall have and exercise such other powers, rights, privileges, immunities, authority, and functions not inconsistent with this charter as may be conferred on or granted to a local governmental subdivision by the constitution and general laws of the state. More specifically, the parish shall have and is hereby granted the right and authority to exercise any power and perform any function necessary, requisite or proper for the management of its affairs, not denied by this charter, or by general law, or inconsistent with the constitution.

The parish has the right, power, and authority to pass all ordinances requisite or necessary to promote, protect, and preserve the general welfare, safety, health, peace, and good order of the parish, including, but not by way of limitation, the right, power and authority to pass ordinances on all subject matters necessary, requisite or proper for the management of parish affairs, and all other subject matter.

Eleven unincorporated communities with small concentrations of residences and assets are dispersed throughout the parish. The aggregate population of each of these communities represents approximately two-thirds of the parish's total population. These communities are also governed by the Terrebonne Parish Consolidated Government. The following communities are identified on many maps and figures throughout this Hazard Mitigation Plan Update (HMPU); Bayou Cane, Gray, Bourg, Montegut, Chauvin, Pointe aux Chenes, Dulac, Schriever, Dularge, Theriot, and Gibson/Bayou Black.

1.1 Geographic Setting

Terrebonne Parish is situated in southeast Louisiana along the state's Gulf of Mexico coastline. The Parish is considered by permitting agencies to be entirely coastal and rural with the exception of the city limits. The parish includes approximately 2,100 square miles and is the second largest parish in Louisiana regarding land area. More than 85% of the parish area is water and wetlands.

Lafourche Parish is to the east, St. Mary Parish is westward, and Assumption Parish is located north of Terrebonne. Figure 1-1 shows communities in Terrebonne Parish, its position in the state, and its large expanse of water and wetlands (light blue and gray).

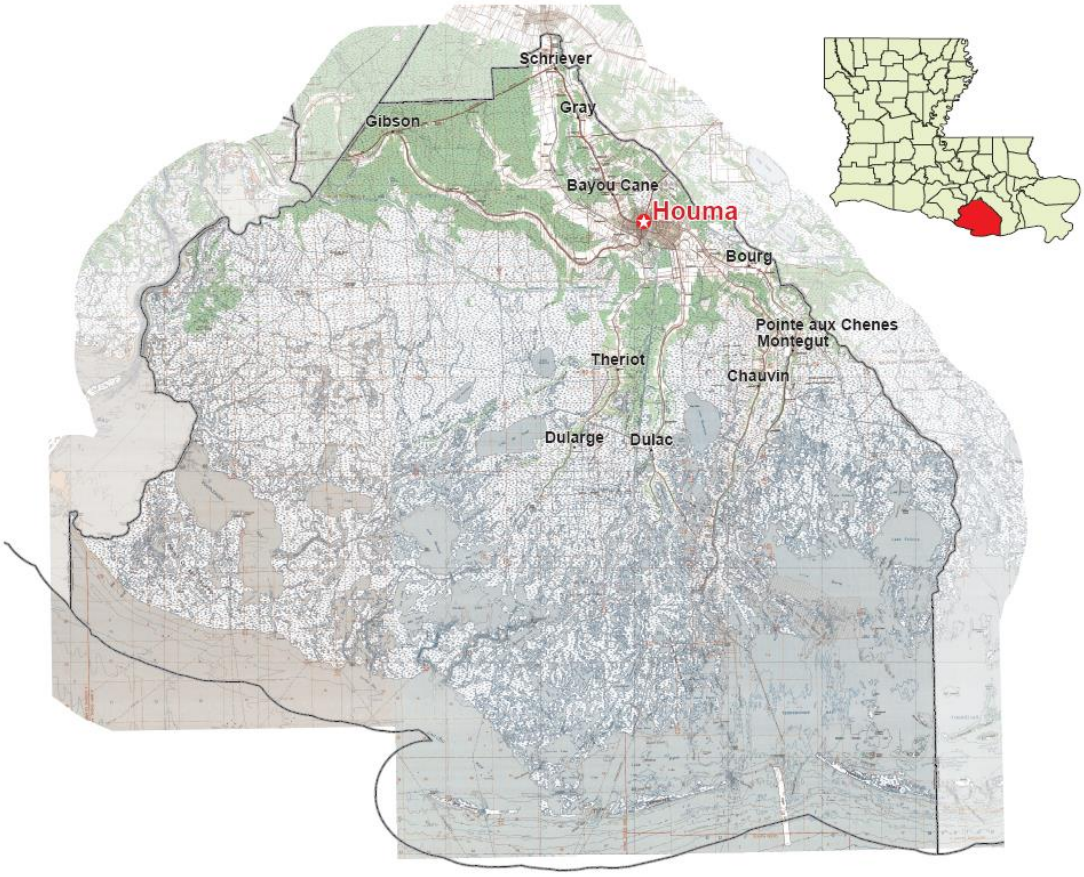


Figure 1-1: Terrebonne Parish Communities

The Terrebonne Levee Conservation has constructed the first lift of the 70 miles of the Morganza to the Gulf (MTTG) system in Terrebonne Parish. Partners in neighboring Lafourche Parish have constructed another eight (8) miles, which also provides protection to Terrebonne. This outer levee is supplemented with redundant protection from the internal levee system which is comprised of a series of forced drainage levees and flood gates. The levee system is augmented with pump stations in the populated portions of the parish to drain storm water and minimize flooding. According to the Terrebonne Parish needs assessment provided via the Louisiana Speaks Long-Term Community Planning website (www.louisianaspeaks-parishplans.org), all levees in the parish located south of the Intracoastal Canal, and with a crown height lower than 10 feet, were compromised during Hurricane Rita in 2005. The levee system at that time was a forced drainage system and not meant to stop storm surge. The parish has responded by adding to the system or raising existing levees to 12 feet (except in LaFourche which has a 14 foot height). This is not yet protection for a 100-year storm, but is greater than any storm surge that has been recorded in Terrebonne. The updated layout of all drainage districts, including levees and pump stations, is presented in the risk assessment section of this HMPU. In the past seven years, the parish has

added 18 new pump stations, automated management of 31 pump stations, and installed 21 backup generators on pump stations.

1.2 Land Use

As a snapshot of the community, Table 1-1 shows the land use/land cover breakdown for Terrebonne Parish. Based upon Environmental Protection Agency (EPA) data, only 5.6% of the parish is urbanized and/or under cultivation. The remaining 94.6% of the 1,326,748 acre parish is forested, wetlands, or water.

Table 1-1: Terrebonne Parish Existing Land Use/Land Cover

Description	Acres	%
Agricultural	37,016	2.8%
Commercial	3,018	0.2%
Industrial	4,955	0.4%
Public Services	4,258	0.3%
Residential	20,072	1.5%
Wetlands	1,252,780	94.8%
Total	**1,322,099**	**100.0%**

The geographic distribution of land use/land cover is illustrated on Figure 1-2. Portions of the parish that are residential, industrial, or commercial are concentrated in the north-central portion of the parish in the vicinity of Houma and the ridges along major bayous.

The land formation of Terrebonne Parish is largely a result of a historic alignment of the Mississippi River delta known as the Lafourche Delta. The following is an excerpt from the *Roadside Geology of Louisiana* by Darwin Spearing, which explains the development of the Lafourche Delta:

"About 3,500 years ago, the Mississippi River shifted west again, this time running south along the course of Bayou Lafourche. Many remnants of the distributary streams of the Lafourche delta remain as part of the landscape south of Thibodaux. The Lafourche delta grew between 3,500 and 400 years ago, the last of the great deltas that preceded the modern delta. Lake-filled marshes in Terrebonne Parish, Terrebonne Bay, Timbalier Bay, and the arcuate offshore islands of Isles Dernieres, Timbalier, and East Timbalier are relics of the Lafourche Delta."

During the LA SAFE meetings, three scenarios were developed based on the perceived risks to the community. The resulting overlay is shown in Figure 1-3.

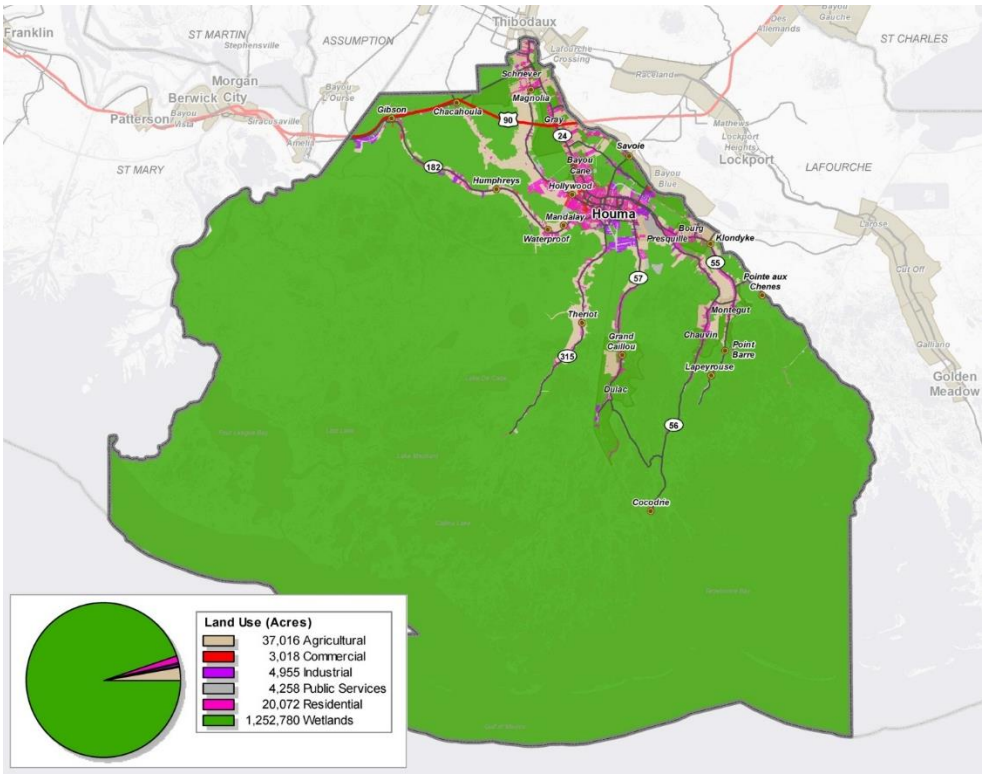


Figure 1-2: Existing Land Use/Land Cover Map (Source: TPCG)

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

Moderate Risk: >0-6' projected storm surge depths or in the 100 year floodplain (SFHA)

High Risk: >6' projected storm surge flood depths

Sources: CPRA Flood Risk Medium Scenario Modeling Data 2017 ; FEMA Preliminary DFIRM 100-year floodplain data for Terrebonne Parish 2008.

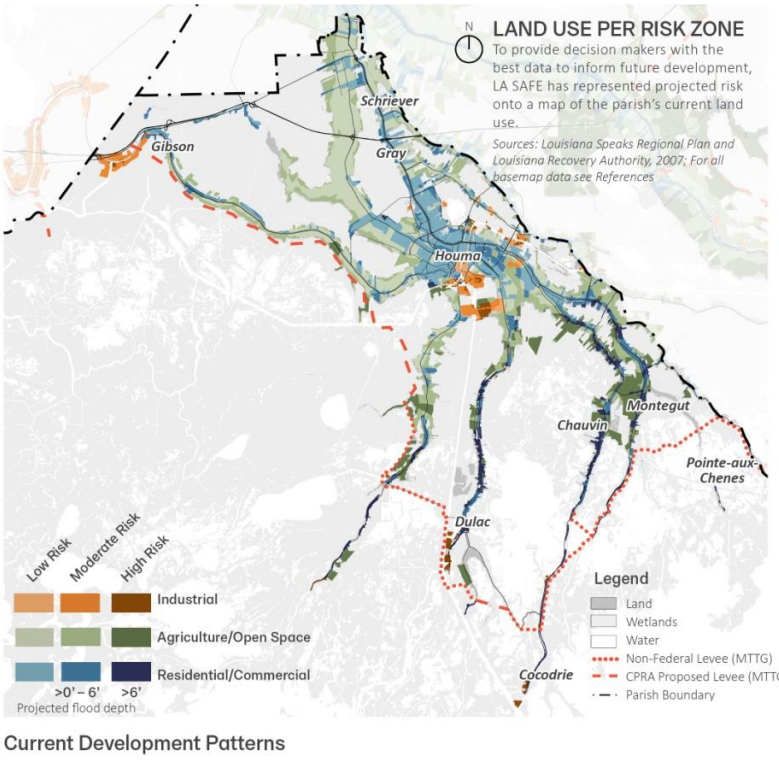


Figure 1-3: Land Use per Risk Zone (Source: LA SAFE Terrebonne Parish Adaptation Strategy).

Most of the growth in the parish over the last five years has been in the low-risk areas.

The parish is located at the southernmost reach of the Terrebonne drainage basin. The drainage basins within and in the immediate vicinity of Terrebonne Parish are identified in the illustration in Figure 1-4.

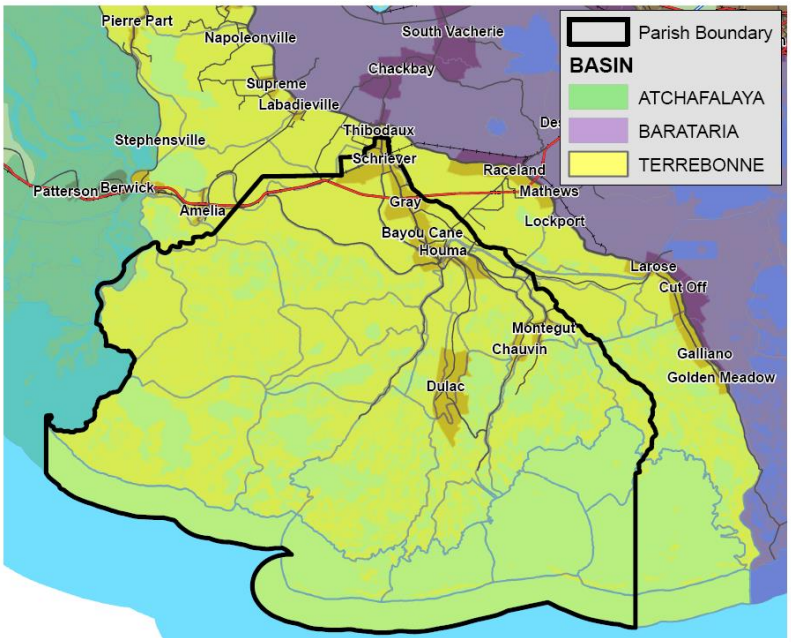


Figure 1-4: Terrebonne Drainage Basin

A combination of its deltaic creation and a historical concentration of oil and gas exploration activities (construction of man-made access canals) is responsible for more than 85% of the parish's total acreage being represented by either water or wetlands. Generally, from north to south, the wetlands include fresh marsh, intermediate brackish marsh, and salt marsh near the coast line. These marshes are intertwined with hundreds of lakes, bays, bayous, and canals. Some of the more notable water bodies within the parish include:

- Bayou Black
- Bayou Dularge
- Bayou Grand Caillou
- Bayou Petit Caillou
- Bayou Terrebonne
- Houma Navigation Channel
- Intracoastal Waterway

These bayous are significant as they have historically provided the land-building sediment that created the highest areas of the parish. The sediment was deposited during annual flooding cycles of Bayou Lafourche on the Lafourche delta lobe. It is upon these finger-like ridges that all urban and agriculture land exist in the parish today. Because of the formation of these ridges through alluvial processes, the three-foot contour clearly defines the ridges as the "high-ground" of the parish. The depiction of these ridge lines form an image that is repeated in this report as virtually all land area other than these ridge areas is susceptible to frequent flooding of some sort; either stormwater, river/bayou flooding, storm surge, or backwater flooding. Figure 1-5 depicts the ridges that form the bulk of non-flooding urban and agricultural land in the parish.

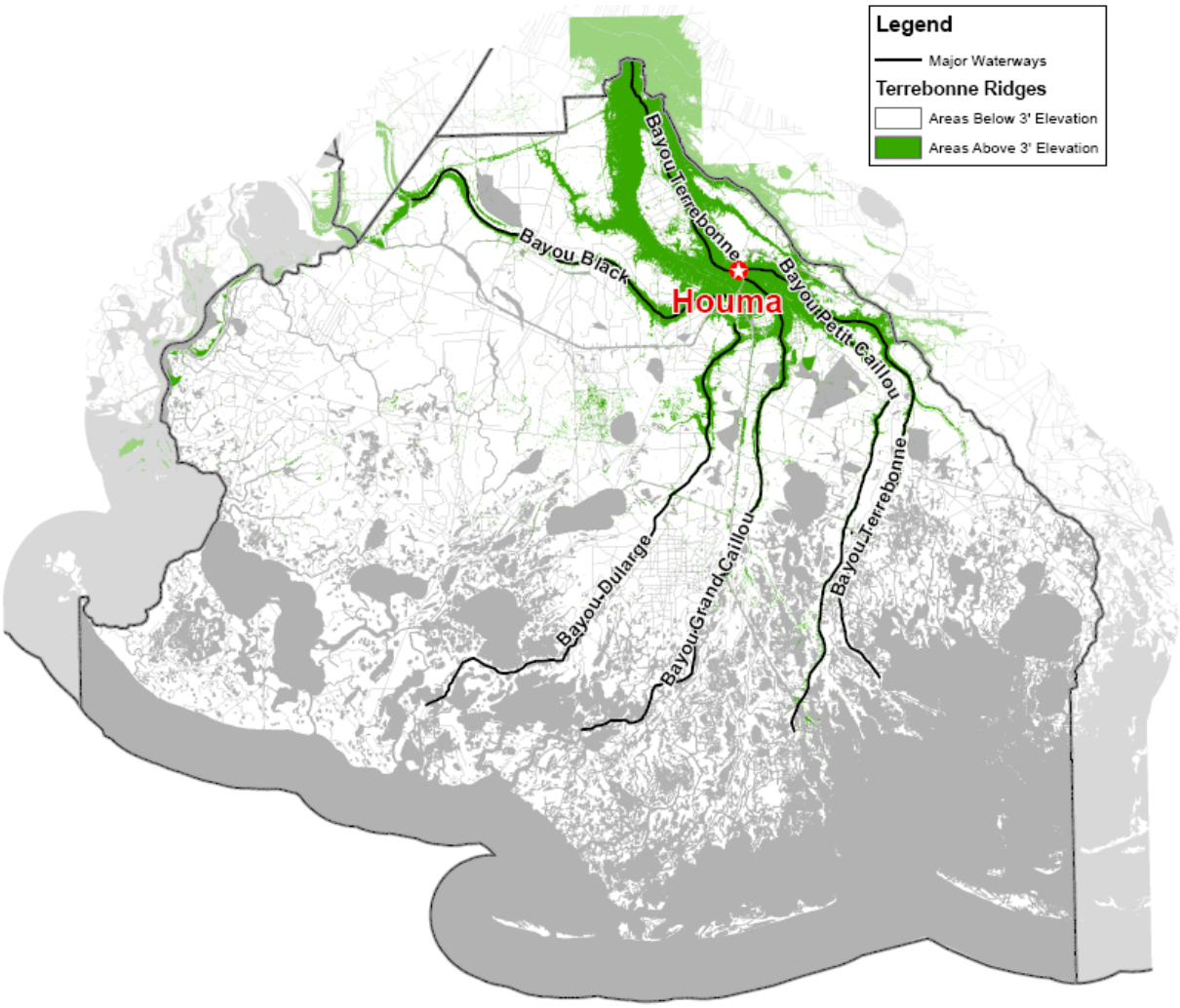


Figure 1-5: Ridge Locations

Land Loss: An Ongoing Threat

Land subsidence and coastal erosion are two causes of land loss in coastal Louisiana. Coastal erosion destroys land and removes sediments critical to the existence of environmental features such as beaches and wetlands. High wind and water events, especially wave action, are increasing contributors to coastal erosion. Land subsidence refers to the lowering of lands' elevation, or land sinking and is often related to events such as the extraction and storage of natural resources and their byproducts, forced drainage removal of water that would otherwise percolate, and natural hazard events such as earthquakes. Land subsidence is also related to other man-made activity such as the collapsed salt dome in Bayou Corne part of Assumption Parish and can lead to sinkholes that reclaim surface land, inundating the cavern to the surface with water.

Terrebonne Basin Persistent Land Loss 1932-2010

Figure 1-6 details wetland loss along coastal Louisiana, showing persistent land loss and land gain along the Terrebonne Basin. It can be observed in the figure that between 1932 and 2010 Terrebonne Basin lost land at a faster rate than it was replaced. Though the United States Geological Survey (USGS) cites hurricanes and extreme storms as major drivers of this historic

land loss, the figure to follow also shows that land is eroding at a slower rate than the previous highs seen in the 70's. The Terrebonne Basin has lost 29.3 percent of its land area while 25 percent of land has been lost coastwide between 1932 and 2010.

Persistent Land Loss and Land Gain in Terrebonne Basin, as defined by the Coastal Wetlands Planning, Protection and Restoration Act Program (n.d.), 1932-2010

Loss															
1932-1956	1956-1973	1973-75	1975-77	1977-85	1985-88	1988-90	1990-95	1995-98	1998-99	1999-02	2002-04	2004-06	2006-08	2008-09	2009-10	Total Land Loss
-75.28	-46.25	-46.65	-50.87	-35.11	-22.97	-27.54	-30.63	-23.12	-22.5	-11.99	-9.63	-18.27	-23.4	-12.31	-4.49	-459.99
Gain																
1932-1956	1956-1973	1973-75	1975-77	1977-85	1985-88	1988-90	1990-95	1995-98	1998-99	1999-02	2002-04	2004-06	2006-08	2008-09	2009-10	Total Land Gain
2.96	0.21	0.25	0.31	0.49	0.26	0.24	0.28	0.4	0.76	0.47	0.37	1.67	0.67	0.66	0.43	10.43

Source: USGS

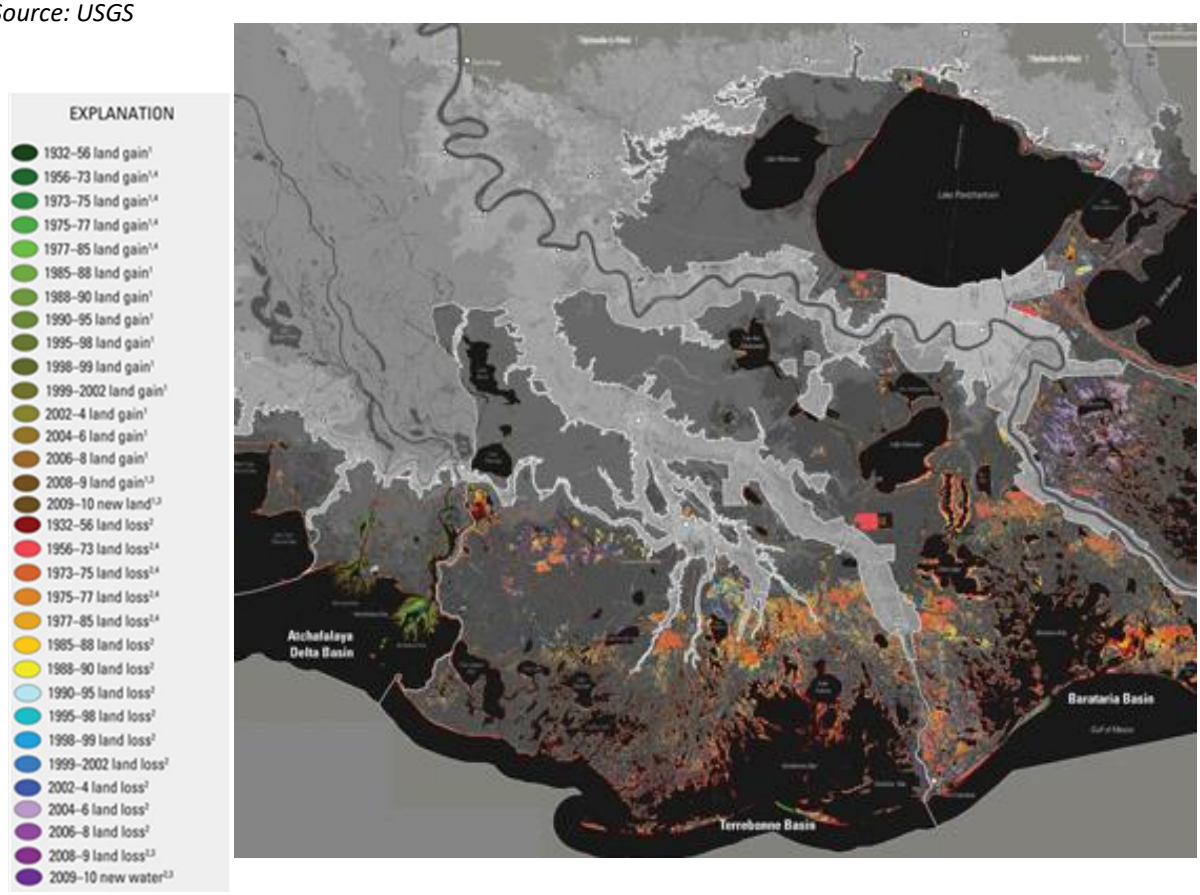


Figure 1-6: Terrebonne Basin Persistent Land Loss 1932-2010

The USGS Coastal & Marine Geology Program report released on July 12, 2017 shows that Louisiana USGS scientists have found a further slowing since 2010. USGS suggested that the lack of major hurricanes since 2008 likely contributed to the stability of the land from 2008 to 2017.

1.3 Population

The population of the parish was 111,860 in 2010 and fell 2 percent by 2020, to 109,580 according to the 2020 Decennial Survey from the U.S. Census Bureau. Table 1-2 shows the 2020 demographics for the parish. Figure 1-7 shows the population of Terrebonne Parish while Figure 1-8 shows the percentage of households with an annual income less than $30K.

Table 1-2: Terrebonne Parish Demographics

Demographics	Residents	Percent
White	69,934	63.82%
Black	21,253	19.39%
American Indian and Alaska Native	6,070	5.54%
Asian	1,322	1.21%
Native Hawaiian and Other Pacific Islander	40	0.04%
Other Race Alone	3,834	3.50%
Two or More Races	7,127	6.50%
Hispanic or Latino	7,358	6.71%
Population Greater Than 65	16,348	14.92%
Population Less Than 18	27,075	24.71%
Population Below Poverty Level	20,554	18.76%
Limited English-Speaking Household	853	2.11%

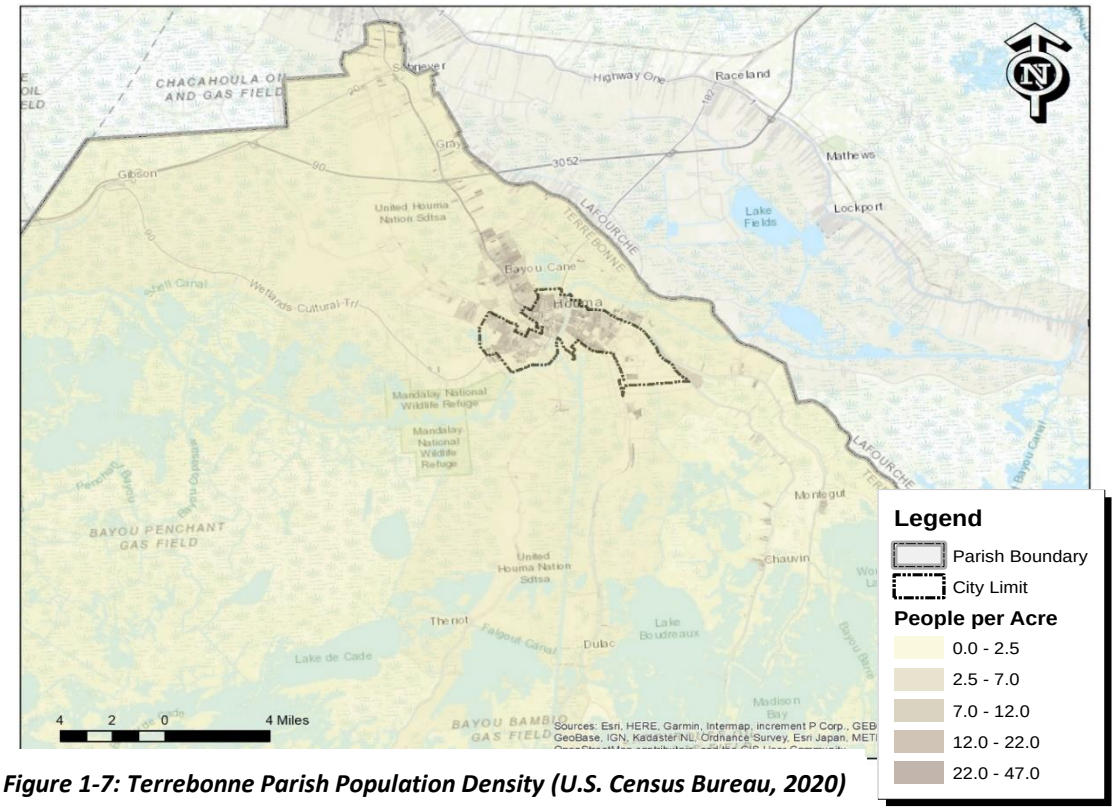


Figure 1-7: Terrebonne Parish Population Density (U.S. Census Bureau, 2020)

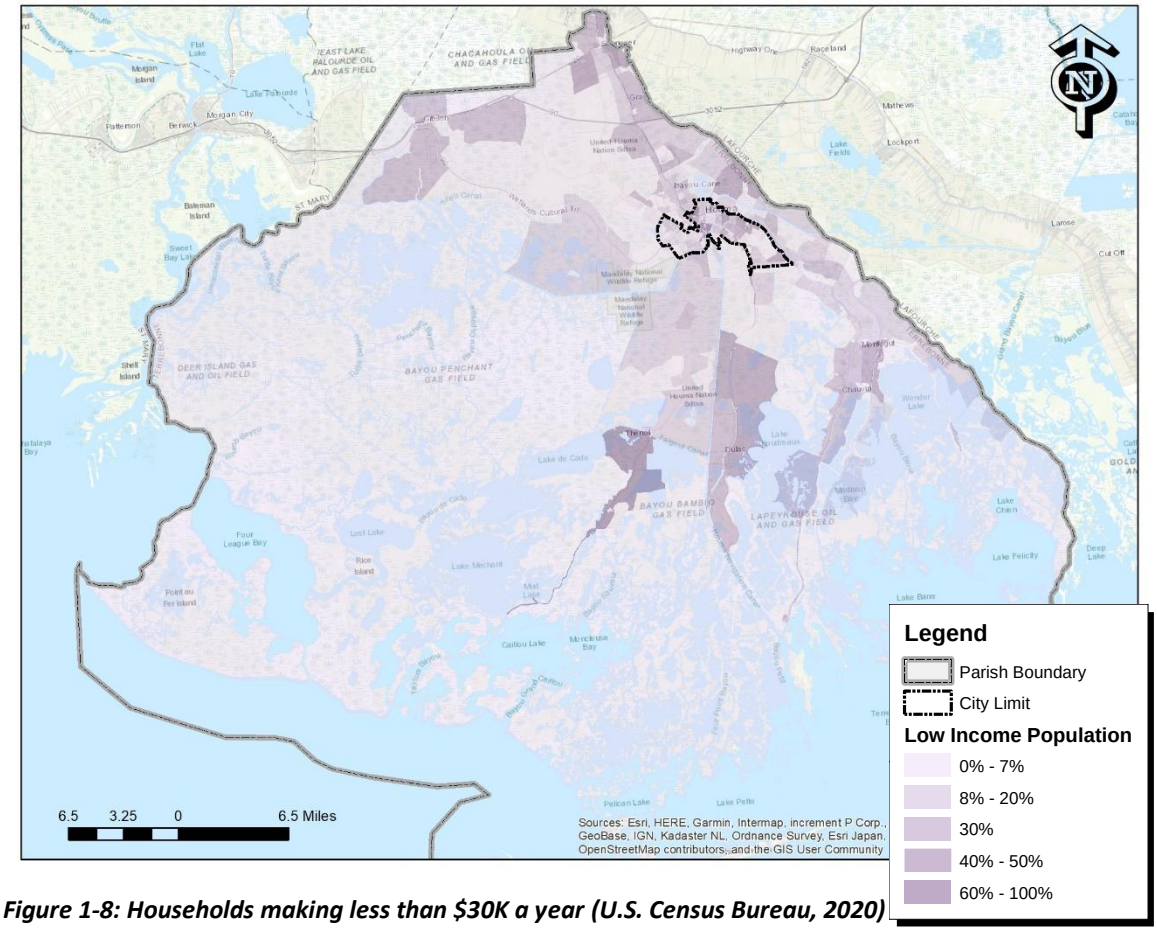


Figure 1-8: Households making less than $30K a year (U.S. Census Bureau, 2020)

1.4 Economy

According to 2017 U.S. Census Bureau data, the parish's top four primary industry sectors based on employment include (1) educational services, health care, and social assistance; (2) retail trade, (3) agriculture, forestry, fishing and hunting, and mining; and (4) Arts, entertainment, recreation, and accommodation and food services. These sectors represent over 50 percent of the parish's total employment (populations 16 years and older) of 47,254 in 2017. Table 1-3 provides a summary of the overall economy based upon employment.

Table 1-3: Terrebonne Parish Employment by Industry Sector, 2017

Industry Sector	Terrebonne Parish, Louisiana	
	Total	%
	Estimate	Estimate
Civilian employed population 16 years and over	47,254	100%
Educational services, and health care and social assistance	8,900	19%
Retail trade	6,549	14%
Agriculture, forestry, fishing and hunting, and mining	5,465	12%
Arts, entertainment, and recreation, and accommodation and food services	4,757	10%
Construction	3,869	8%
Manufacturing	3,613	8%
Professional, scientific, and management, and administrative and waste management services	3,341	7%
Transportation and warehousing, and utilities	3,164	7%
Other services, except public administration	2,400	5%
Finance and insurance, and real estate and rental and leasing	1,735	4%
Public administration	1,707	4%
Wholesale trade	1,214	3%
Information	540	1%

* Population 16 years and over in the labor force

Regarding annual payroll by industry, Healthcare and Social Assistance ($317,865), Manufacturing ($238,839), Mining, Quarrying, and Oil and Gas Extraction ($186,908), and Construction ($182,944) generate the four largest payrolls in Terrebonne.

Industry Sector	Number of Establishments	Annual Payroll ($1,000)
Health care and social assistance	275	317,865
Manufacturing	128	238,839
Mining, quarrying, and oil and gas extraction	86	186,908
Construction	199	182,944
Retail trade	471	177,979
Transportation and warehousing	144	177,547
Professional, scientific, and technical services	253	140,057
Wholesale trade	219	128,564
Administrative and support and waste management and remediation services	116	110,370
Real estate and rental and leasing	156	104,293
Other services (except public administration)	200	100,752
Accommodation and food services	249	78,880
Finance and insurance	187	63,338
Management of companies and enterprises	13	21,368
Information	35	16,221
Educational services	31	11,083
Utilities	3	6,375
Arts, entertainment, and recreation	36	5,788
Agriculture, forestry, fishing and hunting	21	1,459
Total for all sectors	2,823	$2,070,634

This data is provided by the Census Bureau and the ACS 5-year Estimates from 2017 and 2019. Most firms within the parish employ between one and five employees.

2.0 THE PLANNING PROCESS

An open public involvement process is essential to the development of an effective plan. To develop a more comprehensive approach to reducing the effects of natural disasters, the planning process includes the following:

2.1 Public Contributions

§201.6 (b)(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval

Various methods which encouraged and facilitated public comment during the drafting stage and prior to plan approval were incorporated into the planning process. To create the nucleus of parish/local participation, an HMPU Steering Committee was formed. The HMPU Steering Committee was comprised of a diverse group of citizens and professionals from throughout the parish. The Terrebonne Parish Council approved the steering committee.

Two public meetings were held with the Steering Committee, each publicized inviting the general public. Summaries of these public meetings are presented in Appendix B along with a listing of the attendees. One additional public meeting was held in the evening to encourage participation of those who could not come during the day. This was hosted in person and virtually for maximum access. A press release and multimedia posting announced the availability of the draft in addition to direct emails to people or organizations recognized as stakeholders.

The draft plan was provided to the Steering Committee via email and online for the public. All documents, materials, presentations, and drafts were available for review in paper at the Government Tower from 8am until 4:30pm and were brought to each site.

2.2 Other Entity Contributions

§201.6 (b)(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as business, academia and other private nonprofit interests to be involved in the planning process

Local and regional agencies were directly involved in the planning process by way of their participation on the HMPU Steering Committee. These parties included the Parish Planning and Zoning Director, Assessor's Office, the Parish Director of Emergency Preparedness, and key operations personnel from the Public Works Departments, Houma Police Department, and Fire Department. Business interests, religious groups, nonprofit and academic institutions such as the Terrebonne Parish School Board and Tribes with interests in multiple parishes were also represented on the committee. Additionally, the NAACP, Restore or Retreat, TEDA/TEDFO, and State agencies participated. The complete HMPU Steering Committee member list is provided in Appendix C.

Several other agencies and businesses were invited to participate in the plan or, if not possible, to provide data or recommendations. These include, but are not limited to Entergy, SLECA, the Louisiana Department of Natural Resources, the Natural Resources Conservation Service Regional Office, FEMA Region VI, the Louisiana Department of Health and the Council on Aging. A list of partners and outreach efforts is available in Appendix B.

2.3 Review and Incorporation of Existing Plans, Studies, Reports, and Other Technical Information

§201.6 (b)(3) Review and incorporation if appropriate, of existing plans, studies, reports, and technical information

At the outset of the HMPU planning process, a preliminary list of existing plans, studies, and guidance documents was established in cooperation with parish officials and the HMPU Steering Committee. Documents that were initially identified included the following:

- Comprehensive Master Plan Vision 2030
- Terrebonne Parish Hazard Mitigation Plan Update 2009
- Hazard Mitigation Plan Update 2014 – Adopted
- Hazard Mitigation Plan Update 2020 – Adopted
- Louisiana Coastal Master Plan 2017
- Hazard Mitigation Plan Revised December 2005
- LA SAFE Terrebonne Parish Adaptation Strategy.
- Terrebonne Parish Stormwater Drainage & Design Manual
- Status of Projects from March 2015/New Proposed Projects 2018
- Louisiana State Hazard Mitigation Plan, April 2019
- Roberta Grove – Senator Circle Repetitive Loss Area Analysis – June 25,2013
- Roberta Grove – Senator Circle Repetitive Loss Area Analysis – April 2016
- Roberta Grove – Senator Circle Repetitive Loss Area Analysis 2019 Evaluation
- Bayou Cane Repetitive Loss Area Analysis – November 2015
- Bayou Cane Repetitive Loss Area Analysis 2019 Evaluation
- Lafourche Parish Hazard Mitigation Plan Update
- HNC Lock Complex Presentation – April 25, 2016
- National Flood Insurance Program Community Rating System Link
- How to Build a Hazard Mitigation Plan
- Fiscal State of Terrebonne Parish – Gordon Dove, September 12, 2019

Each document was reviewed for relevant content. Information from the plans was incorporated into the planning process as necessary following discussions with the HMPU Steering Committee.

Examples of technical information reviewed and incorporated into the HMPU include historical flood data from FEMA, documented high water marks from the U. S. Army Corps of Engineers, and light detection and ranging (LIDAR) elevation data from the U.S. Geological Survey. The State of Louisiana developed and published the State Hazard Mitigation Plan Update in 2019, which provided data on the risks to Terrebonne Parish from various hazards. FEMA has recently released preliminary flood insurance maps for the parish which were used in the risk assessment. The participants in the plan were also provided the *Fortified Home Re-Roofing Checklist for High Winds*

and Hurricanes to retrofit and increase wind resilience and recommendations of higher standards to avoid multiple hazards.

The first Steering Committee focused on assessing the projects completed since the last HMPU was released. The Steering Committee considered the list of all completed and proposed projects inventories in the 2020 maintenance update of the plan.

The parish was fortunate to have also Louisiana's Strategic Adaptations for Future Environments (LA SAFE) input. The parish, many of the Steering Committee staff, and hundreds of residents participated in a yearlong process of identifying the risks and strategies for resilience and economic stability appropriate for Terrebonne Parish from the community perspective, and strategies and projects to affect that adaptation to new conditions. The full report was made available prior to the first meeting and was supplemented by any number of reports from various nongovernment agencies, government entities, and academia. The Terrebonne Economic Development Authority provided documentation regarding the current industry, payroll, and employment trends to provide a snapshot of the economic advantages or stressors that might affect the focus of the goals and objectives to inform the prioritization of projects to protect assets critical to industry and workers.

The discussion of the Comprehensive Plan, building codes, zoning ordinances, floodplain management regulations, subdivision ordinance and stormwater management regulations spanned several meetings. Each was revisited as projects and proposed risk reduction solutions were suggested. Members of the building community, developers, engineering firms, the planning commission, and the building code enforcement staff participated providing for depth of experience and motivations. Tribal and planning stakeholders were particularly interested in cost effective technologies to prevent coastal land loss and subsequent property damage.

The Steering Committee and parish staff reviewed all of the maps of the critical facilities, and updated them as necessary. The Terrebonne Parish School District asked that their office be considered a critical facility as the reopening of the school is critical to the recovery of the parish after a storm. The students best recover from the mental stress by returning to the classroom schedule and parents can focus on recovery of their homes and returning to their jobs. Some of the schools have been rebuilt as well in lower risk areas. The parish added 30 cell towers and 18 pump stations, each of which is a critical facility.

The TLCD provided a list of projects that they would like to see prioritized now that the parish has largely funded or built the first lift of the levees, the major pump stations, the flood gates, and is seeking funding for the lock system. The lock system will allow economic and recreational activities to continue unabated while the floodgates are closed to reduce saltwater intrusion and high tides. The Department of Coastal Preservation and Restoration and Preservation (DCRP) supported each of these projects. The projects in general turn the focus from the levee system to freshwater introductions, marsh enhancements, project betterments, and small projects with big impacts. Protection and nurturing of the natural environment are crucial to the stability of the culture and the structural installations to protect the built environment. The Planning Department in partnership with local, state, and federal agencies including the United States Army Corps of Engineers (USACE) and the U.S. Department of Housing and Urban Development (HUD) showcased the efficacy of terraces in open marsh for mitigation of storm surge and wave fetch.

Terraces constructed just prior to Hurricane Ida sustained no structural damage and reduced wave action in the open water north of Lake Boudreaux.

2.4 Planning Process Documentation

§201.6 (c)(1) Documentation of the planning process used to develop the plan including (a) how it was prepared, (b) who was involved in the process, and (c) how the public was involved.

2.4.1 How it was prepared…

Terrebonne Parish's most recent Hazard Mitigation Plan was adopted in 2020. The development of the 2023 Terrebonne Parish HMPU complies with 44 CFR §201.6(d)(3) which requires the adoption of a formalized hazard mitigation plan update every five years. These updates ensure that the parish maintains eligibility for FEMA hazard mitigation project funding. The update is meant to reflect changes in the flood insurance rate map updated in the fall of 2022, to document progress on local mitigation efforts outlined in the 2020 HMPU, and to adapt mitigation efforts to changing priorities. The maps no not appear to reflect the construction of the 70 miles of levee protection or the forced drainage improvements. The Parish found or created the appropriate models. The HMPU Steering Committee provided information that was critical to developing the HMPU.

A combination of procedures spelled out in CFR §201.6, workshop manuals, and how-to guidelines were followed throughout the update process. They include the Local Multi-Hazard Mitigation Planning Guidance (2008), the Local Mitigation Plan Review Guide (2011), and the NFIP Community Ratings System Coordinator's Manual (2013).

2.4.2 Who was involved in the process…

The HMPU Steering Committee served as the parish's primary representative body throughout the plan update. Goals of the HMPU Steering Committee included incorporating new data, especially that from recent storm and flood events, identifying new hazards, updating risk and vulnerability assessments, and updating mitigation goals and action items.

Committee membership was comprised of a broad cross-section of the community. A detailed list of HMPU Steering Committee members is presented in Appendix C. The committee determined at the first meeting that they did not need a committee chair in addition to the parish plan coordinator. Entities represented by the HMPU Steering Committee included the following:

- Terrebonne Parish Consolidated Government
- Terrebonne Parish Sheriff's Office
- Terrebonne Parish School Board
- Terrebonne Parish Levee & Conservation District
- Houma Fire Department
- Houma-Terrebonne Chamber of Commerce
- Board of Health
- Consolidated Waterworks District No. 1

- United Houma Nation
- Local Engineering Firms
- Office of Homeland Security and Emergency Preparedness
- Southeastern Louisiana Home Builders Association
- Bayou Board of Realtors
- Bayou Grace
- Terrebonne Parish Assessor's Office
- Louisiana Dept. of Health and Human Services
- South Central Industrial Association
- Terrebonne Regulatory Planning Commission
- Biloxi Chitimacha Choctaw Grand Caillou Band of Muskogees
- Isle de Charles Band of the Biloxi Chitimacha Confederation of Muskogees (BCCM)

Some members of the HMPU Steering Committee are considered significant by the Community Rating System (CRS) compliance for more than one function. Committee members serving dual CRS roles are as follows:

- Carl Dupre - Preventative Measures (codes)
- Chris Pulaski - Property Protection
- Lisa Ledet - Floodplain Manager/ Public Information
- Mitch Marmande, Reggie Dupre, Mart Black - Natural Resources Protection
- Kelli Cunningham – Director of Housing and Human Services
- Earl Eues, Chief Ward, Sherriff - Emergency Services
- Corey Henry, Fire Chief
- Structural Flood Control Projects (David Rome, /Reggie Dupre/ Mitch Marmande)

2.4.3 ***How was the public involved…***

The primary mode of plan update participation included five HMPU Steering Committee meetings, all of which were open to the public. Each HMPU Steering Committee meeting was advertised to increase public awareness and encourage participation. Additionally, the news media was contacted prior to all meetings. The HMPU Steering Committee meetings occurred on the following dates:

- May 27, 2022; 10am
- August 31, 2022; 10am
- August 31, 2022; 11:30am
- October 28, 2022; 10am
- October 28, 2022; 11:30am

One additional meeting was held virtually and in person in the evening for greater access to the public. The meeting was held on:

- March 2, 2023; 5:30pm

All presentations and considered materials were posted on the parish website. There was also a comment form that could be used by anyone to record their comments. The meetings were all advertised on the front page banner and as news items on the site. Each posting provided the website as an option for information and input. Supporting documentation (advertisements, attendance lists, agendas, PowerPoint presentations, etc.) related to the aforementioned meetings are included in Appendix B.

The public was well represented through the participation of the Consolidated Government, a comprehensive group of tribes, nonprofits, parish regulatory agencies, and local engineering firms on the HMPU Steering Committee. Over a six month period, the full group and members of the public met five times to collaborate on the plan's development. Input from the steering committee was key to identifying potential hazard events, collecting data on hazard events that had occurred since the 2020 update, identifying critical facilities, and identifying and prioritizing hazard mitigation projects. There were no meetings closed to the public.

Public participation was encouraged through public notices in the publication of legal record, *The Houma Courier,* of all meetings on the parish website and through local media outlets. Media coverage served as another medium to convey information to and encourage future participation of members of the public unable to attend face-to-face meetings. PowerPoint presentations, meeting notes and all materials discussed or presented were posted on the parish website following all six meetings, and meeting notices were posted on bulletin boards in the Robert "Bobby" Bergeron Government Tower where council and other civic announcements are viewed. Members of the general public came to both the steering committee and evening meeting.

Minutes for each of the meetings can be found in Appendix B.

3.0 RISK ASSESSMENT

§201.6 (c)(2) A risk assessment that provides factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The risk assessment is a four-step process: (1) hazards are identified, (2) hazard events are profiled, (3) an inventory of assets within the community is conducted, and (4) the potential losses experienced by a community due to a hazard are estimated. This section is divided into subsections that address each component of the risk assessment process. This section contains data from the National Oceanic and Atmospheric Administration (NOAA), the Federal Emergency Management Agency (FEMA), Terrebonne Parish, and FEMA HAZUS software which is used to support the four-step risk assessment process. HAZUS is a software program that can estimate economic and some social losses that a community may experience as a result of a specific hazard event. In this HMPU, estimated losses resulting from flooding and hurricanes were calculated due to these storm events' high probability of occurrence in Terrebonne. The HAZUS data considered in this plan has been updated using building footprint data, parcel data, essential facility data, and LiDAR elevation data including first returns.

The HMP Risk Assessment is divided into the following sections:

3.2.1 Identify and Profile Hazards which covers *c§201.6 (c)(2)(i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazards events.*

3.2.2 Inventory Assets and Exposure Assessment which covers *§201.6 (c)(2)(ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.*

3.2.3 Calculate Loss Estimations which covers *§201.6 (c)(2)(ii)(B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(a) of this section and a description of the methodology used to prepare the estimate*, and *§201.6 (c)(2)(iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

3.1 Hazard Identification and Profiling

§201.6 (c)(2)(i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazards events.

The planning team used a combination of data sources such as the NOAA National Centers for Environmental Information (NCEI) information, the National Hurricane Center, the 2015 and 2020

Terrebonne Parish HMPU, the State Hazard Mitigation Plan updated in 2019, and the HMPU Steering Committee input to identify hazards that may potentially impact Terrebonne Parish.

According to the National Climatic Data Center, there have been 332 recorded climatic events recorded in Terrebonne Parish within different time periods depending on the hazard from 1957 to 2022. Table 3-1 provides a summary of those events. In order of highest magnitude, hurricanes/tropical storms/tropical depressions, floods and wind generate the most property damage within the parish. It should be noted that the wind climatic event has the highest probability of occurring and is most attributable to thunderstorm wind.

Table 3-1: Recorded Climatic Events in Terrebonne Parish (NOAA, NCEI)

Event	# of Events	Years of Data	Annual Probability	Property Damage	Crop Damage	Damage /Event
Extreme Temps (Cold)	**10**	**9-27**	**22%**	**-**	**100,000**	**10,000**
Cold/Wind Chill	5	**27**	**7%**	**-**	**100,000**	**20,000**
Heavy Snow	1	**15**	**7%**	**-**	**-**	**-**
Winter Storm	2	**19**	**5%**	**-**	**-**	**-**
Winter Weather	2	**9**	**22%**	**-**	**-**	**-**
Flood	**47**	**17-27**	**1.2 per year**	**321,668,000**	**-**	**6,844,000**
Flash Flood	18	**25**	**52%**	1,545,000	-	85,833
Storm Surge/Tide	18	**25**	**44%**	320,123,000	-	17,784,611
Coastal Flood	5	**27**	**19%**	-	-	-
Heavy Rain	4	**17**	**18%**	-	-	-
Flood	2	**26**	**4%**	-	-	-
Hurricane/Tropical Storm / Depression	**25**	**15-26**	**81%**	**1,687,667,000**	**-**	**36,688,413**
Hurricane	10	**26**	**35%**	1,660,000,000	-	87,368,421
Tropical Storm	14	**25**	**44%**	27,667,000	-	1,106,680
Tropical Depression	1	**15**	**7%**	-	-	-
Wind	**174**	**22-71**	**2.4 per year**	**14,175,000**	**-**	**81,466**
Thunderstorm Wind	125	**59**	**2.1 per year**	1,340,000	-	10,720
Tornado	33	**71**	**46%**	12,805,000	-	388,030
Funnel Cloud	10	**22**	**45%**	-	-	-
High Wind	4	**27**	**11%**	10,000	-	2,500
Waterspout	2	**27**	**7%**	20,000	-	10,000
Drought	**10**	**25**	**40%**	**0**	**4,390,000**	**439,000**
Hail	**28**	**59**	**47%**	**0**	**0**	**0**
Lightning	**17**	**24**	**71%**	**979,500**	**0**	**57,618**
Extreme Temps (Heat)	**2**	**24**	**8%**	-	-	-

During the HMPU Steering Committee meeting held on August 31, 2022 (meeting presentation is in Appendix B), HMPU Steering Committee members were presented with a list of previously identified hazards and new hazards to consider. The existing hazards included:

- Coastal erosion
- Flood (surge, rainfall, and riverine/backwater)
- Hurricane/Coastal (tropical) storm
- Land subsidence (coastal and within forced drainage areas)
- Levee failure
- Saltwater intrusion
- Tornado
- Thunderstorms/lightning/high winds

The State HMP was reviewed, and several additional hazards were also considered including:

- Extreme heat
- Drought
- Wildfire
- Winter Storms
- Wind as separate hazard
- Hailstorms
- Earthquake
- Sinkholes
- Expansive soil

Discussions on each hazard are described in Table 3-2. Those hazards selected to be profiled are identified in the third column and shaded.

Table 3-2: Hazards Identified

Identified Hazard	Comments	Hazards Profiled in Plan Update
Natural Hazards		
Avalanche	No recorded avalanche events have occurred in the parish and therefore will not be explored further as a potential threat in this HMPU.	-
Coastal Erosion	More than 85% of the parish's land area consists of water and wetlands. The Gulf of Mexico comprises the entire southern border of the parish, a large portion of which is subjected to erosion. Coastal erosion is prevalent and will be combined with land subsidence, due to their interconnectedness, and treated as a single hazard in this plan.	Coastal Erosion
Coastal (Tropical) Storm	During the planning session, "coastal storm" was regarded as similar to hurricanes and therefore considered redundant. Impacts of coastal storms are similar to those generated by hurricanes. For purposes of this report, storm water and surge events created by tropical storms and tropical depressions and hurricanes are considered. However, storm	Tropical Storm

Identified Hazard	Comments	Hazards Profiled in Plan Update
	water and surge events related to hurricanes are considered the most serious. Based upon historical events, coastal storms are often the cause of heavy rainfall events with less wind than hurricanes.	
Hurricane	Hurricane hazards are a primary concern regarding flooding from both storm water events and storm surge. Wind damage is also of significant concern. Storm water issues and surge issues are also addressed as flood concerns.	Hurricane
Flood	Flooding is the second most prevalent hazard event type recorded by the NCEI in Terrebonne Parish. Flood concerns are addressed as the major hazard issue in the parish, and as such, will be detailed throughout this HMPU. Additionally, with high river stages and as a result of storm surge, flooding occurs in areas far removed from the source of the primary event. Locally, the term "backwater flooding" identifies this phenomenon. The issue is of such concern that the steering committee chose to identify flooding as a hazard independent of the riverine (including backwater), stormwater, and storm surge hazards.	Flood
Earthquake	No recorded earthquake events have occurred in the parish.	-
Drought	Drought is a minimal concern in Terrebonne Parish as most of the land is marsh reducing the impact on crops and people. The State HMP identifies Terrebonne with a lower annual drought probability of 17% to 21%. Additionally, no anticipated drought related mitigation issues were noted in Terrebonne Parish. While the hazard is possible, it is not considered to be a priority hazard.	-
Expansive Soils	According to Terrebonne Parish's 2005, 2010, 2015, and 2020 HMP, expansive soils are likely to occur. However, the HMPU Steering Committee determined that expansive soils in the parish are not of a magnitude that warrants inclusion in this plan as an action item. The state HMP shows a level of damage ($3M/yr) that suggests that some discussion and study is warranted in the future.	-
Extreme Heat	Two recorded heat events have been recorded in the last 24 years in Terrebonne Parish. One of the events caused a fatality. Due to the potential to be worse in the future, this hazard was identified for profiling.	Extreme Temperatures
Saltwater Intrusion	The parish has three freshwater intakes available for its supply of potable water. These intakes became increasingly vulnerable to saltwater intrusion. Steps have been taken to protect drinking water and to reduce environmental damage, but the HMPU Steering Committee agreed that saltwater	Saltwater Intrusion

Identified Hazard	Comments	Hazards Profiled in Plan Update
	intrusion should be recognized as a significant hazard within this HMPU.	
Land Subsidence	According to Terrebonne Parish's 2015 HMP, land subsidence is likely to occur in the region. Two areas of concern for the Committee included the subsidence due to the removal of resources, and the potential of subsidence due to changing water infiltration patterns after forced drainage is in place. The hazard was identified as a prevalent hazard and will be combined with coastal erosion, due to their interconnectedness in that area, and treated as a single hazard in this plan. Forced drainage areas will be separately developed to improve water storage in particular.	Land Subsidence
Sinkhole/ Salt Domes	There have been no recorded sinkhole events in Terrebonne Parish. Terrebonne's location on the Gulf Coast Salt Dome Basin makes it vulnerable to sinkholes that have been mined and/or utilized for energy storage. In general, sinkholes form gradually (in the case of cover subsidence sinkholes), but they can also occur suddenly (in the case of cover-collapse sinkholes). Sink holes and Salt Domes will be profiled for the purposes of this plan. Concerns for potential sinkholes in Terrebonne Parish are heightened given the Bayou Corne (Assumption Parish) sinkhole that formed in 2012 and continues to expand. The Steering Committee considered the risk in Terrebonne to be limited to the immediate area of the salt domes, and will not prioritize any activity but monitoring.	Sinkhole
Hail Storm	The steering committee concurred that hailstorms will not be of further consideration for the purposes of this plan because the damages incurred per event and frequencies are not significant. Any mitigation actions completed for tornados and hurricane winds will also mitigate for hail.	-
Wildfire	No wildfire events of significance have been recorded in Terrebonne Parish and will not be of further consideration for the purposes of this HMPU.	-
Tsunami	Tsunami events have never been noted in Terrebonne Parish and will not be considered further in this HMPU.	-
Volcano	No volcanoes exist in Terrebonne Parish and will not be of further consideration for the purposes of this HMPU.	-
Severe Winter Storm	Because severe winter storms are so seldom in the coastal area, impacts were considered neither prevalent nor applicable to this planning effort. While winter storms do occur, disruption of government and business is minimal.	-
Landslide	No recorded landslide events have occurred in Terrebonne Parish and will not be of further consideration for the purposes of this HMPU.	-

Identified Hazard	Comments	Hazards Profiled in Plan Update
Tornadoes	Tornadoes are a function of high winds. They have occurred historically in the parish and are likely to occur in the future. Due to the limited impacts created by any single event upon the parish, the HMPU Steering Committee concluded that addressing mitigation measures relative to tornados as a stand-alone hazard should not be considered in this plan, but the tornado hazard will be profiled with other wind events due to the high probability of occurrence. Building to a Fortified standard may be advisable but would need to follow a benefit/cost assessment.	Tornadoes
Ice Events	In January 2014, a mixture of freezing rain and ice impacted the Gulf Coast of Louisiana. However, ice events are not a common occurrence in Louisiana and the NCEI does not record any ice events. This hazard will not be profiled.	-
Sea Level Rise	Sea level rise is directly related to land subsidence in coastal Louisiana. Despite the magnitude of the impact that land subsidence has on Louisiana, GOHSEP acknowledges that the scale of the problem would be better addressed under the auspices of the Louisiana Department of Transportation and Development, the Department of Natural Resources, and the Coastal Protection and Restoration Authority. This hazard will not be profiled independently in this HMPU.	Coastal Erosion, Flood, Saltwater Intrusion
Lightning	Lightning is a natural electrical discharge in the atmosphere that is a by-product of thunderstorms. Every thunderstorm produces lightning. There are three primary types of lightning: intra-cloud, cloud-to-ground, and cloud-to-cloud. Lightning will be profiled for the purposes of this plan.	Lightning
Human-Caused Hazards		
Levee Failure	Dams do not exist in Terrebonne Parish, but the Steering Committee was concerned with manmade releases or breaches of dams upstream of the parish. This would cause riverine flooding or backwater flooding, so those risk reduction efforts are considered relevant to the dams. In Terrebonne Parish, the majority of the levees that existed prior to 2015 were not designed for hurricane protection, but were forced drainage mechanisms. All levees within the parish located south of the Intracoastal Canal reportedly topped and/or breached during Hurricane Rita in 2005 have now been elevated to 12 feet. The levees are not at the FEMA BFE or federally certified and are not reflected in the 2022 FEMA flood maps. Levee overtopping or failure is considered a highly significant hazard event in the area.	Levee/Dam Failure

This list was confirmed by HMPU Steering Committee members in Meeting No. 2 with consideration of the former HMPU (2020) and the State HMP.

Additional Hazards of Concern

In addition to the hazards identified by the HMPU Steering Committee, human-caused hazards, such as environmental disasters, have the potential to cause extensive detrimental impacts to the residents, environment, and economy of Terrebonne Parish. This planning effort was coordinated with the Office of Emergency Preparedness, the coordinator for response after all events. Terrorist threats and the seven lifelines, described in the Building Resilient Infrastructure and Communities program through FEMA, are concerns for the OEP and with a systems-based approach to recovery and resilience, each of these hazards will be considered in the development of mitigation programs to have co-benefits whenever possible. Although this plan does not profile environmental disasters, it is worth noting that the Deepwater Horizon incident in 2010 had profound impacts on various economic sectors within the parish that resulted in social disruption as well as health impacts on individuals. The impacts of the oil spill, and the long-term consequences to the environment, as well as to the health of residents, are as yet unknown.

The following section includes hazard profiles which provide a more in-depth description of each hazard in Terrebonne Parish.

3.1.1 Flood Profile

The issue of flooding was discussed in detail and committee members determined that it is one of the most prevalent and frequent hazards to the parish. According to NOAA data, flooding occurs about once a year. However, anecdotal data suggests a greater frequency using a broader definition instead of the strict definition of a flood. Committee members recommended that the issue of flooding be one of the main focuses during this HMPU planning process. It was also determined that flooding would be subdivided into three categories based on the type of flooding: riverine/backwater, rain/storm water, and storm surge. By separating the types of flooding into these categories, the parish was able to identify specific portions of the parish that may be prone to each type of flooding or hazard event. This approach proved valid in defining both the varying causes of flooding hazards and in determining vulnerability.

In addition to damages from storm surge that would be expected near the coast, the parish experiences flooding in the northern communities that may be caused by poor drainage, road improvements, or subsidence. These flood prone areas outside the SFHA are included in the repetitive loss map shown in Figure 3-1 and the severe repetitive loss map shown in Figure 3-2. The addresses of repetitive loss structures are not shown specifically due to privacy concerns, but are shown generally by Census block both inside and outside the SFHA. The data mapped is from NFIP claims and calls to the Department of Public Works, the Office of Emergency Preparedness, and the mitigation division of the planning department that are logged after every moderate to severe storm. NFIP claims are not reflective of the flooding in these areas. As much of the flooding is persistent pooling on land rather than in-home flooding, this may cause damage such as rotting floors or sinking foundations, which are more difficult to claim with flood insurance. Claims are also suppressed due to unfamiliarity with flood insurance rules or a desire to retain a preferred insurance rate. More specific education regarding flood insurance details is needed rather than

general information about the importance of getting flood insurance. The importance of flood insurance and the mitigation benefits of insurance have been a focus to this point. Uncertainty of flood premiums under Risk Rating 2.0 is causing concern for households considering risk reduction efforts and government programs for affordable housing.

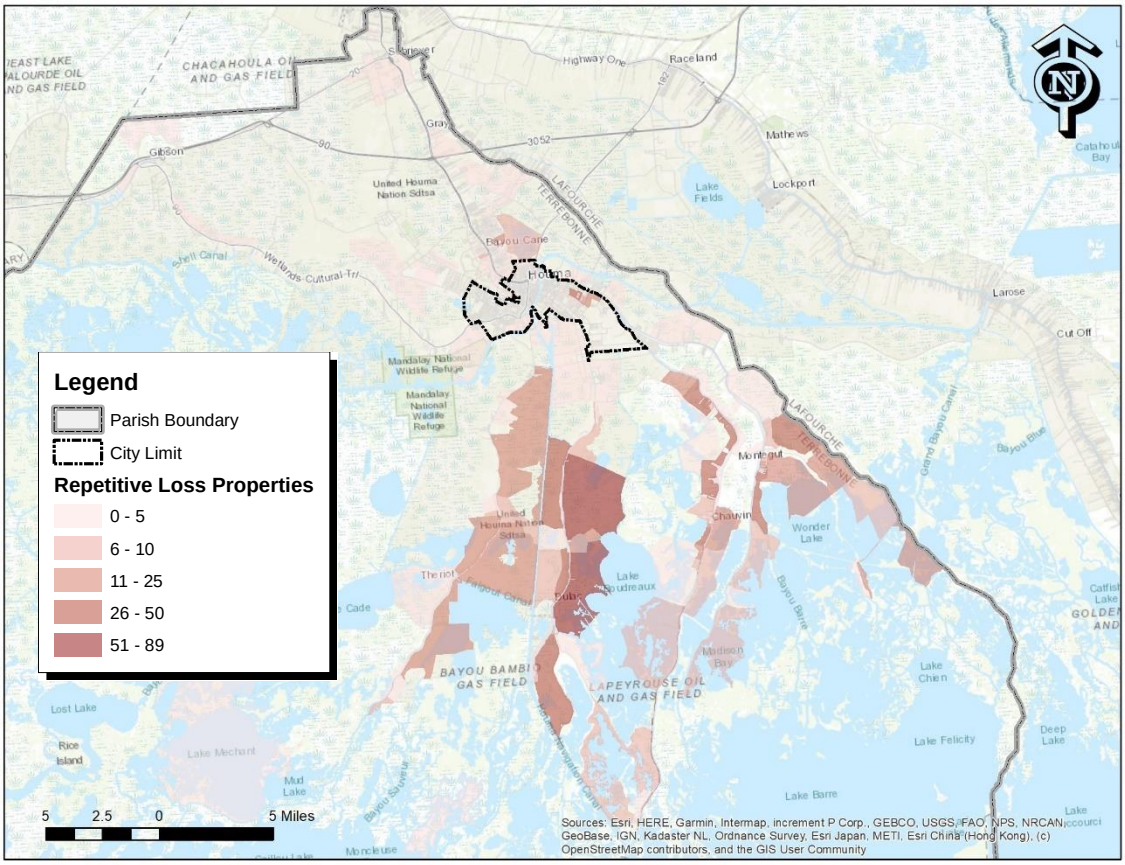


Figure 3-1: Repetitive Loss Properties (FEMA)

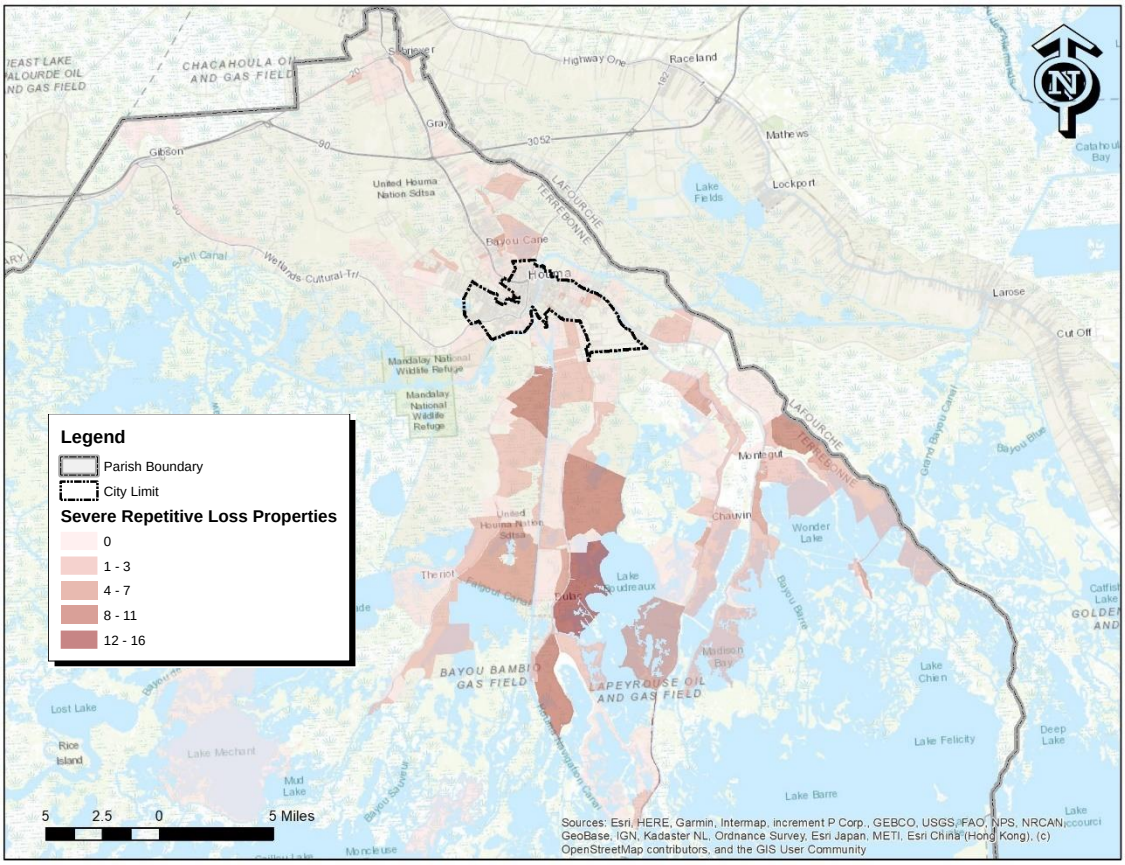


Figure 3-2: Severe Repetitive Loss Properties (FEMA)

FEMA updated the Terrebonne Parish floodplain and released the new maps to the public in 2022. These are still preliminary floodplains as of the end of 2022. Since the levees protecting the parish have not been accredited and do not protect against the 1% annual chance event (commonly referred to 100-year event), they were not considered in the FEMA study. This has resulted in a very large floodplain covering 954,427 acres or 71.7% of the parish. Figure 3-3 shows this new floodplain. Areas in dark blue are the coastal V-zone which is the 100-year floodplain subject to wave action greater than 3', areas in orange are the 100-year coastal floodplain subject to wave action between 1.5-3' high, areas in light blue are the 100-year riverine floodplain, the purple areas found in Houma are the 100-year coastal and riverine floodplain, and the green areas are 100-year floodplains subject to shallow flooding averaging between 1' and 3' in depth. Figure 3-3 shows the updated floodplain.

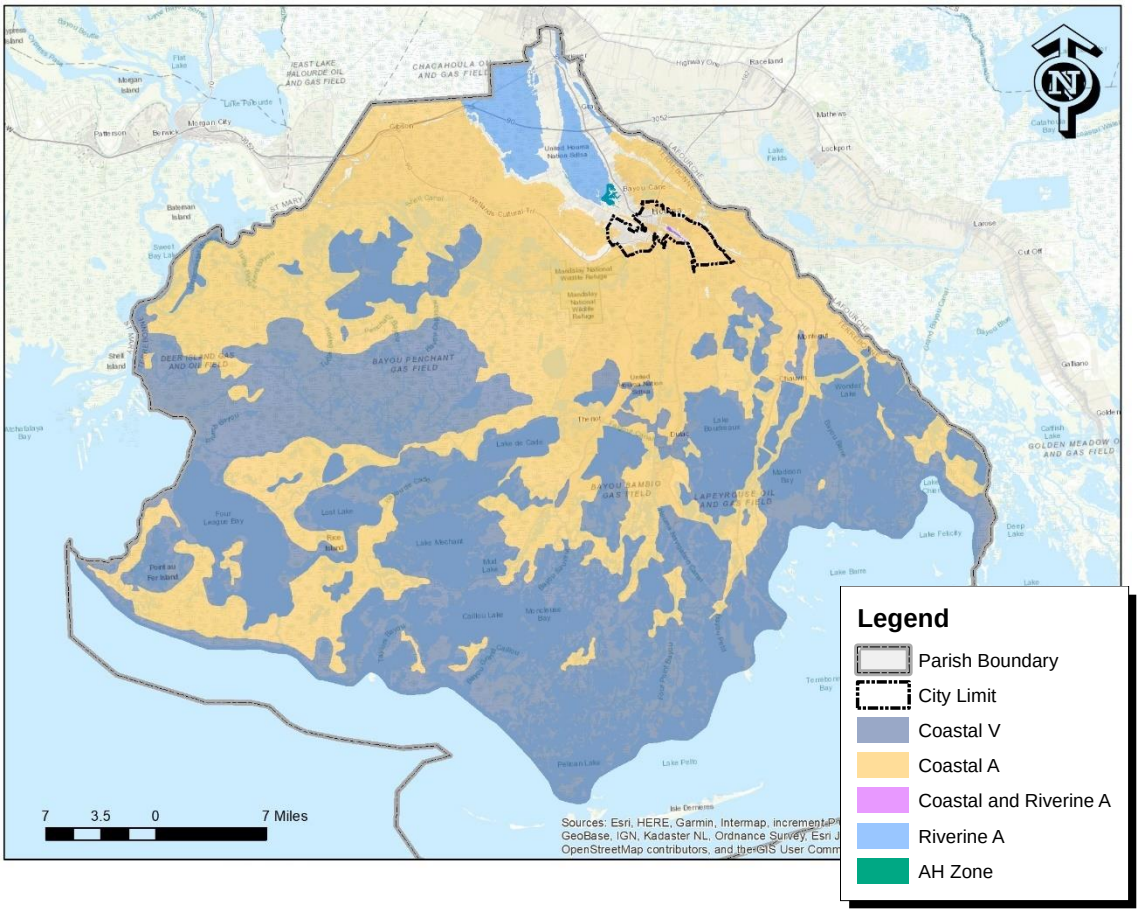


Figure 3-3: 1% Annual Chance Floodplain (FEMA, 2021)

Rainfall/Storm water

Storm water excesses caused by large amounts of rainfall in a short period of time occur frequently in this coastal parish. Generally, the most damaging events were a function of tropical storms and hurricanes. Primarily low-lying areas of the parish suffered damage from past events including Hurricane Juan in 1985 and Tropical Storm Allison in 2001 and spring flooding in 2016 and 2019.

Storm surge

Storm surge caused by winds of hurricanes and tropical storms cause inundation of coastal floodplains and through coastal river and drainage systems. In the case of storm surge, southerly winds and high tides rise over and through bayous, canals and marshlands. Low lying coastal areas of Terrebonne Parish are vulnerable to this type of flooding since it is predominately a marshland coast located near the Gulf of Mexico. This type of inundation is anticipated to be significantly reduced due to the implementation of the MTTG footprint and the series of floodgates and the planned lock system. Forced drainage systems with pumps accompanying the floodgates maintain levels of water in the marsh to avoid flooding from surge, southerly winds and high tides.

Riverine/Backwater

Riverine flooding, by definition, is river based. Despite the abundance of waterways located within the parish, there are no rivers that are subject to significant water level fluctuations and contribute to flooding. There are, however, many bayous, canals, and marshland that effectively drain the parish into the Gulf of Mexico in the absence of a strong southerly push created by wind. Riverine flooding is not considered a significant threat to Terrebonne Parish unless external threats are combined, such as dam failure.

Backwater flooding is normally associated with riverine flooding and connotes a lack of velocity. Low lying areas, particularly those outside of protection levees are at risk. A heavy rainfall event combined with a strong southerly wind hinders drainage outflow causing backwater flooding to the same areas susceptible to storm surge. The floodgate system has been designed in part to minimize flooding through the bayous from the south, and internal levees are being places to stop flow from the marshes. The Gibson/Bayou Black area is currently a focus due to flooding from the Atchafalaya. This phenomenon generally results in the flooding of areas of the parish located south of the City of Houma. Historically, flooding is generally widespread but shallow in these areas. Backwater flooding has occurred when the storm surge flowed through the pump station outfall pipes inhibiting drainage. The addition of pumps to the system dilutes that risk. Water flooding land and pooling in Gibson has prompted a similar response first identified by the U.S. Army Corps of Engineers and is now being implemented by the parish.

Three pump stations in the Gibson area include: Hanson Canal, Bayou Black Pump Station, and the Elliot Jones pump station. Each of the pump stations format and capacity are the same. The three pump stations have a maximum capacity of pumping 1,000,000 gallons every 2 minutes and 15 seconds. The three pump stations are the implementation of a project envisioned and studies by the USACE about 20 years ago. The USACE determined that about 6,000 cfs would need to be managed, and each of the pump stations will handle approximately a third of that load with similar costs and output. The neighborhood once had homes with subsistence gardens and relative flood safety. The current conditions have ruined the gardens with standing water and are believed to cause sinking and floor damage by the residents.

Previous occurrences of flood events are detailed in Table 3-3.

Table 3-3: Historical Flood Events in Terrebonne Parish (NCEI, 1996 to 2022)

Date	Type	Property Damage	Tide/Rainfall
10/5/1996	Coastal Flood	$3M	+3-4’ tide
4/5/1997	Coastal Flood	$0	N/A
10/16/2006	Coastal Flood	$0	1-2”
5/1/2010	Coastal Flood	$0	2”
10/25/2015	Coastal Flood	$0	+2-4’ tide
1/6/1998	Flash Flood	$35,000	4-9”
6/26/1999	Flash Flood	$500,000	3-10”
6/6/2001	Flash Flood	$75,000	11-23”
6/6/2001	Flash Flood	$500,000	11-23”
6/10/2001	Flash Flood	$250,000	11-23”

Date	Type	Property Damage	Tide/Rainfall
10/9/2004	Flash Flood	$50,000	5-16”
10/22/2007	Flash Flood	$0	3-10”
5/22/2008	Flash Flood	$0	1-5”
8/17/2008	Flash Flood	$0	1-3”
3/27/2009	Flash Flood	$0	1-8”
12/14/2009	Flash Flood	$0	1”
7/18/2011	Flash Flood	$0	1-3”
9/4/2011	Flash Flood	$25,000	1-4”
3/23/2012	Flash Flood	$0	1-3”
7/20/2012	Flash Flood	$10,000	1-4”
4/14/2015	Flash Flood	N/A	N/A
10/26/2019	Flash Flood	$0	N/A
6/24/2020	Flash Flood	$100,000	N/A
3/23/2021	Flash Flood	$0	6-7”
2/12/1997	Flood	$0	N/A
9/10/1997	Flood	$0	N/A
12/21/2006	Heavy Rain	$0	1-6"
9/5/2014	Heavy Rain	$0	1.5” in 30 min.
3/23/2021	Heavy Rain	$0	2.57” in 3 hours
3/23/2021	Heavy Rain	$0	10”
9/12/1998	Storm Surge/tide	N/A	N/A
6/30/2003	Storm Surge/tide	$1,000,000	5-10”
9/15/2004	Storm Surge/tide	$5,000	N/A
9/22/2004	Storm Surge/tide	$5,000	N/A
10/9/2004	Storm Surge/tide	$18,000	N/A
9/23/2005	Storm Surge/tide	$34,560,000	1-2”
9/23/2005	Storm Surge/tide	$138,240,000	1-2”
8/3/2008	Storm Surge/tide	$0	1-4”
9/1/2008	Storm Surge/tide	$9,400,000	1-5”
9/11/2008	Storm Surge/tide	$100,000,000	<1”
9/2/2011	Storm Surge/tide	$45,000	1-2"
8/28/2012	Storm Surge/tide	$10,000,000	<1"
8/28/2012	Storm Surge/tide	$1,000,000	<1"
6/21/2017	Storm Surge/tide	$0	6.5”, +4-6’ tide
7/12/2019	Storm Surge/tide	$0	+3-6’ tide
9/15/2020	Storm Surge/tide	$0	+2-4’ tide
9/21/2020	Storm Surge/tide	$0	+3-4’ tide
10/09/2020	Storm Surge/tide	$100,000	+4-5’ tide
10/28/2020	Storm Surge/tide	$25,000,000	+3-5.5’ tide
8/28/2021	Storm Surge/tide	$750,000	+10-15’ tide
	Terrebonne Total:	**$321,668,000**	

Based on previous occurrences the parish is susceptible to between one and 23 inches of rainfall in a flood event. Recent events such as Tropical Storm Imelda suggest that up to 40 inches is a realistic scenario while Hurricane Ida in 2021 produced tides of ten to fifteen feet above average. The pumping capacity in the parish is developing not only robust water movement capacity, but storage for detention of these flows in natural systems such as the Shell property. This property provides over 4,139 acres of wetland which is sufficient to hold 1.8 billion gallons of water once the drainage levees are in place and pump station diversions connected.

Flood event damages and expenses collected by TPCG are provided in Table 3-4 while the Terrebonne Parish Presidential Disaster Declarations are provided in Table 3-5. The Hurricane Ida declaration is provided in the hurricane section.

Table 3-4: FEMA Flood Disaster Declarations

Year	FEMA #	Name	Parish Damages and Expenses
2016	EM 3376	Severe Storm and Flooding	$11,539,617.43
2019	4462	May Flooding*	$808,016.95*
		Total:	**$12,347,634.38**

Source: TPCG, 2020 ** Estimated*

Table 3-5: Terrebonne Parish Presidential Flood Disaster Declarations (1965 to 2022)

Year	DR#	Storm Name	Impact	Damage (Billions)
1973	374	Severe Storms, Flooding	Heavy rains and flooding	N/A
1980	616	Severe Storms, Flooding	Heavy rains and flooding	N/A
1991	902	Severe Storms, Flooding	Heavy rains and flooding	N/A
1991	904	Flooding, Severe storm, tornado	Heavy rains and flooding	N/A
1995	1049	Rainstorm/flood	Heavy rains and flooding	N/A
2009	1863	Severe Storms, Flooding, Tornado	High winds, heavy rains, and flooding	N/A
2011	4015	Flooding	Mississippi River Flooding	$4.00
2013	4102	Severe storms and flooding	High winds, heavy rains, and flooding	N/A
2016	3376	Flooding	Heavy rains and flooding	$0.014
2019	3413	Flooding	Heavy rains and flooding	N/A
2019	4462	Flooding	Heavy rains	$0.008

Source: FEMA, 2022

Flooding from Morganza Spillway (May 2019)

The threat of flooding from the spillway was met with the combined efforts of the parish and the Army National Guard to put portable pumps and two miles of flood tubes in place to move 500 million gallons per day from the area already saturated from months of backwater flooding from the Atchafalaya. Pumps moved water from above the floodgates to below to allow the water to flow to the Intracoastal Canal.

Pumping Water through Intracoastal Canal. (Source: TPCG)

Pumps at Spanish Trail in Gibson with intake through temporary structures to draw down the bayou in anticipation of the spillway flooding. Three temporary installations at different gates were put in place for the same purpose. A temporary barge structure was put in place St. Mary Levee District as it had been before in Bayou Chene to provide more protection from the backwater flooding. It has now been replaced with a permanent structure.

The Bayou Chene project is considered to be critical for Terrebonne Parish, and the TLCD and the TPCG expended $400,000 towards construction of the structure. Terrebonne works with partner agencies and neighboring parishes as some mitigation projects may not be within our borders.

The May 2019 flooding was not declared a disaster until September 19, 2019. Public Assistance was available to the parish, but fortunately there was no need for significant Hazard Mitigation Grant Program funds for the parish or individuals.

The Mississippi River Flood 2011 (April – May, 2011)

W. Bayou Chene Flood Control Structure. (Source: WWNO – New Orleans Public Radio)

This flood illustrates the repeated flood events from the Mississippi via the Atchafalaya. The combination of springtime snowmelt and rainfall resulting from multiple major storm systems

between April 23 and May 2 made 2011 a record-setting year for flooding in the central United States.[1] For the Mississippi River, this caused the most intense river flooding recorded within the past century. NOAA estimates that economic losses related to the flooding ranged from $3-$4B.

The adjacent picture shows water being diverted from the Mississippi River to Lake Pontchartrain on May 10, 2011 via the Bonnet Carre Spillway. Water from the Mississippi River was also diverted to the Atchafalaya River, which resulted in its cresting on May 30, 2011. Terrebonne Parish mobilized pumps to the western part of the parish in preparation for flooding; however, St. Mary Levee District installed a barge in Bayou Chene, which prevented flooding in Terrebonne Parish.

Lake Pontchartrain near the Bonnet Carre Spillway, (Souce: Nola.com, 2011)

Bayou Cane – Flooding in Surrounding Areas

According to TPCG, Bayou Cane experiences flooding from rains more often than from hurricanes. In particular, there is flooding on Douglas around the intersection of D Street. The neighborhood occasionally ropes off the intersection to stop cars from driving through as the car traffic makes waves that in turn flood some of the homes along the street. Mire, Collins, and Funderburk in Bayou Cane experience shallow flooding in rains as well. The intersection of Alma and Westside Boulevard was closed to traffic occasionally between 2013 and 2014 due to high waters from flooding caused by rain events. Projects have alleviated this to some extent and drainage improvements from Alma to St. Louis Canal Road have recently been implemented. Closer to Martin Luther King Boulevard, but still in Bayou Cane, Jean Street, Mike Street, and sometimes all the way to Duet Street residents experience flooding from rain events. Some improvements have been made and buyouts executed, but the risk remains for the other structures. Additional culverts were given notice to proceed in the fall of 2020 to protect street navigability and property. Westview and Louis Streets have experienced flooding. The structures at the end of Westview have been bought out or elevated at the election of the owners. Structures on Harding and Louis were also purchased due to shallow but repeated flooding. This level of participation may have been a result of the repetitive loss studies in the area. Prospect Street sees some flooding near the bridge in rains. This is nearer to the Roberta Grove area. This area is also targeted for elevations.

Future Flood Events

Future flood events will occur and will cause major impacts in the future. According to the Climate Explorer which presents future climate scenarios using the Localized Constructed Analogs (LOCA) method (Pierce et al. 2014), rainfall events with 2" or more of precipitation will occur more often with both the low and high emissions scenarios. The coastal flooding will cause additional impacts due to sea level rise. The recorded sea level rise at the NOAA tidal station for Grand Isle, Louisiana (closest to Terrebonne Parish) is shown in Figure 3-4. The sea level will continue to increase in the future.

[1] http://www.srh.noaa.gov/jan/?n=2011_05_ms_river_flood

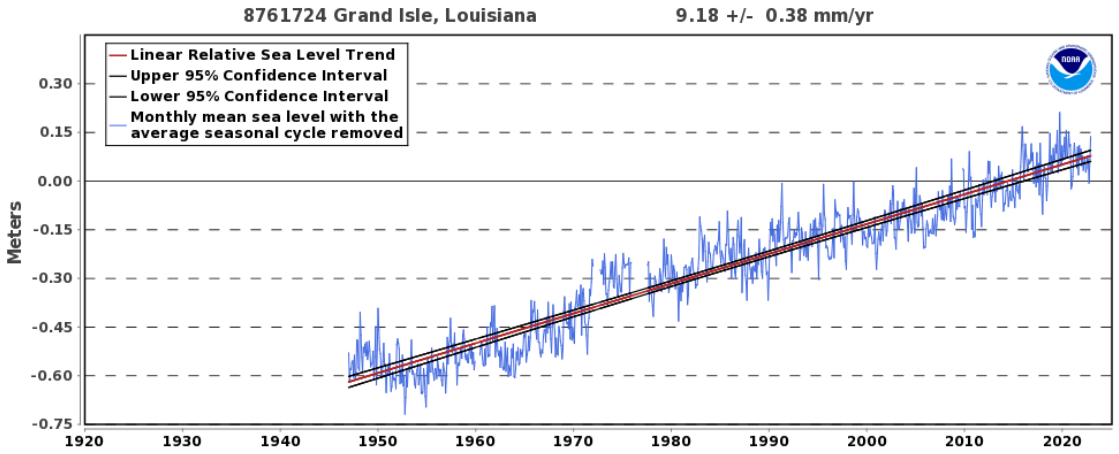


Figure 3-4: Sea Level Change (NOAA, 2022)

3.1.2 Hurricane and Tropical Storm Profile

Because of the proximity of the parish along the Gulf coast, the region is highly prone to hurricanes and tropical storms. The parish has a history of damage linked to hurricanes and tropical storms that have occurred in the past. Twenty presidentially declared disasters associated with hurricanes and tropical storms have occurred in the parish since 1965. Even more, hurricanes and tropical storms have an 81 percent annual probability in the parish. As such, hurricanes and the resultant wind and flood damage were designated as a significant hazard to the community. Based on the storm events profiled later in this section and Terrebonne Parish's location in coastal Louisiana, it is estimated that Terrebonne Parish could experience between 2.5 and 15 feet storm surges, and between 1- 23' of rain related specifically to hurricanes, tropical storms, and tropical depressions. Figure 3-5 shows the historic storms which have passed through Terrebonne Parish.

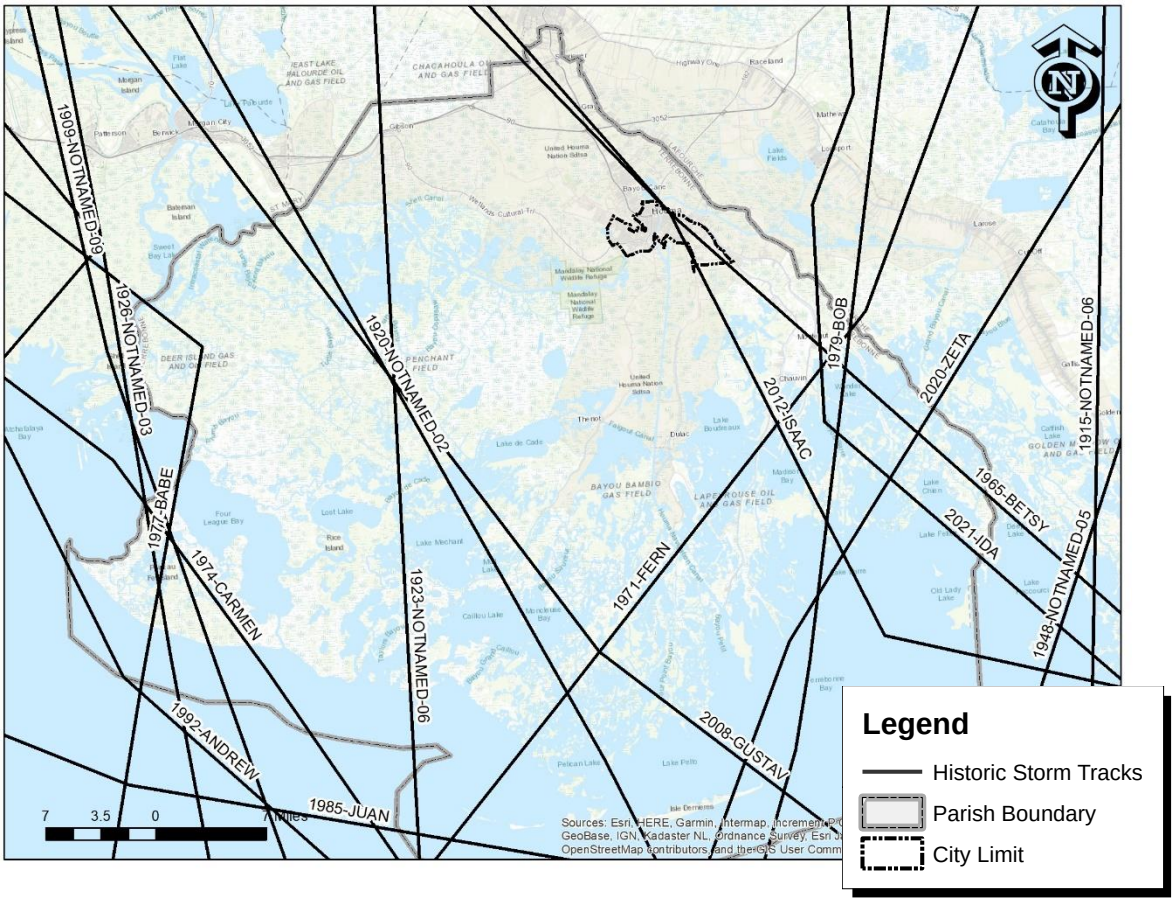
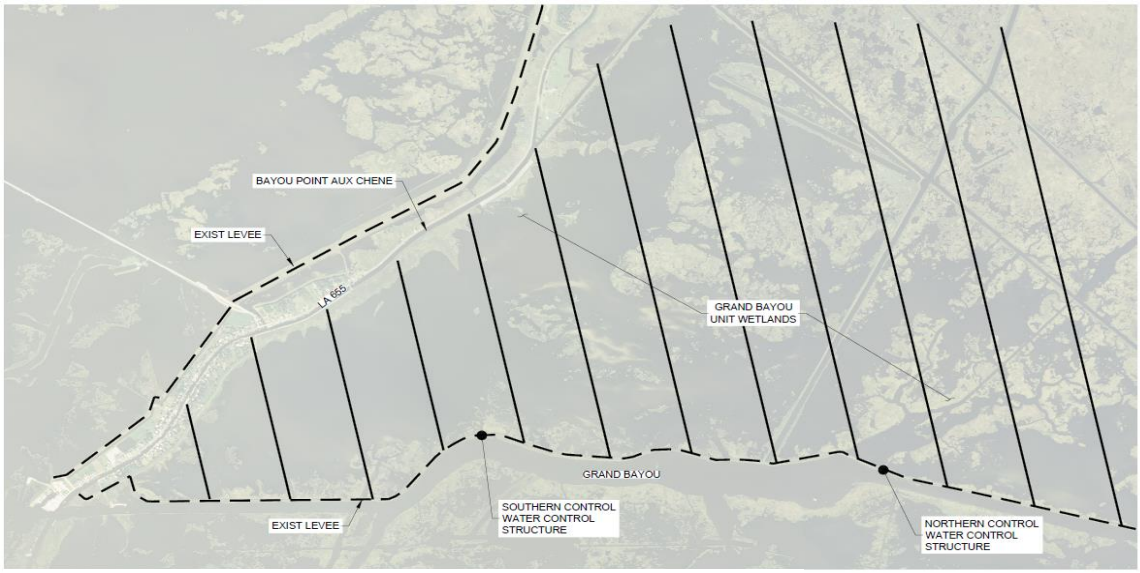


Figure 3-5: Historic Storm Tracks

The design of the Morganza to the Gulf Hurricane Protection Levee in Terrebonne Parish has been extended to provide protection for several communities, including Grand Caillou, Dulac, and portions of Bayou Dularge. Isle de Jean Charles and Point aux Chenes remain outside the MTTG. Lafourche Parish is pursuing an Eastern tie in for the MTTG expanding the footprint to Lockport, and replacing two environmental structures near the Ponte aux Chenes Wildlife Management Area. Each will provide protection from surge and backwater flooding from the east that otherwise could flow into the GIWW and the MTTG systems. These projects are included in the list of priorities for this plan as they protect Terrebonne as well as Lafourche. The current weir structures will be replaced by three box culverts, slide gates, flood gates, and a wall. This new installation will account for flood risk by incorporating overbuild in the elevation by starting at 6-8 feet rather than 4 feet and moving up to 10 feet over 10 years. This will be accomplished with a partnership between Terrebonne and Lafourche, and will be managed in a partnership between the South Lafourche Levee District and the LA Dept. of Wildlife and Fisheries. This will shore up a weak point in the current system.



Levee System (Source: TLCD All South Consulting Engineers)

Local redundant levees with corresponding pump stations have been added to the system to protect the Bayou Dularge, Grand Caillou, and Dulac communities. Point aux Chenes is outside the levee, but efforts by Terrebonne and Lafourche to increase the internal levee system are planned. Terraces to protect the marsh and the Wildlife Management Area are already implemented. The State has provided a $48M relocation package to the residents of Isle de Jean Charles for all volunteers resulting in 36 structures built and 3 more planned at this time. A marsh restoration project is through engineering and will build a barrier to reduce the effect of wave action on Island Road (Coastal Wetlands Planning, Protection and Restoration Act [CWPPRA] Island Road Marsh Creation and Nourishment Project [TE-117]). Further, five public parking areas for fishing were constructed on the north side of the road. The parish also put in a 5 foot high wall on the Gulf side to stop the road from washing out in storms so that people can still reach cultural artifacts that require maintenance. A buyout project has been funded through LA SAFE for primary residences outside the MTTG footprint. There was concern that the lower bayou communities might see increased surge heights because of the construction of the Morganza levees. The results of the LAMP process will inform whether this is projected or not. Preliminary results do not suggest any significant increase in vulnerability for these areas. Hazard mitigation strategies, including community relocation, may become necessary to reduce the vulnerability of these communities. The parish is continuing to monitor the need for buyout programs that mirror the state program by providing sufficient funding for replacement housing rather than fair market value.

Numerous hurricanes and tropical storms have impacted the study area. A table summarizing the tropical storms, depressions, and hurricanes relevant to Terrebonne Parish is provided in Table 3-6.

Table 3-6: Historical Hurricane, Tropical Storm, and Tropical Depression Events in Terrebonne Parish (NCEI, 1996 to 2022)

Date	Type	Property Damage	Windspeed/Tide
7/17/1997	Hurricane	$0	96 mph / 5.4’
9/27/1998	Hurricane	$40,000	55-65 mph
10/02/2002	Hurricane	$5,540,000	61-69 mph / 4-7’
9/15/2004	Hurricane	$5,000	83-100 mph / 3-5’
7/5/2005	Hurricane	$500,000	70 mph / 5.5’
8/28/2005	Hurricane	$42,500,000	127 mph / 7-10’
9/1/2008	Hurricane	$5,000,000	117 mph / 5-8’
8/28/2012	Hurricane	$1,320,000	86 mph / 4-7’
10/28/2020	Hurricane	$25,000,000	110 mph / 2-6’
8/29/2021	Hurricane	$750,000,000	100-150 mph / 10-15’
9/10/1998	Tropical Storm	$4,500,000	60 mph
9/19/1998	Tropical Storm	$0	46 mph
9/25/2002	Tropical Storm	$6,390,000	50 mph / 4-6’
6/30/2003	Tropical Storm	$2,000,000	Not Available
9/22/2004	Tropical Storm	$0	48 mph / 2-3’
10/9/2004	Tropical Storm	$12,000	55 mph / 2-4’
9/23/2005	Tropical Storm	2,880,000	42 mph / 5-7’
8/3/2008	Tropical Storm	$0	44 mph / 1-3’
9/11/2008	Tropical Storm	$500,000	55 mph / 4-8’
11/9/2009	Tropical Storm	$0	74 mph / 2-6.5’
9/2/2011	Tropical Storm	$15,000	60 mph / 3-5’
6/20/2017	Tropical Storm	$0	49 mph / 4-6’
7/12/2019	Tropical Storm	$0	69 mph / 5-9’
10/9/2020	Tropical Storm	$100,000	70 mph / 2-3’
8/24/2008	Tropical Depression	$0	Minimal
	Total:	**$321,668,000**	

The most recent flood event to threaten Terrebonne Parish occurred in 2019 and is detailed in. The Hurricane Ida declaration is provided in the hurricane section.

Hurricane event damages and expenses collected by TPCG are provided in Table 3-7 while the Terrebonne Parish Presidential Disaster Declarations are provided in Table 3-8. The Hurricane Ida declaration is provided in the hurricane section.

Table 3-7: Hurricanes and Tropical Storms

Year	FEMA #	Name	Parish Damages and Expenses
2017	EM 3392	Tropical Storm	$113,559.45
2019	4458	Hurricane Barry*	$1,813,199.47
		Total:	**$1,926,758.92**

Source: TPCG ** Estimated*

Table 3-8: Terrebonne Parish Presidential Disaster Declarations (1965 to 2022)

Year	DR#	Storm Name	Impact	Damage (Billions)
1965	208	Hurricane Betsy	Storm surge, flooding, and destructive winds	$21.90
1971	315	Hurricane Edith	Flooding and high winds	$0.30
1974	448	Hurricane Carmen	High winds and tidal flooding	$1.60
1985	752	Hurricane Juan	Storm surge, heavy rain, and flooding	$4.10
1992	956	Hurricane Andrew	High winds, heavy rains, and flooding	$56.00
1998	1246	Tropical Storm Frances & Hurricane Georges	Destructive winds, storm surge, tornado, and flooding	$4.60
2001	1380	Tropical Storm Allison	High winds, heavy rains, and flooding	$6.50
2002	1435	Tropical Storm Isidore	High winds, heavy rains, and flooding	$0.40
2002	1437	Hurricane Lili	High winds and storm surge	$1.10
2004	1548	Hurricane Ivan	Winds	$15.50
2005	1603 & 3212	Hurricane Katrina	high winds	$81.00
2005	1607 & 3260	Hurricane Rita	Storm surge and flooding	$10
2008	1792	Hurricane Ike	Heavy rains and high winds	Gustav & Ike
2008	1786	Hurricane Gustav	Heavy rains and high winds	$8 to $20B
2011	4041	Tropical Storm Lee	High winds, heavy rains, and flooding	$1.60
2012	4080	Hurricane Isaac	Heavy rains, high winds	$1.00
2017	3392	Tropical Storm Nate	High winds, heavy rains, and flooding	$0.007
2019	4458	Hurricane Barry	High winds, heavy rains, and flooding	$0.60
2020	4577	Hurricane Zeta	Storm surge, flooding, and destructive winds	$0.05
2021	4611	Hurricane Ida	Storm surge, flooding, and destructive winds	$1.20

Note [(1)]: Loss estimates for all affected areas and are not limited to Terrebonne Parish. Data obtained from *Normalized Hurricane Damage in the United States*: 1900-2005, R. Pielke, et. al. and the FEMA data visualization for 2016-2022.

Hurricane and Tropical Storm Profiles

The most extreme examples of the hazard events that have impacted Terrebonne Parish are presented in the following text beginning in 1965 with Hurricane Betsy. Each event description includes a graphic that illustrates the path taken by the storm. The path is color coded according to the Saffir-Simpson Hurricane Wind Scale to establish the storm's intensity as it approached and made landfall. Every category of hurricane (1-5) can occur in the entirety of the planning area. The colors and the Saffir-Simpson Hurricane Scale are illustrated to the right. Although the Saffir-Simpson has been criticized for failing to take into account the physical size of the storm and the precipitation, it's being used due to how common it is to describe a hurricane, tropical storm, and tropical depression.

Saffir-Simpson Hurricane Wind Scale

Category	Wind Speed
5 (major)	≥157 mph ≥252 km/h
4 (major)	130–155 mph 209–251 km/h
3 (major)	111-129 mph 178-208 km/h
2	96-110 mph 154-177 km/h
1	74-95 mph 119-152 km/h
Additional Classifications	
Tropical Storm	39-73 mph 63-117 km/h
Tropical Depression	0-38 mph 0-62 km/h

Hurricane Betsy (1965)

Hurricane Betsy made landfall near the mouth of the Mississippi River in Louisiana on September 9, 1965. The hurricane was a category 3 storm with maximum winds of 140 miles per hour recorded in Terrebonne Parish. According to NOAA, Terrebonne experienced approximately five inches of rainfall during this storm. Grand Isle, which is 70 miles southeast of Houma, experienced 15' storm surge. The event caused widespread wind and water damage to area homes and businesses in Terrebonne. In addition, the area's agricultural crops (sugarcane) suffered significant losses. One fatality was reported. It should be noted that at this period in history there was not an extensive levee system in place. The level of damage experienced in Louisiana reflected that reality. Hurricane Betsy is often referred to as "Billion Dollar Betsy."

Hurricane Betsy's Storm Track

Source:noaa.gov

Hurricane Juan (1985)

Hurricane Juan struck the Louisiana coast in the vicinity of Morgan City on October 29, 1985 as a Category 1 hurricane. Maximum sustained winds were approximately 85 miles per hour. The storm had a very erratic and slow-moving track allowing several passes over coastal Louisiana before moving eastward (see storm path to the right).

Hurricane Juan's Storm Track

Source: noaa.gov

Hurricane Juan consisted mainly of large amounts of rainfall dropped over a short period of time. Rainfall totals for southern Louisiana

ranged from 10 to 15 inches accounting for the extreme amount of flooding. Greater than 11 inches of rainfall was recorded in the City of Houma over a four-day period. NOAA records approximately 10 inches of rainfall parish wide. A combination of storm surge and extraordinary rainfall led to extensive flooding. The flooding caused significant losses to agricultural crops and hundreds of homes and businesses were flooded in Terrebonne Parish. Similar to Hurricane Betsy, there was not an extensive levee system in place. In addition, the 1970's marked a period of intensive land loss in coastal Louisiana as discussed previously. Accordingly, widespread damage reflected that reality.

Hurricane Andrew (1992)

Hurricane Andrew is the second most destructive hurricane in United States (U.S.) history with damages estimated at $56 billion. It made its second U.S. landfall (first in Florida) on August 26, 1992 at Point Chevreuil, Louisiana, (southwest of Morgan City) as a Category 3 storm with winds of 115 miles per hour. The storm's track would guide it up the Atchafalaya River system just west of Terrebonne Parish. Hurricane Andrew's path is illustrated in the adjacent graphic.

Hurricane Andrew's Storm Track

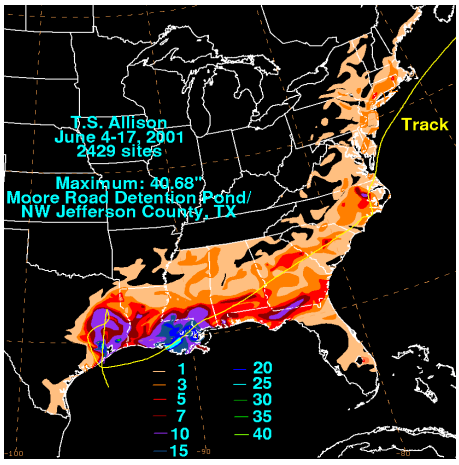
Source: noaa.gov

Terrebonne Parish was located on the eastern side of the storm's eye wall and therefore sustained widespread damage. The damage was caused by a combination of high winds and storm surge (9 feet recorded in Terrebonne Bay). In addition to storm surge, Terrebonne experienced between five and seven inches of rainfall (NOAA). Notable effects include estimated losses of 25% of the parish's sugarcane crop, extensive power outages, and inundation of several hundred homes by flood waters. Flooded communities included Pointe aux Chenes, Chauvin, Dulac, Montegut, Isle de Jean Charles, and Dularge. The following graphic illustrates the magnitude of the storm's surge on Louisiana's central coastline. At this point in time Terrebonne Parish was still protected by drainage levees that were less than 6 feet in height.

Tropical Storm Allison (2001)

Tropical Storm Allison made its initial landfall near Freeport, Texas on June 5, 2001 with 50 mile per hour winds. The storm stalled over land in Texas and retreated south and re-entered the Gulf of Mexico. It slowly drifted to the east and made a second landfall near Morgan City, Louisiana on June 11, 2001. Tropical Storm Allison left a severely drenched Texas and Louisiana in its path. Many areas in southeast Louisiana received as much as 20" of rain over three days. The storm produced a 2.5' storm surge in Cameron, Louisiana and isolated areas reported rainfall totals approaching 35 inches as a result of the storm. The community of Schriever in northern Terrebonne Parish experienced 30 inches of rain. Generally, the parish experienced between 15 and 23 inches of rainfall. It is estimated that 131 homes in the parish were damaged or destroyed by flood waters and 25,000 residents were

Tropical Storm Allison's Storm Track and Rainfall Data



displaced due to high water. The accompanying graphic illustrates the storm's track as well as rainfall accumulations produced by the storm. Allison will be remembered as one of the costliest Tropical Storms in U.S. history with 41 deaths and a $5 billion price tag associated with the damage.

Hurricane Lili (2002)

Hurricane Lili made landfall on October 3, 2002, near Intracoastal City, Louisiana (Vermilion Parish) as a Category 1 storm. However, the designation of the storm is not truly representative of the storm itself. Just prior to making landfall, the storm had a maximum designation of a Category 4, causing all oil production in the central area of the Gulf of Mexico to cease operations. Hurricane Lili's path is illustrated to the right.

Hurricane Lili's Storm Track

Source: noaa.gov

The storm was responsible for damages associated with both wind (greater than 78 miles per hour) and storm surge (6 to 8 feet) in Terrebonne Parish. NOAA also records that Terrebonne experienced up to five inches in rainfall from this storm event. The strongest effects of the storm were experienced in the southern portion of the parish. Damage included widespread power outages, destruction of approximately 35% of the parish's sugarcane crop and substantial damage of more than 300 homes.

Hurricane Katrina (2005)

After crossing southern Florida, Hurricane Katrina made U.S. landfall for the second time on August 29, 2005, near Buras/Triumph, Louisiana. The hurricane was a category 3 storm with wind speeds of 125 miles per hour. Hurricane Katrina was the most damaging natural disaster in U.S. history with an estimated $81 Billion worth of damage. Much of that damage was limited to extreme east and southeast Louisiana and the Mississippi gulf coast and was caused by high winds and large storm surge (estimated 14 feet in Plaquemines Parish, Louisiana). Between three and five inches of rain fell in Terrebonne.

Hurricane Katrina's Storm Track

Source: noaa.gov

However, Terrebonne Parish was largely spared of Hurricane Katrina's devastating effects due to its location on the western side of the storm's eye wall. The parish experienced minimal wind damage as a result of the storm. As the graphic illustrates, Katrina pushed inland along the southeastern Louisiana-Mississippi border and then established a north-northeast track.

Hurricane Rita (2005)

Hurricane Rita made landfall on September 24, 2005, along the Louisiana-Texas border near Johnsons Bayou, Louisiana. The hurricane came ashore as a Category 3 storm with sustained winds of 120 mph. As graphically depicted below, Hurricane Rita initially followed a path along the western Louisiana-Texas border and then turned northwest.

Hurricane Rita's Storm Track

Source: noaa.gov

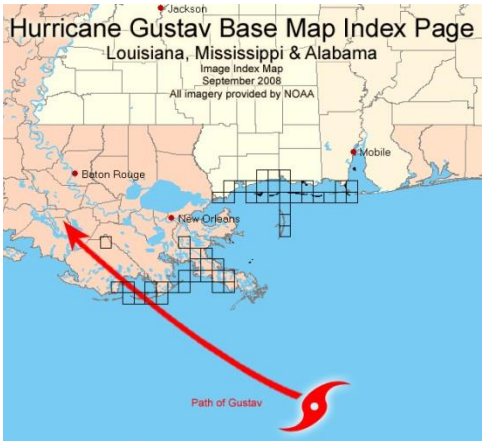
Hurricane Rita caused an estimated $10 billion in damages. Despite the fact that the eye of the storm made landfall approximately 190 miles west of the City of Houma, Hurricane Rita had a significant impact on Terrebonne Parish - much more than did Hurricane Katrina. Approximately one inch of rain fell in Terrebonne, and the impact and damages were largely a result of storm surge that caused extensive flooding, primarily south of Houma. An 8' storm surge was recorded in Calcasieu Parish. All levees located south of the Intracoastal Canal failed and more than 10,000 homes and business were flooded.

Cattle Round Up After a Levee Break in Chauvin, Louisiana

Source: TPCG

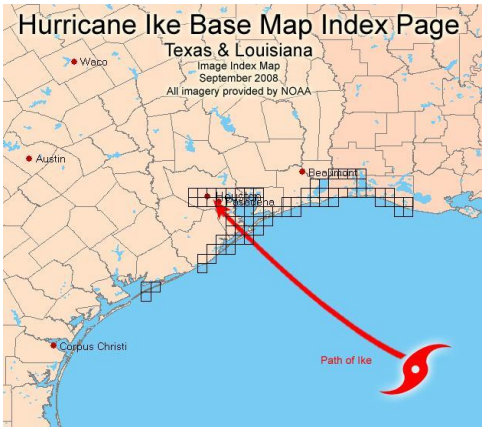
Hurricanes Gustav (Sept. 1) and Ike (Sept. 12-13), 2008

Hurricane Gustav is known as one of the most devastating hurricanes of 2008, causing physical damage and fatalities in multiple countries including Jamaica, the Cayman Islands, Cuba, Haiti, the Dominican Republic, and the United States (namely Louisiana). Hurricane Gustav was the first storm in Louisiana's history to necessitate a mandatory evacuation of residents within all at-risk coastal parishes.[2] Over two million people were evacuated from the region.



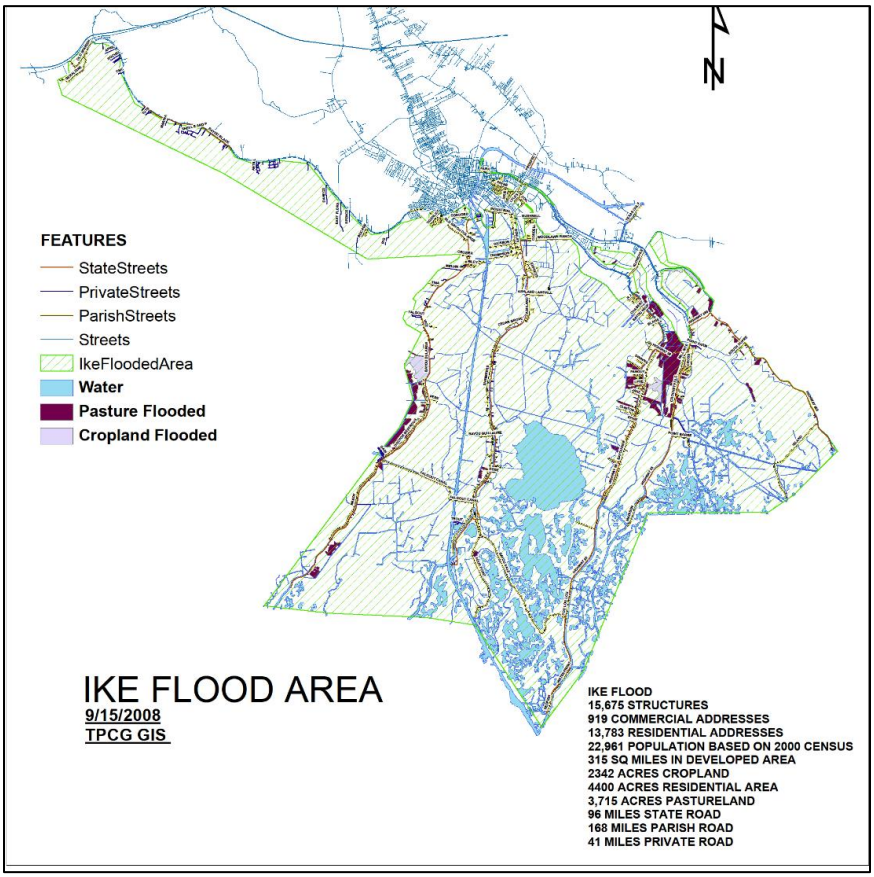
Hurricane Gustav entered the Gulf of Mexico and made its final landfall on September 1, 2008, as a Category 2 hurricane in Cocodrie, Louisiana, a shrimping and crabbing village located in Terrebonne Parish south of Houma. The storm produced maximum sustained winds of 104 miles per hour and inundated the southernmost portion of the parish from the Lower Atchafalaya River to just east of State Route 317. Terrebonne Parish experienced mostly wind damage from the hurricane and avoided widespread flooding.

[2] State of Louisiana Governor's Office of Homeland Security and Emergency Preparedness. State of Louisiana After-Action Report and Improvement Plan: Hurricanes Gustav and Ike.



Another hurricane impacted Louisiana approximately two weeks after Hurricane Gustav. Though Hurricane Ike made landfall in Galveston Island, Texas, on September 12 and 13, 2008, Category 2 winds from Hurricane Ike produced surges in coastal Louisiana that ranged between three feet and six feet in height in areas east of Grand Isle. Storm surge heights increased west of Grand Isle, reaching a maximum of 10 feet at some locations. In Terrebonne nearly every levee was overtopped, and there was widespread residential and roadway flooding. According to NOAA, Hurricanes Gustav and Ike caused between one and two inches of rainfall in Terrebonne Parish. The Louisiana Economic Development Department estimates that Hurricanes Gustav and Ike caused 51 deaths and between $8 and $20 billion in physical damage across the state.

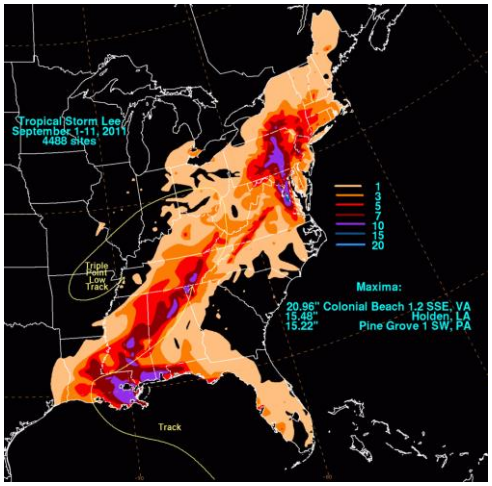
Terrebonne Parish expended approximately $1,973,953.05 on recovery projects that resulted from damages to parish properties from Hurricanes Gustav and Ike. The extent of the flooding for Hurricane Ike is provided below. The projects funded with federal funding from the 2008 storms are ongoing, though most projects are complete.



Tropical Storm Lee (September 2011)

On October 28, 2011, President Obama declared a state of emergency in Louisiana as a result of damage caused by Tropical Storm Lee. The storm made landfall between September 1 and 11, 2011. The tropical storm impacted the parishes of East Feliciana, Jefferson, Lafourche, Plaquemines, St. Bernard, St. Charles, Terrebonne, and West Feliciana. Terrebonne Parish was impacted by tidal surge that brought Bayou Terrebonne to 6.5 feet above sea level at the Montegut floodgate and up to five feet of flood waters into some areas. Between four and five inches of rain fell in the parish. Fortunately, there were no major road closures and no reports of house flooding in northern Terrebonne, although there were reports of homes flooding in the low portions of the parish such as Cocodrie, Isle de Jean Charles, and Pointe aux Chenes.

Tropical Storm Lee Storm Track and Rainfall Data

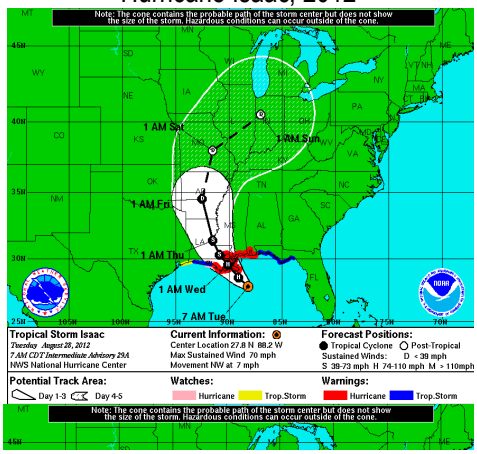


Source: NOAA

Hurricane Isaac Aug. 29, 2012

Hurricane Isaac was a Category 1 hurricane that reached Terrebonne Bay on August 29, 2012.[3] The hurricane generated maximum sustained winds of 80 miles per hour along the coast but weakened to a tropical storm and then a tropical depression as it progressed over southeastern Louisiana. It reached winds of up to 60 miles per hour in Houma. Approximately one billion dollars in damage was caused by the hurricane. According to NOAA, approximately 1.5 and 6 inches of rain fell as a result of the storm.

Hurricane Isaac, 2012



Terrebonne Parish experienced extensive damage to barrier islands and marshland, especially those that were in the process of being restored by the Coastal Protection and Restoration Authority, including Whiskey Island Back Barrier Marsh and Timbalier Island Dune Marsh. Over the last century Louisiana's barrier islands have decreased in land mass, with some decreasing by more than 50%. This trend has significant impacts for future storm surge protection in coastal Louisiana, which is why CPRA endeavored to undertake the Whiskey and Timbalier Island projects. However, damage to these critical restoration projects only compounds the financial toll of resulting property damage on communities. It is estimated that damage to the restoration projects in Terrebonne ($18M) totaled more than the cost of property damage ($16M) caused by the storm in the parish.

[3] http://www.doa.louisiana.gov/cdbg/DR/Isaac/Isaac_Background.htm

In Terrebonne, over 1,000 homes were damaged with approximately 20 homes with reported water inside. Damage in Terrebonne Parish represented a small fraction of the total 59,000 homes damaged statewide by the storm. Roads were inundated and fields of sugar cane were damaged.

Isle de Jean Charles, which is located in the coastal southeastern portion of the parish has been repeatedly damaged with each storm event impacting coastal Louisiana, and Hurricane Isaac is the most recent incidence. Some homes on this island experienced between one and three feet of flooding from Isaac. Many homes have roof and interior damage. As a result, the Louisiana Native American community of Isle de Jean has participated in a voluntary resettlement to a more secure inland Terrebonne Parish location. The Isle de Jean Charles Band of Biloxi-Chitimacha-Choctaw community is the first community in the lower 48 states to be so severely impacted by coastal erosion and sea level rise that permanent relocation has been taken by a majority of the permanent residents. Funding provided through the National Disaster Resilience Competition in 2015 through HUD and the Louisiana Office of Community Development has built houses for 30 families and is constructing 5 more.

The parish endured significant damage and received roughly $1.5 million in HMGP funds for this storm, and $678,000 Community Development Block grants for low to moderate income grant recipients.

Hurricane Barry (2019)

Hurricane Barry landed west of coastal Louisiana and caused $600 million in damages according to the National Weather Service. Terrebonne Parish was not as heavily impacted compared to past events. Maximum 1-minute sustained winds of 75 mph.

National Hurricane Center – Hurricane Barry Track

The surge created a brief overtopping of the levees under construction in Montegut and lower Dularge. There was a call for a mandatory evacuation of structures on Highway 315 and Brady Road south of Falgout Canal while the levee was shored up and the overtopping stopped with a temporary work accomplished by local contractors. The Dularge levee is now at 9’ and had it been at 9’ or completed to the final 12 feet it would not have been overtopped. The Montegut Levee is under construction with completion expected by 2021.

A voluntary evacuation notice was in effect, but the Coast Guard rescued four (4) people and a cat by helicopter from Isle de Jean Charles and eight (8) more by boat and taken to the Houma-Terrebonne Airport for a health evaluation. Many structures on the island are elevated, and each permanent resident has the opportunity through the State LA SAFE resettlement project to relocate to a new home and community in a safer location. Other mitigation efforts for Isle de Jean Charles have been considered.

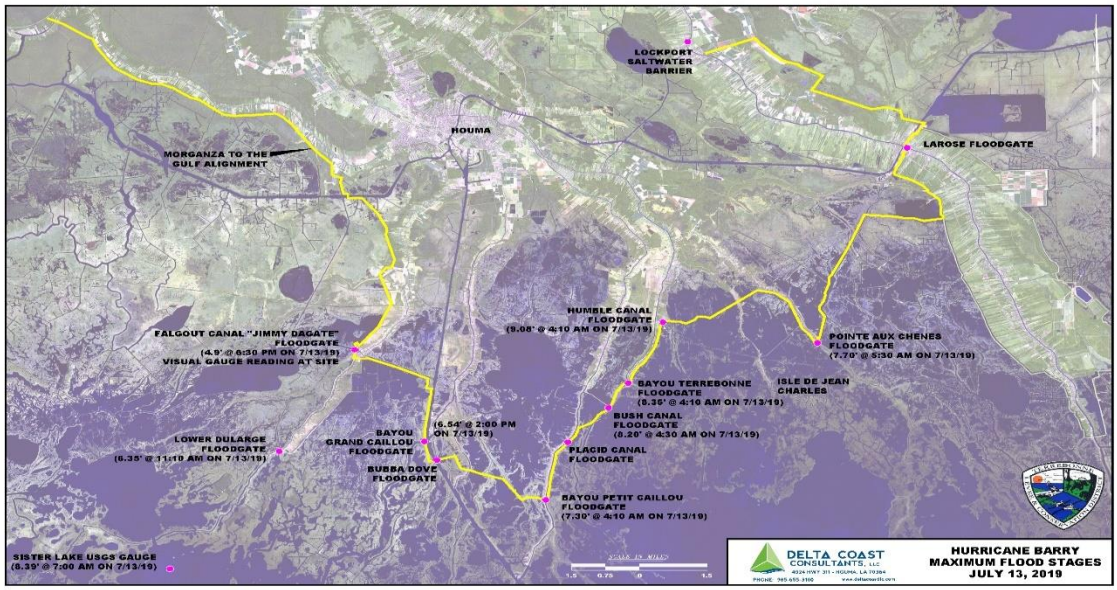
Two structures in Pointe aux Chenes in Terrebonne and eight in Lafourche flooded with reports of 2-4' in the homes. Elevated structures were above the water and no damage was reported (photo right). The Terrebonne residents were insured and have been advised of their nonstructural mitigation options. A temporary levee reach has been constructed to protect the area and further projects considered.

The water height at the Morganza Spillway led to discussions of levee and dam failure, and proposals that would both reduce the pressure on the spillway and provide sediment and freshwater to the marshes in western Terrebonne. These will be discussed in the project section of this plan.

The map below illustrates the protection level of the levee system and the series of gauges that captured high water marks in Terrebonne and Lafourche parish along the MTTG proposed alignment. Note that the current alignment is being proposed to extend beyond Larose to Lockport. Except for the 7.7' high water at the Point aux Chenes floodgate, the high-water elevation readings dropped from east to west. The high-water marks at the floodgates were captured as follows:

- Humble Canal – 9.08';
- Bush Canal – 8.2';
- Bayou Petit Caillou – 7.03';
- Bayou Grand Caillou – 6.54';
- Lower Dularge – 6.35'; and
- Falgout Canal – 4.9'.

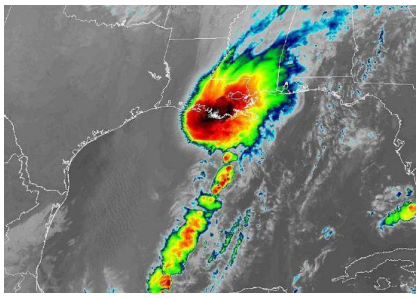
This data helps support the position of the levee district that the levee system may not require a consistent elevation, but one that varies based on the protection of each area. However, Terrebonne has yet to experience a hit directly to the west that could illustrate the outcome of such a storm.



Source: TLCD

Tropical Depression Olga

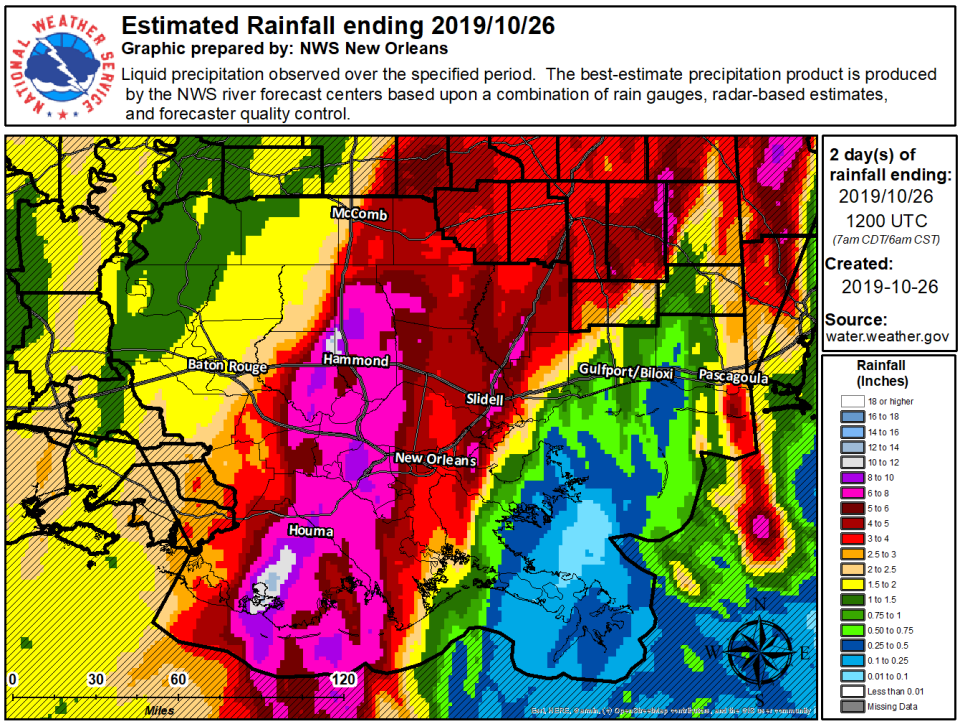
Though not a presidentially declared disaster, Tropical Depression Olga was fast moving, and tested the new defenses of Terrebonne Parish October 25, 2019. The parish closed the Bubba Dove Floodgate on the Houma Navigation Canal in anticipation of three (3) foot wave surges and closed all other floodgates and flood control structures in the MTTG levee system. Pump stations were operating in the forced drainage areas to control any flash floods from the predicted 4" rainfall.



Source: The Times; 10/26/2020

According to the National Weather Service, a swath of heavy rainfall of 6 to 8 inches occurred from Friday into early Saturday from Terrebonne and Lafourche Parishes traveling northeast. Parts of Terrebonne Parish experienced an estimated 10-14 inches. "Widespread and significant street flooding was reported in Houma and surrounding areas during the early morning Saturday. Due to dry soils conditions leading up to the event, only a few [bayous] reached flood stage, with mostly minor flooding reported."

The map below was created for the event using both rain gauges and radar to estimate the total rainfall from this storm.



Source: https://www.weather.gov/lix/OlgaSummary National Weather Service

Some flooding and damages were reported from properties outside the MTTG footprint or where the first lift and associated pump stations haven't been completed. The Louisiana Universities Marine Consortium, or LUMCON, is in Cocodrie outside all flood protections. Fortunately, the coastal laboratory was built elevated, so there are limited areas of the structure that have ever been inundated.

In Bayou Black, residents reported that there was backwater flooding from the closure of the Bayou Black Floodgate, and there was 10-12" in the houses by the time the pump station turned on according to area residents. This risk may be resolved since the Hanson Canal Pump Station is online, and the other two pump stations in that area outlined in the Bayou Black Area Analysis are both funded and underway.

Hurricane Zeta (2020)

On October 26, 2020 Louisiana Governor John Bel Edwards issued a state of emergency for the entire state. The town of Grand Isle issued a mandatory evacuation on October 27 as a voluntary evacuation was ordered for Jean Lafitte that same day. Sustained tropical storm force winds began spreading onshore in southeastern coast of Louisiana around 18:00 UTC on October 28. A wind gust to 52 mph was reported at Houma.

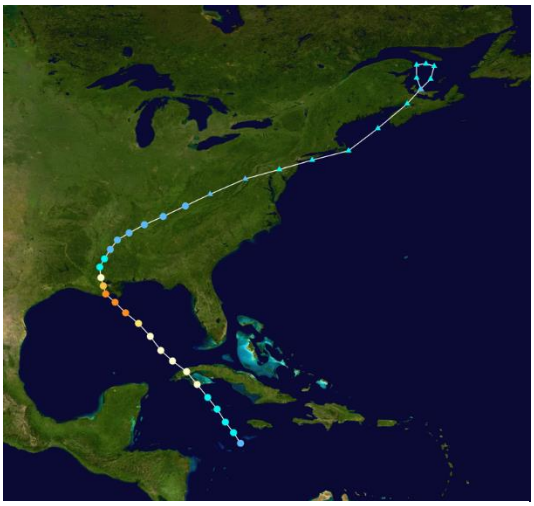
Source: National Hurricane Center; 10/30/2020

A gas station was damaged in Grand Isle and a tree fell on a home in Chauvin. Numerous utility

lines were downed in Houma and storm surge flooded Golden Meadow while also depositing a boat on it. The eye of Zeta moved directly over New Orleans, where winds gusted to 94 mph, a large tree was snapped in Bayou St. John, and a tree was blown down onto a car in the Garden District. Overall, Zeta caused $1.25 billion damage in Louisiana. Zeta produced extensive wind damage across southeast Louisiana with measured sustained winds up to 87 mph and gusts up to 110 mph. Thousands of power poles were downed and thousands of homes experienced minor damage. Storm surge ranged from a few feet to several feet. There was a total of 1 fatality and 1 injury outside of Terrebonne Parish.

Hurricane Ida (2021)

Ida originated from a tropical wave in the Caribbean Sea on August 23rd and on August 26th, the wave developed into a tropical depression, which organized further and became Tropical Storm Ida later that day, near Grand Cayman. On a northwestward track, Ida intensified into a hurricane on August 27, just before moving over western Cuba. A day later, the hurricane underwent rapid intensification over the Gulf of Mexico as it passed over a warm core eddy and reached major hurricane strength. It was just under 72 hours from tropical depression formation to category 4 strength with 150 mph winds. Ida remained at its peak intensity of 150 mph winds and a minimum central pressure of 929 millibars as it made landfall near Port Fourchon midday on August 29th. It didn't weaken to a tropical storm until it reached near the Louisiana/Mississippi border.



Source: National Hurricane Center; 9/4/2021

In Houma, whiteout conditions were recorded, with flying debris and many houses damaged or destroyed. Wireless services were knocked out temporarily. An urgent flood warning was issued for Braithwaite, in Plaquemines Parish, when one of the levees was overtopped.

The parish suffered extreme impacts as the eyewall raked the eastern half of the parish as it moved inland. There was widespread catastrophic damage to structures throughout the parish and both of the parish's hospitals were damaged. According to the parish's substantial damage report, an estimated 750 buildings were substantially damaged including 250 which were completely demolished. Apartment complexes were damaged and a chlorine line break made water provision difficult immediately after the storm leading to a boil water warning. An estimated 60% of homes in the parish's bayou communities were deemed unsafe for habitation, with many losing their roof structures removed, collapsed walls, or trees falling through them. The LUMCON Marine Center in Cocodrie suffered substantial damage, and several public buildings including two fire departments also suffered major structural damage. Most power poles were snapped or damaged. Nearly every road in the parish was blocked by downed trees, utility poles, or other debris. During the storm, 2 offshore vessels broke free, crashing into the Bouquet Bridge near Dulac. The entire parish was left without power and most without water service following

the storm. The strong winds and current caused damage to the parish's main floodgate on the Houma Navigational Canal which was designed to withstand stronger forces from the south.

Ida produced extensive to catastrophic damage across southeast Louisiana. On Grand Isle, around 40% of the structures were destroyed and the island was uninhabitable. Lafourche Parish had similar damages compared to Terrebonne Parish. 100+ mph wind gusts reached as far inland as Interstate 12. These winds damaged more than 30,000 poles, over 36,000 spans of wire and nearly 6,000 transformers. Of those more than 30,000 Louisiana poles, nearly 80% of those broken or damaged are from the most heavily impacted areas. In total, the number of damaged or destroyed poles from Ida is more than hurricanes Katrina, Ike, Delta, and Zeta combined.

Future Hurricane Events

Future hurricane events will occur and will cause major impacts in the future. Warmer temperatures in the Gulf of Mexico will produce more intense hurricane wind speeds. Over the last forty years, the number of major hurricanes has increased while the number of smaller hurricanes has decreased (NOAA/GFDL, 2022). Warmer water temperatures also cause wetter hurricanes, with a 10-15 percent increase in precipitation from storms projected.

Coastal surge will cause additional impacts due to sea level rise. The recorded sea level rise at the NOAA tidal station for Grand Isle, Louisiana (closest to Terrebonne Parish) is shown in Figure 3-4. The sea level will continue to increase in the future.

3.1.3 Saltwater Intrusion Profile

The Houma Navigation Canal is the primary waterway through which saltwater reaches Terrebonne Parish fresh waterways and marshes. At present, normal tide brings saltwater from the Gulf north into the parish by intruding the Gulf Intracoastal Waterway (GIWW). Due to the location of smaller waterways that feed into the HNC, when the saltwater travels north towards Houma, surrounding freshwater marshes are also destroyed. Saltwater intrusion in the GIWW also occurs in a similar manner from tidal influences from Bayou Lafourche. Furthermore, storm events exaggerate saltwater intrusion occurrences as storm surge push more saltwater further inland, reaching more fresh waterways and marshes than would occur during normal tidal events.

To alleviate saltwater intrusion's impacts on the parish, a lock for the Houma Navigation Canal was designed to assist in storm protection and resulting intrusion. The parish has currently installed 10 floodgates and will be adding a lock component to the three bayous that support the most significant marine traffic.

Figure 3-6 illustrates the location of the Houma Navigation Canal and the GIWW in relation to Houma and shows the location of the USGS measurement station that records salinity levels in the channel. According to measurements taken at this station, daily mean salinity levels in the Houma Navigation Canal were recorded at 3.91 parts per thousand for the year 2009, 1.78 for 2010, and 4.89 for 2012 (USGS Water Information System).

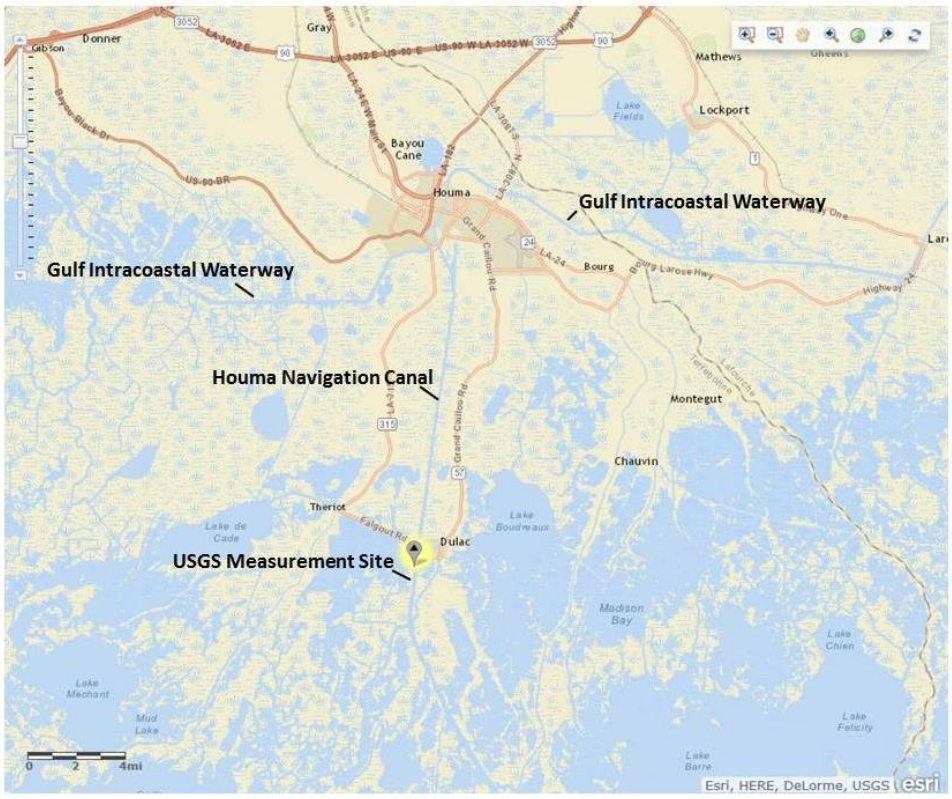


Figure 3-6: Location of HNC and GIWW

As described previously, a marked harm of saltwater intrusion is the loss of marsh or wetland. This leads to further land subsidence, more open water, more erosion of soils, and higher winds over newly open water in a hurricane situation. In the case of a strong northward tidal push due to sustained south winds (as is the case in a tropical storm or hurricane event), saltwater intrusion significantly impacts the parish's potable water sources.

The parish's potable water intakes are jeopardized by salt water from the Gulf of Mexico, especially the Houma water treatment plant #1. There have been documented instances where the City of Houma has resorted to its secondary potable water intake at Houma Water Treatment Plant #2 due to chloride concentrations more than the U.S. EPA's regulatory threshold of 250 parts per million. An example of this occurred following the storm surge of Hurricane Rita.

The parish has the ability to obtain its potable water supply from three different sources referred to as "water treatment plants." A brief description of each source follows.

Schriever Water Treatment Plant. This plant pumps surface water from Bayou Lafourche, which in turn, obtains most of its water from the Mississippi River. In May of 2013 the citizens of Terrebonne Parish voted to join the Bayou Lafourche Fresh Water District thereby guaranteeing an unlimited supply of raw fresh water from Bayou Lafourche. The reservoir at this plant can hold up to a five-day supply at maximum production. In the forty-eight years of operation of the Schriever facility, there has never been a time when the raw water supply, Bayou Lafourche fed from the Mississippi River in Donaldsonville, has been unavailable for an extended amount of time.

Houma Water Treatment Plant #1. The primary source of water for this treatment plant is surface water pumped from the Gulf Intracoastal Waterway (GIWW). The GIWW is fed by a combination of sources, including: rainwater runoff, Mississippi River influence, Atchafalaya River influence, and tidal water influence.

Houma Water Treatment Plant #2. Surface water pumped from Bayou Black serves as the secondary or backup supply of water for this treatment plant. This supply is activated when excessive chloride (salt) concentrations are detected in the GIWW. Currently, a large plant is being built by the water department on Bayou Lafourche that may eliminate the need for water from Bayou Black during any time other than emergencies.

According to Terrebonne Parish Consolidated Waterworks (TPCW), the GIWW source has had problems with salinity for the last 40 plus years but with the proposed Houma Navigational Canal lock system in Dulac, they would expect for that to no longer be the case. The plant has its own reservoir that can be supplied with water from either source at a maximum production/consumption of 3 days of raw water supplies.

Future Saltwater Intrusion Events

TPCW has recorded a trend developing over the years, whereby salinity levels peak during hurricane season between August and November. As saltwater intrusion is a result of hurricane storm surge, one can assume the probability of the occurrence to be the same as a hurricane in any given year, or 81%. Saltwater intrusion events will follow the future probability of hurricane events and will increase due to sea-level rise shown in Figure 3-4.

3.1.4 Levee Failure Profile (includes floodwalls and pump stations)

As previously discussed, a comprehensive system of hurricane protection levees have been constructed in Terrebonne Parish (Morganza-to-the-Gulf). The parish also relies on drainage levees to force water to drain in certain patterns. When confronted with hurricane storm surge of excessive height or velocity, the drainage levees in Terrebonne Parish have historically been overtopped. In addition, degradation of wetlands from storm events and manmade activity exacerbates the impacts of surge in Terrebonne. The parish's drainage levees were not constructed for tropical storm or hurricane induced surge waters. The MTTG is designed for a 12-foot surge, and if in place, would have been two feet higher than the surge for Hurricane Ike.

Considering the four hurricanes (Allison, Lili, Rita, and Ike) which have resulted in failure of forced drainage levees since the year 2000, the probability of levee failure in Terrebonne was estimated at 25% per year in 2015. Rather than wait for federal funding for the Morganza to the Gulf system, the parish funded storm surge protection levees by instituting local taxes and bonds to complete the current system. The contiguous portions of the MTTG levee protection system that has been built to 12 feet will reduce the probability of levee failure in Terrebonne. It should be noted that the Hurricane Barry overtopping was of an incomplete levee that is now at 9' and will be 12' when complete, and is not considered a "failure." This yearly probability varies based on a storm's track in relation to parish levees, as well as the construction of new levees and upgrades to existing levees.

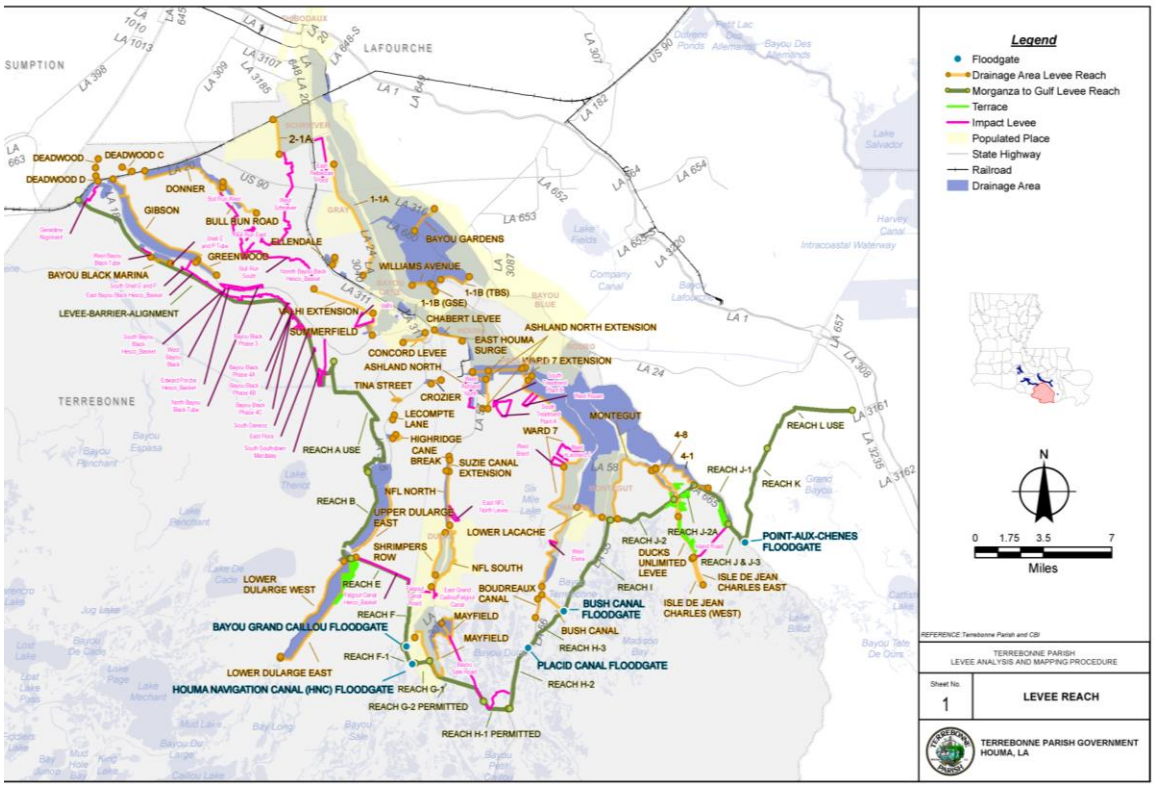
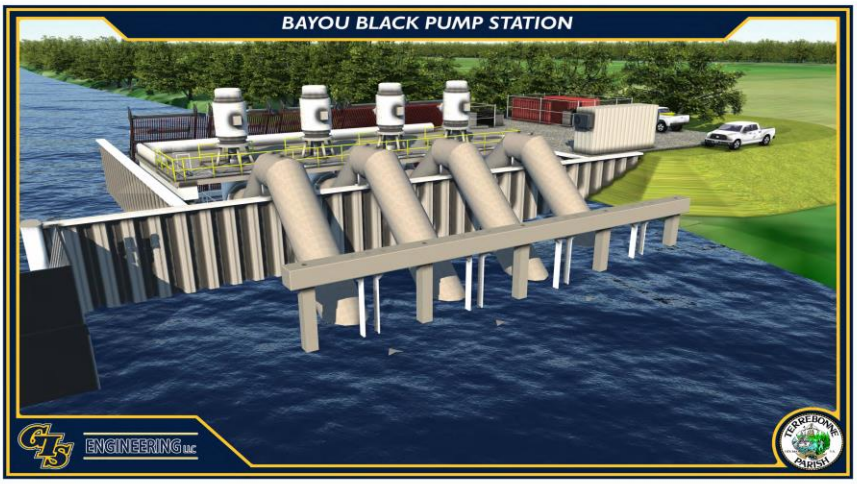
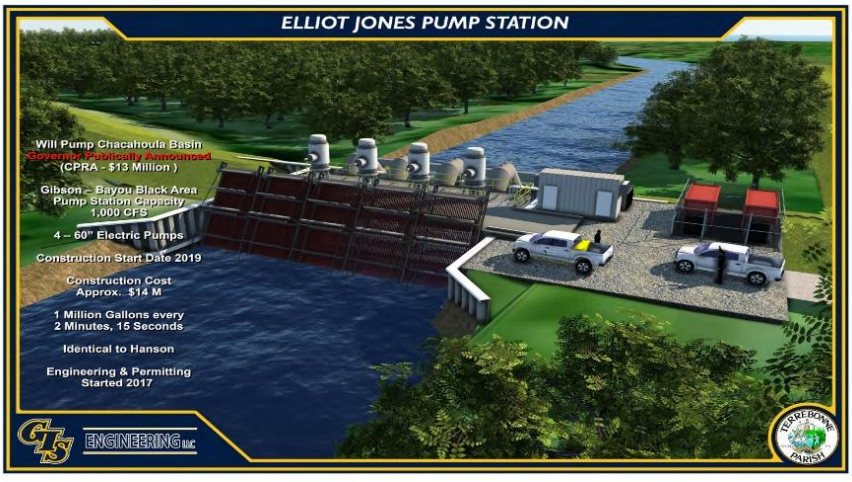


Figure 3-7: LAMP Levee Reach Map (APTIM)

Figure 3-7 shows the LAMP Levee Reach map illustrating the various levees and other mitigating structural installations in the parish considered in the ongoing mapping process. All hurricane protection levees in the parish are maintained by the Terrebonne Levee & Conservation District. There are no USACE certified levees in the parish. All drainage levees and pump stations are operated by TPCG.

Pump stations are also a major consideration in the parish. According to information provided by the Terrebonne Parish Department of Public Works (DPW), there are individual pumps dispersed throughout the parish. These pumps are a critical component of the parish's flood protection system as they facilitate the movement of storm water out of developed areas, over drainage levees, and into the surrounding bayous and marshes. The parish is investing in power redundancy for these pump stations and slowly adding to the Supervisory Control and Data Acquisition (SCADA) remote management for enhanced operability and cameras to ward off vandalism and theft. All new pump stations are fitted with generators to ensure continuous power and operation. The Elliot Jones Pump Station Project is in construction and the Bayou Black Pump Station Project is awaiting an imminent grant from FEMA to implement it. Engineering is preliminary on these projects.





The forced drainage levees and the drainage pumps combine to form individual drainage systems. These systems or areas are managed by the Terrebonne Parish Department of Public Works (DPW). Inundation for hurricane events ranged from two to six feet.

Future Levee Failure Events
Increasing the height of the levee system should help reduce the probability of levee failure in the future. However, sea-level rise and additional major flooding and hurricane events will increase the probability of levee failure.

3.1.5 Tornado Profile

The HMPU Steering Committee concluded that the tornado hazard will be profiled in this plan due to its high probability of occurrence although addressing mitigation measures relative to tornados as a stand-alone hazard will not be considered.

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm or sometimes as a result of a hurricane and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. Tornadoes often form in convective cells like that of thunderstorms or in the right forward quadrant of a hurricane, far from the hurricane eye. The damage from a tornado is the result of high wind speeds and wind-blown debris. Tornadoes can occur at any time of year. Tornado damage severity is measured by the Fujita Tornado Scale based on wind speed shown in Table 3-9. The entire planning area is susceptible to tornadoes ranging between an F0 and F2, as recorded by historic NCEI information.

Because of the unpredictability of tornado paths and the destruction of commonly used instruments, direct measurements of wind speeds have not been made in tornadoes. Wind speeds are judged from the intensity of damage to buildings.

High winds are capable of imposing large lateral (horizontal) and uplift (vertical) forces on buildings. Residential buildings can suffer extensive wind damage when they are improperly designed and constructed and when wind speeds exceed design levels. The effects of high winds on a building will depend on the following factors:

- Wind speed (sustained and gusts) and duration of high winds
- Height of building above ground
- Exposure or shielding of the building (by topography, vegetation, or other buildings) relative to wind direction
- Strength of the structural frame, connections, and envelope (walls and roof)
- Shape of building and building components
- Number, size, location, and strength of openings (windows, doors, vents)
- Presence and strength of shutters or opening protection
- Type, quantity, velocity of windborne debris

A tornado watch is issued to alert people to the possibility of a tornado developing in the area. Under a tornado watch, a tornado has not been seen but the conditions are very favorable for tornadoes to occur at any moment. Conditions favorable for a tornado to occur include:

- Dark greenish or orange-gray skies
- Large hail
- Large, dark, low-lying, rotating or funnel-shaped clouds
- A loud roar that is similar to a freight train

Table 3-9: Fujita Tornado Measurement Scale

Category	Wind Speed	Examples of Possible Damage
F5 (major)	Incredible 261-318 mph	Incredible damage. Strongframe houses lifted off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur.
F4 (major)	Devastating 207-260 mph	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large projectiles generated.
F3 (major)	Severe 158-206 mph	Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; cars lifted off ground and thrown.
F2	Significant 113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; box cars overturned; large trees snapped or uprooted, light-object projectiles generated.
F1	Moderate 73-112 mph	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F0	<73 mph	Light damage. Some damage to chimneys branches broken off trees; shallow rooted trees pushed over; sign boards damaged.

Note: *These precise wind speed numbers are actually guesses and have never been scientifically verified. Different wind speeds may cause similar-looking damage from place to place even from building to building. Without a thorough engineering analysis of tornado damage in any event, the actual wind speeds needed to cause that damage are unknown. Source: NOAA*

A tornado warning is issued when a tornado has been sighted or when Doppler radar identifies a distinctive "hook-shaped" area within a local partition of a thunderstorm line that is likely to form a tornado.

Previous occurrences of tornado events are detailed in Table 3-10 and are shown in Figure 3-8.

Table 3-10: Terrebonne Parish Tornado History, 1957-2019 (NCEI)

Date	Type	Magnitude	Injury	Property Damage
3/21/1957	Tornado	N/A	0	$25,000
5/11/1959	Tornado	F0	0	N/A
11/22/1961	Tornado	F2	0	$2,500
9/6/1967	Tornado	F1	0	$25,000
11/1/1977	Tornado	F1	0	$25,000

Date	Type	Magnitude	Injury	Property Damage
11/8/1977	Tornado	F1	2	$250,000
7/9/1982	Tornado	F0	0	$2,500
2/12/1984	Tornado	F1	0	$250,000
11/16/1987	Tornado	F1	0	$250,000
7/24/1988	Tornado	F1	0	$25,000
3/29/1990	Tornado	F1	7	$250,000
5/28/1990	Tornado	F0	0	N/A
11/1/1991	Tornado	F1	0	$250,000
11/20/1992	Tornado	F1	0	$2,500
1/17/1994	Tornado	F0	0	$5,000
1/18/1995	Tornado	F1	0	$250,000
8/24/1998	Tornado	F0	0	N/A
1/2/1999	Tornado	F1	0	$700,000
3/15/2000	Tornado	F2	36	$10,000,000
8/31/2000	Tornado	F0	0	N/A
12/13/2001	Tornado	F1	0	$100,000
3/31/2002	Tornado	F1	0	$75,000
10/3/2002	Tornado	F1	0	$25,000
7/6/2004	Tornado	F0	0	$5,000
11/2/2004	Tornado	F0	0	$2,000
11/27/2004	Tornado	F1	0	$50,000
3/14/2007	Tornado	F0	0	$5,000
12/26/2007	Tornado	F0	0	$25,000
3/5/2011	Tornado	N/A	0	$50,000
11/16/2011	Tornado	N/A	0	$30,000
2/25/2013	Tornado	N/A	0	$100,000
10/25/2015	Tornado	N/A	0	$0
		Total	**45**	**$12,779,500**

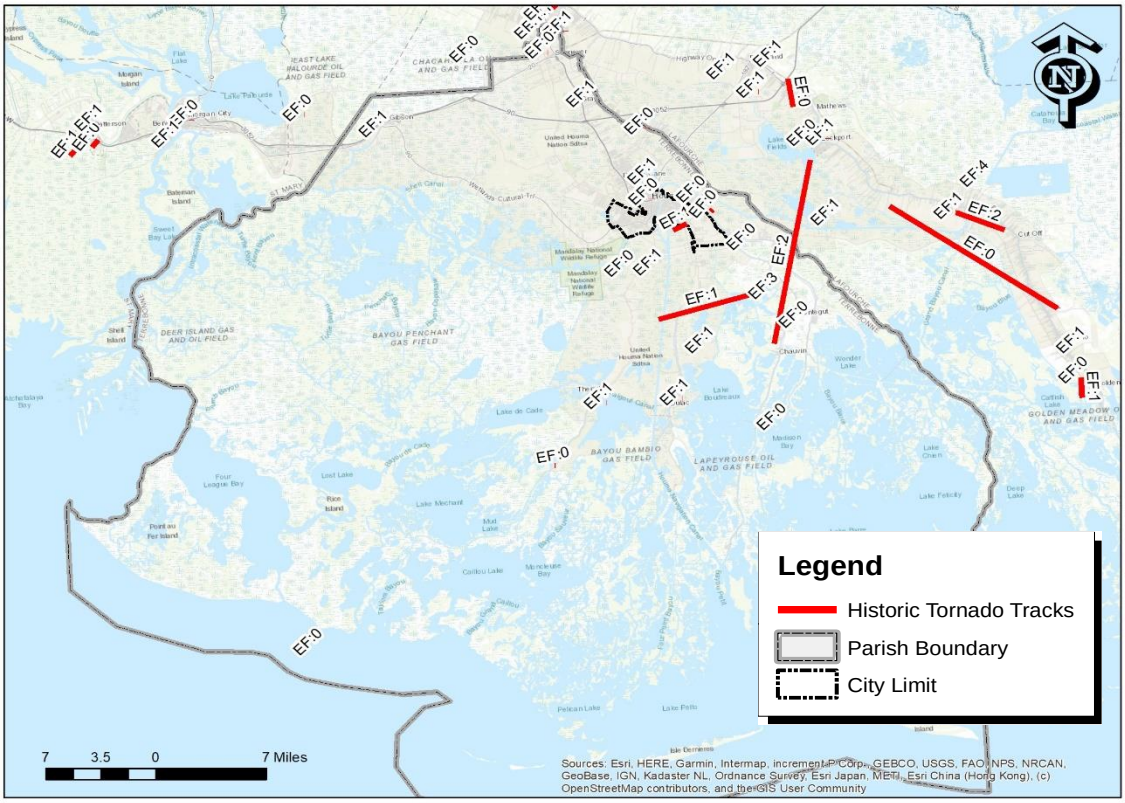


Figure 3-8: Historical Tornadoes (NOAA)

The parish has not had any federally declared disasters due to a tornado alone. Terrebonne Parish Presidential Disaster Declarations for tornadoes are provided in Table 3-11.

Table 3-11: Terrebonne Parish Presidential Disaster Declarations

Year	DR#	Storm Name	Impact	Damage (Billions)
1998	1246	Tropical Storm Frances & Hurricane Georges	Destructive winds, storm surge, tornado, and flooding	$4.60

Terrebonne Parish is most vulnerable to the effects of tornadoes during severe tropical storms and hurricanes. Some structural mitigation actions have been identified which will reduce damages caused by tornadoes; however, some wind mitigation actions identified under the hurricane hazard may also lessen the effects of tornado-force winds.

Future Tornado Events

Climate data from the NOAA reports 33 tornadoes within Terrebonne Parish between the years 1957-2022 with an annual probability of forty-six percent. It is anticipated that this probability will stay the same or become more probable as the number of larger hurricanes increases.

3.1.6 Coastal Erosion

According to Restore or Retreat, a nonprofit organization focused on coastal advocacy, 90 percent of all wetlands loss in the lower 48 states occurs in Louisiana, with approximately 60 percent of Louisiana's land loss occurring in the Barataria and Terrebonne basins. Barataria and Terrebonne Basins are losing between 10 and 11 square miles of wetlands per year, as stated by Restore or Retreat. As discussed earlier, coastal erosion destroys land and removes sediments critical to the existence of environmental features such as beaches and wetlands. High wind and water events, especially wave action, are increasing contributors to coastal erosion. Coupled with land subsidence and sea-level rise, Terrebonne faces marked challenges to storm protection.

In Terrebonne, the most concentrated land loss has occurred south of the Intracoastal Waterway near populated communities. West of Dulac and south of Theriot, significant land loss occurred from 1956 through 1973. Within the same time period, significant land loss occurred south of Montegut as well. Southeast of Morgan City, the period from 1932 to 1956 marked a period of concentrated land loss. More recently, occurring land loss concentrations are located south of Amelia and the Gulf Intracoastal Waterway and west of Montegut.

In addition, tides and heavy storms in the Gulf are eroding Louisiana's marshy coastline at an alarming rate. Coastlines in southern Terrebonne Parish are sinking or eroding away with incoming water eating at the marshes and wetlands that buffer and drain the higher and drier land.

Figure 3-9 shows the relative sea level in coastal Louisiana while Figure 3-10 shows the elevations of the parish.

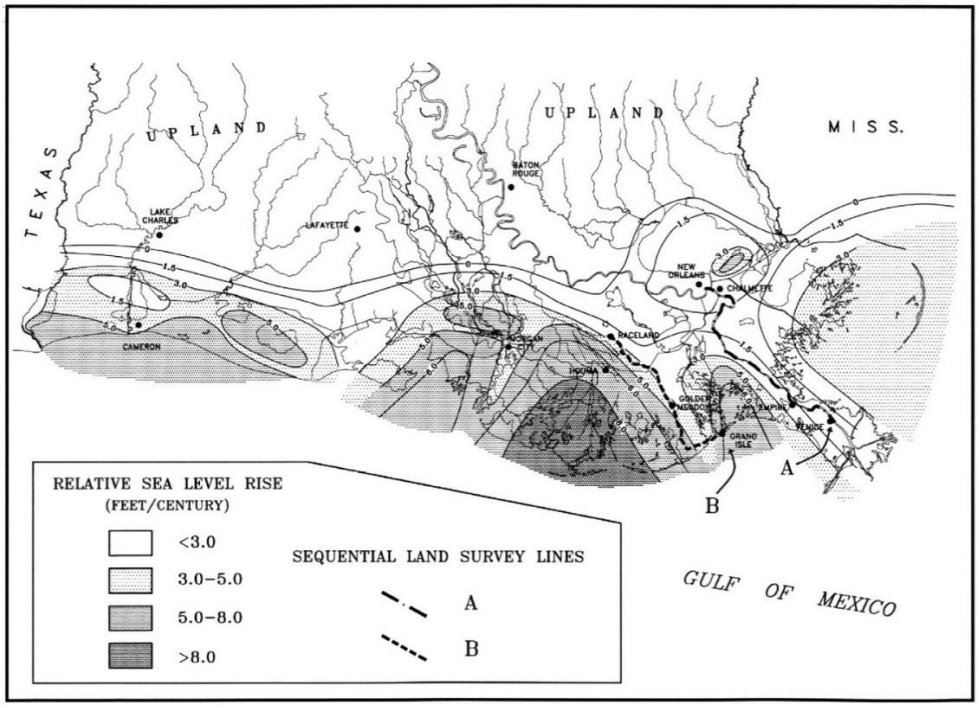


Figure 3-9: Relative Sea Level Rise in Coastal Louisiana

The Parish must research and prioritize methods that are cost effective and will preserve the elevation of land in the Parish. Seasonal sediment deposits historically restoring the soils may be possible on a large scale to raise the wetlands through the sediment pipelines if funded.

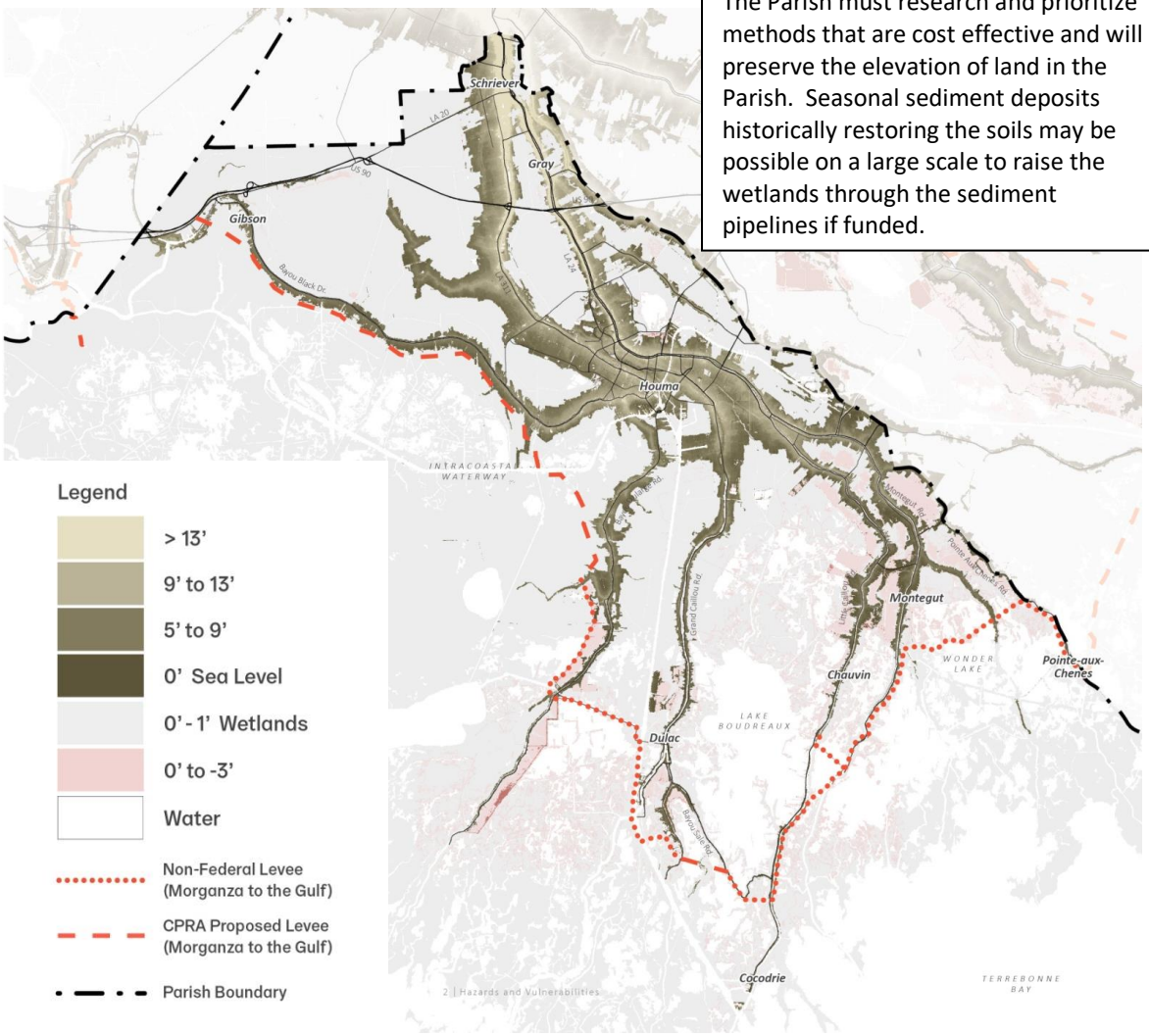


Figure 3-10: Terrebonne Parish Elevations

Evaluating land loss at a narrower geographic scale, the Deltaic Plan of Louisiana has experienced the greatest sea level rise as recorded by USACE tide gage stations located between Cameron, Louisiana to Cedar Key Florida. According to *Faulting, Subsidence and Land Loss in Coastal Louisiana,* the rate of sea level rise attributable to melted glaciers has been exceeded by the rate of sea level rise observed along coastal Louisiana. This increased sea level rise is related to coastal erosion.

Future Coastal Erosion and Land Subsidence Events

Approximately 60.9 percent of Terrebonne's land mass is anticipated to be below sea level by the year 2100. This percentage is nearly double the projected proportion of land below sea level in Terrebonne by 2050.

The aforementioned rise in the proportion of Terrebonne's land mass below sea level is attributable to climate change, according to the National Oceanic and Atmospheric Administration (NOAA). Figure 3-11 shows the percent land below sea level through 2100 of coastal parishes.

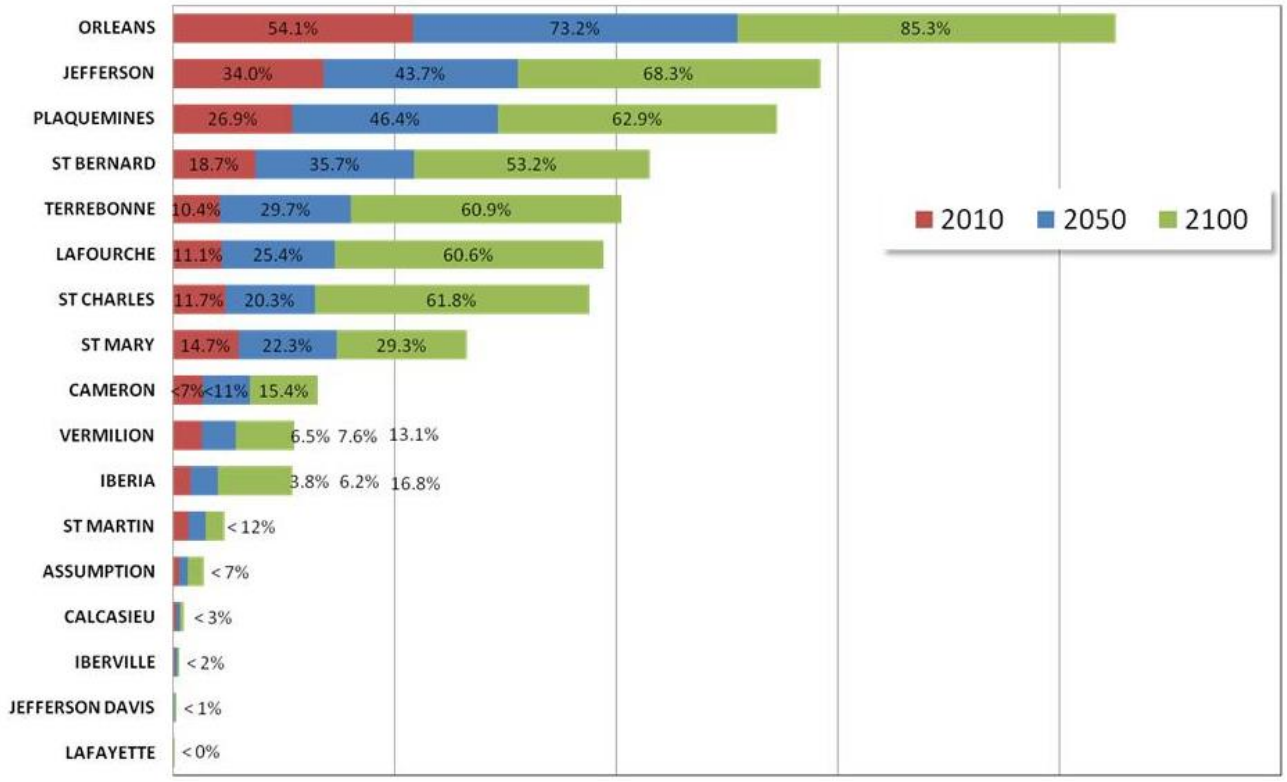


Figure 3-11: Percent Land Below Sea Level by Parish Through 2100

It is difficult to quantify per event loss estimates for strictly coastal erosion in this plan. However, since subsidence heightens the effects of flooding, one can assume subsidence increases flood losses by 0.01% per year. The future probability will increase with sea-level rise.

3.1.7 Lightning Profile

Lightning is a natural electrical discharge in the atmosphere that is a by-product of thunderstorms. Every thunderstorm produces lightning. There are three primary types of lightning: intra-cloud, cloud-to-ground, and cloud-to-cloud. Cloud-to-ground lightning has the potential to cause the most damage to property and crops, while also posing as a health risk to the populace in the area of the strike.

Damage caused by lightning is usually to homes or businesses. These strikes have the ability to damage electrical equipment inside the home or business and can also ignite a fire that could destroy homes or crops.

Lightning continues to be one of the top three storm-related killers in the United States per FEMA, but it also can cause negative long-term health effects to the individual that is struck.

NOAA has developed a lightning activity level (LAL) to measure the number of lightning strikes per 15 minutes which is shown in Table 3-12. Terrebonne can expect all levels (1-6) throughout all areas of the parish.

Table 3-12: NOAA's Lightning Activity Level (LAL)

LAL	Cloud and Storm Development	Lightning Strikes / 15 minutes
1	No thunderstorms.	-
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Similar to LAL 3 except thunderstorms are dry.	

Lightning is a climatological based hazard and has the same probability of occurring throughout the entire planning area for Terrebonne Parish. An extensive search of lightning strikes to have any significant impact to property or people in the Terrebonne Parish planning area over the last several years returned seventeen incidents as shown in the table below with related loss estimates. Table 3-13 identifies the historical events.

Table 3-13: Terrebonne Parish Lightning History (NCEI)

Date	Type	Time	Property Damage	Deaths	Injuries
7/24/1999	Lightning	1100	-	2	0
9/8/1999	Lightning	1300	500,000	0	0
7/25/2002	Lightning	1230	20,000	0	0
6/2/2004	Lightning	550	500	0	0
7/18/2004	Lightning	645	2,000	0	0
8/5/2004	Lightning	2230	-	0	0

Date	Type	Time	Property Damage	Deaths	Injuries
6/6/2005	Lightning	1800	-	0	0
6/16/2005	Lightning	1630	-	0	0
8/21/2005	Lightning	800	15,000	0	0
8/21/2005	Lightning	1530	65,000	0	0
7/1/2007	Lightning	1200	-	0	2
8/17/2008	Lightning	1700	15,000	0	0
7/9/2009	Lightning	834	-	0	1
8/21/2009	Lightning	1455	20,000	0	0
8/20/2010	Lightning	1300	40,000	0	0
6/25/2014	Lightning	1745	2,000	0	0
6/27/2022	Lightning	1300	300,000	0	0

Lightning can strike anywhere and is produced by every thunderstorm, so the chance of lightning occurring in Terrebonne Parish is high. However, lightning that meets the definition that is used by NCDC that actually results in damages to property and injury or death to people is a less likely event. According to the State Hazard Mitigation Plan, a major lightning strike in Terrebonne Parish is likely to occur more than once a year. The annual probability of a lightning strike is 100%.

Future Lightning Events

Since 1999, there have been 17 lightning events that have resulted in property damages according to the NCEI database. The future probability will remain similar although, with additional development, impacts may increase.

3.1.8 Sinkhole Profile

Sinkholes are areas of ground—varying in size from a few square feet to hundreds of acres, and reaching in depth from 1 to more than 100 ft.—with no natural external surface drainage. Sinkholes are usually found in karst terrain—that is, areas where limestone, carbonate rock, salt beds, and other water-soluble rocks lie below the Earth's surface. Karst terrain is marked by the presence of other uncommon geologic features such as springs, caves, and dry streambeds that lose water into the ground. In general, sinkholes form gradually (in the case of cover subsidence sinkholes), but they can also occur suddenly (in the case of cover-collapse sinkholes).

Sinkhole formation is a very simple process. Whenever water is absorbed through soil, encounters water-soluble bedrock, and then begins to dissolve it, sinkholes start to form. The karst rock dissolves along cracks; as the fissures grow, soil and other particles fill the gaps, loosening the soil above the bedrock. The increase of water and soil in the rock pushes open the cracks, again drawing more soil and water into it. This positive feedback loop continues, unless clay plugs into the cracks in the bedrock, at which time a pond may form. A sudden cover-collapse sinkhole occurs when the topsoil above dissolving bedrock does not sink, but forms a bridge over the soil that is sinking beneath it.

Both kinds of sinkholes can occur naturally or through human influence. While sinkholes tend to form naturally in karst areas, sinkholes can form in other geological areas that have been altered by humans such as mining, sewers, hydraulic fracture drilling, groundwater pumping, irrigation, or storage ponds. In all of these cases, and others, the cause for the sinkhole is that support for surface soil has been weakened or substantially removed.

In the United States, 20% of land in the United States is susceptible to sinkholes. Most of this area lies in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. In Louisiana, most of the sinkholes are precipitated by the human-influenced collapse of salt dome caverns. The collapse of a salt dome is usually a slow process; however, it may occur suddenly and without any advance warning.

Currently, there are twelve identifiable salt dome locations in Terrebonne Parish. Figure 3-12 displays the locations of these salt domes. As depicted in the figure, the sink holes are dispersed throughout the parish. Data had not been collected on the area, depth, or rate of expansion at the time of the 2015 Plan Update. TPCG will work to fill in this data gap prior to the next plan update.

There have been no recorded incidents of sinkholes or salt dome collapses in Terrebonne Parish to date. Due to the fact there have been no reported sink holes in Terrebonne Parish, the annual probability for a sink hole is assessed at less than 1%. Figure 3-13 shows the annualized losses for sinkholes by jurisdiction.

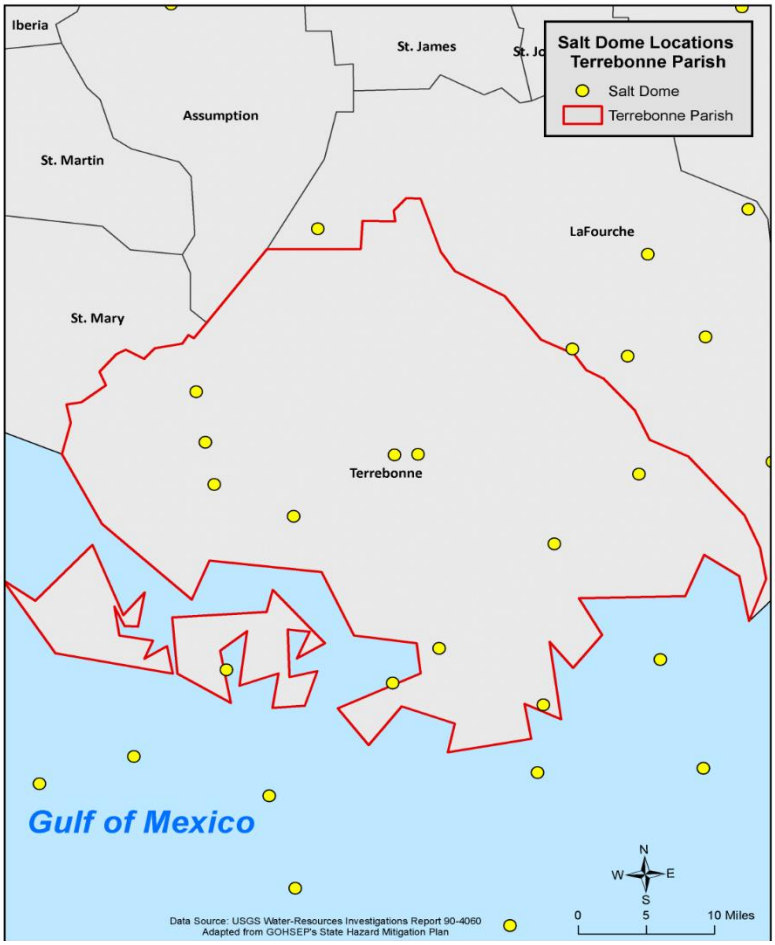


Figure 3-12: Salt Dome Locations in Terrebonne Parish

Figure 3-13: Annualized Losses from Sinkholes

There have been two notable sinkhole incidents in Louisiana, Bayou Corne in neighboring Assumption Parish in 2012, and the Lake Piegneur sinkhole in Iberia Parish in 1980. The Bayou Corne consumed approximately 30 acres, or 0.05 square miles and the Lake Piegneur sinkhole consumed 65 acres or 0.1 square miles. Based on these two previous sinkholes, the area in danger of being immediately consumed by a sinkhole in Louisiana (including Terrebonne Parish) is between 0.05 and 0.1 square miles.

Future Sinkhole Events

Sinkholes occurring in the future have a similar probability as the current probabilities which is assumed to be less than 1% annually.

3.1.9 Land Subsidence Profile

Land subsidence in Terrebonne Parish can be defined as the loss of surface elevation due to the loss of subsurface density. According to *Faulting, Subsidence and Land Loss in Coastal Louisiana,* subsidence in Terrebonne Parish has been measured to be between 2.1' and 3.5' of loss of elevation every 100 years with the probability of continued subsidence at 100 percent.

It is assumed that subsidence has always occurred in Terrebonne, but because seasonal flooding and the sediment associated with it has been limited by water control structures, the natural balance has been adversely affected by man-made structures. Subsidence is caused by a diverse set of human activities and natural processes. Those two causes are profiled below.

Collapse of surface materials into underground voids is the most dramatic form of subsidence. In Terrebonne Parish, it is assumed that the removal of oil and gas deposits have caused most of the subsidence-related voids in this area. The area most affected by this process has been the wetlands. In the early part of the 20th century, this area was found to be rich in oil and gas, and significant amounts of these resources were removed from the wetlands.

Two related factors contributing to subsidence in Terrebonne Parish have been the disconnection of Bayou Terrebonne to the Mississippi River and the introduction of levee systems. The construction of levee systems with forced drainage has eliminated natural river sediment functions from occurring. These forced drainage areas have essentially dried out and compacted at a higher rate than surrounding areas, causing subsidence within the levee system. These risks are most prominent in the Southern region of Terrebonne Parish, south of the Intracoastal Canal but areas to the north have been affected, to a lesser extent. Maximum rates measured by geodetic surveys are approximately 0.5 inches per year.

All states with low-lying coasts are vulnerable to accelerated sea-level rise, but Louisiana's coast is much more so because of the subsidence of the Mississippi River delta. Until humans intervened, the surface elevation of the broad delta complex had kept pace with rising sea level for several thousand years, largely because the river built delta lobes and nourished wetland vegetation. The rates of natural subsidence and sea-level rise along the Louisiana coast have been exacerbated by human modifications, primarily levees which have isolated the Mississippi River from a delta complex that depends on an annual flooding cycle. These modifications cut off the delta-building process of the river. Louisiana's coastal system has also been heavily impacted by channels dug for navigation and mineral extraction, which have allowed high-salinity Gulf waters to migrate inland. Over a million acres of coastal land have been lost since the 1930s, and between 25 and 35 square miles continue to be lost each year. Louisiana's coastal ecosystems are threatened with systemic collapse.

Areas of Terrebonne Parish, as described above, face a high risk of continued subsidence in years to come. Terrebonne Parish is highly vulnerable to continued subsidence due to its close proximity to the surrounding wetlands, highly organic soils, and dependence on forced drainage systems which remove water from localized areas.

Terrebonne Parish is located within a local planning unit that has a "high" subsidence rate that ranges between 2.1' and 3.5' of land loss per century.

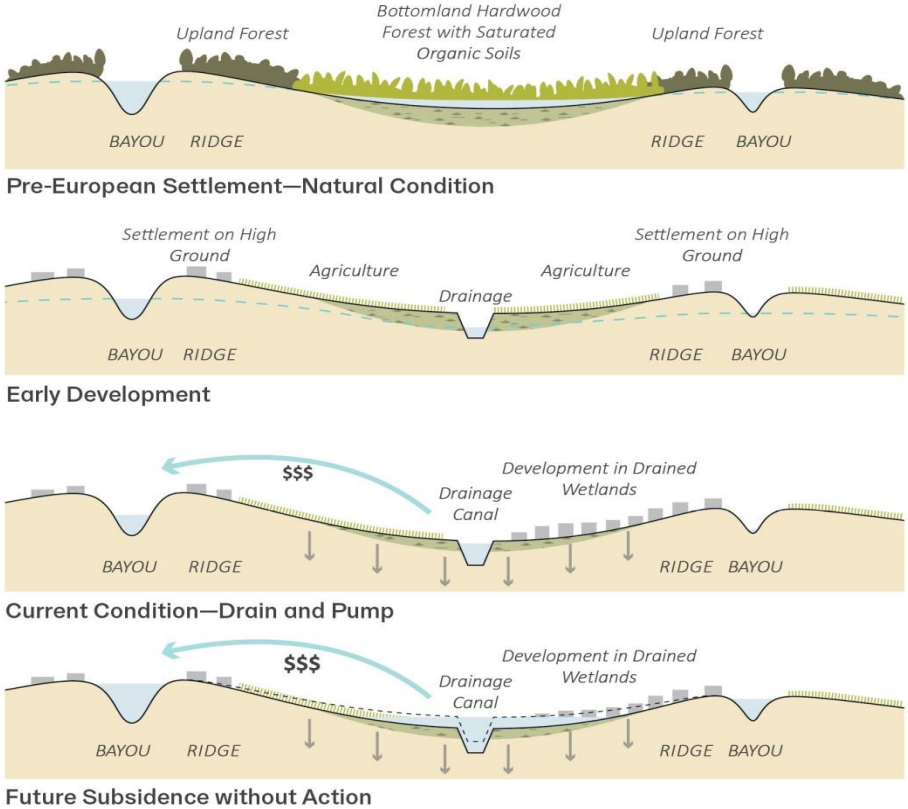
Terrebonne Parish experiences shallow subsidence from compaction of soils both in the coastal areas, and the forced drainage areas. The subject was discussed at length in the LA SAFE meetings, and the following synopsis captures that discussion.

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

The parish and the state Adaptation Plan both propose engagement of an approach that uses gray and green infrastructure to meet a balance between keeping water on the land, and protecting the built environment.

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

The graphic below illustrates how the change in pumping practices can encourage or exacerbate subsidence unintentionally. This is a critical point to understand now that such a large area of the parish is in a forced drainage.



LA SAFE Terrebonne Parish Adaptation Strategy, p. 51.

The subcommittee developed in 2019 has committed to review the actions that can be taken to ensure that the water can be pumped from the system to reduce flooding while retaining sufficient soil saturation

to support the built and natural environments. This group has been distracted by Hurricane Ida recovery efforts and COVID prior to that, and will reconvene this summer (2023) with the coordination of Parish staff.

The subsidence potential of the area is in part due to the types of soils, each of which respond at different levels of subsidence when dry. The soils have been mapped and the level of risk that they will subside captured (see Figure 3-14 below).

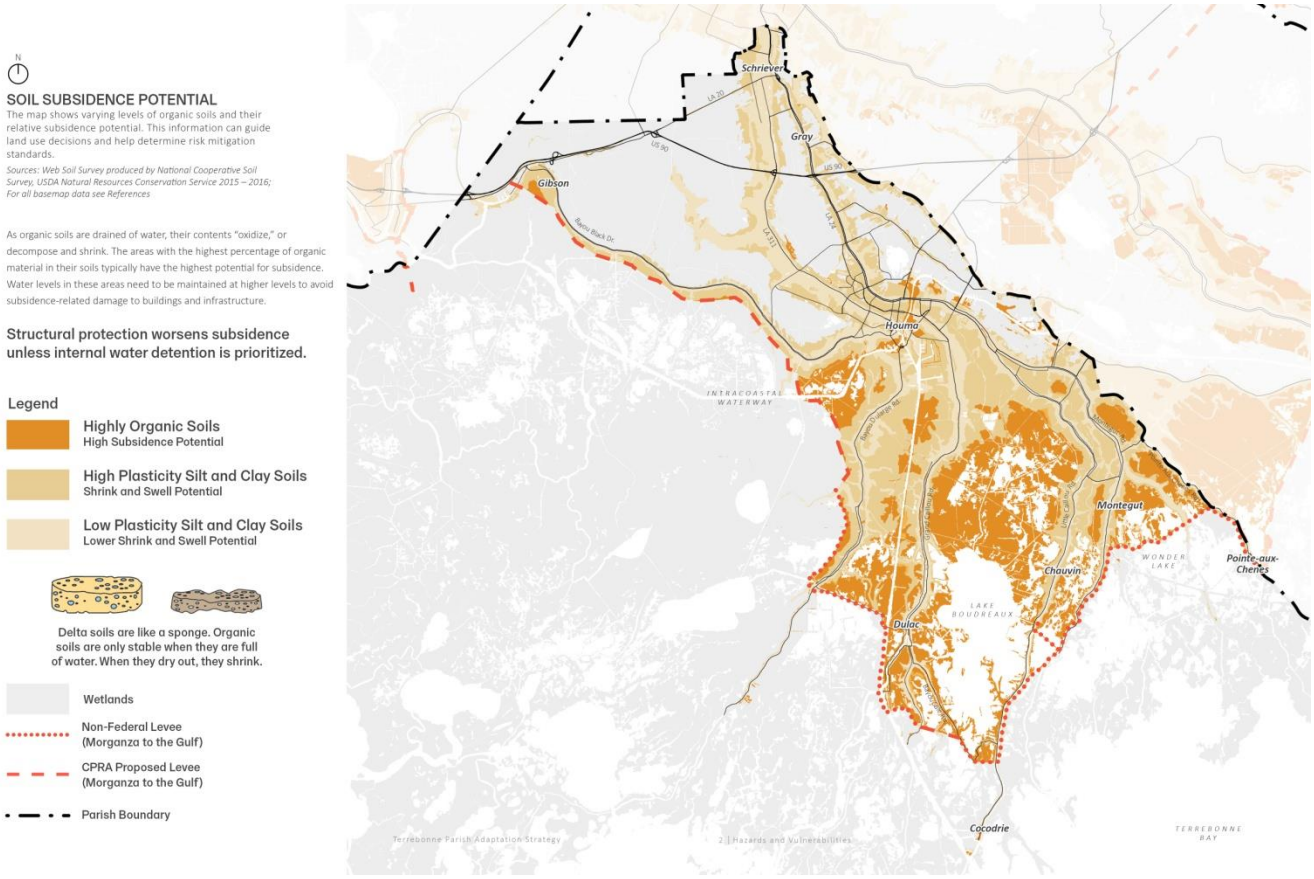


Figure 3-14: Soil Subsidence Potential (LA SAFE Terrebonne Parish Adaptation Strategy, pp. 52-53)

Future Land Subsidence Events

Subsidence in the future will be similarly to previous probabilities with smart development practices in place.

3.1.10 Extreme Temperatures Profile

What is considered an excessively cold temperature varies according to the normal climate for that area. Whenever temperatures drop decidedly below normal and wind speed increases, heat leaves the human body more rapidly, increasing the possibility of negative effects of the extreme cold temperatures. When cold temperatures and wind combine, dangerous wind chills can develop. Wind chill is how cold it feels when outside and is based on the rate of heat loss on exposed skin from wind and cold. As the wind

increases, it draws heat from the body, driving down skin temperature, and eventually the internal body temperature. Therefore, the wind makes it feel much colder than the actual temperature.

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it. Hypothermia is most likely at very cold temperatures, but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red, cold skin and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death.

In addition to the threat posed to humans, extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the electrical grid, which can lead to temporary outages. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service. Some of the secondary effects presented by extreme/excessive cold include dangerous conditions to livestock and pets.

A heat wave is a prolonged period of excessive heat, often combined with high humidity. These conditions can be dangerous and even life-threatening without proper precautions. Heat-related illnesses, like heat exhaustion or heat stroke, happen when the body is not able to properly cool itself. Extreme heat can cause injury or death to humans and animals.

Heat is more harmful to human health when humidity is high because humid air hinders the evaporation of sweat, and thus reduces the body's ability to cool itself. To determine the effect of both heat and humidity, the National Weather Service formulated the Heat Index. These Heat Index thresholds were utilized as criteria for the issuance of heat advisories and excessive heat warnings. This index is a measure of how hot it really feels when relative humidity is factored in with the actual air temperature. The danger an individual experiences is highly dependent on age, with the elderly and the very young at a higher risk of a heat disorder or death than an average adult.

Previous occurrences of extreme temperature events are detailed in and are shown in Table 3-14.

Table 3-14: Terrebonne Parish Extreme Temperature History, (NCEI)

Date	Type	Injury	Property Damage
6/19/1998	Heat	1	$0
8/10/2011	Heat	0	$0
2/2/1996	Cold	0	$0
12/18/1996	Cold	0	$0
1/2/2010	Cold	0	$100,000

Future Extreme Temperature Events

Days with extreme heat are going to increase in the future. According to the Climate Explorer which presents future climate scenarios using the Localized Constructed Analogs (LOCA) method (Pierce et al. 2014), days with temperatures over 90°F will double by 2050 (shown in Figure 3-15).

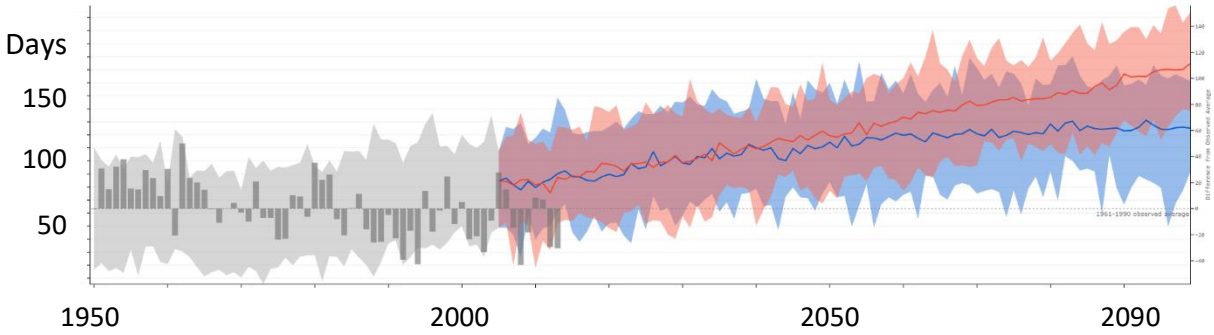


Figure 3-15: Days with Temperatures over 90°F shown by Year

Days of extreme cold will also increase due to the Arctic warming which is increasing the number of extreme cold temperatures. Figure 3-16 shows how the Arctic changes lead to cold waves in the southern U.S.

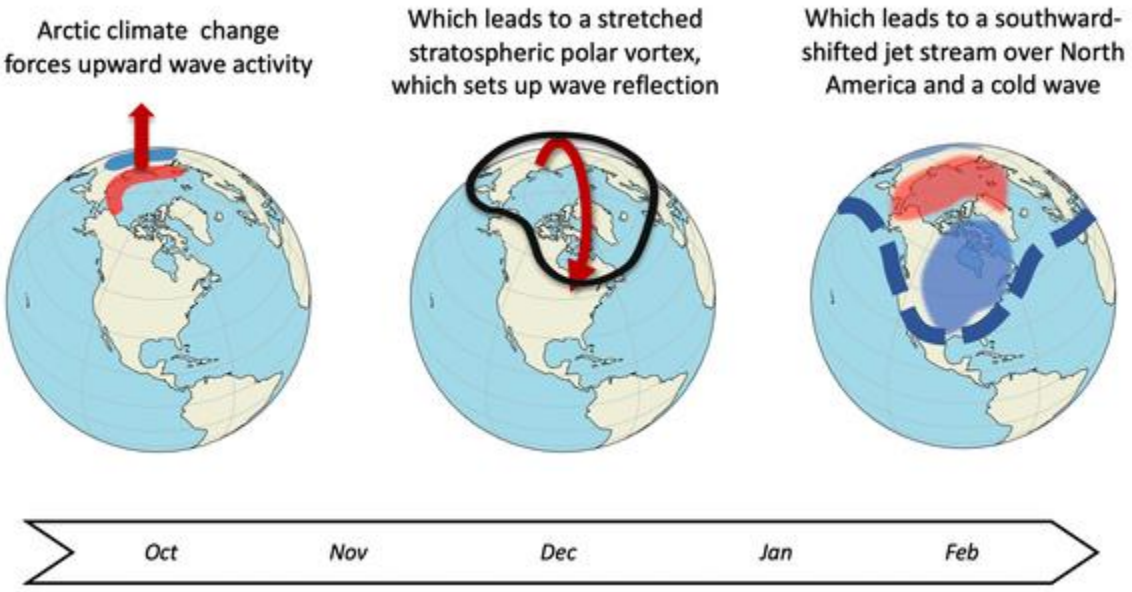


Figure 3-16: Linking Arctic Variability and Change with Extreme Winter Weather in the U.S. (Science, 2021)

3.2 Inventory Assets and Vulnerability Assessment

§201.6 (c)(2)(ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

This section provides an inventory of community assets including critical facilities. It is important to identify any critical facilities which may be impacted by hazard events. For many of the hazards, an analysis has been conducted at the site level to identify all buildings which may be impacted. These results have been categorized by how the building is used (e.g. residential, commercial, industrial, etc.). To get to this level of detail, parish parcel data and building footprint data were used. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. Table 3-15 shows the total number of buildings; and structure, content, and total replacement values.

Table 3-15: Terrebonne Parish Building Stock

Building Occupancy	Total Buildings	Structure Replacement Value ($)	Content Replacement Value ($)	Total Replacement Value ($)
Single-Family Housing	38,611	13,821,578,584	6,910,789,292	**20,732,367,876**
Manufactured Housing	1,342	63,085,868	31,542,934	**94,628,802**
Multi-Family Housing	2,602	1,789,707,254	894,853,627	**2,684,560,881**
Other Residential	32	117,191,722	58,595,861	**175,787,583**
Commercial	4,618	5,487,944,294	5,487,944,294	**10,975,888,588**
Industrial	621	835,908,555	1,253,862,833	**2,089,771,388**
Government	156	386,321,890	455,162,823	**841,484,713**
Education	91	714,897,856	722,610,399	**1,437,508,255**
Agricultural	17	7,904,825	7,904,825	**15,809,650**
Religious	133	256,153,427	256,153,427	**512,306,854**
TOTAL	**48,223**	**23,480,694,275**	**16,079,420,315**	**39,560,114,590**

Due to the number of facilities the parish wanted to assess; the Steering Committee decided to create two tiers. Tier one facilities include emergency response, utilities, and municipal structures while tier two includes assisted living, home health, housing authority, child care, civic center, groceries, pharmacies, libraries, and gas stations. A complete list of the critical facilities can be found in Appendix D. Figure 3-17, Figure 3-18, Figure 3-19, Figure 3-20, and Figure 3-21 show the tier 1 facilities while Figure 3-22, Figure 3-23, Figure 3-24, Figure 3-25, and Figure 3-26 show the tier 2 facilities.

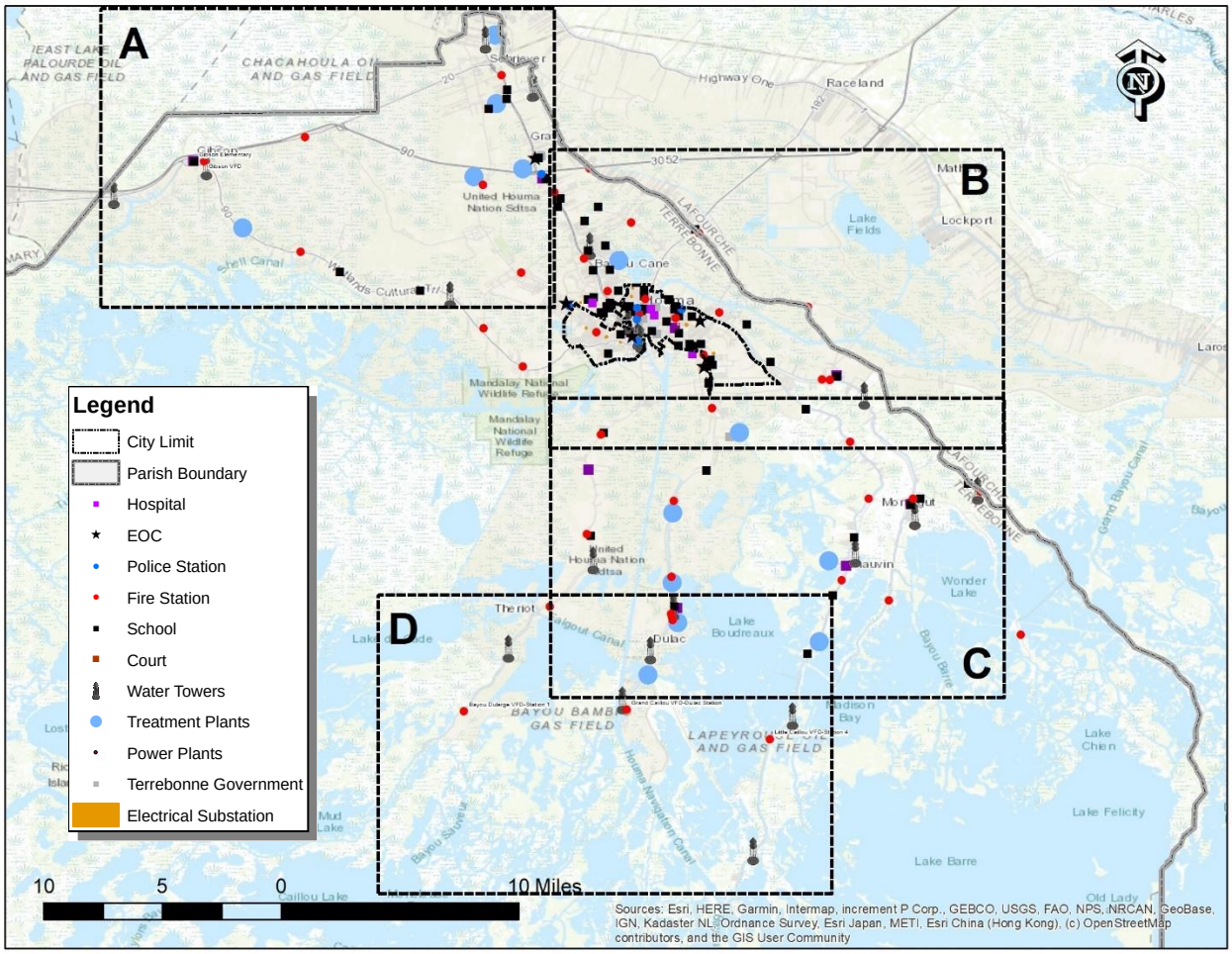


Figure 3-17: Critical Facilities - Tier 1

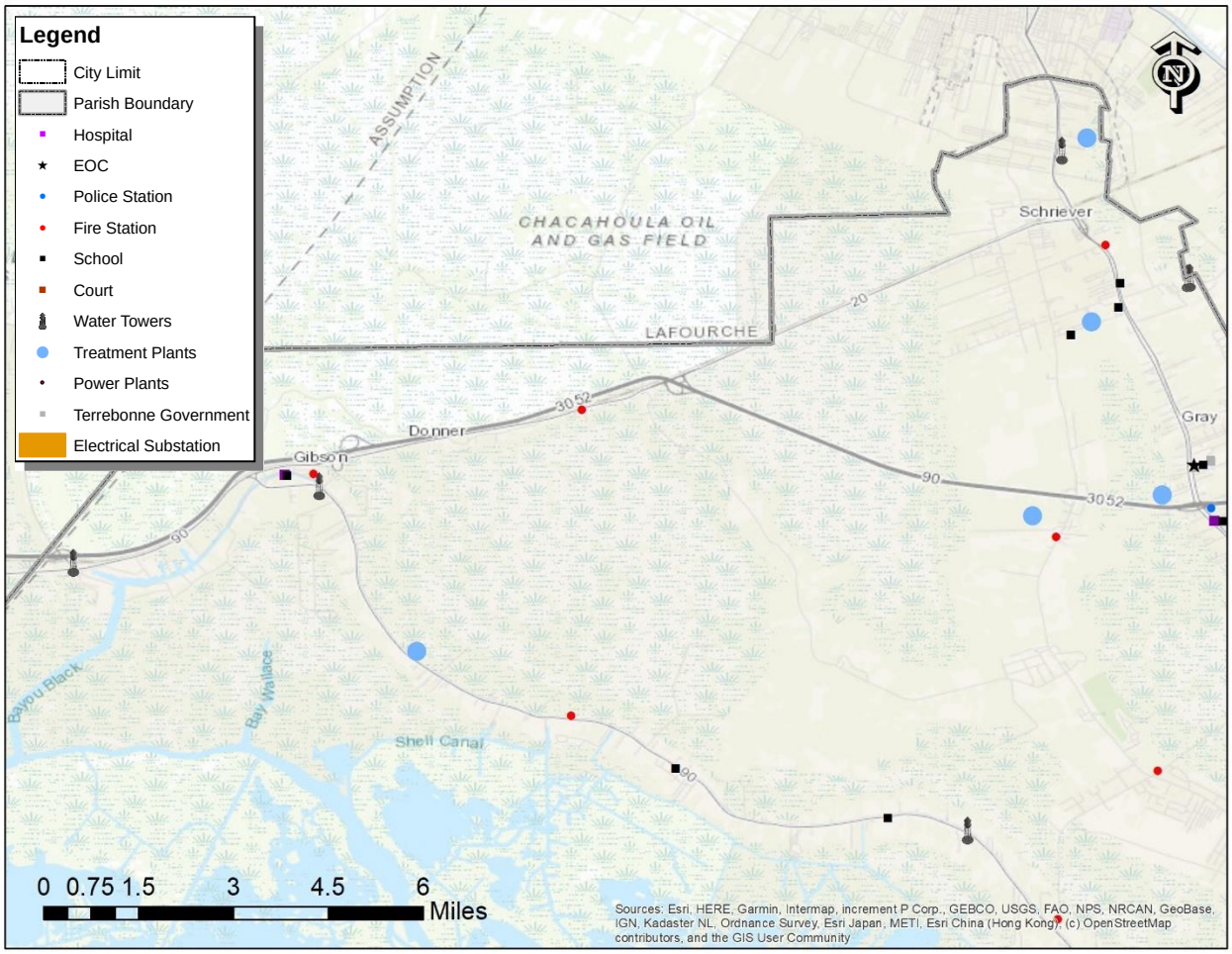


Figure 3-18: Critical Facilities - Tier 1 Section A

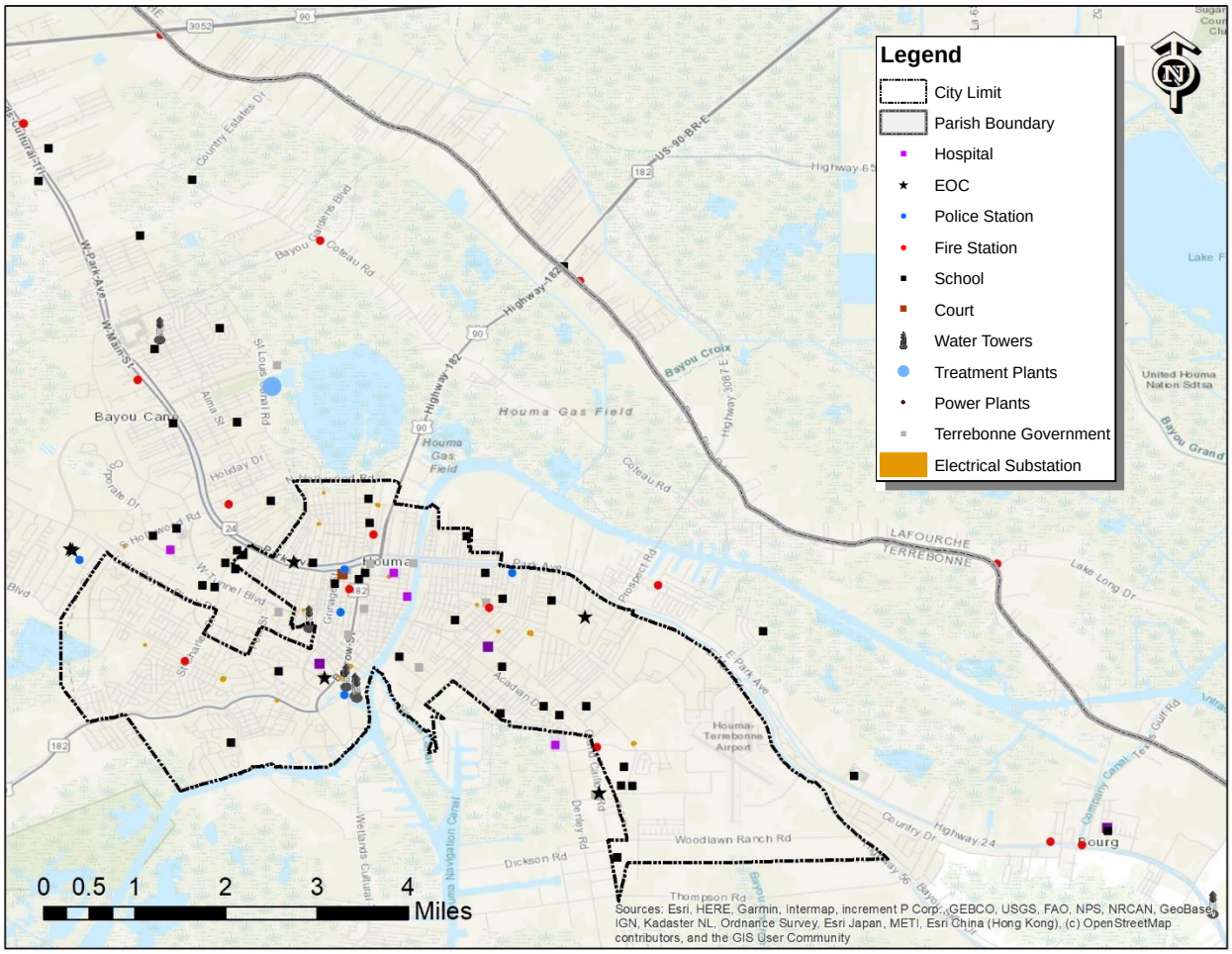


Figure 3-19: Critical Facilities - Tier 1 Section B

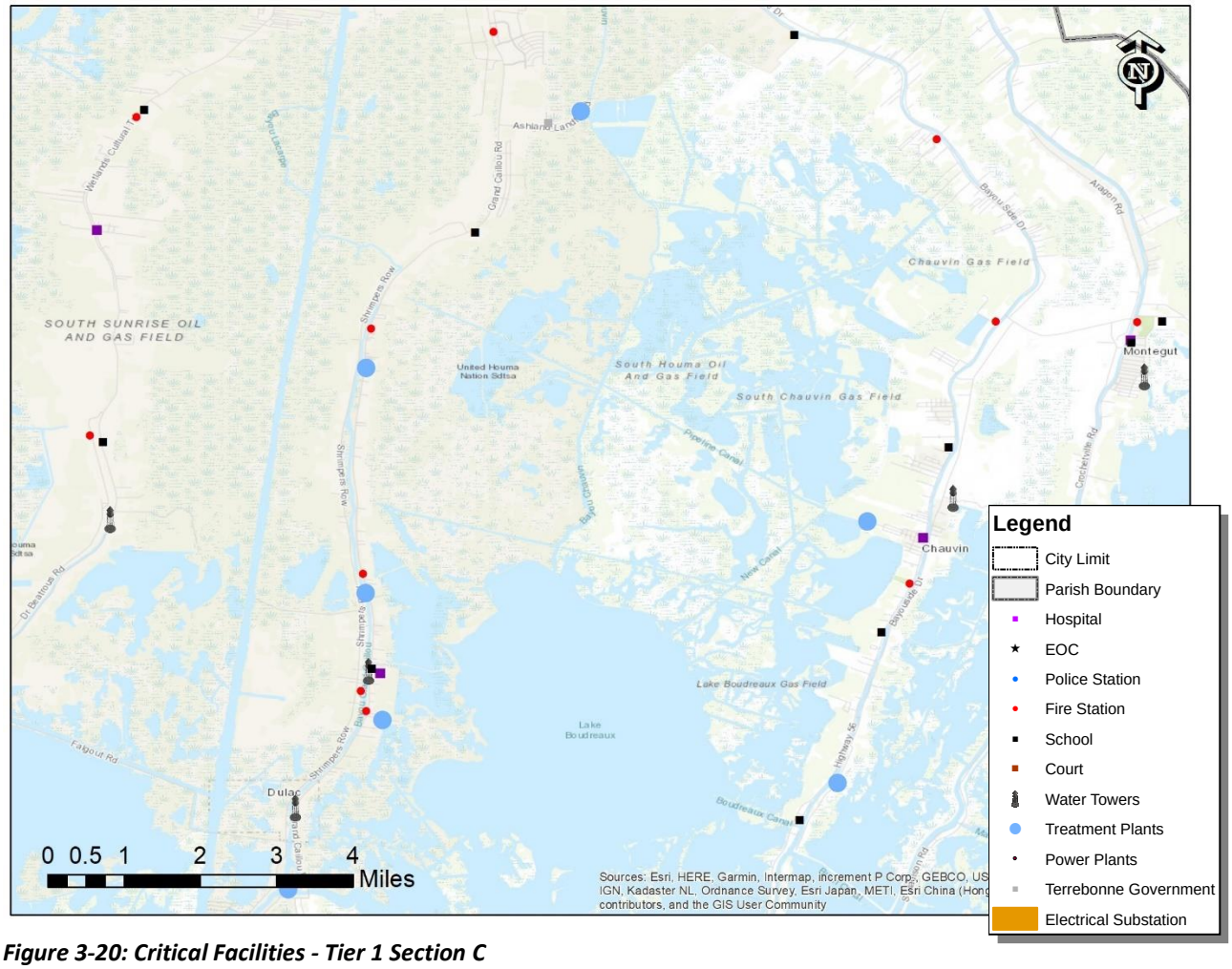


Figure 3-20: Critical Facilities - Tier 1 Section C

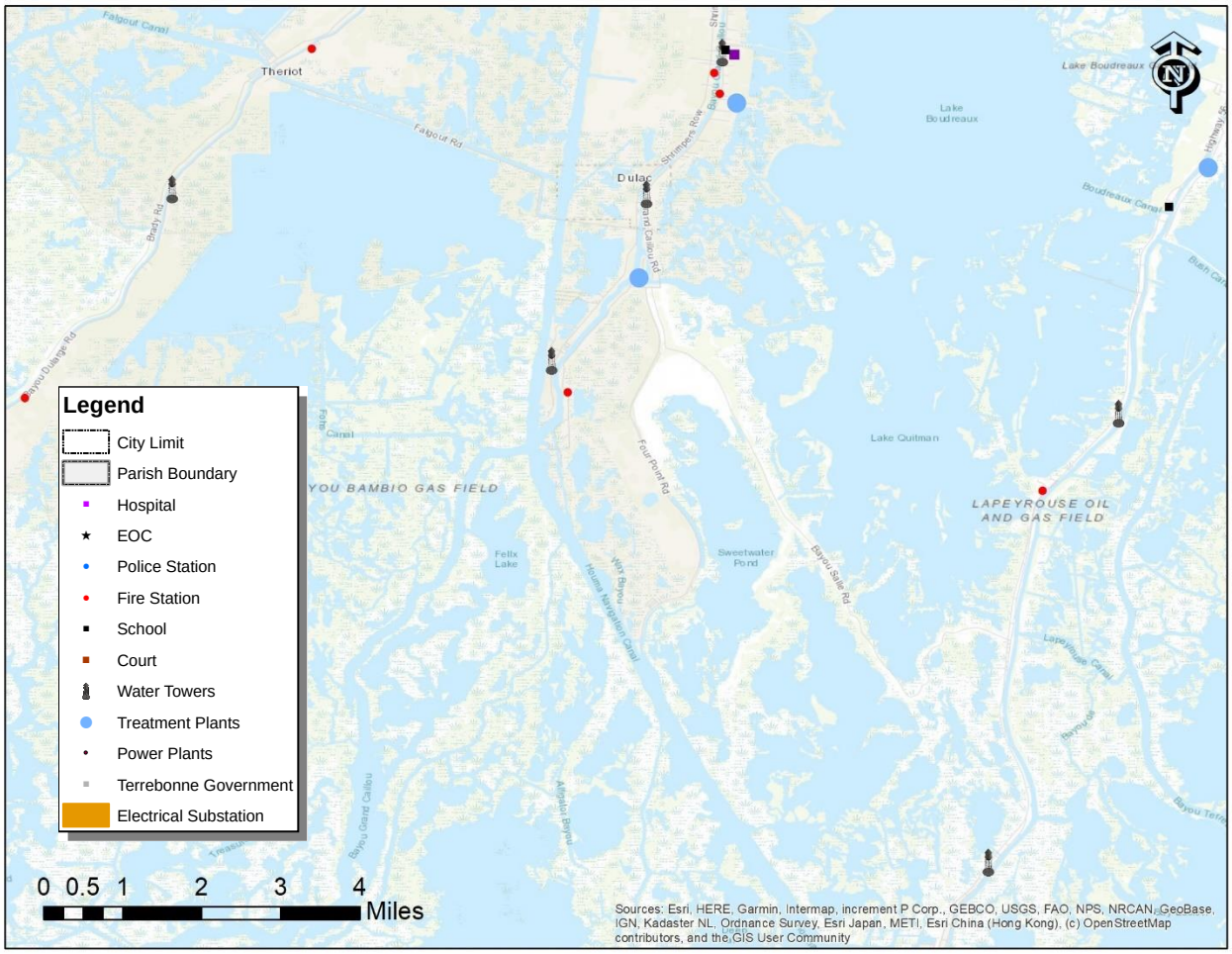


Figure 3-21: Critical Facilities - Tier 1 Section D

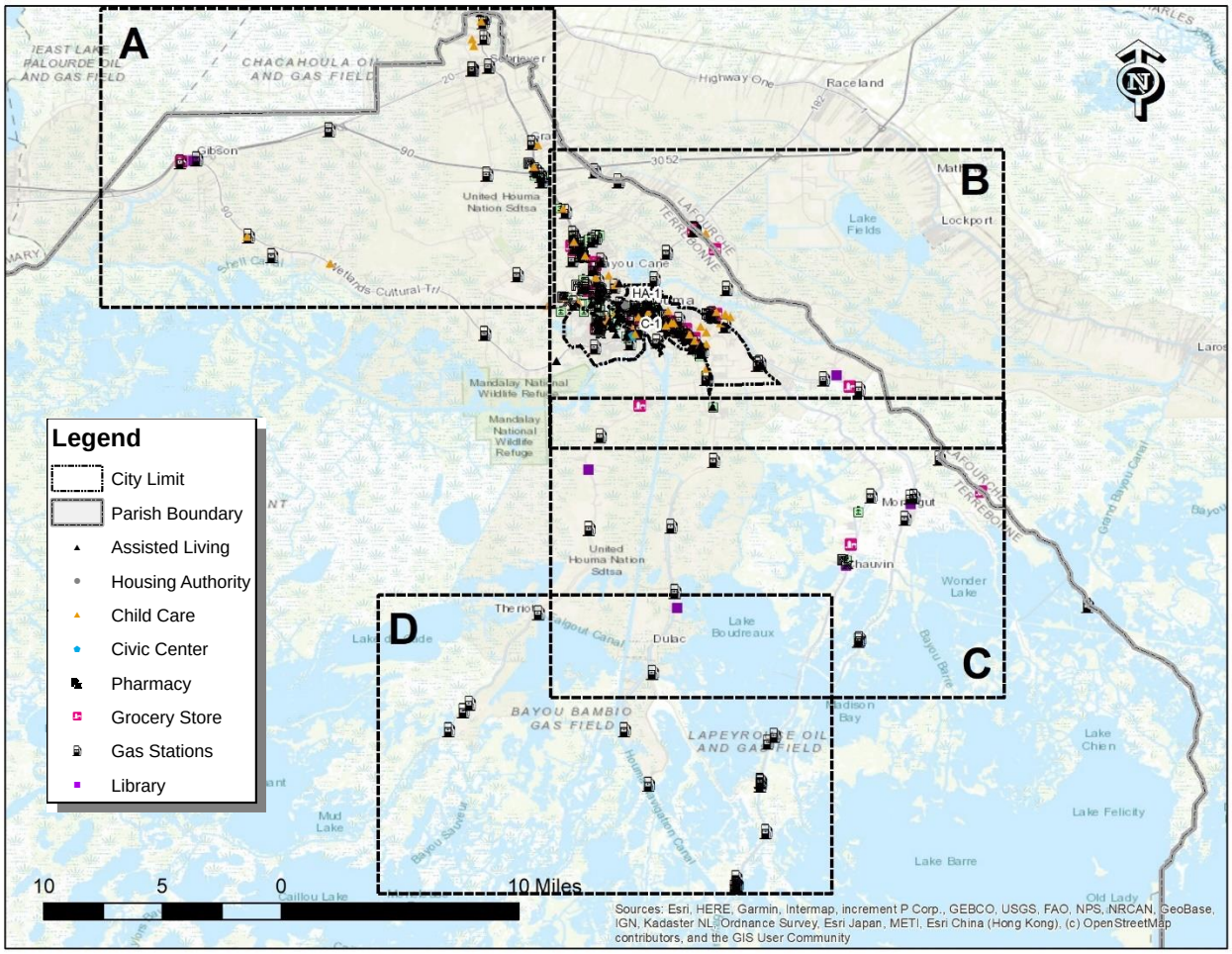


Figure 3-22: Critical Facilities - Tier 2

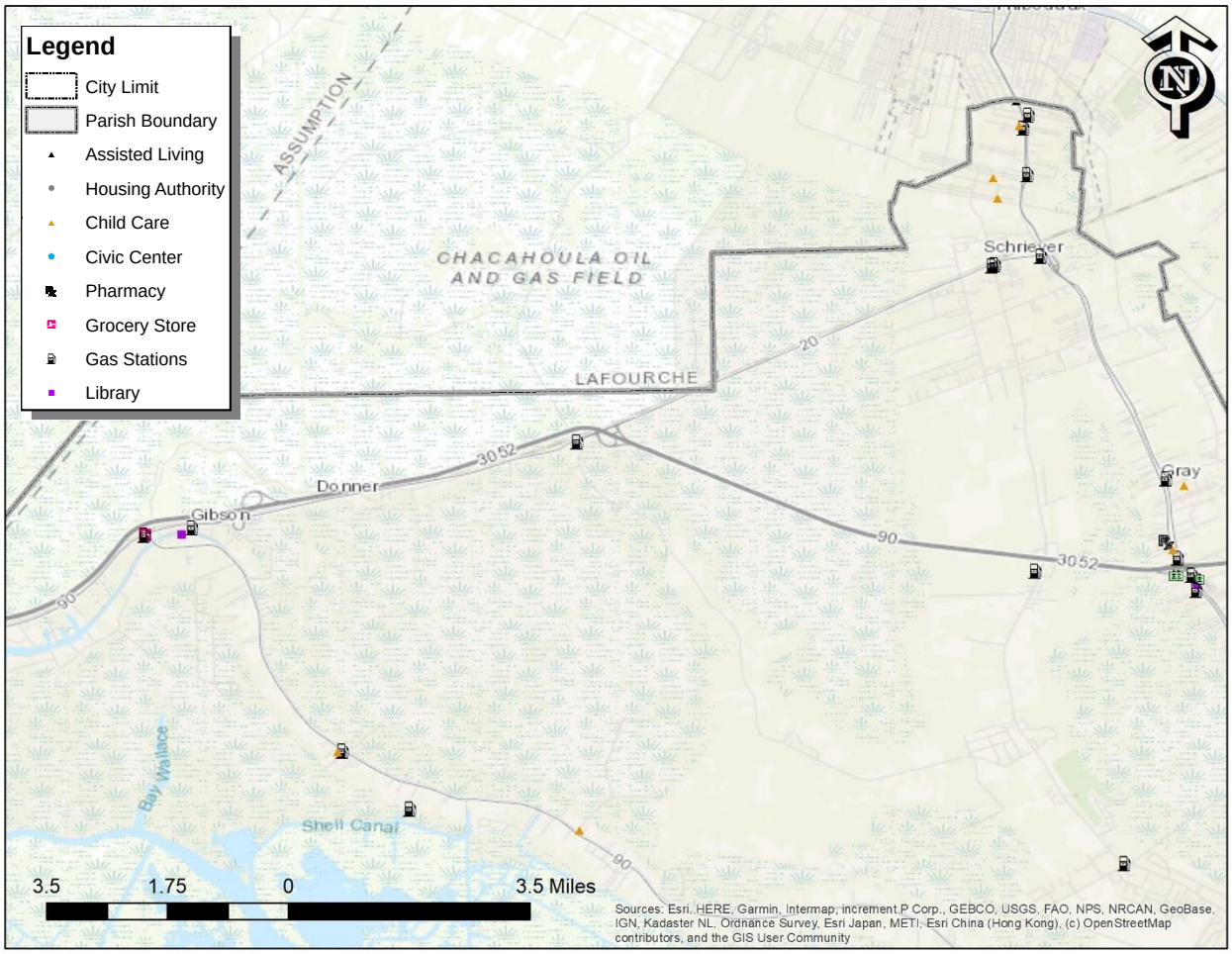


Figure 3-23: Critical Facilities - Tier 2A

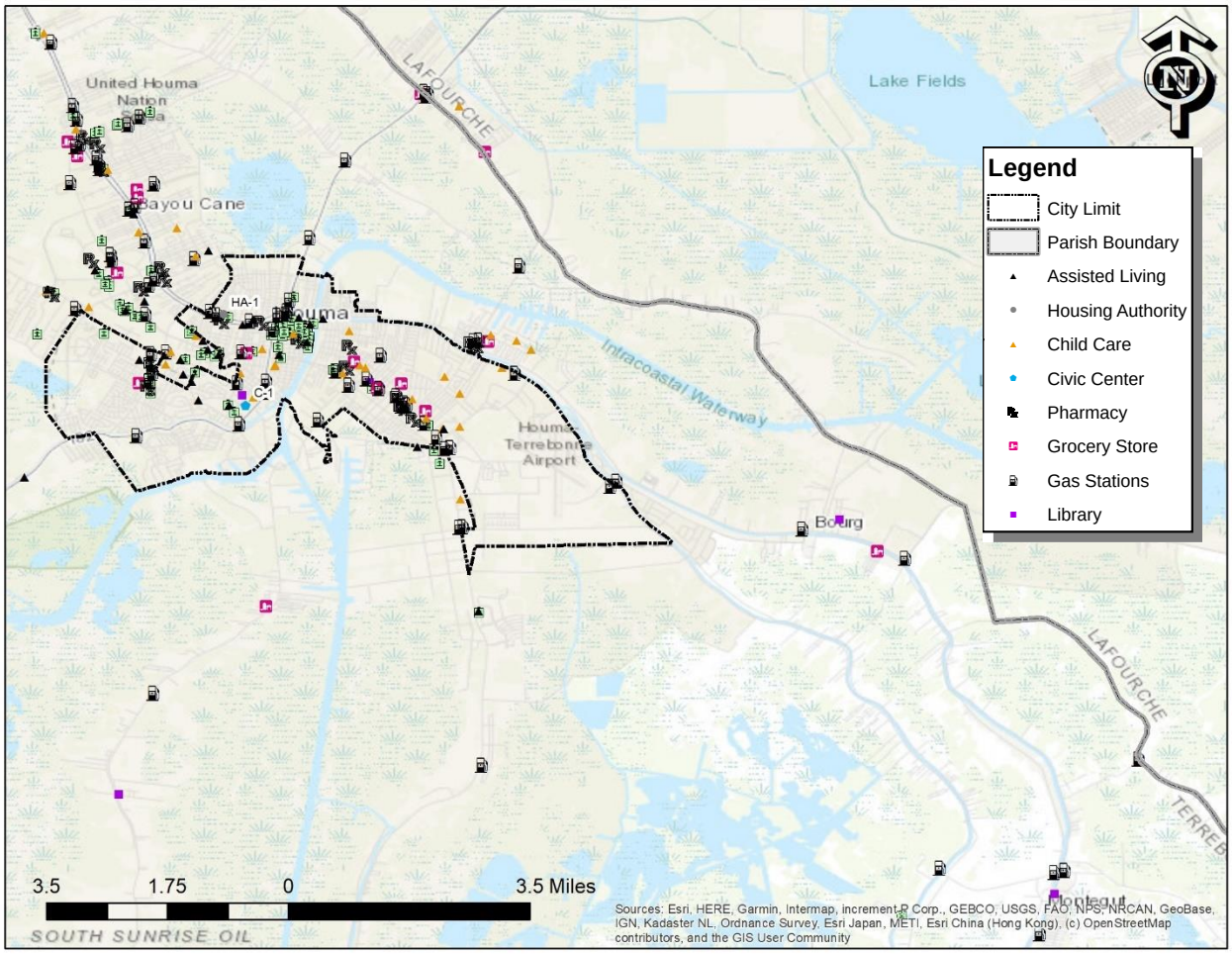


Figure 3-24: Critical Facilities - Tier 2B

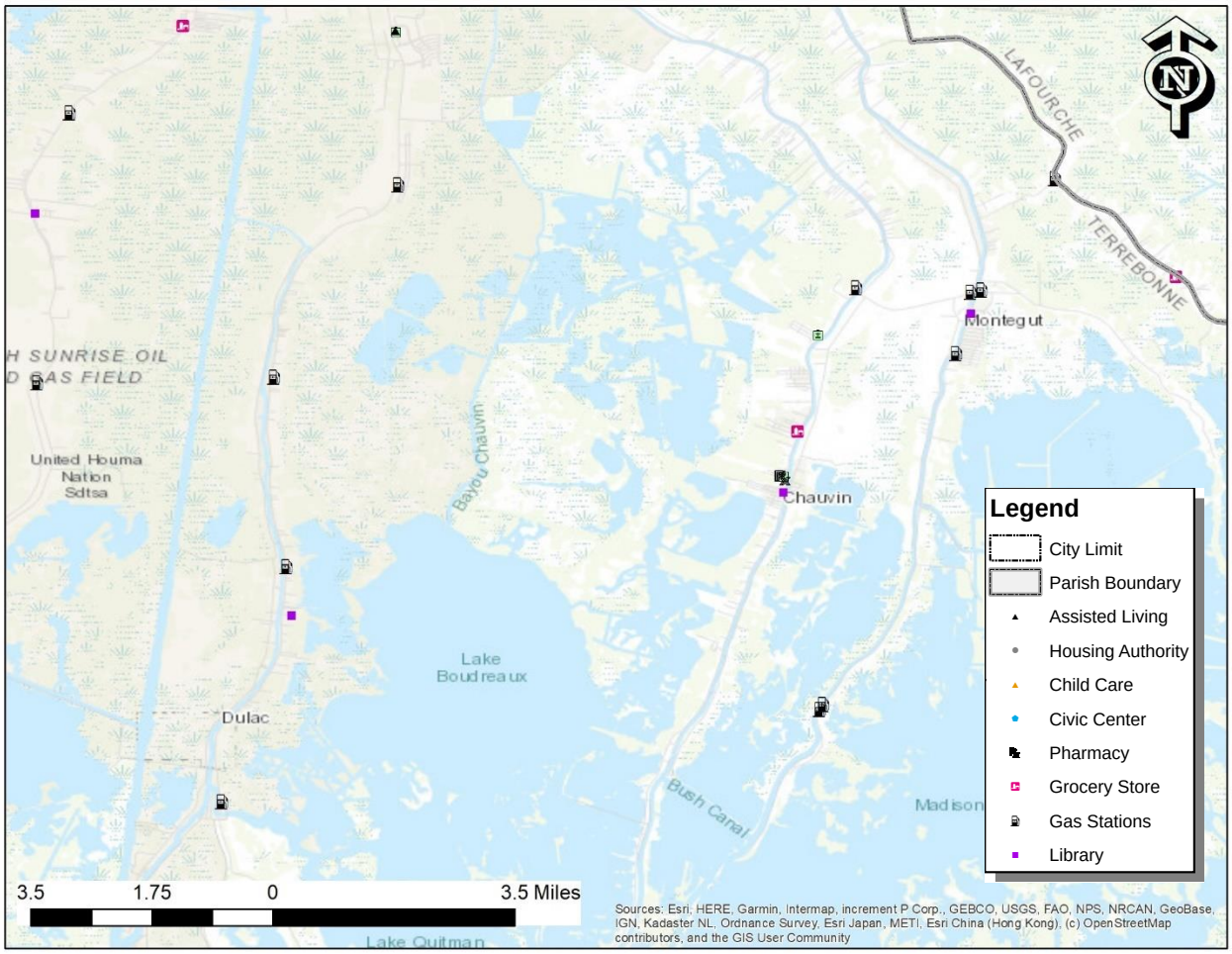


Figure 3-25: Critical Facilities - Tier 2C

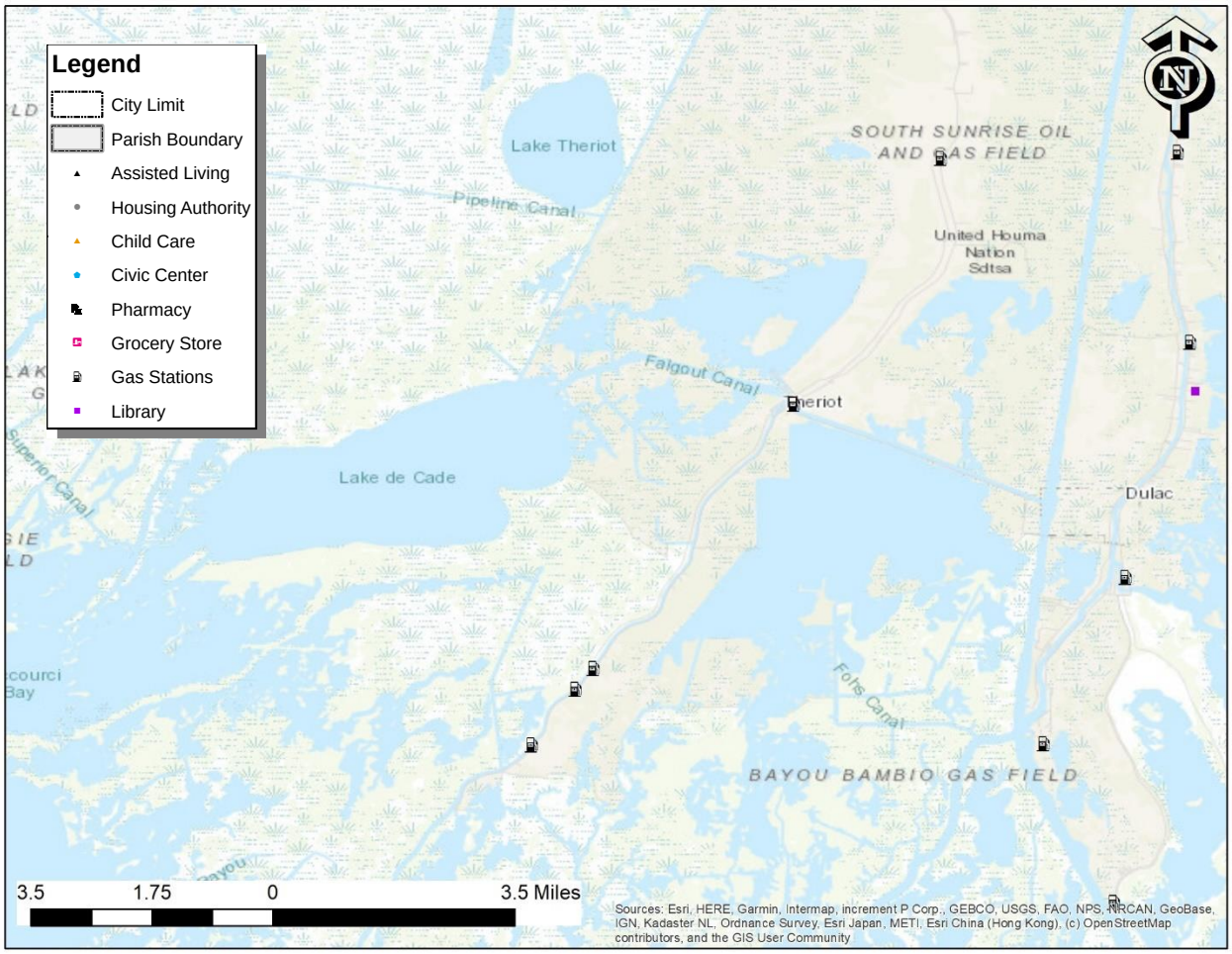


Figure 3-26: Critical Facilities - Tier 2D

3.2.1 Development Trends

§201.6 (c)(2)(ii)(C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions

A detailed description of land use data is provided in Section 1.2. Physical and cultural aspects of the parish including land use, drainage basins, and the economy were noted. The text below focuses on future land use and its bearing on this Hazard Mitigation Plan.

From 1980 to 2000, the parish population increased from 94,393 to 104,503. In October of 2003, when the parish government completed its comprehensive master plan (CMP), it was anticipated that the population would continue to experience positive growth. According to the 2010 U.S. Census, Terrebonne's population grew to 111,860 over the ten year period from 2000 to 2010, exceeding previous growth projections, and in 2020 is has decreased by 2%.

Terrebonne Parish completed a Comprehensive Master Plan (CMP) in 2003, which was updated in 2009 and 2013. In that original planning document, for the purpose of evaluation the parish was segregated

into 18 development zones. A brief discussion of the anticipated population changes within each zone as well as existing influences or issues that impact population trends was provided. Though this discussion was last updated in 2003 and it is possible that population projections may have adjusted due to an increase of over 17,000 residents between the 2000 and 2010 Census, it still reflects the present push and pull factors influencing migration out of and into the development zones, and is relevant to the priorities that the parish has carried forward into the present HMPU process. The discussion below provides an understanding of anticipated migration patterns within the parish.

It is anticipated that residential areas that existed in the 1980s will accommodate expected growth. However, the subdivision of land holdings and resulting new home sites have continued to develop at a minimal rate in some areas and a more accelerated rate in others. As more impervious surfaces are constructed with increased development, runoff rates will increase and enhanced pumping capacity may become a concern. At this time, and in the foreseeable future, this is considered significant.

To encourage development in lower flood risk areas, the Westside Boulevard extensions and Valhi extension is helping keep development away from the coast.

Development Zone 1 (Montegut)
The twenty-year projection for this zone is a 9.4% decrease in population. This is consistent with current out migration trends due to increased risk of flooding, which limits the available land for development. Most current residents live there because of the commercial fishing, family heritage, or because of easy access to the vast amounts of wetlands in this area.

Development Zone 2 (Bourg)
The twenty-year population forecast for this zone is a 26.4% increase in population. This is consistent with current trends of in migration. This area is attractive to residents because of availability of residential neighborhoods, and less risk of flooding.

Development Zone 3 (Chauvin)
A 7.9% decrease in population is predicted for this zone over the next twenty-years. It appears the out migration documented in this area will continue, based on flooding concerns, and available, protected property elsewhere.

Development Zone 4 (Grand Caillou)
Population is projected to increase in this zone by 30% over the next twenty years. This increase will most likely occur in the northern region of this development zone. The lower areas of this zone are vulnerable to the same flooding events that affect the previously discussed areas. However, the northern portion of this development zone includes a substantial mobile home community. This neighborhood was developed in the early 1980's, and when the economy declined the land was difficult to market and the development was entrenched in bankruptcy for many years. Although, FMEA has stiffened elevation requirements in this zone, mobile homes are generally placed approximately 4 feet above the natural ground, which meets the FEMA requirements. This area will continue to develop.

Development Zone 5 (Dularge)
An 8.1% decrease in population is predicted in this zone during the next twenty years. This is a bayou community, and population changes will be affected by issues similar to Development Zones 1 and 3.

Development Zone 6 (East Houma)
A very small increase (0.6%) in population is projected in the next twenty years. This is because adequate housing exists and there is very little available space for further residential development.

Development Zone 7 (South Industrial)
The projection is for a 7.9% decrease in population for the next twenty years. This area is dominated by industrial development, and there is little area for residential development. It is anticipated that in the future, those few residents will either move or will not expand their households.

Development Zone 8 (North Industrial)
The projection is for an increase by 13.2% over the next twenty years in this zone. This increase can be attributed to the availability of developable land, and the recent conversion of agricultural areas to residential.

Development Zone 9 (Schriever)
This zone has witnessed considerable growth over the last ten years and population is expected to grow by 26.8% over the next twenty years. This area has vast amounts of available land suitable for development and has been positively impacted by the completion of Highway 90. This area offers residents the ability to locate in an urban setting while still enjoying a rural life.

Development Zone 10 (Upper Bayou Blue)
Population is projected to expand by 35.9% in the next twenty years in this zone. This area has been positively impacted by the opening of Bayou Gardens Boulevard which provides easier access to a major retail center (Southland Mall).

Development Zone 11 (Bayou Cane)
Population is expected to grow at a moderate 13.8% rate over the next twenty years. This area is presently well developed, but there are still a few large tracts of land that can be developed.

Development Zone 12 (Hwy. 311)
This is the fastest growing zone in the parish with a projected 79.2% population increase in the next twenty years. Many reasons for the expected high growth are transportation accessibility, little flooding issues, and availability of land.

Development Zone 13 (Chacahoula)
The projection for this zone is a population decrease by 29.6% over the next twenty years. This percent change is somewhat misleading due to the relatively low present population in this area. This area has three 500,000 gpm pumps to mitigate flooding.

Development Zone 14 (Gibson)
The projection for this area is a population decrease by 87.1% over the next twenty years. Similar to the Chacahoula area, flooding impacts and availability of land elsewhere in the parish affect residential development. This area has three 500,000 gpm pumps to mitigate flooding.

Development Zone 15 (Bayou Black)
Population in this zone is expected to grow at a rate of 19.7% over the next twenty years. This is due to the rural qualities of Old Bayou Black. There is a vast amount of agriculture land suitable for residential development, and the areas close to Houma will be developed first.

Development Zone 16 (Lower Bayou Blue)
Population in this zone is projected to grow at a rate of 51.1% over the next twenty years. There is suitable land available for development along Coteau Road and lower Bayou Blue and the completion Prospect Avenue to U.S. 182 provides easy access to Houma.

Development Zone 17 (West Houma)
This area is currently the most populous Development Zone and is projected to experience a 21.4% growth rate over the next twenty years. The area has currently many lots available with more anticipated for future development.

Development Zone 18 (Western Marsh)
This zone consists entirely of wetlands. There are no residences in this zone, and no population change is projected.

Based upon the past several decades of parish development and the management of that development, Terrebonne Parish Consolidated Government is fully aware of state and federal mandates regarding coastal zone management, flood zone and hazard management, and protecting the valuable coastal areas of the state.

The parish completed a Comprehensive Plan Update, *Vision 2030: Terrebonne's Plan for Its Future*, in February 2013. The plan asserts that while the parish has experienced considerable growth over the last 20 years, the parish's population will grow at a slower rate over the next 20 years, peaking at 122,250 by 2030. The importance of orderly land development remains a concern for the parish and the CMP presented three land use projection scenarios for the parish based on past and current comprehensive plans. Table 3-16 shows the forecasted population change between 1900 and 2030 for the three land use scenarios.

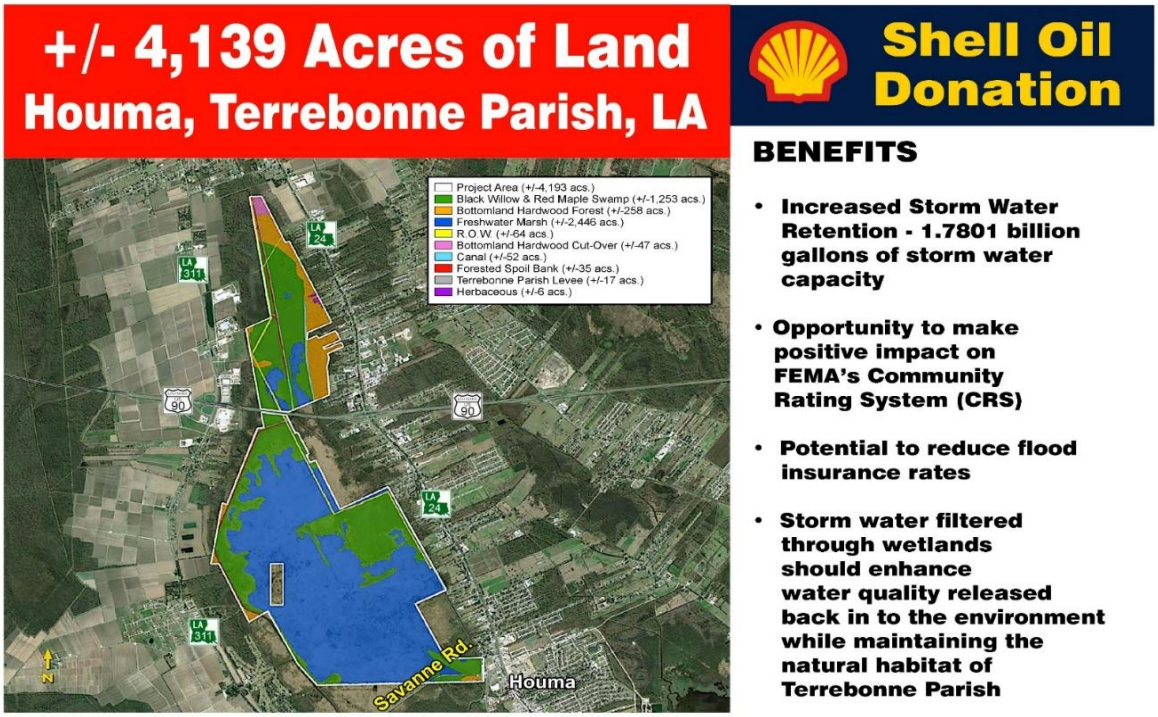
Table 3-16: Forecasted Land Use Scenarios

Scenario	Projection Span	Acres Consumed Per Span	Year of Total Consumption
Scenario #1	7 Years	3,021	2154
Scenario #2	19 Years	5,832	2229
Scenario #3	20 Years	3,085	2450
Source: Vision 2030: Terrebonne's Plan for Its Future			

It should be noted that 90 percent of Terrebonne's land is considered environmentally sensitive. Therefore, the land that is available for development is generally related to farming, vacant, and open space uses. Regardless of the year of total consumption of available developable land, the increase in impervious surfaces related to development and the resulting reduction in agricultural, vacant, and open space land will undoubtedly increase pressure on environmentally sensitive lands within the parish. This concern reflects the 2003 CMP development zone discussion as it highlights the role of flooding concerns and protected developable land in projected population growth or decline. The 2013 Comprehensive Plan

proposed action items to achieve a sustainable balance between development activities, preservation of natural resources, and open space.

The parish has retained largely the same goals for approaching hazard mitigation as were adopted in the 2015 HMPU. In alignment with those goals, Terrebonne Parish Consolidated Government has instituted preventative measures to minimize repetitive losses resulting from hazard events since the last plan. The parish's existing zoning ordinances and corresponding maps conform to FEMA guidelines, and the parish will update its zoning ordinances if and when needed to ensure compliance to FEMA regulations. The parish proposed an open space zoning area that includes the environmentally sensitive marshland and wetlands as viewed in Figure 3-27, but that was rejected by the landowners, which are predominantly mining and timber interests. The parish has developed a voluntary participation procedure which was provided to these landowners in 2020. Shell has donated a 4,139 acre property to the parish which will be kept in open space and used as a stormwater sink and recreation area. The parish also has adopted the International Building Codes (IBCs) and advisory base flood elevations (ABFEs) which dictate wind and flood related guidelines. The parish has financed engineering and Hydrologic and Hydraulic studies to support a pump station and berm system to manage this area and reduce flood risks throughout the northern reaches of the parish.



Source: GIS Engineering

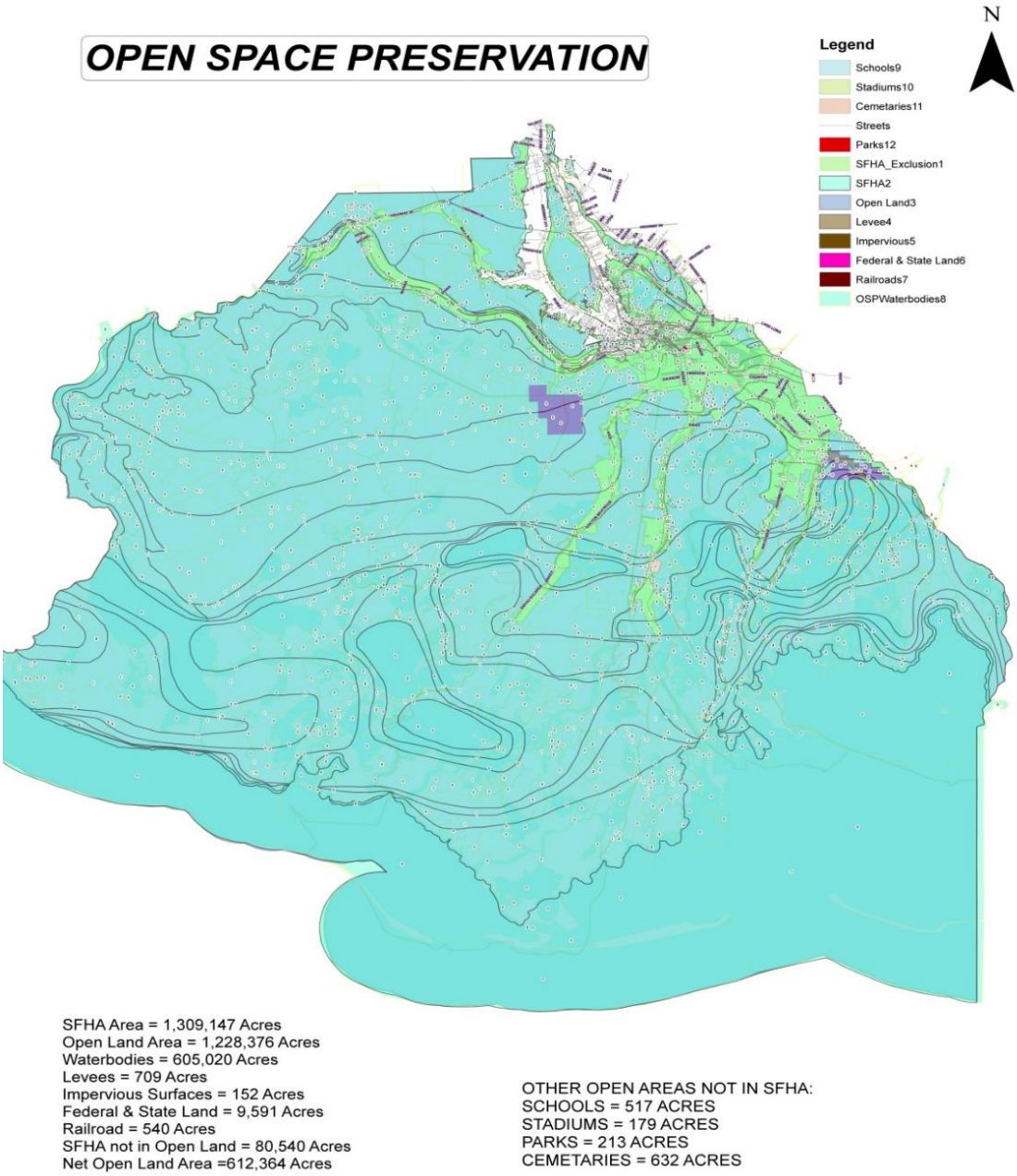


Figure 3-27: Open Space Preservation (TPCG)

The next sections will discuss how vulnerable these assets are to the specified hazard. This assessment will include Identifying what and who is exposed to the hazard and how susceptible they may be to the hazard.

§201.6 (c)(2)(ii)(A) The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located on the identified hazard areas

3.2.2 *Flood Vulnerability*

To help determine flood vulnerability, the preliminary FEMA floodplain was used which contains both coastal and riverine 1% annual chance floodplains. Since this new floodplain does not take into account the extensive levee system for the parish, the Hurricane IDA flooding modeled by the Louisiana State University (LSU) using the ADCIRC computer model was used. Additionally, Hazus (SLOSH and SWAN models) was used to model the Hurricane Ike surge. The LSU and Hazus models take into account the levee system.

Buildings and Infrastructure

Nearly half of the single-family home values and more than seventy-five percent of the manufactured housing in Terrebonne is exposed to the FEMA hazard scenario. Overall, about 45% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values at nearly $18 billion. Table 3-17 shows the building stock exposed to the new FEMA floodplain.

Table 3-17: Buildings Exposed to the FEMA Flood Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	21,139	6,890,853,077	3,445,426,539	**10,336,279,616**	49.9%
Manufactured Housing	1,015	47,438,857	23,719,429	**71,158,286**	75.2%
Multi-Family Housing	1,031	688,944,311	344,472,156	**1,033,416,467**	38.5%
Other Residential	14	34,689,574	17,344,787	**52,034,361**	29.6%
Commercial	2,199	2,253,014,098	2,253,014,098	**4,506,028,196**	41.1%
Industrial	301	350,142,930	525,214,395	**875,357,325**	41.9%
Government	111	135,278,348	150,988,880	**286,267,228**	34.0%
Education	43	254,827,231	254,966,710	**509,793,941**	35.5%
Agricultural	10	4,119,068	4,119,068	**8,238,136**	52.1%
Religious	78	117,882,355	117,882,355	**235,764,710**	46.0%
TOTAL	**25,941**	**10,777,189,849**	**7,137,148,417**	**17,914,338,266**	**45.3%**

Additionally, Table 3-18 shows the tier 1 and 2 critical facilities which are exposed to this hazard scenario. There are several fire stations, schools, and utilities exposed to the scenario shown in Figure 3-28.

Table 3-18: Critical Facilities Exposed to the FEMA Flood Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	10
Fire Station	23	Child Care	14
Government	10	Fuel Station	52
Hospital	1	Grocer	8
Police	1	Library	6
School	26	Pharmacy	4
Shelter	5	**TOTAL**	**94**
Utility	107		
TOTAL	**173**		

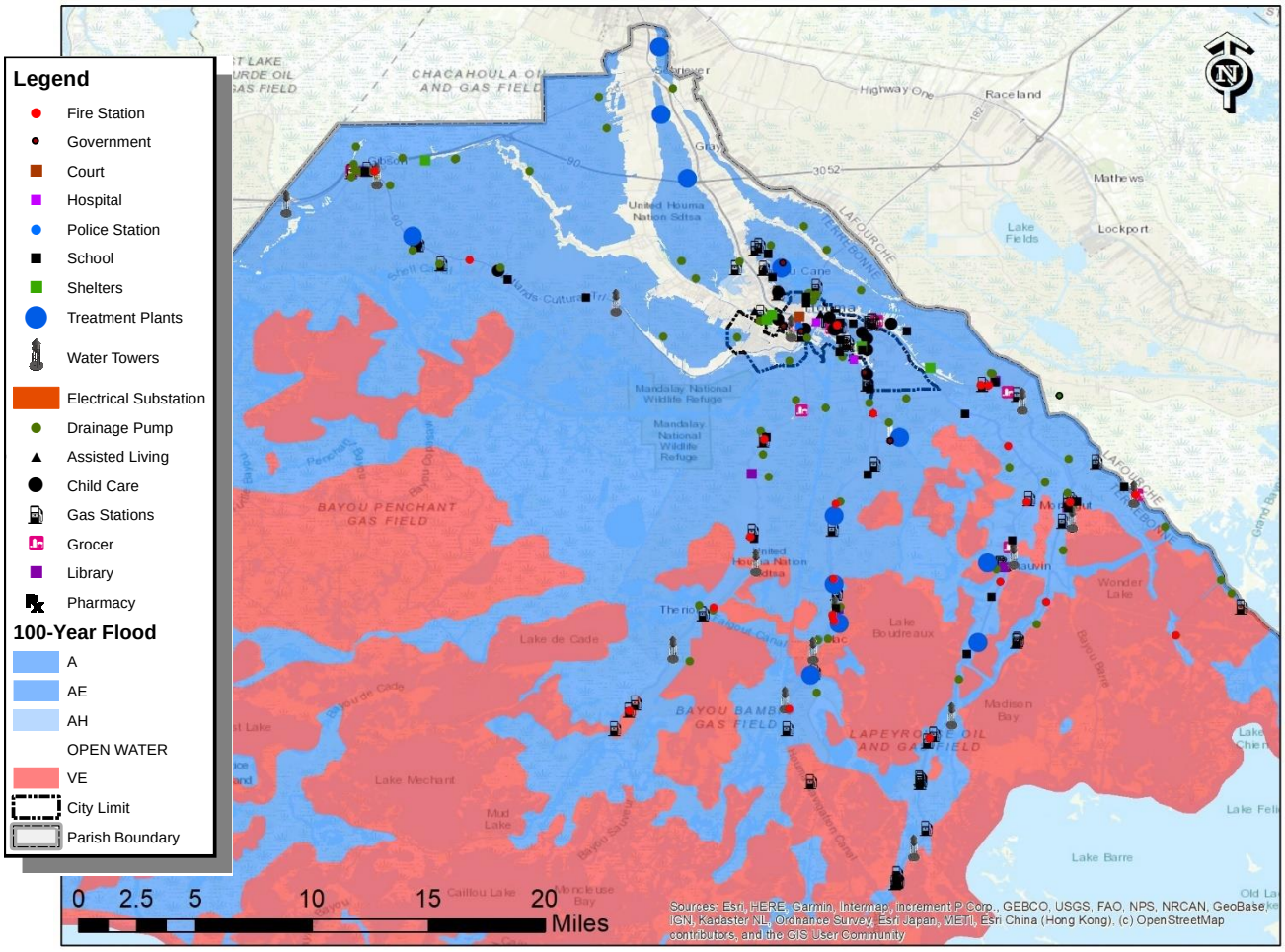


Figure 3-28: Critical Facilities Exposed to FEMA Floodplain Projections

The exposure for the LSU Ida model is provided in Table 3-19. Nearly 5% of the single-family home values in Terrebonne are exposed to this hazard scenario. Other residential buildings, which include nursing homes and hotels, had nearly 12% exposure while the manufactured housing wasn't exposed at all. Overall, about 4% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values a little over $1.5 billion.

Table 3-19: Buildings Exposed to the Hurricane Ida Surge Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	2,154	676,449,241	338,224,620	**1,014,673,861**	4.9%
Manufactured Housing	0	0	0	**0**	0.0%
Multi-Family Housing	27	5,332,909	2,666,454	**7,999,363**	0.3%
Other Residential	10	13,949,274	6,974,637	**20,923,911**	11.9%
Commercial	168	185,947,039	185,947,039	**371,894,078**	3.4%
Industrial	8	9,230,117	13,845,175	**23,075,292**	1.1%

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Government	24	16,820,380	18,623,374	**35,443,754**	4.2%
Education	5	16,497,185	16,497,185	**32,994,370**	2.3%
Agricultural	0	0	0	**0**	0.0%
Religious	10	15,927,278	15,927,278	**31,854,556**	6.2%
TOTAL	**2,406**	**940,153,423**	**598,705,762**	**1,538,859,185**	**3.9%**

Additionally, Table 3-20 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. There are several fire stations, schools, and utilities exposed to the scenario shown in Figure 3-29.

Table 3-20: Critical Facilities Exposed to Hurricane Ida Surge Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	0
Fire Station	5	Child Care	0
Government	2	Fuel Station	9
Hospital	0	Grocer	0
Police	0	Library	1
School	2	Pharmacy	0
Shelter	1	**TOTAL**	**10**
Utility	22		
TOTAL	**32**		

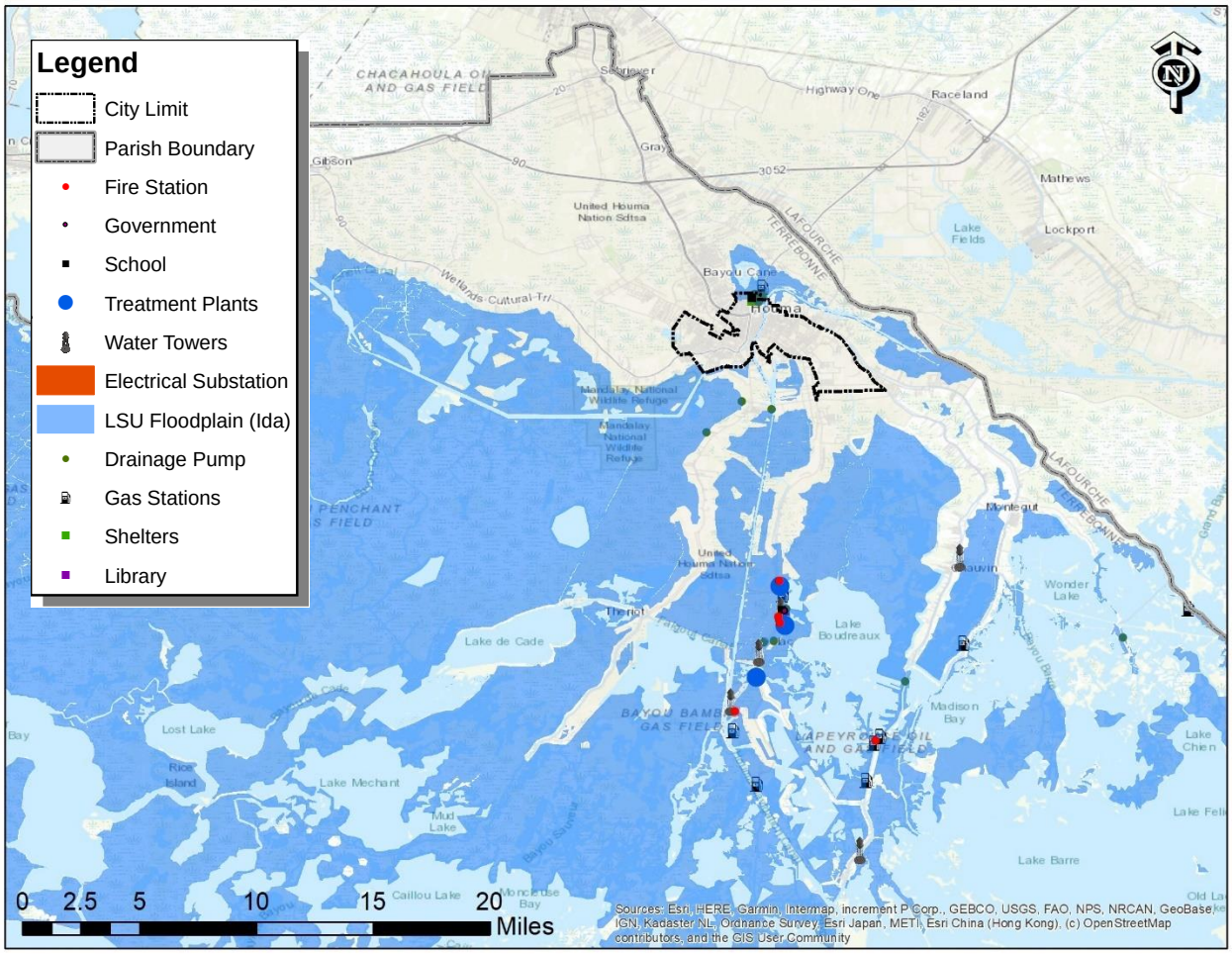


Figure 3-29: Critical Facilities Exposed to Hurricane Ida Surge (LSU)

The results for Hurricane Ike are similar to the Ida results and can be found in Appendix E.

Buildings and infrastructure which have been elevated out of the floodplain are less susceptible to flood impacts as are buildings which have undergone dry and wet floodproofing. Some building types are more susceptible to flooding such as mobile homes which may shift off their foundations. Building elevations have been included in the loss estimation modeling conducted in Hazus and provided in the next section to address these susceptibilities.

People

To help determine which areas will be more adversely impacted due to poverty, the site-level residential exposure was overlaid with the U.S. Census data showing population percentage living below the poverty level. The results for the FEMA floodplain data can be seen in Figure 3-30. The results for the LSU Ida model can be seen in Figure 3-31. The Hazus Ike model is similar to the LSU Ida model population impacts. In the first chart below, five percent of the residential impacts were in a high poverty area (50-100% poverty rate) while 21% of the residential impacts were in low poverty areas (0-7.1% poverty rate). Appendix E provides maps of these impacted areas.

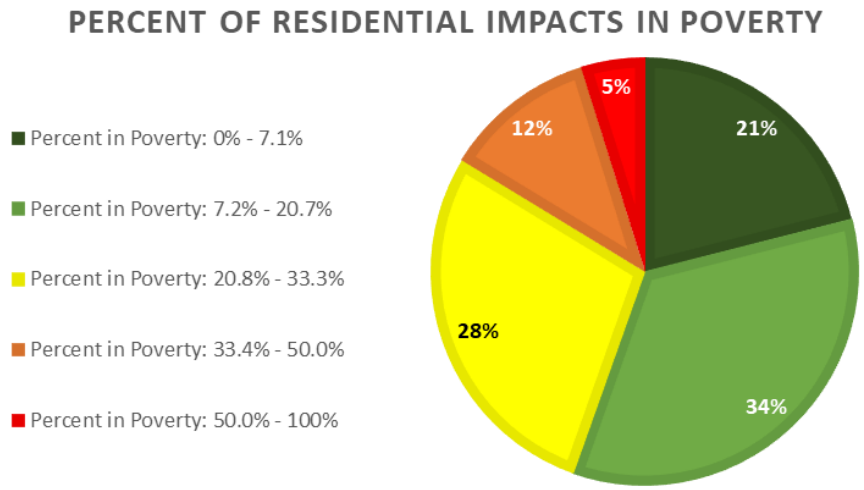


Figure 3-30: Residential Impacts by Poverty Level (FEMA Floodplain)

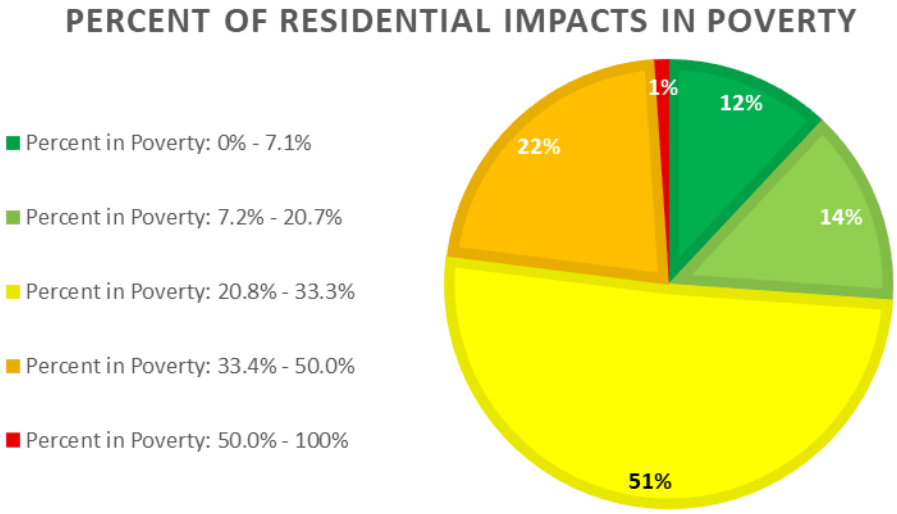


Figure 3-31: Residential Impacts by Poverty Level (LSU Model)

3.2.3 Hurricane and Tropical Storm Vulnerability

The entire parish is potentially exposed to hurricane force winds. Areas closer to the shore would typically be exposed to higher windspeeds. Surge is covered in 3.2.2 (vulnerability) and 3.3.1 (loss).

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts for the hurricane events were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 3-32.

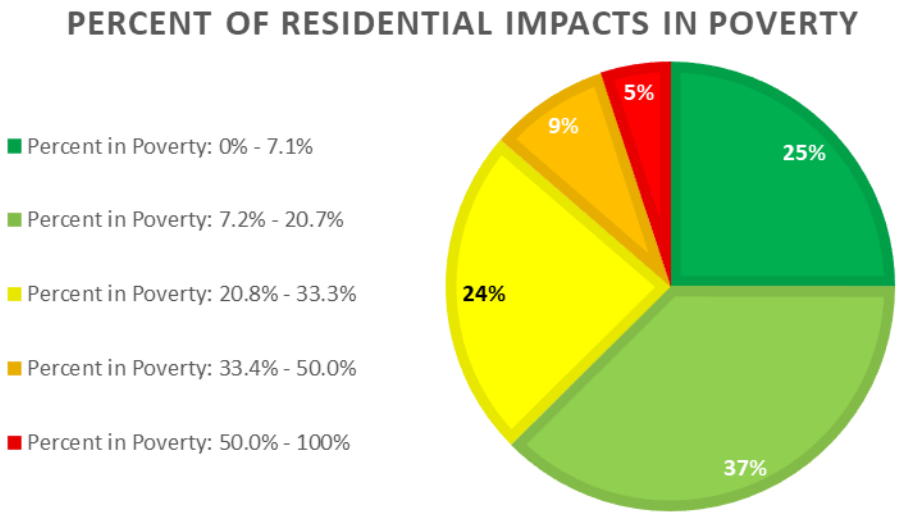


Figure 3-32: Residential Impacts by Poverty Level (Hurricane)

Certain building types and characteristics are more susceptible to high windspeeds. Mobile homes are more susceptible to high windspeeds even if they have anchoring. Hip roofs are more wind resilient than gable roofs. Flat roofs with gravel on the top of them can cause debris issues for other buildings in the area as the gravel impacts windows. Shuttering can help prevent wind damage and loss. There are several different types of hurricane straps (roof wall connection) which can be used to reduce wind damage too. Some of the critical facilities, such as the EOC, have been built to withstand major hurricane force winds.

3.2.4 Salt Water Intrusion Vulnerability

The parish's potable water intakes are jeopardized by salt water from the Gulf of Mexico, especially the Houma water treatment plant # 1. There have been documented instances where the City of Houma has resorted to its secondary potable water intake at Houma Water Treatment Plant #2 due to chloride concentrations in excess of the U.S. EPA's regulatory threshold of 250 parts per million. An example of this occurred following the storm surge of Hurricane Rita.

The parish has the ability to obtain its potable water supply from three different sources referred to as "water treatment plants." The location of each plant is provided on a map of the critical facilities associated with potable water included in Section 3.2. A brief description of each source follows.

Schriever Water Treatment Plant - This plant pumps surface water from Bayou Lafourche, which in turn, obtains most of its water from the Mississippi River. In May of 2013 the citizens of Terrebonne Parish voted to join the Bayou Lafourche Fresh Water District thereby guaranteeing an unlimited supply of raw fresh water from Bayou Lafourche. The reservoir at this plant can hold up to a five-day supply at maximum production. In the forty-eight years of operation of the Schriever facility there has never been a time when the raw water supply, Bayou Lafourche fed from the Mississippi River in Donaldsonville, has been unavailable for an extended amount of time.

Houma Water Treatment Plant #1 - The primary source of water for this treatment plant is surface water pumped from the Gulf Intracoastal Waterway (GIWW). The GIWW is fed by a combination of sources, including: rainwater runoff, Mississippi River influence, Atchafalaya River influence, and tidal water influence.

Houma Water Treatment Plant #2 - Surface water pumped from Bayou Black serves as the secondary or backup supply of water for this treatment plant. This supply is activated when excessive chloride (salt) concentrations are detected in the GIWW.

According to Terrebonne Parish Consolidated Waterworks (TPCW), the GIWW source has had problems with salinity for the last 40 plus years but with the proposed Houma Navigational Canal lock system in Dulac, they would expect for that to no longer be the case. During the last several years when the Bubba Dove barge has been closed, the salinity of the GIWW has remained acceptable for human consumption water. The plant has its own reservoir that can be supplied with water from either source and at maximum production/consumption has a 3 day supply of raw water.

All of Terrebonne Parish is potentially exposed to saltwater intrusion especially those who are serviced by Houma Water Treatment Plant #1.

3.2.5 Levee Failure Vulnerability

To help determine levee failure vulnerability, the areas in the FEMA floodplain protected by the levee were determined and all the buildings in those areas were identified. Individual sections of the levee were not assessed separately. Instead, all the buildings in the protected area were assessed together. This assessment does not include areas that would be flooded and are not protected by the levee system.

Buildings and Infrastructure

More than twenty percent of the single-family homes and multi-family homes are exposed to a potential dam failure scenario. Overall, nearly 17% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values at over $6.5 billion. Table 3-21 shows the building stock exposed behind the levee system.

Table 3-21: Buildings Exposed to the Levee Failure Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	9,559	3,099,135,849	1,549,567,925	**4,648,703,774**	22.4%
Manufactured Housing	139	6,256,991	3,128,496	**9,385,487**	9.9%
Multi-Family Housing	278	425,314,486	212,657,243	**637,971,729**	23.8%
Other Residential	1	2,423,383	1,211,692	**3,635,075**	2.1%
Commercial	417	354,446,520	354,446,520	**708,893,040**	6.5%
Industrial	43	63,666,131	95,499,196	**159,165,327**	7.6%
Government	65	90,994,765	99,196,448	**190,191,213**	22.6%
Education	20	100,428,100	12,436,929	**112,865,029**	7.9%
Agricultural	5	1,449,330	1,449,330	**2,898,660**	18.3%
Religious	45	57,851,784	57,851,784	**115,703,568**	22.6%
TOTAL	**10,572**	**4,201,967,339**	**2,387,445,563**	**6,589,412,902**	16.7%

Additionally, Table 3-22 shows the tier 1 and 2 critical facilities which are exposed to this hazard scenario. There are several fire stations, schools, and utilities exposed to the scenario.

Table 3-22: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	1
Fire Station	18	Child Care	3
Government	1	Fuel Station	25
Hospital	0	Grocer	5
Police	0	Library	5
School	13	Pharmacy	4
Shelter	2	**TOTAL**	**43**
Utility	54		
TOTAL	**88**		

People

To help determine which areas will be more adversely impacted due to poverty, the site-level residential exposure was overlaid with the U.S. Census data showing population percentage living below the poverty level. The results for the levee failure data can be seen in Figure 3-33.

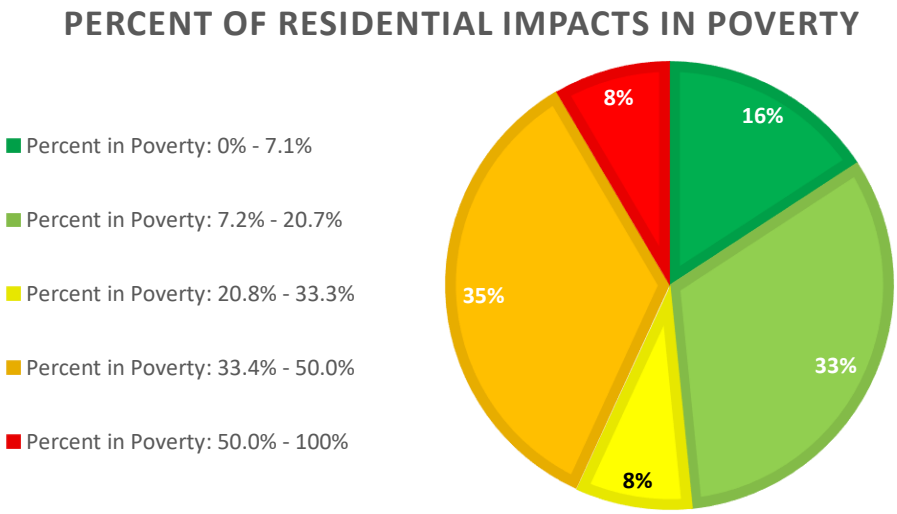


Figure 3-33: Residential Impacts by Poverty Level (Levee Failure)

3.2.6 Tornado Vulnerability

Tornadoes are not confined to a single area so all of Terrebonne Parish should be considered exposed to the tornado hazard. Terrebonne Parish is most vulnerable to the effects of tornadoes during severe tropical storms and hurricanes. Some structural mitigation actions have been identified which will reduce damages caused by tornadoes; however, some wind mitigation actions identified under the hurricane hazard may also lessen the effects of tornado-force winds.

People who reside in mobile homes are most susceptible to damage from tornadoes. Even if anchored, mobile homes do not withstand high wind speeds as well as permanent, site-built structures. There are 86 mobile home parks in Terrebonne Parish. They are listed in Table 3-23.

Table 3-23: Trailer Parks

Addie Authement
Al's Trailer Park
Alton James Jr. Mobile Home Park
Arthur Breaux
Azalea Trailer Park
Bayou View Trailer Park
Bayou Wind Mobile Home Park
Betty Desselle Dupre Street
Betty Desselle Trailer Park Peters Street
Biondo Trailer Park
Blue Bayou Trailer Park
Bon Villa Mobile Home Park
Bonvillain's Trailer Park
Callegan's Mobile Home Park
Capri Court Trailer Park
Carriage Cove Trailer Park
Charles Robinson Trailer Park
Clarence Matthews Mobile Home Park
Comet Mobile Home Park
Coteau Trailer Park (renamed Willow Wood Mobile Home Park)
Country Boy No. 1
Country Boy Trailer Park No.2
Creel's Mobile Home Park
Crestview Trailer Park
Crochet Trailer Park
Daniel Turner Mobile Home Park #1
Daniel Turner Mobile Home Park #2
David Gagneaux Mobile Home Park
Duplantis Trailer Park
Dupre Mobile Home Park
Faith Trailer Park

Family Mobile Home Park
Fanguy's Trailer Park
Gene's Mobile Home Park
Glover Mobile Home Park
Goodman's Trailer Park
Harris guidry Trailer Park
Hebert Brother Mobile Home Park
Hedgeford Trailer Court
Hope Street Mobile Home Village
Houma Mobile Home Park (bayou side)
Ingram Mobile Home Park
Ira Neil Mobile Home Park
Ja Mon Rentals Trailer Park
Jerry's Trailer Park
Jimmy Doirion Trailer Park
Johnson Mobile Home Park
Ken Rembert Trailer Park
Kim Burton Trailer Park
Knightshed Trailer Park
La Bonne Vie Mobile Home Park
Landry's Mobile Home Park
Le Visage Rouge Trailer Park
LeCompte Trailer Park
Levron Trailer Park
Memory Lane Trailer Park
Millers Trailer Court
Mott's Trailer Park
Mulligan Mobile Home Park
Myrna Mobile Home Park
Myrna Mobile Home Park

Nelo's Mobile Homes
North American Fabricators Mobile Home Park
O'Brien Mobile Home Park
Oakview Mobile Home Park
Patrick Duplantis Mobile Home Park
PHI Mobile Home Park
Pel's Mobile Home Park
Peltier Trailer Park
Poche Trailer Park
Porche Trailer Park
Quality Shipyard Mobile Home Park
Remwood Trailer Park
Robert Price Mobile Home Park
Rolands Trailer Park
Saadi Mobile Home Park
Slatter Street Mobile Home Park
SONOCO Mobile Home Park
South Van Trailer Park
Theriot Trailer Park
Victoria Mobile Home Park
Whitney's Trailer Park
Wilow Woods Mobile Home Park (See Coteau Trailer Park)
Wilson's Mobile Home Park
Wilson Gaidry Trailer Park

3.2.7 Coastal Erosion Vulnerability

All states with low-lying coasts are vulnerable to accelerated sea-level rise, but Louisiana's coast is much more so because of the subsidence of the Mississippi River delta. Until humans intervened, the surface elevation of the broad delta complex had kept pace with rising sea level for several thousand years, largely because the river built delta lobes and nourished wetland vegetation. The rates of natural subsidence and sea-level rise along the Louisiana coast have been exacerbated by human modifications, primarily levees which have isolated the Mississippi River from a delta complex that depends on an annual flooding cycle. These modifications cut off the delta-building process of the river. Louisiana's coastal system has also

been heavily impacted by channels dug for navigation and mineral extraction, which have allowed high-salinity Gulf waters to migrate inland. Over a million acres of coastal land have been lost since the 1930s, and between 25 and 35 square miles continue to be lost each year. Louisiana's coastal ecosystems are threatened with systemic collapse.

Areas of Terrebonne Parish, face a high risk of continued subsidence in years to come. Terrebonne Parish is highly vulnerable to continued subsidence due to its close proximity to the surrounding wetlands, highly organic soils, and dependence on forced drainage systems which remove water from localized areas. All the buildings, infrastructure, and people should be considered exposed to some degree of erosion and land subsidence.

Building and Infrastructure

To support an exposure analysis, all the structures on an elevation of 1' or less located adjacent to the coastal wetlands were identified in Table 3-24. Most of the buildings very susceptible to coastal erosion are single family homes although there are some commercial and government buildings. Additionally, parts of Bayou Dularge Road (315), Waterfront Drive, Redfish Street, Highway 56, and S. Madison Road (55) may be subjected to erosion in the future. Overall, there is over half a billion dollars in exposure.

Table 3-24: Buildings Exposed to the Coastal Erosion Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	631	345,508,098	172,754,049	**518,262,147**	2.5%
Commercial	32	20,155,606	20,155,606	**40,311,212**	0.4%
Government	4	1,547,968	1,547,968	**3,095,936**	0.4%
TOTAL	**667**	**367,211,672**	**194,457,623**	**561,669,295**	1.4%

There are three critical facilities exposed to the coastal erosion: two pump stations and a water tower.

People

To help determine which areas will be more adversely impacted due to poverty, the site-level residential exposure was overlaid with the U.S. Census data showing population percentage living below the poverty level. The results for the coastal erosion hazard can be seen in Figure 3-34.

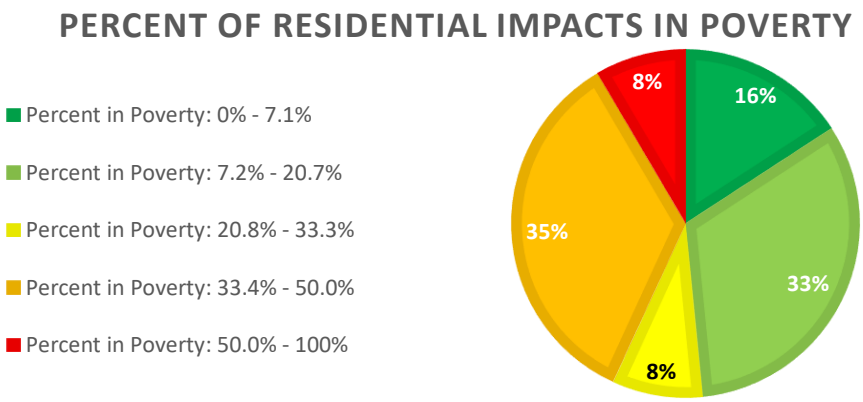


Figure 3-34: Residential Impacts by Poverty Level (Coastal Erosion)

3.2.8 Lightning Vulnerability

Lightning can strike anywhere and is produced by every thunderstorm, so the chance of lightning occurring in Terrebonne Parish is high. However, lightning that meets the definition that is used by NCDC that actually results in damages to property and injury or death to people is a less likely event. According to the State Hazard Mitigation Plan, a major lightning strike in Terrebonne Parish is likely to occur more than once a year. The annual probability of a lightning strike is 100%. All of Terrebonne Parish is potentially exposed to lightning strikes. Recently constructed buildings are not more vulnerable to lightning than existing structures, however, critical facilities will be encouraged to be constructed with lightning rods in the future to reduce susceptibility.

3.2.9 Sinkhole Vulnerability

Currently, there are twelve identifiable salt dome locations in Terrebonne Parish. The figure below displays the locations of these salt domes. As depicted in the figure to follow, the sink holes are dispersed throughout the parish.

Due to isolated locations of the salt domes there is little to no risk to lives of citizens with the exception being the residents within two miles of the salt domes if they were to collapse. Future development will be discouraged within the 2-mile buffer zone surrounding the salt domes. No new critical facilities were constructed within the 2-mile buffer zone since the last plan update and no salt domes were noted to have expanded. In addition, the activity surrounding the salt domes has remained consistent and has not increased.

Building and Infrastructure

To support an exposure analysis, all the structures within two miles of a salt dome were identified in Table 3-25. Most of the buildings near a salt dome are single family homes although there are some other residential, commercial, and government buildings. Overall, there is more than $165M in exposure.

Table 3-25: Buildings Exposed to the Sinkhole Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	310	90,572,126	45,286,063	**135,858,189**	0.7%
Other Residential	8	11,885,707	5,942,854	**17,828,561**	10.1%
Commercial	17	4,640,568	4,640,568	**9,281,136**	0.1%
Government	1	888,350	1,332,525	**2,220,875**	0.3%
TOTAL	**336**	**107986751**	**57202010**	**165,188,761**	0.4%

There is one critical facility exposed to the sinkhole hazard, the Little Caillou Volunteer Fire Department – Station #4. The other residential buildings are hotels.

People

To help determine which areas will be more adversely impacted due to poverty, the site-level residential exposure was overlaid with the U.S. Census data showing population percentage living below the poverty level. The results for the sinkhole hazard can be seen in Figure 3-35.

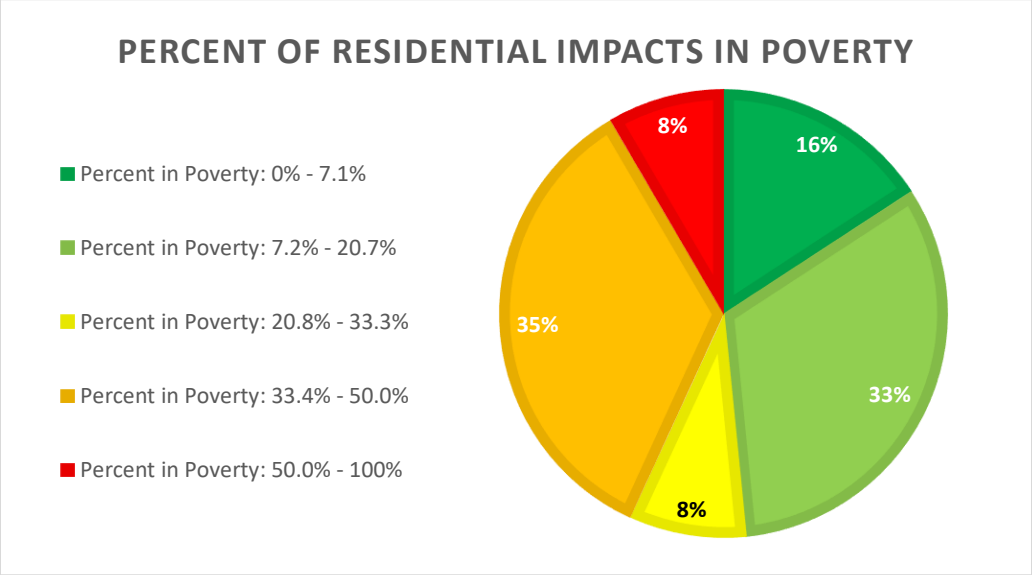


Figure 3-35: Residential Impacts by Poverty Level (Sinkhole)

3.2.10 Land Subsidence Vulnerability

The subsidence potential of the area is in part due to the types of soils, each of which respond at different levels of subsidence when dry. The soils have been mapped and the level of risk that they will subside captured in Figure 3-14 (Section 3.1.9).

To conduct an exposure assessment for land subsidence, the soils indicative of subsidence identified in Section 3.1.9 were used. The buildings and infrastructure on these soil types were queried and provided

in Table 3-26. There is a total of $60.5M exposed to subsidence-susceptible areas mostly consisting of single-family homes.

Table 3-26: Buildings Exposed to the Subsidence Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	95	24,818,920	12,409,460	**37,228,380**	0.2%
Commercial	12	11,217,977	11,217,977	**22,435,954**	0.2%
Government	2	425,081	425,081	**850,162**	0.1%
TOTAL	**109**	**36461978**	**24052518**	**60,514,496**	0.2%

There is one critical facility exposed to the subsidence hazard: a water tower.

People
To help determine which areas will be more adversely impacted due to poverty, the site-level residential exposure was overlaid with the U.S. Census data showing population percentage living below the poverty level. The results for the subsidence hazard can be seen in Figure 3-36.

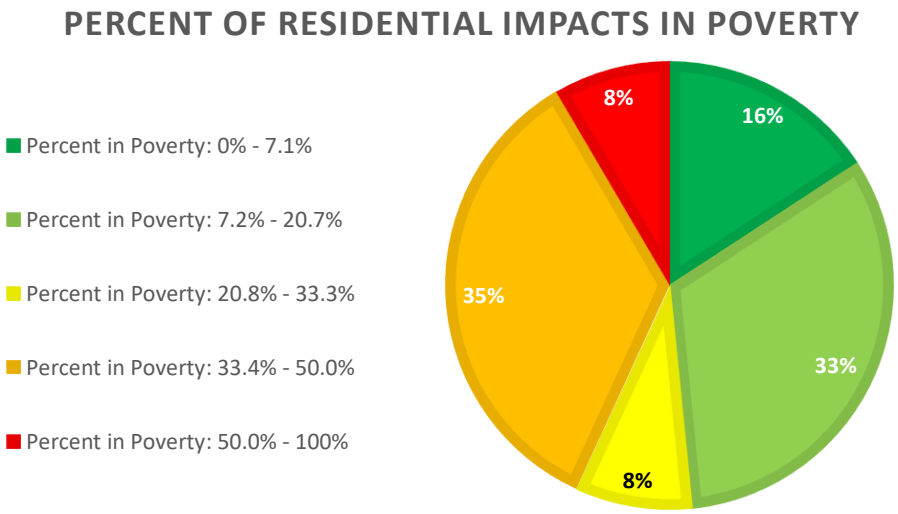


Figure 3-36: Residential Impacts by Poverty Level (Subsidence)

3.2.11 Extreme Temperatures Vulnerability

The entire parish should be considered exposed to the extreme cold and heat hazards due to the nature of the events.

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly

dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it. Hypothermia is most likely at very cold temperatures, but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red, cold skin and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death.

In addition to the threat posed to humans, extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the electrical grid, which can lead to temporary outages. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service. Some of the secondary effects presented by extreme/excessive cold include dangerous conditions to livestock and pets.

Extreme heat can pose severe and life-threatening problems for people. According to the NWS, it is one of the leading weather-related killers in the United States, resulting in hundreds of fatalities each year and even more heat-related illnesses. Health risks to residents in the region exposed to extreme heat include dehydration, heat cramps, fainting, heat exhaustion, and heat stroke. Extreme heat has a special impact on the most vulnerable segments of the population - the elderly, young children and infants, impoverished individuals, and persons who are in poor health. The high-risk population groups with specific physical, social, and economic factors that make them vulnerable include:

- Older persons (age > 65)
- Infants (age < 1)
- Homeless population
- Very low and low income persons
- People who are socially isolated
- People with mobility restrictions or mental impairments
- People taking certain medications (e.g., for high blood pressure, depression, insomnia)
- People engaged in vigorous outdoor exercise or work or those under the influence of drugs or alcohol.

Households with a lower income may have trouble cooling their home due to costs and lack of air conditioning. This population has been identified in Figure 3-37.

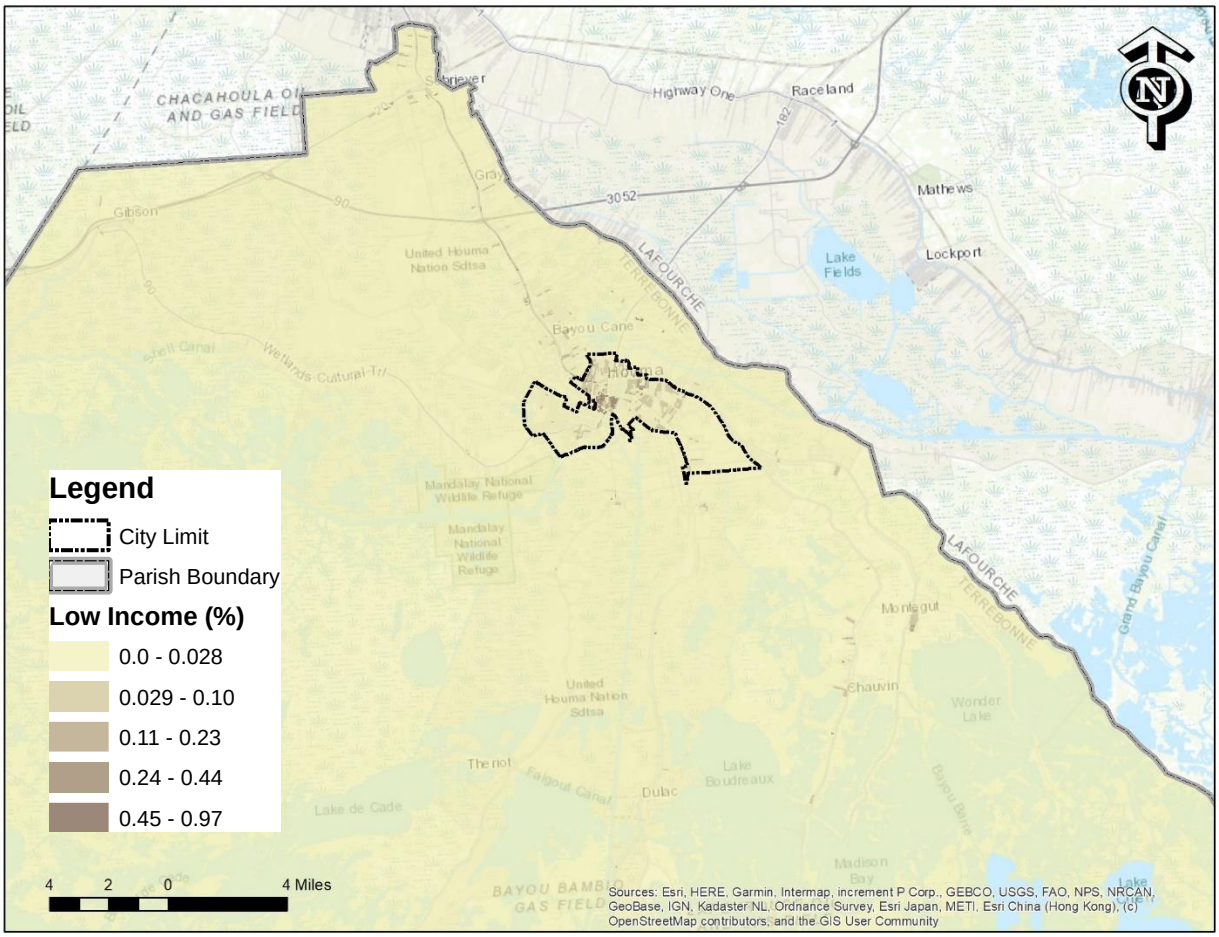


Figure 3-37: Low Income Population (U.S. Census Bureau, 2020)

The impact of excessive heat is most prevalent in urban areas, where urban heat island effects prevent urban buildings from releasing heat built up during the daylight hours. Secondary impacts of excessive heat are severe strain on the electrical power system and potential brownouts or blackouts.

Extreme heat can have a negative impact on transportation. Highways and roads are damaged by excessive heat as asphalt roads soften and concrete roads expand and can buckle, crack, or shatter. Stress is also placed on automobile cooling systems, diesel trucks, and railroad locomotives which lead to an increase in mechanical failures.

3.3 Calculate Loss Estimates

§201.6 (c)(2)(ii)(B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(a) of this section and a description of the methodology used to prepare the estimate*, and *§201.6 (c)(2)(iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

For this section a combination of risk modeling using the Hazus software and a review of previous impacts will be used to better quantify the hazard impacts. Where the previous section provides information on what is at risk, this section provides economic and social impacts associated with a probability.

3.3.1 Flood Loss Estimations

The flood economic impacts are modeled in Hazus using the depth of water at the building's location to determine the amount of loss the structure and contents will sustain. Buildings with a higher first floor height will sustain less loss than those closer to the ground. Inventory loss refers to businesses inventory, the products a business or industry sells. Table 3-27 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard. A detailed Hazus analysis using FEMA's floodplain maps can be found here in Appendix E while a detailed Hazus analysis using LSU's Hurricane Ida surge can also be found here in Appendix E.

For the FEMA floodplain, more than half the total loss is associated with damage to single-family homes with more than a quarter of the loss coming from commercial structures which are typically built on concrete pads one foot above grade (unless elevated). Overall, there is a total building loss of nearly $7.3 billion.

Table 3-27: Flood Building Impacts

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	20,978	2,781,772,255	1,510,659,211	0	**4,292,431,466**	41.5%
Manufactured Housing	678	13,237,926	5,328,251	0	**18,566,177**	26.1%
Multi-Family Housing	891	188,514,450	115,628,577	0	**304,143,027**	29.4%
Other Residential	13	3,572,554	4,919,528	0	**8,492,082**	16.3%
Commercial	2,179	322,535,943	998,017,577	820,818,044	**2,141,371,564**	29.3%
Industrial	301	36,775,773	104,827,876	20,432,813	**162,036,462**	16.2%
Government	103	20,959,301	114,727,608	0	**135,686,909**	47.4%
Education	31	18,781,203	94,366,842	0	**113,148,045**	22.2%
Agricultural	10	254,390	1,037,712	1,051,474	**2,343,576**	15.7%
Religious	68	9,806,408	71,591,479	0	**81,397,887**	34.5%
TOTAL BUILDING LOSS	**25,252**	**3,396,210,203**	**3,021,104,661**	**842,302,331**	**7,259,617,195**	

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 3-28 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 3-28: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	10,810,000	530,820,000	214,390,000	25,460,000	**781,480,000**
Commercial	844,710,000	265,440,000	176,830,000	916,590,000	**2,203,570,000**
Industrial	21,070,000	16,510,000	3,620,000	24,330,000	**65,530,000**
Others	131,540,000	82,400,000	8,780,000	1,277,730,000	**1,500,450,000**
TOTAL BUSINESS INTERRUPTION LOSS	**1,008,130,000**	**895,170,000**	**403,620,000**	**2,244,110,000**	**4,551,030,000**
TOTAL BUILDING LOSS (from Error! Reference source not found.**)**					**7,259,617,195**
TOTAL LOSS					**11,810,647,195**

Tier 1 critical facility damage was modeled and is provided in Appendix E. Additional utility impacts include 70 drainage pump stations, South Water Treatment Plant, North Water Treatment Plant, Combon Bridge Minor Treatment Plant, 8 package plants, 15 elevated water tanks, and 10 substations.

Using the FEMA floodplain results in an average annual loss of $118.1M, but the analysis does not include the levee system which would provide loss reductions at lower return periods. Using the historical data for flood loss, the average annual loss is $12.4M.

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data.

Table 3-29 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 3-30 shows the debris amounts and categories for this hazard scenario.

A little more than half the population of Terrebonne was modeled to be displaced during this hazard scenario with a little more than 6,000 requiring public shelter. The 123,745 tons of debris will require approximately 8,250 dump truck loads to clean up assuming 15 tons per haul.

Table 3-29: Social Impacts

Social Impacts	Population
Population Displaced	55,556
Shelter Requirements	6,158

Table 3-30: Debris Amounts

Debris Type	Debris Amount (Tons)
Finish	56,019
Structure	30,486
Foundation	37,240
TOTAL	**123,745**

3.3.2 Hurricane and Tropical Storm Loss Estimations

The hurricane wind economic impacts are modeled in Hazus using the windspeeds calculated at the centroid of the Census Tract and applied to all buildings within that Census Tract. There are certain building characteristics which make that building less susceptible to damage such as roof shape (e.g. hip roofs perform better than gable roofs) and shuttering. The building loss is mostly governed by keeping the building envelope intact during the event. Table 3-31 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

For the 100-year hurricane event, more than half the total loss is associated with damage to single-family homes with nearly a quarter of the loss coming from commercial structures. The high loss ratios for manufactured housing show that mobile homes are especially susceptible to high wind speeds. Overall, there is a total building loss of over $2.1 billion.

Table 3-31: Building Impacts (100-Year Hurricane)

Building Impacts	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	833,881,245	296,664,236	0	**1,130,545,481**	5.5%
Manufactured Housing	8,557,354	2,996,133	0	**11,553,488**	12.2%
Multi-Family Housing	196,682,956	36,928,106	0	**233,611,062**	8.7%
Other Residential	11,684,454	2,049,429	0	**13,733,883**	7.8%
Commercial	292,247,423	163,024,716	33,238,288	**488,510,427**	4.1%
Industrial	86,651,442	66,645,786	9,885,132	**163,182,360**	7.3%
Government	10,490,547	6,403,789	0	**16,894,336**	2.0%
Education	52,202,438	29,827,994	0	**82,030,432**	5.7%
Agricultural	713,694	426,636	402,673	**1,543,003**	7.2%
Religious	9,783,364	4,695,607	0	**14,478,971**	2.8%
TOTAL BUILDING LOSS	**1,502,894,917**	**609,662,432**	**43,526,093**	**2,156,083,443**	**5.5%**

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 3-32 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 3-32: Business Interruption Loss (100-Year Loss)

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	975,640	164,607,410	65,278,740	2,298,450	**233,160,240**
Commercial	27,011,100	56,614,820	28,123,530	32,366,150	**144,115,600**
Industrial	1,215,270	7,677,120	1,084,550	1,822,800	**11,799,740**
Others	1,942,940	17,109,670	1,467,120	11,169,440	**31,689,170**
TOTAL BUSINESS INTERRUPTION LOSS	**31,144,950**	**246,009,020**	**95,953,940**	**47,656,840**	**420,764,750**
TOTAL BUILDING LOSS (from Error! Reference source not found.**)**					**2,156,083,443**
TOTAL LOSS					**2,576,848,193**

Tier 1 critical facility damage was modeled and is provided in Appendix E. The Hazus hurricane wind model does not support utility impacts at this time. Hazus models the hurricane average annual loss at $105.2M.

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 3-33 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 3-34 shows the debris amounts and categories for this hazard scenario.

A little more than 4% of the population of Terrebonne was modeled to be displaced during this hazard scenario with nearly 1,200 requiring public shelter. The 1,543,844 tons of debris will require approximately 102,923 dump truck loads to clean up assuming 15 tons per haul.

Table 3-33: Social Impacts (100-Year Hurricane)

Social Impacts	Population
Population Displaced	4,741
Shelter Requirements	1,175

Table 3-34: Debris Amounts (100-Year Hurricane)

Debris Type	Debris Amount (Tons)
Brick/Wood	182,497
Concrete/Steel	2,181
Tree	1,359,166
TOTAL	**1,543,844**

3.3.3 Salt Water Intrusion Loss Estimations

Losses due to salt water intrusion in Terrebonne Parish have not been recorded. This is a hazard that may cause issues in the future and should be recorded.

3.3.4 Levee Failure Loss Estimations

Although Hazus doesn't explicitly model levee failure impacts, it does calculate flood impacts and if those impacts are isolated, their contribution can be quantified. Selecting the part of the 100-year floodplain which would be protected by the levee and identifying the losses in those areas were used to assess a levee failure. The flood economic impacts are modeled in Hazus using the depth of water at the building's location to determine the amount of loss the structure and contents will sustain. Buildings with a higher first floor height will sustain less loss than those closer to the ground. Inventory loss refers to businesses inventory, the products a business or industry sells. Table 3-35 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

For the levee impacts, more than 70% of the total loss is associated with damage to single-family homes with more than a 15% of the loss coming from commercial structures which are typically built on concrete pads one foot above grade (unless elevated). Overall, there is a total building loss of over $3.5 billion. This amount would assume that the entire system was overwhelmed during an event so it is a very conservative estimate.

Table 3-35: Levee Failure Building Impacts

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	9,559	1,627,813,160	876,261,419	0	**2,504,084,138**	12.1%
Manufactured Housing	139	3,189,820	1,214,809	0	**4,404,768**	4.7%
Multi-Family Housing	278	126,047,816	77,865,527	0	**203,913,621**	7.6%
Other Residential	1	16,872	30,933	0	**47,806**	0.0%
Commercial	417	81,980,749	246,372,456	211,248,918	**539,602,540**	4.9%
Industrial	43	8,928,213	26,840,079	5,350,562	**41,118,897**	2.0%
Government	65	16,124,946	90,661,246	0	**106,786,257**	12.7%
Education	20	12,436,929	59,508,417	0	**71,945,366**	5.0%
Agricultural	5	132,133	499,810	542,319	**1,174,267**	7.4%
Religious	45	7,004,531	51,320,663	0	**58,325,239**	11.4%

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
TOTAL BUILDING LOSS	**10,572**	**1,883,675,169**	**1,430,575,359**	**217,141,799**	**3,531,402,899**	8.9%

Since the levee losses are for a 1% annual chance event, the annual loss would be $35.3M. There would also be several thousand displaced households if the entire levee system failed at once.

3.3.5 Tornado Loss Estimations

Hazus doesn't support the tornado hazard, so losses were determined using the historical data. There was $12,805,000 in damage over 33 years which means the average annual loss was $388,030. There also were 45 injuries during these 33 years which annualizes to 1.5 injuries per year in Terrebonne.

3.3.6 Coastal Erosion Loss Estimations

Hazus doesn't support the coastal erosion and land subsidence hazards and there are few historical losses so the exposure estimate was used to help calculate potential loss. There is $562M in exposure that will continue to be adversely affected by erosion towards the mid-century mark without intervention. If this total amount is annualized, it amounts to $20.8M a year with over 600 households displaced. The parish will begin collecting more detailed data concerning losses due to coastal erosion and land subsidence since it is impacting more and more people in the parish.

3.3.7 Lightning Loss Estimations

Hazus doesn't support the lightning hazard, so losses were determined using the historical data. There was $979,500 in damage over 24 years which means the average annual loss was $40,813. There were also 2 deaths and 3 injuries during that time period producing annual deaths of .08 and injuries of 0.13.

3.3.8 Sinkhole Loss Estimations

Hazus doesn't support the sinkhole hazard and there are no historical losses so the exposure estimate was used to help calculate potential loss. There is $165M in exposure that could be impacted by sinkholes. A sinkhole would typically impact a smaller area near the salt dome. The average value of a structure within 2 miles of the salt dome is $491,633. If we assume a sink hole is a 100-year event (conservative estimate), the annual loss would be $4,916 with a displaced home.

3.3.9 Extreme Temperatures Loss Estimations

Hazus doesn't support extreme temperatures, so losses were determined using the historical data. There was $100,000 in damage over 27 years which means the average annual loss was $3,704. There was one reported death due to extreme heat during this time. So annual deaths were calculated to be 0.04.

3.3.10 Potential Problems Identified in the Risk Assessment

After analyzing the impacts in the previous risk modeling sections, the following potential problems have been identified:

- Structures which have not been elevated and are located in low-lying areas produce a great deal of the loss. These include several commercial structures which built on slab on grade foundations. Gas stations, grocers, and pharmacies are not typically elevated. These are mapped in Section 3.2.2.
- Several fire stations and schools are impacted by flood waters in events smaller than the 100-year return period. These are mapped in Section 3.2.2.
- Several assisted living facilities are potentially impacted by flooding and surge. Plans should include how to evacuate and respond to this group of vulnerable people. These are mapped in Section 3.2.2.
- Several utilities are potentially impacted by flooding and storm surge. Some electrical substations are built adjacent to canals, pump stations which have not been elevated, and water supply in low lying areas should be considered. These are mapped in Section 3.2.2.
- The parish government owns some buildings in the floodplain (such as the courthouse) which could be moved to another, safer location. These are mapped in Section 3.2.2.
- Older homes that have not been elevated should be targeted for elevation projects or buyouts.
- Mobile homes are highly damaged in flood and wind events. Mitigation focused on this manufactured housing should be identified and taught to contractors and homeowners.
- Communities close to the coastline such as Cocodrie and Dulac should integrate erosion estimates and sea-level rise into their planning.
- Areas of the parish which have a high level of poverty should have ways made available to cool down during the summer such as cooling centers. These centers should be within walking distance of the need or have public transportation provided to residents. Areas of poverty are mapped in Figure 3-37.

3.4 Hazard Ranking

Ranking hazards helps the city set goals and mitigation priorities. To compare the risk of different hazards, and prioritize which are more significant, requires a scoring system for equalizing the units of analysis. As not all hazards assessed in this plan have precisely quantifiable probability or impact data, a scoring system based on multi-criteria decision analysis (MCDA) methodology was developed to rank all the hazards. This multi-criterion ranking analysis approach prioritizes hazard risk based on a blend of quantitative factors from the available data, such as historical data, local knowledge, public survey, and Hazus assessment. This hazard ranking analysis assigns varying degrees of risk to five categories for each of the hazards, including: probability (how often it can occur), impact (economic, social, and environmental loss), spatial extent (the size of the area affected), warning time (how long does a community have to prepare for the event), and duration. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor derived from a review of best practice plans. Some of these hazard characteristics, like probability and impact, are more important than others and are weighted more heavily.

To calculate a rank score value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories represents the final rank score, as demonstrated in the following equation:

Hazard Score Value = [(Probability x 30%) + (Impact x 30%) + (Spatial Extent x 20%) + (Warning Time x 10%) + (Duration x 10%)]

Table 3-36 provides the hazard characteristic, level description, level criteria, level index value, and weighting value.

Table 3-36. Hazard Ranking Criteria

Hazard Characteristic	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, in any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	30%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shudown of critical facilities for more than one day.	2	
	Critical	Mulitiple deaths/injuires possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical faicliteis for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	Long	More than 24 hours	1	10%
	Moderate	12 to 24 hours	2	
	Short	6 to 12 hours	3	
	Very short or no warning	less than 6 hours	4	
Duration	Very short	Less than 6 hours	1	10%
	Short	Less than 24 hours	2	
	Moderate	Less than one week	3	
	Long	More than one week	4	

Table 3-37 provides the final hazard ranking for Terrebonne Parish. Each hazard characteristic is assigned a value between 1 (lowest value) and 4 (highest value). When the risk values were calculated, if the value was greater than 3, it was assigned as a high risk hazard. If the value was greater than 2 and less than or equal to 3, it was assigned as a moderate risk. If the value was less than or equal to 2, it was assigned as a low risk hazard. The flood, extreme temperatures, and severe winter storms hazards were ranked highest. The wildfires/brushfires, hurricanes/wind, thunderstorms, drought, infectious disease, invasive species, hazardous materials, and earthquakes are all ranked as moderate. The landslide and tornado hazards are ranked as low.

Table 3-37. Final Hazard Ranking of Hazards for Terrebonne Parish

Hazards	Probability	Impact	Spatial Extent	Warning Time	Duration	Total	Rank
Flood	4	4	3	4	2	3.6	High
Hurricanes/Wind	3	4	4	1	2	3.2	High
Salt Water Intrusion	1	2	2	4	2	1.9	Low
Levee Failure	2	3	2	4	2	2.5	Mod.
Tornadoes	1	2	1	3	1	1.5	Low
Coastal Erosion	4	2	2	2	4	2.8	Mod.
Lightning	4	1	1	2	1	2	Mod.
Sinkhole	1	2	1	4	4	1.9	Low
Land Subsidence	1	2	1	4	4	1.9	Low
Extreme Temperatures	2	2	4	2	2	2.4	Mod.

§201.6 (c)(2)(iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area

As discussed previously, Terrebonne Parish is a consolidated government, so the plan is not multi-jurisdictional.

4.0 MITIGATION STRATEGY

Information presented below provides documentation in conformance with sections (c)(3)(i, ii, iii, and iv) relative to mitigation strategies evaluated for hazards identified in Terrebonne Parish, Louisiana.

4.1 Mitigation Goals

§201.6 (c)(3)(i) A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The Terrebonne Parish HMPU Steering Committee reviewed and analyzed the risk assessment evaluation performed for the parish as well as goals reflective of that risk assessment. Goals and action items that would have the greatest benefit in reducing or eliminating hazard damage to the parish were identified.

The method that the Steering Committee used to consider potential action items in a systematic way was the Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) Method. This method helps the Steering Committee to weigh the pros and cons of different alternative actions for each of the identified actions and objectives. The approach for the 2023 plan was to incorporate systems-based project groups to ensure that for each effort, all support infrastructure or training, manpower, infrastructure, and maintenance, for examples, was also considered. These recommendations were provided to the public and parish for comment.

The goals developed to reduce or avoid long-term vulnerabilities to the identified hazards are listed below:

Goal 1: Identify and pursue preventive measures that will reduce future damages and preserve lives from natural hazards.

Goal 2: Increase resilience of all entities, facilities, and utilities that support all lifelines through a systems-based analysis that includes support services, equipment and personnel.

Goal 3. Enhance public awareness, public education, and understanding of local vulnerabilities and risk reduction practices.

Goal 4: Reduce repetitive flood losses in the parish and continue participation in the Community Rating System program.

Goal 5: Facilitate sound development and implementing nature-based solutions in the parish to reduce or eliminate the potential impact of hazards.

4.2 Mitigation Objectives and Actions

§201.6 (c)(3)(ii) The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

The Terrebonne Parish Hazard Mitigation Plan Update Committee identified projects that would reduce and/or prevent future damage from naturally occurring hazard events. This coordinated effort, which included the planning committee, the consultant team, and other engineering representatives, was accomplished with frequent and open communications including committee meetings, telephone conversations, emails, and face-to-face meetings. Areas of concern gleaned from the Recovery Meetings were reported by various consultants and Parish employees and incorporated into the projects. These were further reviewed in each public meeting.

The projects and resulting action items relate to parish goals which are presented immediately following the Project List attachment. Projects include those that may be eligible under the proposed FEMA Building Resilient Infrastructure and Communities (BRIC) grant program. The parish specifically reached out to entities that are responsible for the community lifelines in the parish to capture the current conditions and projects that could increase the resilience of those critical infrastructure assets and service providers. A list of outreach efforts and meetings is included in Appendix B.

The parish will continue to focus on hardening of critical structures. The parish has already wind hardened the Government Tower, the Generating Station, the Houma Police Department, and the Courthouse Annex, and has shutters on the Houma Fire Department. The TOHSEP office was moved to a Cat 5 building outside the Special Flood Hazard Area (SFHA) as were most of the Public Works offices, the Juvenile Justice Facility and the Animal Shelter. Each of these buildings and the fire departments have redundant power and the span bridges and pump stations will have redundant power. Advances in communications and evacuation procedures and routes has also been accomplished along with an update to the Flood Response Plan.

Regardless of the topic, education was central to all activities reviewed. Ongoing efforts were applauded, but in most instances, increased education was identified as a necessary component of any resulting plan. For example, the evacuation routes have been developed, but are not widely known. The parish is investing in a flood gate and lock system backed up by pump stations and retention basins. The public should have access to training that explains how the system works together, and who is responsible for each element of the process. Educational initiatives are also necessary to bring industries a more detailed knowledge of the safety and resilience practices including insurance professionals, real estate interests, banks and builders. Without the education aspect, enforcement would be frustrating, expensive, and less productive. The decision was made to work toward a common goal embraced by the population after a coordinated educational program. Action items and the proposed project list includes outreach initiatives from the Multijurisdictional Program for Public Information, Levee Safety, Safe Harbor, etc. The objectives for education are listed below Goal 3.

The established and agreed upon objectives and actions relative to the established goals are shown below. The timeframe, potential funding sources, staff, and hazard(s) mitigated are provided with the mitigation actions. These goals, objectives and actions should be read as representative of the types of projects that the parish has identified as properties for risk reduction and long-term resilience. In each circumstance, the systems-based approach assumes that any requirement necessary to support the resulting installation, structure or program is also included by logic or reference. For example, reducing risk to a building to enable continuous or immediate occupation after a storm also requires hardening of all utilities to the structure, access to it, staff to run it and safe housing and food for that staff. All projects are described in Appendix F.

Goal 1: Identify and pursue preventive measures that will reduce future damages and preserve lives from natural hazards.

1. **Objective 1.1:** Ensure existing structures are structurally sound to endure hurricane-force winds and fortified building codes are used.

Action 1.1.1: *Wind harden structures.*

- Timeframe: 1-5 years
- Funding: FEMA HMGP, local, regional, and other federal
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane

2. **Objective 1.2:** Ensure all citizens and employees of Terrebonne Parish are safe from natural hazards.

Action 1.2.1: *Construct safe rooms at critical facilities and assess whether new structures should include a category 5 area for employees and whether they can be made multi-purpose.*

- Timeframe: 1-5 years
- Funding: FEMA HMGP, local, regional, and federal
- Staff: Public Works, Planning and Zoning, Public Safety
- Hazard Event Mitigated: Hurricane/Tornado

Action 1.2.2: *Expand the coverage and participation in the parish's hazard early warning system.*

- Timeframe: 1-5 years
- Funding: FEMA BRIC, local, state and regional.
- Staff: Office of Emergency Preparedness
- Hazard Event Mitigated: Hurricane/Tornado

Action 1.2.3: *Incorporate vulnerable populations into evacuation plans.*

- Timeframe: 1-5 years
- Funding: local, state and regional.
- Staff: Office of Emergency Preparedness
- Hazard Event Mitigated: Hurricane

Action 1.2.4: *Evaluate shelter for public use during large events.*

- Timeframe: 1-5 years,
- Funding: local, state and regional.
- Staff: Office of Emergency Preparedness
- Hazard Event Mitigated: Hurricane

Action 1.2.5: *Continue to construct a storm surge protection levee and the proposed lock system from Morganza to the Gulf to reduce the effects of saltwater intrusion.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion

Action 1.2.6: *Pursue approvals and funding for coastal restoration projects such as sediment diversions to reduce land subsidence in coastal areas.*

- Timeframe: Ongoing
- Funding: Local
- Staff: Planning and Zoning, Public Works
- Hazard Event Mitigated: Coastal Erosion/Land Subsidence

Action 1.2.7: *Study foreseeable subsidence that is often correlated with forced drainage areas under pump, and retention.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Existing parish administration, DCRP

- Hazard Event Mitigated: Coastal Erosion/Land Subsidence

Action 1.2.8: *Monitor agricultural activities and encourage smart farming practices to reduce soil compaction and acceleration of subsidence.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Planning and Zoning
- Hazard Event Mitigated: Land Subsidence

Action 1.2.9: *Install lightning rods on all critical facilities*.

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Public Safety/Public Works
- Hazard Event Mitigated: Lightning

Action 1.2.10: *Install and maintain surge protection on all critical electronic equipment located in critical facilities.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: All parish Departments and Public Safety
- Hazard Event Mitigated: Lightning

Action 1.2.11: *Initiate study on salt domes to fill in data gaps and identify hazard effects.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Planning and Zoning
- Hazard Event Mitigated: Sinkholes

Action 1.2.12: *Identify cooling and heating centers and make sure they have backup power.*

- Timeframe: 1-5 years
- Funding: local, federal
- Staff: Planning and Zoning, Public Safety
- Hazard Event Mitigated: Extreme Temperatures

- **Objective 1.3:** Ensure all first responders are adequately equipped and trained to respond to a storm event.

Action 1.3.1: *Purchase or upgrade communication devices as necessary to ensure interoperability among first responders and develop recurring cost funding source.*

- Timeframe: 1-5 years,
- Funding: HMGP, local, regional, and federal
- Staff: parish, Public Safety, 9-1-1
- Hazard Event Mitigated: Hurricane/Tornado/Flooding/Levee Failure

Action 1.3.2: *Purchase generators for critical facilities (see Attachment c3-1 for locations) to ensure operation during and after a hazard event.*

- Timeframe: 1-5 years,
- Funding: HMGP, local, regional, and federal
- Staff: Public Safety, Public Works
- Hazard Event Mitigated: Hurricane/Tornado/Flooding/Levee Failure

- **Objective 1.4:** Protect historic and cultural resources, such as cemeteries and gathering places from all natural hazards.

  Action 1.4.1: *Identify vulnerable historic and cultural resources, and opportunities to protect and/or relocate historic assets threatened by sea level rise.*

  - Timeframe: Ongoing
  - Funding: local, federal
  - Staff: Planning and Zoning
  - Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/Land Subsidence

Goal 2: Increase resilience of all entities, facilities, and utilities that support all lifelines through a systems-based analysis that includes support services, equipment, and personnel.

Objective 2.1 Create resilient power infrastructure tailored to serve all areas of the parish.

Action 2.1.1 *Harden or decentralize power grid generation through permanent or temporary microgrids to avoid long-term outages.*

Action 2.1.2 *Bury power lines when feasible.*

Action 2.1.3 *Harden feeders and other transmission connections.*

Objective 2.2 Provide resilience hubs with access to power, health, sanitation and communication support for critical facilities and public use.

Objective 2.3 Enhance safety and resilience of public facilities including schools, libraries, recreation facilities and auditoriums to serve as shelters and resilience hubs.

Action 2.3.1 *Support the critical function of schools and community centers as shelters and safe spaces for response and recovery.*

Objective 2.4 Study and support pre-placement or isolation of water sources for health and safety and air conditioning functionality immediately after an event.

Objective 2.5 Ensure access to health services for first responders during events and the public during recovery.

Objective 2.6 Seek out and encourage public private partnerships to achieve risk reduction and resilience goals.

Goal 3: Enhance public awareness and understanding of local vulnerabilities and risk reduction practices**.**

- **Objective 3.1:** Increase public awareness of hazard areas and educate the public on mitigation through existing channels and organizations and their memberships.

  All Actions in this section will be approached as follows:

  - Timeframe: 1-5 years
  - Funding: BRIC, Local and State
  - Staff: Planning and Zoning in coordination w/ TOHSEP, TSD, IT, etc.

    Hazard Event Mitigated: All Hazards with a focus on Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/ Tornado/Lightning/Sinkholes.

  Action 3.1.1: *Continue to advertise public meetings during the hazard mitigation planning process and throughout the year.*

Action 3.1.2: *TOHSEP will continue to attend public gatherings, provide yearly materials for mitigation and preparedness, and updates to the registration system for people needing evacuation or other services in preparation for an event.*
Action 3.1.3: *Continue web and email postings of mitigation programs available to reduce risks.*
Action 3.1.4: *Develop or identify and place pamphlets in the libraries and the parish's Robert "Bobby" Bergeron Government Tower regarding the risk of sinkholes and other identified hazards.*
Action 3.1.5 *Increase social media to increase penetration of messaging.*
Action 3.1.6 *Increase education regarding Law and Ordinance and Flood Insurance Claims to assist in elevation or other code compliance.*
Action 3.1.7 *Increase transparency on the website and links to useful material.*
Action 3.1.8 *Provide age-appropriate materials for schools to support physical and mental health through knowledge of natural hazard preparation and recovery.*
Action 3.1.9 *Educate communities currently residing in at risk areas on the evacuation plans, access to shelter, and transportation assistance as needed.*
Action 3.1.10 *Promote increased participation in the NFIP and continued participation in the Community Ratings System.*
Action 3.1.11: *Better promote the Multijurisdictional Program for Public Information to educate population on risk reduction strategies, their responsibilities, and the parish's responsibility for enforcement.*
Action 3.1.12 *Gather and present information on subsidence and climate change as models mature and understanding improves.*
Action 3.2.13 *Increase understanding of public, real estate, banking, and mortgage stakeholders regarding the value of flood and wind safety building alternatives.*
Action 3.2.13 *Develop tree planting educational materials.*

Goal 4: Reduce repetitive flood losses in the parish and continue with the CRS program.

- **Objective 4.1.:** Eliminate threat of flood damage to structures in Terrebonne Parish including storm surge and levee failure.

Action 4.1.1: *Continue to upgrade drainage infrastructure including subsurfacing ditches.*

- Timeframe: 1-5 years
- Funding: FEMA HMA, FEMA BRIC, Local, State
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion

Action 4.1.2: *Identify unpermitted culverts and enforce current codes.*

- Timeframe: 1-10 years,
- Funding: Local
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.3: *Elevate or acquire all RL and SRL structures in Terrebonne Parish (see Attachment c2-25 on page 111).*

- Timeframe: 1-10 years
- Funding: HMA, FMA, PDM
- Staff: Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.4: *Develop new and more accurate models to project the impact of various mitigation activities such as levee system improvement and nature-based solutions.*

- Timeframe: 1-10 years
- Funding: CDBG, FMA, PDM, BRIC, Watershed Initiative
- Staff: Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.5: Elevate equipment that is vulnerable to flood damage (see Attachment c3-1 for locations)

- Timeframe: 1-5 years
- Funding: HMA, Local, State
- Staff: Public Works
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.6: *Flood proof public buildings vulnerable to flood damage that cannot be relocated.*

- Timeframe: 1-5 years
- Funding: FEMA HMGP
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.7: *Construct Morganza to the Gulf Hurricane Protection Levee which would protect both new and current developments.*

- Timeframe: 1-10 years,
- Funding: local, regional, and federal
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.8: *Collaborate with communities to design, evaluate, and implement relocation strategies for communities located outside the levee systems.*

- Timeframe: 1-10 years,
- Funding: local, regional, and federal
- Staff: Planning and Zoning, Public Safety
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.9: *Ensure that current and future building elevations take the needs of those individuals with access and functional needs into account. This includes the incorporation of lifts.*

- Timeframe: 1-10 years
- Funding: local, regional, and federal
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.10: *Assess ability of current efforts to protect the Island Road from surge and tidal impacts for sufficiency. This might include engineered solutions to decrease wave impacts and/or erosion control mechanisms along the edges of the road.*

- Timeframe: 1-10 years,
- Funding: local, regional, and federal
- Staff: Public Works, Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 4.1.11: *Consider State freeboard requirements and explore adopting local freeboard ordinances.*

- Timeframe: 1-5 years
- Funding: local, regional, and federal
- Staff: Planning and Zoning, Public Works

- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Goal 5: Facilitate sound development in the parish and implement nature-based solutions **to reduce or eliminate potential impacts of hazards.**

- **Objective 5.1:** Promote and permit commercial and industrial development, including public critical facilities, outside of hazard areas to limit business interruption, property damage, and impairment to critical facilities in strict accordance with the parish zoning, flood management, and other applicable state and federal regulations.

  Action 5.1.1: *Enforce building codes to ensure that future development does not increase hazard losses.*
  - Timeframe: 1-5 years
  - Funding: No additional funds required
  - Staff: Planning and Zoning
  - Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/ Tornado

  Action 5.1.2: *Guide future residential development away from hazard areas using zoning regulations or tax options while maintaining other parish priorities such as economic development and the quality of life.*
  - Timeframe: 1-5 years
  - Funding: Local/BRIC for outreach or modeling
  - Staff: Planning and Zoning
  - Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/ Tornado/Sinkholes

  Action 5.1.3: *Provide safe locations for files, records, and computer equipment.*
  - Timeframe: 1-5 years
  - Funding: CDBG/HMA/BRIC
  - Staff: Parish
  - Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/ Tornado

  Action 5.1.4: *Examine current zoning regulations and determine what new regulations could be passed to reduce the effects of hazards on new buildings and infrastructure.*
  - Timeframe: 1-5 years
  - Funding: No additional funds required
  - Staff: Planning and Zoning
  - Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/ Tornado

- **Objective 5.2**: Promote preservation and/or conservation of flood prone areas for parish parks, recreation areas, and general flood plain management.

  Action 5.2.1: *Participate in existing programs at the state and federal levels oriented to environmental enhancement and conservation.*
  - Timeframe: 1-5 years
  - Funding: local, regional, and federal
  - Staff: Planning and Zoning, Recreation, Parks, & Grounds, Coastal Restoration and Preservation

- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion/ Tornado

Action 5.2.2: *Continue to participate in the NFIP (including Houma under the Consolidated Government) and incorporate Community Ratings System principles as appropriate.*

- Timeframe: 1-5 years
- Funding: Local, BRIC
- Staff: Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 5.2.3: *Establish a public outreach campaign to ensure all homeowners in floodplains are aware of the types of coverage options under the NFIP.*

- Timeframe: 1-5 years
- Funding: HMA, state
- Staff: Planning and Zoning, Housing and Human Services
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure

Action 5.2.4: *Work with landowners in flood prone areas, particularly outside of the levee systems, and other stakeholders to identify flood mitigation and climate adaptation measures to reduce flood risk.*

- Timeframe: 1-5 years
- Funding: HMA, state
- Staff: Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion

Action 5.2.5: *Work with communities currently residing in flood prone areas, particularly outside of the levee systems, on the identification of flood mitigation and climate adaptation measures to reduce flood risk.*

- Timeframe: 1-5 years
- Funding: HMA, state, CDBG, local
- Staff: Planning and Zoning
- Hazard Event Mitigated: Hurricane/Flooding/Levee Failure/Saltwater Intrusion/ Coastal Erosion

Action 5.2.6: *Research partners and low tech or low-cost alternatives for marsh, coastal or shoreline protection or restoration programs to reduce harm from all hazards.*

Action 5.2.7: *Seek opportunities to provide heat and cold moderation through planting of trees, ponds or other temperature and humidity moderating installations.*

Action 5.2.8: *Require each drainage, restoration or preservation project to include an alternative that provides natural benefits such as water retention, tree/vegetative stabilization, water quality improvement or improved habitat value.*

4.3 Mitigation Projects

The Terrebonne Parish Project List resulting from the HMPU 2020 is presented in Appendix F to show the progress from that planning effort to the 2023 list of proposed projects. Two truncated listings of projects based on projects' status and prioritization are provided in this section. The project list has been reduced both by completing projects, and by changing the format of the list to list each project once in the rows, and provide all of the projects and characteristics in the columns.

In reviewing and evaluating the potential project list, the Steering Committee considered a variety of factors including the STAPLEE method, including cost effectiveness of each mitigation project. A project's eligibility for federal mitigation grants was not considered as the plan is focused on what needs to be done rather than what the federal government will fund. This process required evaluation of each project's engineering feasibility, cost effectiveness, and environmental and cultural factors.

4.4 Mitigation Prioritization, Implementation, and Administration

§201.6 (c)(3)(iii) …shall include an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The Hazard Mitigation Steering Committee, partners, and the public have identified hazard mitigation projects to be included in the parish Hazard Mitigation Plan. The actions presented on the previous pages were categorized to organize priorities by HMGP grant eligibility. Projects not deemed eligible and/or covered in other programs can be located in the full project list in Appendix F. Potential projects identified included properties and areas that have localized flooding or drainage problems as noted in the Terrebonne Parish Hazard Mitigation Plan Update (2020). Projects carried over from the HMPU (2020) can also be found in Appendix F. Most of the projects from the original plan were not eligible for HMGP funding, but those that do were carried forward to project prioritization. The project list reviewed for prioritization also included consideration of repetitive loss (RL) and severe repetitive loss (SRL) properties in the parish. Appendix F captures discussion of prioritization and feasibility based on several criteria.

Prioritization

The STAPLEE prioritization method used for this HMPU considers seven criteria:

Criteria	Description
Social	Based on the idea that community consensus is a necessary precondition for successful implementation of mitigation measures. This also means that measures should not affect adversely a particular segment of the population or a particular neighborhood, or adversely impact local cultural values or resources.
Technical	Address the technical feasibility of the proposed action in terms of effectiveness, secondary impacts, and the technical capabilities of the community to implement and sustain this action.

Criteria	Description
Administrative	Address the administrative capabilities require to implement each mitigation action. For example, does the jurisdiction have the necessary organization, staff, and funding sources to implement and sustain the mitigation process?
Political	Considers the need for political support for migration actions. This means that all stakeholders in the political process, especially political organizations and institutions both inside and outside the community, should support the measure.
Legal	Used to determine the appropriate legal authority necessary to implement each mitigation action and whether such an authority can be delegated. In addition, the migration action is examined from the standpoint of current statues, codes, ordinances, and other regulations, as well as the possible legal ramifications of the action's implementation.
Economic	Address the cost-effectiveness of the proposed action and its economic impact on the community. It is only reasonable to expect that the benefits of implementation will exceed the costs incurred. Economic considerations also consider the economic impact of the community's future development.
Environment	Although most mitigation actions are beneficial for the environment, some actions may have adverse impacts, which must be considered and addressed.

Implementation

Upon approval of the Hazard Mitigation Plan by state and federal authorities, parish officials will meet with each of the respective governmental units regarding planning and implementation of the respective projects. The parish will then initiate activities required to implement the projects in each Department. Due to the exceptional opportunity of having a storm and the resulting funding available, several projects in this plan are already being submitted for Hazard Mitigation Grant Program funding or Public Assistance grant funds.

On parish-wide projects the Planning and Zoning Director, and Mitigation Planner will meet with appropriate staff to ensure conformance to the plan requirements.

Administration

The responsibility of policy and permitting matters as they relate to the siting of structures in flood-prone areas will continue to be administered by the parish government. Public awareness of the above initiatives will also be facilitated by the parish government.

5.0 PLAN MAINTENANCE

§201.6 (c)(4)(i) A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Terrebonne Parish has developed a plan maintenance process to ensure that regular review and update of the Hazard Mitigation Plan occurs. The parish has formed a Hazard Mitigation Plan Evaluation Committee that consists of select members from the parish staff, local agencies, and the Hazard Mitigation Plan Update Committee, which was responsible for preparing the HMPU as included herewith. The HMP Evaluation Committee consists of the following representation:

1. Terrebonne Parish President
2. Terrebonne Parish Manager
3. Planning and Zoning Director (responsible for overall coordination of HMP maintenance activities)
4. Terrebonne Parish Recovery Planner
5. Terrebonne Parish Director of Public Works
6. Terrebonne Office of Homeland Security and Emergency Preparedness Director
7. Terrebonne Parish Sheriff
8. Houma Police Department Chief
9. Houma Fire Department Chief

The Parish Planning and Zoning Director is responsible for contacting HMP Evaluation Committee members in the first quarter of the year on an annual basis. The Recovery Planner will survey the Departments and stakeholder partners and develop an inventory of progress on objectives and projects. All directors and the HMPU Steering Committee will be invited to a meeting to discuss the changes in hazard risk and progress toward mitigation action implementation. The information will be sent to the committee members for comment or additions. If warranted, the revisions will be adopted by the Council. Maintenance updates may also include updates to maps or other materials to make them more accessible to the average member of the public.

In addition, starting January 1, members have a one-month period in which to respond to or initiate a meeting if any one member feels that issues need to be addressed. However, should a hazard event occur and the need for update analysis surface, a meeting can be called by the Parish Planning and Zoning Director or requested by a committee member through the Parish Administration.

The Parish Planning and Zoning Director is also responsible for maintaining plan review comments. Members of the evaluation committee will monitor the plan on an ongoing basis using phone calls and emails to contact those responsible for implementing the plan's action items and bring the project status reports to the yearly evaluation meetings. Ideas to be discussed will include, but are not limited to, the following:

- Does the steering committee membership need to be updated?
- Have new hazard events occurred?
- Has new funding been allotted?
- Have projects been implemented?

- Have project priorities changed?
- Are there new projects to discuss?

In addition to the yearly evaluations, the questions listed above and additional considerations will be made during the formal update process to be completed and approved by FEMA within a five-year cycle. Updates to the Hazard Mitigation Plan will be made fully utilizing the representation of the HMP committee formed for this purpose. The Parish Planning and Zoning Director is also responsible for monitoring the progress of the action items and will report the status of the projects to the HMP Evaluation Committee yearly.

5.1 Incorporating into Local Planning

§201.6 (c)(4)(ii) A process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Members of parish departments who interact on planning issues, such as the Parish President, Parish Manager, Parish Director of Planning and Zoning, Parish OEP Director, and the Sheriff will review the relevance of the HMP's risks and vulnerabilities identified. They will also review the goals, objectives, and actions for mitigating the risks, and catalogue all said information for use in future HMP updates as well as other local planning mechanisms.

Since Hurricane Ida, the Parish has undertaken a public listening tour in support of a Recovery Plan, and will be further inviting public comment on an Action Plan for Community Development Block Grant funding. Those consultants and parish staff will be briefed on the HMPU findings, goals, objectives, successes and projects for consistency and validation.

When appropriate, Parish Government, by way of the individuals who served on the HMPU Steering Committee and the HMP Evaluation Committee, will address the need to incorporate requirements of the mitigation plan into the respective zoning ordinances, comprehensive plans, and/or capital improvement plans if deemed necessary and if not previously included. An effort will be made by all HMPU Steering Committee members to ensure consistency in all future planning efforts with the mitigation goals and risk assessment presented in this plan. Consistency between all planning efforts will ensure a decrease in losses related to hazard events within future and existing developments. The former hazard mitigation plan's goals were incorporated into Goal 5 of *Vision 2030: Terrebonne's Plan for Its Future* and are anticipated to be updated in the next iteration currently in development. Appendix F illustrates the current integration of projects and project types showing the various plans that include the projects or project types proposed.

If amendments to existing ordinances or new ordinances are required, the Parish Council will be responsible for its respective updates.

5.2 Public Participation in Plan Maintenance Process

§201.6 (c)(4)(iii) Discussion on how the community will continue public participation in the plan maintenance process

The Parish Planning and Zoning Director is responsible for coordinating continued public participation. Copies of the plan will be kept on file at the parish government office (7836 Park Avenue, Houma, LA). Contained in the plan and presented in section (c)(4)(i) is a list members of the plan evaluation committee that may be contacted. In addition, copies of the plan and proposed changes will be posted on the parish government website (http://www.tpcg.org/index.php?f=flooding&p=hmpu). This website will continue to have an e-mail address, phone numbers, and the online form through which the public can direct their comments or concerns. The local newspaper will also be notified about public meetings, plan updates, and mitigation success stories.

5.3 Plan Review, Evaluation, and Implementation Based on Future Conditions

§201.6 (d)(3). Plan review, evaluation, and implementation based on changing conditions, future development, and mitigation efforts.

As is evident in the discussions, goals and objectives, and the proposed new projects for this plan update, a lot has changed in the last seven years, and the parish is planning ahead for the next 50 years. New construction in the parish is predominantly in the north and west quadrants of the parish as captured above. parish residents have slowly and voluntarily moved away from the coast. Commercial activity has also shifted out of the SFHA. There has been a slow and voluntary move of residents, and nonfunctionally water access commercial activity is also focused outside the special flood hazard area. This is not to say that the parish is abandoning the fishing community and other industry that must be performed at the water's edge or in marshes. The parish is mitigating repetitive loss structures and the new FEMA floodplain maps will support safer building requirements for the future. The community is supportive as evidenced by their input to the LA SAFE process and the adaptation measures that align with this plan.

The flood and hurricane risk assessments in the report have had major updates since the last HMPU with the new maps and Hazus modeling. The parish has worked with FEMA and their consultants for many years to develop this more accurate set of maps to best identify their risks and vulnerabilities and better provide cost benefit assessments of proposed activities. The Parish, having identified through this planning process the lack of inclusion of the protection system in the maps, lack of base flood elevation and 500 year flood elevations requested in the process, and the resulting obsolescence of the maps, will approach FEMA Risk Mapping for an update or seek funding to develop a local standard. That standard would be presented to FEMA as an alternate map for all flood regulation activities.

The proposed direction for the future includes not only the updated mapping and risk assessments, but improved models for daily use in permitting, and to inform a uniform development standard of protection to be used in all drainage as well as building activities. Seeing gaps in the funding streams, the parish is considering options for community support for flood insurance or other underfunded needs. The education initiatives will continue to pursue participation in insurance and mitigation programs and include campaigns to show the effect of current progress, and the options that are available for the future. The parish has taken steps over the last six years to increase the regional focus of these mitigation efforts, including collaborating with neighbors which is reflected in the project list and the meetings that have been held during this process. Meetings will continue as we update this plan again with input from the ongoing subcommittees and our local and regional partners.

6.0 PLAN ADOPTION

§201.6 (c)(5) Documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council). For multi-jurisdiction requesting approval of the plan must document that it has been formally adopted.

Documentation that the plan has been formally approved by the Terrebonne Parish Council is presented in Appendix A. Terrebonne Parish is a consolidated government without independent incorporated municipalities.

TERREBONNE PARISH, LOUISIANA

HAZARD MITIGATION PLAN UPDATE 2023
APPENDICES

February 16, 2023

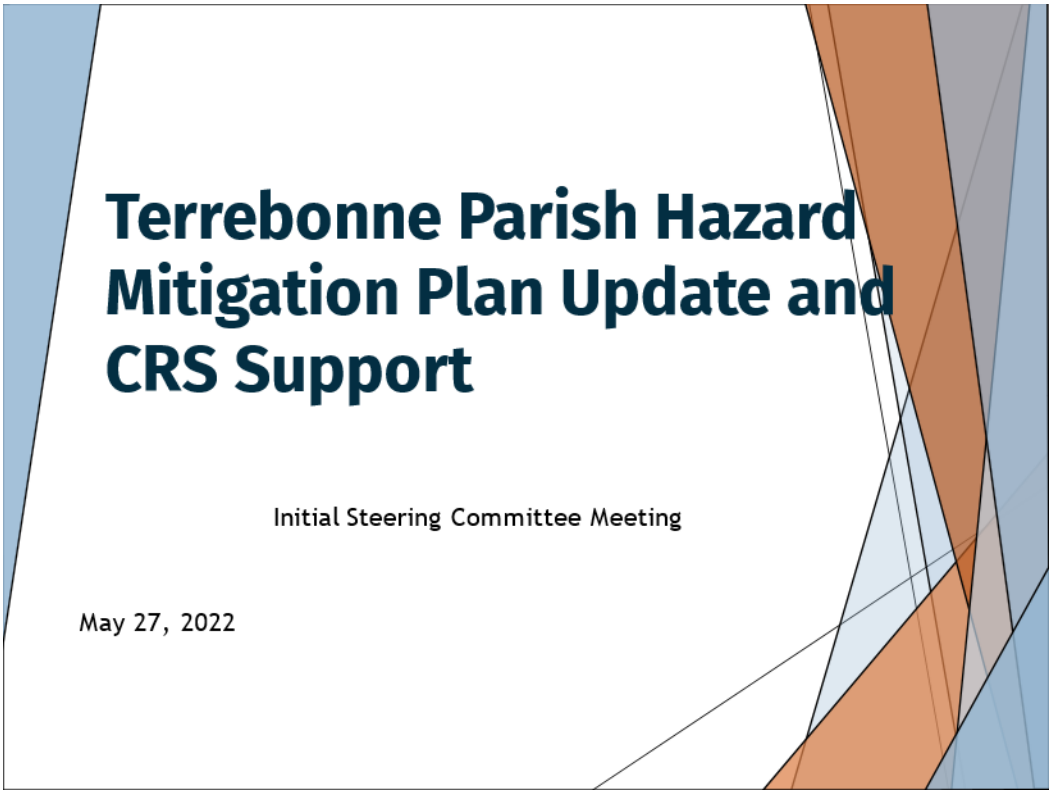
Terrebonne Parish Consolidated Government
8026 W. Main Street
Houma, Louisiana 70360
985-868-5050

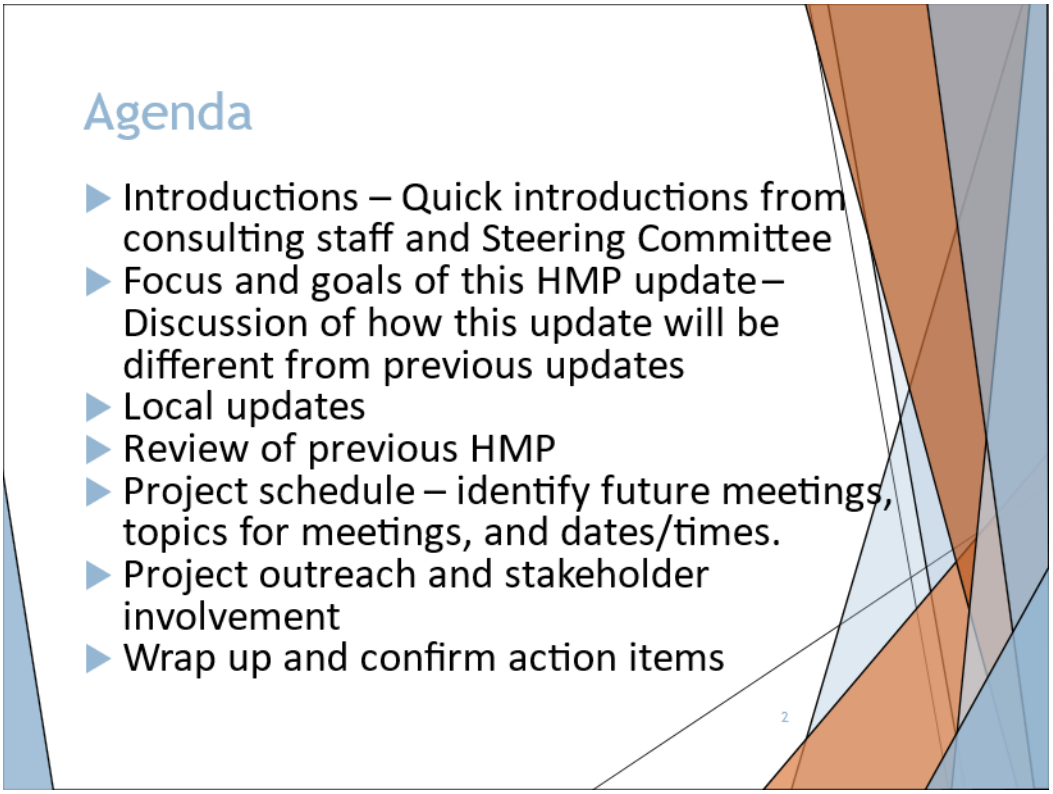
Parish President, Gordon E. Dove
Prepared by: Jennifer C. Gerbasi

APPENDIX A: ADOPTION RESOLUTION

PLACEHOLDER

APPENDIX B: MEETINGS


Terrebonne Parish Hazard Mitigation Plan Update and CRS Support
Initial Steering Committee Meeting
May 27, 2022


Agenda
Introductions – Quick introductions from consulting staff and Steering Committee
Focus and goals of this HMP update – Discussion of how this update will be different from previous updates
Local updates
Review of previous HMP
Project schedule – identify future meetings, topics for meetings, and dates/times.
Project outreach and stakeholder involvement
Wrap up and confirm action items
2

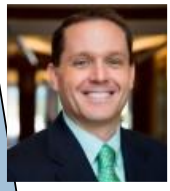
Introductions – Consultant Team

Bill Bohn is a risk assessment specialist and Hazus expert with 20 years experience supporting communities and projects around the world with hazard risk assessments and mitigation projects. He has supported more than fifty hazard mitigation plans in the U.S. and has supported the States of Hawaii and Rhode Island with Climate Adaptation Plans. He is the lead author of FEMA 433 Using Hazus for Risk Assessment. He is authorized to teach all the FEMA Hazus courses and has been an instructor at the Emergency Management Institute for seventeen years.

Mr. Bohn will be the project manager and lead risk assessor for this project.

Jamie Caplan has over twenty years of emergency management experience that will directly benefit this project. This experience includes developing stakeholder engagement workshops and strategies for resiliency planning and hazard mitigation projects. Ms. Caplan has managed multiple large and small disaster planning and resiliency projects. Her expertise includes stakeholder involvement and outreach, developing collaborative risk management solutions and drafting hazard mitigation plans.

Ms. Caplan will be the Hazard Mitigation Planner for this project.



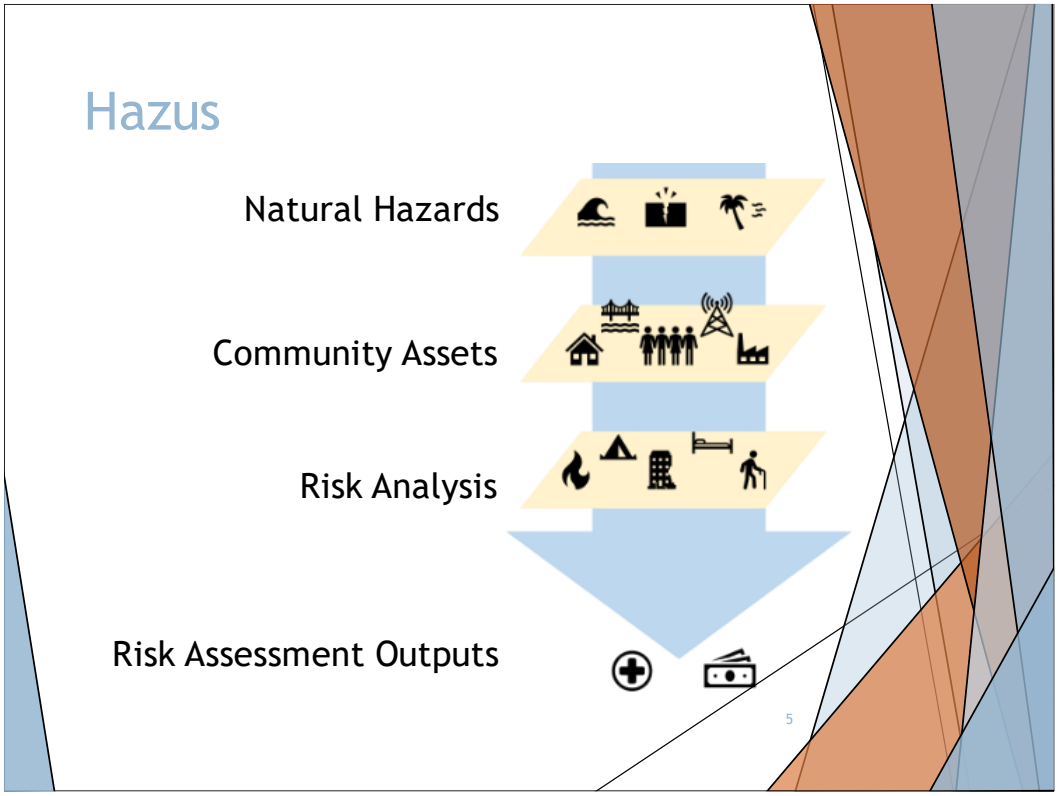
Darrin Punchard is an urban planning and resilience strategy consultant who has spent his career working with states and local communities to prevent natural hazards from becoming disasters. He has more than two decades of experience in hazard mitigation planning with specialized expertise in risk assessment, risk communication, benefit-cost analysis, and the development of actionable strategies for risk reduction. He has helped communities prepare floodplain management plans that have achieved among the highest credit scores in the nation under FEMA's Community Rating System (CRS). Darrin served as the lead consultant to FEMA on the development of the Local Mitigation Planning Handbook, the official guide for preparing local hazard mitigation plans in compliance with federal regulations.

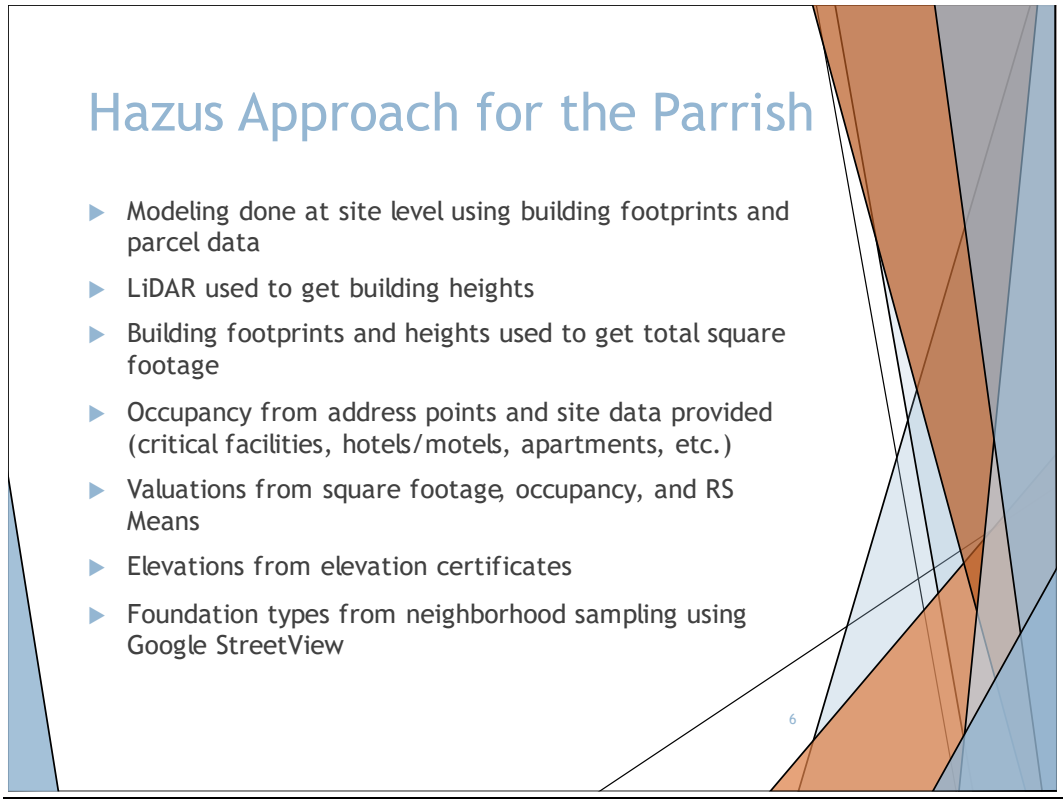
Mr. Punchard will be the CRS Lead for this project.

Focus and Goal of this Update

- Hazus integration into risk assessment
- Maximize CRS points
- Update risk assessment and mitigation strategy

4


Hazus
Natural Hazards
Community Assets
Risk Analysis
Risk Assessment Outputs
5

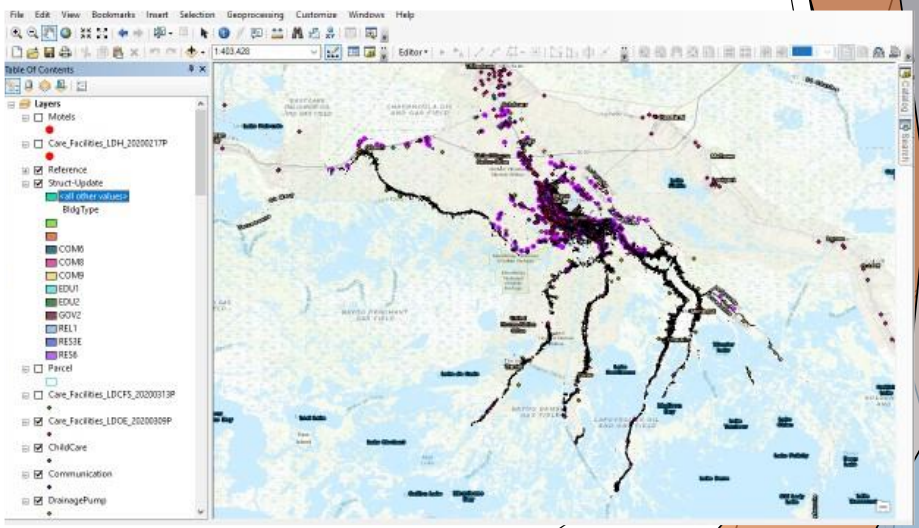

Hazus Approach for the Parrish
Modeling done at site level using building footprints and parcel data
LiDAR used to get building heights
Building footprints and heights used to get total square footage
Occupancy from address points and site data provided (critical facilities, hotels/motels, apartments, etc.)
Valuations from square footage, occupancy, and RS Means
Elevations from elevation certificates
Foundation types from neighborhood sampling using Google StreetView
6

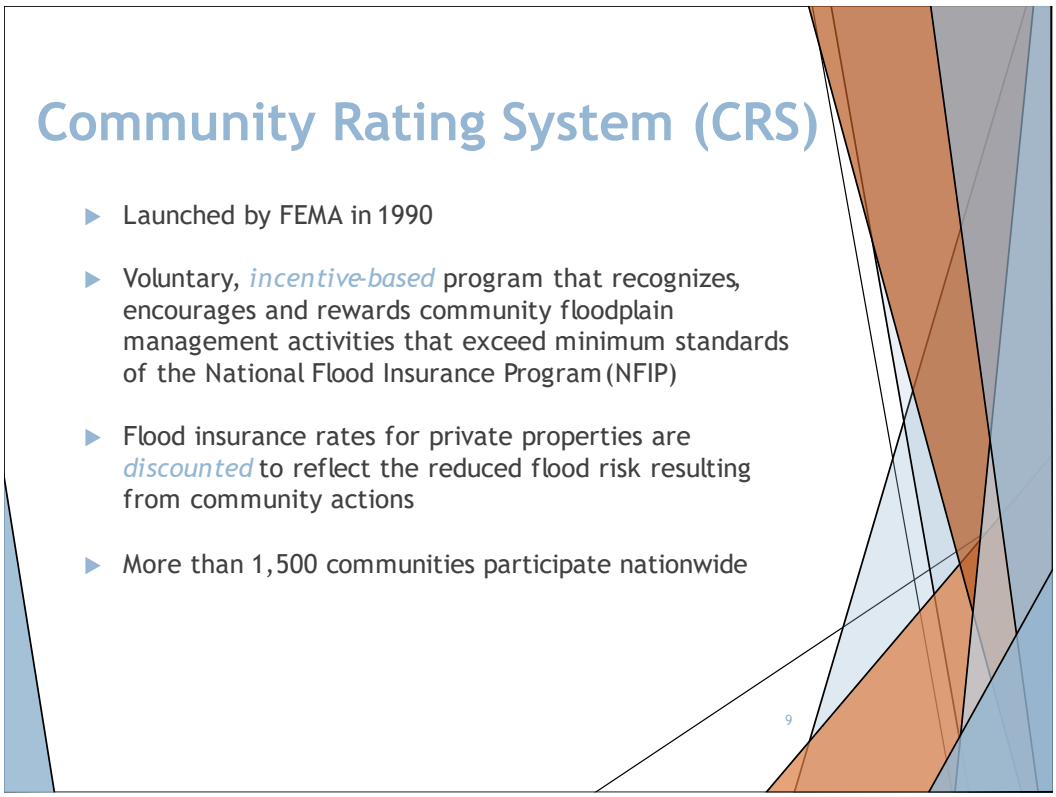
Data Collected

- Building footprints
- Address points
- Critical facility data
- Flood hazard data
- LiDAR
- Bridge, road, rail data
- Elevation certificates

7

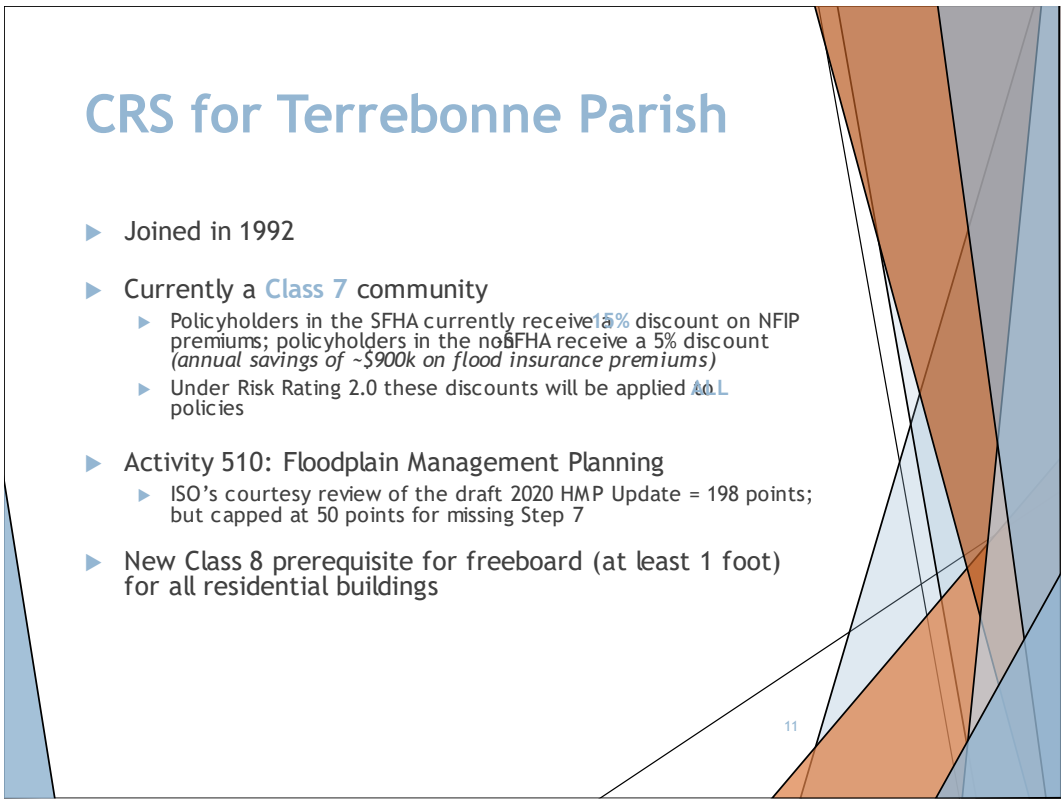
Modeling Conducted at Site Level

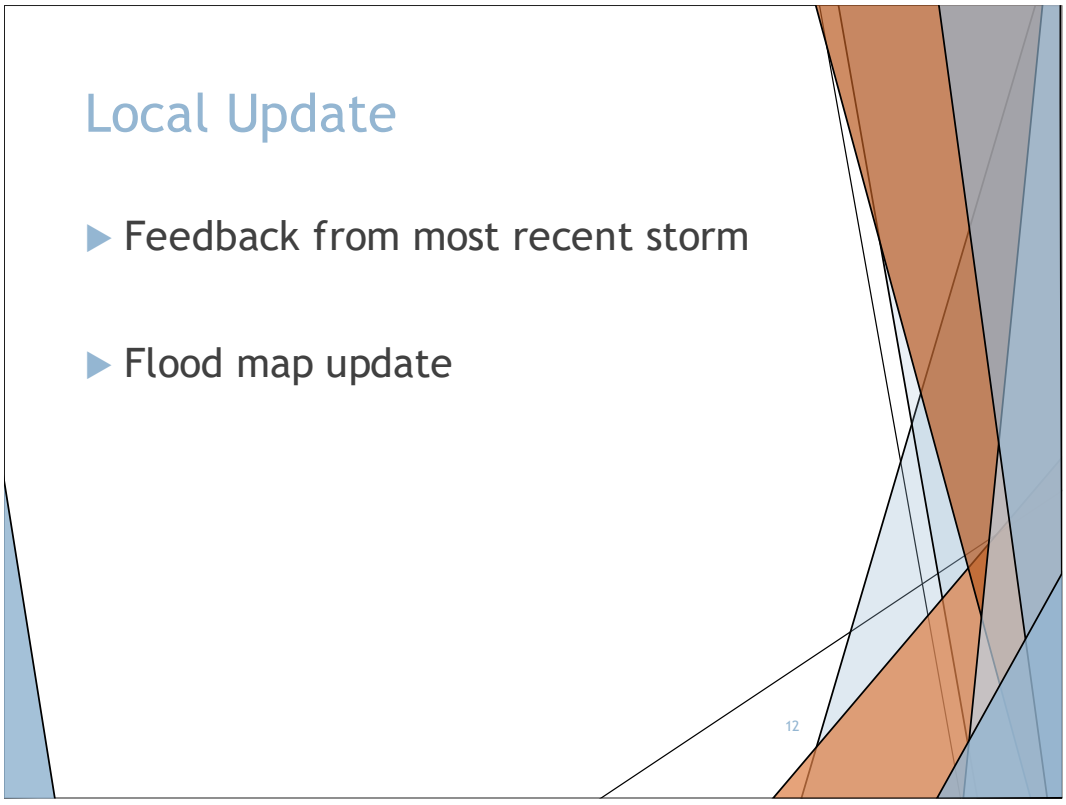


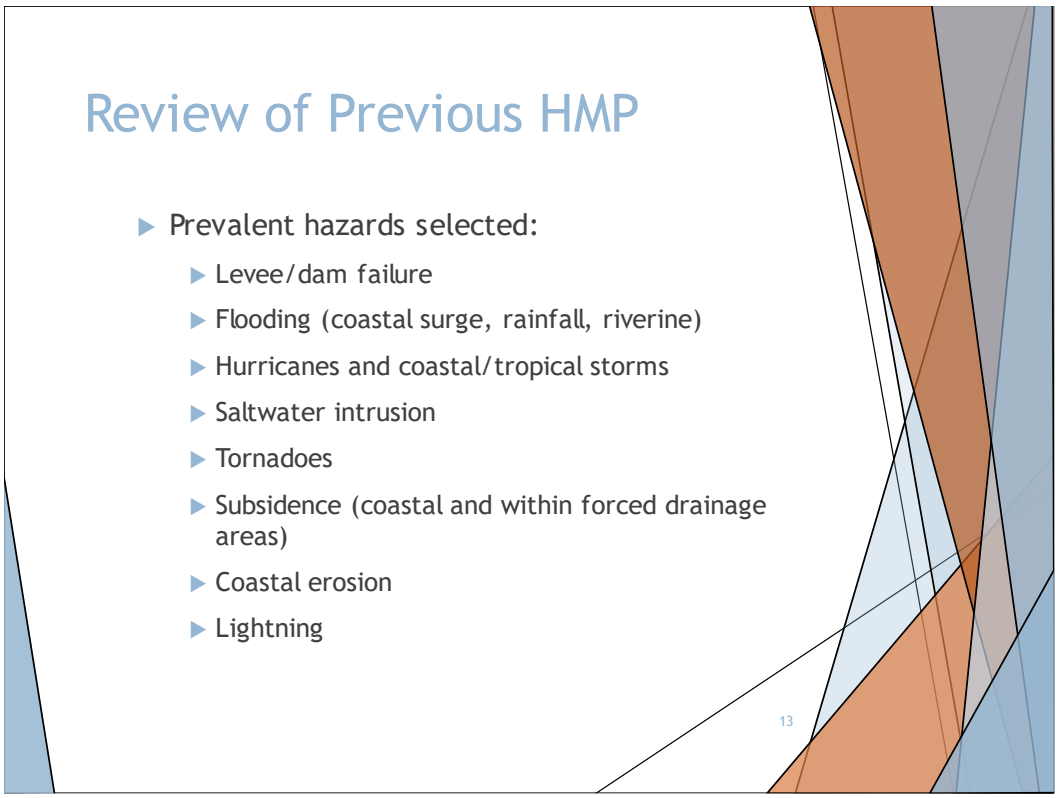


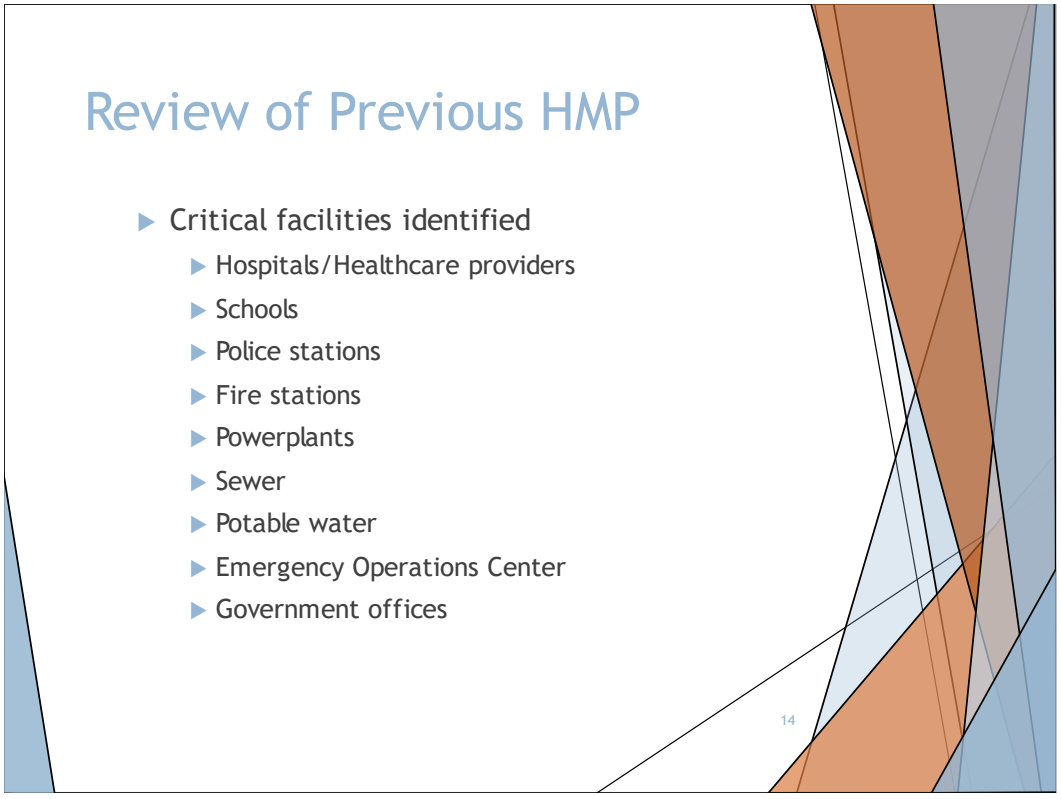
CRS Credits, Classes, and Discounts

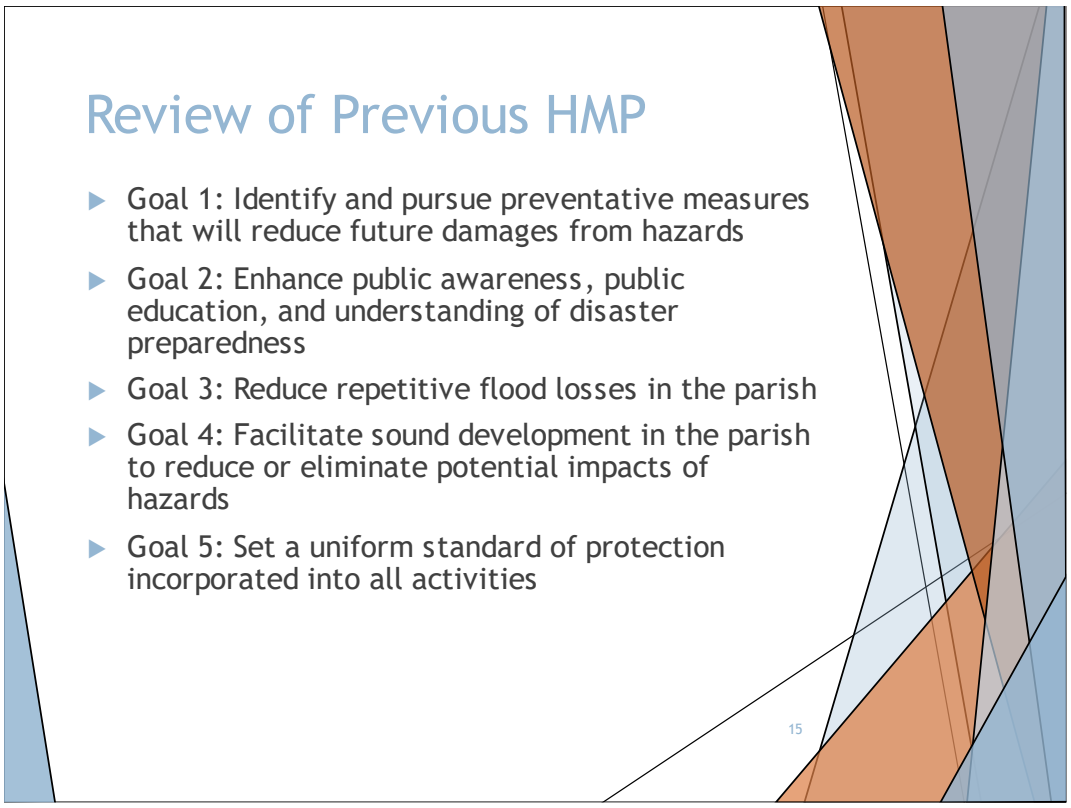
Credit Points	CRS Class	Premium Discount
4,500+	1	45%
4,000–4,499	2	40%
3,500–3,999	3	35%
3,000–3,499	4	30%
2,500–2,999	5	25%
2,000–2,499	6	20%
1,500–1,999	7	15%
1,000–1,499	8	10%
500–999	9	5%
0–499	10	0%

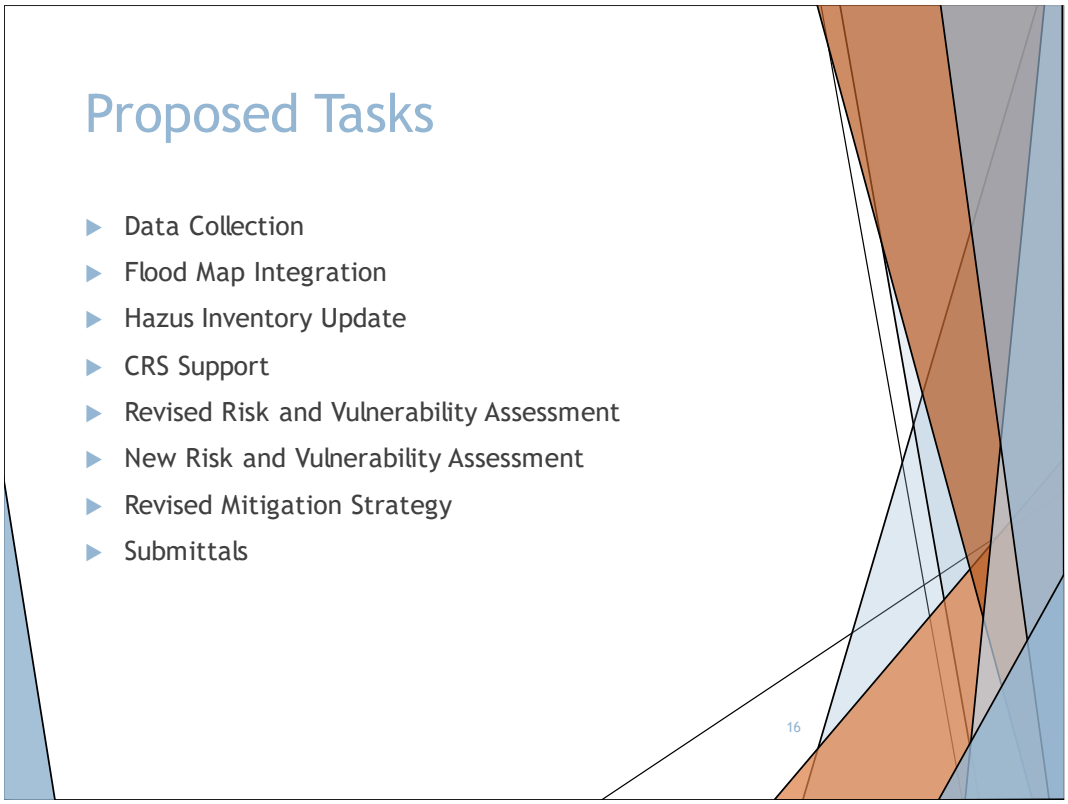

CRS for Terrebonne Parish
Joined in 1992
Currently a Class 7 community
Policyholders in the SFHA currently receive a 15% discount on NFIP premiums; policyholders in the non-SFHA receive a 5% discount (annual savings of ~$900k on flood insurance premiums)
Under Risk Rating 2.0 these discounts will be applied to ALL policies
Activity 510: Floodplain Management Planning
ISO's courtesy review of the draft 2020 HMP Update = 198 points; but capped at 50 points for missing Step 7
New Class 8 prerequisite for freeboard (at least 1 foot) for all residential buildings
11


Local Update
Feedback from most recent storm
Flood map update
12

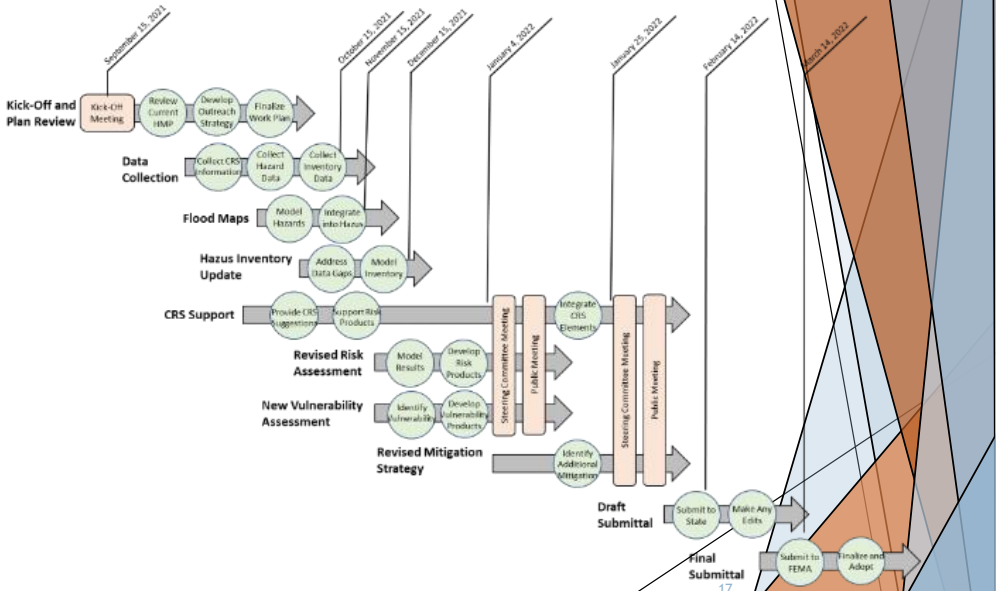

Review of Previous HMP
Prevalent hazards selected:
Levee/dam failure
Flooding (coastal surge, rainfall, riverine)
Hurricanes and coastal/tropical storms
Saltwater intrusion
Tornadoes
Subsidence (coastal and within forced drainage areas)
Coastal erosion
Lightning
13


Review of Previous HMP
Critical facilities identified
Hospitals/Healthcare providers
Schools
Police stations
Fire stations
Powerplants
Sewer
Potable water
Emergency Operations Center
Government offices
14


Review of Previous HMP
Goal 1: Identify and pursue preventative measures that will reduce future damages from hazards
Goal 2: Enhance public awareness, public education, and understanding of disaster preparedness
Goal 3: Reduce repetitive flood losses in the parish
Goal 4: Facilitate sound development in the parish to reduce or eliminate potential impacts of hazards
Goal 5: Set a uniform standard of protection incorporated into all activities
15


Proposed Tasks
Data Collection
Flood Map Integration
Hazus Inventory Update
CRS Support
Revised Risk and Vulnerability Assessment
New Risk and Vulnerability Assessment
Revised Mitigation Strategy
Submittals
16

Schedule



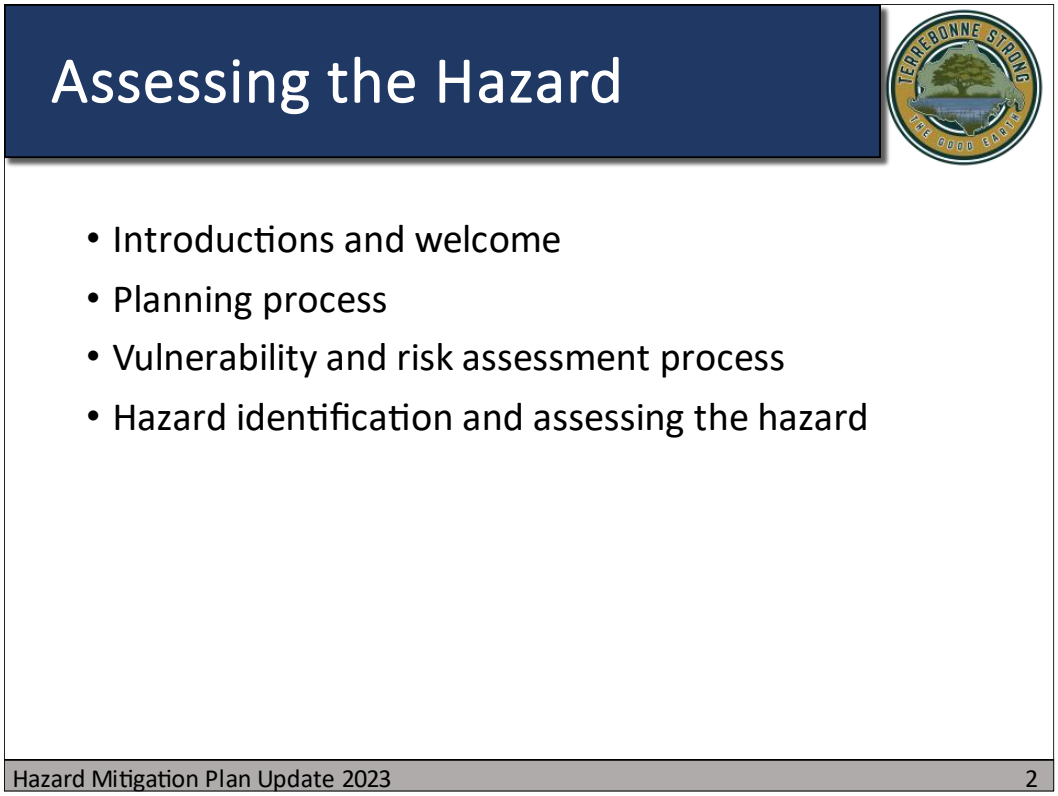
Project Outreach and Stakeholder Involvement

- Hazard Mitigation Steering Committee
  - Provide supporting data or information
  - Assist in the identification and prioritization of mitigation actions
  - Review and comment on the draft plan
  - Approve final draft for submission to State
- Public outreach
  - "Ground-truthing" - local knowledge
  - Consensus building
  - Hazard Mitigation Committee
  - Public meetings and surveys
  - Stakeholder meetings

18


Next Steps and Questions
Bill Bohn
bbohn@sobisinc.com
703-655-4071
19


TERREBONNE PARISH
HAZARD MITIGATION PLAN UPDATE 2023
PUBLIC MEETING & STEERINGCOMMITTEE MEETING #2
August 31, 2022
Office of Homeland Security and Emergency Preparedness
Presented by: Bill Bohn


Assessing the Hazard
• Introductions and welcome
• Planning process
• Vulnerability and risk assessment process
• Hazard identification and assessing the hazard
Hazard Mitigation Plan Update 2023
2

Introductions

- Name
- Organization
- Role

Hazard Mitigation Plan Update 2023 3

What's in the Mitigation Plan?

- Community profiles – demographics, employment, growth areas, natural environment, and built environment
- Hazard information and risk assessment – natural, human-caused, and technological hazards
- Community capabilities
- Mitigation goals, objectives, and actions
- Maintenance strategies – maintenance plan for the next five years

Hazard Mitigation Plan Update 2023 4

Role of Steering Committee

- Provide supporting data and information
- Assist in the identification and prioritization of hazards to address
- Assist in the identification and prioritization of mitigation actions
- Review and comment on the draft plan

Hazard Mitigation Plan Update 2023 5

HMP Planning Process

Hazard Mitigation Plan Update 2023 6

Focus of this Update

- Update the risk assessment with a detailed, site - specific Hazus analysis
- Lower insurance costs
- Update Plan with recent hazard information and experiences

Hazard Mitigation Plan Update 2023 7

Community Rating System (CRS)

- Launched by FEMA in 1990 (Terrebonne Parish joined in 1992)
- Voluntary, *incentive-based* program that recognizes, encourages and rewards community floodplain management activities that exceed minimum standards of the National Flood Insurance Program (NFIP)
- Flood insurance rates for private properties are *discounted* to reflect the reduced flood risk resulting from community actions
- Parish is currently a Class 7 community

Hazard Mitigation Plan Update 2023 8

Community Rating System (CRS) Steps

Mitigation Planning Elements*	CRS Planning Steps**
A. Planning Process	1. Organize to prepare the plan
	2. Involve the public
	3. Coordinate
	10. Implement, evaluate, revise
B. Hazard Identification and Risk Assessment	4. Assess the hazard
	5. Assess the problem
C. Mitigation Strategy	6. Set goals
	7. Review possible activities
	8. Draft an action plan
D. Plan Update	10. Implement, evaluate, revise 5-year update
E. Plan Adoption	9. Adopt the plan

Hazard Mitigation Plan Update 2023 9

Definitions- Hazard

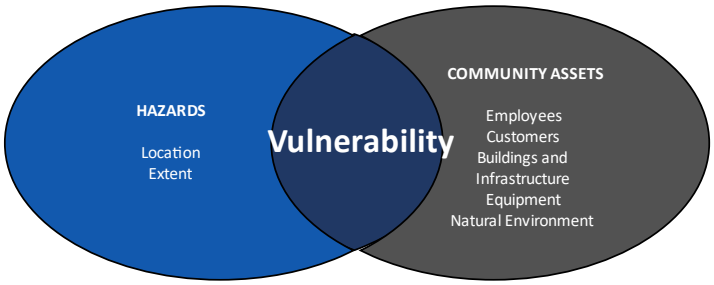
- Hazard means an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss. (FEMA)

Source: Local Mitigation Planning Handbook, FEMA 2013.

Hazard Mitigation Plan Update 2023 10

What is Vulnerability?

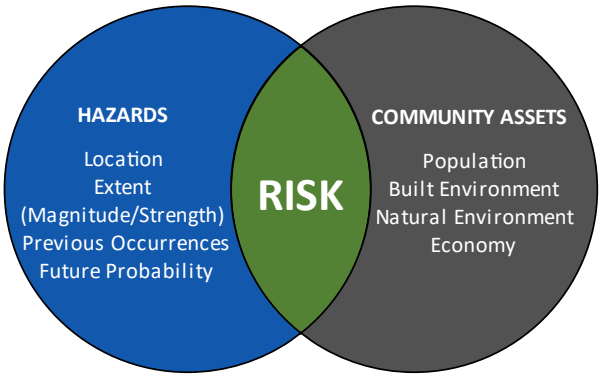
- Vulnerability definition: The susceptibility of people, property, industry, resources, ecosystems, or historical buildings and artifacts to the negative impact of a disaster. (FEMA)



Hazard Mitigation Plan Update 2023 11

What is Risk?

- The potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets.



Source: Local Mitigation Planning Handbook, FEMA 2013.

Hazard Mitigation Plan Update 2023 12

What is Risk Assessment?

- Product or process that collects information and assigns values to risks for the purpose of ranking priorities, developing or comparing courses of action, and informing decision making. (FEMA)

Hazard Mitigation Plan Update 2023 13

Risk/Vulnerability Section of th Plan

- Hazard description
- Geographic location and extent of hazard
- Magnitude and severity
- Previous occurrences
- Relationship to other hazards
- Vulnerability and risk
- Impacts – social, economic, and environmental

Hazard Mitigation Plan Update 2023 14

Hazards Addressed in Previous HMP

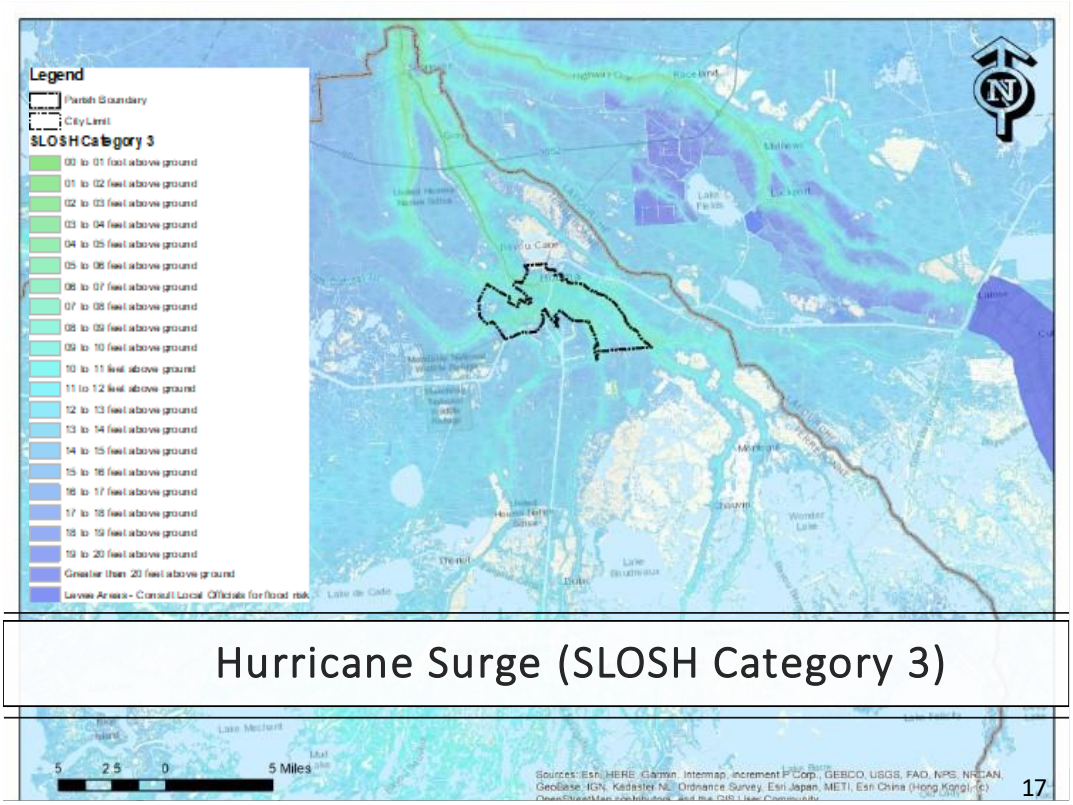
- Flooding (surge, rainfall, and riverine/backwater)
- Levee failure
- Hurricanes and coastal/tropical storms
- Saltwater intrusion
- Tornadoes
- Subsidence (coastal and within forced drainage areas)
- Coastal erosion
- Lightning

Hazard Mitigation Plan Update 2023 15

Additional Hazards to Consider

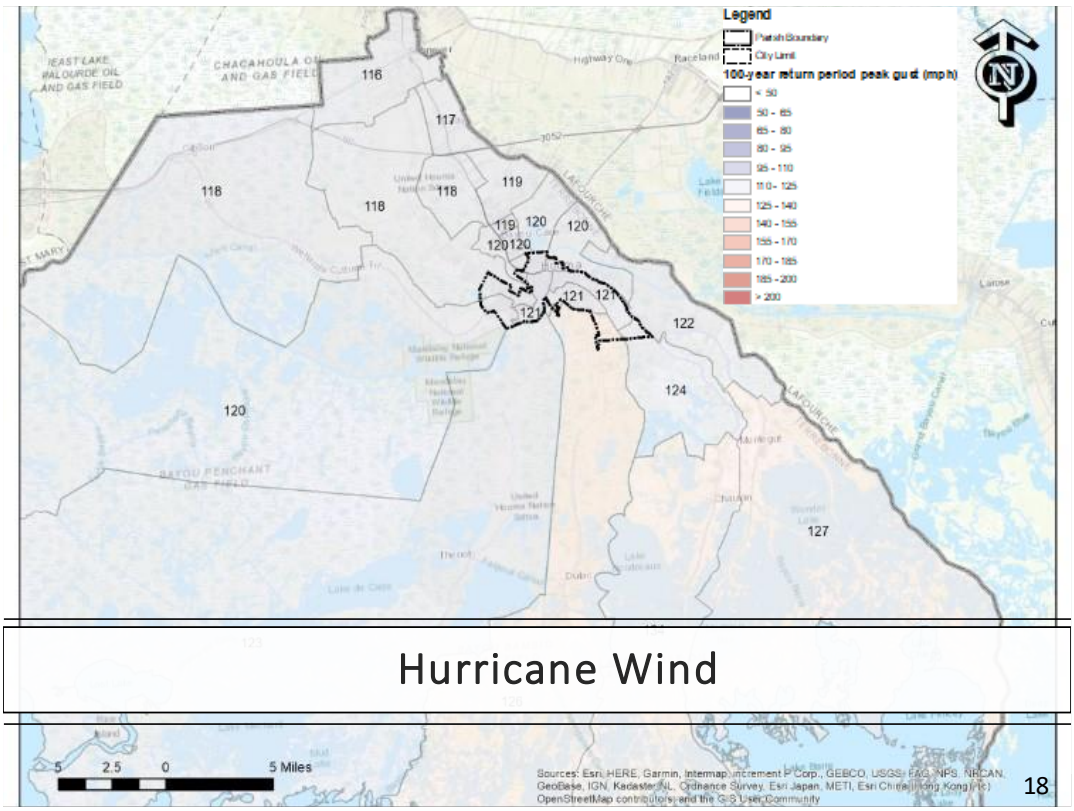
- Extreme heat
- Drought
- Wildfire
- Winter Storms
- Wind as separate hazard
- Hailstorms
- Earthquake
- Sinkholes
- Expansive soil

Hazard Mitigation Plan Update 2023 16



Hurricane Surge (SLOSH Category 3)

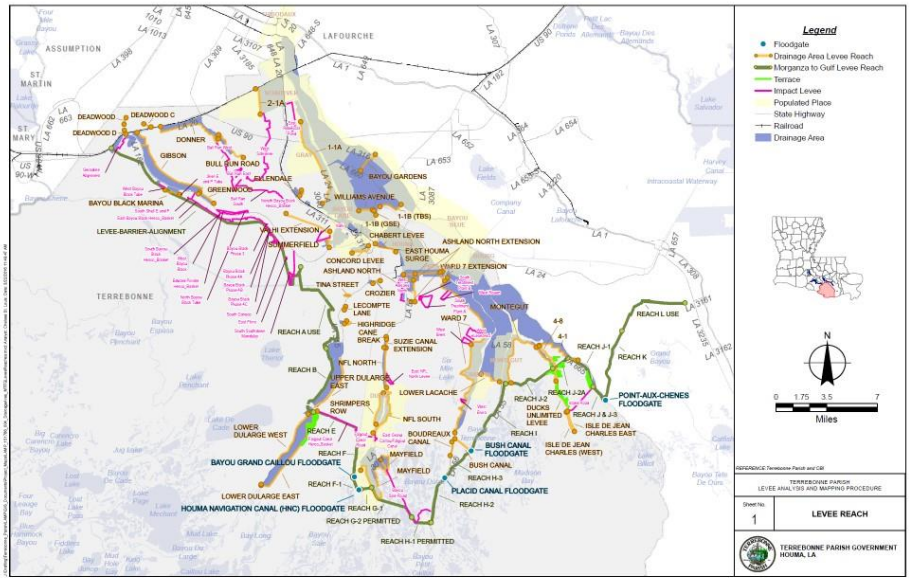
17



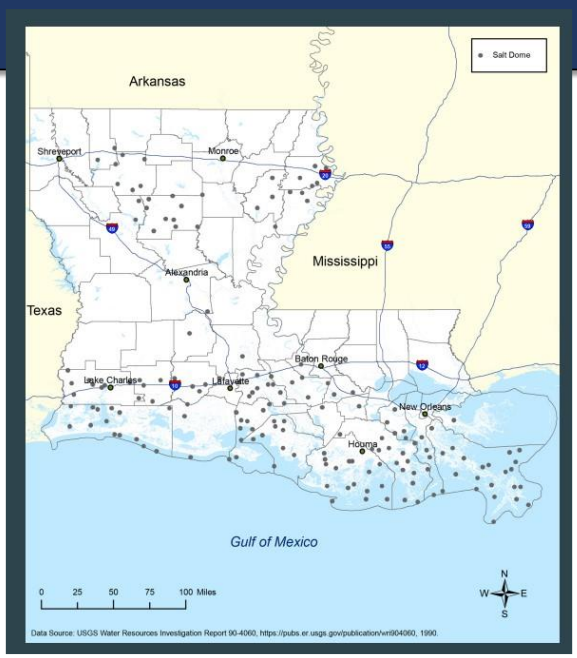
Hurricane Wind

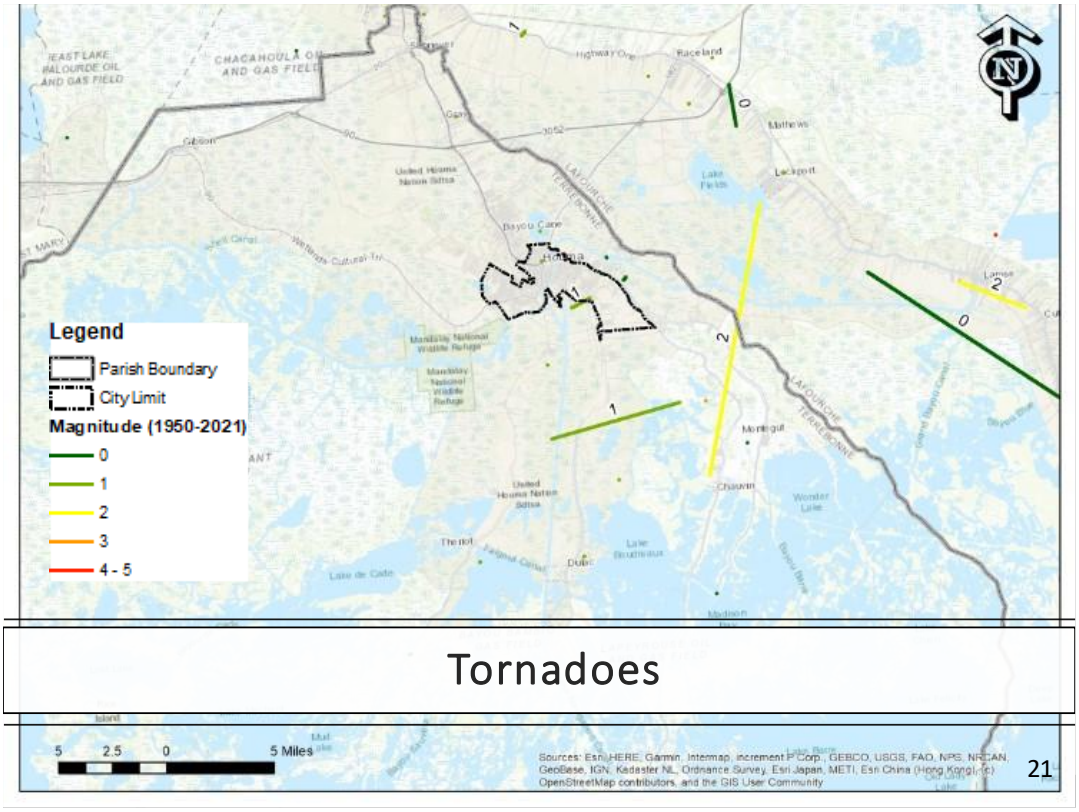
18

Levee Reach



Saltwater Intrusion

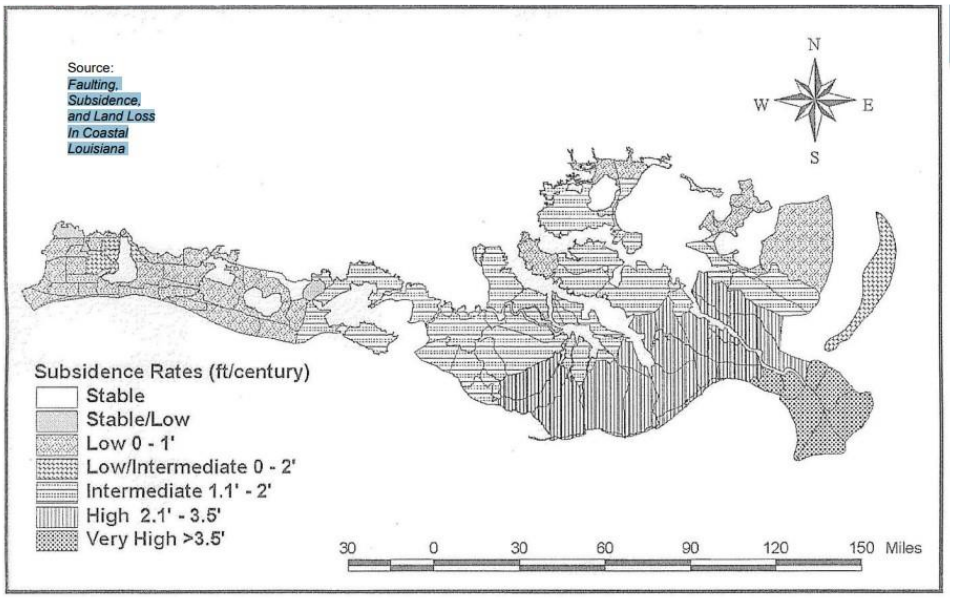




Tornadoes

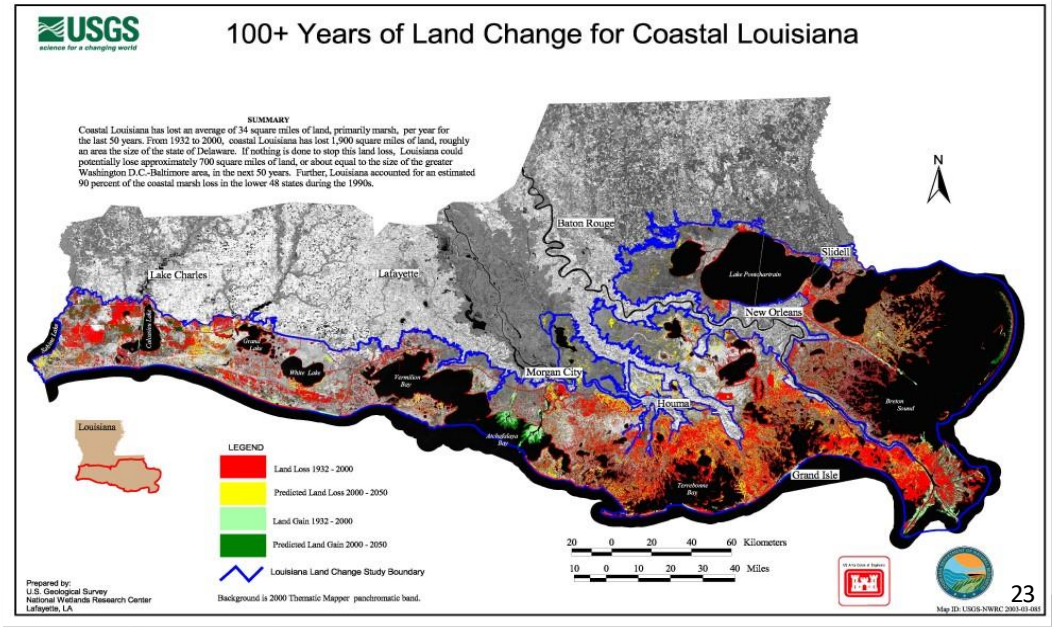
21

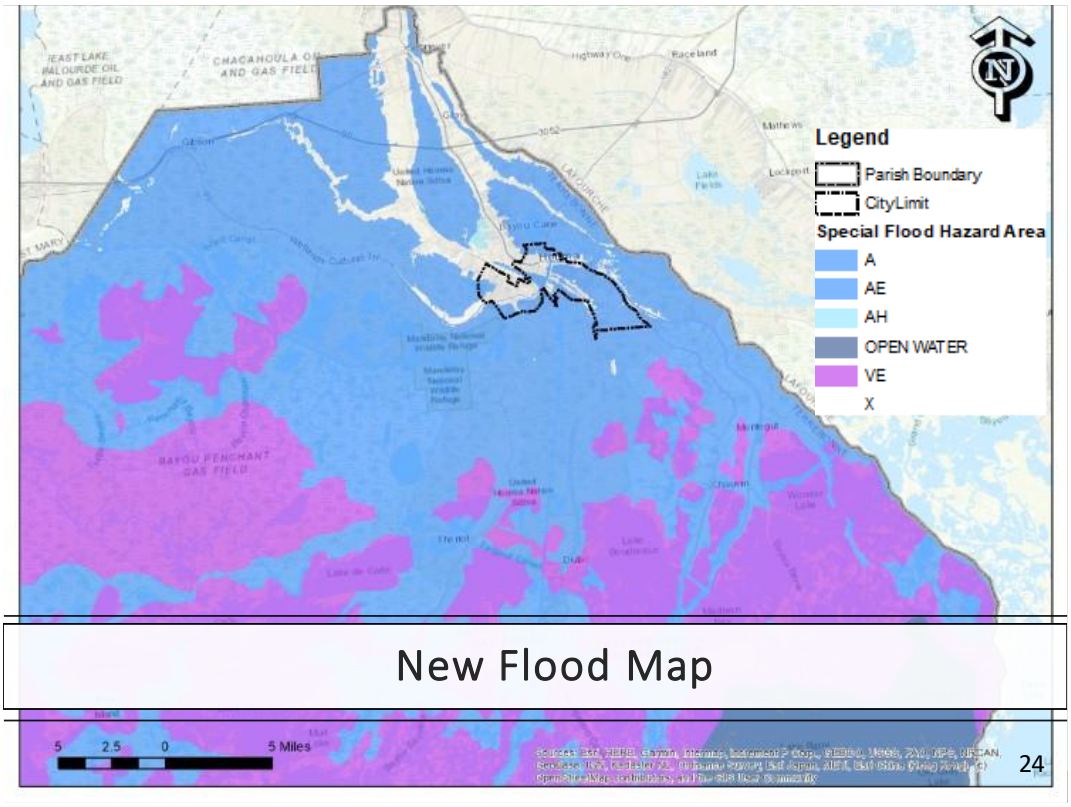
Subsidence



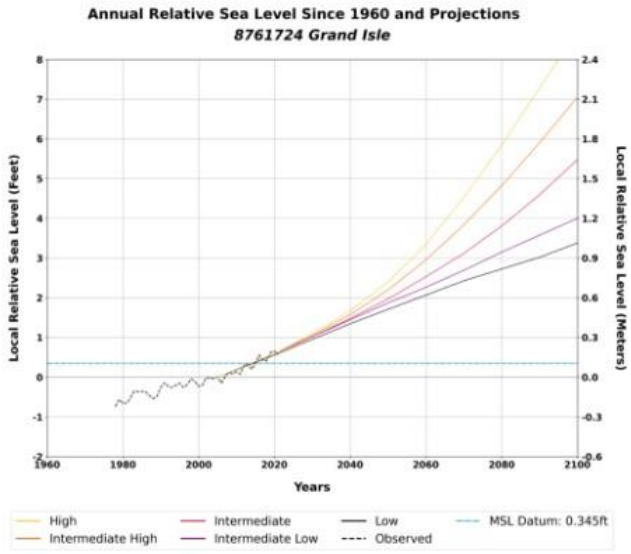
Hazard Mitigation Plan Update 2023 22

Coastal Erosion





Sea Level Rise



Hazard Mitigation Plan Update 2023 25

Additional Flood Discussion

- Discuss
  - Flood sources and previous events
  - Levee breach locations
  - Future development in the floodplain
  - Climate change impacts
- Identify other locations of flooding

Hazard Mitigation Plan Update 2023 26

Next Steps

- Confirm critical facilities
- Review hazard impacts
- Assess the problems and potential impacts

Hazard Mitigation Plan Update 2023 27

Assessing the Problem

- Review critical facilities
- Review Hazus approach
- Identify who is impacted
- Identify what is impacted
- Discuss next steps

Hazard Mitigation Plan Update 2022 2

Update Critical Facilities

- Hospitals
- Assisted living
- Home health
- Medical
- Emergency operations centers
- Police centers
- Fire stations
- Schools
- Parish-owned buildings
- Childcare
- Civic center
- Utilities

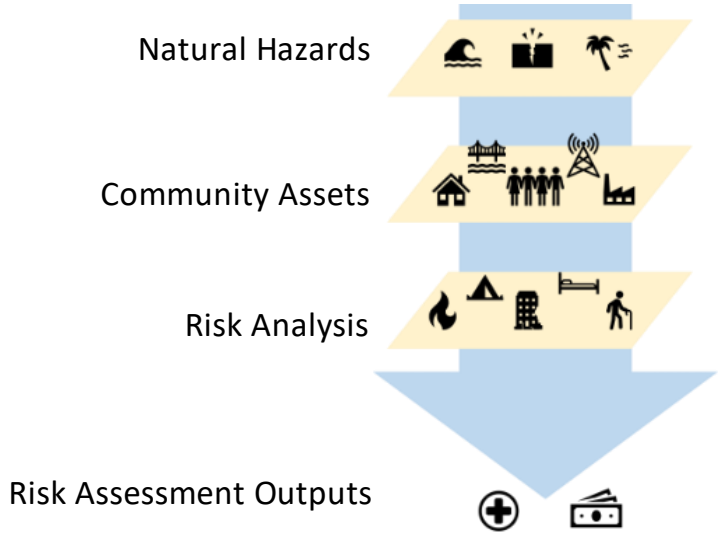
Hazard Mitigation Plan Update 2022 3

Critical Facilities to Consider

- Gas stations
- Pharmacies
- Grocery stores
- Health clinics/urgent care
- Jails
- Others?

Hazard Mitigation Plan Update 2022 4

Hazus



Hazard Mitigation Plan Update 2022 5

Hazus

- Supports flood, hurricane, and earthquake risk assessments
- Provides outputs on structural and content damages and losses, business interruption losses, displaced population, and short -term shelter requirements using tables and maps

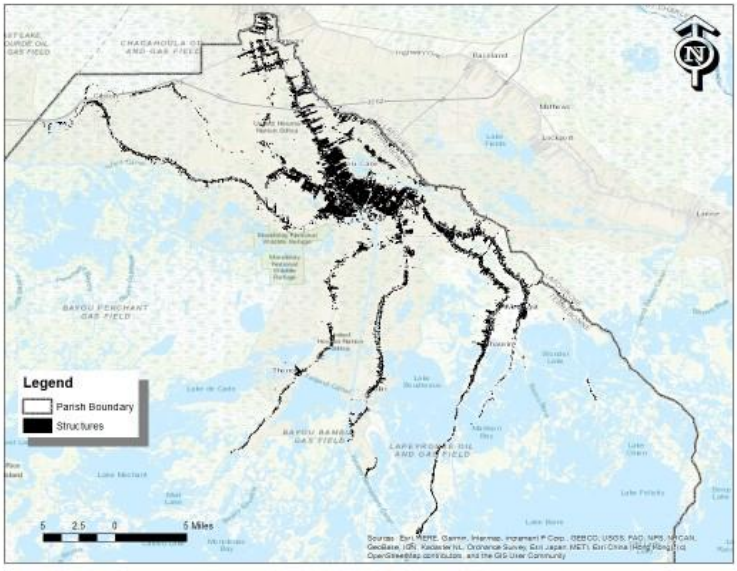
Hazard Mitigation Plan Update 2022 6

HazusApproach for Parish

- Modeling done at site level using building footprints and parcel data
- LiDAR used to get building heights
- Building footprints and heights used to get total square footage
- Occupancy from address points and site data provided (critical facilities, hotels/motels, apartments, etc.)
- Valuations from square footage, occupancy, and RS Means
- Elevations from elevation certificates
- Foundation types from neighborhood sampling using Google StreetView

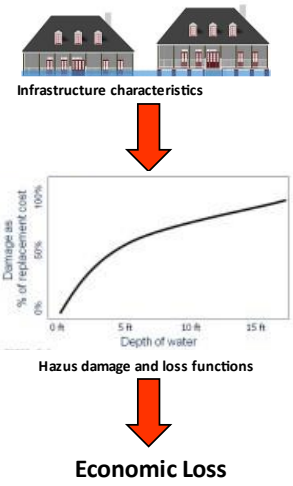
Hazard Mitigation Plan Update 2022 7

Modeling Each Structure



Hazard Mitigation Plan Update 2023 8

Site Level Methodology



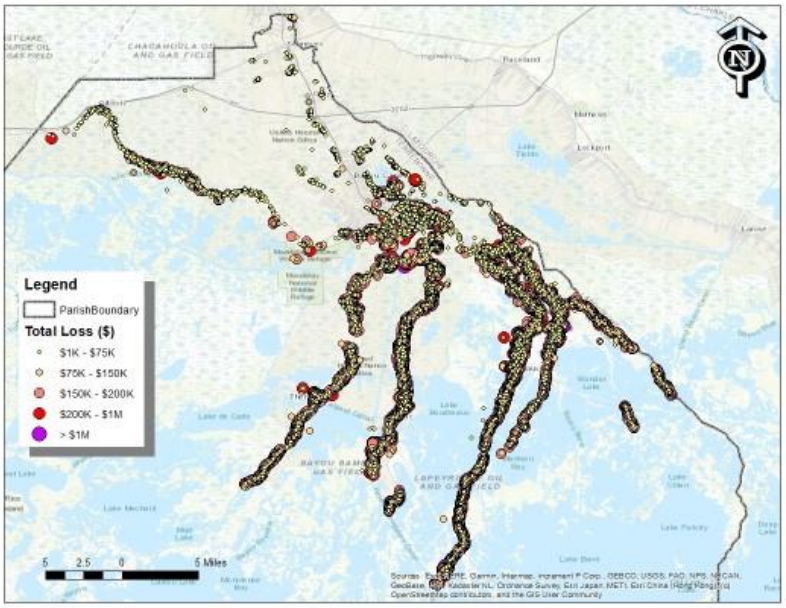
Hazard Mitigation Plan Update 2022

HazusScenario Development

- Flood
  - 100- and 500-year
- Levee breach scenario
- Hurricane
  - 100-, 500-year, deterministic scenario
  - Wind and surge scenarios
- Sea-Level Rise scenarios

Hazard Mitigation Plan Update 2022 10

100-Year Flood Loss (Hazus)



Hazard Mitigation Plan Update 2023

100-Year Flood Loss (Hazus)

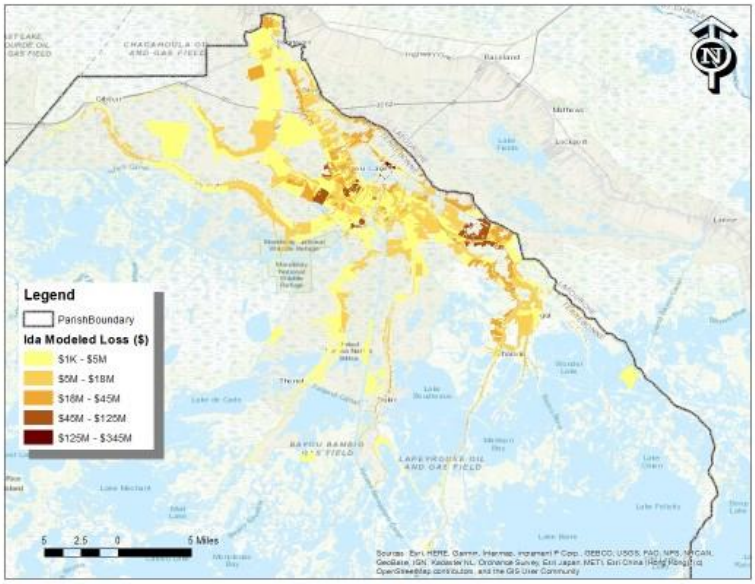
	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)
Residential	1,857,975,527	934,868,189	0
Commercial	327,579,761	1,046,683,241	113,326,250
Other	19,759,852	57,684,284	0

	Debris - Finish (tons)	Debris - Structure (tons)	Debris - Foundation (tons)
Residential	156,901	68,331	262,812
Commercial	44,270	19,412	10,303
Other	1,568	1,842	1,513

	Income Loss ($)	Relocation Loss ($)	Rental Income Loss ($)	Wage Loss ($)
Residential	26,090,720	390,965,489	216,632,040	62,064,289
Commercial	540,254,621	171,349,413	128,512,060	604,762,636
Other	98,273,928	49,136,964	5,459,663	272,983,134

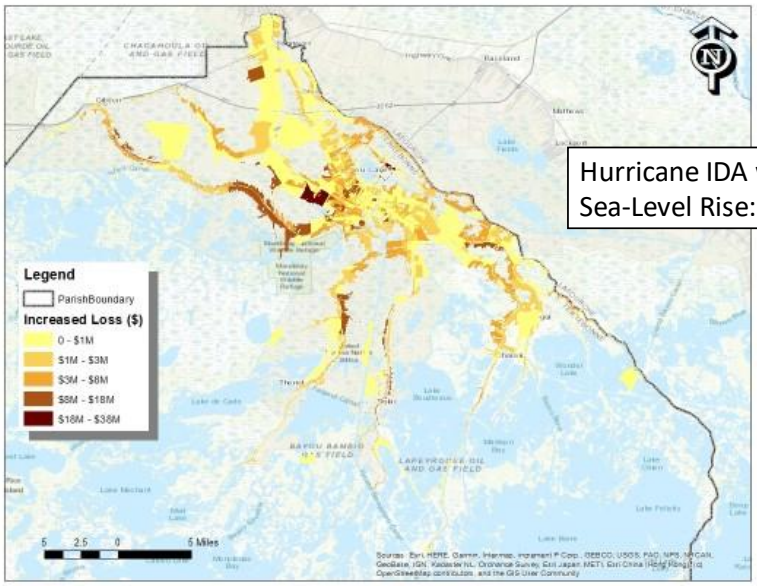
Hazard Mitigation Plan Update 2023

Modeled Hurricane IDA Wind and Storm Surge Loss (Hazus)



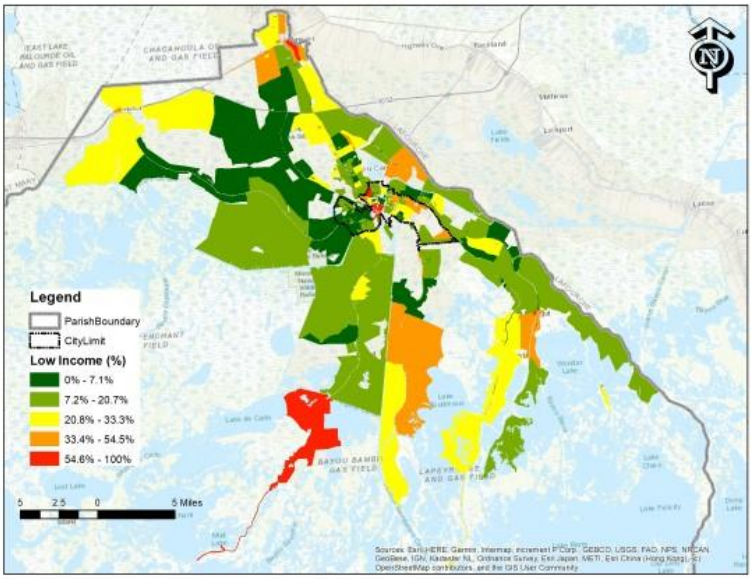
Hazard Mitigation Plan Update 2023

Hurricane Ida with Sea-Level Rise Wind and Surge Loss (Hazus)



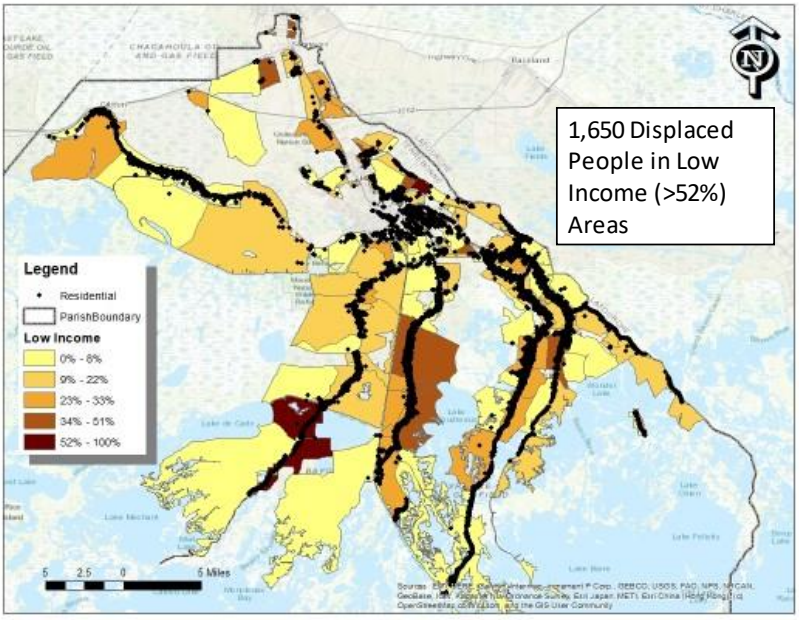
Hazard Mitigation Plan Update 2023

Who is Impacted?



Hazard Mitigation Plan Update 2023 15

Social Impacts



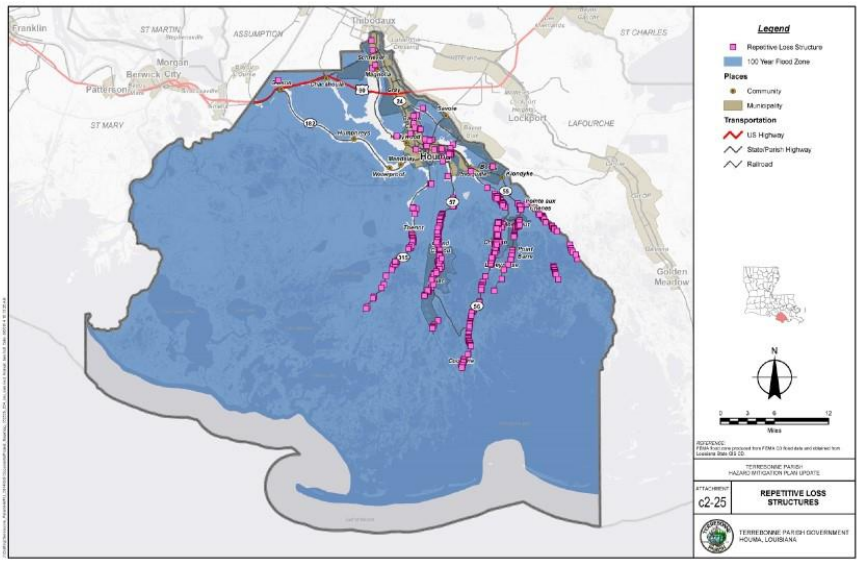
Hazard Mitigation Plan Update 2023

Social Vulnerability Indicators

- Household – age, race and ethnicity, language, renter, single-parent household
- Poverty – below poverty line, unemployment rate, no vehicle access, public assistance, median income
- Health – disabled, diabetes, high blood pressure, obesity, no health insurance
- Sources – 2020 Decennial and ACS Census data, CDC health data

Hazard Mitigation Plan Update 2022 12

Repetitive Loss Structures



Hazard Mitigation Plan Update 2023

Hurricane Ida Impacts

- What went well
- What didn't go well, and lessons learned

Hazard Mitigation Plan Update 2023 19

Flood Impacts

- Type of flooding experienced
- Warning and evacuation
- Public health
- Critical facilities and infrastructure
- Economic

Hazard Mitigation Plan Update 2023 20

Other Hazard Impacts

- Hurricanes – $1.66B, 10 events (not including Ida)
- Tornadoes - $12.8M, 4 injuries or fatalities, 28 events
- Lightning - $680K, 3 injuries or fatalities, 15 events

- Extreme heat - $0
- Drought - $0, 3 events
- Wildfire - $0, no events
- Winter Storms - $0, 3 events
- Hail - $0, 23 events
- Earthquake -$0, no events
- Sinkholes
- Expansive Soil

Hazard Mitigation Plan Update 2022

Next Steps

- Review risk assessment outputs and findings
- Review and identify mitigation goals and objectives (early October)

Hazard Mitigation Plan Update 2023 22


TERREBONNE PARISH
HAZARD MITIGATION PLAN UPDATE 2023
STEERING COMMITTEE MEETING #4
October 28, 2022
Office of Homeland Security and Emergency Preparedness
Presented by: Jamie Caplan and Bill Bohn

Reviewing Existing Mitigation Goals and Objectives

- Introductions and welcome
- Review risk assessment results
- Describe the mitigation strategy
- Review capabilities
- Review existing mitigation goals and objectives
- Consider updating mitigation goals and objectives

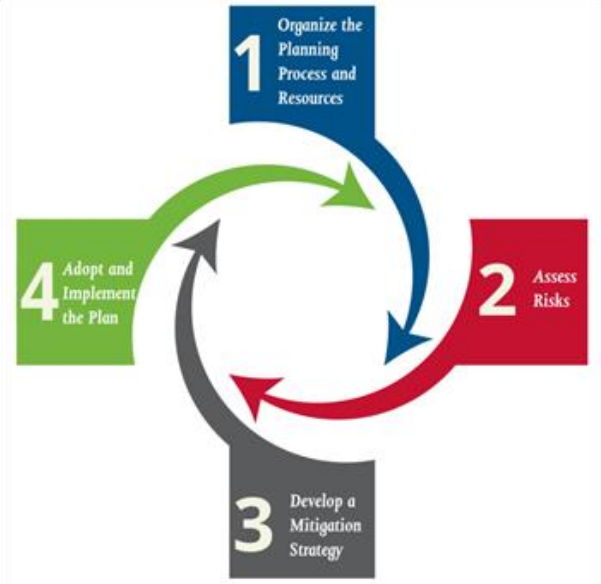
Hazard Mitigation Plan Update 2023 2

Introductions

- Name
- Organization
- Role
- Top three priorities that you would like to see undertaken to reduce risk.

Hazard Mitigation Plan Update 2023 3

HMP Planning Process



Hazard Mitigation Plan Update 2023 4

Community Rating System (CRS) Steps

Mitigation Planning Elements*	CRS Planning Steps**
A. Planning Process	1. Organize to prepare the plan
	2. Involve the public
	3. Coordinate
	10. Implement, evaluate, revise
B. Hazard Identification and Risk Assessment	4. Assess the hazard
	5. Assess the problem
C. Mitigation Strategy	6. Set goals
	7. Review possible activities
	8. Draft an action plan
D. Plan Update	10. Implement, evaluate, revise 5-year update
E. Plan Adoption	9. Adopt the plan

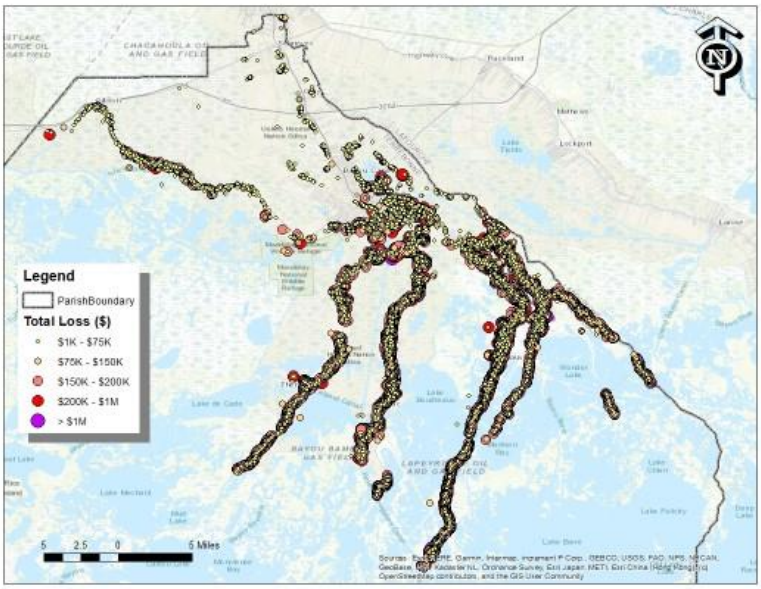
Hazard Mitigation Plan Update 2023 5

Hazards Selected

- Flooding
- Levee failure
- Hurricanes and coastal/tropical storms
- Saltwater intrusion
- Tornadoes
- Subsidence
- Coastal erosion
- Lightning
- *Extreme temperatures*

Hazard Mitigation Plan Update 2023

Review Risk Assessment Results



Hazard Mitigation Plan Update 2023

Critical Facility Impacts

Critical Facility	# Impacted
Police Station	1
Fire Station	23
Medical	1
School	26
Substations	10
Water Towers	15
Assisted Living	10

Critical Facility	Type	Damage	Depth
Montegut Middle & Elementary School	School	>50% Damage	12'
Grand Caillou Elementary	School	>50% Damage	10'
Lacache Middle	School	>50% Damage	9'
Boudreaux Canal Elementary	School	>50% Damage	9'
Point-aux-Chenes Elementary	School	>50% Damage	8'
Lacache Middle	School	>50% Damage	7'
Grand Caillou Middle	School	>50% Damage	5'
Grand Caillou VFD-Dulac Station	Fire Station	>50% Damage	9'
Bayou Dularge VFD-Station 1	Fire Station	>50% Damage	9'
Montegut/Point-Aux-Chenes VFD-Station 4	Fire Station	>50% Damage	8'
Little Caillou VFD-Station 3	Fire Station	>50% Damage	6'
Montegut/Point-Aux-Chenes VFD-Station 2	Fire Station	>50% Damage	6'
Chabert Medical Center	Medical	~5% Damage	2'

Hazard Mitigation Plan Update 2023

Mitigation Strategy

- Capability Assessment
  - Existing authorities, policies, programs and resources and your ability to improve these
  - NFIP participation and compliance
- Mitigation Strategy
  - Goals to reduce hazards
  - Range of mitigation actions with a focus on new and existing buildings and infrastructure
  - Plan to implement actions including prioritization order

Hazard Mitigation Plan Update 2023

Capability Assessment

- Planning and regulatory capabilities
- Administrative and technical capabilities
- Financial capabilities
- Education and outreach capabilities

Hazard Mitigation Plan Update 2023

Goals

- Goals must reduce the risk of the identified hazards.
- Goals are broad, long-term policy and vision statements that explain what is to be achieved by implementing the mitigation strategy.

Hazard Mitigation Plan Update 2023

Previous Goals

- Goal 1: Identify and pursue preventive measures that will reduce future damages from hazards.
- Goal 2: Enhance public awareness, public education, and understanding of disaster preparedness.
- Goal 3: Reduce repetitive flood losses in the parish.
- Goal 4: Facilitate sound development in the parish to reduce or eliminate the potential impact of hazards.
- Goal 5: Assess the feasibility of setting a uniform standard of protection incorporated into all drainage, development and mitigation activities.

Hazard Mitigation Plan Update 2023

Goal Statement Revisions

1. Identify and pursue preventive measures that will reduce future damages from hazards.
2. Enhance public awareness, public education, and understanding of disaster preparedness.
3. Reduce repetitive flood losses in the parish.
4. Facilitate sound development in the parish to reduce or eliminate the potential impact of hazards.
5. Assess the feasibility of setting a uniform standard of protection incorporated into all drainage, development and mitigation activities.

Should we add?
- Save Lives
- Save Property
- Natural Hazards
- Climate Change
- Land Use Regulations

Should we remove or Replace?
- Preparedness
- Sound Development– Best Practices
- Drainage, Development, & Mitigation – Structure and Infrastructure Projects

Hazard Mitigation Plan Update 2023

Objectives

- Detailed statements of direction that indicate what is necessary and important to achieve.

Hazard Mitigation Plan Update 2023

Goal 1: Identify and pursue preventive measures that will reduce future damages from hazards.

- 1.1: Ensure existing structures are structurally sound to endure hurricaneforce winds
- 1.2: Ensure all citizens and employees of Terrebonne Parish are safe from high winds (hurricanes and tornado related)
- 1.3: Ensure all first responders are adequately equipped to respond to a storm event
- 1.4: Protect citizens from saltwater intrusion
- 1.5: Reduce the effects of Land Subsidence
- 1.6: Protect historic and cultural resources, such as cemeteries and gathering places from all hazards
- 1.7: Protect critical facilities from lightning strikes
- 1.8: Protect citizens from sinkholes

12 Actions

Hazard Mitigation Plan Update 2023

Goal 2: Enhance public awareness and understanding of disaster preparedness.

- 2.1: Increase public awareness of hazard areas and educate the public on mitigation through existing channels and organizations and their memberships

13 Actions

Hazard Mitigation Plan Update 2023

Goal 3: Reduce repetitive flood losses in the parish.

- 3.1.: Eliminate threat of flood damage to structures in Terrebonne Parish including storm surge and levee failure.

9 Actions

Hazard Mitigation Plan Update 2023

Goal 4: Facilitate sound development in the parish to reduce or eliminate potential impacts of hazards.

- 4.1: Promote and permit commercial and industrial development, including public critical facilities, outside of hazard areas to limit business interruption, property damage, and impairment to critical facilities in strict accordance with the parish zoning, flood management, and other applicable state and federal regulations.
- 4.2: Promote preservation and/or conservation of flood prone areas for parish parks, recreation areas, and general flood plain management

10 Actions

Hazard Mitigation Plan Update 2023

Goal 5: Assess the feasibility of setting a uniform standard of protection incorporated into all drainage, development and mitigation activities

- Assess the feasibility of setting a uniform standard of protection incorporated into all drainage, development and mitigation activities

3 Actions

Hazard Mitigation Plan Update 2023

Reviewing and Identifying Mitigation Actions

- Review existing mitigation actions
- Identify new mitigation actions
- Next steps

Hazard Mitigation Plan Update 2023 2

Community Rating System (CRS) Steps

Mitigation Planning Elements*	CRS Planning Steps**
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D. Plan Update	10. Implement, evaluate, revise 5-year update
E. Plan Adoption	9. Adopt the plan

Hazard Mitigation Plan Update 2023 3

Mitigation Actions

- Mitigation actions are a measure, project, plan or activity proposed to reduce current and future vulnerabilities described in the risk assessment.

The Fiscal Year 2022 BRIC program's priorities are to:

- Incentivize natural hazard risk reduction activities that mitigate risk to public infrastructure and disadvantaged communities, as referenced in Executive Order 14008 - Tackling the Climate Crisis at Home and Abroad
- Incorporate nature-based solutions, including those designed to reduce carbon emissions
- Enhance climate resilience and adaptation
- Increase funding for the adoption and enforcement of the latest published editions of building codes
- Encourages hazard mitigation projects that meet multiple program priorities

Hazard Mitigation Plan Update 2023

Types of Mitigation Actions

- Local Plans and Regulations
- Structure and Infrastructure Projects
- Natural Systems Protection
- Education and Awareness Activities

Hazard Mitigation Plan Update 2023 5

FEMA Community Lifelines

- **Safety and Security** - Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter** - Food, Water, Shelter, Agriculture
- **Health and Medical** - Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy** - Power Grid, Fuel
- **Communications** - Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation** - Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Material** - Facilities, HAZMAT, Pollutants, Contaminants

While lifelines were developed to support response planning and operations, the concept can be applied across the entire preparedness cycle.

Efforts to protect lifelines, prevent and mitigate potential impacts to them, and building back stronger and smarter during recovery will drive overall resilience of the nation.

https://www.fema.gov/emergency managers/practitioners/lifelines

Hazard Mitigation Plan Update 2023

Previous Mitigation Actions

- Current status
  - Completed
  - Completed + To Be Continued
  - Partially Completed or In Progress
  - Delayed
  - Cancelled
- Description
  - Explain the current status
- Keep for 2023 plan?
  - Yes or No
- Updates or changes described for 2023

FEMA REQUIREMENT
The plan must include a status update for all mitigation actions identified in the previous mitigation plan!

Hazard Mitigation Plan Update 2023 7

Previous and Current Mitigation Actions

- Open current action tracker
- Open recovery project tracker

Hazard Mitigation Plan Update 2023

2023 New Mitigation Actions

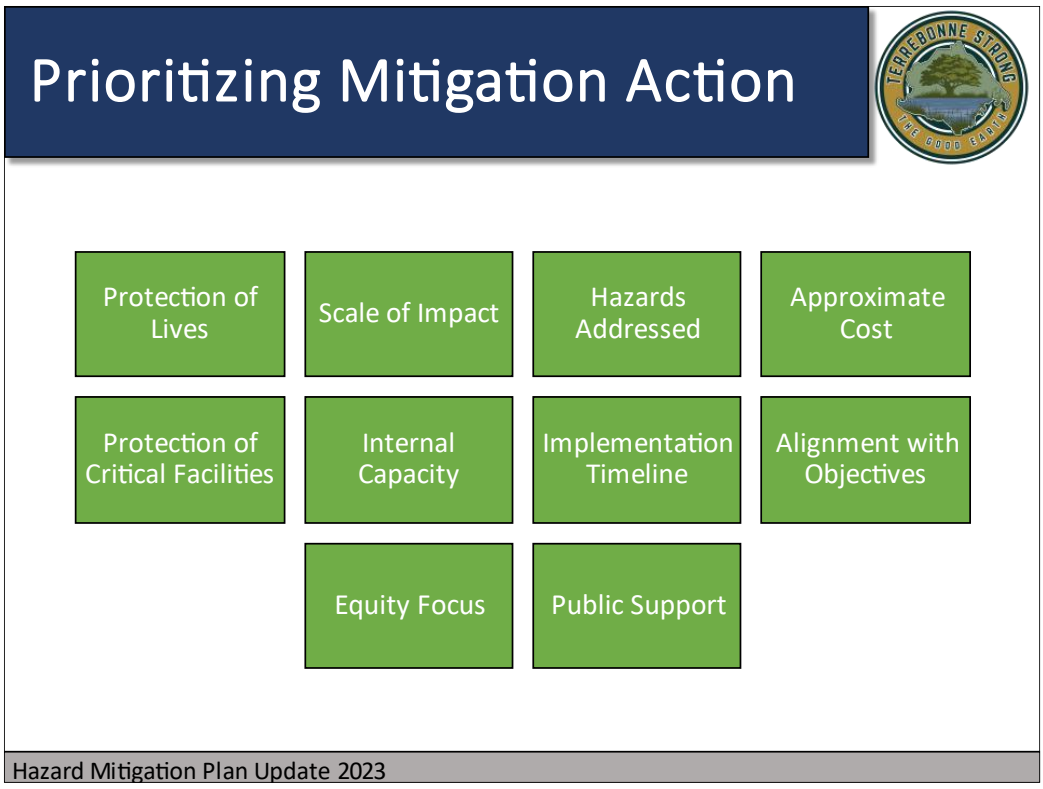
- Water system viability
- Electrical grid hardening
- Roof hardening
- Hospital resilience
- Generators for essential facilities
- Business continuity planning
- Debris removal
- Additional flood mitigation actions
- Cooling center

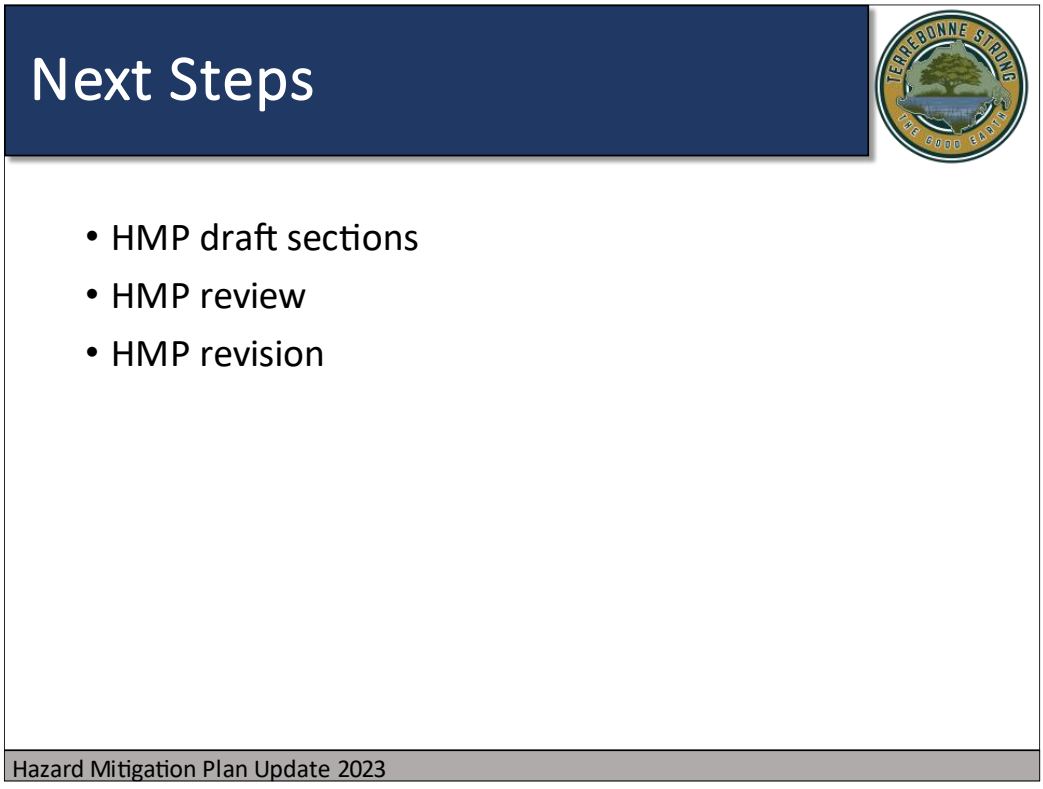
Hazard Mitigation Plan Update 2023

Mitigation Assessment

- Several different methodologies
- Multi-criteria assessment
  - Social – Does the public support the mitigation?
  - Technical – Is the mitigation technically feasible and is it effective at reducing future losses?
  - Administrative – Are the resources available: staffing, funding, and maintenance requirements met?
  - Political – Is there a political champion and support?
  - Legal – Are proper laws, ordinances, and resolutions in place to support the mitigation?
  - Economic – Is the mitigation cost effective?
  - Environmental – How will the mitigation impact the land and water, endangered species?

Hazard Mitigation Plan Update 2023


Prioritizing Mitigation Action
Protection of Lives
Scale of Impact
Hazards Addressed
Approximate Cost
Protection of Critical Facilities
Internal Capacity
Implementation Timeline
Alignment with Objectives
Equity Focus
Public Support
Hazard Mitigation Plan Update 2023


Next Steps
• HMP draft sections
• HMP review
• HMP revision
Hazard Mitigation Plan Update 2023

Terrebonne Parish Steering Committee Meeting #1

Organizing and Coordinating the Planning Process

May 27, 2022, 10am to Noon

Introductions and welcome

- Meeting began with introduction of members, their roles, departments, and organizations.
- Focus of this update will include integrating Hazus into the risk assessment, maximizing CRS points, and updating the risk assessment and mitigation strategy.

Hazus

- An overview of Hazus was provided including the methodology combining the natural hazards and community assets into a risk assessment. Hazus provides economic outputs and social impacts.
- The Hazus approach for the Parish involves modeling all facilities at the site level using building footprints and parcel data. LiDAR will be used to develop the flood depth grid and derive the building heights using the first return. The building heights and building footprints can be used to get the building square footage. The building occupancy is coming from the address points and site data (critical facilities, hotels/motels, apartments, etc.). Valuations will be calculated using the square footage occupancy, and RS Means values. Foundations and elevations will come from neighborhood sampling using Google StreetView and elevation certificates.
- The data that has been collected so far includes: building footprints, address points, critical facility data, flood hazard data, LiDAR, bridge, road, rail locations, and elevation certificates.
- The new floodplain map will be converted into a flood depth grid and integrated into Hazus.
- Hazus will be used for flooding and hurricane scenarios with the results provided in the updated Hazard Mitigation Plan (HMP).

Community Rating System (CRS)

- The history of the CRS was described. It is a voluntary, incentive-based program which encourages the community floodplain management activities that exceed the minimum standards of the NFIP.
- The CRS point system, class, and discounts were described.
- The Terrebonne Parish CRS history was discussed – joined in 1992, currently a Class 7 community with a 15% discount on NFIP premiums for annual savings of $900K. A new prerequisite was discussed which is required for Class 8 or better communities – at least one foot of freeboard for all residential buildings. This means that new buildings must add one foot of height (freeboard) above the base flood elevation.

Local Update and Review of previous HMP

- A discussion on the flood gate performance during Ida was provided.
- Hazards identified in the previous HMP were discussed – flooding (surge, rainfall, riverine/backwater), levee failure, hurricanes and coastal/tropical storms, saltwater intrusion, tornadoes, subsidence, coastal erosion, and lightning. New hazards will be discussed during the risk assessment.

- Critical facilities were identified – hospitals, schools, police stations, fire stations, powerplants, sewer, potable water, emergency operations center, and government offices. These will be discussed in more detail during the risk assessment.
- Previous goals were identified and will be discussed in detail during the mitigation presentations.
- Proposed tasks and schedule were reviewed. Since the contract started later, a new schedule will be implemented.

Outreach and Stakeholder Involvement

- Roles of the Steering Committee were provided including providing supporting data and information, identifying and prioritizing mitigation actions, and reviewing and commenting on draft plan.
- Public outreach will be conducted using existing public outreach meetings set up for the other planning processes going on in the Parish. It was thought that the community might be overloaded with meetings if they were all separate. The public meetings will allow for time for the HMP.

Next Steps – complete data integration and begin developing risk assessment scenarios.

Attendance List

Hazard Mitigation Plan Steering Committee Meeting
May 27, 2022 – 10:00 a.m.

Name	Agency/Dept	Email Address
Chris J. Rues, Jr.	Terrebonne DHSEP	crues@tpcg.org
Neil Malbrough	GIS Engineering, LLC	neilm@gisy.com
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Corbin Hebert	Delta Coast Consultants, LLC	corbin.h@deltacoastllc.com
Title: mitigation	GIS Engineering, LLC	mitigation@gisy.com
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Mike Sobert	Consolidated Waterworks	michael@sobert@tpcwww
Clay Naquin	TPCG Solid Waste	cnaquin@tpcg.org
Wesley Theodeau	TPP Planning Commission / AAC P	tdeaune@bellsouth.net
Patrick Gordon	South Central Planning & Development	Patto.scpdc.org
Darin Guidry	Terrebonne Parish Council	dguidry@tpcg.org
Mike Toups	TPCG - Parish Manager	mctoups@tpcg.org
Marty ALTIMUS	CSRS / MET-C	Martin.altimus@mcleroy.com
Jason Bergeron	CSRS - Division Manager	jason.bergeron@csrs-inc.com
Theresa Dardar	Pointe-au-Chien Indian Tribe	theresadardar@gmail.com

Hazard Mitigation Plan Steering Committee Meeting
May 27, 2022 – 10:00 a.m.

Name	Agency/Dept	Email Address
Philip Crabtree	Terrebonne Parish Sheriff's Office	pcrabtree@tpso.net
Reggie Duplantis	TLCD	rduplantis@tlcd.org

Terrebonne Parish Steering Committee Meeting #2

Assessing the Hazard

August 31, 2022, 11am to Noon

Introductions and welcome

- Meeting began with introduction of members, their roles, departments, and organizations.
- An introduction to this process was provided since not all members attended the first meeting.

Planning process

- An introduction to the hazard mitigation planning process was provided.
- The different elements of the Hazard Mitigation Plan (HMP) were identified – community information; risk assessment; capability assessment; mitigation goals, objectives, and actions; and maintenance.
- Role of the Steering Committee was provided including providing supporting data and information, identifying and prioritizing hazards and mitigation actions, and commenting on the HMP.
- Plan will focus on using a Hazus assessment for the risk assessment process, lowering insurance costs, and integrating the latest hazard information (including Hurricane Ida) into the HMP.
- The Community Rating System (CRS) was described as a way for the community to reduce their insurance premiums.

Vulnerability and risk assessment process

- Hazard, vulnerability, risk, and risk assessment were defined.
- A description of the risk and vulnerability section of the plan was provided including hazard descriptions, locations and extents, magnitude and severity, previous occurrences, and relationships with other hazards.

Hazard identification and assessing the hazard

- Hazards identified in the previous HMP were discussed – flooding (surge, rainfall, riverine/backwater), levee failure, hurricanes and coastal/tropical storms, saltwater intrusion, tornadoes, subsidence, coastal erosion, and lightning.
- Additional hazards identified in the State HMP were discussed – extreme heat, drought, wildfire, winter storms, wind as a separate hazard, hailstorms, earthquake, sinkholes, and expansive soil.
- It was determined that an additional hazard of Extreme Temperatures which would include extreme heat and extreme cold would be added to the new HMP. This would include a description of brownouts and blackouts.
- New FEMA maps were discussed. There is a preliminary map which has been made public and was included as a slide. The floodplain for the Parish covers most of the Parish boundary and includes coastal and inland flooding. Other locations of flooding were also discussed.
- Hazard maps for wind, surge, levee breach, saltwater intrusion, tornadoes, subsidence, coastal erosion, and sea-level rise were provided and discussed.
- A discussion on the flood gate performance during Ida was provided.

Next Steps - confirm critical facilities, and assess the problems and potential impacts.

Attendance List

Terrebonne Parish Hazard Mitigation Plan Update 2023
Steering Committee Meeting #2
August 31, 2022

Last	First	Agency	Email	Signature
Armand	Jennifer	Bayou Community Foundation	jennifer@armandcreative.com	
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Terrebonne Parish Hazard Mitigation Plan Update 2023
Steering Committee Meeting #2
August 31, 2022

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Terrebonne Parish Hazard Mitigation Plan Update 2023
Steering Committee Meeting #2
August 31, 2022

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Terrebonne Parish Steering Committee Meeting #3

Assessing the Problem

August 31, 2022, 12:30pm to 1:30pm

Introductions and welcome

- Meeting began with introduction of members, their roles, departments, and organizations.

Review critical facilities

- Current critical facilities include hospitals, assisted living, home health, medical, emergency operations centers, police centers, fire stations, schools, parish-owned buildings, childcare, civic center, and utilities.
- Due to the large number of critical facilities, a tiered approach will be implemented with the top tier being Parish-owned facilities critical for operations.
- Other facilities the Committee would like to consider include gas stations, pharmacies, grocery stores, health clinics/urgent care, jails, churches, non-profits, nursing homes, government (non-Parish) owned, communications, school board-owned, bridges, tunnel, airports, port, fuel storage, public housing, and banks.
- School locations needs to be updated due to storm damage and relocations.

Review Hazus approach

- Hazus is a GIS-based risk assessment tool provided by FEMA.
- The Hazus assessment for this project will involve a site-level analysis for flooding and hurricanes. This means that every building in the Parish will be assessed on a site by site basis providing for a more accurate risk assessment. Several datasets have already been collected and some critical facilities will be updated to support the assessment.
- Deterministic and probabilistic methods of analysis were discussed. Deterministic refers to a specific scenario in time such as a historical event while probabilistic refers to looking at an event that could occur with a specific likelihood (e.g. 1% annual chance event).
- The combination of coastal erosion, subsidence, and sea-level rise with hurricane and flood events was discussed.

Identify what is impacted

- The preliminary 100-year Hazus flood results were provided showing residential, commercial, and other losses. These numbers were provided in tables and maps.
- Modeled Hurricane Ida losses were also provided. These numbers will be compared with the actual losses to help improve model results.
- Hurricane Ida with 2’ of sea-level rise was modeled producing an additional $2B in losses.
- Repetitive loss structures were shown (in general locations) and discussed.
- Previous losses for the hazards identified were reviewed.
- Hurricane Ida impacts were discussed – flooding, warning and evacuation, critical facilities impacted, public health concerns, and economic loss.

Identify who is impacted

- Hazus and the 2020 Census data were used to identify who would be impacted by the 100-year flood. Low income populations were mapped in the Parish and displaced households were overlaid with these populations.
- Social vulnerability indicators were discussed – household, poverty, and health indicators to see if there were any specific to the Parish that should be used.

Discuss next steps – review risk assessment outputs and findings, and review and identify mitigation goals and objectives.

Attendance List

Terrebonne Parish Hazard Mitigation Plan Update 2023
Steering Committee Meeting #3
August 31, 2022

Last	First	Agency	Email	Signature
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Naquin	Albert	Biloxi-Chitamacha Island Road Band	whitebuffaloa@netscape.net	
Parr	Ann	Bayou Grace	bayougrace@bayougrace.org	
Rogers	Jan	Regulatory Planning Commission	janjrogers@charter.net	
Sobert	Michael	Consolidated Waterworks District	msobert@tpcg.org	
Soignet	Tim	Terrebonne Parish Sheriff's Office	rtsoignet@tpso.net	
TBD		NAACP	twaynej@bellsouth.net	
TBD		Terrebonne Ministerial Alliance	simsjrhaywood@yahoo.com	
Walker	Jay	South Louisiana Bank	jayw@ayeee.com	
		TEDA/TEDFO		
Chair		Terrebonne Parish Council	dwguidry@tpcg.org	
Vice-Chair		Terrebonne Parish Council	dbabin@tpcg.org	
Black	Mart		mblack@tpcg.org	
Dupre	Carl		cdupre@tpcg.org	
Eues	Earl		eeues@tpcg.org	
Ledet	Lisa		lisaledet@tpcg.org	
Pulaski	Chris		cpulaski@tpcg.org	
Rome	David		drome@tpcg.org	
Cunninghan	Kelli		kcunningham@tpcg.org	
Henry	Corey	Houma Fire Department	chenry@tpcg.org	
Coleman	Dana	Houma Police Department	dcoleman@tpcg.org	
Naquin	Clay	Solid Waster Department	cnaquin@tpcg.org	
Daigle	Melissa	SeaGrants	mtrosc2@tigers.lsu.edu	
Pearson	Marion	GOHSEP	marion.pearson@la.gov	
Giering	Jeffrey	GOHSEP	Jeffrey.Giering@LA.GOV	

Terrebonne Parish Steering Committee Meeting #5

Reviewing Possible Activities

October 28, 2022, 11:30pm to 12:30pm

Introductions and welcome

- Meeting began with introduction of members, their roles, departments, and organizations.

Review mitigation actions

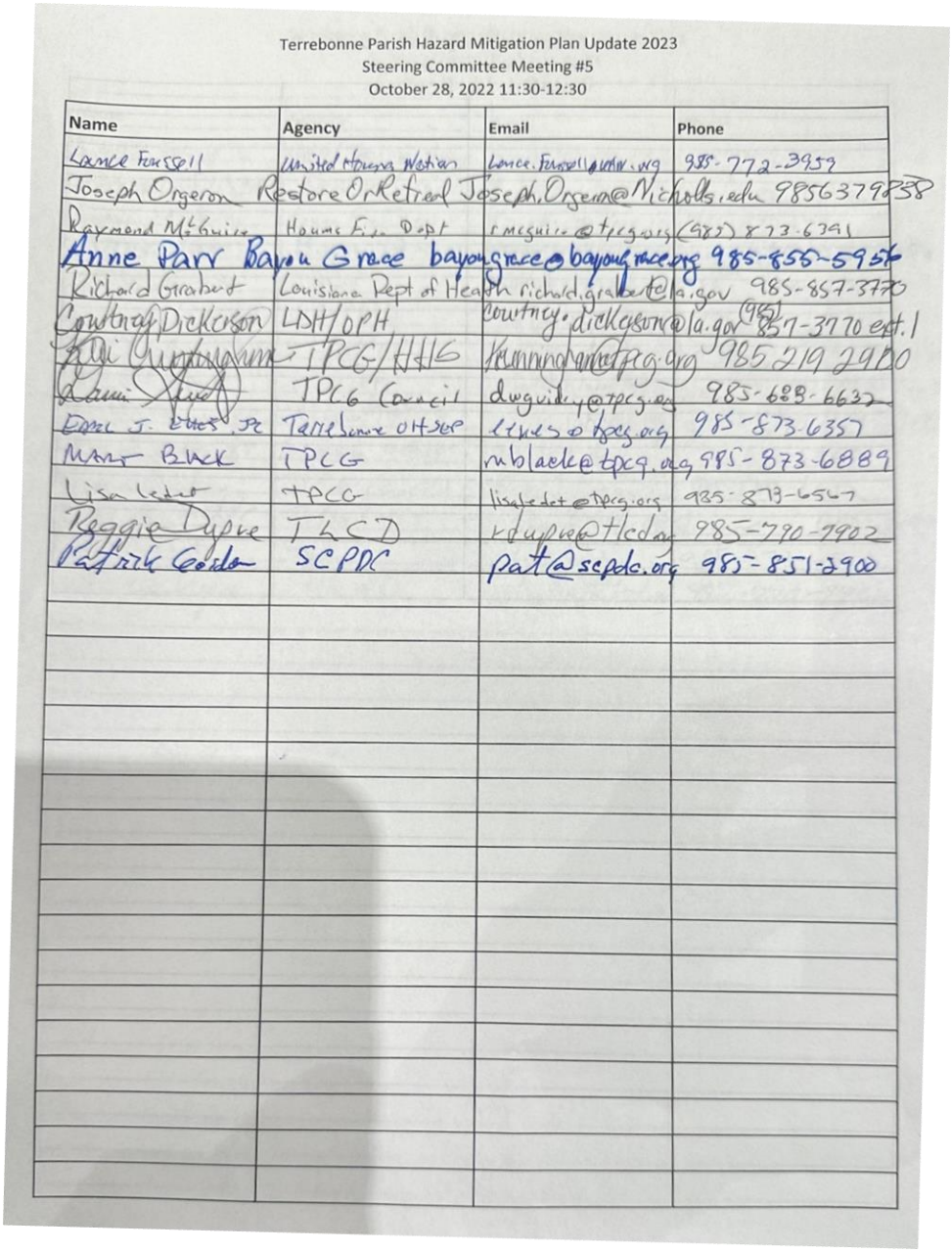
- Mitigation actions were described generally
- Specific mitigation actions identified in the previous HMP were printed and sent around to the Committee Members to get their input.
- Actions were characterized – local plans and regulations, structure and infrastructure projects, natural systems protection, and education and awareness activities.
- FEMA community lifelines were described.

Identify mitigation activities

- The Steering Committee discussed community priorities including: saving lives, vulnerable populations, equity, nature-based solutions, economic stability, strengthening critical facilities, landuse regulations, communication, utilities, and maintaining local culture.
- New actions discussed included: water system viability; electrical grid hardening; roof hardening; hospital resilience; generators for essential facilities; business continuity planning; debris removal; cooling center; portable StarLink Units; wastewater treatment; initial road clearing; ensuring shelters are ready/adequate; subsurfacing ditches and hardening, screening, and studies; identifying un-permitted culverts and enforcing local codes/ordinances; fortified building codes; evacuating vulnerable populations; making public buildings multi-purpose; tree planting education; explore freeboard and consider State changes; flood gates; affordable housing concerns – aging, HVAC, elevators not working; moving courthouse and jail to safter location; open ditches catching debris; work with council on aging to improve the pre-registration for evacuations and educate the public on it; and plant more trees – buffers wind, species matters.
- Prioritizing mitigation actions was discussed with a few examples provided – STAPLEE (social, technical, administrative, political, legal, economic, and environmental) and a locally-focused methodology looking at protection of lives, scale of impact, hazards addressed, approximate costs, protection of critical facilities, internal capacity, implantation timeline, alignment with objectives, equity focused, and public support.

Discuss next steps – drafting mitigation plan and review.

Attendance List



Terrebonne Parish Hazard Mitigation Plan Update 2023
Steering Committee Meeting #5
October 28, 2022 11:30-12:30

Name	Agency	Email	Phone
Lance Fonsell	United Houma Nation	Lance.Fonsell@uhn.org	985-772-3959
Joseph Orgeron	Restore Or Retreat	Joseph.Orgeron@Nicholls.edu	9856379858
Raymond McGuire	Houma Fire Dept	rmcguire@tpcg.org	(985) 873-6391
Anne Parr	Bayou Grace	bayougrace@bayougrace.org	985-855-5957
Richard Graubert	Louisiana Dept of Health	richard.graubert@la.gov	985-857-3770
Courtney Dickerson	LDH/OPH	courtney.dickerson@la.gov	(985) 857-3770 ext. 1
[illegible]	TPCG/HHG	[illegible]@tpcg.org	985 219 2900
[illegible]	TPCG Council	dwguidry@tpcg.org	985-688-6632
Darrel J. Eues, Jr.	Terrebonne OHSEP	deues@tpcg.org	985-873-6357
Mary Black	TPCG	mblacke@tpcg.org	985-873-6889
Lisa Ledet	TPCG	lisaledet@tpcg.org	985-873-6547
Reggie Dupre	TLCD	rdupre@tlcd.org	985-790-7902
Patrick Gordon	SCPDC	pat@scpdc.org	985-851-2900

APPENDIX C: STEERING COMMITTEE MEMBERSHIP

Steering Committee Membership

Name	Agency	Position
Jennifer Gerbasi	Terrebonne Parish Consolidated Government (TPCG)	Recovery Planner
Curtis Constrantiche	Terrebonne Parish School District	Risk Manager
Duffy Duplantis	TPCG Assessor's Office	Chief Deputy
Joseph Orgeron	Restore or Retreat	Executive Director
Cohen Guidry	Terrebonne Economical Development Authority	Chief Executive Officer
Darrin Guidry	Terrebonne Parish Council	Council Member
Earl Eues	Homeland Security and Emergency Preparedness	Director
Chris Pulaski	Planning and Zoning	Director
Kelli Cunningham	Housing and Human Services	Director
Corey Henry	Houma Fire Department	Fire Chief
Lisa Ledet	TPCG	Floodplain Manager/Assistant Director (Regulatory)
Wayne Thibodaux	NAACP	Representative
Lance Fussell	United Houma Nation	Representative
Anne Parr	Bayou Grace Community Services	President
Richard Grabert	Louisiana Dept. of Health	Sanitarian
Courtney Dickerson	Louisiana Dept. of Health	Sanitarian
Mart Black	Coastal Restoration and Preservation	Director
Reggie Dupre	Terrebonne Levee & Conservation District	Executive Director
Patrick Gordon	South Central Planning & Development Commission	Chief of Planning

APPENDIX D: CRITICAL FACILITIES

Critical Facilities

Hospitals

- Chabert Medical Center
- Gulf States LTAC of Houma
- Physicians Surgery Specialty Hospital
- Terrebonne General Health System

Assisted Living

- Bonne Terre Village
- Chateau Terrebonne Health Care
- Heritage Manor of Houma
- Homestead Assisted Living
- Maison De'Ville Nursing Home
- Suites at Sugar Mill Point
- TARC
- Terrebonne House
- The Oaks of Houma

Home Health

- Anointed Care Services LLC
- Bayou Home Care
- Hospice of South Louisiana
- Journey Hospice
- Lafourche ARC - Main Office
- Lafourche ARC
- Synergy Home Health Care River Region
- Terrebonne Home Care, Inc
- The Medical Team
- Total Pharmacy Services

Medical

- Acadian Ambulance Services
- Cardiovascular Institute of the South
- Terrebonne Behavioral Health Center
- Terrebonne Parish Health Unit

Emergency Operations Centers

- 911-Terrebonne Communications District
- Office of Emergency Preparedness (OEP)

Police Stations

- Houma Police Department
- State Police
- State Police Traffic Violation
- Houma PD Special Operations Unit
- Houma PD Administration Building
- Houma PD Storage Unit
- Houma PD Dispatch
- Houma PD Substation
- Houma PD Investigation Division
- Terrebonne Parish Sheriff's Office

Fire Stations

- Bayou Black VFD --Station 2
- Bayou Blue Fire Department
- Bayou Blue VFD--Station 2
- Bayou Blue VFD--Station 3
- Bayou Cane Fire Protection District
- Bayou Cane VFD--Hollywood Road Station
- Bayou Cane VFD--Savanne Road Station
- Bayou Cane VFD-W Park Av Station
- Bayou Dularge VFD
- Bayou Dularge VFD--Station 1
- Bayou Dularge VFD--Station 2
- Bayou Dularge VD--Station 4
- Bourg VFD
- Bourg VFD
- Coteau Volunteer Fire Department
- Donner-Chacahoula--Central Station
- Gibson East VFD
- Gibson VFD
- Grand Caillou VFD
- Grand Caillou VFD--Bobtown Station
- Grand Caillou VFD--Dulac Fire Station
- Grand Caillou VFD--Dulac Sub Station
- Grand Caillou VFD--Station 6
- Houma FD--Airbase Station 5
- Houma FD--Central
- Houma FD--East Houma Station 3
- Houma FD--North Houma Station 2
- Houma FD--South Houma Station 1
- Little Caillou VFD--Station 2
- Little Caillou VFD--Station 3

- Little Caillou VFD--Station 4
- Little Caillou VFD—Upper Station 1
- Montegut--Station 1
- Montegut--Station 2
- Montegut--Station 3
- Montegut--Station 4
- Schriever Volunteer Fire Dept.
- Schriever VFD--Gray Station
- Schriever VFD--Ellsworth Station
- Village East VFD--Central Station
- West Terrebonne F&R (Gibson East)
- West Terrebonne F&R--(TPCG) Don/Ch
- West Terrebonne Fire & Rescue (TPCG)

Schools

- Acadian Elementary
- Andrew Price Admin
- Anunziata
- Bayou Black Elementary
- Bayou Blue Elementary
- Bayou Cane Adult Ed Center
- Boudreaux Canal Elementary
- Bourg Elementary
- Broadmoor Elementary
- Caldwell Middle
- Coteau-Bayou Blue Elementary
- Covenant Christian Preschool
- Dularge Elementary
- Dularge Middle
- East Houma Elementary
- East Street Alternative
- Ellender Memorial High
- Elysian Fields Middle
- Evergreen Junior High
- Fletcher Community College
- Genesis Alternative High School
- Gibson Elementary
- Grand Caillou Elementary
- Grand Caillou Middle
- Greenwood Middle
- H.L. Bourgeois High
- Holy Rosary
- Honduras Elementary
- Houma Christian
- Houma Junior High
- Jane Community Home
- Juvenile Justice Center
- Lacache Middle
- Legion Park Middle
- Lisa Park Elementary
- Little Calliou Elementary
- Maria Immaculata Catholic School
- Montegut Elementary
- Montegut Middle
- Mulberry Elementary
- Oaklawn Junior High
- Oakshire Elementary
- Omega Institute of Cosmetology
- Pointe-Aux-Chenes Elementary School for Exceptional Children
- Schriever Elementary
- South Louisiana Beauty College
- South Louisiana Trade School
- South Terrebonne High School
- Southdown Elementary
- St. Bernadette Catholic School
- St. Francis De Sales
- St. Gregory Barbarigo School
- St. Matthew's Episcopal School
- TARC
- Louis Miller Technical High School
- Terrebonne High School
- Terrebonne Parish School Board
- Terrebonne Voc Rehab
- Upper Little Caillou Elementary
- Vanderbilt Catholic High
- Village East Middle
- West Park Elementary Special Education and Federal Center

Housing Authority Buildings

- Houma Terrebonne Housing Authority (Bayou Towers)

- Houma Terrebonne Housing Authority (Senator Circle)

Child Care

- Louis Infant Crisis Center
- MacDonnell Methodist Children Services

Civic Center

- Houma-Terrebonne Civic Center

Utilities

- TP Utilities Department
- South Wastewater Treatment Plant
- North Wastewater Treatment Plant
- Houma Generating Plant
- Consolidated Waterworks
- Houma Water Treatment Plant
- Schriever Water Treatment Plant
- Public Works Yard

Courts

- City Courthouse
- Courthouse
- Courthouse Annex

Sewage Utility

- Eureka Heights S/D - Gray
- Fairlane Sewage Corp - Gray
- Halliburton Energy Services
- Terrebonne Parish Pollution Control
- TPCG Pollution Control South Treatment Plant

Water Utility

- Andrew Price Regulator
- Bac-t Lab
- Bayou Black RW Pump Station
- Bayou Black Tank
- Bayou Dularge Tank
- Benoit Pump Station
- Blimp Bas PS
- Boudreaux Canal Pump Station
- Chauvin Tank Cocodrie Tank
- Dulac Pump Station
- Dulac Tank
- Dumas Tank
- Elliot Jones
- Gibson Tank
- Grand Caillou Tank
- Hanson SG
- Houma GS 1
- Houma GS 2
- Houma GS 3
- Houma Plant 3
- Houma Plant High Service
- Intracoastal RW Pump Station
- Klondyke Tank
- Lafort Canal RW PS
- Legion Building
- Lower Dulac Tank
- Main Office
- Minors SG
- Montegut Tank
- Munson PS
- North Terrebonne Standpipe
- Pointe-Aux-Chenes Pump Station
- Pointe-Aux-Chenes Tank
- Presque Isle PS
- Robinson Canal Pump Station
- Robinson Canal Tank
- Schriever GS 1
- Schriever GS 2
- Schriever Tank
- Shell PS
- South Terrebonne PS
- Texaco Master Meter
- Theriot Tank
- West Gibson Tank
- Williams Street PS

APPENDIX E: HAZUS OUTPUTS

Hazus Outputs

Hazus Scenario: FEMA Floodplain (2022)

Hazus Version: 6.0 *Hazus Run Date:* December 2022

Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. The preliminary FEMA floodplain data was converted into a flood depth grid for the 100-year event. FEMA's floodplain does *not* include the levee system in the modeling.

Floodplain Size: 954,427 acres (71.7% of the Parish)

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. These are the buildings located in the floodplain. Table 1 shows the buildings exposed to the hazard by occupancy. It includes the number of buildings, total structure value, total content value, and total overall value. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. The last column provides the percentage of the value of the buildings by occupancy that are in the hazard area compared to the total overall numbers for the Parish.

Nearly half of the single-family home values and more than seventy-five percent of the manufactured housing in Terrebonne is exposed to this hazard scenario. Overall, about 45% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values at nearly $18 billion.

Table 1: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	21,139	6,890,853,077	3,445,426,539	**10,336,279,616**	**49.9%**
Manufactured Housing	1,015	47,438,857	23,719,429	**71,158,286**	**75.2%**
Multi-Family Housing	1,031	688,944,311	344,472,156	**1,033,416,467**	**38.5%**
Other Residential	14	34,689,574	17,344,787	**52,034,361**	**29.6%**
Commercial	2,199	2,253,014,098	2,253,014,098	**4,506,028,196**	**41.1%**
Industrial	301	350,142,930	525,214,395	**875,357,325**	**41.9%**
Government	111	135,278,348	150,988,880	**286,267,228**	**34.0%**
Education	43	254,827,231	254,966,710	**509,793,941**	**35.5%**
Agricultural	10	4,119,068	4,119,068	**8,238,136**	**52.1%**
Religious	78	117,882,355	117,882,355	**235,764,710**	**46.0%**
TOTAL	**25,941**	**10,777,189,849**	**7,137,148,417**	**17,914,338,266**	**45.3%**

Additionally, Table 2 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. There are several fire stations, schools, and utilities exposed to the scenario. Damage estimates for these facilities are provided in the next section.

Table 2: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	10
Fire Station	23	Child Care	14
Government	10	Fuel Station	52
Hospital	1	Grocer	8
Police	1	Library	6
School	26	Pharmacy	4
Shelter	5	**TOTAL**	**94**
Utility	107		
TOTAL	**173**		

Economic Impacts

Economic impacts are modeled in Hazus using the depth of water at the building's location to determine the amount of loss the structure and contents will sustain. Buildings with a higher first floor height will sustain less loss than those closer to the ground. Inventory loss refers to businesses inventory, the products a business or industry sells. Table 3 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

More than half the total loss is associated with damage to single-family homes with more than a quarter of the loss coming from commercial structures which are typically built on concrete pads one foot above grade (unless elevated). Overall, there is a total building loss of nearly $7.3 billion.

Table 3: Building Impacts

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	20,978	2,781,772,255	1,510,659,211	0	**4,292,431,466**	41.5%
Manufactured Housing	678	13,237,926	5,328,251	0	**18,566,177**	26.1%
Multi-Family Housing	891	188,514,450	115,628,577	0	**304,143,027**	29.4%
Other Residential	13	3,572,554	4,919,528	0	**8,492,082**	16.3%
Commercial	2,179	322,535,943	998,017,577	820,818,044	**2,141,371,564**	29.3%
Industrial	301	36,775,773	104,827,876	20,432,813	**162,036,462**	16.2%
Government	103	20,959,301	114,727,608	0	**135,686,909**	47.4%
Education	31	18,781,203	94,366,842	0	**113,148,045**	22.2%
Agricultural	10	254,390	1,037,712	1,051,474	**2,343,576**	15.7%
Religious	68	9,806,408	71,591,479	0	**81,397,887**	34.5%
TOTAL BUILDING LOSS	**25,252**	**3,396,210,203**	**3,021,104,661**	**842,302,331**	**7,259,617,195**	

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 4 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 4: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	10,810,000	530,820,000	214,390,000	25,460,000	**781,480,000**
Commercial	844,710,000	265,440,000	176,830,000	916,590,000	**2,203,570,000**
Industrial	21,070,000	16,510,000	3,620,000	24,330,000	**65,530,000**
Others	131,540,000	82,400,000	8,780,000	1,277,730,000	**1,500,450,000**
TOTAL BUSINESS INTERRUPTION LOSS	**1,008,130,000**	**895,170,000**	**403,620,000**	**2,244,110,000**	**4,551,030,000**
				TOTAL BUILDING LOSS (from Table 3)	**7,259,617,195**
				TOTAL LOSS	**11,810,647,195**

Tier 1 critical facility damage was modeled and is provided in Table 5. Additional utility impacts include 70 drainage pump stations, South Water Treatment Plant, North Water Treatment Plant, Combon Bridge Minor Treatment Plant, 8 package plants, 15 elevated water tanks, and 10 substations.

Table 5: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Name	Damage	Tier 1 Critical Facility Type	Name	Damage
Fire Station	Bayou Dularge VFD	30%	Hospital	Leonard J Chabert Medical Center	0% (main bldg.) to 13% (bldg. south of main)
Fire Station	Bayou Dularge VFD-Station 1	32%	Police	Houma Police Department	19%
Fire Station	Bayou Dularge VFD-Station 2	10%	School	Boudreaux Canal Elementary	14%
Fire Station	Bayou Dularge VFD-Station 4	19%	School	Bourg Elementary	6%
Fire Station	Bourg VFD	2%	School	Broadmoor Elementary	1%
Fire Station	Bourg VFD	3%	School	Dularge Elementary	9%
Fire Station	Gibson East VFD	11%	School	Dularge Middle	8%

Tier 1 Critical Facility Type	Name	Damage	Tier 1 Critical Facility Type	Name	Damage
Fire Station	Gibson VFD	8%	School	East Street School	3%
Fire Station	Grand Caillou VFD	22%	School	Elysian Fields Middle	9%
Fire Station	Grand Caillou VFD-Bobtown Station (North)	23%	School	Gibson Elementary	5%
Fire Station	Grand Caillou VFD-Bobtown Station (South)	12%	School	Grand Caillou Elementary	17%
Fire Station	Grand Caillou VFD-Dulac Station (North)	33%	School	Grand Caillou Middle	9%
Fire Station	Grand Caillou VFD-Dulac Station (South)	32%	School	Greenwood Middle	8%
Fire Station	Grand Caillou VFD-Station 6	11%	School	Jane Community Home	15%
Fire Station	Houma Fire Department-East Houma Station 3	5%	School	Lacache Middle	11%
Fire Station	Little Caillou VFD-Station 2	17%	School	Little Caillou Elementary	15%
Fire Station	Little Caillou VFD-Station 3	19%	School	Montegut Elementary	10%
Fire Station	Little Caillou VFD-Station 4	23%	School	Montegut Middle	25%
Fire Station	Little Caillou VFD-Upper Station 1	17%	School	Point-aux-Chenes Elementary	14%
Fire Station	Montegut/Point-Aux-Chenes VFD-Station 1	13%	School	South Louisiana Beauty College	5%
Fire Station	Montegut/Point-Aux-Chenes VFD-Station 2	20%	School	St. Gregory Barbarigo	3%
Fire Station	Montegut/Point-Aux-Chenes VFD-Station 3	16%	School	Upper Little Caillou Elementary	8%
Fire Station	Montegut/Point-Aux-Chenes VFD-Station 4	28%	School	Village East Elementary	3%
Government	Chauvin Post Office	14%	Shelter	Devon Keller Memorial Center	10%
Government	LUMCON	65%	Shelter	West Houma Gym	19%
Government	Council on Aging	19%	Shelter	Dumas Auditorium	1%
Government	Detention Center	19%	Shelter	East Houma Gym	12%
Government	Pollution Control, Engineering	5%			
Government	Purchasing, Utilities	1%			
Government	Solid Waste	17%			

Figure 1 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

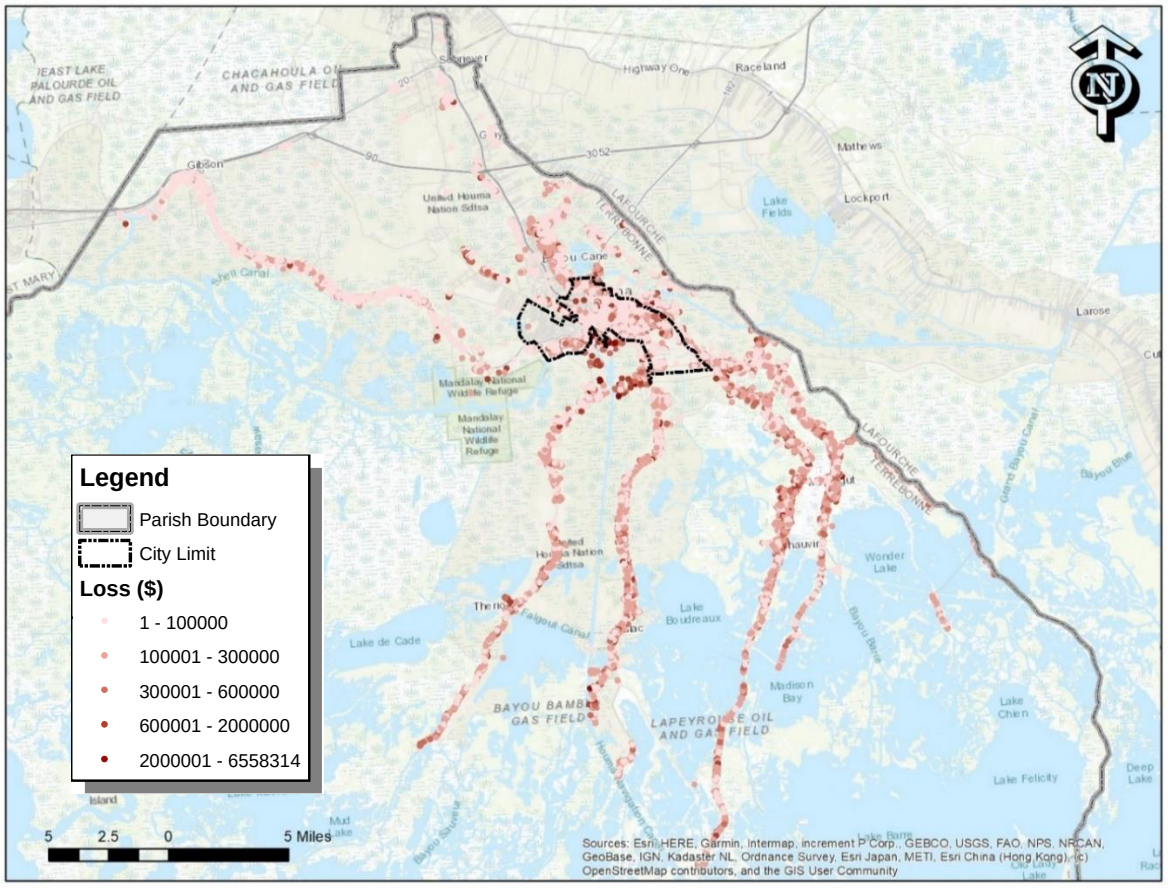


Figure 1: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data.

Table 6 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 7 shows the debris amounts and categories for this hazard scenario.

A little more than half the population of Terrebonne was modeled to be displaced during this hazard scenario with a little more than 6,000 requiring public shelter. The 123,745 tons of debris will require approximately 8,250 dump truck loads to clean up assuming 15 tons per haul.

Table 6: Social Impacts

Social Impacts	Population
Population Displaced	55,556
Shelter Requirements	6,158

Table 7: Debris Amounts

Debris Type	Debris Amount (Tons)
Finish	56,019
Structure	30,486
Foundation	37,240
TOTAL	**123,745**

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 2 and Figure 3.

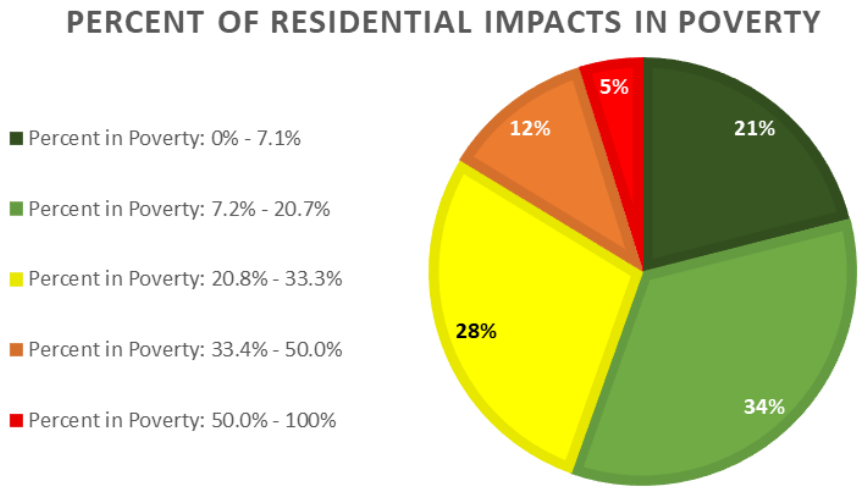


Figure 2: Residential Impacts by Poverty Levels

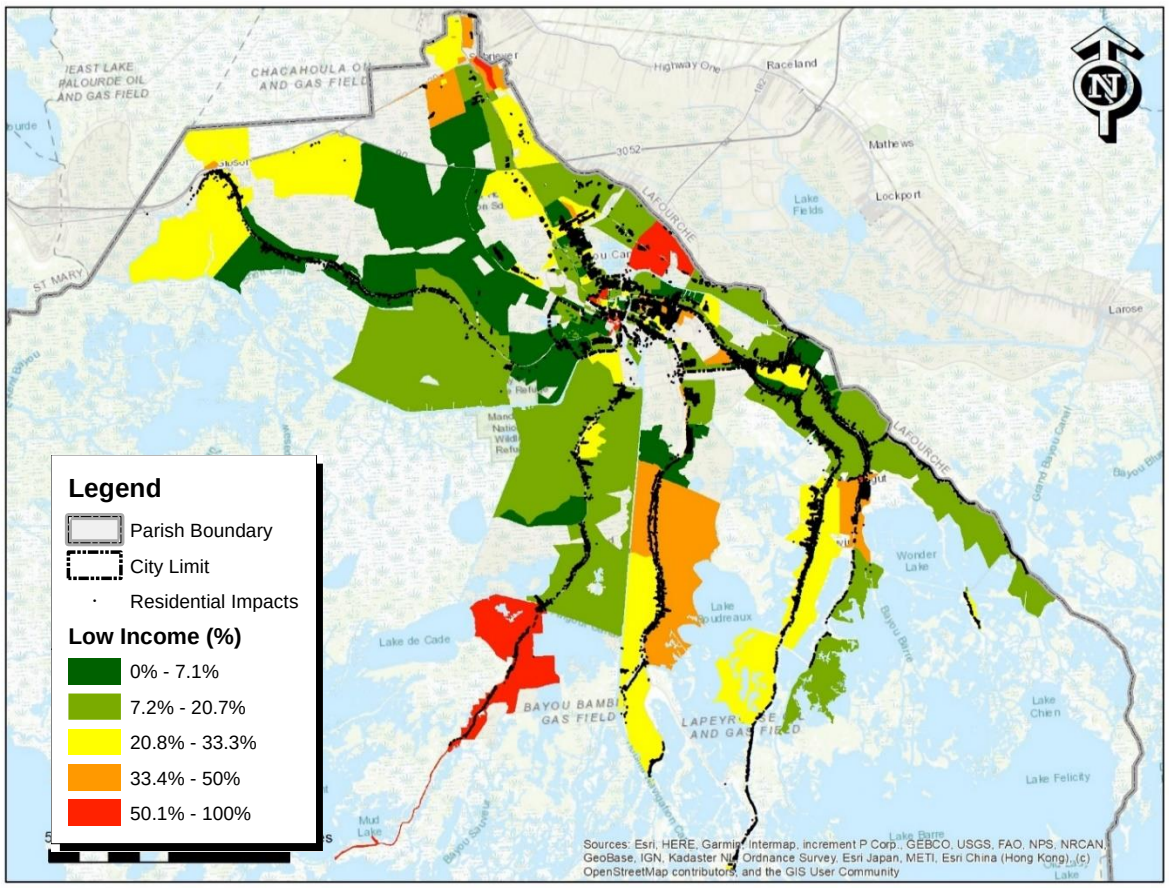


Figure 3: Map of Residential Impacts by Poverty

Hazus Scenario: Louisiana State University (2022)

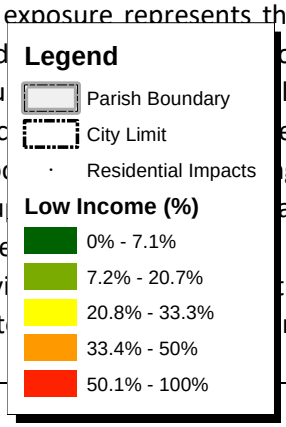
Hazus Version: 6.0 *Hazus Run Date:* December 2022

Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. LSU used ADCIRC to model the storm surge from Hurricane Ida. The output of this model was then integrated into Hazus to develop loss estimates. LSU's surge grid does include the levee system in the modeling.

Floodplain Size: 566,619 acres (42.4% of the Parish)

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. These are the build odplain. Table 8 shows the buildings exposed to the hazard by occupancy. It inclu ldings, total structure value, total content value, and total overall value. The struc ed using the building's square footage and RSMeans replacement value ($/sqft) asso g occupancy. The content value was based on the structure value and the occu azus methodologies (e.g. residential content values = 0.5 x residential structure value is not the building's market value or tax assessment value. The last column provi he value of the buildings by occupancy that are in the hazard area compared to the t r the Parish.



Nearly 5% of the single-family home values in Terrebonne are exposed to this hazard scenario. Other residential buildings, which include nursing homes and hotels, had nearly 12% exposure while the manufactured housing wasn't exposed at all. Overall, about 4% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values a little over $1.5 billion.

Table 8: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	2,154	676,449,241	338,224,620	**1,014,673,861**	4.9%
Manufactured Housing	0	0	0	**0**	0.0%
Multi-Family Housing	27	5,332,909	2,666,454	**7,999,363**	0.3%
Other Residential	10	13,949,274	6,974,637	**20,923,911**	11.9%
Commercial	168	185,947,039	185,947,039	**371,894,078**	3.4%
Industrial	8	9,230,117	13,845,175	**23,075,292**	1.1%
Government	24	16,820,380	18,623,374	**35,443,754**	4.2%
Education	5	16,497,185	16,497,185	**32,994,370**	2.3%
Agricultural	0	0	0	**0**	0.0%
Religious	10	15,927,278	15,927,278	**31,854,556**	6.2%
TOTAL	**2,406**	**940,153,423**	**598,705,762**	**1,538,859,185**	3.9%

Additionally, Table 9 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. There are several fire stations, schools, and utilities exposed to the scenario. Damage estimates for these facilities are provided in the next section.

Table 9: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	0
Fire Station	5	Child Care	0
Government	2	Fuel Station	9
Hospital	0	Grocer	0
Police	0	Library	1
School	2	Pharmacy	0
Shelter	1	**TOTAL**	**10**
Utility	22		
TOTAL	**32**		

Economic Impacts

Economic impacts are modeled in Hazus using the depth of water at the building's location to determine the amount of loss the structure and contents will sustain. Buildings with a higher first floor height will sustain less loss than those closer to the ground. Inventory loss refers to businesses inventory, the products a business or industry sells. Table 3 shows the structure, content, and inventory losses for the different

occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

More than half the total loss is associated with damage to single-family homes with more than a quarter of the loss coming from commercial structures which are typically built on concrete pads one foot above grade (unless elevated). Overall, there is a total building loss of over $221 million.

Table 10: Building Impacts

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	2,010	70,031,537	41,573,449	0	**111,606,996**	11.0%
Manufactured Housing	0	0	0	0	**0**	0.0%
Multi-Family Housing	24	586,515	290,109	0	**876,648**	11.0%
Other Residential	10	869,823	1,809,392	0	**2,679,225**	12.8%
Commercial	189	13,976,481	41,594,611	37,271,056	**92,842,337**	14.9%
Industrial	16	1,752,212	3,096,888	557,207	**5,406,323**	21.0%
Government	14	703,036	4,751,046	0	**5,454,096**	15.4%
Education	4	318,403	1,719,967	0	**2,038,374**	6.2%
Agricultural	0	0	0	0	**0**	0.0%
Religious	1	7,589	97,409	0	**104,999**	0.3%
TOTAL BUILDING LOSS	**2,268**	**88,245,596**	**94,932,871**	**37,828,263**	**221,008,998**	

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 11 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 11: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	810,000	32,480,000	10,430,000	1,910,000	**45,630,000**
Commercial	52,960,000	18,390,000	11,870,000	57,920,000	**141,140,000**
Industrial	2,450,000	2,200,000	580,000	3,040,000	**8,270,000**
Others	6,780,000	5,890,000	660,000	180,950,000	**194,280,000**

TOTAL BUSINESS INTERRUPTION LOSS	**63,000,000**	**58,960,000**	**23,540,000**	**243,820,000**	**389,320,000**
				TOTAL BUILDING LOSS (from Table 3)	**221,008,998**
				TOTAL LOSS	**610,328,998**

Tier 1 critical facility damage was modeled and is provided in Table 12. Additional utility impacts include 12 drainage pump stations, Combon Bridge Minor Treatment Plant, 2 package plants, 5 elevated water tanks, and 2 substations.

Table 12: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Name	Damage	Tier 1 Critical Facility Type	Name	Damage
Fire Station	Grand Caillou VFD-Dulac Station	10%	School	St. Gregory Barbarigo	5%
Fire Station	Little Caillou VFD-Station 4	11%	Shelter	West Houma Gym	11%
Government	Coroner's Office	5%			

Figure 4 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

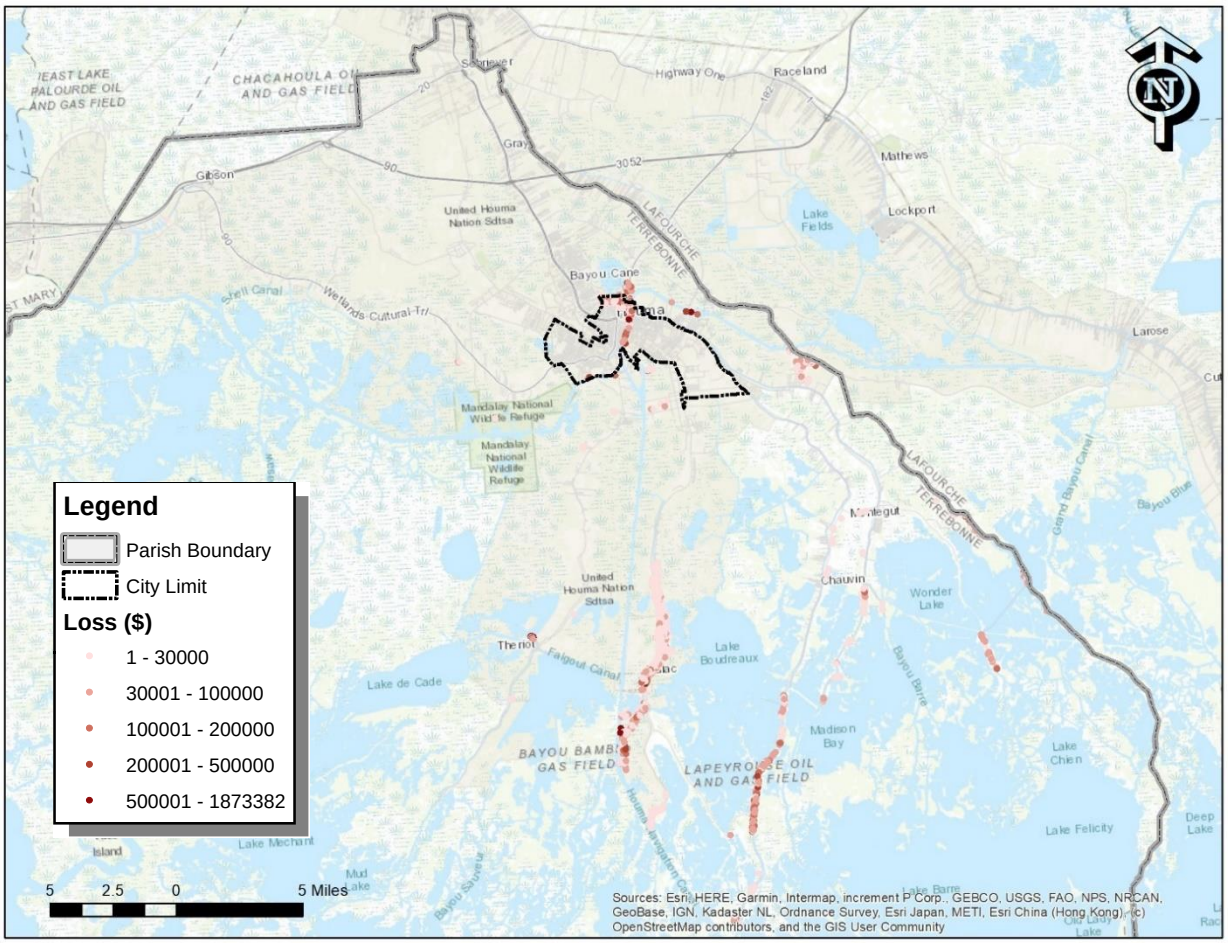


Figure 4: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 13 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 14 shows the debris amounts and categories for this hazard scenario.

A little less than 3% of the population of Terrebonne was modeled to be displaced during this hazard scenario with a little more than 750 requiring public shelter. The 4,218 tons of debris will require approximately 282 dump truck loads to clean up assuming 15 tons per haul.

Table 13: Social Impacts

Social Impacts	Population
Population Displaced	3,179
Shelter Requirements	753

Table 14: Debris Amounts

Debris Type	Debris Amount (Tons)
Finish	2,560
Structure	499
Foundation	1,159
TOTAL	**4,218**

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 5 and Figure 6.

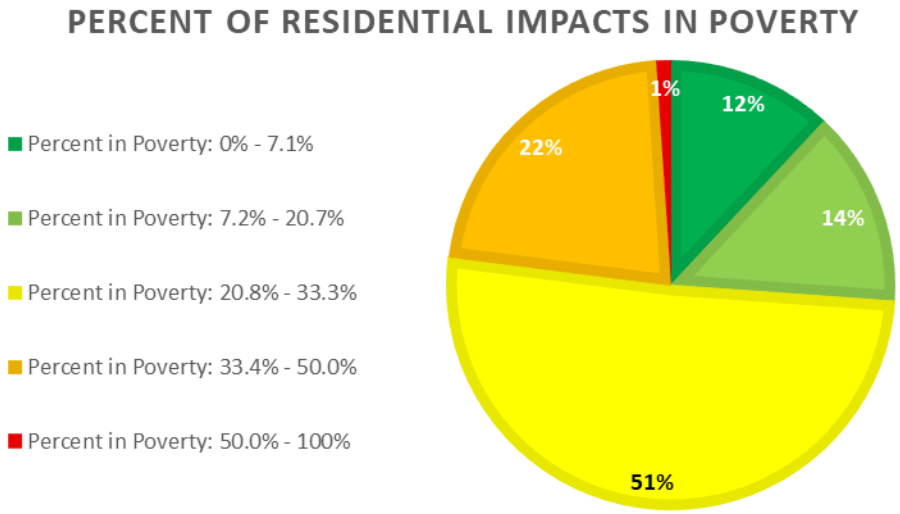


Figure 5: Residential Impacts by Poverty Levels

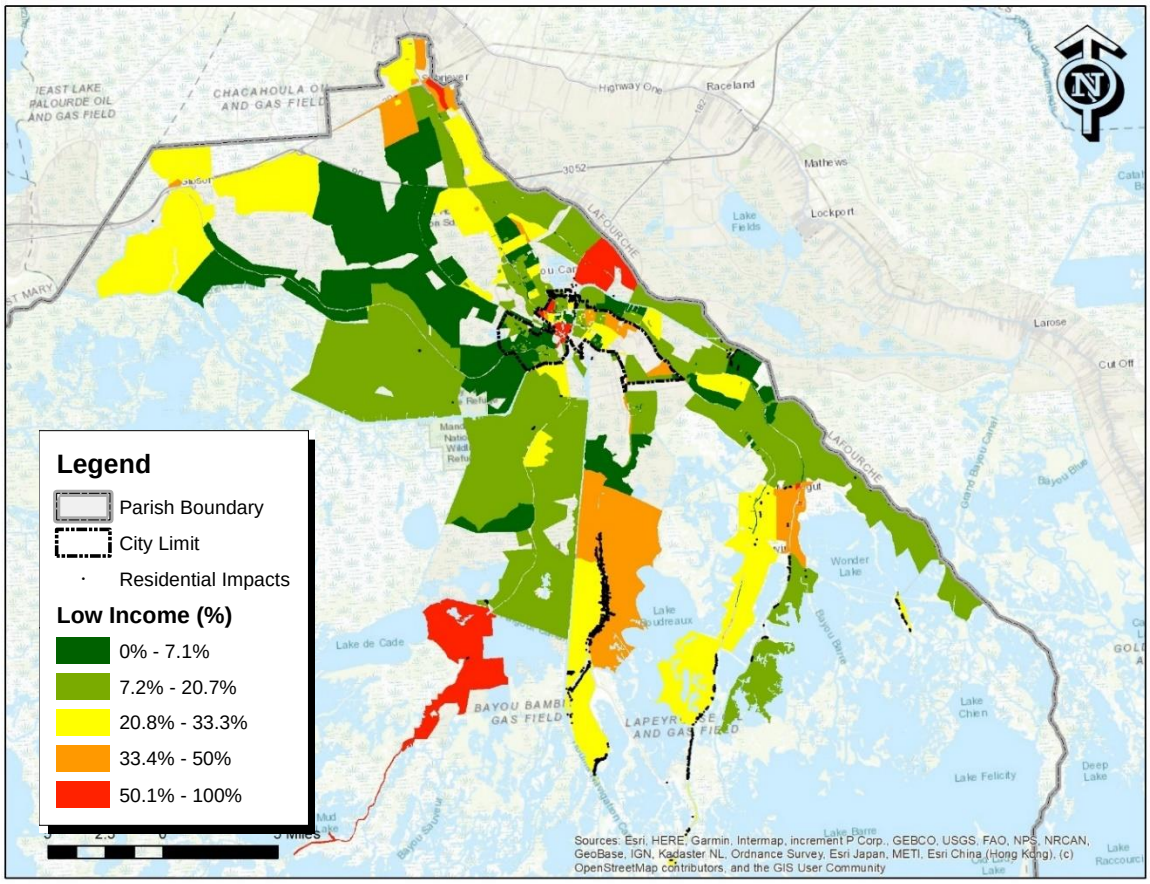


Figure 6: Map of Residential Impacts by Poverty

Hazus Scenario: Hurricane Ike (Hazus Surge Model) (2023)

Hazus Version: 6.0 *Hazus Run Date:* January 2023

Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. The levee system was added to the elevation model and Hazus was used to model the surge (combination of SLOSH and SWAN). Hazus was used to develop the losses.

Floodplain Size: 463,117 acres (34.8% of the Parish)

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. These are the buildings located in the floodplain. Table 15 shows the buildings exposed to the hazard by occupancy. It includes the number of buildings, total structure value, total content value, and total overall value. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. The last column provides the percentage of the value of the buildings by occupancy that are in the hazard area compared to the total overall numbers for the Parish.

Over 5% of the single-family home values in Terrebonne are exposed to this hazard scenario. Other residential buildings, which include nursing homes and hotels, had nearly 9% exposure while the manufactured housing wasn't exposed at all. Overall, a little over 3% of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values a little over $1.3 billion.

Table 15: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	2,018	743,160,856	371,580,428	**1,114,741,284**	5.4%
Manufactured Housing	0	0	0	**0**	0.0%
Multi-Family Housing	0	0	0	**0**	0.0%
Other Residential	7	10,151,057	5,075,529	**15,226,586**	8.7%
Commercial	91	90,381,595	90,381,595	**180,763,190**	1.6%
Industrial	0	0	0	**0**	0.0%
Government	10	4,969,670	5,997,592	**10,967,262**	1.3%
Education	1	1,831,363	1,831,363	**3,662,726**	0.3%
Agricultural	0	0	0	**0**	0.0%
Religious	3	2,812,865	2,812,865	**5,625,730**	1.1%
TOTAL	**2,130**	**853,307,406**	**477,679,372**	**1,330,986,778**	3.4%

Additionally, Table 16 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. There is one fire stations and four utilities (two drainage pumps, one treatment plant, and one water tower) exposed to the scenario along with three fuel stations. Damage estimates for these facilities are provided in the next section.

Table 16: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	0	Assisted Living	0
Fire Station	1	Child Care	0
Government	0	Fuel Station	3
Hospital	0	Grocer	0
Police	0	Library	0
School	0	Pharmacy	0
Shelter	0	**TOTAL**	**3**
Utility	4		
TOTAL	**5**		

Economic Impacts

Economic impacts are modeled in Hazus using the depth of water at the building's location to determine the amount of loss the structure and contents will sustain. Buildings with a higher first floor height will sustain less loss than those closer to the ground. Inventory loss refers to businesses inventory, the products a business or industry sells. Table 17 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

Most of the total loss is associated with damage to single-family homes with more than twenty percent of the loss coming from commercial structures which are typically built on concrete pads one foot above grade (unless elevated). Overall, there is a total building loss of over $259 million.

Table 17: Building Impacts

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	2,018	132,263,693	67,841,941	0	**200,105,634**	18.0%
Manufactured Housing	0	0	0	0	**0**	0.0%
Multi-Family Housing	0	0	0	0	**0**	0.0%
Other Residential	7	219,210	402,251	0	**621,461**	4.1%
Commercial	91	7,783,331	26,261,883	23,730,206	**57,775,420**	32.0%
Industrial	0	0	0	0	**0**	0.0%
Government	10	69,263	338,203	0	**407,466**	3.7%
Education	0	0	0	0	**0**	0.0%
Agricultural	0	0	0	0	**0**	0.0%
Religious	3	0	18,855	0	**18,855**	0.3%

Building Impacts	Buildings Impacted	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
TOTAL BUILDING LOSS	**2,129**	**140,335,497**	**94,863,133**	**23,730,206**	**258,928,836**	**19.5%**

Tier 1 critical facility damage was modeled and is provided in Table 18. Additional utility impacts include two drainage pumps, one treatment plant, and one water tower.

Table 18: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Name	Damage
Fire Station	Grand Caillou VFD-Dulac Station	8%

Figure 7 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

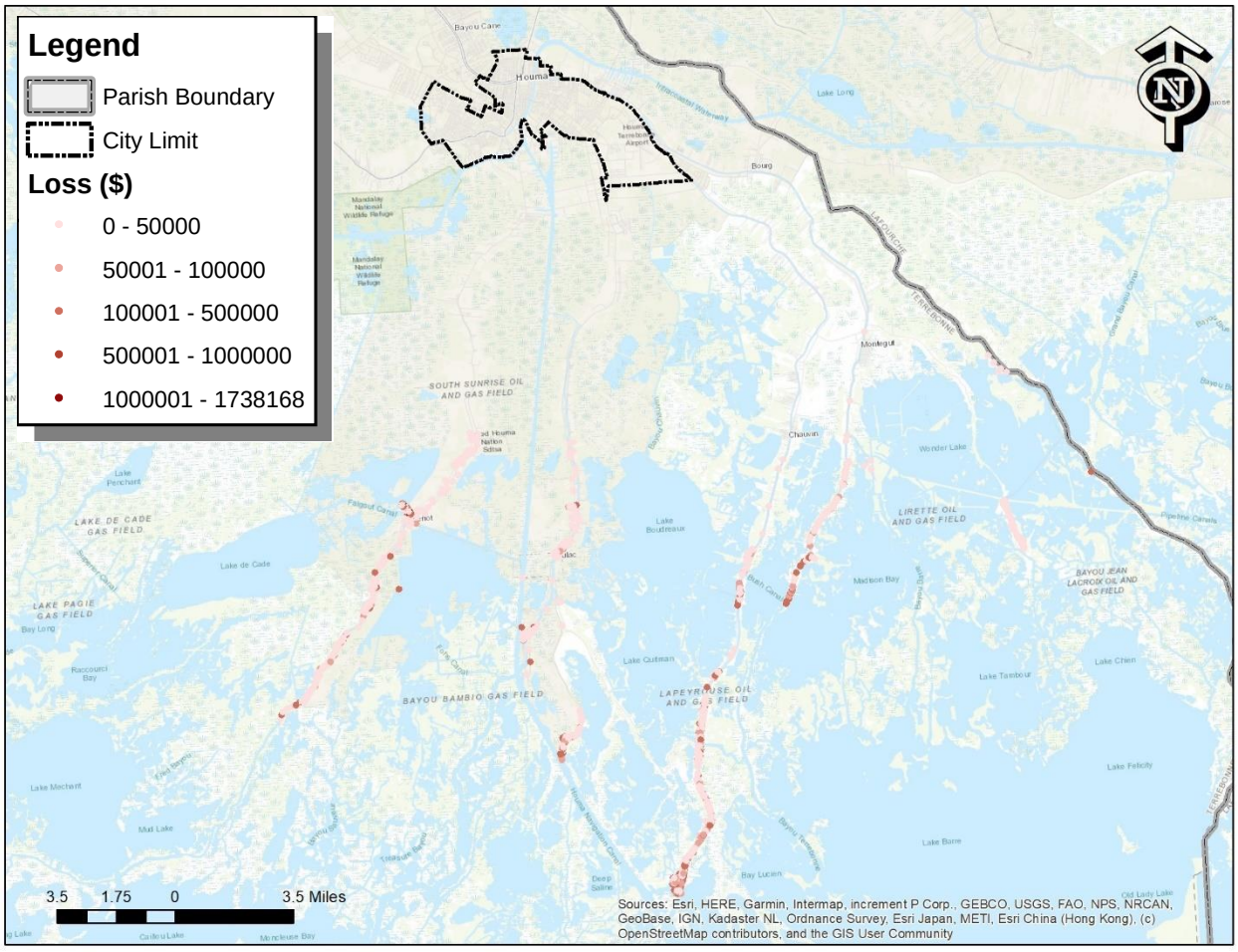


Figure 7: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 19 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 20 shows the debris amounts and categories for this hazard scenario.

A little more than 1% of the population of Terrebonne was modeled to be displaced during this hazard scenario with a little more than 250 requiring public shelter. The 2,884 tons of debris will require approximately 193 dump truck loads to clean up assuming 15 tons per haul.

Table 19: Social Impacts

Social Impacts	Population
Population Displaced	1,351
Shelter Requirements	261

Table 20: Debris Amounts

Debris Type	Debris Amount (Tons)
Finish	968
Structure	569
Foundation	1,347
TOTAL	**2,884**

The poverty impacts were very similar to the previous LSU scenario.

Hazus Scenario: 50-Year Hurricane Wind

Hazus Version: 6.0 *Hazus Run Date:* December 2022

Model Updates: Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. Hazus was used to model the 50-year hurricane event.

Windspeeds: 88 to 117 mph

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. All buildings in the Parish will be exposed to hurricane winds. Table 21 shows the buildings exposed to the hazard by occupancy. It includes the number of buildings, total structure value, total content value, and total overall value. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. The last column provides the percentage of the value of the buildings by occupancy that are in the hazard area compared to the total overall numbers for the Parish.

Over half of the exposure comes from single-family home values while commercial properties make up over a quarter of the exposure. Other residential buildings, which include nursing homes and hotels, had nearly 12% exposure while the manufactured housing wasn't exposed at all. Overall, all of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values nearly $40 billion.

Table 21: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	38,611	13,821,578,584	6,910,789,292	**20,732,367,876**	100%
Manufactured Housing	1,342	63,085,868	31,542,934	**94,628,802**	100%
Multi-Family Housing	2,602	1,789,707,254	894,853,627	**2,684,560,881**	100%
Other Residential	32	117,191,722	58,595,861	**175,787,583**	100%
Commercial	4,618	5,487,944,294	5,487,944,294	**10,975,888,588**	100%
Industrial	621	835,908,555	1,253,862,833	**2,089,771,388**	100%
Government	156	386,321,890	455,162,823	**841,484,713**	100%
Education	91	714,897,856	722,610,399	**1,437,508,255**	100%
Agricultural	17	7,904,825	7,904,825	**15,809,650**	100%
Religious	133	256,153,427	256,153,427	**512,306,854**	100%
TOTAL	**48,223**	**23,480,694,275**	**16,079,420,315**	**39,560,114,590**	100%

Additionally, Table 22 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. All tier 1 and tier 2 critical facilities should be considered exposed to this hazard scenario. Damage estimates for these facilities are provided in the next section.

Table 22: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	2	Assisted Living	8
Fire Station	40	Child Care	41
Government	34	Fuel Station	118
Hospital	4	Grocer	18
Police	6	Library	9
School	59	Pharmacy	22
Shelter	15	**TOTAL**	**216**
Utility	122		
TOTAL	**282**		

Economic Impacts

Economic impacts are modeled in Hazus using the windspeeds calculated at the centroid of the Census Tract and applied to all buildings within that Census Tract. There are certain building characteristics which make that building less susceptible to damage such as roof shape (e.g. hip roofs perform better than gable roofs) and shuttering. The building loss is mostly governed by keeping the building envelope intact during the event. Table 23 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

More than half the total loss is associated with damage to single-family homes with nearly a quarter of the loss coming from commercial structures. The high loss ratios for manufactured housing and agricultural buildings show that these trailers and barns are especially susceptible to high wind speeds. Overall, there is a total building loss of over $900 million.

Table 23: Building Impacts

Building Impacts	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	358,481,672	108,013,286	0	**466,494,958**	2.3%
Manufactured Housing	4,867,518	1,531,881	0	**6,399,399**	6.8%
Multi-Family Housing	94,363,703	12,509,823	0	**106,873,526**	4.0%
Other Residential	5,753,298	744,056	0	**6,497,354**	3.7%
Commercial	114,534,480	54,752,810	10,615,800	**179,903,090**	1.5%
Industrial	36,506,230	26,472,870	3,962,720	**66,941,820**	3.0%
Government	4,163,199	2,400,591	0	**6,563,790**	0.8%
Education	17,296,251	8,607,566	0	**25,903,817**	1.8%
Agricultural	1,214,529	670,894	633,257	**598,303**	3.8%
Religious	3,608,178	1,475,466	0	**5,083,644**	1.0%
TOTAL BUILDING LOSS	**640,789,058**	**217,179,243**	**15,211,777**	**871,259,701**	2.3%

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 24 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 24: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	217,740	61,628,570	25,981,640	513,010	**88,340,960**
Commercial	8,922,700	23,226,910	10,877,580	10,442,270	**53,469,460**
Industrial	496,620	3,352,660	441,000	728,790	**5,019,070**
Others	1,556,170	6,035,910	484,700	9,232,630	**17,309,410**
TOTAL BUSINESS INTERRUPTION LOSS	**11,193,230**	**94,244,050**	**37,784,920**	**20,916,700**	**164,138,900**
				TOTAL BUILDING LOSS (from Table 3)	**871,259,701**
				TOTAL LOSS	**1,035,398,601**

Tier 1 critical facility damage was modeled and is provided in Table 25. The Hazus hurricane wind model does not support utility impacts at this time.

Table 25: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Probability of Sustaining Severe Damage or Greater	Loss of Use (Days)
Emergency Operations Center	0% to 12%	0
Fire Station	0% to 8%	0
Government	0% to 5%	Not Supported
Hospital	0% to 29%	0 to 1
Police	0% to 2%	0
School	0% to 28%	0 to 17
Shelter	0% to 7%	Not Supported

Figure 8 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

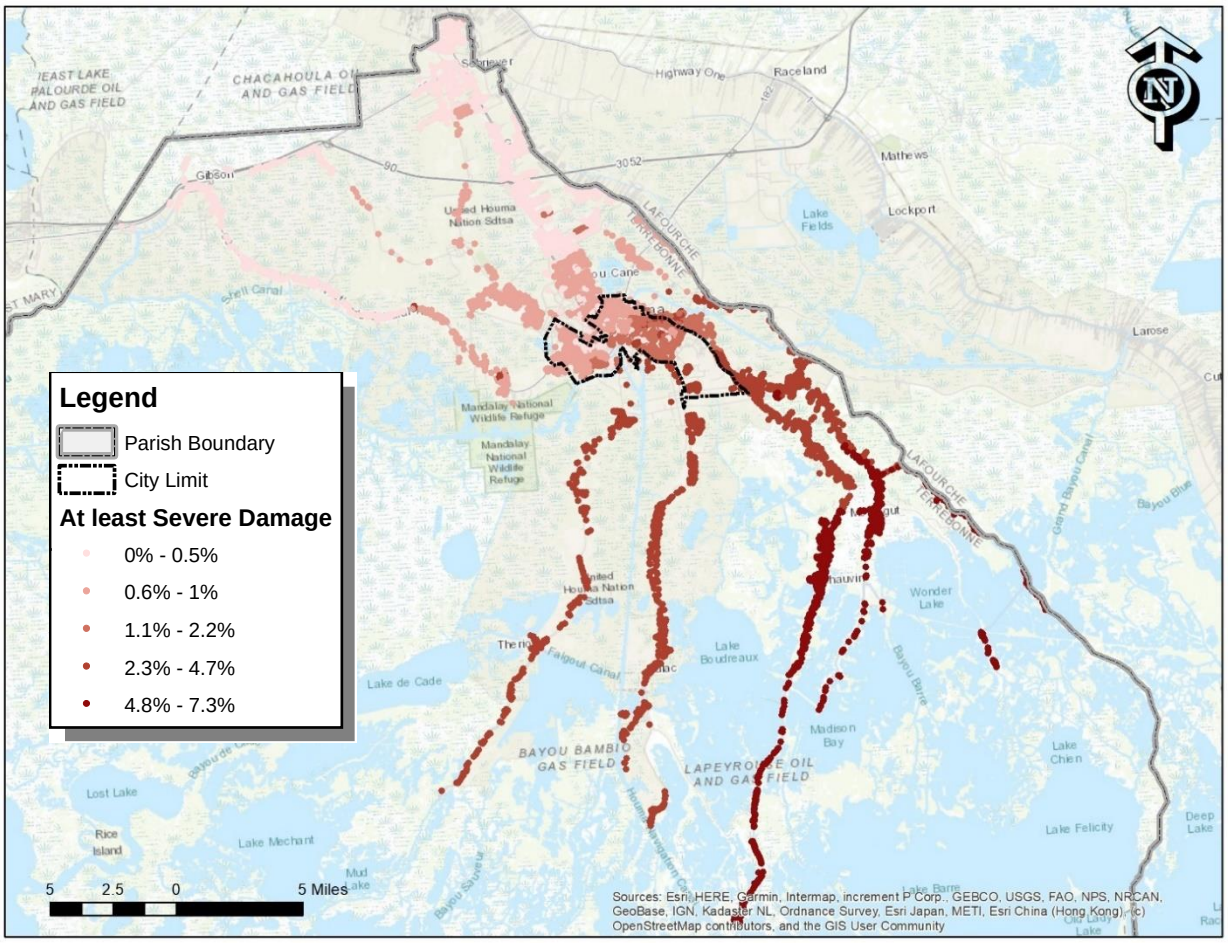


Figure 8: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 26 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 27 shows the debris amounts and categories for this hazard scenario.

A little less than 2% of the population of Terrebonne was modeled to be displaced during this hazard scenario with nearly 400 requiring public shelter. The 1,051,172 tons of debris will require approximately 70,079 dump truck loads to clean up assuming 15 tons per haul.

Table 26: Social Impacts

Social Impacts	Population
Population Displaced	1,590
Shelter Requirements	398

Table 27: Debris Amounts

Debris Type	Debris Amount (Tons)
Brick/Wood	85,264
Concrete/Steel	631
Tree	965,277
TOTAL	**1,051,172**

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 9 and Figure 10.

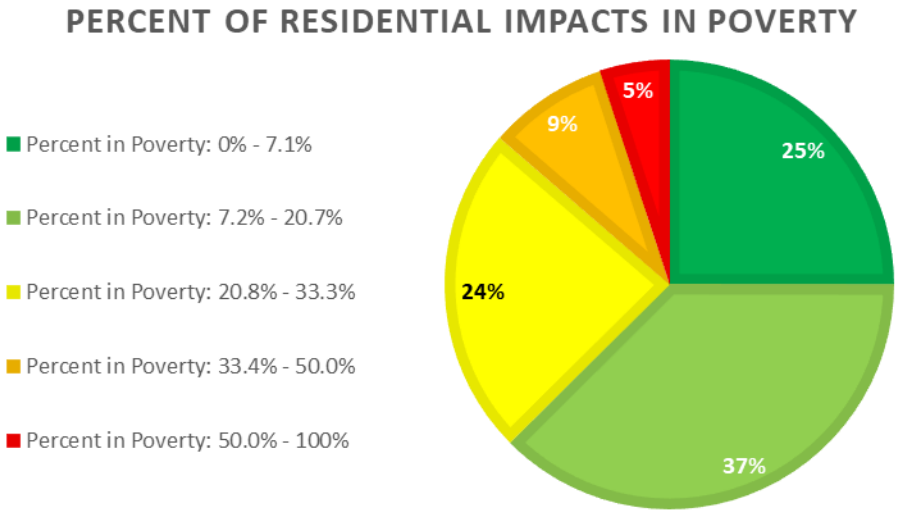


Figure 9: Residential Impacts by Poverty Levels

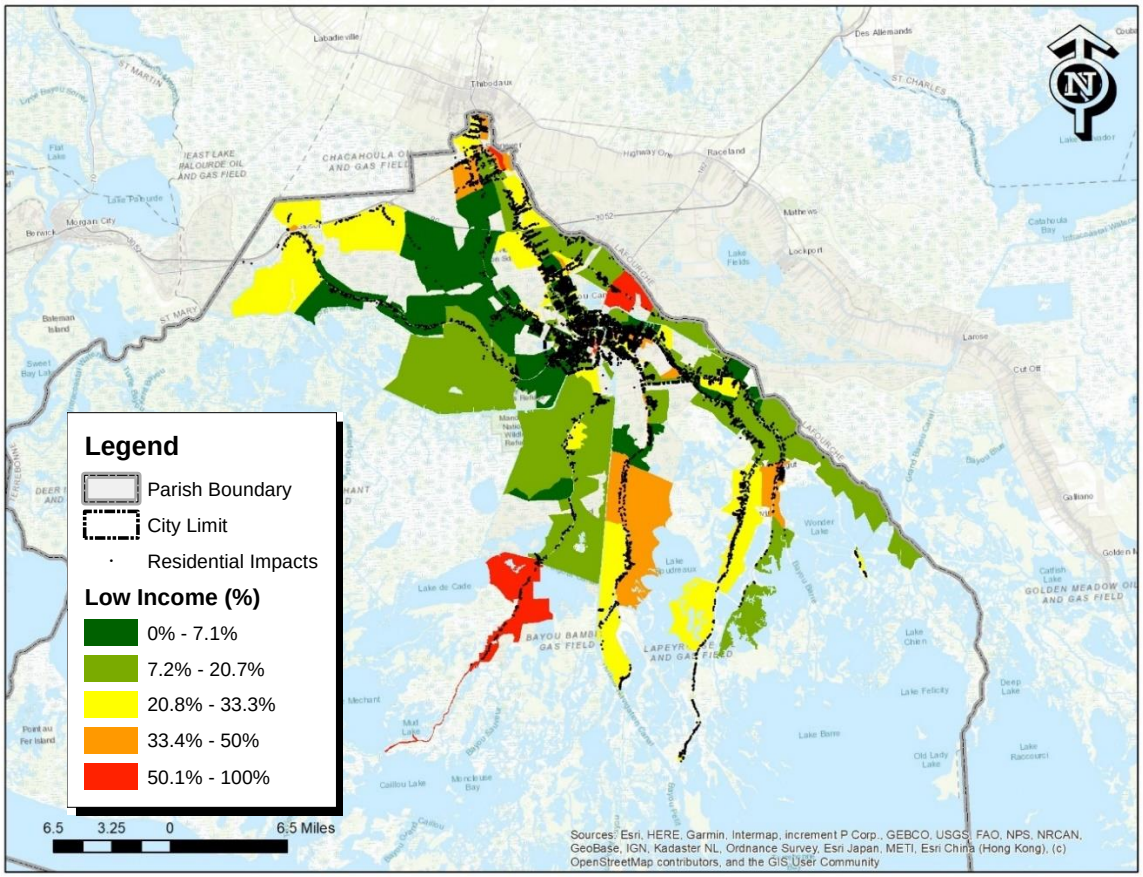


Figure 10: Map of Residential Impacts by Poverty

Hazus Scenario: 100-Year Hurricane Wind

Hazus Version: 6.0 *Hazus Run Date:* December 2022

Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. Hazus was used to model the 100-year hurricane event.

Windspeeds: 112 to 120 mph

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. All buildings in the Parish will be exposed to hurricane winds. Table 28 shows the buildings exposed to the hazard by occupancy. It includes the number of buildings, total structure value, total content value, and total overall value. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. The last column provides the percentage of the value of the buildings by occupancy that are in the hazard area compared to the total overall numbers for the Parish.

Over half of the exposure comes from single-family home values while commercial properties make up over a quarter of the exposure. Other residential buildings, which include nursing homes and hotels, had nearly 12% exposure while the manufactured housing wasn't exposed at all. Overall, all of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values nearly $40 billion.

Table 28: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	38,611	13,821,578,584	6,910,789,292	**20,732,367,876**	100%
Manufactured Housing	1,342	63,085,868	31,542,934	**94,628,802**	100%
Multi-Family Housing	2,602	1,789,707,254	894,853,627	**2,684,560,881**	100%
Other Residential	32	117,191,722	58,595,861	**175,787,583**	100%
Commercial	4,618	5,487,944,294	5,487,944,294	**10,975,888,588**	100%
Industrial	621	835,908,555	1,253,862,833	**2,089,771,388**	100%
Government	156	386,321,890	455,162,823	**841,484,713**	100%
Education	91	714,897,856	722,610,399	**1,437,508,255**	100%
Agricultural	17	7,904,825	7,904,825	**15,809,650**	100%
Religious	133	256,153,427	256,153,427	**512,306,854**	100%
TOTAL	**48,223**	**23,480,694,275**	**16,079,420,315**	**39,560,114,590**	100%

Additionally, Table 29 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. All tier 1 and tier 2 critical facilities should be considered exposed to this hazard scenario. Damage estimates for these facilities are provided in the next section.

Table 29: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	2	Assisted Living	8
Fire Station	40	Child Care	41
Government	34	Fuel Station	118
Hospital	4	Grocer	18
Police	6	Library	9
School	59	Pharmacy	22
Shelter	15	**TOTAL**	**216**
Utility	122		
TOTAL	**282**		

Economic Impacts

Economic impacts are modeled in Hazus using the windspeeds calculated at the centroid of the Census Tract and applied to all buildings within that Census Tract. There are certain building characteristics which make that building less susceptible to damage such as roof shape (e.g. hip roofs perform better than gable roofs) and shuttering. The building loss is mostly governed by keeping the building envelope intact during the event. Table 30Table 3 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

More than half the total loss is associated with damage to single-family homes with nearly a quarter of the loss coming from commercial structures. The high loss ratios for manufactured housing show that mobile homes are especially susceptible to high wind speeds. Overall, there is a total building loss of over $2.1 billion.

Table 30: Building Impacts

Building Impacts	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	833,881,245	296,664,236	0	**1,130,545,481**	5.5%
Manufactured Housing	8,557,354	2,996,133	0	**11,553,488**	12.2%
Multi-Family Housing	196,682,956	36,928,106	0	**233,611,062**	8.7%
Other Residential	11,684,454	2,049,429	0	**13,733,883**	7.8%
Commercial	292,247,423	163,024,716	33,238,288	**488,510,427**	4.1%
Industrial	86,651,442	66,645,786	9,885,132	**163,182,360**	7.3%
Government	10,490,547	6,403,789	0	**16,894,336**	2.0%
Education	52,202,438	29,827,994	0	**82,030,432**	5.7%
Agricultural	713,694	426,636	402,673	**1,543,003**	7.2%
Religious	9,783,364	4,695,607	0	**14,478,971**	2.8%
TOTAL BUILDING LOSS	**1,502,894,917**	**609,662,432**	**43,526,093**	**2,156,083,443**	**5.5%**

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 31 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 31: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	975,640	164,607,410	65,278,740	2,298,450	**233,160,240**
Commercial	27,011,100	56,614,820	28,123,530	32,366,150	**144,115,600**
Industrial	1,215,270	7,677,120	1,084,550	1,822,800	**11,799,740**
Others	1,942,940	17,109,670	1,467,120	11,169,440	**31,689,170**
TOTAL BUSINESS INTERRUPTION LOSS	**31,144,950**	**246,009,020**	**95,953,940**	**47,656,840**	**420,764,750**
				TOTAL BUILDING LOSS (from Table 3)	**2,156,083,443**
				TOTAL LOSS	**2,576,848,193**

Tier 1 critical facility damage was modeled and is provided in Table 32. The Hazus hurricane wind model does not support utility impacts at this time.

Table 32: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Probability of Sustaining Severe Damage or Greater	Loss of Use (Days)
Emergency Operations Center	0% to 12%	0
Fire Station	1% to 12%	0
Government	4% to 12%	Not Supported
Hospital	4% to 35%	2 to 10
Police	11% to 12%	0
School	2% to 75%	2 to 54
Shelter	4% to 16%	Not Supported

Figure 11 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

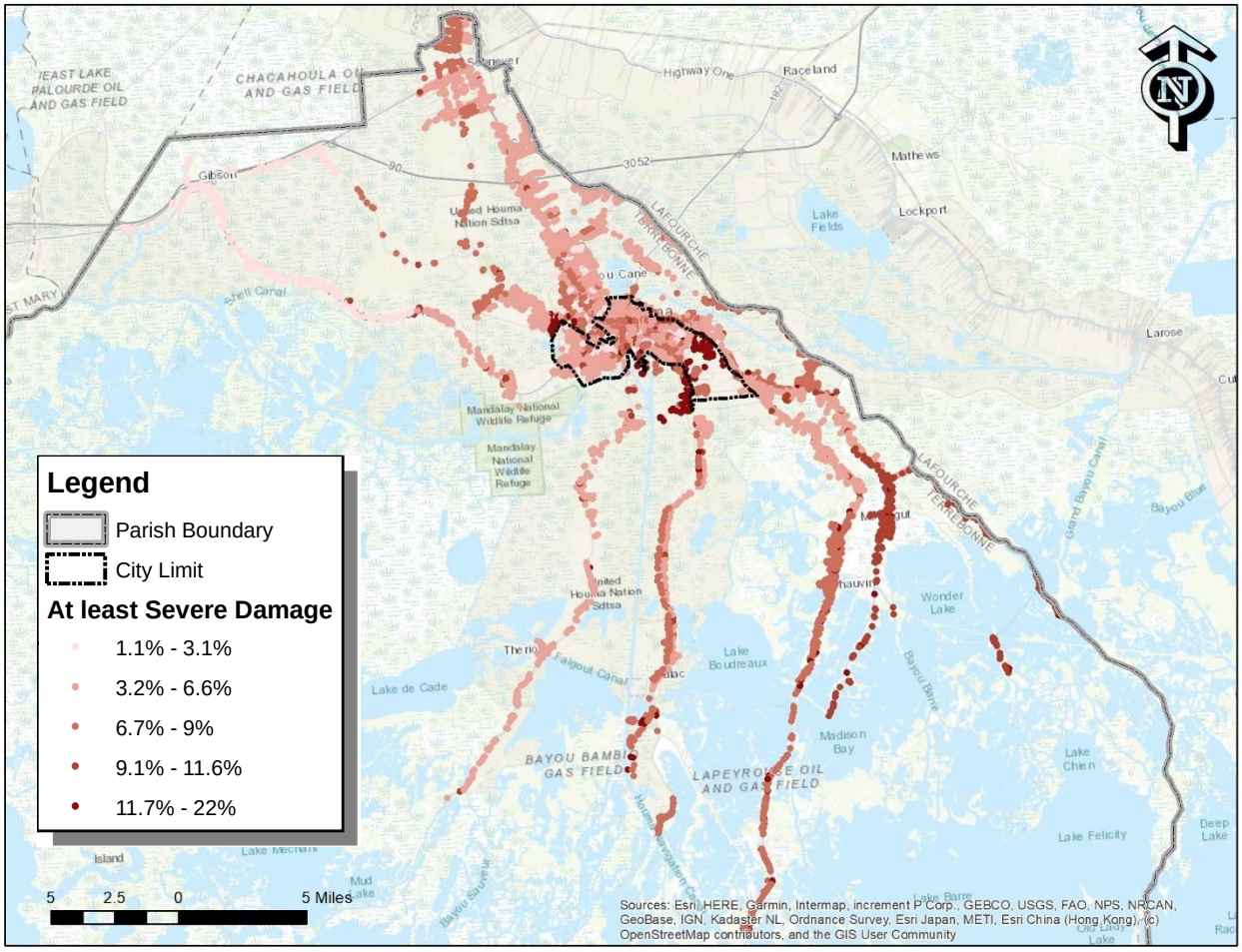


Figure 11: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 33 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 34 shows the debris amounts and categories for this hazard scenario.

A little more than 4% of the population of Terrebonne was modeled to be displaced during this hazard scenario with nearly 1,200 requiring public shelter. The 1,543,844 tons of debris will require approximately 102,923 dump truck loads to clean up assuming 15 tons per haul.

Table 33: Social Impacts

Social Impacts	Population
Population Displaced	4,741
Shelter Requirements	1,175

Table 34: Debris Amounts

Debris Type	Debris Amount (Tons)
Brick/Wood	182,497
Concrete/Steel	2,181
Tree	1,359,166
TOTAL	**1,543,844**

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 12 and Figure 13.

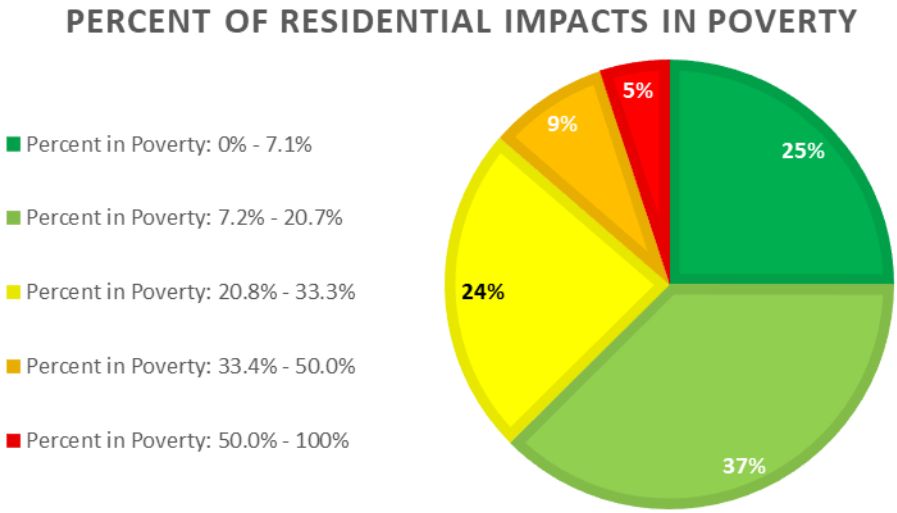


Figure 12: Residential Impacts by Poverty Levels

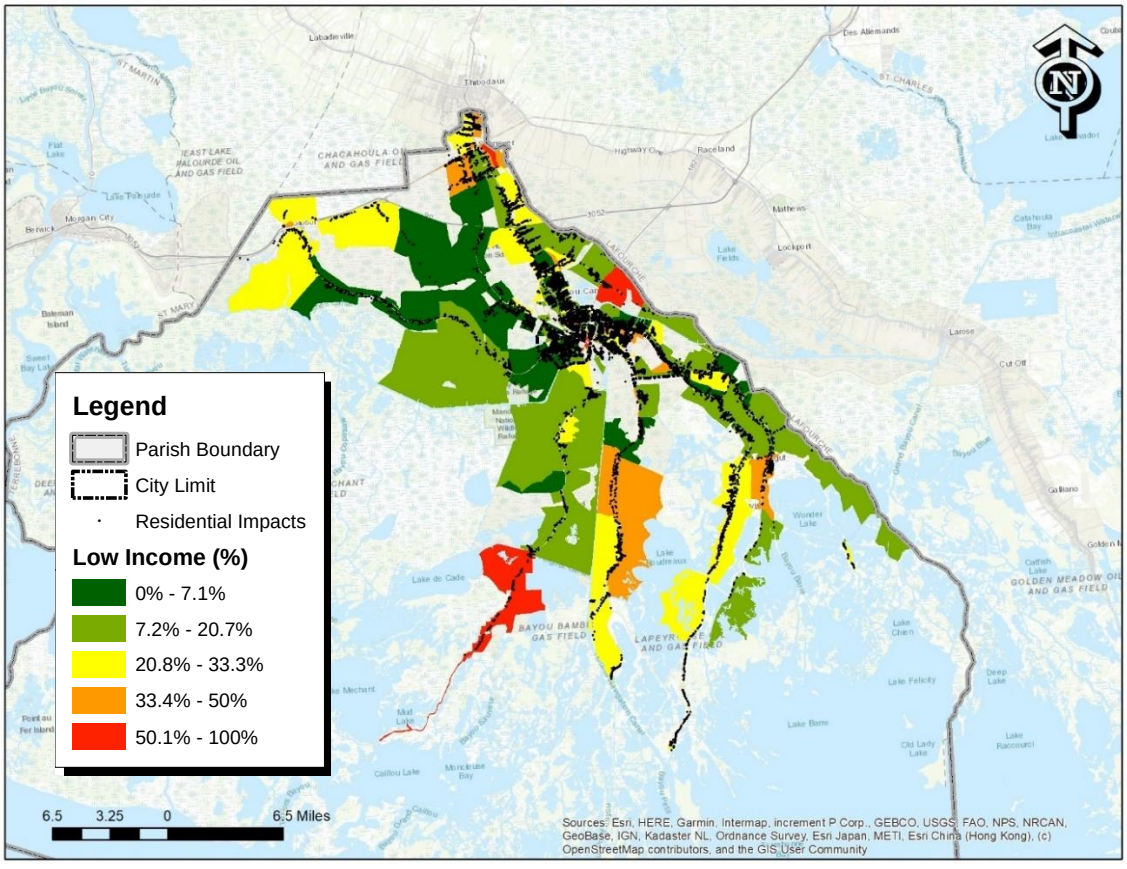


Figure 13: Map of Residential Impacts by Poverty

Hazus Scenario: 500-Year Hurricane Wind

Hazus Version: 6.0 *Hazus Run Date:* December 2022

Model Updates: Building footprints and parcel data were used to create a user-defined building dataset in Hazus. Hazus was used to model the 500-year hurricane event.

Windspeeds: 128 to 140 mph

Exposure

The exposure represents the buildings and building value that is exposed to the hazard. All buildings in the Parish will be exposed to hurricane winds. Table 35 shows the buildings exposed to the hazard by occupancy. It includes the number of buildings, total structure value, total content value, and total overall value. The structure value was calculated using the building's square footage and RSMeans replacement value ($/sqft) associated with the building occupancy. The content value was based on the structure value and the occupancy class using the Hazus methodologies (e.g. residential content values = 0.5 x residential structure value). The structure value is not the building's market value or tax assessment value. The last column provides the percentage of the value of the buildings by occupancy that are in the hazard area compared to the total overall numbers for the Parish.

Over half of the exposure comes from single-family home values while commercial properties make up over a quarter of the exposure. Other residential buildings, which include nursing homes and hotels, had nearly 12% exposure while the manufactured housing wasn't exposed at all. Overall, all of Terrebonne's building inventory is exposed to this hazard scenario with the total exposure values nearly $40 billion.

Table 35: Buildings Exposed to the Hazard

Building Occupancy	Buildings Exposed	Structure Exposed ($)	Content Exposed ($)	Total Exposure ($)	Value Exposed
Single-Family Housing	38,611	13,821,578,584	6,910,789,292	**20,732,367,876**	100%
Manufactured Housing	1,342	63,085,868	31,542,934	**94,628,802**	100%
Multi-Family Housing	2,602	1,789,707,254	894,853,627	**2,684,560,881**	100%
Other Residential	32	117,191,722	58,595,861	**175,787,583**	100%
Commercial	4,618	5,487,944,294	5,487,944,294	**10,975,888,588**	100%
Industrial	621	835,908,555	1,253,862,833	**2,089,771,388**	100%
Government	156	386,321,890	455,162,823	**841,484,713**	100%
Education	91	714,897,856	722,610,399	**1,437,508,255**	100%
Agricultural	17	7,904,825	7,904,825	**15,809,650**	100%
Religious	133	256,153,427	256,153,427	**512,306,854**	100%
TOTAL	**48,223**	**23,480,694,275**	**16,079,420,315**	**39,560,114,590**	100%

Additionally, Table 36 shows the tier 1 and 2 facilities which are exposed to this hazard scenario. All tier 1 and tier 2 critical facilities should be considered exposed to this hazard scenario. Damage estimates for these facilities are provided in the next section.

Table 36: Critical Facilities Exposed to Hazard

Tier 1 Critical Facilities	Buildings Exposed	Tier 2 Critical Facilities	Buildings Exposed
Emergency Operations Center	2	Assisted Living	8
Fire Station	40	Child Care	41
Government	34	Fuel Station	118
Hospital	4	Grocer	18
Police	6	Library	9
School	59	Pharmacy	22
Shelter	15	**TOTAL**	**216**
Utility	122		
TOTAL	**282**		

Economic Impacts

Economic impacts are modeled in Hazus using the windspeeds calculated at the centroid of the Census Tract and applied to all buildings within that Census Tract. There are certain building characteristics which make that building less susceptible to damage such as roof shape (e.g. hip roofs perform better than gable roofs) and shuttering. The building loss is mostly governed by keeping the building envelope intact during the event. Table 37 shows the structure, content, and inventory losses for the different occupancies in Terrebonne. The last column shows the loss ratio which compares the loss of the structure to what was exposed to the hazard.

More than half the total loss is associated with damage to single-family homes with nearly a quarter of the loss coming from commercial structures. The high loss ratios for manufactured housing show that mobile homes are especially susceptible to high wind speeds. Overall, there is a total building loss of nearly $10 billion.

Table 37: Building Impacts

Building Impacts	Structure Loss ($)	Content Loss ($)	Inventory Loss ($)	Total Loss ($)	Loss Ratio
Single-Family Housing	2,763,975,170	1,174,516,789	0	**3,938,491,959**	19.0%
Manufactured Housing	27,866,476	11,792,487	0	**39,658,963**	41.9%
Multi-Family Housing	513,702,741	157,782,756	0	**671,485,497**	25.0%
Other Residential	30,613,211	8,456,554	0	**39,069,765**	22.2%
Commercial	1,012,058,862	702,610,951	134,193,435	**1,848,863,248**	15.6%
Industrial	313,786,787	282,864,884	41,752,642	**638,404,313**	28.6%
Government	40,370,318	29,527,135	0	**1,714,669,813**	8.3%
Education	185,358,624	122,910,354		**596,651,671**	21.4%
Agricultural	1,115,256	754,145	711,805	**2,581,206**	27.6%
Religious	35,048,645	20,849,344	0	**55,897,989**	10.9%
TOTAL BUILDING LOSS	**4,923,896,090**	**2,512,065,399**	**176,657,882**	**9,545,774,424**	**18.8%**

Hazus also models the loss due to business interruption. The methodology assigns number of days the business will not be functioning and calculates losses due to business income, relocation, rental income, and wage loss. Table 38 provides the four categories of business interruption loss by building occupancy. Residential occupancies include hotels, motels, and nursing homes.

The results show that the business interruption loss is a major component of the overall losses due to the number of businesses impacted by the hazard and the length of time it would take to get the businesses up and running again. Hazus does factor in the delay getting contractors for rebuilding due to the high demand.

Table 38: Business Interruption Loss

Business Interruption Impacts	Business Income Loss ($)	Relocation Costs ($)	Rental Income Loss ($)	Wage Loss ($)	Total Loss ($)
Residential	4,260,620	474,387,050	180,890,360	10,029,930	**669,567,960**
Commercial	166,508,330	161,752,250	91,383,480	215,479,750	**635,123,810**
Industrial	5,496,120	20,402,790	3,703,560	8,325,640	**37,928,110**
Others	2,472,460	52,736,220	5,083,520	13,150,990	**73,443,190**
TOTAL BUSINESS INTERRUPTION LOSS	**178,737,530**	**709,278,310**	**281,060,920**	**246,986,310**	**1,416,063,070**
				TOTAL BUILDING LOSS (from Table 3)	**9,545,774,424**
				TOTAL LOSS	**10,961,837,494**

Tier 1 critical facility damage was modeled and is provided in Table 39. The Hazus hurricane wind model does not support utility impacts at this time.

Table 39: Tier 1 Critical Facility Damage

Tier 1 Critical Facility Type	Probability of Sustaining Severe Damage or Greater	Loss of Use (Days)
Emergency Operations Center	0% to 44%	0
Fire Station	19% to 45%	0
Government	18% to 52%	Not Supported
Hospital	26% to 53%	8 to 15
Police	37% to 43%	0
School	26% to 87%	43 to 177
Shelter	20% to 42%	Not Supported

Figure 14 shows the building impacts to Terrebonne. The darker red dots show the higher damage locations.

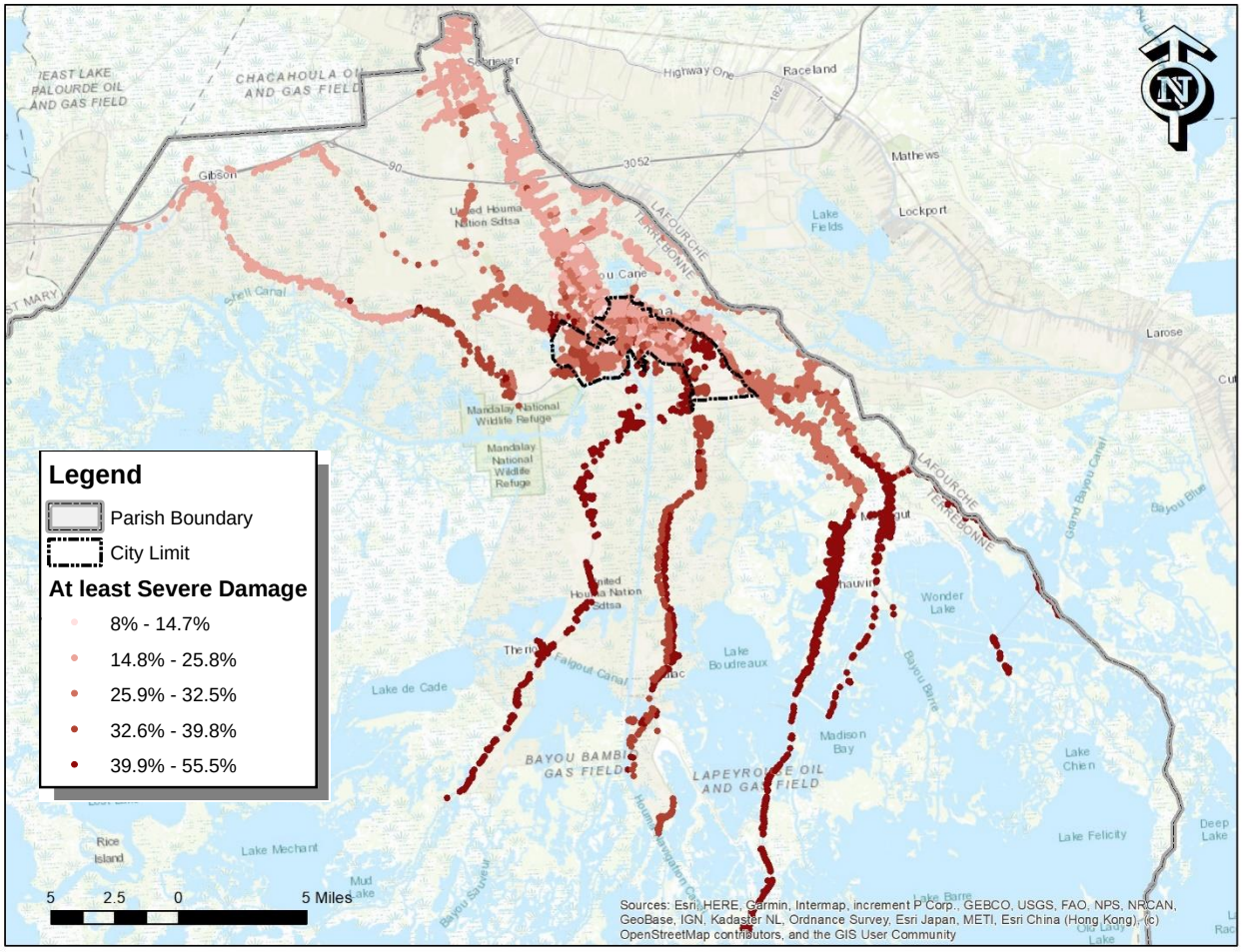


Figure 14: Building Impacts

Social Impacts

Hazus models some social impacts such as the number of households and population displaced from a hazard scenario and how many of those people will most likely seek public shelter based on demographic data. Table 40 shows the modeled displaced population and shelter requirements for this hazard scenario. Hazus also models the debris amounts for the buildings impacted in three categories building finishes, structure, and foundation. Table 41 shows the debris amounts and categories for this hazard scenario.

A little more than 22% of the population of Terrebonne was modeled to be displaced during this hazard scenario with a little over 6,000 requiring public shelter. The 2,923,187 tons of debris will require approximately 194,880 dump truck loads to clean up assuming 15 tons per haul.

Table 40: Social Impacts

Social Impacts	Population
Population Displaced	24,357
Shelter Requirements	6,003

Table 41: Debris Amounts

Debris Type	Debris Amount (Tons)
Brick/Wood	598,508
Concrete/Steel	19,542
Tree	2,305,137
TOTAL	**2,923,187**

To help determine which areas will be more adversely impacted due to poverty, the Hazus site-level residential impacts were overlaid with the U.S. Census data showing population percentage living below the poverty level. The results can be seen in Figure 15 and Figure 16.

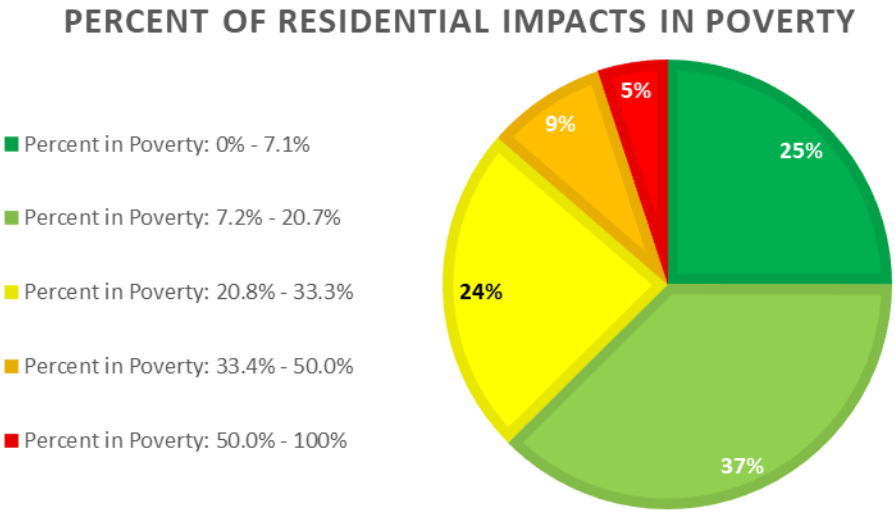


Figure 15: Residential Impacts by Poverty Levels

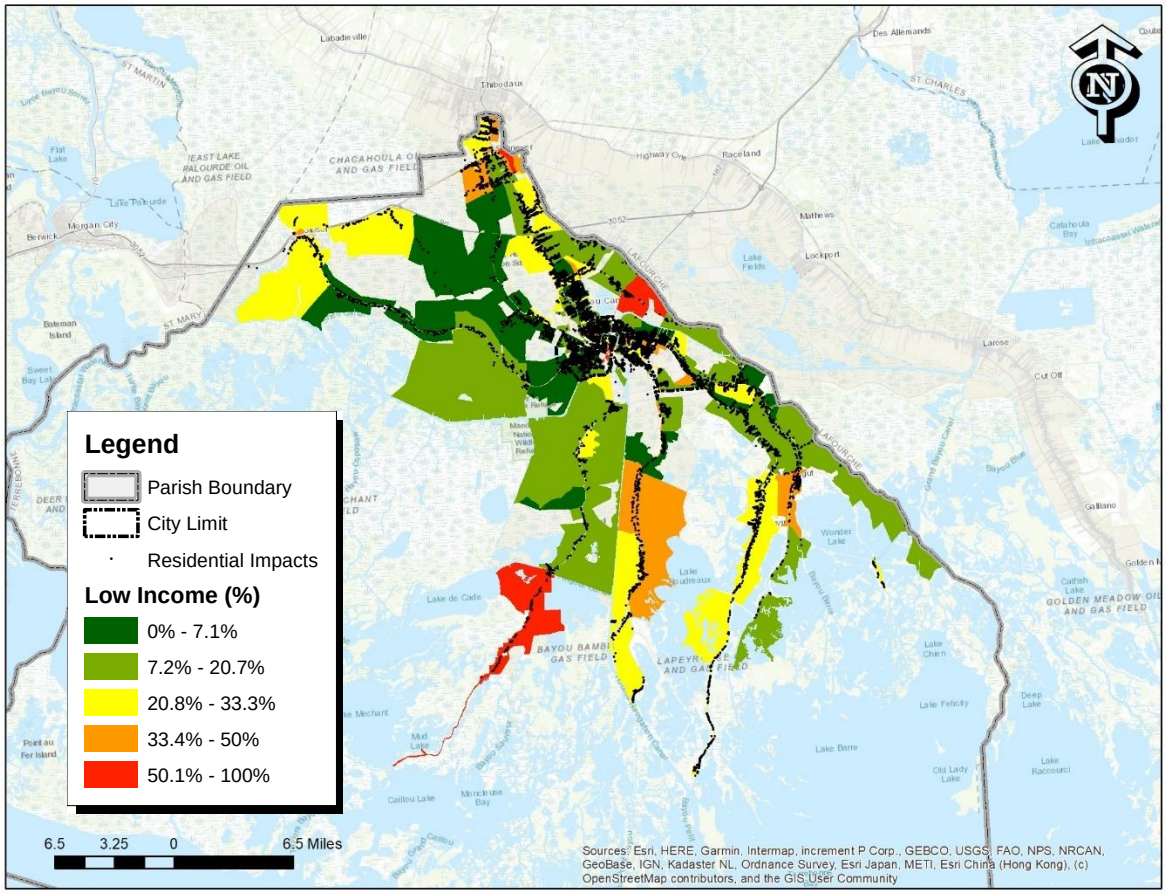


Figure 16: Map of Residential Impacts by Poverty

APPENDIX F: MITIGATION PROJECTS

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Oyster Bed Construction Phase	Coastal Restoration/Preservation	Partially Funded	$6,000,000.00	5-10 years	P&Z	Coastal Erosion	High
Lake Barre' Living Shoreline Protection Project	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion	High
Lake Felicity Ridge Restoration Project	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion	High
H&H Studies on lake shorelines and marsh projects	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Flooding	High
Whiskey Island Restoration	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion	High
Raccoon Island Breakwater Demonstration	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
North Lake Menchant Landbridge Restoration	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
New Cut Dune and Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
Mandalay Bank Protection Demonstration	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
Isles Dernieres Restoration Trinity Island	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Isles Dernieres Restoration East Island	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
GIWW Bank Restoration of Critical Areas in Terrebonne Parish	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
Floating Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Terrebonne Bay Shore Protection Demonstration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Raccoon Island Shoreline Protection/Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	High
Lake Chapeau Sediment Input and Hydrologic Restoration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Falgout Canal Planting Demonstration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
West Lake Boudreaux Shoreline Protection and Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Brady Canal Hydrologic Restoration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Timbalier Island Planting Demonstration Overview	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Timbalier Island Dune and Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Thin Mat Floating Marsh Enhancement	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
South Lake De Cade Freshwater Introduction	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Point Au Fer Canal Plugs--Saltwater Intrusion	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Drainage Study -- Airport Commission	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Penchant Bases Natural Resources Plan--Increment 1	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Whiskey Island Back Barrier Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Coastwide Reference Monitoring Systems	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Falgout Canal Freshwater Enhancement Phase I	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Shoreline Protection on Houma Navigational Canal	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Construct Emergency Operations Center	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Falgout Canal Water Control Structure to +10'	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Wind Retrofit -- City Hall (IT Department)	Wind Retrofit	Completed	Completed	Completed	Completed	Completed	Completed
Wind Retrofit -- Civic Center (Shutters or Window Film)	Wind Retrofit	Completed	Completed	Completed	Completed	Completed	Completed
Wind Retrofit -- Courthouse Annex (Window Film)	Wind Retrofit	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Wind Retrofit -- Government Tower (Window Screens, Doors)	Wind Retrofit	Completed	Completed	Completed	Completed	Completed	Completed
Wind Retrofit -- Harden Front and Back Doors of Convention Center	Wind Retrofit	Completed	Completed	Completed	Completed	Completed	Completed
Wind Retrofit -- Juvenile Detention Center	Wind Retrofit	Planning	TBD	5-10 years	P&Z	Wind	Mid-range
Wind Retrofit -- New Roll-up Door at EOC -- 911	Wind Retrofit	Planning	TBD	5-10 years	P&Z	Wind	Mid-range
Wind Retrofit -- Roof of Convention Center	Wind Retrofit	Planning	TBD	5-10 years	P&Z	Wind	Mid-range
Drainage Improvement -- Coteau 1-1B Bar Screen Cleaner	Flood Risk Reduction	Planning	TBD	1-5 years	CRP	Flooding	High
Drainage Improvement -- D-07 Smithridge Pump Station Bar Screen Cleaner	Flood Risk Reduction	Planning	TBD	1-5 years	CRP	Flooding	High
Drainage Improvement -- D-3 Upper Montegut Bar Screen Cleaner	Flood Risk Reduction	Planning	TBD	1-5 years	CRP	Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Drainage Improvement -- Island Road (Stabilize roadway shoulders and embankment)	Flood Risk Reduction	Planning	TBD	1-5 years	CRP	Flooding	High
Drainage Improvement -- Michael Street, Buquet Street, and Daigle Street (Increase Culvert size to drain streets during heavy rain fall)	Flood Risk Reduction	Planning	TBD	1-5 years	CRP	Flooding	High
Safe Room - OEP (Substitute)	Public Safety	Planning	TBD	5-10 years	CRP	Wind	Mid-range
Communications - Community Alert System (First Call), Reverse 911, Community Hotline, Alert FM, Redundant Phone System at EOC	Communication	Planning	TBD	1-5 years	CRP	Flooding, Wind, Tornado, Levee Failure	High
Levee Safety Educational Promotions	Public Education	Planning	TBD	1-5 years	CRP	Flooding, Levee Failure	High
Develop a Program for Public Information	Public Education	Planning	TBD	1-5 years	CRP	All Hazards	High
Four P25 Motorola Communications Consoles to be located within the Terrebonne 911 Cat. 5 Hurricane resistant facility located at 110 Capital Blvd. to be used for Interoperable Communications between all 15 Terrebonne Fire Districts (13 Fire Departments), Law Enforcement Agencies, OEP, Utilities & Parish Departments	Communication	Planning	TBD	1-5 years	OEP	Flooding, Wind, Tornado, Levee Failure	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
(cost $138,000) replacement due to obsolesence							
Safe Room - Bayou Country Road	Public Safety	Planning	TBD	5-10 years	TLCD	Wind, Tornado	Mid-range
Emergency Preparedness -- Purchase of Drone for Damage Assessment	Public Safety	Planning	TBD	5-10 years	Finance IT	Flooding, Wind, Tornado, Levee Failure	Mid-range
Bayou Decade Ridge Restoration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion	High
Bayou Decade Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion	High
Bayou Penchant Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion	High
HNC-Lake Mechant Marsh Creation	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion	High
Generator -- 100KW for Terrebonne General	Redundant Power	Planning	TBD	1-5 years	P&Z	Flooding, Wind, Tornado, Levee Failure	High
Work with the communities currently residing in at risk areas on the development of evacuation plans including access to shelter and	Public Safety	Planning	TBD	1-5 years	OEP	Wind, Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
transportation assistance as needed. (Tribal)							
Black Start Generator - Utility Department	Redundant Power	Completed	Completed	Completed	Completed	Completed	Completed
Bayou Pointe aux Chenes Ridge Restoration	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Point Au Fer Island Shoreline Protection	Coastal Restoration/Preservation	Planning	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Mid-range
Communications -- Conversion of SCADA system from Phone to Radio (Airbase Jr., Applied Hydraulics, Ashland North 1, Ashland North 2, Ashland South, Bobtown, Bourg Heights, Central Heights, Clinton St. Package Plant, Dulac, Edgewood, Frank, Grmoco, Green Acres 1, Green Acres 2, Indian Ridge, Jail, James, Lafayette Woods, Mary Hughes, Moffet/Saia, Orange/Marjorie, Patriot Point, Presque Isle 1, Presque Isle 2, Riley, Rounds, Sandcastle, Sarah, Smithridge 1, Smithridge 2, Thunderbird, Village East)	Communication	Planning	TBD	1-5 years	CRP	All Hazards	High
Communications -- Hazard Warning System (Gauges Strategically Placed, N-Star)	Communication	Planning	TBD	1-5 years	CRP	Flooding, Wind, Tornado, Levee Failure	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Communications for Water Treatment -- 41 Mobiles	Communication	Planning	TBD	1-5 years	CRP	Flooding, Wind, Tornado, Levee Failure	High
Communications Tower (Theriot, LA)	Communication	Planning	TBD	1-5 years	OEP	Flooding, Wind, Tornado, Levee Failure	High
Emergency Preparedness -- Small Power Radio Station for Hazard Alert	Communication	Planning	TBD	1-5 years	Utilities	Flooding, Wind, Tornado, Levee Failure	Mid-range
911 and First Responder Communications need to be consistently available and interoperable.	Communication	Planning	TBD	1-5 years	CRP	Flooding, Wind, Tornado, Levee Failure	High
Identify mechanisms to protect the Island Road from surge and tidal impacts. This might include engineered solutions to decrease wave impacts and/or erosion control mechanisms along the edges of the road. (Tribal)	Community Preservation	Planning	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Fisherman and Seafood Cultivation Loan Program	Demonstration	Planning	TBD	5-10 years	OEP	Flooding	Mid-range
5 New Company vehicles Forced Drainage Levee Maintenance	Equipment	Partially Funded	200000	1-5 years	Public Works	Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
2 Gradals 4400 xl / Daily maintenance and storm debris cleanup.	Equipment	Partially Funded	850000	1-5 years	Public Works	Flooding	High
1 vacuum truck / culvert cleaning / storm response	Equipment	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
1 50ft boom excavator with tree cutter attachment	Equipment	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Remote Weather Stations at Fire Stations throughout Parish	Equipment	Planning	TBD	1-5 years	OEP	Flooding	High
Vehicles for various departments due to obselesence/age	Equipment	Planning	TBD	1-5 years	ALL	Flooding	High
USAR vehicles for Supply Transport and Evacuation Response	Equipment	Planning	TBD	1-5 years	OEP	Flooding	High
Search and Rescue Equipment	Equipment	Planning	TBD	1-5 years	HFD	Flooding	High
Combining Traditional Elevation and Restoration with Stormwater Retention or Soil Stabilization Projects	Flood Risk Reduction	Application	TBD	5-10 years	P&Z	Flooding	Low
Alma at Westside Drainage improvement project	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Westside/Alma Drainage Project – ASCE	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Coordinate Recreation Activities with Stormwater Retention	Flood Risk Reduction	Duplicates other project	TBD	1-5 years	Public Works	Flooding	Mid-range
Dual Use Park and Regional Stormwater Retention or Detention as Necessary	Flood Risk Reduction	Ongoing	TBD	1-5 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Flood Proof Essential Community Facilities (Power Plants, Substations, Hospitals) (3-8)	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	High
Generator -- Public Works -- Portable Trailer Unit Mounted for 6 Treatment Plants (56KW)	Flood Risk Reduction	Planning	300000	1-5 years	Public Works	Flooding	High
Generator -- Public Works Valhi Lift Station (135KW)	Flood Risk Reduction	Planning	140000	5-10 years	Public Works	Flooding	Mid-range
Generator -- Public Works, Service Center Yard (400 KW 208/480 Volt)	Flood Risk Reduction	Planning	300000	5-10 years	Public Works	Flooding	Mid-range
Implement Capital Improvement Program to Enhance Inner Ring of Tidal Protection/Forced Drainage Levees	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
Flood Proof Terrebonne Parish EOC, Terrebonne Parish General Medical Center, Chabert Medical Center, The TPCG Generating Station and the 2 Consolidated Waterworks Treatment Plants	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Develop Master Drainage Plan	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Pursue elevation/acquisition/reconstruction and flood proofing projects and structural solutions to flooding.	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Investigate and implement localized interior drainage	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
projects at Lower Bayouside Drive, Savanne Road, Ringo Cocke to Hudson Canal, LA 311 at Hollywood Road, Parish Road 15 at Mandalay, and Susie Canal at Ashland South, which are repetitive loss areas, and reduce its flood potential.							
Forced Drainage 1-1B Channel Improvement (Maintenance & Dredging)	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
Drainage Improvement -- Ashland North D-60 Tideflex valves on discharge pipes	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Drainage Improvement -- Bayou Grand Caillou (D-9 South the Landfill Road, Widen and Deepen Channel)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Drainage Improvement -- Bayou Grand Caillou (From Oaklawn School to D-9 Pump Station, Widen and Deepen Channel)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Drainage Improvement -- Bayou Lacache Pump Canal (Widen and Deepen Canal from Lacache Estate to Pump Station)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Relocation -- Deadwood	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	High
Drainage Improvement -- Bayou Lacarpe (Widen Channel from Tunnel Blvd to pump station and upgrade bar screen cleaner	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Drainage Improvement -- Bellaire Drive (Increase Culvert Sizes and Slope Ditches)	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Drainage Improvement -- Crochetville Road Storm Water Diversion canal with flap gates	Flood Risk Reduction	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Drainage Improvement -- Evelyn Lateral Between (Subsurface drainage in lateral ditch from Frank street to Percy street)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Drainage Improvement -- Isle of Cuba Transfer (Off-site fuel storage -- gas and diesel)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Drainage Improvement -- Lower Montegut D-2 Tideflex Valves on discharge pipes	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Drainage Improvement -- Martin Luther King Blvd (Increase Culvert Size in pump canal under highway in bonanza system)	Flood Risk Reduction	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Drainage Improvement -- Oak Forest Street (Increase in Culvert Sizes and Pump Station)	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Drainage Improvement -- Royce Street (Increase culvert size to stop rainfall flooding)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Drainage Improvement -- South Ellendale Estates Lateral (Dig and possible widen lateral from subdivision to Hanson Canal)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Elevation -- Bayou Dularge Tank building and chlorination equipment	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Fire Station (raise 2', history of flooding, 75'x75' Slab) (1466 Hwy 665)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Fire Station in Chauvin	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Generator for Riley Drive Lift Station	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Grand Caillou Tank building	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Industrial Blvd from Van Ave to Pump Station	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
EOC Hardening	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Elevation -- Leachate Removal System	Flood Risk Reduction	Planning	TBD			Flooding	
Generator -- City Hall (with switching capacity)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Coteau Fire Station (Natural Gas, includes change over switch to ensure response to emergency calls)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Gov't Towers	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Houma Fire Department, Central Station (50KW)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Houma Police Department Building (Cummings	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
model GFGA 500 KW 120/208 Volt 3 phase, 60 hertz, 1800RPM NG set)							
Generator -- OEP 911 (60KW)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Pollution Control Portable Unit Trailer Mounted for 10 treatment plants (50 KW)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Generator -- Public Works Service Center Yard (400KW)	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Elevation -- Lift Stations with Self Priming Pumps (Bourg Heights, Edgewood, Ashland North, Ashland North II, Ashland South, Woodlawn Ranch, Saia, Prospect, Carriage Cove, Green Acres I, Green Acres II, Lafayette Woods, Lorraine Park, Presque Isle, Presque Isle II, Chabert Medical Center, Service Center, Smithridge I, Smithridge II, South Terrebonne Estates, Riley Drive)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Lift Stations with Submersible Pumps (Bobtown, Dulac, Orange Street, Airbase Jr., Patriot Point, Rounds Road, Applied Hydraulics, Gemoco, Indian Ridge, James Road, Sandcastle, Thunderbird Road)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation - Lower Dulac Tank Building and Chlorination equipment	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Elevation -- Montegut Station (100'x75')	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Orange Street Wastewater Plant Controls	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Pointe-Aux Chenes Pump Station building and electrical pump, regulating valve and meter	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Robinson Canal P.S. Building, electrictal pump, regulating valve, and meter	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Scale	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- South Terrebonne Pump Station building and pump	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Terrebonne General Medical Center Main Plant Electrical Switch Gear, Boilers, and Chillers ($2,750,000)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- Texaco Master Meter Building, regulating valve and meter	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation -- West Gibson Tank building and chlorination equipment	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation of Local Evacuation Route -- 1 Mile Section of LA 56 in Chauvin, LA (Ward 7 Evacuation Routes)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation of Local Evacuation Route -- 1.5 Mile Section of LA 315 near the Dularge Bridge	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
(Evacuation Route for Bayou Dularge and Crozier, Floods in a strong south wind)							
Elevation of Pump Station Roads -- D-19, D-12, and D-5 Pumps	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Elevation to ABFE -- D-01-06, 11, 15, 21, 36, 37, 41-62, 65, 69 Gear Drives, Motors, and Controls	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Drainage Improvement -- Ann Carroll, Jean Street, Duet Street, and Grace Street (Upgrade Culvert size to drain water from middle of streets)	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Floodproof -- Terrebonne Parish General Medical Center, The TPCG Generating Station, and the 2 Consolidated Waterworks Treatment Plants	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Work with communities currently residing in flood prone areas, particularly outside of the levee systems, on the identification of flood mitigation and climate adaptation measures to reduce flood risk. (Tribal)	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Cypress Grove Culverts and Sluice Gates	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Incorporate Regional Stormwater Management	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
project with State Watershed Initiative							
1-1A Stormwater Retention Basin	Flood Risk Reduction	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Westside Stormwater Detention Project	Flood Risk Reduction	Duplicates other project	Duplicates other project	Duplicates other project	Duplicates other project	Duplicates other project	Duplicates other project
Monarch /Hollywood outfall channel / Drainage improvements /	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Cat 5 Public Works / Drainage office / North Campus	Flood Risk Reduction	Partially Funded - Change to Cat 5 Wind Retrofit to North Campus	TBD	5-10 years	Public Works	Flooding	Mid-range
Revitalize 10 Drainage Pump Stations	Flood Risk Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Shell/Savanne regional Stormwater Retention and Recreation Facility Berm	Flood Risk Reduction	Partially Funded	TBD	1-5 years	Public Works	Flooding	Mid-range
Funding for Elevators for Physically Impaired	Flood Risk Reduction	Planning	yes	1-5 years	P&Z	Flooding	High
Flood Insurance Support	Flood Risk Reduction	Planning	yes	1-5 years	P&Z	Flooding	Mid-range
Bayou Country Sports Park	Flood Risk Reduction	Partially Funded	TBD	1-5 years	P&Z	Flooding	Low
Increase Availablity of Floodsafe Affordable Housing	Flood Risk Reduction	Planning	TBD	1-5 years	HHS	Flooding	High
100 year flood design criteria for new roads	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
100 year flood design criteria for sewer and drainage pump stations	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Explore Freeboard	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	High
(From D-12 to Cement Lined Ditch, Widen and Deepen	Flood Risk Reduction	Planning	TBD	5-10 years	Public Works	Flooding	High
Bayou LaCache Wetland Park	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	Mid-range
Buyouts for Permanent Resident Households	Flood Risk Reduction	Planning	TBD	5-10 years	P&Z	Flooding	High
Living Mitigation - Lake Boudreaux Construction Phase	Floodplain Restoration	Complete	Complete	Complete	Complete	Complete	Complete
Lake Boudreaux Shoreline Stabilization Project - Ongoing	Floodplain Restoration	Partially Funded	TBD	1-5 years	CRP	Flooding	Mid-range
Liberty Street Dredging and Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Beach and Back Barrier Marsh Restoration	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Chacahoula Basin Hydrologic Restoration	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Freshwater Introduction via Blue Hammock Bayou	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Identification of Donor and Placement Sites for Sediment Deposition	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Levee District Boudreaux Marsh Terrace Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Cypress Tree Plantings for Natural Retention and Shoreline Stabilization	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Phase 2 of the Bayou Terrebonne Freshwater Introduction Project	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Increase flow into the Atchafalaya and Sediment through Pipeline	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Caillou Lake-Lake Mechant Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Falgout Canal Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Golden Meadow-Montegut Marsh Creation - Component A	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
North Terrebonne Bay Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Point Au Fer Island Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Atchafalaya River Diversion	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Dulac-Cocodrie Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Lower Atchafalaya Marsh Creation	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
Mauvais Bois Ridge Restoration	Floodplain Restoration	Planning	TBD	5-10 years	CRP	Flooding	Mid-range
New Water Storage Tank -- Terrebonne General Medical Center (1,000,000 Gallons, $750,000)	Health	Planning	TBD	5-10 years	Public Works	All Hazards	Mid-range
Terrebonne GIWW Marsh Creation	Health	Planning	TBD	5-10 years	HHS	All Hazards	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Include mental health and stress reduction in shelter plan	Health	Planning	TBD	5-10 years	HHS	All Hazards	Mid-range
Emergency Preparedness -- Message Boards	Public Education	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Retraining and educational programs for economic stability and local job creation	Public Education	Underway	TBD	1-5 years	P&Z	All Hazards	High
Educate the Public in Disaster Awareness	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Sponsor a "Multi-Hazard Awareness" Week	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Safe Harbor Study and Education Campaign	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Library Storm Preparation and Recovery Flashcards	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Storm Preparedness Literacy Project	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Educational video on evacuation options	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
Emergency Preparedness -- Evacuation Sign Purchase and Placement	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	High
South Louisiana Wetlands Discovery Center – Jonathon Foret	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Flood Disclosures	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Standard Operating Procedure to determine whether it is cost effective or warranted to have a	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
safe room in any new public building to protect the staff.							
Drone assessment before and after storm events.	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Grand Caillou Environmental, Cultural, and Business Center	Public Education	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Feasibility and Practicality of New Shelters (3-8)	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
North-South Hurricane Evacuation Route	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Emergency Preparedness -- Creation of alternative staging area	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Emergency Preparedness -- Military Showers	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Emergency Preparedness -- Nursing Home Evacuation Coordination/Plan	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Permanent signage for evacuation routes	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Portable billboards to update emergency instructions or evacuation routes/changes	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Safe Harbor pilings	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Fire Station on the Airport Property	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Install two communications towers for Public Safety	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Increase volunteer training for call centers	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Broadcast messages on the radio/TV in more languages.	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Houma Seafood Market and Harbor of Refuge	Public Safety	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Bayou Black Pump Station - Geraldine Street	Pump Station/Accessory	Funded	13,000,000	1-5 years	Public Works	Flooding, Levee Failure	High
Hanson Canal- Chacahoula Pump Station	Pump Station/Accessory	Completed	Completed	Completed	Completed	Completed	Completed
Hanson Canal Generators -	Pump Station/Accessory	Completed	Completed	Completed	Completed	Completed	Completed
Modification to Village East Lift Station (Conversion from Dry Pit to Submersible Station)	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Drainage Improvement -- Benoit Crossing (Remove Portable Pump and place permanent pump)	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Drainage Improvement -- D-13 Industrial Blvd. Motorized screw gates	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Drainage Improvement -- D-20 Schriever Pump Station Bar Screen Cleaner	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Drainage Improvement -- Industrial Pump D-13 Trash Screen and Bar Screen Cleaner	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Drainage Improvement -- Old Spanish Trail 6-1B (Put Screw Gates on Culvert Crossings)	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Emergency Preparedness -- Gauge installation at pump stations near major roadways and bridges/floodgates	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Replacement of wooden lift station fence/gates with chain link to mitigate wind damage	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
HNC Pump Station/Bayou Grand Caillou	Pump Station/Accessory	Application	96,000,000	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Elliot Jones Pump Station	Pump Station/Accessory	Funded	13,000,000	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
1-1A Drainage Pump Station @ Fannie Street	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
20 5:1 M22 Gear Drives for Woodlawn Pump Station and Coteau Pump Stations.	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Bar screen cleaners for Woodlawn Station and also 1-1b Hwy 182 Pump Station	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Terrebonne Basin Watershed – HNC at Bayou Grand Caillou, Phase 1 & 2 – GIS	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
1-1A Watershed – Water Control Structure – GIS	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Bayou LaCarpe Pump Station – Location “C” – ASCE	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Replacement of the D-18 Pump Station, Falgout Canal - DC	Pump Station/Accessory	Planning	TBD	5-10 years	Public Works	Flooding, Levee Failure	Mid-range
Pump Station Generator - Public Works drainage	Redundant Power	Funded	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Generators--Montegut Middle School	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Connect Station to emergency generator -- Munson PS	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Firehouse Generator Project	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Generator for North Fire Station	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Generator fro Houma Regional Airport	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Evacuation Shelter Generators	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Generator -- 150KW for Valhi Lift Station	Redundant Power	Planning	TBD	5-10 years	Public Works	Wind, Flooding, Levee Failure	Mid-range
Central Terrebonne Freshwater Enhancement	Saltwater Intrusion	Planning	TBD	5-10 years	Public Works	Saltwater Intrusion	Mid-range
Wonder Lake Environmental Control Structures	Saltwater Intrusion	Planning	TBD	5-10 years	Public Works	Saltwater Intrusion	Mid-range
Freshwater Introduction into the Lake Boudreaux Basin	Saltwater Intrusion	Planning	TBD	5-10 years	Public Works	Saltwater Intrusion	Mid-range
Morganza to Gulf – DC	Structural Flood Reduction	Partially Funded	TBD	5-10 years	Public Works	Flooding	Mid-range
Gibson to Houma Hurricane Protection	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Secure Congressional Authorization and Construct the Morganza to the Gulf Hurricane Protection System and Enhance and Protect Critical Waterways in the Parish.	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Susie Canal Improvements in Grand Caillou -- 5.3 Miles to +8'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Industrial Blvd Gap -- 2.1 Miles to +8'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Bayou Grand Caillou Water Control Structure to +10'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Susie Canal Improvements in Grand Caillou to +10'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Brady Road Levee in Dularge -- 1 mile to +10'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Ashland/Woodlawn -- 2.9 Miles to +8'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
East Theriot to +10'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Lower Point Au Chene -- .85 Miles to +10'	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Elevation to ABFE -- D-02 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-03 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-04 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-06 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-11 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-15 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-21 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-36 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-37 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-40 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-42 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-43 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Elevation to ABFE -- D-44 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-46 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-47 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-48 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-49 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-50 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-51 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-53 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-54 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-56 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-59 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-60 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-61 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-62 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Elevation to ABFE -- D-65 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Elevation to ABFE -- D-69 Gear Drives, Motors, and Controls	Structural Flood Reduction	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Extension Orange Street Projects in Grand Caillou -- 2.0 Miles to +10'	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
West Ward 7 -- 15.9 Miles to +10'	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Brady Road Levee in Dularge -- .25 miles to Falgout Canal to +8'	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Intracoastal Canal Near Palm Street -- 2.3 Miles to +6.5'	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Bayou Point Au Chene Sluice Gate to +10'	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Flood Protection -- Sea wall at Public Works Yard Grand Caillou Road	Structural Flood Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Flood Wall and Pump Installation for Terrebonne General	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Drainage Improvement -- Old Spanish Trail 6-1B (Place area under Force Drainage to Stop Backwater Flooding)	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Drainage Improvement -- Savanne Road to Summerfield (Create a force drainage area to stop backwater and storm events flooding)	Structural Flood Reduction	Completed	Completed	Completed	Completed	Completed	Completed
Drainage Improvement -- (Chabert Medical Center Levee/Houma Industrial Park)	Structural Flood Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Build Levee from Thompson Road to Industrial Pump Station							
Rebuild and relocate the 1-1a Bonanza Levee	Structural Flood Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Rebuild and relocate the Donner Chacahoula Levee	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Redundant Protection for PAC	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Lower Bayou Side Drive Levee	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Lower Shrimpers Row flood control improvements	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Brady Road (Lower Dularge) flood control	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Fortify Levees Wear 90 deg turns to avoid runup and erosion.	Structural Flood Reduction	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Construct Transportation Improvements Designed to Increase the Economic Viability of Terrebonne Parish	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Survey major thoroughfares for shoreline hardening - avoid undermining of transportation routes	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Elevation of Savanne Road-Rouses Going West to curve	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
LA Hwy 55 Road Ramp/ Floodgate	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
New Tower for the Airport and other upgrades	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Brady Road Bridge – DC	Transportation	Funded	TBD	5-10 years	Public Works	Flooding	Mid-range
Valhi Extension (Savanne to Rouses Road) – GIS	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	High
Evacuation Route Beefit Cost Assessment tool	Transportation	Planning	TBD	5-10 years	Public Works	Flooding	Mid-range
Wind Retrofit -- Bac-T Lab (install shutters or impact resistant glass on windows, strengthen doors)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Bob Jones Building (Cat 4 or 5) vegetation	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Bourg Fire Station, 2 Bay Doors (22'x10', 14'x10') and 3 Windows (36"x36")	Wind Retrofit	Planning	Yes		HFD	Wind	Mid-range
Wind Retrofit -- Buquet Bridge and Klondyke Bridge Tender's Buildings (Cat 3)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	High
Wind Retrofit -- Coteau Fire Station (include main structure, apparatus room, generator room doors)	Wind Retrofit	Planning	Yes	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Evergreen Junior High	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Fire Stations (central, #2, #3, #4) Shutters	Wind Retrofit	Planning	Yes	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Garage Doors (407 Island)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Gulf States LTAC	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Wind Retrofit -- Headstart Center	Wind Retrofit	Planning	Yes	5-10 years	HHS	Wind	Mid-range
Wind Retrofit -- Houma Junior High	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Houma Municipal Auditorium	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Legion Park Middle	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Main Library	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Montagut, Pointe Aux Chenes Fire Stations (5 Windows at 1466 Hwy 665, 6 Windows at 407 Island Rd, 6 Windows at 1746 Hwy 55)	Wind Retrofit	Planning	Yes	5-10 years	P&Z	Wind	Mid-range
Wind Retrofit -- Morgue	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- North Terrebonne Standpipe (strengthen door)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Schriever Elementary	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Sludge Press Building (strengthen doors)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- South Terrebonne High School	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Terrebonne High School	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit and Elevation -- Houma Plant 3 (Install shutters or impact resistant glass on	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
windows, strengthen doors, raise pumps and electrical panels)							
Wind Retrofit and Elevation -- Houma Plant High Service pumps and electrical panels, strengthen door	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit and Elevation -- Lafort Canal RW PS (elevate pumps and generator, strengthen door)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit and Elevation -- Munson PS (Elevate Building, electrical pumps, regulating valves and meters, Install Shutters on windows, strengthen the doors)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit and Elevation -- Shell PS (elevate pumps and electrical panels, strengthen door)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit and Elevation -- Williams Street Pump Station (elevate pumps and electrical panels, strengthen door)	Wind Retrofit	Planning	Yes	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Waterworks Office Complex at 8814 Main Street, Houma, LA	Wind Retrofit	Planning	TBD	5-10 years	Public Works	Wind	Mid-range
Wind Retrofit -- Montegut Fire Department (1105 Hwy 55) Garage Doors	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Wind Retrofit -- Bourg Fire Department (4317 Hwy 24) Windows with Shutters	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Coteau Fire Department (2325 Coteau Rd) Window with Shutters	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Little Caillou Fire Department (4588 Hwy 56) Windows with Shutters	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Little Caillou Fire Department (5610 Hwy 56) Windows with Shutters	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Wind Retrofit -- Little Caillou Fire Department (6668 Hwy 56) Windows with Shutters	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Pollution Control Operator's Room Hardening	Wind Retrofit	Planning	TBD	5-10 years	Public Works	Wind	High
Fire House Hardening - Windows and Doors	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
All HPD and 911 facilities need to be hardened.	Wind Retrofit	Planning	TBD	5-10 years	HFD	Wind	Mid-range
Safe Room for the Levee District	Wind Retrofit	Planning	363000	5-10 years	TLCD	Wind	Mid-range
Evacuation Shelter Hardening	Wind Retrofit	Planning	TBD	5-10 years	OEP	Wind	Mid-range
Wind Retrofit -- West Park Elementary	Wind Retrofit	Planning	Yes	5-10 years	TEDA	Wind	Mid-range
North Lost Lake Marsh Creation/Enhancement	Coastal Restoration/Preservation	Construction	TBD	5-10 years	Public Works		High
Wind Retrofit -- Southdown Elementary	Wind Retrofit	Construction	Yes	5-10 years	Public Works	Wind	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Safe House -- Houma Fire Department 2101 East Tunnel Blvd.	Public Safety	Completed	Completed	Completed	Completed	Completed	Completed
Coastwide Nutria Control Program	Coastal Restoration/Preservation	Continous	TBD	5-10 years	Public Works	Coastal Erosion	Mid-range
Reduce the Potential for Future Flood Losses through the Terrebonne Parish Flood Hazard Mitigation Program	Flood Risk Reduction	Continous	TBD	1-5 years	P&Z	Flooding	High
Review the existing floodplain ordinance to improve the Parish's "Community Rating System (CRS) rating to reduce the flood insurance premium.	Flood Risk Reduction	Continous	TBD	1-5 years	P&Z	Flooding	High
RL and Severe RL Properties -- Elevation, Acquisition, Mitigation Reconstruction (Parish)	Flood Risk Reduction	Continous	Yes	1-5 years	P&Z	Flooding	High
Increase Affordable Housing throughout the Parish	Community Preservation	Continuous	TBD	1-5 years	HHS	Flooding	Mid-range
Promote Purchase of Flood Insurance	Flood Risk Reduction	Continuous	TBD	1-5 years	P&Z	Flooding	Mid-range
Increase Public Awareness of Hazards and Hazard Areas	Public Education	Continuous	TBD	1-5 years	P&Z	All Hazards	Mid-range
Elevation and Reconstruction--Residential	Flood Risk Reduction	Continuous	TBD	1-5 years	P&Z	Flooding	Mid-range
Drainage Improvement -- Bonanza Pump Station D-27 Tideflex valves on discharge pipes	Equipment	Complete	Complete	Complete	Complete	Complete	Complete

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Cane Break to Ashland Levee -- 3.4 Miles to +8'	Structural Flood Reduction	Engineering Funded	TBD	1-5 years	Public Works	Flooding	High
Upper Dularge East Levee to +10'	Structural Flood Reduction	Engineering Funded	TBD	1-5 years	Public Works	Flooding	
Bayou Dularge Ridge Restoration	Coastal Restoration/Preservation	Engineering Funded	TBD	1-5 years	CRP	Coastal Erosion, Flooding	High
Bayou Terrebonne Ridge Restoration	Coastal Restoration/Preservation	Engineering Funded	TBD	1-5 years	CRP	Coastal Erosion, Flooding	High
Increase Atchafalaya Flow to Eastern Terrebonne	Coastal Restoration/Preservation	Engineering Funded	TBD	1-5 years	CRP	Coastal Erosion, Flooding	Mid-range
Atchafalaya Long Distance Sediment Pipeline	Coastal Restoration/Preservation	Feasibility Study Completed	TBD	1-5 years	CRP	Coastal Erosion, Flooding	Mid-range
Upper Dularge East Levee -- 5.2 Miles to +8'	Structural Flood Reduction	Engineering Complete	TBD	1-5 years	Public Works	Flooding	Mid-range
Ashland North -- 1.5 Miles to +8'	Structural Flood Reduction	Complete	Complete	Complete	Complete	Complete	Complete
Relocation -- Jean Charles	Community Preservation	Complete	Complete	Complete	Complete	Complete	Complete
Small Bayou LaPointe Ridge Restoration	Coastal Restoration/Preservation	Funded	TBD	10-15 years	CRP	Coastal Erosion, Flooding	Low
Terrebonne Bay Marsh Creation - Nourishment	Coastal Restoration/Preservation	Funding Requested	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Ridge Habitat Restoration in Terrebonne Parish	Coastal Restoration/Preservation	Funding Requested	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Barrier Shoreline Restoration in Terrebonne Parish	Coastal Restoration/Preservation	Funding Requested	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Generator -- 100KW for W. Woodlawn Station	Redundant Power	Funding Requested	75000	5-10 years	Public Works	All Hazards	Mid-range
Generator -- 200KW for South Wastewater Treatment Plant	Redundant Power	Funding Requested	150000	5-10 years	Public Works	All Hazards	Mid-range
Generator -- Lift Stations Receiving Effluent from Hospitals, Chabert Medical Center (50 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Lift Stations Receiving Effluent from Hospitals, Terrebonne General Medical Center (50 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Major Lift Stations, Douglas (50 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Major Lift Stations, Highland Drive (150 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Major Lift Stations, Mire (75 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Major Lift Stations, Westside (50 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Major Lift Stations, Westview (100 KW)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- Montegut, Pointe Aux Chenes Fire Stations (need 40-50 KW -- $15,000)	Redundant Power	Complete	Complete	Complete	Complete	Complete	Complete
Generator -- North Terrebonne Treatment Plant	Redundant Power	Funding Requested	500000	5-10 years	Public Works	All Hazards	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Generator -- Pollution Control, S. Treatment Plant Effluent Lift Station (250 KW)	Redundant Power	Funding Requested	250000	5-10 years	Public Works	All Hazards	Mid-range
Generator -- Pollution Control, S. Treatment Plant Perimeter Drainage Pump Station (100 KW)	Redundant Power	Funding Requested	75000	5-10 years	Public Works	All Hazards	Mid-range
Generator -- Public Works -- Forced Drainage Pump Station D-03, D-07, D-12, 20KW	Redundant Power	Funding Requested	250000	5-10 years	Public Works	All Hazards	Mid-range
150KW generators for Mire, Idlewild, and Elysian Lift Stations	Redundant Power	Funding Requested	175000	5-10 years	Public Works	All Hazards	Mid-range
100 Amp, 3-way SS Disconnects for generator ready connections (approx. 40 Lift station sites)	Redundant Power	Funding Requested	TBD	1-5 years	Public Works	All Hazards	High
Generator -- 100KW for Chabert Medical Center	Redundant Power	Funding Requested	75000	1-5 years	Public Works	All Hazards	High
Ship Shoal: Whiskey West Flank Restoration	Coastal Restoration/Preservation	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Lower Bayou LaCache Hydrologic Restoration	Coastal Restoration/Preservation	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Safe Room -- Gov't Towers Parking Structure (Pet Shelter)	Equipment	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Vehicle lift for HPD EOC	Equipment	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Generator Study/Environmental Review/Provision of Generators	Redundant Power	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete
Generator Study/Environmental Review/Provision of Quick Connects	Redundant Power	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete	Obsolete

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Houma Navigational Canal Lock	Flood Risk Reduction	Partial	TBD	5-10 years	Public Works	Flooding	High
Mississippi River Long Distance Sediment Pipeline	Coastal Restoration/Preservation	Partial	TBD	5-10 years	Public Works	Coastal Erosion, Flooding	Mid-range
Bayou Chene Floodgate	Flood Risk Reduction	Complete	Complete	Complete	Complete	Complete	Complete
20 Pump Stations/Scada/Telemetry, the automation of forced drainage Pump Stations to reduce response time and flooding. Monitored and controlled remotely during storm events	Flood Risk Reduction	Partially funded by TPCG	1700000	1-5 years	Public Works	Flooding	High
Generator -- Public Works, Buquet Bridge (75 KW 120/240 Volt)	Redundant Power	Pending	TBD	1-5 years	Public Works	All Hazards	High
Generator -- Public Works, Klondyke Bridge (75 KW 120/240 Volt)	Redundant Power	Pending	TBD	1-5 years	Public Works	All Hazards	High
Marsh Restoration Using Dredged Material in Terrebonne Basin	Coastal Restoration/Preservation	Planning Funded	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Timbalier Islands Barrier Island Restoration	Coastal Restoration/Preservation	Planning Funded	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Isle Dernieres Barrier Island Restoration	Coastal Restoration/Preservation	Planning Funded	TBD	5-10 years	CRP	Coastal Erosion, Flooding	Mid-range
Automatic Bar Screen Cleaners (Pump Stations -- D-58, D-03, D-69, D-22, D-28, D-07, D-21)	Pump Station/Accessory	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Generator -- Public Works -- Portable Generator for Bridges (80 KW)	Redundant Power	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Generators -- Lift Stations Receiving Effluent from Hospitals, Valhi II (125 KW)	Redundant Power	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Safe room -- Coteau Fire Station	Public Safety	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Multipurpose Operation of the Houma Navigational Canal	Planning Policy	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Plan, Implement, and Construct Parish wide Sewerage	Health	Redundant	Redundant	Redundant	Redundant	Redundant	Redundant
Barrier Plan (Big Bayou Black/Gibson) 1/3 of project -- 8.4 Miles to +6.5'	Structural Flood Reduction	TCLD	TBD	1-5 years	Public Works	Flooding	High
Barrier Plan (Big Bayou Black/Gibson) 1/3 of project -- 8.4 Miles to +6.5'	Structural Flood Reduction	TCLD	TBD	1-5 years	Public Works	Flooding	High
Barrier Plan (Big Bayou Black/Gibson) 1/3 of project -- 8.4 Miles to +6.5'	Structural Flood Reduction	TCLD	TBD	1-5 years	Public Works	Flooding	High
Nutria Harvest for Wetland Restoration Demonstration	Demonstration	Underway	TBD	5-10 years	CRP	Flooding	Mid-range
North Lake Boudreaux Basin Freshwater Introduction and Hydrologic Management	Coastal Restoration/Preservation	Underway	TBD	5-10 years	CRP	Flooding	Mid-range
Morganza to the Gulf	Structural Flood Reduction	Underway	TBD	5-10 years	Public Works	Flooding	High
Cane Break to Ashland Levee to +10'	Structural Flood Reduction	Underway	TBD	5-10 years	Public Works	Flooding	High
Blackstart Capacity -- Houma Power Plant	Redundant Power	Completed	Completed	Completed	Completed	Completed	Completed

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Wind Retrofit -- Houma PD	Wind Retrofit	Completed	Completed	Completed	Completed	Completed	Completed
Education regarding flood safety and property valuation	Public Education	Underway			P&Z	Flooding	
Communications Tower North Campus/Telemetry/Forced Drainage	Communication	Underway	1200000	5-10 years	Public Works	Flooding	Mid-range
Madison Bay Marsh Creation & Terracing	Coastal Restoration/Preservation	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient
Generator -- Port Commission Forced Drainage (50 KW)	Redundant Power	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient
Wind Retrofit and Elevation -- Schriever Plant (install shutters or impact resistant glass on windows, strengthen doors, elevate pumps)	Wind Retrofit	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient
Wind Retrofit -- Houma Water Treatment Facility	Wind Retrofit	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient
Wind Retrofit -- Schriever Water Treatment Facility	Wind Retrofit	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient	Withdrawn by Recipient
Closure of Breaches of GIWW	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	High
Houma and Vicinity Hurricane Protection	Planning Policy	Planning	TBD	1-5 years	P&Z	Wind, Flooding	Mid-range
Update Parish Emergency Operations Plan	Planning Policy	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Review of Louisiana Coastal Zone Management Program	Planning Policy	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Expand and Improve Parish wide Sewerage Facilities	Health	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Develop a Detailed Business Recruitment and Retention Plan	Planning Policy	Planning	TBD	1-5 years	TEDA	All Hazards	Mid-range
Adopt additional residential and commercial building regulations, which include stricter building standards, Land Use Regulations throughout the Parish consistent with to those that exist within the Urban Services District of Houma and incorporate dry flood proofing techniques. When the International Building Codes become mandatory, they will supersede the existing codes.	Planning Policy	Planning	TBD	1-5 years	P&Z	Flooding, Wind	Mid-range
Infiltration Reduction of Underground Wastewater System (Testing needed for Locations)	Health	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Communications (Fire, Law Enforcement, Parish, Other) Equipment purchased 2003-2013 now obsolete. Need to purchase next model.	Communication	Planning	TBD	1-5 years	OEP	All Hazards	High
Dry Floodproof RL Structure Next to Robinson Canal (Meeting #3)	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT
Dry Floodproofing -- Infiltration Reduction of Underground Wastewater Collection System	Flood Risk Reduction	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT	TAKE OUT

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Identify vulnerable historic and cultural resources, as well as opportunities to protect and/or relocate historic assets (Tribal)	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Protect historic and cultural resources, such as cemeteries and gathering places from all hazards (Tribal)	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Collaborate with communities to design, evaluate, and implement Relocation Strategies for communities located outside of the levee systems (Tribal)	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Ensure that current and future building elevations take the needs of those individuals with access and functional needs into account. This includes the incorporations of lifts. (Tribal)	Public Safety	Planning	TBD	1-5 years	P&Z	Flooding	High
Structure Inventory	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
Storm Recovery Phase Code Enforcement Capacity	Structural Flood Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Review capacity to increase nonresidential structure mitigations	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Local Support for Mitigation Activities - Match	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Develop H&H Study List for Advance Assistance	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Identify Opportunities/seek funding for engineering, H&H Studies for living shorelines	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Identify Opportunities/seek funding for engineering, H&H Studies for feasible marsh creation or restoration options.	Planning Policy	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Seek opportunities to work with university system/ academics to study the efficacy of new technologies	Planning Policy	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Study permit application support initiatives and regulatory advocacy to promote private investment safer, more energy efficient structures	Planning Policy	Planning	TBD	1-5 years	P&Z	All Hazards	Mid-range
Research avenues to identify any and all funding sources to support private investment in flood or wind mitigation efforts including new construction.	Planning Policy	Planning	TBD	1-5 years	P&Z	Wind, Flooding	Mid-range
Investigate projects to improve drainage improvements down Grand Caillou/Dulac and identify and fund specific projects	Planning Policy	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
Research the benefit of bulk-heading of lands on Shrimpers Row that meet with the Navigational Canal to protect shorelines and property and identify and fund specific projects	Planning Policy	Planning	TBD	1-5 years	P&Z	Coastal Erosion, Flooding	Mid-range

Project	Project Type	Status	Estimated Funding Needed	Desired Timeline to Complete	Responsible Department/ Division for Implementation	Hazard Reduced	Priority
Research the effect of erosion and degraded marsh conditions on pipelines to support coastal restoration or protection efforts.	Flood Risk Reduction	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Le Petit de Terrebonne – DDG	Flood Risk Reduction	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
J-45 needs to be prioritized as the equipment needs updating regularly.	Equipment	Planning	TBD	1-5 years	Public Works	All Hazards	Mid-range
Increase number of Housing Choice Vouchers Available	Community Preservation	Planning	TBD	1-5 years	HHS	All Hazards	Mid-range
Need models for assessing the level of protection that can be expected by a project	Planning Policy	Planning	TBD	1-5 years	P&Z	Flooding	Mid-range
Homeless Services	Health	Planning	TBD	1-5 years	HHS	All Hazards	Mid-range
HNC/Bayou Grand Caillou By-pass canal	Transportation	Planning	TBD	1-5 years	Public Works	Flooding	Mid-range
Equipment necessary to maintain levees and drainage infrastructure	Equipment	Planning	TBD	1-5 years	Public Works	Flooding, Levee Failure	Mid-range