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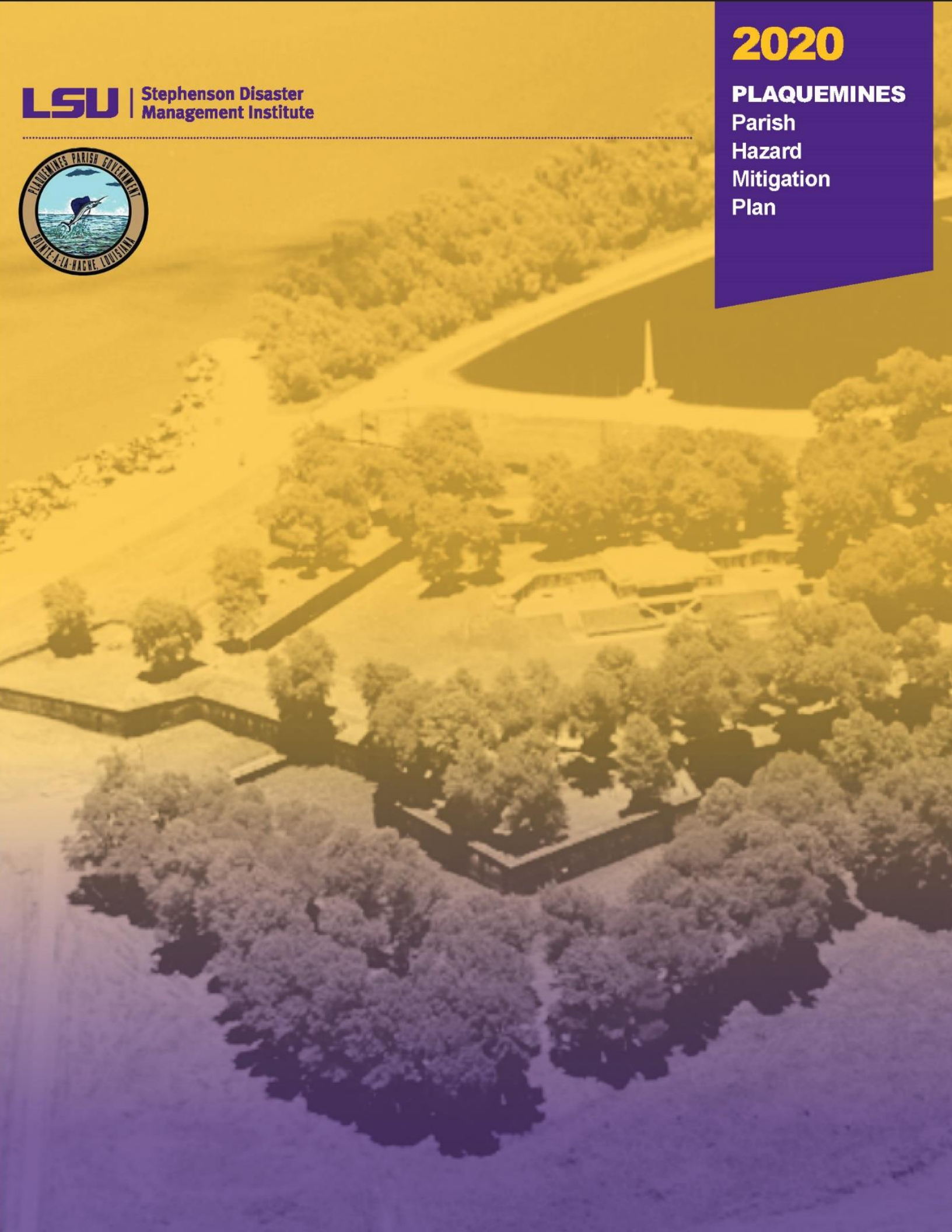
2020

PLAQUEMINES Parish Hazard Mitigation Plan



PLAQUEMINES PARISH
HAZARD MITIGATION PLAN UPDATE

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Plaquemines Parish

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1. Introduction

Hazard Mitigation is defined as sustained actions taken to reduce or eliminate long-term risk from hazards and their effects. Hazard Mitigation Planning is the process through which natural hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies that would lessen the impacts are determined, prioritized, and implemented.

In that regard, this plan (a) documents the Plaquemines Parish Hazard Mitigation Plan Update (HMPU) process; (b) identifies natural hazards and risks within the parish; and (c) identifies the parish's hazard mitigation strategy to make Plaquemines Parish less vulnerable and more disaster resistant. It also includes mitigation project scoping to further identify scopes of work, funding sources, and implementation timing requirements of proposed selected mitigation projects. Information in the plan will be used to help guide and coordinate mitigation and local policy decisions affecting future land use.

The Plaquemines Parish Hazard Mitigation Plan is a single jurisdictional plan that covers the unincorporated communities of Belle Chasse, Boothville, Buras, Empire, Pointe a la Hache, Port Sulphur, Triumph, and Venice, among others. Multi-Jurisdictional requirements are not required nor addressed in this plan update.

The Federal Emergency Management Agency (FEMA), now under the Department of Homeland Security, has made reducing losses from natural disasters one of its primary goals. The Hazard Mitigation Plan (HMP) and subsequent implementation of recommended projects, measures, and policies is the primary means to achieving these goals. Mitigation planning and project implementation has become even more significant in a post-Katrina and Rita environment in south Louisiana.

This Hazard Mitigation Plan is a comprehensive plan for disaster resiliency in Plaquemines Parish. The parish is subject to natural hazards that threaten life and health and have caused extensive property damage. To better understand these hazards and their impacts on people and property, and to identify ways to reduce those impacts, the parish's Office of Homeland Security and Emergency Preparedness undertook this Natural Hazards Mitigation Plan. "Hazard mitigation" does not mean that all hazards are stopped or prevented. It does not suggest complete elimination of the damage or disruption caused by such incidents. Natural forces are powerful and most natural hazards are well beyond our ability to control. Mitigation does not mean quick fixes. It is a long term approach to reduce hazard vulnerability. As defined by FEMA, "hazard mitigation" means any sustained action taken to reduce or eliminate the long-term risk to life and property from a hazard event.

Every community faces different hazards and every community has different resources and interests to bring to bear on its problems. Because there are many ways to deal with natural hazards and many agencies that can help, there is no one solution for managing or mitigating their effects. Planning is one of the best ways to correct these shortcomings and produce a program of activities that will best mitigate the impact of local hazards and meet other local needs. A well-prepared plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and programs, preventing conflicts and reducing the costs of implementing each individual activity.

Under the Disaster Mitigation Act of 2000 (42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from FEMA. FEMA also recognizes plans through its Community Rating

System (CRS), a program that reduces flood insurance premiums in participating communities. This program is further described in Section Three: Capability Assessment.

This plan identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural hazards. It fulfills the Federal mitigation planning requirements, qualifies for CRS credit, and provides Plaquemines Parish and its communities with a blueprint for reducing the impacts of these natural hazards on people and property.

Geography, Population and Transportation

Geography

Plaquemines Parish is located in the southeast portion of Louisiana along the state's Gulf of Mexico coastline. Essentially bisected from the northwest to the southeast by the Mississippi River, Plaquemines Parish is bordered to the northeast by St. Bernard Parish, to the north by Orleans Parish, and to the west by Jefferson Parish. Plaquemines Parish includes a surface area of approximately 2567 square miles (or 1,642,977 acres), of which 68% (1,110,107 acres) is water and a mere 1% (19,527 acres) is urban development. Below, *Figure 1-1* shows the geographical location of Plaquemines Parish.

Figure 1-1: Location of Plaquemines Parish

The geography of Plaquemines Parish mainly consists of relatively flat floodplains and bodies of water. The largest concentration of urban development is found in the northeastern part of the parish. Coincidentally, this is also the area with the highest natural elevation in the parish. Plaquemines Parish is bisected by the Mississippi River, resulting in two separate portions that are only commutable by ferry. The bulk of the land within the parish can be found on the west bank of the Mississippi River, although this is a bit misleading as

the majority of the parish acreage consists of wetlands and open water. Most of the actual land found in Plaquemines Parish is located along the levees of the Mississippi River, particularly along the west bank.

Approximately 90% of the total land area of Plaquemines Parish is located within FEMA's 100-year floodplain. The only significant area outside the 100-year floodplain is the land in the northern portion of the parish in the Belle Chasse community along Hwy 23, which is in the 500-year floodplain.

Plaquemines Parish weather is typically warm and humid. Variations in daily temperature are determined by distance from the Gulf of Mexico and, to a much lesser degree, by differences in elevation. The average annual temperature for the state as a whole is 68ºF. January is typically the coldest month for Louisiana, averaging approximately 54ºF, while July is typically the warmest at an average of 83ºF. Winter months are usually mild with cold spells of short duration. For Plaquemines Parish in particular, the summer months are usually quite warm, with an average daily maximum temperature in July and August of 93°F. Winters are typically mild. Snowfall averages less than two inches per year. Average annual rainfall for the area is 59.8 inches. Plaquemines Parish is susceptible to the normal weather dangers, such as tornados and floods, but due to its location within the state and its proximity to the Gulf of Mexico, the parish is extremely susceptible to tropical cyclones. Hurricane season lasts from June 1st to November 30th, with most hurricanes forming in August, September, and October.

Population

The population of Plaquemines Parish is estimated at 23,410 (2018 estimate) with a population percent change from April 1, 2010 – July 1, 2018 of 1.6%.

Table 1-1: Plaquemines Parish Population
(Source: US Census)

	2010 Census	2018 Estimate	Percent Change 2010 -2018
Total Population	23,042	23,410	1.60%
Population Density (Pop/Sq. Mi.)	29.5	-------	-------
Total Households	-------	10,396	-------
Persons Per Household	-------	2.61	-------

Table 1-2: Plaquemines Parish Business Patterns
(Source: US Census, CBP)

Business Description	Number of Establishments	Number of Employees	Annual Payroll ($1,000)
Retail Trade	62	514	12,270
Manufacturing	35	1,286	109,363
Health Care and Social Assistance	22	425	17,847
Mining, Quarrying, Oil and Gas Extraction	27	728	57,179
Transportation and Warehousing	91	1,553	95,088
Construction	59	638	34,943
Administration/Support and Waste Management/Remediation Services	40	292	12,694
Real Estate and Rental and Leasing	28	286	16,431
Wholesale Trade	64	994	60,958
Other Services (except Public Administration)	53	450	22,062
Accommodation and Food Services	55	660	15,886
Financial and Insurance	23	113	6,637
Professional, Scientific, and Technical Services	54	539	39,371
Information	3	9	341
Educational Services	6	100-249	___
Arts, Entertainment, and Recreation	18	191	3,356
Agriculture, Forestry, Fishing and Hunting	12	33	1,001
Utilities	8	20-99	___

Transportation

The main transportation arteries through Plaquemines Parish are Louisiana State Highways 23 and 39, both of which run along either side of the Mississippi River. Louisiana Highway 23 enters the parish from the northwest and continues along the west bank of the Mississippi River, connecting all west bank communities from Belle Chasse to Venice, the last community down the Mississippi accessible by automobile. Sections of the original LA-23, such as the area south of Port Sulphur through Empire, Buras, and Fort Jackson, are signed as Parish Road 11. On the east bank of the Mississippi River, Highway 39 enters Plaquemines Parish from St. Bernard Parish to the northeast and continues south to the community of Bohemia, which is the last community accessible by automobile on the east bank. Both of these state highways are significant evacuation routes for Plaquemines Parish, especially for those leaving the southern portions of the parish as there are no other roadways that exit the parish.

Although there are no roads that connect the west bank of Plaquemines Parish to the east bank, there are two ferries that traverse the Mississippi River within the parish. The more heavily used of the two ferries, the Belle Chasse – Scarsdale Ferry, connects Belle Chasse on the east bank and Scarsdale on the west bank. Further down river, the Pointe a la Hache Ferry connects West Pointe a la Hache and Pointe a la Hache. It's the last vehicle crossing of the river in the downriver direction.

The New Orleans International Airport services Plaquemines Parish, and is located approximately 20 miles away from the parish. Every major domestic airline and several international carriers serve the New Orleans International Airport, providing one-and-two-stop service to nearly all major domestic and international destinations. In addition, the New Orleans Lakefront Airport is a general aviation facility also approximately 20 miles from Plaquemines Parish. It is a full service airport with three runways that can support any type of flight craft. Lastly, there are several small air strips and heliports in Plaquemines Parish that service industry and private planes.

Hazard Mitigation

To fully understand hazard mitigation efforts in Plaquemines Parish and throughout Louisiana, it is first crucial to understand how hazard mitigation relates to the broader concept of emergency management. In the early 1980s, the newly-created Federal Emergency Management Agency (FEMA) was charged with developing a structure for how the federal, state, and local governments would respond to disasters. FEMA developed the *four phases of emergency management*, an approach which can be applied to all disasters. The four phases are as follows:

- **Hazard Mitigation**—described by FEMA and the Disaster Mitigation Act of 2000 (DMA 2000) as "any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event." The goal of mitigation is to save lives and reduce property damage. Besides significantly aiding in the obviously desirous goal of saving human lives, mitigation can reduce the enormous cost of disasters to property owners and all levels of government. In addition, mitigation can protect critical community facilities and minimize community disruption, helping communities return to usual daily living in the aftermath of disaster. Examples of mitigation involve a range of activities and actions including the following: land-use planning, adoption and enforcement of building codes, and construction projects (e.g., flood proofing homes through elevation, or acquisition or relocation away from floodplains).

- **Emergency Preparedness**—includes plans and preparations made to save lives and property and to facilitate response operations in advance of a disaster event.

- **Disaster Response**—includes actions taken to provide emergency assistance, save lives, minimize property damage, and speed recovery immediately following a disaster.

- **Disaster Recovery**—includes actions taken to return to a normal or improved operating condition following a disaster.

Figure 1-2 illustrates the basic relationship between these phases of emergency management. While hazard mitigation may occur both before and after a disaster event, it is significantly more effective when implemented before an event occurs. This is one of the key elements of this plan and its overall strategy*:* reduce risk before disaster strikes in order to minimize the need for post-disaster response and recovery.

As *Figure 1-2* demonstrates, mitigation relies on updating in the wake of disaster. This can give the appearance that mitigation is only reactive rather than proactive. In reality, however, post-disaster revision is a vital component of improving mitigation. Each hazardous event affords an opportunity to reduce the consequences of future occurrences.

Unfortunately, this cycle can be painful for a community. For instance, the risks of disasters that could create catastrophic incidents in Louisiana were thought to be relatively well-understood prior to 2005. However, the impact of the 2005 hurricane season on the Gulf Coast region of the United States prompted a new level of planning and engagement related to disaster response, recovery, and hazard mitigation. Hurricanes Katrina and Rita hit three weeks apart and together caused astonishing damage to human life and to property. The two storms highlighted a hurricane season that spawned 28 storms—unparalleled in American history. The 2005 hurricane season confirmed Louisiana's extreme exposure to natural disasters and both the positive effects and the concerns resulting from engineered flood-protection solutions.

Figure 1-2: The Four Phases of Emergency Management and their Relation to Future Hazard Mitigation (Source: Louisiana State Hazard Mitigation Plan 2014)

The catastrophic events of 2005 had profound impacts on emergency management and hazard mitigation throughout Louisiana. As detailed later in this document, significant funding has been made available to the State of Louisiana and its parishes for the purpose of hazard mitigation planning. The storms also raised awareness of the importance of hazard mitigation among decision-makers and the general population, which has been particularly important since natural hazards will likely be increasing in frequency, magnitude, and impact in the coming years due to climate change.

General Strategy

During the last update to the Louisiana State Hazard Mitigation Plan, the State Hazard Mitigation Team (SHMT) began a long-term effort to better integrate key components of all plans with hazard mitigation implications in Louisiana to ensure that the programs, policies, recommendations, and implementation strategies are internally consistent. As each of these documents has been adopted by various agencies within the state, the SHMT has worked to incorporate this information into the decision process.

Part of the ongoing integration process is that the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) encourages the parishes and the local communities with independent hazard mitigation plans to utilize the same plan format and methodologies as the State Hazard Mitigation Plan in order to create continuity of information from local to state mitigation plans and programs.

The 2020 Plaquemines Parish Hazard Mitigation Plan (HMP) maintains much of the information from the 2015 plan version, but it now reflects the order and methodologies of the 2019 Louisiana State Hazard Mitigation Plan.

The sections in the 2015 Plaquemines HMP were as follows:

- Chapter One Introduction
- Chapter Two Planning Process
- Chapter Three Risk Assessment
- Chapter Four Mitigation Strategy
- Chapter Five Plan Adoption
- Chapter Six Plan Maintenance
- Chapter Seven Appendices
- Chapter Eight Endnotes

This plan update now also coheres with the Plain Writing Act of 2010, which requires federal agencies to use clear communication that is accessible, consistent, understandable, and useful to the public. While the State of Louisiana and its political subdivisions are not required to meet such standards, the Act aligns with best practices in hazard mitigation. Since successful hazard mitigation relies on full implementation and cooperation at all levels of government and community, a successful hazard mitigation plan must also be easily used at all of these levels. Nevertheless, the Plaquemines Parish Hazard Mitigation Steering Committee was not ignorant or dismissive of the successful analysis and mitigation planning executed in previous plan updates. This plan update remains coherent with those documents, retaining language and content when needed, deleting it when appropriate, and augmenting it when constructive.

2020 Plan Update

This 2020 plan update proceeds with the previous goals of the Plaquemines Parish Hazard Mitigation Plan. The current goals are as follows:

1. Reduce losses to existing and future property due to hazards
2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
3. Ensure the abilities of emergency services providers to continue operating during hazardous events
4. Protect existing public and private infrastructure from damage

This plan update makes a number of textual changes throughout, with the most obvious changes being data related and structural. First, the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information's (NCEI) Storm Events Database was used in the analysis, which provides historical hazard data from 1950 to 2019. Furthermore, all of the sections were updated to reflect the most current information and the most current vision of the plan update. Second, instead of ten separate sections for numerous tables, maps and appendices, the HMP update has four sections and five appendices. The most significant changes are the newly developed hazard profiles and risk assessments, as well as the removal of much repetition between sections from the previous plan updates.

The 2020 plan update is organized generally as follows:

- Section One Introduction
- Section Two Hazard Identification and Parish-wide Risk Assessment
- Section Three Capability Assessment
- Section Four Mitigation Strategies
- Appendix A Planning Process
- Appendix B Plan Maintenance
- Appendix C Essential Facilities
- Appendix D Plan Adoption
- Appendix E State Required Worksheets

Table 1-3: 2020 Plan Update Crosswalk

Plan Update Crosswalk	
Chapter One: Introduction	Section 1: Introduction
Chapter Two: Planning Process	Appendix A: Planning Process
Chapter Three: Risk Assessment	Section 2: Hazard Identification and Parish wide Risk Assessment
Chapter Four: Mitigation Strategy	Section 4: Mitigation Strategy
Chapter Five: Plan Adoption	Appendix D: Plan Adoption
Chapter Six: Plan Maintenance	Appendix B: Plan Maintenance
Chapter Seven: Appendices	Appendix A-E
Chapter Eight: Endnotes	

Despite numerous changes in this plan update, the plan remains consistent in its emphasis on the few types of hazards that pose the most risk to loss of life, injury, and property in Plaquemines Parish and its communities. The extent of this risk is dictated primarily by its geographic location. Most significantly, Plaquemines Parish remains at high risk of water inundation from various sources, including flooding and tropical cyclone activity. All of the parish is also at high risk of damages from high winds and wind-borne debris—caused by various meteorological phenomena. Other hazards threaten the parish and/or its communities, although not to such great degrees and not in such widespread ways. In all cases, the relative social vulnerability of areas threatened and affected plays a significant role in how governmental agencies and their partners (local, parish, state and federal) prepare for and respond to disasters.

Mitigation efforts related to particular hazards are highly individualized by jurisdiction. While Plaquemines is a single jurisdiction plan, they do have multiple communities that are partners in mitigation strategy efforts. Flexibility in response and planning is essential. The most important step forward to improve hazard management capability is to improve coordination and information sharing between the various levels of government regarding hazards.

2. Hazard Identification and Parish-Wide Risk Assessment

This section assesses the various hazard risks that Plaquemines Parish faces in order to identify a strategy for mitigation. Having identified the categories of hazards, emergencies, disasters, and catastrophes, this section details the major climatological and natural/human-influenced hazards by (1) defining them, (2) explaining how they are measured, (3) describing their geographic extent, (4) surveying their previous occurrences, and (5) evaluating their future likelihood of occurrences.

The table below provides an overview of the hazards that had been previously profiled in the Plaquemines Parish Hazard Mitigation Plan published in 2015, as well as the hazards that were identified in the state's 2019 Hazard Mitigation Plan that were considered to be of high or medium risk for the parish by the state. Those hazards identified as high or medium risk by the state or previously identified as a risk by the parish, have been determined to provide a risk to the parish and will be profiled in this section.

Table 2-1: Hazard Profile Summary

Hazard	Profiled in Last Plan	Considered Medium or High Risk in the State's HM Plan	Profiled in the 2020 Update
Coastal Hazards	X		X
Flooding	X	X	X
Levee Failure	X		X
Sinkholes	X		X
Thunderstorms (Hail, Lightning, & Wind)		X	X
Tornadoes	X	X	X
Tropical Cyclones	X	X	X

Prevalent Hazards to the Community

While many of the hazards identified in *Table 2-1* occur in the parish, their occurrence was not merited for further study by the planning committee. The determination was made to focus attention and resources on the most prevalent hazards, which include the hazards previously profiled, along with thunderstorms.

The following hazards have been selected to be included in this risk assessment:

a) Coastal Hazards
b) Flooding
c) Levee Failure
d) Sinkholes
e) Thunderstorms (Hail, Lightning, & Wind)
f) Tornadoes
g) Tropical Cyclones

For analysis purposes, the impact of the critical and prevalent hazards is summarized as follows:

- Flooding from rivers and waterways, rain storms, tropical cyclones, and hurricanes in the following forms:
    a) Riverine
    b) Stormwater
    c) Surge
    d) Backwater flooding (as the result of river flooding and surge)
    e) Coastal
- High wind damage most commonly resulting from hurricanes, thunderstorms, and tornadoes
- Property damage resulting from all profiled natural hazards

The potential destructive power of tropical cyclones and flooding, along with coastal hazards, were determined to be the most prevalent hazards to the parish. All 23 disaster declarations received by Plaquemines Parish have resulted from either tropical cyclones (21 declarations) or flooding (2 declarations), which validates these as the most significant hazards. Therefore, the issues of hurricanes and floods will both serve as the main focus during the mitigation planning process. Hurricanes present risks from the potential for flooding, primarily resulting from storm surge, and high wind speeds. While storm surge is considered the hazard with the most destructive potential, the risk assessment will also asses non-storm surge flooding as well. Flooding can also occur from non-hurricane events, as flash floods are a common occurrence due to heavy rainfall.

Hurricanes, tropical storms, and heavy storms are fairly common occurrences, and resultant wind damage is of utmost concern. Damage from high winds can include roof damage, destruction of homes and commercial buildings, downed trees and power lines, and damage and disruption to services caused by heavy debris. A wind map for Plaquemines Parish is included in the hurricane risk assessment.

Plaquemines Parish is also susceptible to tornadoes. Tornadoes can spawn from tropical cyclones or severe weather systems that pass through Plaquemines Parish. High winds produced by tornadoes have the potential to destroy residential and commercial buildings, as well as create wind-borne objects from the debris produced by the destruction of the natural and human environment, such as building materials and trees.

Previous Occurrences

Table 2-2 summarizes federal disaster declarations for Plaquemines Parish since 1965. Information includes names, dates, and types of disaster.

Table 2-2: Plaquemine Parish Major Disaster Declarations

Disaster Number	Year	Declaration
208	1965	Hurricane Betsy
272	1969	Hurricane Camille
374	1973	Severe Storms & Flooding
448	1974	Hurricane Carmen
752	1985	Hurricane Juan
956	1992	Hurricane Andrew

Disaster Number	Year	Declaration
1246	1998	Hurricane Georges/TS Frances
1435	2002	Tropical Storm Isidore
1437	2002	Hurricane Lili
1548	2004	Hurricane Ivan
1601	2005	Tropical Storm Cindy
1603/3212	2005	Hurricane Katrina
1607/3260	2005	Hurricane Rita
1786/3289	2008	Hurricane Gustav
1792	2008	Hurricane Ike
4041	2011	Tropical Storm Lee
4080	2012	Hurricane Isaac
3347	2012	Tropical Storm Isaac
3376	2016	Flooding
4345	2017	Tropical Storm Harvey
3392	2017	Tropical Storm Nate
4458	2019	Hurricane Barry
3416	2019	Tropical Storm Barry

Probability of Future Hazard Events

The probability of a hazard event occurring in Plaquemines Parish is estimated in the table on the following page. The percent chance of an event happening during any given year was calculated by posting past events and dividing by the time period. Unless otherwise indicated, the time period used to access probability followed the method used in the State of Louisiana's most current Hazard Mitigation Plan. The primary source for historical data used throughout the plan is the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information's (NCEI) Storm Events Database, which provides historical hazard data from 1950 to 2019. In staying consistent with the state plan, the Storm Events Database was evaluated for the last twenty-five years (1994 – 2019) in order to determine future probability of a hazard occurring. While the 25-year record used by the State was adopted for the purpose of determining the overall probability, in order to assist with determining estimated losses, unless otherwise stated, the full 70-year record was used when Hazus wasn't available to determine losses. This full record was used to provide a more extensive record to determine losses. All assessed damages were adjusted for inflation in order to reflect the equivalent amount of damages with the value of the U.S. dollar today.

The following table shows the annual probability for each hazard occurring across the parish and in separate jurisdictions:

Table 2-3: Probability of Future Hazard Reoccurrence

Hazard	Probability
	Plaquemines Parish
Coastal Hazards	100%
Flooding	100%
Levee Failure	< 1%
Sinkholes	< 1%
Thunderstorms (Hail)	24%
Thunderstorms (High Wind)	100%
Thunderstorms (Lightning)	< 1%
Tornadoes	40%
Tropical Cyclones	35%

As shown in *Table 2-3*, coastal hazards, flooding events, and high winds from thunderstorms have the highest annual chance of occurrence in the parish (100%). These hazards are followed by tornadoes (40%), Tropical Cyclones (35%), and hail from thunderstorms (24%). Levee failure, sinkholes, and lightning all have an annual chance of occurrence in the parish of less than 1%.

Inventory of Assets for the Entire Parish

As part of the Risk Assessment, the planning team identified essential facilities throughout the parish. Several methods were used to assist in identifying all essential facilities, including field data collected by the Louisiana Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) on critical infrastructure from a previous hazard mitigation project.

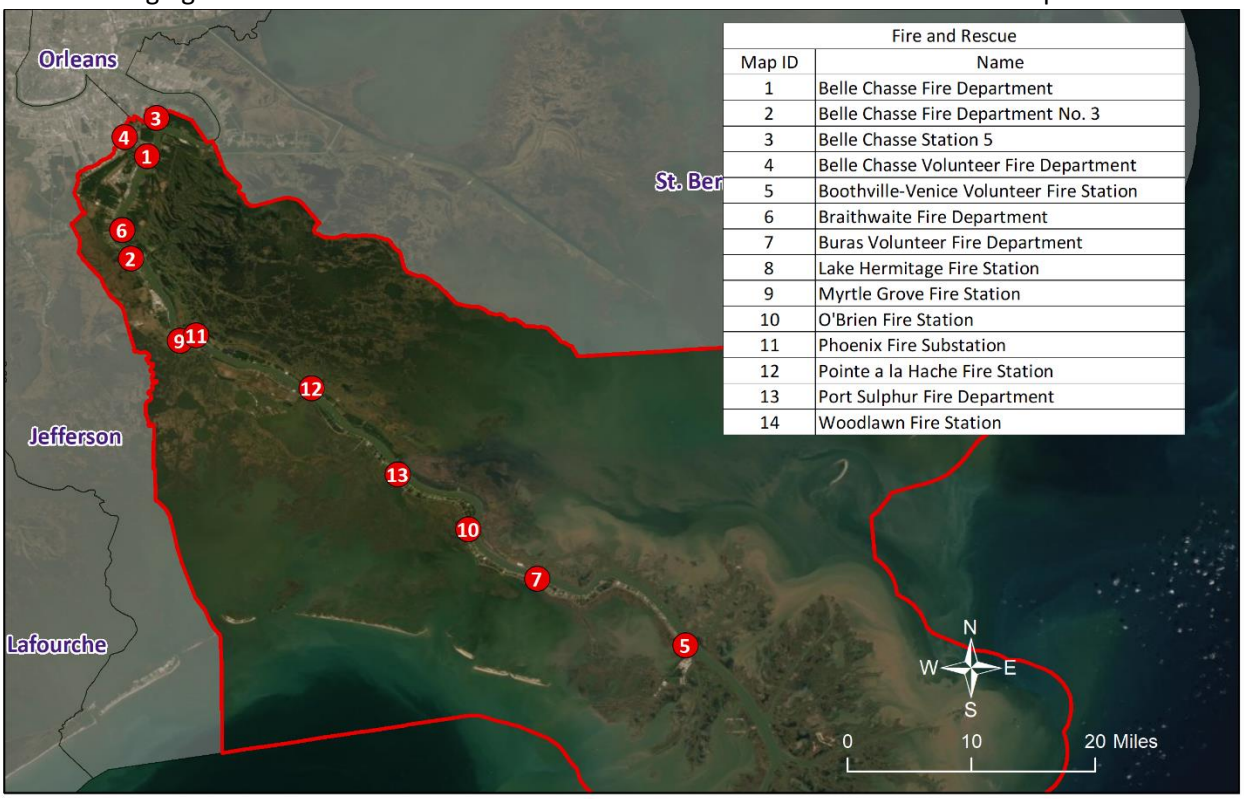
Within the entire planning area, there is an estimated value of $2,344,219,000 in structures throughout the parish. The table below provides the total estimated value for each type of structure by occupancy.

Table 2-4: Estimated Total of Potential Losses throughout Plaquemines Parish

Occupancy	Plaquemines Parish
Agricultural	$10,340,000
Commercial	$384,300,000
Government	$29,012,000
Industrial	$146,852,000
Religion	$60,057,000
Residential	$1,691,980,000
Education	$21,678,000
Total	**$2,344,219,000**

Essential Facilities of the Parish

The following figures show the locations and names of the essential facilities within the parish:



Fire and Rescue	
Map ID	Name
1	Belle Chasse Fire Department
2	Belle Chasse Fire Department No. 3
3	Belle Chasse Station 5
4	Belle Chasse Volunteer Fire Department
5	Boothville-Venice Volunteer Fire Station
6	Braithwaite Fire Department
7	Buras Volunteer Fire Department
8	Lake Hermitage Fire Station
9	Myrtle Grove Fire Station
10	O'Brien Fire Station
11	Phoenix Fire Substation
12	Pointe a la Hache Fire Station
13	Port Sulphur Fire Department
14	Woodlawn Fire Station

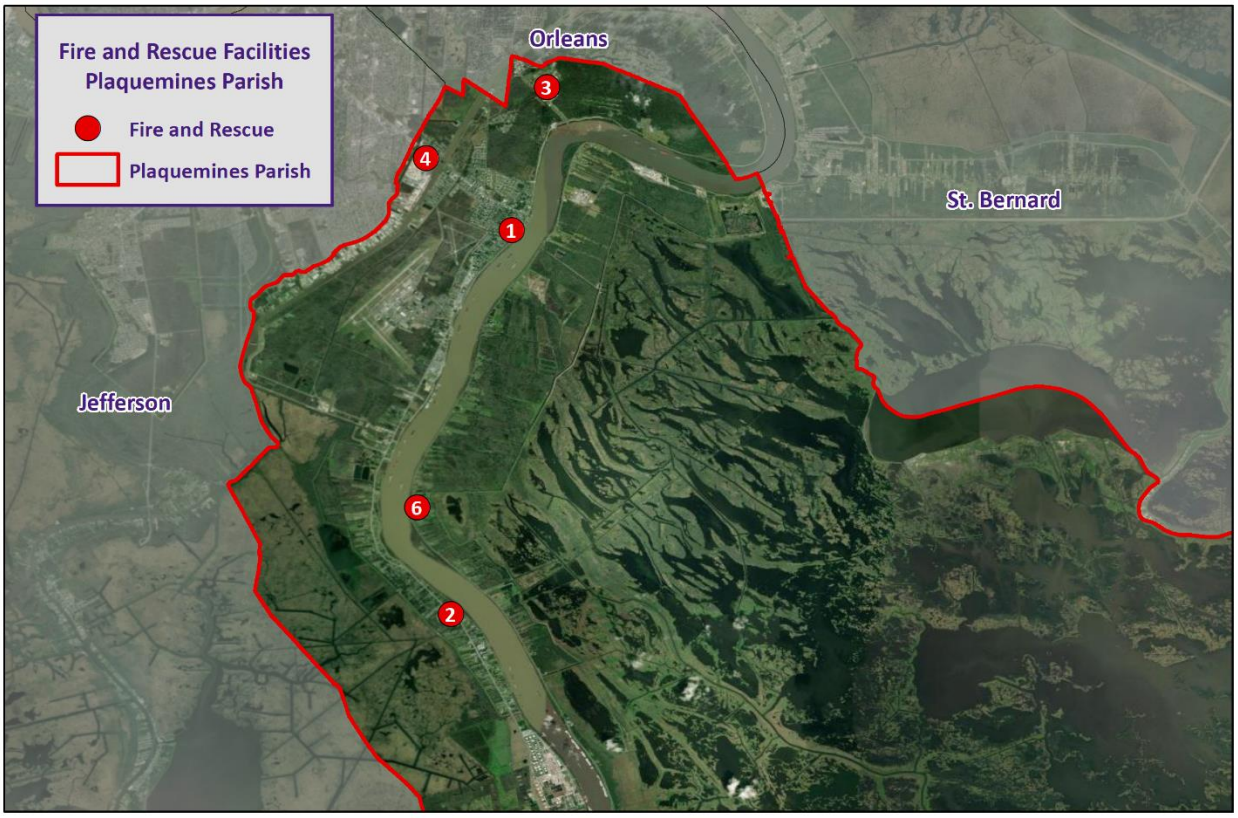


Figure 2-1: Fire and Rescue Facilities in Plaquemines Parish

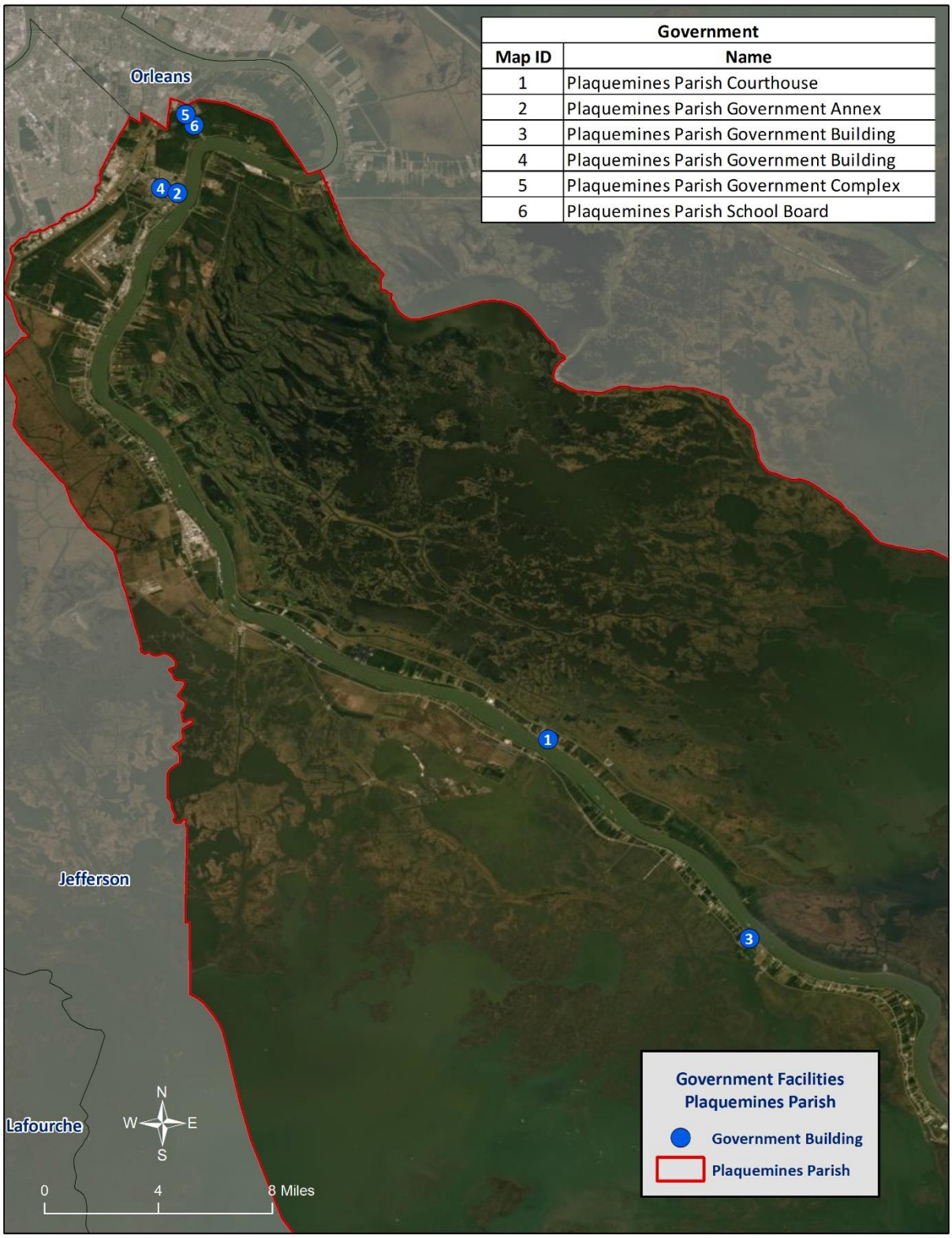
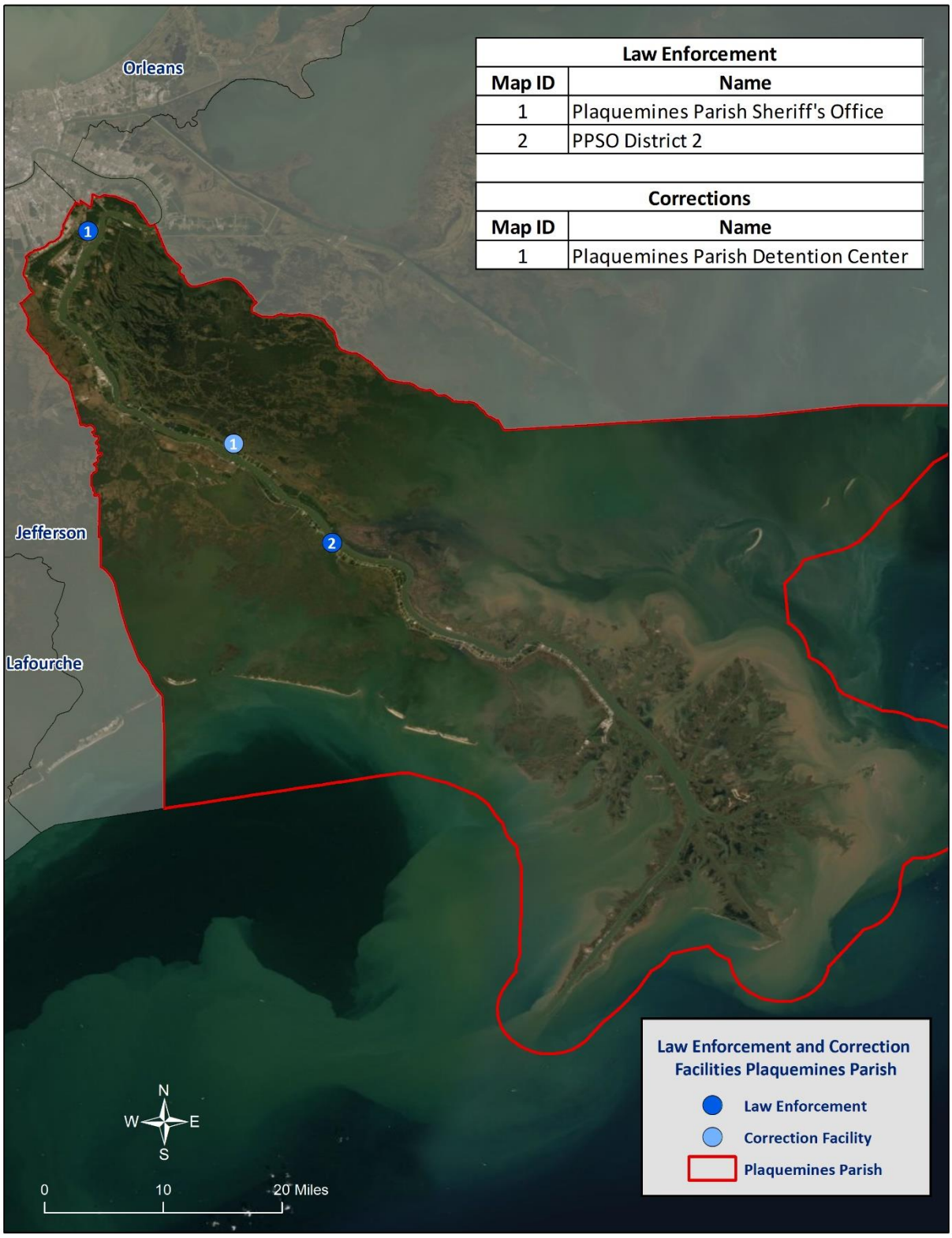


Figure 2-2: Government Buildings in Plaquemines Parish



Law Enforcement	
Map ID	Name
1	Plaquemines Parish Sheriff's Office
2	PPSO District 2

Corrections	
Map ID	Name
1	Plaquemines Parish Detention Center

Figure 2-3: Law Enforcement and Correction Facilities in Plaquemines Parish

Figure 2-4: Emergency Medical Services in Plaquemines Parish

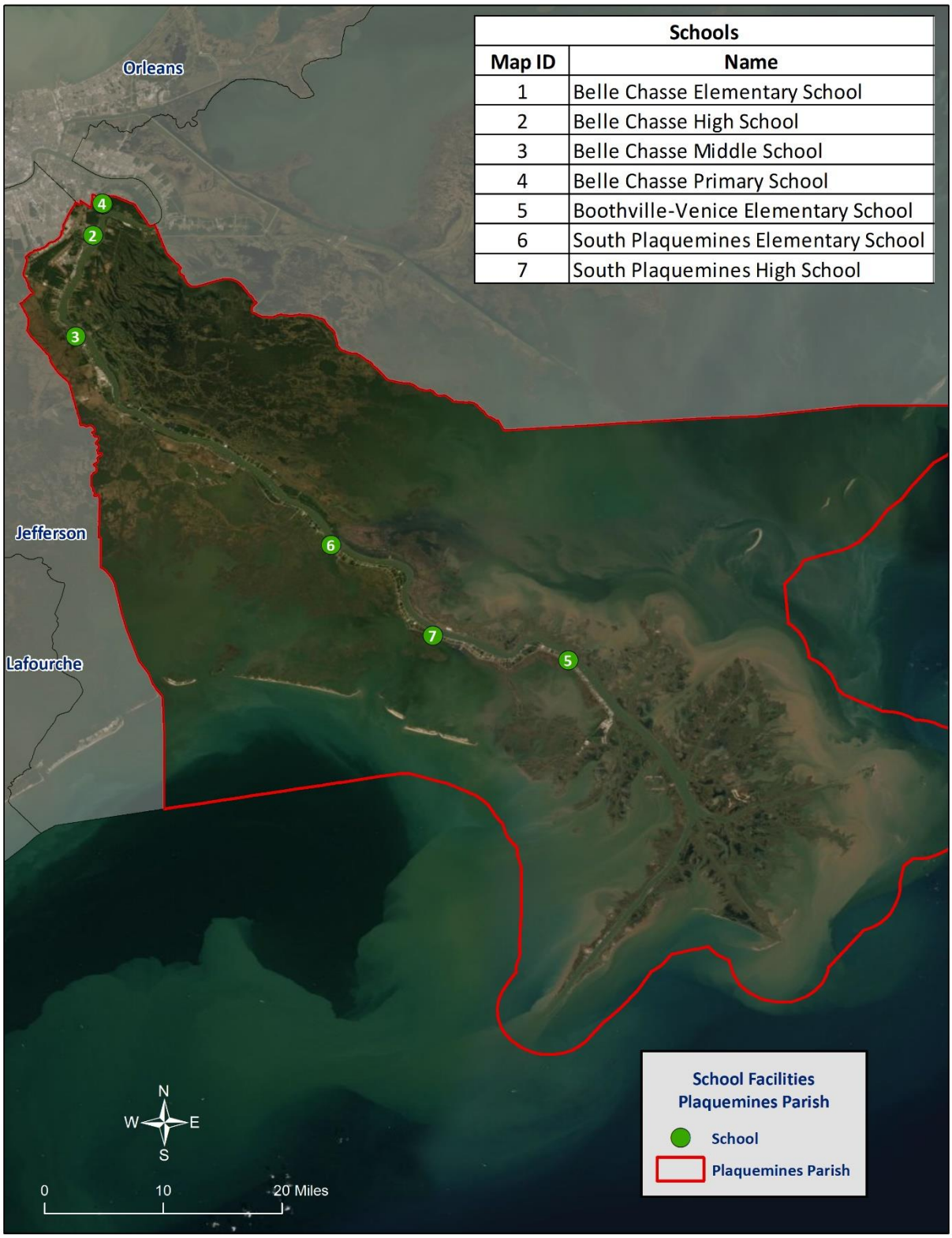
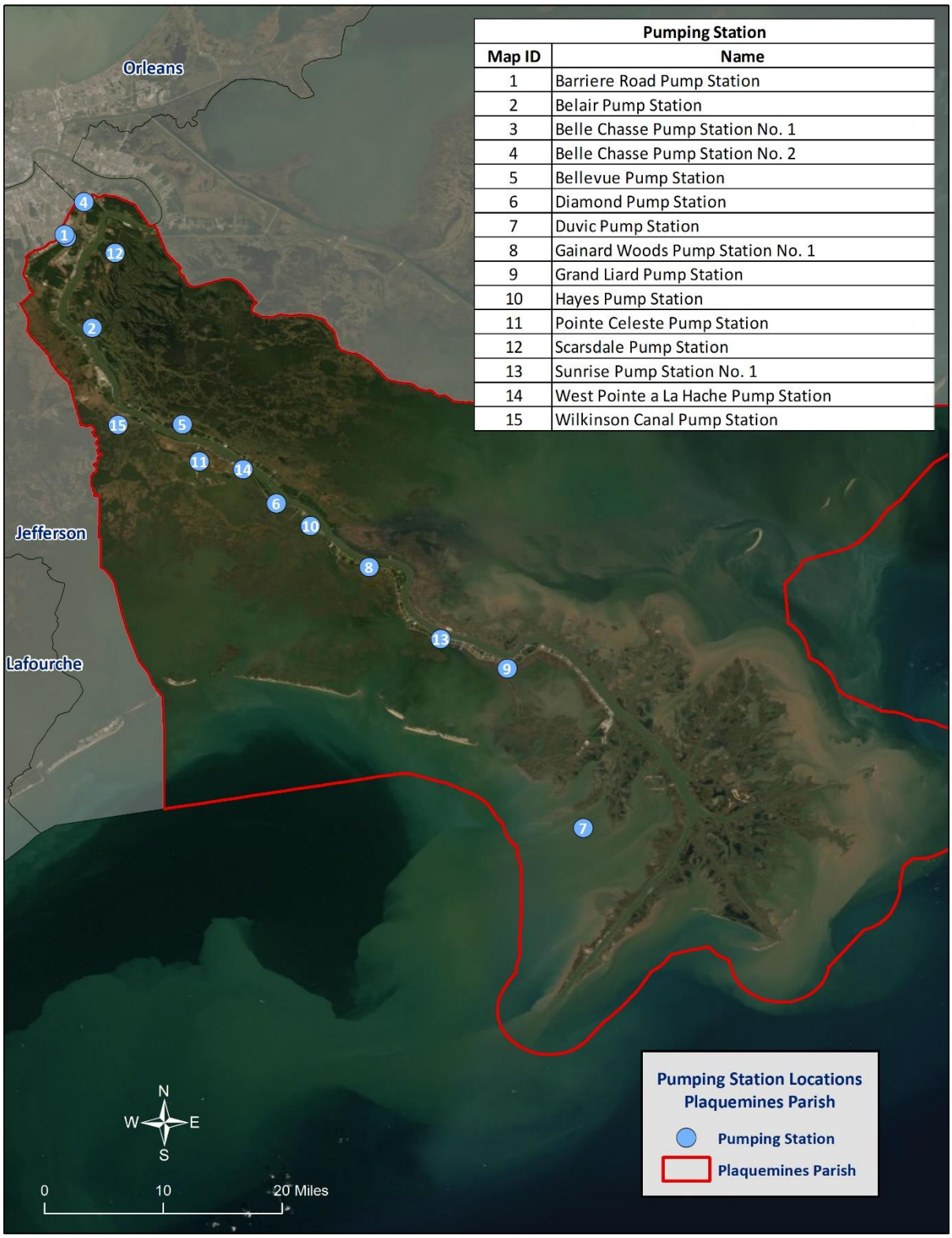


Figure 2-5: School Facilities in Plaquemines Parish

Figure 2-6: Library Facilities in Plaquemines Parish



Pumping Station	
Map ID	Name
1	Barriere Road Pump Station
2	Belair Pump Station
3	Belle Chasse Pump Station No. 1
4	Belle Chasse Pump Station No. 2
5	Bellevue Pump Station
6	Diamond Pump Station
7	Duvic Pump Station
8	Gainard Woods Pump Station No. 1
9	Grand Liard Pump Station
10	Hayes Pump Station
11	Pointe Celeste Pump Station
12	Scarsdale Pump Station
13	Sunrise Pump Station No. 1
14	West Pointe a La Hache Pump Station
15	Wilkinson Canal Pump Station

Figure 2-7: Pumping Stations in Plaquemines Parish

Future Development Trends

Plaquemine Parish experienced a decline in population and housing between the years of 2000 and 2019, decreasing from a population of 26,757 with 10,481 housing units in 2000 to a population of 23,410 with 10,094 housing units in 2019. Population decreased overall by 13.9% from 2000 to 2010; however, there was a slight growth (1.6% overall) in population from 2010 to 2019. The same trend occurred in housing units with an overall decline of approximately 8.4% from 2000 to 2010, and an overall increase in housing units of approximately 5.2% from 2010 to 2019. The future population and number of buildings can be estimated using U.S. Census Bureau housing and population data. The following tables show population and housing unit estimates from 2000 to 2019:

Table 2-5: Population Growth Rate for Plaquemines Parish

Total Population	Plaquemines Parish
1-Apr-00	26,757
1-Apr-10	23,042
1-Jul-18	23,410
Population Growth between 2000 – 2010	-13.9%
Average Annual Growth Rate between 2000 – 2010	-1.4%
Population Growth between 2010 – 2018	1.6%
Average Annual Growth Rate between 2010 – 2014	0.2%

Table 2-6: Housing Growth Rate for Plaquemines Parish

Total Housing Units	Plaquemines Parish
1-Apr-00	10,481
1-Apr-10	9,696
1-Jul-18	10,094
Housing Growth between 2000 – 2010	-8.4%
Average Annual Growth Rate between 2000 – 2010	-0.8%
Housing Growth between 2010 – 2014	5.2%
Average Annual Growth Rate between 2010 – 2014	0.6%

Future Hazard Impacts

Hazard impacts were estimated for five years and ten years in the future (2024 and 2028). Yearly population and housing growth rates were applied to parish inventory assets for composite flood and tropical cyclones. Based on a review of available information, it is assumed that population and housing units will continue to grow slightly within Plaquemines Parish from the present until 2028. A summary of estimated future impacts is shown in the table on the next page. Dollar values are expressed in future costs and assume an annual rate of inflation of 1.02%.

Table 2-7: Estimated Future Impacts, 2018-2028
(Source: Hazus, US Census Bureau)

Hazard / Impact	Total in Parish (2019)	Hazard Area (2019)	Hazard Area (2024)	Hazard Area (2028)
Flood Damage				
Structures	10,094	2,898	2,993	3,092
Value of Structures	$2,344,219,000	$673,024,173.39	$731,321,769.60	$794,669,125
# of People	23,410	6,721	6,788	6,856
Tropical Cyclone Damage				
Structures	10,159	10,159	10,426	10,768
Value of Structures	$2,383,492,278	$2,344,219,000	$2,547,276,093.78	$2,767,922,066
# of People	23,410	23,410	23,645	23,882

Population and housing numbers have continued to increase steadily since the last update to the Plaquemines Parish Hazard Mitigation Plan. However, initiatives such as active floodplain management have restricted the development of flood prone areas to continue supporting and encouraging safer communities within Plaquemines Parish. Additionally, the Plaquemines Parish Comprehensive Master Plan has addressed the need to continue to explore coastal and infrastructure needs to mitigate natural hazards while also preparing for and fostering an enhanced and robust economy. This includes addressing the needs of targeted industries while also maintaining mitigation actions which protect these industries, the economy, and the populace within the parish and its jurisdictions.

Land Use

The Plaquemines Parish Land Use table is provided below. Residential, commercial, and industrial areas account for only 1% of the parish's land use. Water areas is the largest category, accounting for 1,110,107 acres (68%) of parish land. At 368,276 acres, wetlands account for 22% of parish lands, while 141,514 acres of agricultural areas account for 9% of parish lands. The parish also consists of 3,553 acres of forested areas, accounting for less than 1% of all parish lands.

Table 2-8: Plaquemines Parish Land Use
(Source: USGS Land Use Map)

Land Use	Acres	Percentage
Agricultural Land, Cropland, and Pasture	141,514	9%
Wetlands	368,276	22%
Forest Land (Not including forested wetlands)	3,553	< 1%
Urban/Development	19,527	1%
Water	1,110,107	68%

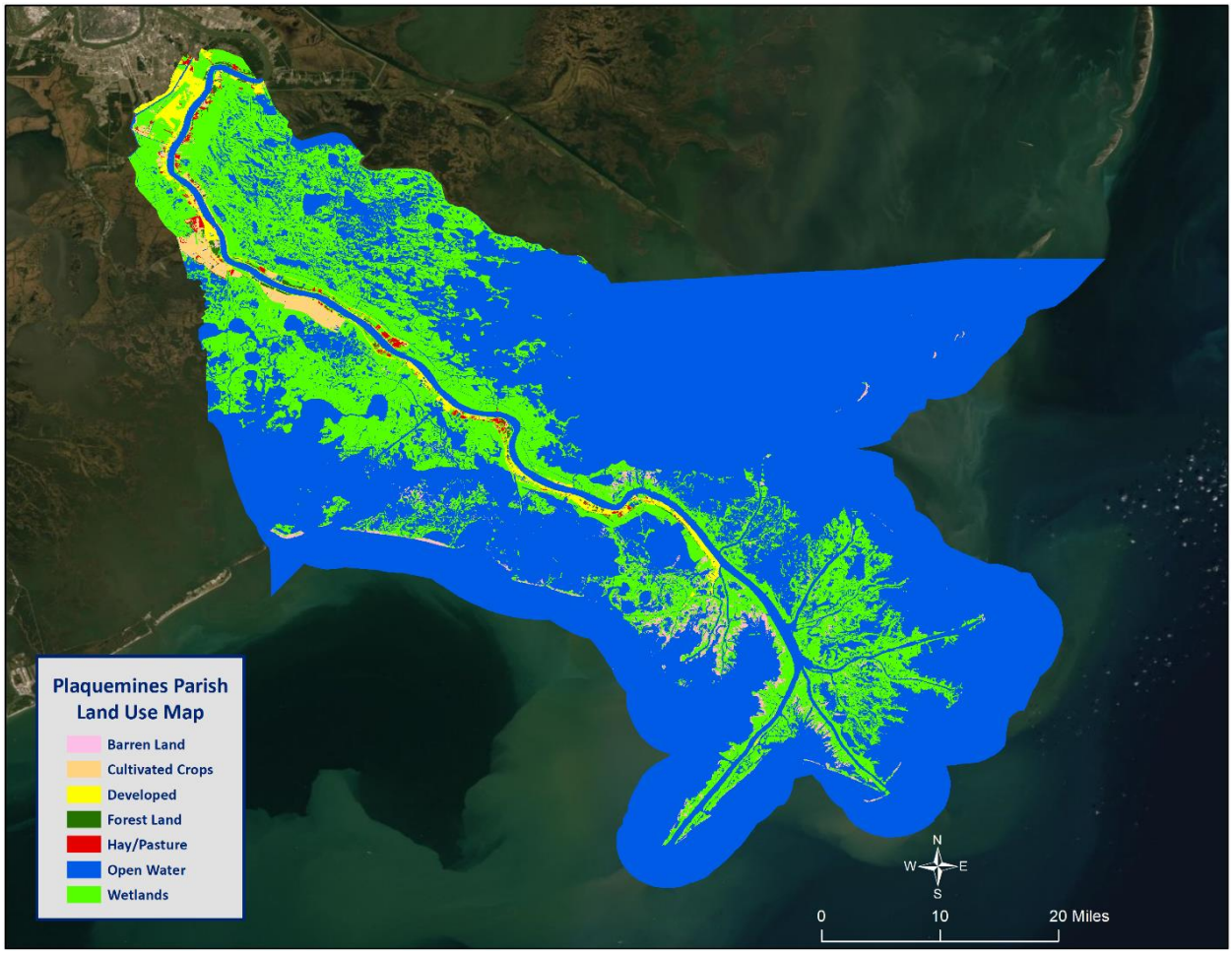


Figure 2-8: Plaquemines Parish Land Use Map
(Source: USGS Land Use Map)

Assessing Vulnerability Overview

The purpose of assessing vulnerability is to quantify and/or qualify exposure and determine how various threats and hazards impact life, property, the environment, and critical operations in Plaquemines Parish. Vulnerability can be defined as the manifestation of the inherent states of the system (e.g., physical, technical, organizational, cultural) that can be exploited to adversely affect (cause harm or damage to) that system. For example, identifying areas in the parish that suffer disproportional damages from flooding compared with other areas, or overall exposure of an entire town to flooding. Identifying and understanding vulnerability to each threat and hazard provides a strong foundation for developing and pursuing mitigation actions.

The Vulnerability Assessment section for each hazard builds upon the information provided in the Risk Assessment by assessing the potential impact and amount of damage that each hazard has on each campus location. To complete the assessment, best available data were collected from a variety of sources, including local, state, and federal agencies, and multiple analyses were performed qualitatively and quantitatively. The estimates provided in the Vulnerability Assessment should be used to understand relative risk from each hazard and the potential losses that may be incurred; however, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning specific hazards and their effects on the built environment, as well as incomplete datasets from approximations and simplifications that are necessary to provide a meaningful and complete analysis. Further, most datasets used in this assessment contain relatively short periods of records, which increases the uncertainty of any statistically-based analysis.

Quantitative Methodology

The quantitative methodology consists of utilizing a detailed GIS-based approach informed through the development of comprehensive hazard and infrastructure databases. This data-centric approach forms the foundation for our quantitative vulnerability assessment. GIS technology allowed for the identification and analysis of potentially at-risk community assets such as people and infrastructure. This analysis was completed for hazards that can be spatially defined in a meaningful manner (i.e., hazards with an official and scientifically determined geographic extent) and for which GIS data were readily available.

Qualitative Methodology

The qualitative assessment relies less on technology, but more on historical and anecdotal data regarding expected hazard impacts. The qualitative assessment completed for Plaquemines Parish is based on the Priority Risk Index (PRI). The purpose of the PRI is to prioritize all potential hazards, and then group them into three categories of high, moderate, or low risk to identify and prioritize mitigation opportunities. The PRI is a good practice to use when prioritizing hazards because it provides a standardized numerical value for hazards to be compared. PRI scores were calculated using five categories:

- Probability
- Impact
- Spatial Extent
- Warning Time
- Duration

Each degree of risk is assigned a value (1-4) and a weighting factor. To calculate the Risk Factor for a given hazard, the assigned risk value for each category is multiplied by the weighted factor, and the sum of all six categories is totaled together to determine the final Risk Factor. The highest possible Risk Factor is 4.0.

Risk Factor = [(Probability * 0.25) + (Impact * 0.25) + (Spatial Extent * 0.20) + (Warning Time *0.15) + (Duration * 0.15)]

Priority Risk Index and Hazard Risk Factor

Hazard risk is determined by calculating the Risk Factor for each hazard impacting Plaquemines Parish. A summary of the PRI is found in following table. The conclusions drawn from the qualitative and quantitative assessments are fitted into three categories based on High, Moderate, or Low designations. Hazards identified as high risk have risk factors of 2.5 or greater. Risk Factors ranging from 2.0 to 2.4 are deemed moderate risk hazards. Hazards with Risk Factors less than 2.0 are considered low risk.

Table 2-9: Summary of the Enhanced Priority Risk Index

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	25%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of critical facilities.	1	25%
	Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than one day.	2	
	Critical	Multiple deaths/injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of critical facilities for more than a 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	More than 24 hours	Self-explanatory	1	15%
	12 to 24 hours	Self-explanatory	2	
	6 to 12 hours	Self-explanatory	3	
	Less than 6 hours	Self-explanatory	4	
Duration	Less than 6 hours	Self-explanatory	1	15%
	Less than 24 hours	Self-explanatory	2	
	Less than one week	Self-explanatory	3	
	More than one week	Self-explanatory	4	

Table 2-10: Associated Risk Factor with PRI Value Range

Risk Factor	PRI Range
High Risk	2.5 to 4.0
Moderate Risk	2.0 to 2.4
Low Risk	0 to 1.9

Table 2-11: Risk Assessment for Plaquemines Parish

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration	Overall Risk
Coastal Hazards	4	3	4	1	4	**3.3**
Tropical Cyclones	3	4	4	1	4	**3.3**
Flooding	4	3	3	2	3	**3.1**
Tornadoes	3	3	2	4	3	**2.95**
Thunderstorms (Wind)	4	2	4	3	1	**2.9**
Levee Failure	1	3	3	4	3	**2.65**
Thunderstorms (Hail)	2	2	4	3	1	**2.4**
Sinkholes	1	2	1	3	2	**1.7**
Thunderstorms (Lightning)	1	1	2	3	1	**1.5**

Hazard Identification

Coastal Hazards

Coastal land loss is the loss of land (especially beach, shoreline, or dune material) by natural and/or human influences. Coastal land loss occurs through various means, including erosion, subsidence (the sinking of land over time as a result of natural and/or human-caused actions), saltwater intrusion, coastal storms, littoral drift, changing currents, manmade canals, rates of accretion, and sea level rise. The effects of these processes are difficult to differentiate because of their complexity and because they often occur simultaneously, with one influencing each of the others.

Some of the worst recent contributors to coastal land loss in the state are the tropical cyclones of the past two decades. Two storms that stand out in this regard are Hurricanes Katrina and Rita. These powerful cyclones completely covered large tracts of land in a very brief period, permanently altering the landscape. The disastrous legacy of these storms concentrated already ongoing efforts to combat coastal land loss. Consistent with the 2014 State Hazard Mitigation Plan Update, coastal land loss is considered in terms of two of the most dominant factors: sea level rise and subsidence.

Sea level rise and subsidence impact Louisiana in a similar manner—again making it difficult to separate impacts. Together, rising sea level and subsidence—known together as relative sea level rise—can accelerate coastal erosion and wetland loss, exacerbate flooding, and increase the extent and frequency of storm impacts. According to NOAA, global sea level rise refers to the upward trend currently observed in the average global sea level. Local sea level rise is the level that the sea rises relative to a specific location (or, benchmark) at the coastline. The most prominent causes of sea level rise are thermal expansion, tectonic actions (such as sea floor spreading), and the melting of the Earth's glacial ice caps. The current U.S. Environmental Protection Agency (EPA) estimate of global sea level rise is 10–12 in. per century, while future sea level rise could be within the range of 1–4 ft. by 2100. According to the U.S. Geological Survey (USGS), the Mississippi Delta plain is subject to the highest rate of relative sea level rise of any region in the nation largely due to rapid geologic subsidence.

Subsidence results from a number of factors including:

- Compaction/consolidation of shallow strata caused by the weight of sediment deposits, soil oxidation, and aquifer draw-down (shallow component)
- Gas/oil/resource extraction (shallow & intermediate component)
- Consolidation of deeper strata (intermediate components)
- Tectonic effects (deep component)

For the most part, subsidence is a slow-acting process with effects that are not as evident as hazards associated with discrete events. Although the impacts of subsidence can be readily seen in coastal parishes over the course of decades, subsidence is a "creeping" hazard. The highest rate of subsidence is occurring at the Mississippi River Delta (estimated at greater than 3.5 ft./century). Subsidence rates tend to decrease inland, and they also vary across the coast.

Overall, subsidence creates three distinct problems in Louisiana:

- By lowering elevations in coastal Louisiana, subsidence accelerates the effects of saltwater intrusion and other factors that contribute to land loss.
- By lowering elevations, subsidence may make structures more vulnerable to flooding.
- By destabilizing elevations, subsidence undermines the accuracy of surveying benchmarks (including those affecting levee heights, coastal restoration programs, surge modeling, BFEs, and other engineering inputs), which can contribute to additional flooding problems if construction occurs at lower elevations than anticipated or planned.

Location

Historic areas of coastal land loss and gain (*Figure 2-9*) and subsidence rates (*Figure 2-10)* have been quantified for Plaquemines Parish using data from the U.S. Geologic Survey and Louisiana Coastal Protection and Restoration Authority (CPRA). Since 1932, the average annual land loss in Louisiana is 35 mi^2, while the average annual land gain has been 3 mi^2 for a net loss of 32 mi^2 per year. Land loss is occurring throughout the entire area of Plaquemines Parish. Portions of the "birdfoot" area of the parish are experiencing new land gain through sedimentation deposits from the Mississippi River, but land loss is dominating the parish. (*Figure 2-9*). Additionally, subsidence is also occurring throughout Plaquemines Parish (*Figure 2-10*).

Previous Occurrences / Extent

Coastal land loss is an ongoing process, including discrete (hurricanes) and continuous (subsidence, sea level rise) processes. While historic flood loss data undoubtedly includes the effects of coastal land loss, specific previous occurrences have not been identified as a source of direct disaster damage in Louisiana. Rather, the effects of the underlying flood or hurricane storm surge hazard are recorded. Land loss is a significant hazard, however, and assessment of the added flood impacts caused by land loss is quantified in the following sections. The southern portion of Plaquemines Parish can expect to experience subsidence rates of approximately 35 mm annually. The western portions of Plaquemines Parish can expect subsidence rates upwards of 25 mm annually, while the eastern portions of the parish can expect subsidence rates of approximately 10 mm annually.

Frequency / Probability

Subsidence, sea level rise, and coastal land loss are ongoing hazards. Based on historical subsidence rates and land loss/gain trends, the probability of future land loss in Louisiana is 100% certain, but actual rates of subsidence and land loss/gain vary along the coast based on various meteorological, geological, and human-influenced dynamics (e.g., water/resource extraction, canal dredging, saltwater intrusion, marsh restoration projects, etc.).

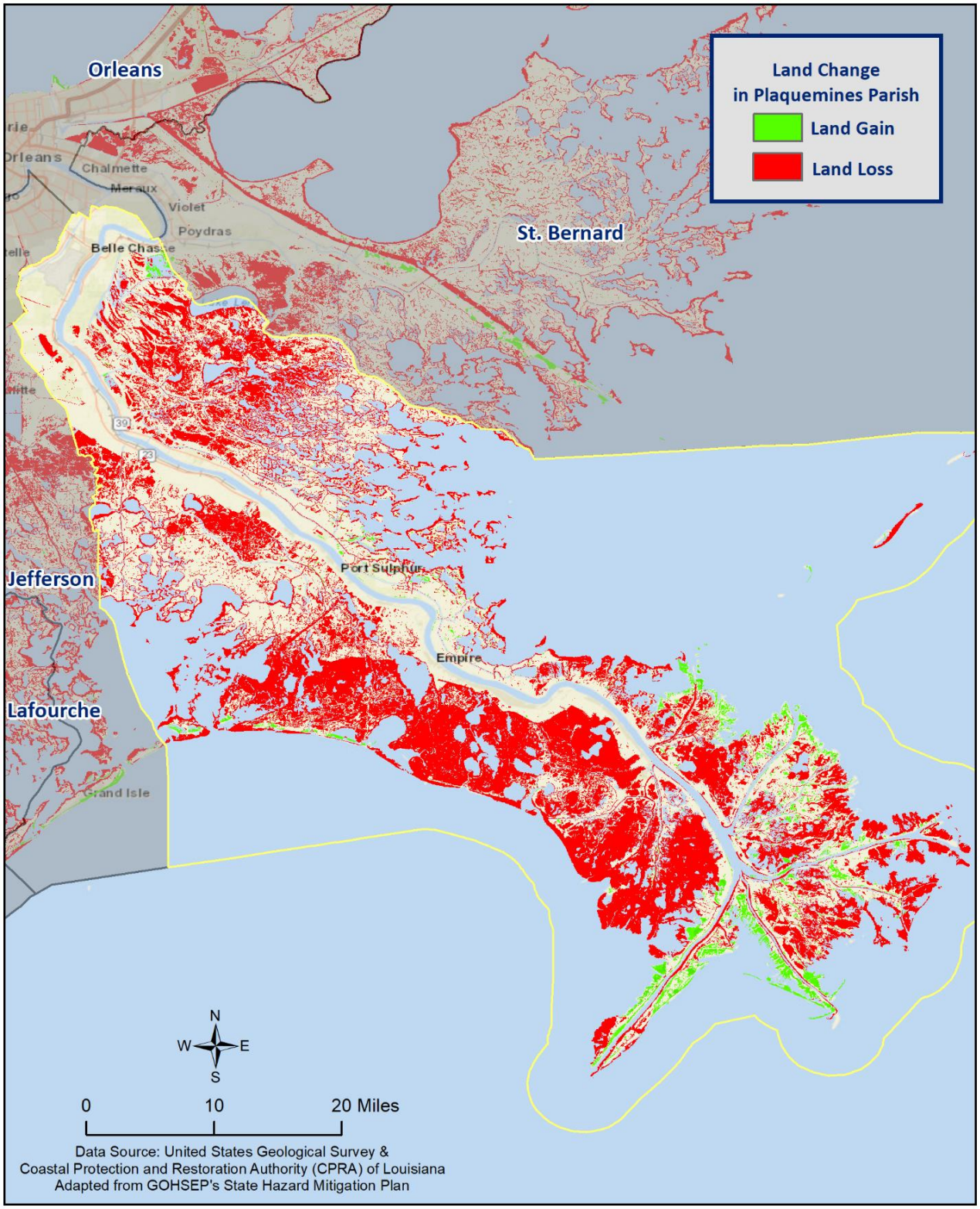


Figure 2-9: Historical Areas of Land Loss and Gain between 1932 and 2010 (Source: State of Louisiana Hazard Mitigation Plan)

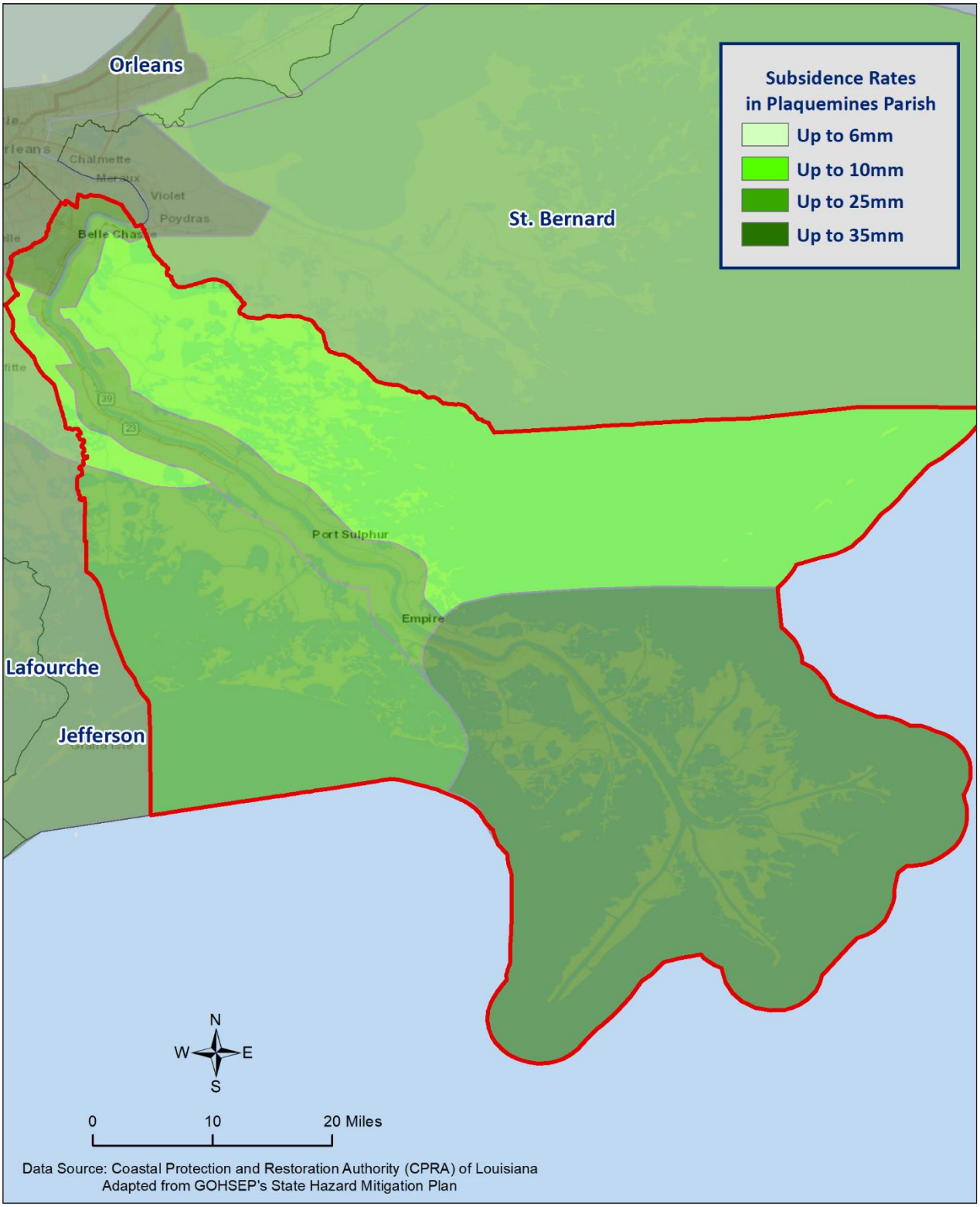


Figure 2-10: Maximum Annual Subsidence Rates Based on Subsidence Zones in Coastal Louisiana (Source: State of Louisiana Hazard Mitigation Plan)

Estimated Potential Loses

To determine the estimated potential losses, the methodology implemented in the 2014 Louisiana State Plan Update was used. In the state plan, two parameters were considered to estimate the projected increase in coastal flood losses from storm surge scenarios – global sea level rise and subsidence. A timeframe of 10 years was used for evaluation of future effects of sea level rise and subsidence for comparison with current conditions. The NOAA Sea, Lake and Overland Surges from Hurricanes (SLOSH) model was used to estimate the maximum of maximum (MOM) storm surge elevations for a Category 1 hurricane at mean tide along the coast of Louisiana. The MOM scenario is not designed to describe the storm surge that would result from a particular event, but rather evaluates the impacts of multiple hurricane scenarios with varying forward speeds and storm track trajectories to create the maximum storm surge elevation surface that would occur given the simultaneous occurrence of all hurricane events for a given category.

There are many global sea level rise scenarios from which to select; however, within a 10-year timeframe, methods that predict accelerating sea level rise rates do not deviate significantly from straight line methods. Therefore, a linear sea level rise projection for the sea level rise occurring in 10 years (SLR2024) using a linear global sea level rise rate of 3.1 mm/year was used (IPCC, 2007), which is also in accordance with the CPRA Coastal Master Plan. This resulted in an increase of 0.1 feet, which was applied to the NOAA MOM storm surge elevation results over the model output domain.

$$SLR_{2024} = 0.0031 \frac{m}{year} x\ 10\ years$$

$$SLR_{2024} = 0.031\ meters = 0.10\ ft\ in\ 2024$$

To estimate the effects of subsidence, the elevation profile for southern Louisiana was separated into sections based on subsidence zones. The 20th percentile values for subsidence were used, in accordance with the CPRA Master Plan, and subtracted from the digital elevation model (DEM) for each zone and re-joined to create a final subsided ground elevation layer.

To perform the economic loss assessment, depth grids were created for current conditions (SLOSH MOM Results – Current Land Elevation) and for projected 2024 conditions ([SLOSH MOM Results + 0.1 ft sea level rise] – [Current Land Elevation – Subsidence]). Hazus was used to calculate economic loss for the current and future depth grids.

Figure 2-11 shows the projected increase in total flood loss resulting from a SLOSH Category 1 MOM in the year 2024, with many areas expecting increase in losses. Some areas that would be currently unaffected by a SLOSH Category 1 MOM would be impacted in ten years based on subsidence and sea level rise projections (*Figure 2-12*).

To determine annual potential loss estimates for coastal land loss, increased exposure estimates over the next 10 years calculated using Hazus were annualized at the parish level (*Figure 2-13*). To provide an annual estimated potential loss per jurisdiction, the total loss for the census block groups within each jurisdiction were calculated. Based on hazard exposure, *Table 2-12* provides an estimate of annual potential losses for Plaquemines Parish.

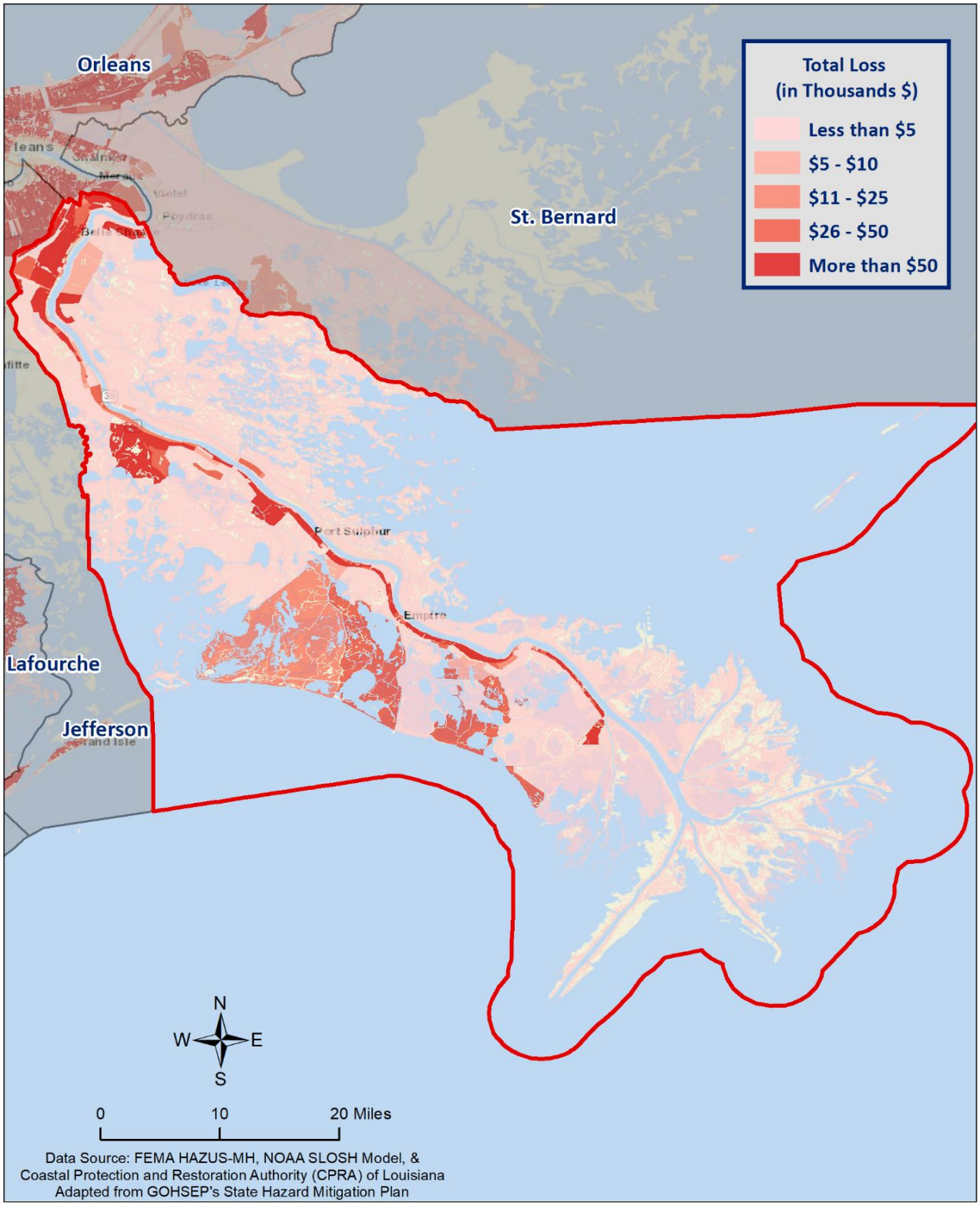


Figure 2-11: Increase in Total Loss Estimates in 2024 by Census Block Group Based on the Hazus Flood Model and NOAA SLOSH Model
(Source: State of Louisiana Hazard Mitigation Plan)

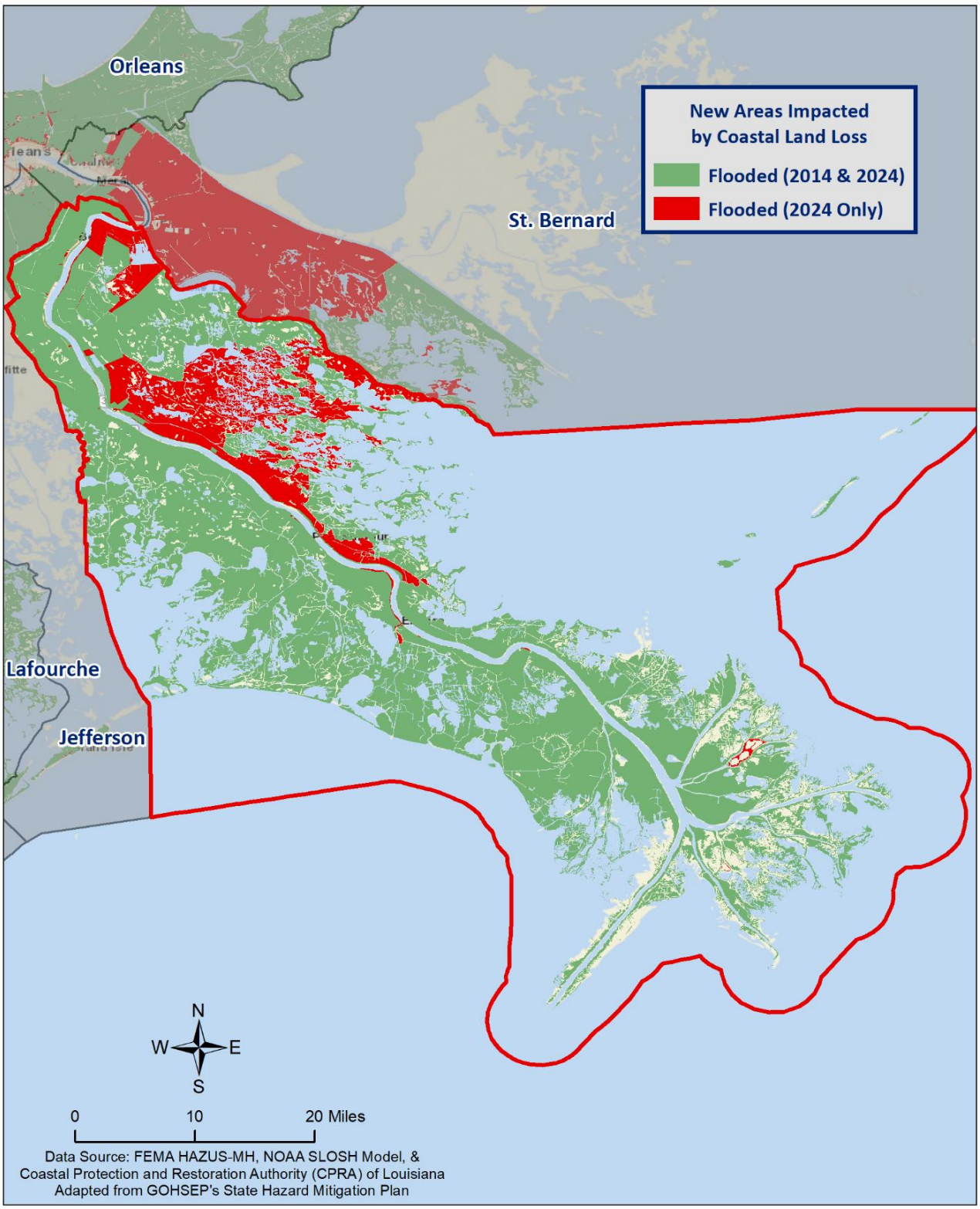


Figure 2-12: Census Block Groups not Currently Impacted by Category 1 Hurricane Storm Surge but Expected to be Impacted in 2024 are Shown in Red
(Source: State of Louisiana Hazard Mitigation Plan)

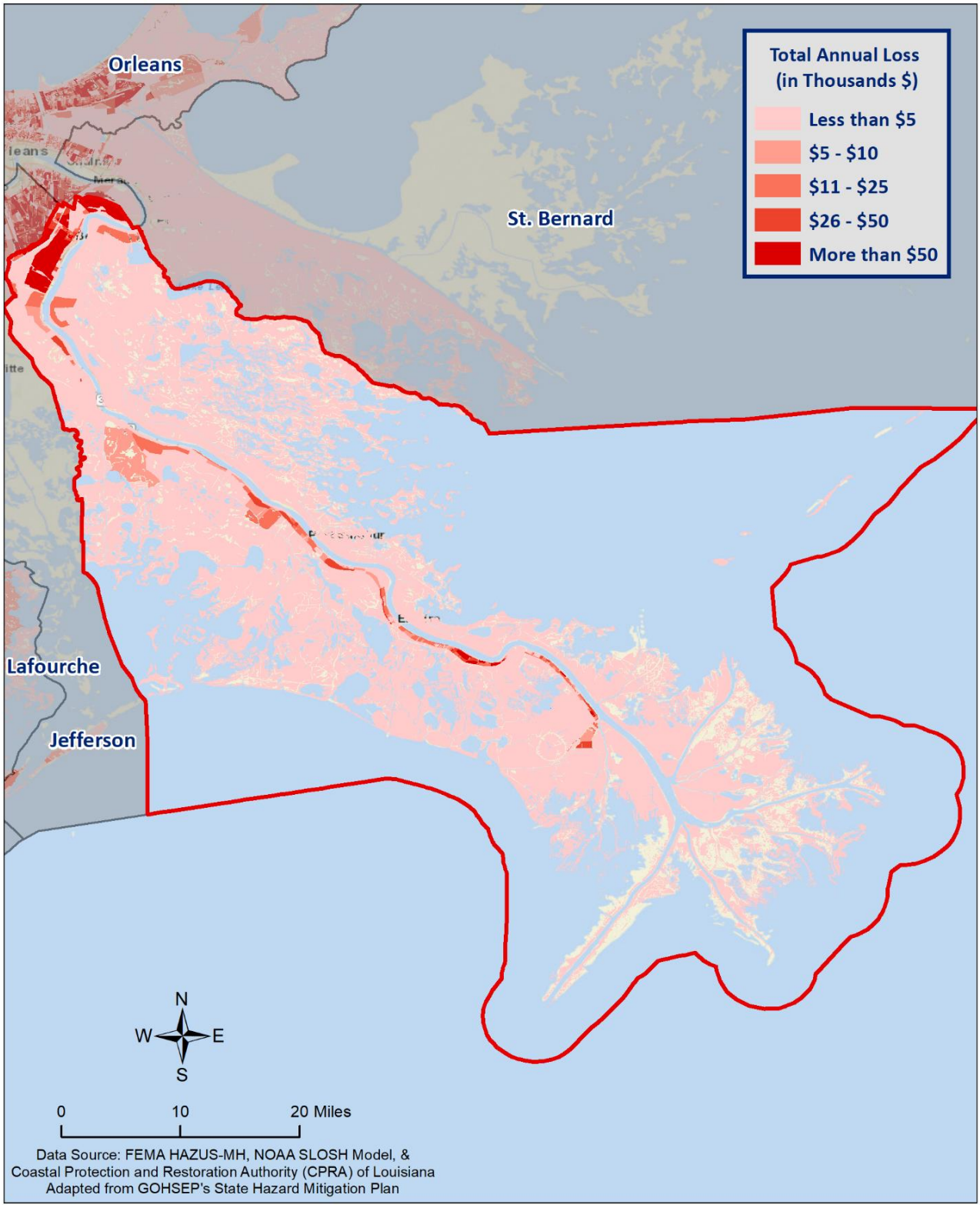


Figure 2-13: Estimated Annual Losses for Coastal Land Loss by Census Block Group

The following table shows the current and future exposure potential based on the Hazus inventory database.

Table 2-12: Estimated Annual Losses for Coastal Land Loss in Plaquemines Parish (Source: Hazus)

Coastal Land Loss Estimated Annual Potential Losses
$8,220

Threat to People

Coastal land loss can impact all demographics and age groups. Buildings located within highly vulnerable coastal land loss areas could be eventually permanently shut down and forced to re-locate. Long-term sheltering and permanent relocation could be a concern for communities that are at the highest risk for future coastal land loss. The total population within the parish that is susceptible to the effects of coastal land loss are shown in the following table.

Table 2-13: Number of People Susceptible to Coastal Land Loss in Plaquemines Parish

Number of People Exposed to Hurricane Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Plaquemines Parish	23,410	23,410	100%

The Hazus hurricane model was used to identify populations vulnerable to coastal land loss throughout the jurisdictions in the tables below:

Table 2-14: Population Vulnerable to Coastal Land Loss in Plaquemines Parish

Plaquemines Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	23,410	100%
Persons Under 5 years	1,618	6.9%
Persons Under 18 years	4,813	20.6%
Persons 65 Years and Over	2,617	11.2%
White	16,506	70.5%
Minority	6,904	29.5%

Vulnerability

See Appendix C for parish and municipality buildings that are susceptible to coastal land loss and subsidence.

Flooding

A flood is the overflow of water onto land that is usually not inundated. The National Flood Insurance Program defines a flood as:

> A general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waves, unusual and rapid accumulation or runoff of surface waters from any source, mudflow, or collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Factors influencing the type and severity of flooding include natural variables such as precipitation, topography, vegetation, soil texture, and seasonality, as well as anthropogenic factors such as urbanization (extent of impervious surfaces), land use (agricultural and forestry tend to remove native vegetation and accelerate soil erosion), and the presence of flood-control structures such as levees and dams.

Excess precipitation, produced from thunderstorms or hurricanes, is often the major initiating condition for flooding, and Louisiana can have high rainfall totals at any time of day or year. During the cooler months, slow-moving frontal weather systems produce heavy rainfalls, while the summer and autumn seasons produce major precipitation in isolated thunderstorm events (often on warm afternoons) that may lead to localized flooding. During these warmer seasons, floods are overwhelmingly of the flash flood variety, as opposed to the slower-developing river floods caused by heavy stream flow during the cooler months.

In cooler months, particularly in the spring, Louisiana is in peak season for severe thunderstorms. The fronts that cause these thunderstorms often stall while passing over the state, occasionally producing rainfall totals exceeding ten inches within a period of a few days. Since soil tends to be nearly saturated at this time (due to relatively low overall evaporation rates), spring typically becomes the period of maximum stream flow across the state. Together, these characteristics increase the potential for high water, with low-lying, poorly drained areas being particularly susceptible to flooding during these months.

In Louisiana, six specific types of flooding are of main concern: riverine, flash, ponding, backwater, urban, and coastal.

- **Riverine flooding** occurs along a river or smaller stream. It is the result of runoff from heavy rainfall or intensive snow or ice melt. The speed with which riverine flood levels rise and fall depends not only on the amount of rainfall, but even more on the capacity of the river itself, as well as the shape and land cover of its drainage basin. The smaller the river, the faster that water levels rise and fall. Thus, the Mississippi River levels rise and fall slowly due to its large capacity. Generally, elongated and intensely-developed drainage basins will reach faster peak discharges and faster falls than circular-shaped and forested basins of the same area.
- **Flash flooding** occurs when locally intense precipitation inundates an area in a short amount of time, resulting in local stream flow and drainage capacity being overwhelmed.
- **Ponding** occurs when concave areas (e.g., parking lots, roads, and clay-lined natural low areas) collect water and are unable to drain.
- **Backwater flooding** occurs when water slowly rises from a normally unexpected direction where protection has not been provided. A model example is the flooding that occurred in LaPlace during Hurricane Isaac in 2012. Although the town was protected by a levee on the side facing

the Mississippi River, floodwaters from Lake Maurepas and Lake Pontchartrain crept into the community on the side of town opposite the Mississippi River.

- **Urban flooding** is similar to flash flooding but is specific to urbanized areas. It takes place when storm water drainage systems cannot keep pace with heavy precipitation, and water accumulates on the surface. Most urban flooding is caused by slow-moving thunderstorms or torrential rainfall.
- **Coastal flooding** can appear similar to any of the other flood types, depending on its cause. It occurs when normally dry coastal land is flooded by seawater, but may be caused by direct inundation (when the sea level exceeds the elevation of the land), overtopping of a natural or artificial barrier, or the breaching of a natural or artificial barrier (i.e., when the barrier is broken down by the sea water). Coastal flooding is typically caused by storm surge, tsunamis, or gradual sea level rise.

Historically, in Plaquemines Parish, most of these flooding events have historically been observed. For purposes of this assessment, ponding, flash flood, and urban flooding are considered to be flooding as a result of storm water from heavy precipitation thunderstorms

Based on stream gauge levels and precipitation forecasts, the National Weather Service (NWS) posts flood statements, watches, and warnings. The NWS issues the following weather statements with regard to flooding:

- **Flood Categories**
  - Minor Flooding: Minimal or no property damage, but possibly some public threat.
  - Moderate Flooding: Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations.
  - Major Flooding: Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
  - Record Flooding: Flooding which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.

- **Flood Warning**
  - Issued along larger streams when there is a serious threat to life or property.

- **Flood Watch**
  - Issued when current and developing hydrometeorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent.

Floods are measured mainly by probability of occurrence. A 10-year flood event, for example, is an event of small magnitude (in terms of stream flow or precipitation) but with a relatively high annual probability of recurrence (10%). A 100-year flood event is larger in magnitude, but it has a smaller chance of recurrence (1%). A 500-year flood is significantly larger than both a 100-year event and a 10-year event, but it has a lower probability than both to occur in any given year (0.2%). It is important to understand that an X-year flood event does not mean an event of that magnitude occurs only once in X years. Instead, it means that on average, we can expect a flood event of that magnitude to occur once every X years. Given that such statistical probability terms are inherently difficult for the general population to understand, the Association of State Floodplain Managers (ASFPM) promotes the use of more tangible expressions of flood probability. As such, the ASFPM also expresses the 100-year flood event as having a 25% chance of occurring over the life of a 30-year mortgage.

It is essential to understand that the magnitude of an X-year flood event for a particular area depends on the source of flooding and the area's location. The size of a specific flood event is defined through historic data of precipitation, flow, and discharge rates. Consequently, different 100-year flood events can have very different impacts. The 100-year flood event in two separate locations have the same likelihood to occur, but they do not necessarily have the same magnitude. For example, a 100-year event for the Mississippi River means something completely different in terms of discharge values (ft^3/s) than for the Amite River. Not only are the magnitudes of 100-year events different between rivers, they can be different along any given river. A 100-year event upstream is different from one downstream due to the change of river characteristics (volume, discharge, and topography). As a result, the definition of what constitutes a 100-year flood event is specific to each location, river, and time, since floodplain and river characteristics change over time. Finally, it is important to note that each flood event is unique. Two hypothetical events at the same location, given the same magnitude of stream flow, may still produce substantially different impacts if there were different antecedent moisture characteristics, different times of day of occurrence (which indicates the population's probable activities at the flood's onset), or other characteristic differences.

The 100-year flood event is of particular significance since it is the regulatory standard that determines the obligation (or lack thereof) to purchase flood insurance. Flood insurance premiums are set depending on the flood zone, as modeled by National Flood Insurance Program (NFIP) Rate Maps. The NFIP and FEMA suggest insurance rates based on Special Flood Hazard Areas (SFHAs), as diagrammed in *Figure 2-14*.

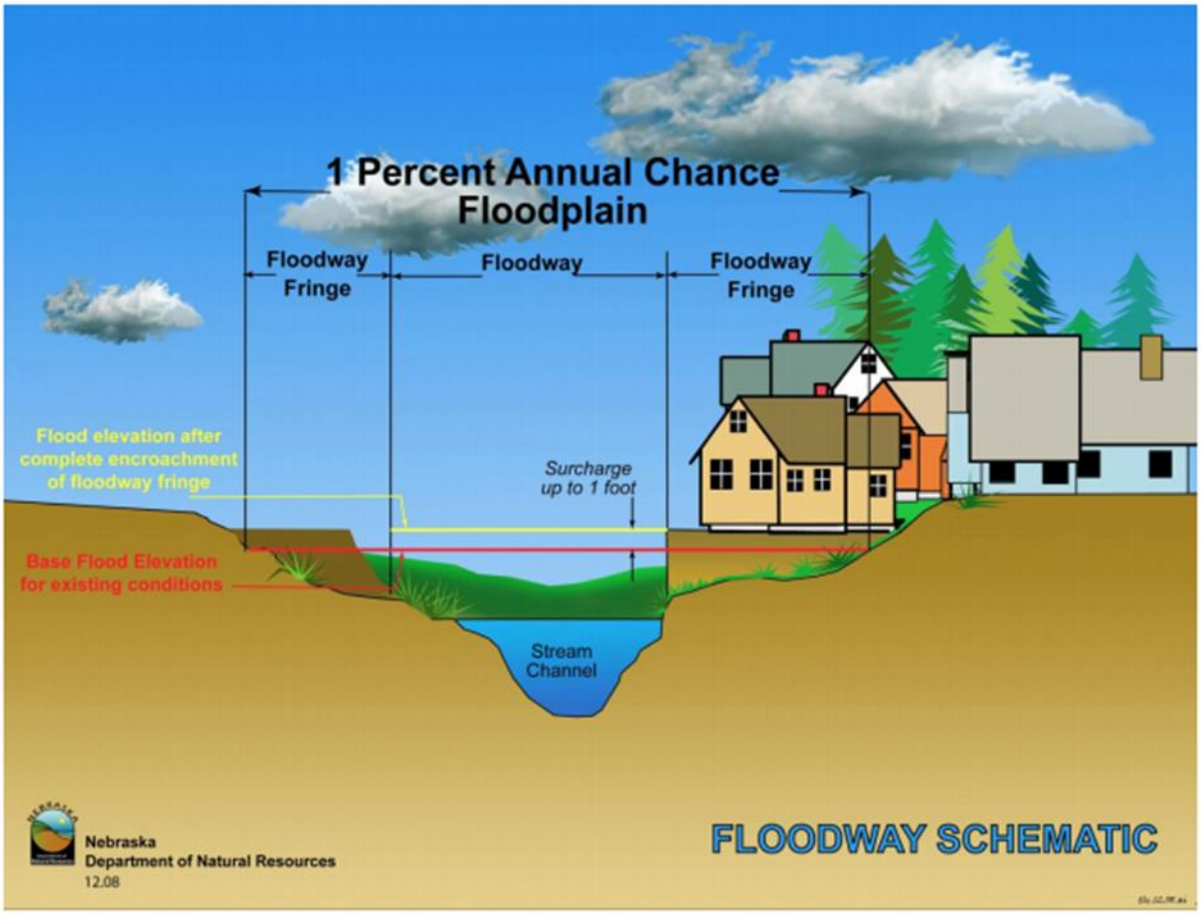


Figure 2-14: Schematic of 100-year Floodplain. The Special Flood Hazard Area (SFHA) extends to the end of the floodway fringe.
(Source: Nebraska Department of Natural Resources)

A SFHA is the land area covered by the floodwaters of the base flood (red line in *Figure 2-14*), where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.

Property Damage

The depth and velocity of flood waters are the major variables in determining property damage. Flood velocity is important because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation. In some situations, deep and fast moving waters can push a building off its foundation. Structural damage can also be caused by the weight of standing water (hydrostatic pressure).

Another threat to property from a flood is called "soaking". When soaked, many materials change their composition or shape. Wet wood will swell, and if dried too quickly, will crack, split, or warp. Plywood can come apart and gypsum wallboard can deteriorate if it is bumped before it has time to completely dry. The longer these materials are saturated, the more moisture, sediment, and pollutants they absorb.

Soaking can also cause extensive damage to household goods. Wooden furniture may become warped, making it unusable, while other furnishings such as books, carpeting, mattresses, and upholstery usually are not salvageable. Electrical appliances and gasoline engines will flood, making them worthless until they are professionally dried and cleaned.

Many buildings that have succumbed to flood waters may look sound and unharmed after a flood, but water has the potential to cause severe property damage. Any structure that experiences a flood should be stripped, cleaned, and allowed to dry before being reconstructed. This can be an extremely expensive and time consuming effort.

Repetitive Loss Properties

Repetitive loss structures are structures covered by a contract for flood insurance made available under the NFIP that:

a. Have incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded 25 percent of the market value of the structure at the time of each such flood event; and
b. At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.

Severe repetitive loss (SRL) is defined by the Flood Insurance Reform Act of 2004 and updated in the Biggert-Waters Flood Insurance Reform Act of 2012. For a property to be designated SRL, the following criteria must be met:

a. It is covered under a contract for flood insurance made available under the NFIP; and
b. It has incurred flood related damage –
    1) For which four or more separate claims payments have been made under flood insurance coverage with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or
    2) For which at least two separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Figures regarding repetitive loss structures for Plaquemines Parish are provided in the table below:

Table 2-15: Repetitive Loss Structures for Plaquemines Parish

Jurisdiction	Number of Structures	Residential	Commercial	Government	Total Claims	Total Claims Paid	Average Claim Paid
Plaquemines Parish	406	359	46	1	896	$81,977,570	$91,493

Of the 406 repetitive loss properties, 376 were able to be geocoded in order to provide an overview of where the repetitive loss structures are located throughout the parish. *Figure 2-15* shows the approximate location of the 376 structures, while *Figure 2-16* shows where the highest concentration of repetitive loss structures are located. Through the repetitive loss map, it is clear the primary concentrated area of repetitive loss structures is focused in northern area of Plaquemines Parish.

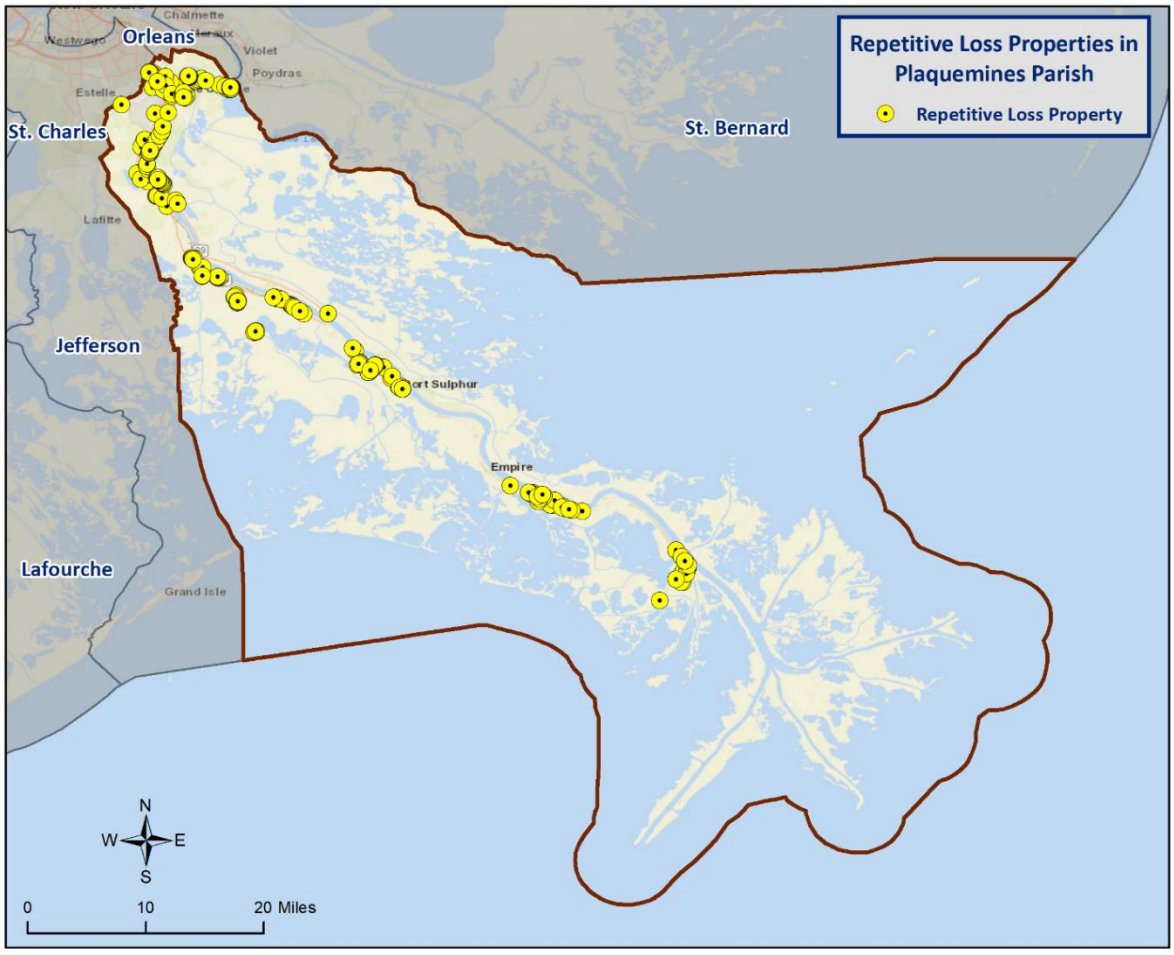


Figure 2-15: Repetitive Loss Properties in Plaquemines Parish

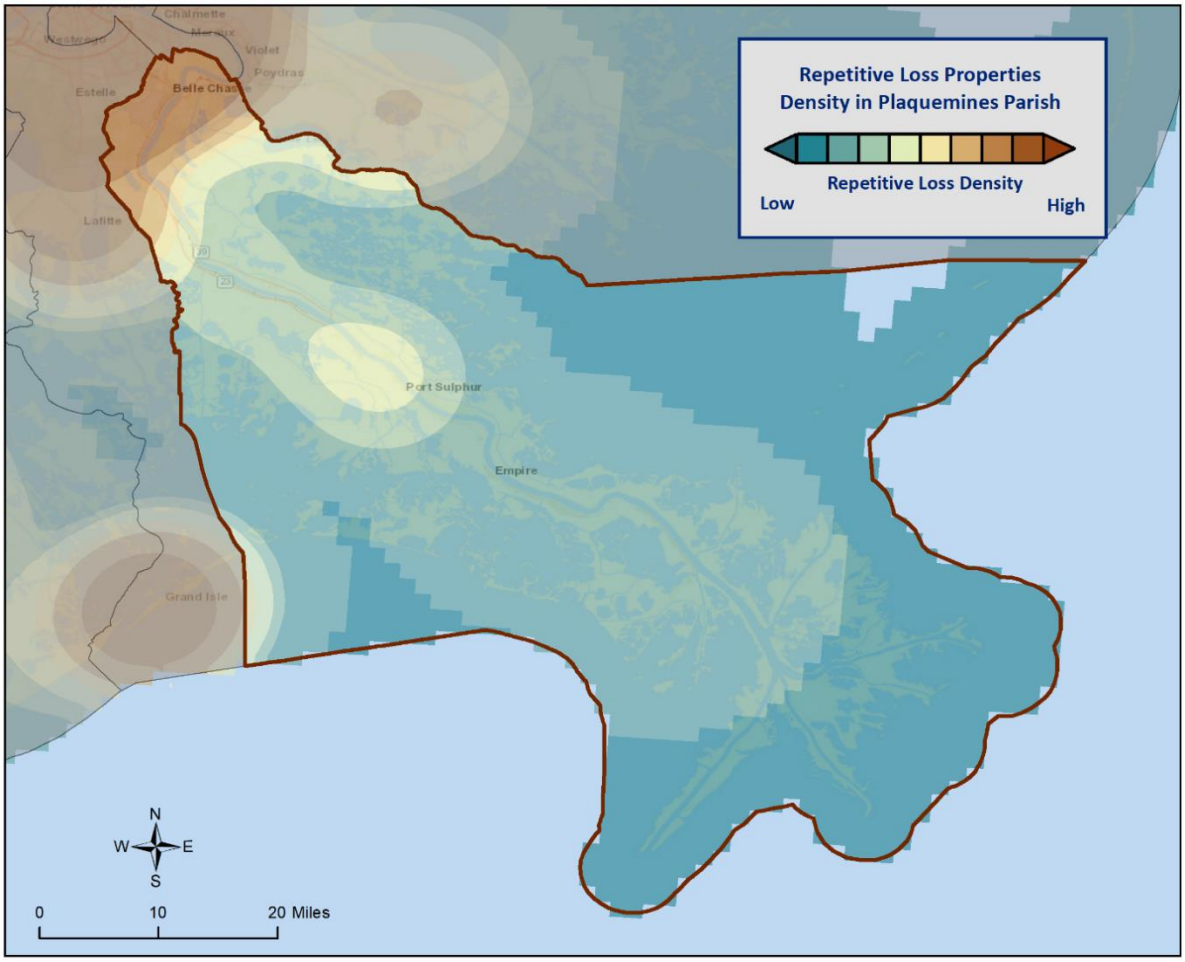


Figure 2-16: Repetitive Loss Property Densities in Plaquemines Parish

National Flood Insurance Program

Flood insurance statistics indicate that Plaquemines Parish has 5,318 flood insurance policies with the NFIP, with total annual premiums of $4,148,451. Plaquemines Parish is a participant in the NFIP. Plaquemines Parish will continue to adopt and enforce floodplain management requirements, including regulating new construction Special Flood Hazard Areas, and will continue to monitor activities including local requests for new map updates. Flood insurance statistics and additional NFIP participation details for Plaquemines Parish is provided in the tables to follow.

Table 2-16: Summary of NFIP Policies for Plaquemines Parish

Location	No. of Insured Structures	Total Insurance Coverage Value	Annual Premiums Paid	No. of Insurance Claims Filed Since 1978	Total Loss Payments
Plaquemines Parish	5,318	$1,562,668,000	$4,148,451	5,549	$358,297,539

Table 2-17: Summary of Community Flood Maps for Plaquemines Parish

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Date Joined the NFIP	Tribal
220139#	Plaquemines Parish	1/17/1985	5/1/1985	9/30/1993	5/1/1985	No

According to the Community Rating System (CRS) list of eligible communities dated May 1, 2019, Plaquemines Parish does not participate in the Community Rating System.

Threat to People

Just as with property damage, depth and velocity are major factors in determining the threat posed to people by flooding. It takes very little depth or velocity for flood waters to become dangerous. A car will float in less than two feet of moving water, and can be swept downstream into deeper waters, trapping passengers within the vehicle. Victims of floods have often put themselves in perilous situations by entering flood waters that they believe to be safe, or by ignoring travel advisories.

Major health concerns are also associated with floods. Flood waters can transport materials such as dirt, oil, animal waste, and chemicals (e.g., farm, lawn, and industrial) that may cause illnesses of various degrees when coming in contact with humans. Flood waters can also infiltrate sewer lines and inundate wastewater treatment plants, causing sewage to backup and creating a breeding ground for dangerous bacteria. This infiltration may also cause water supplies to become contaminated and undrinkable.

Flooding in Plaquemines Parish

By definition, flooding is caused when an area receives more water than the drainage system can convey. The following is a synopsis of the types of flooding that Plaquemines Parish experiences.

Flash Floods: Flash floods are characterized by a rapid rise in water level, high velocity, and large amounts of debris. They are capable of uprooting trees, undermining buildings and bridges, and scouring new channels. Major factors in flash flooding are the high intensity and short duration of rainfall, as well as the steepness of watershed and stream gradients.

Local Drainage or High Groundwater Levels: Locally heavy precipitation may produce flooding in areas other than delineated floodplains or along recognizable drainage channels. If local conditions cannot accommodate intense precipitation through a combination of infiltration and surface runoff, water may accumulate and cause flooding problems.

Backwater Flooding: Backwater flooding is normally associated with riverine flooding and connotes minimal velocity. All low-lying areas are at risk. A heavy rainfall event coupled with a swollen river, canal, bayou, or marsh hinders drainage outflow, causing backwater flooding to the same areas susceptible to storm surge.

Riverine Flooding: Riverine flooding, by definition, is river-based. Most of the riverine flooding problems occur when the Sabine River crests at flood stage levels, causing extensive flooding in low-lying areas.

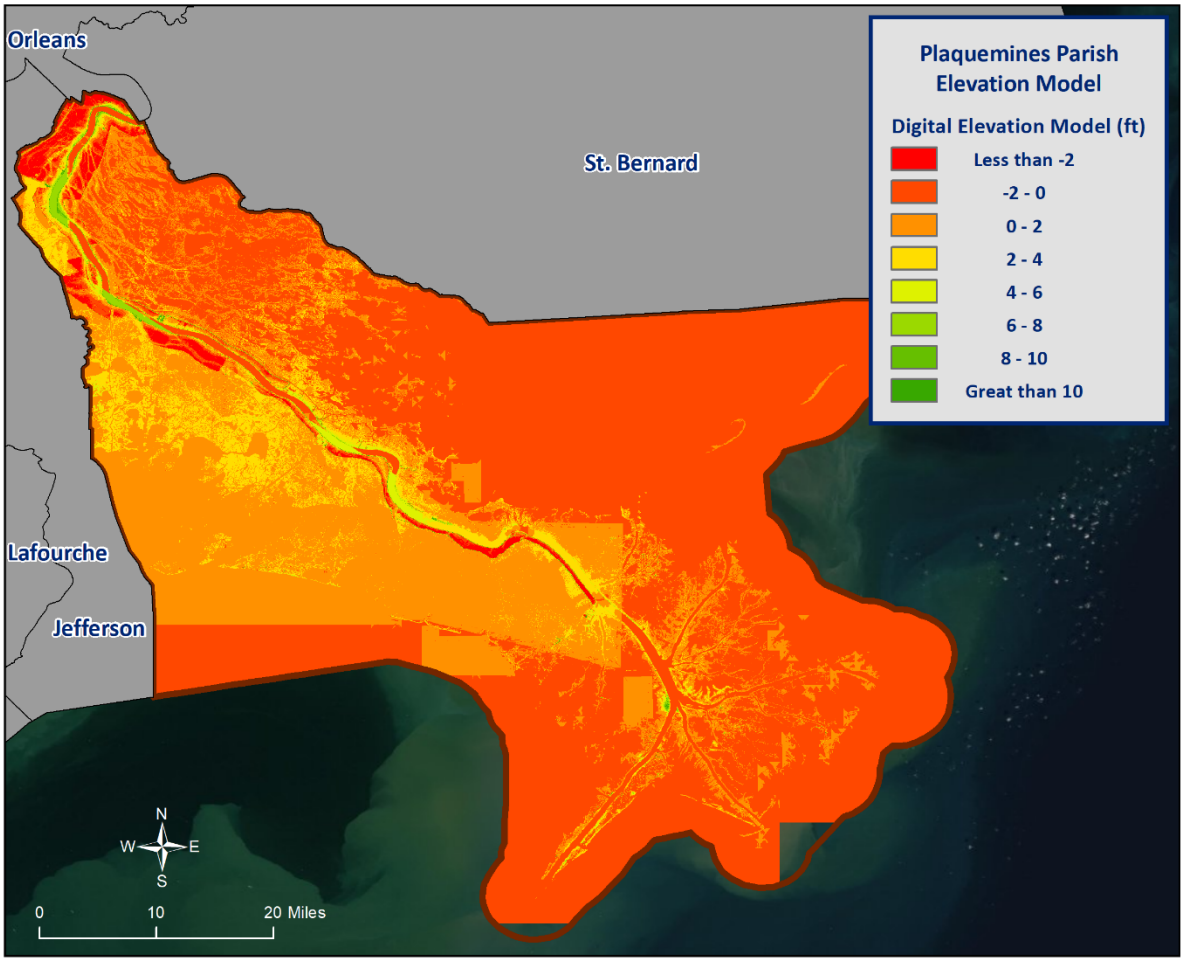


Figure 2-17: Elevation throughout Plaquemines Parish

The digital elevation model (DEM) in the figure above for Plaquemines Parish is instructive in visualizing where the low-lying and high risk areas are for the parish. Elevations in the parish range from below sea level (elevation below NAVD88) to 20 feet. The highest elevations in the parish are just over 10 feet with the highest elevation located in the vicinity of Belle Chasse (20 ft.). These higher elevations are mainly concentrated along the banks of the Mississippi River and are not common for the majority of the area.

Location

Plaquemines Parish is located at the confluence of the Ponchartrain, Mississippi, and Barataria drainage basins. All urban and agricultural land is located along the natural levee or ridge that is adjacent to the Mississippi River. All land area outside of this natural levee system is susceptible to frequent flooding due to the low-lying nature of these areas. There are several flood protection areas upriver of Plaquemines Parish designed to alleviate pressure on downriver communities. Therefore, riverine flooding would only be seen in Plaquemines Parish if the Mississippi River levee system failed or was overtopped by flood waters.

The following is a flood zone map displaying 100- and 500-year flood zones for Plaquemines Parish:

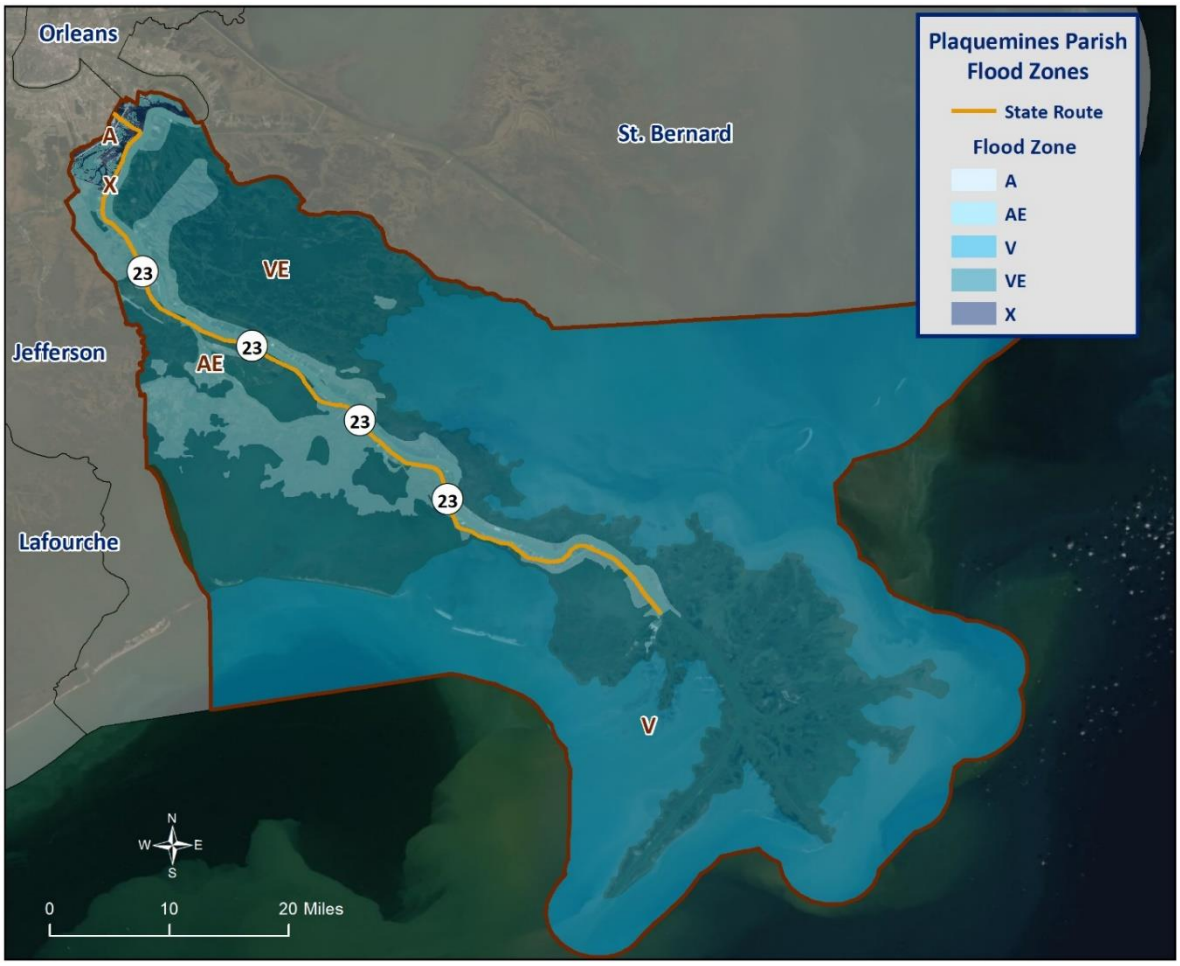


Figure 2-18: Plaquemines Parish Areas within the Flood Zones.

Previous Occurrences / Extents

Historically, there have been 28 flooding events that have created significant flooding in Plaquemines Parish between 1996 and 2019. On the next page is a brief synopsis of the five flooding events that have occurred since the last Plaquemines Parish HMP Update in 2015.

Table 2-18: Historical Floods in Plaquemines Parish with Locations since the 2015 Plaquemines Parish HMP Update

Date	Extents	Type of Flooding	Estimated Damages	Location
June 20, 2017	Elevated tides due to Tropical Storm Cindy caused low-lying areas and roads to flood. Highway 1 through Leeville and near Port Fourchon were inundated with up to 2 feet of water.	Storm Surge/Tide	$0	Lower Plaquemines Parish
October 7, 2017	Elevated tides due to Hurricane Nate caused minor impacts in the Pointe A La Hache area and other areas in lower Plaquemines Parish.	Storm Surge/Tide	$0	Lower Plaquemines Parish
July 7, 2018	Several reports of localized street flooding with 2 to 2.5 inches of rain falling in under a hour.	Heavy Rain/Flash Flood	$0	Sone Chasse
October 9, 2018	The National Ocean Service gauge at Pilots Station East reported 2.5 feet of storm surge.	Storm Surge/Tide	$0	Lower Plaquemines Parish
July 11, 2019	Storm surge flooding from Tropical Storm Barry causing a local back levee to become overtopped flooding parts of Louisiana Highway 23 and several lift stations.	Storm Surge/Tide	$0	Lower Plaquemines Parish

The worst-case scenarios are based on historical flooding events. Storm water excesses and riverine flooding primarily affect the low-lying areas of the parish, and flood depths of up to six feet can be expected in Plaquemines Parish.

Frequency / Probability

The NCEI Storm Events Database identified 28 flooding events within the Plaquemines Parish planning area since 1996. The table below shows the probability and return frequency for each jurisdiction.

Table 2-19: Annual Flood Probabilities for Plaquemines Parish

Jurisdiction	Annual Probability	Return Frequency
Plaquemines Parish	100%	1 to 2 events a year

Based on historical record, the overall flooding probability for the entire Plaquemines Parish planning area is 100%, with 28 events occurring over a 24-year period.

Estimated Potential Losses

Using the Hazus Flood Model, the 100-year flood scenario, along with the Parish DFIRM, was analyzed to determine losses from this worst-case scenario. On the next page, Table 2-20 shows the total economic losses that would result from this occurrence.

Table 2-20: Estimated Losses in Plaquemines Parish from a 100-year Flood Event (Source: Hazus)

Jurisdiction	Estimated Total Losses from 100-Year Flood Event
Plaquemines Parish	$822,863,000

The Hazus Flood model also provides a breakdown for seven primary sectors (Hazus occupancy) throughout the parish. The losses for Plaquemines Parish by sector are listed in the following table:

Table 2-21: Estimated 100-year Flood Losses for Plaquemines Parish by Sector (Source: Hazus)

Plaquemines Parish	Estimated Total Losses from 100-Year Flood Event
Agricultural	$433,000
Commercial	$172,211,000
Government	$738,000
Industrial	$101,423,000
Religious / Non-Profit	$1,113,000
Residential	$546,722,000
Schools	$223,000
Total	**$822,863,000**

Threat to People

The total population within the parish that is susceptible to a flood hazard is shown in the table below:

Table 2-22: Vulnerable Populations Susceptible to a 100-year Flood Event (Source: Hazus)

Number of People Exposed to Flood Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Plaquemines Parish	23,410	6,721	28.7%

The Hazus flood model was also extrapolated to provide an overview of vulnerable populations throughout the jurisdictions in the following table:

Table 2-23: Vulnerable Populations Susceptible to a 100-year Flood Event in Plaquemines Parish (Source: Hazus)

Plaquemines Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	6,721	28.7%
Persons Under 5 Years	464	6.9%
Persons Under 18 Years	1,382	20.6%
Persons 65 Years and Over	751	11.2%
White	4,739	70.5%
Minority	1,982	29.5%

Vulnerability

See Appendix C for parish and municipality buildings that are susceptible to flooding due to proximity within the 100-year flood plain.

Levee Failure

Levees and floodwalls are flood control barriers constructed of earth, concrete, or other materials. For the purposes of this plan, levees are distinguished from smaller flood barriers (such as berms) by their size and extent. Berms are barriers that only protect a small number of structures, or at times only a single structure. Levees and floodwalls are barriers that protect significant areas of residential, commercial, or industrial development; at a minimum, they protect a neighborhood or small community. Levee failure involves the overtopping, breach, or collapse of the levee. Levee failure is especially destructive to nearby development during flood and hurricane events.

The northern half of Louisiana is protected by levees on the Ouachita River, under the authority of the Vicksburg District of the United States Army Corp of Engineers (USACE). The Vicksburg District encompasses 68,000 mi^2 in the states of Arkansas, Mississippi and Louisiana. They manage seven drainage basins, including the Yazoo, Pearl, Big Black, Red, Ouachita, and Mississippi Rivers; 12 locks and dams on the Pearl, Red, and Ouachita Rivers; 1,808 miles of levees, including 468 miles along the Mississippi River; and multiple lakes with 1,709 miles of shoreline.

Coastal and southern Louisiana are protected by an extensive levee system under the authority of the New Orleans District of the USACE. This system includes 30,000 mi^2 of Louisiana south of Alexandria, including 961 miles of river levees in the Mississippi River and Tributaries Project, 449 miles of river levees in the Atchafalaya Basin, and 340 miles of hurricane-protection levees. Other levees have been built along stretches of rivers throughout Louisiana by local levee districts and private citizens. The data regarding these non-federal levees are managed by the individual entity responsible for construction and subsequent maintenance and are not kept in a consistent format for comprehensive hazard analysis.

The effects of a levee failure on property is similar to that of a flood, as discussed in the flooding section. One major difference is that the velocity of the water is increased in the area of the breach, so the potential for property damage is higher in these areas.

A levee failure occurs during high water events, so the populace is normally alerted to the potential danger. Levees are normally monitored during these events and the population in danger is alerted to a possible levee failure. However, if people consider themselves safe once a levee has been breached and do not evacuate, the results could be deadly.

Location

Levees play a vital role in protecting Plaquemines Parish from flooding, particularly floods caused by tropical cyclones and storm surge, but also rare occasions of Mississippi River flooding. Levees in Plaquemines Parish are located along the entire Westbank and along the Eastbank extending down to Pointe a la Hache. Levees within Plaquemines Parish are not always Federal levees designed to withstand 100-year flood events or storm surge. Many were built by local authorities to augment Federal flood protection measures or to protect communities that were not identified to receive Federal funds for flood protection. The following figure provides the location of both local and federally constructed and maintained levees.

Figure 2-19: Locally and USACE Federally Constructed, Operated, and maintained Levees in Plaquemines Parish

Previous Occurrences / Extents

The NCEI Storm Events Database does not record anthropogenic disasters such as levee failures; therefore, it was necessary to rely on local knowledge and media reports. Plaquemines Parish has experienced catastrophic loss due to levee failure in the past including failures associated with Hurricane Katrina in 2005 and Hurricane Isaac in 2012. Plaquemines Parish could experience flood inundation of approximately 20 feet in certain communities such as those located along the east bank as a worst case scenario.

Since the 2015 HMP Update, levee failures occurred within the boundaries of Plaquemines Parish due to Hurricane Barry. Storm surge of approximately four feet from Hurricane Barry overwhelmed a levee in Myrtle Grove, causing the area to become inundated with flood waters (Figure 2-20). Along Highway 26 in Pointe la Hache, a levee under construction failed, allowing flood waters to enter the area and threatened to close off the only road out of the area (Figure 2-21).

Figure 2-20: Over-topping of the Levee in Myrtle Grove, Louisiana due to Hurricane Barry (Source: Fox 10 News in Mobile, Alabama)

Figure 2-21: Failure of a Levee in Pointe a la Hache, Louisiana due to Hurricane Barry (Source: Fox 10 News in Mobile, Alabama)

Frequency / Probability

It is nearly impossible to predict and model levee failure and its impacts on Plaquemines Parish. Due to the unpredictability of levee failures, it is calculated that the probability of a levee failure is less than 1% annually.

Estimated Potential Loses

Determining the annualized loss as a result of levee failure is difficult in Plaquemines Parish as there is little data available on past levee failure events. The National Levee Database (NLD) was utilized to determine the levee systems within Plaquemines Parish, the risk level, and populace/infrastructure at risk. The NLD is a congressional authorized database that documents levees in the United States and is maintained by the U.S. Army Corps of Engineers (USACE). The table on the next page provides an extensive list of the levee systems in Plaquemines Parish with the risk associated with each system.

Table 2-24: Levee Systems and Risk Associated with each System in Plaquemines Parish and Surrounding Areas
(Source: National Levee Database)

System	Length (Miles)	People at Risk	Structures at Risk	Property Value at Risk	Overall Risk
Caernarvon to Phoenix	21.66	1,009	487	$122M	Low
Donner Canal West Bank Sub System	5.23	27,624	8,583	$4.31B	N/A
Fort Jackson Protection System	0.76	0	0	$0	N/A
Lower Donner Canal	5.12	1,058	25	$52.5M	N/A
Mississippi River (Plaquemines-1 Left Side)	17.81	904	325	$157M	N/A
Mississippi River East Bank System	35.09	0	9	$578K	N/A
New Orleans East Bank	179.15	483,442	228,581	$101B	High
New Orleans East Bank Forty Arpent	23.02	41,470	19,289	$7.51B	N/A
New Orleans West Bank	116.34	19,953	5,906	$2.06B	High
Oakhill to St. Jude Polder	56.33	2,752	1,052	$334M	Moderate
Phoenix to Bohemia Polder	30.97	890	424	$85.2M	Low
Plaquemines Levees System	3.02	79	83	$80M	N/A
St. Jude to Venice Polder	73.05	4,895	2,319	$422M	Moderate

Vulnerability

See Appendix C for parish and municipality building exposure to levee failures.

Sinkholes

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. Figure 1 illustrates the development of a cover subsidence sinkhole. As the soil sinks from the surface, a depression forms, which draws in more water, funneling it down to the water-soluble rock. 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 top soil above dissolving bedrock does not sink, but forms a bridge over the soil that is sinking beneath it. As Figure 2 demonstrates, underground soil continues to fill the bedrock fissures, until finally the soil bridge collapses and fills the void 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.

Location

Currently, there are 11 identifiable salt dome locations in Plaquemines Parish. Figure 2-22 displays the location of the salt domes. As depicted in Figure 2-22, the sink holes are located sporadically throughout Plaquemines Parish.

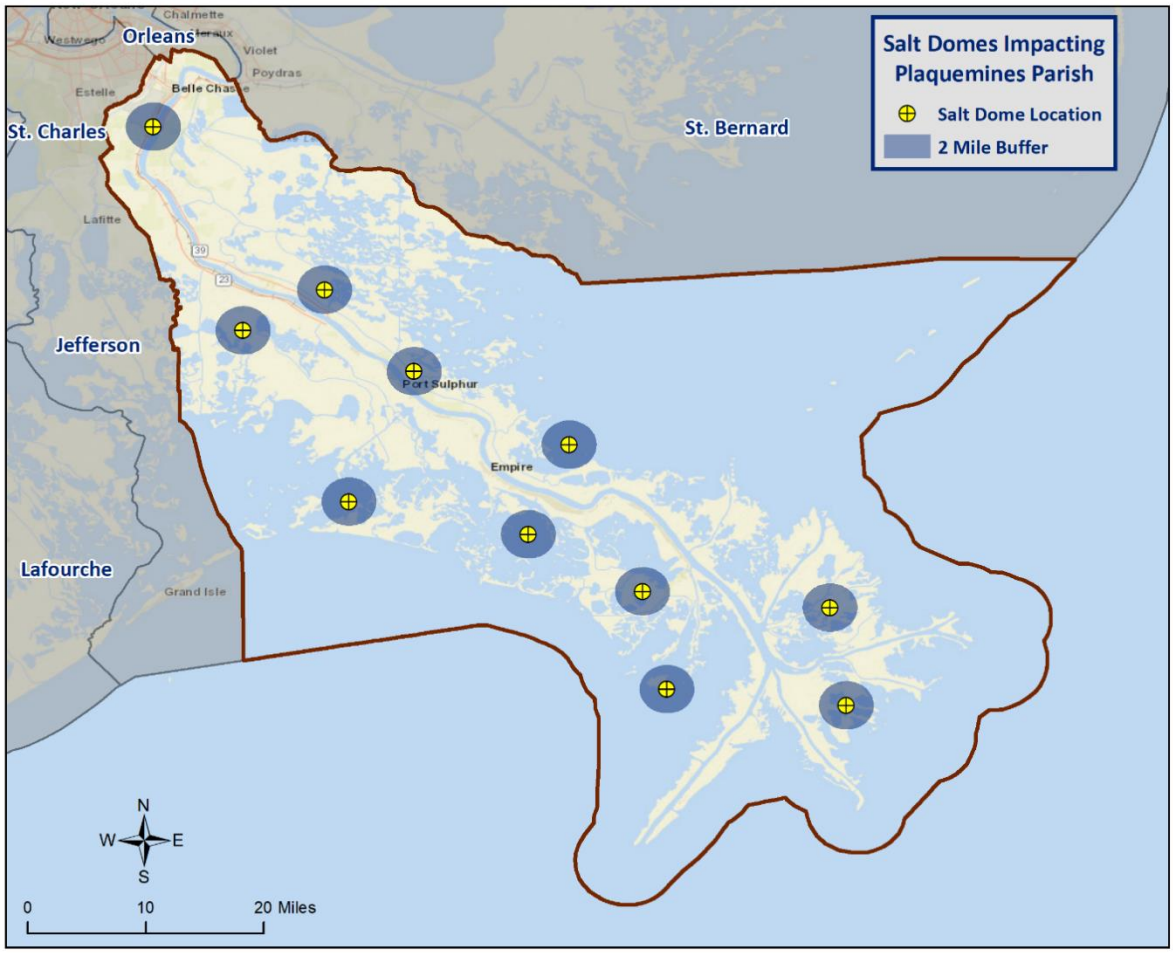


Figure 2-22: Salt Dome Locations in Plaquemines Parish

Previous Occurrences / Extent

There have been no recorded incidents of sinkholes or salt dome collapses in Plaquemines Parish to date.

Frequency / Probability

Since there has been no recorded incidents of sinkhole or salt dome collapse in Plaquemines Parish, the annual chance of occurrence is calculated at less than 1%.

Estimated Potential Losses

The salt domes were analyzed to determine the number of people and houses that are potentially susceptible to losses from a sink hole materializing from the salt dome. The table on the next page shows data on potential exposure based on a two-mile buffer around the center of the salt dome. The values were determined by querying the 2010 U.S. Census block data to determine the number of houses and people located within two miles of the salt dome. Critical facilities were also analyzed to determine if they fell within the two-mile buffer of the salt dome. Total value for all occupancy group from Hazus was used to estimate a total loss of all facilities that were within two miles of the salt domes.

Table 2-25: Estimated Potential Losses from a Sinkhole Formation
(Source: U.S. 2010 Census Data and Hazus)

Salt Dome Name	Total Building Exposure	Critical Infrastructure Exposure	Number of People Exposed	Number of Houses Exposed
Delta Duck Club	$125,000	0	0	0
Garden Island Bay	$0	0	0	0
Lake Hermitage	$6,346,000	0	37	6
Lake Washington	$0	0	0	0
Plaquemines 1	$0	1	0	0
Plaquemines 2	$0	0	0	0
Potash	$40,563,000	1	560	242
Quarantine Bay	$0	0	0	0
Stella	$225,821,000	0	3,095	1,218
Venice	$320,000	0	0	0
West Bay	$0	1	0	0

There are a total of 11 salt dome locations. Five of the salt dome locations contain structures within a two mile buffer which could be impacted by a salt dome collapse, with the buffer of three salt domes containing critical infrastructure. There is $273,175,000 infrastructure value, 3,692 people, 1,360 homes, and three critical infrastructure facilities exposed to potential sinkhole hazards within Plaquemines Parish.

Vulnerability

See Appendix C for parish and municipality building exposure to a sinkhole hazard.

Thunderstorms

The term "thunderstorm" is usually used as a catch-all term for several kinds of storms. Here "thunderstorm" is defined to include any precipitation event in which thunder is heard or lightning is seen. Thunderstorms are often accompanied by heavy rain and strong winds and, depending on conditions, occasionally by hail or snow. Thunderstorms form when humid air masses are heated, which causes them to become convectively unstable and therefore rise. Upon rising, the air masses' water vapor condenses into liquid water and/or deposits directly into ice when they rise sufficiently to cool to the dew-point temperature.

Thunderstorms are classified into four main types (single-cell, multicell, squall line, and supercell), depending on the degree of atmospheric instability, the change in wind speed with height (called wind shear), and the degree to which the storm's internal dynamics are coordinated with those of adjacent storms. There is no such interaction for single-cell thunderstorms, but there is significant interaction with clusters of adjacent thunderstorms in multicell thunderstorms and with a linear "chain" of adjacent storms in squall line thunderstorms. Though supercell storms have no significant interactions with other storms, they have very well-organized and self-sustaining internal dynamics, which allows them to be the longest-lived and most severe of all thunderstorms.

The life of a thunderstorm proceeds through three stages: the developing (or cumulus) stage, the mature stage, and the dissipation stage. During the developing stage, the unstable air mass is lifted as an updraft into the atmosphere. This sudden lift rapidly cools the moisture in the air mass, releasing latent heat as condensation and/or deposition occurs, and warming the surrounding environment, thus making it less dense than the surrounding air. This process intensifies the updraft and creates a localized lateral rush of air from all directions into the area beneath the thunderstorm to feed continued updrafts. At the mature stage, the rising air is accompanied by downdrafts caused by the shear of falling rain (if melted completely), or hail, freezing rain, sleet, or snow (if not melted completely). The dissipation stage is characterized by the dominating presence of the downdraft as the hot surface that gave the updrafts their buoyancy is cooled by precipitation. During the dissipation stage, the moisture in the air mass largely empties out.

The Storm Prediction Center in conjunction with the National Weather Service (NWS) have the ability to issue advisory messages based on forecasts and observations. The following are the advisory messages that may be issued with definitions of each:

- *Severe Thunderstorm Watch*: Issued to alert people to the possibility of a severe thunderstorm developing in the area. Expected time frame for these storms is three to six hours.

- *Severe Thunderstorm Warning*: Issued when severe thunderstorms are imminent. This warning is highly localized and covers parts of one to several counties (parishes).

A variety of hazards might be produced by thunderstorms, including lightning, hail, tornadoes or waterspouts, flash floods, and high-speed winds called downbursts. Nevertheless, given all of these criteria, the National Oceanic and Atmospheric Administration (NOAA) characterizes a thunderstorm as severe when it produces one or more of the following:

- Hail of 1 inch in diameter or larger
- Wind gusts to 58 mph or greater
- One or more tornadoes

Tornadoes and flooding hazards have been profiled within this report; therefore, for the purpose of thunderstorms, the sub hazards of hail, high winds, and lightning will be profiled.

Thunderstorms occur throughout Louisiana at all times of the year, although the types and severity of those storms vary greatly, depending on a wide variety of atmospheric conditions. Thunderstorms generally occur more frequently during the late spring and early summer when extreme variations exist between ground surface temperatures and upper atmospheric temperatures.

Hazard Description

Hailstorms

Hailstorms are severe thunderstorms in which balls or chunks of ice fall along with rain. Hail develops in the upper atmosphere initially as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface, fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, get caught in another updraft whereupon re-freezing and deposition grows another concentric layer of ice, and fall after developing enough weight, sometimes after several trips up and down the cloud. The size of hailstones varies depending on the severity and size of the thunderstorm. Higher surface temperatures generally mean stronger updrafts, which allows more massive hailstones to be supported by updrafts, leaving them suspended longer. This longer time means larger hailstone sizes. The tables on the next page display the TORRO Hailstorm Intensity Scale along with a spectrum of hailstone diameters and their everyday equivalents.

Table 2-26: TORRO Hailstorm Intensity Scale

Intensity Category		Hail Diameter (mm)	Probable Kinetic Energy	Typical Damage Impacts
H0	Hard Hail	5	0 - 20	No damage
H1	Potentially Damaging	5 - 15	>20	Slight general damage to plant, crops
H2	Significant	10 - 20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20 - 30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25 - 40	>500	Widespread glass damage, vehicle body work
H5	Destructive	30 - 50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40 - 60		Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50 - 75		Severe roof damage, risk of serious injuries
H8	Destructive	60 - 90		Severe damage to aircraft bodywork
H9	Super Hailstorms	75 - 100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Table 2-27: Spectrum of Hailstone Diameters and their Everyday Description. (Source: National Weather Service)

Spectrum of Hailstone Diameters	
Hail Diameter Size	**Description**
1/4”	Pea
1/2”	Plain M&M
3/4”	Penny
7/8”	Nickle
1” (severe)	Quarter
1 1/4”	Half Dollar
1 1/2”	Ping Pong Ball / Walnut
1 3/4”	Golf Ball
2”	Hen Egg / Lime
2 1/2"	Tennis Ball
2 3/4"	Baseball
3”	Teacup / Large Apple
4”	Softball
4 1/2"	Grapefruit
4 3/4” – 5”	Computer CD-DVD

Hailstorms can cause widespread damage to homes and other structures, automobiles, and crops. While the damage to individual structures or vehicles is often minor, the cumulative cost to communities, especially across large metropolitan areas, can be quite significant. Hailstorms can also be devastating to crops. Thus, the severity of hailstorms depends on the size of the hailstones, the length of time the storm lasts, and where it occurs. Hail rarely causes loss of life, although large hailstones can cause bodily injury.

High Winds

In general, high winds can occur in a number of different ways, within and without thunderstorms. The Federal Emergency Management Agency (FEMA) distinguishes these as shown in *Table 2-28*.

Table 2-28: High Winds Categorized by Source, Frequency, and Duration
(Source: Making Critical Facilities Safe from High Wind, FEMA)

High Winds Categories			
High Wind Type	**Description**	**Relative Frequency in Louisiana**	**Relative Maximum Duration in Louisiana**
Straight-line Winds	Wind blowing in straight line; usually associated with intense low-pressure area	High	Few-minutes – 1 day
Downslope Winds	Wind blowing down the slope of a mountain; associated with temperature and pressure gradients	N/A	N/A
Thunderstorm Winds	Wind blowing due to thunderstorms, and thus associated with temperature and pressure gradients	High (especially in the spring and summer	~Few minutes – several hours
Downbursts	Sudden wind blowing down due to downdraft in a thunderstorm; spreads out horizontally at the ground, possibly forming horizontal vortex rings around the downdraft	Medium-to-High(~5% of all thunderstorms)	~15 – 20 minutes
Northeaster (nor'easter) Winds	Wind blowing due to cyclonic storm off the east coast of North America; associated with temperature and pressure gradients between the Atlantic and land	N/A	N/A
Hurricane Winds	Wind blowing in spirals, converging with increasing speed toward eye; associated with temperature and pressure gradients between the Atlantic and Gulf and land	Low-to-Medium	Several days
Tornado Winds	Violently rotating column of air from base of a thunderstorm to the ground with rapidly decreasing winds at greater distances from center; associated with extreme temperature gradient	Low-to-Medium	Few minutes – few hours

The only high winds of present concern are thunderstorm winds and downbursts. Straight-line winds are common but are a relatively insignificant hazard (on land) compared to other high winds. Downslope winds are common but relatively insignificant in the hilly areas of Louisiana where they occur. Nor'easters are cyclonic events that have at most a peripheral effect on Louisiana, and none associated with high winds. Winds associated with hurricanes and tornadoes will be considered in their respective sections.

Table 2-29 presents the Beaufort Wind Scale, first developed in 1805 by Sir Francis Beaufort, which aids in determining relative force and wind speed based on the appearance of wind effects.

Table 2-29: Beaufort Wind Scale
(Source: NOAA's SPC)

Beaufort Wind Scale			
Force	**Wind (MPH)**	**WMO Classification**	**Appearance of Wind Effects on Land**
			Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-7	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	8-12	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	13-17	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	18-24	Fresh Breeze	Small trees in leaf begin to sway
6	25-30	Strong Breeze	Larger tree branches moving, whistling in wires
7	31-38	Near Gale	Whole trees moving, resistance felt walking against wind
8	39-46	Gale	Twigs breaking off trees, generally impedes progress
9	47-54	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	55-63	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	54-73	Violent Storm	
12	74+	Hurricane	

Major damage directly caused by thunderstorm winds is relatively rare, while minor damage is common and pervasive, and most noticeable when it contributes to power outages. These power outages can have major negative impacts such as increased tendency for traffic accidents, loss of revenue for businesses, increased vulnerability to fire, food spoilage, and other losses that might be sustained by a loss of power.

Power outages may pose a health risk for those requiring electric medical equipment and/or air conditioning.

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. 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 has the ability to cause negative long-term health effects to the individual that is struck. The following table outlines the lightning activity level that is a measurement of lightning activity.

Table 2-30: Lightning Activity Level (LAL) Grids

LAL	Cloud and Storm Development	Lightning Strikes/15 Min
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. 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.	>25
6	Similar to LAL 3 except thunderstorms are dry	

Hazard Profile

Hailstorms

Location

Hailstorms are a meteorological phenomenon that can occur anywhere. Therefore, the entire planning area for Plaquemines Parish is at risk for hailstorms. The worst-case scenario for hailstorms is hail up to a 2” diameter.

Previous Occurrences / Extents

Historically, there have been 17 hail incidents in Plaquemines Parish. Hailstorm diameters have ranged from one inch to two inches per the National Climatic Data Center since 1950. The most frequently recorded hail sizes have been 1.75-inch in diameter. Since the last update, there has been one hailstorm event in Plaquemines Parish. On the next page, Table 2-31 provides an overview of the hail storm which impacted the Plaquemines Parish Planning area since the 2015 Plaquemines Parish HMP update.

Table 2-31: Hailstorm Events in Plaquemines Parish since the 2015 Hazard Mitigation Plan Update (Source: NCEI Storm Events Database)

Date	Recorded Hail Size (inches)	Location
June 27, 2019	1	SONE CHASSE

Frequency

Hailstorms occur frequently within Plaquemines Parish with an annual chance of occurrence calculated at 24% based on the records for the past 70 years (1950-2019). *Figure 2-23* displays the density of hail storm events in Plaquemines Parish, while *Figure 2-24* provides an overview of hailstorm size based on location.

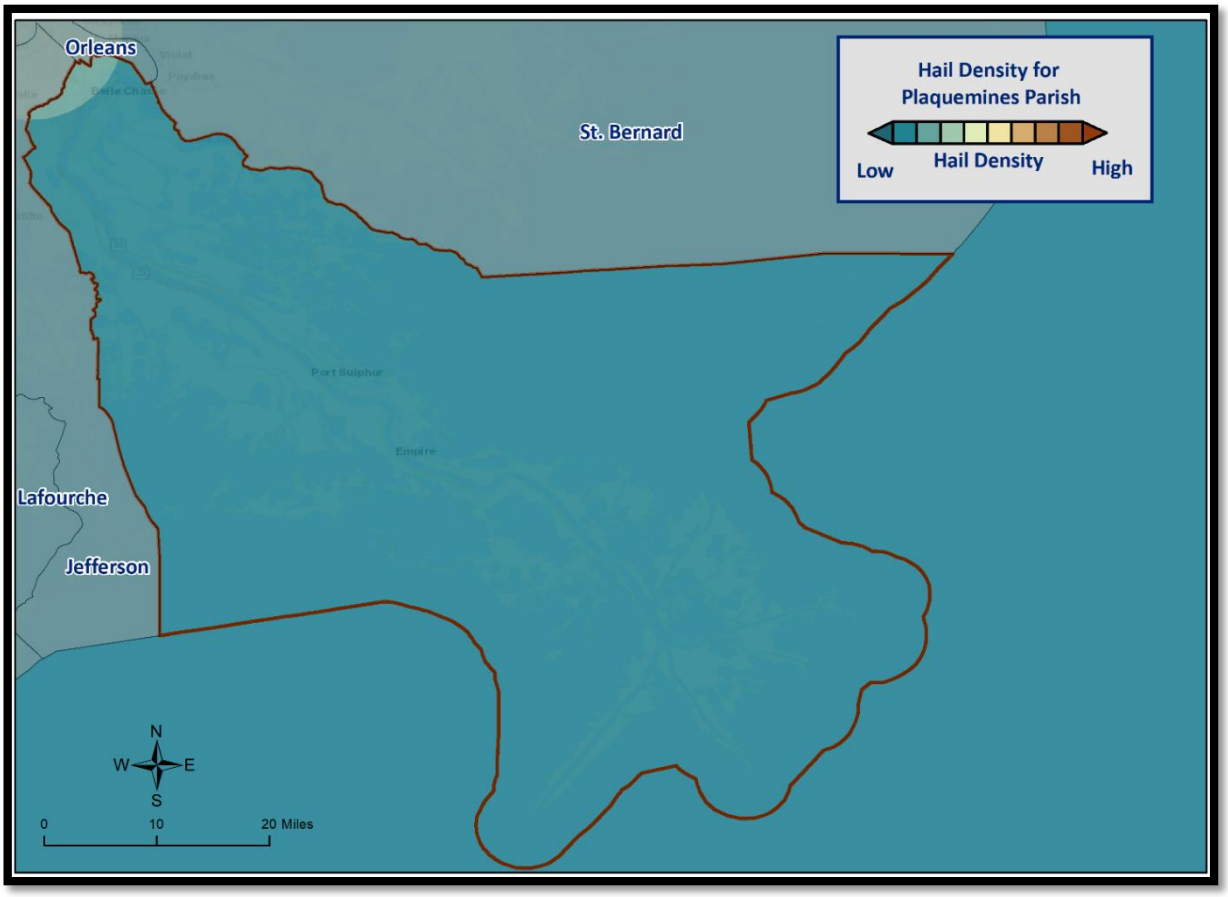


Figure 2-23: Density of Hailstorms by Diameter from 1950-2019

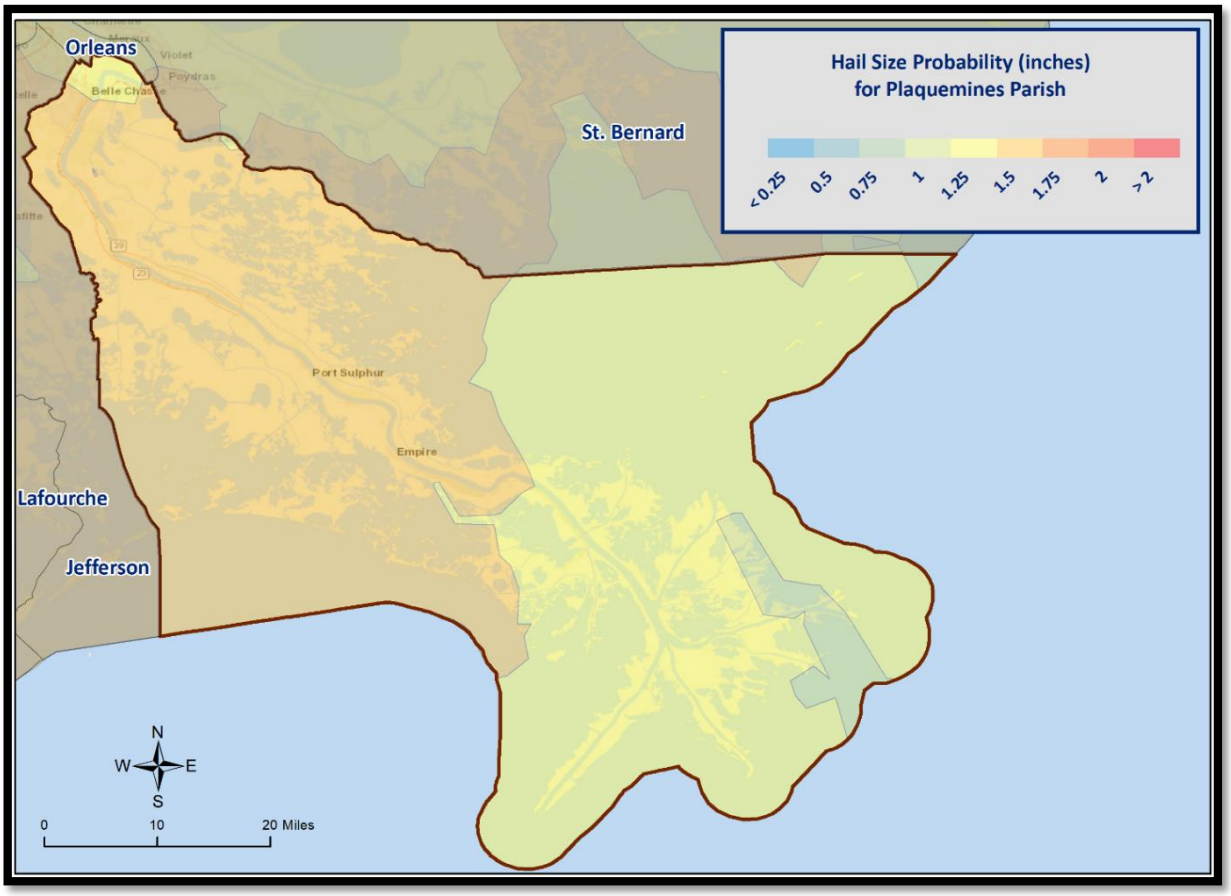


Figure 2-24: Hail Size Probability in Inches for Plaquemines Parish

Estimated Potential Losses

Per the NCEI Storm Events Database, there have been 17 hailstorm events in Plaquemines Parish; however, there have been no reported damage, fatalities, or injuries as a result of these events.

Vulnerability

See Appendix C for parish and municipality buildings that are susceptible to hailstorms.

High Winds

Location

Because high winds are a meteorological phenomenon that can occur anywhere, the entire planning area for Plaquemines Parish is at risk from high winds. The worst-case scenario for thunderstorm high wind is wind speeds of approximately 100 mph.

Previous Occurrences / Extents

Historically, there have been 77 thunderstorm high wind events in Plaquemines Parish. High winds have ranged from 57 mph to 100 mph per the National Climatic Data Center since 1950. The most frequently recorded high wind speed has been 57 mph. Since the last update, there has been one high wind event in Plaquemines Parish. Table 2-32 provides an overview of the high wind speed which impacted the Plaquemines Parish Planning area since the 2015 Plaquemines Parish HMP update.

Table 2-32: Previous Occurrences for Thunderstorm High Wind Events since the 2015 Hazard Mitigation Plan Update
(Source: NCEI Storm Events Database)

Location	Date	Recorded Wind Speeds (mph)	Property Damage	Crop Damage
POINTE A LA HACHE	April 13, 2016	69	$0	$0

Frequency

High winds are a common occurrence within Plaquemines Parish with an annual chance of occurrence calculated at 100% based on the records for the past 70 years (1950-2019). *Figure 2-25* provides an overview of thunderstorm wind speed probabilities in Plaquemines Parish.

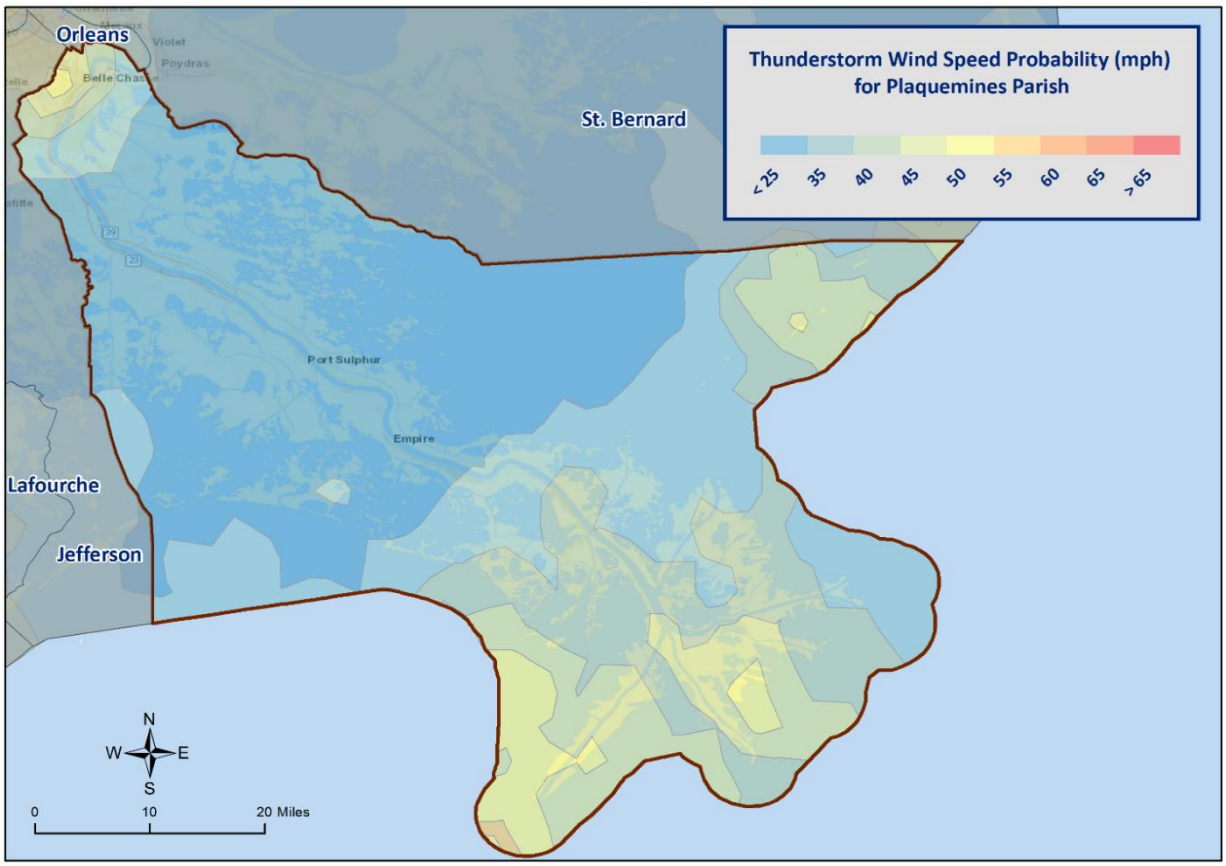


Figure 2-25: Thunderstorm High Wind Speed Probability in Miles Per Hour for Plaquemines Parish

Estimated Potential Losses

Since 1950, there have been 77 significant wind events that have resulted in property damages according to NCEI Storm Events Database. The total property damages associated with those storms have totaled approximately $666,500. To estimate the potential losses of a wind event on an annual basis, the total damages recorded for wind events was divided by the total number of years of available wind data in the NCEI Storm Events Database (1950 - 2019). This provides an annual estimated potential loss of $9,521 and $8,656 per event. The table on the next page provides an estimate of potential property losses for Plaquemines Parish:

Table 2-33: Estimated Annual Property Losses in Plaquemines Parish resulting from Wind Damage

Estimated Annual Potential Losses from Thunderstorm Winds for Plaquemines Parish
$9,521

There have been no reported injuries or fatalities as a result of a thunderstorm high wind event over the 70-year record.

Vulnerability

See Appendix C for parish and municipality buildings that are susceptible to thunderstorm high winds.

Lightning

Location

Like hail and high winds, lightning is a meteorological phenomenon that can occur anywhere within the Plaquemines Parish planning area. The worst-case scenario for lightning events is a lightning activity level of 4 which is approximately 16 to 25 lightning strikes every 15 minutes.

Previous Occurrences / Extent

Historically, there has been one lightning event in Plaquemines Parish between the years 1950 and 2019. Since the last HMP update, there have been no significant lighting events within the boundaries of Plaquemines Parish.

Frequency

Lightning can strike anywhere and is produced by every thunderstorm, so the chance of lightning occurring in Plaquemines Parish is high. However, lightning that meets the definition that is used by the NCEI Storm Events Database that results in damages to property and injury or death to people is a less likely event. Plaquemines Parish experienced one significant lightning event between the years 1950 and 2019 resulting in a < 1% annual chance of occurrence.

Estimated Potential Losses

Per the NCEI Storm Events Database, there has been on lightning event in Plaquemines Parish; however, there have been no reported damage, fatalities, or injuries as a result of this event.

Vulnerability

See Appendix C for parish and municipality building exposure to lightning hazards.

Tornadoes

Tornadoes (also called twisters and cyclones) are rapidly rotating funnels of wind extending between storm clouds and the ground. For their size, tornadoes are the most severe storms, and 70% of the world's reported tornadoes occur within the continental United States, making them one of the most significant hazards Americans face. Tornadoes and waterspouts form during severe weather events, such as thunderstorms and hurricanes, when cold air overrides a layer of warm air, causing the warm air to rise rapidly, which usually occurs in a counterclockwise direction in the northern hemisphere. The updraft of air in tornadoes always rotates because of wind shear (differing speeds of moving air at various heights), and it can rotate in either a clockwise or counterclockwise direction; clockwise rotations (in the northern hemisphere) will sustain the system, at least until other forces cause it to die seconds to minutes later.

Since February 1, 2007, the Enhanced Fujita (EF) Scale has been used to classify tornado intensity. The EF Scale classifies tornadoes based on their damage pattern rather than wind speed; wind speed is then derived and estimated. This contrasts with the Saffir-Simpson scale used for hurricane classification, which is based on measured wind speed. *Table 2-34* shows the EF scale in comparison with the old Fujita (F) Scale, which was used prior to February 1, 2007. When discussing past tornadoes, the scale used at the time of the hazard is used. Damage and adjustment between scales can be made using the following tables.

Table 2-34: Comparison of the Enhanced Fujita (EF) Scale to the Fujita (F) Scale

	Enhanced Fujita Scale					
	EF0	**EF1**	**EF2**	**EF3**	**EF4**	**EF5**
Wind Speed (mph)	65-85	86-110	111-135	136-165	166-200	>200
	Fujita Scale					
	F0	**F1**	**F2**	**F3**	**F4**	**F5**
	<73	73-112	113-157	158-206	207-260	>261

Table 2-35: Fujita and Enhanced Fujita Tornado Damage Scale

Scale	Typical Damage
F0/EF0	Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.
F1/EF1	Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2/EF2	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; light-object missiles generated; cars lifted off ground.
F3/EF3	Severe damage. Roofs and some walls torn of well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4/EF4	Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5/EF5	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

The National Weather Service (NWS) has the ability to issue advisory messages based on forecasts and observations. The following are the advisory messages that may be issued with definitions of each:

- *Tornado Watch*: Issued to alert people to the possibility of a tornado developing in the area. A tornado has not been spotted but the conditions are favorable for tornadoes to occur.
- *Tornado Warning*: Issued when a tornado has been spotted or when radar identifies a distinctive "hook-shaped" area within a thunderstorm line.

Structures within the direct path of a tornado vortex are often reduced to rubble. Structures adjacent to the tornado's path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path, that the building type and construction techniques are critical to the structure's survival. Although tornadoes strike at random, making all buildings vulnerable, mobile homes, homes on crawlspaces, and buildings with large spans are more likely to suffer damage.

The major health hazard from tornadoes is physical injury from flying debris or being in a collapsed building or mobile home. Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions, any glass, brick, or other debris blown into the interior is life threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged.

Peak tornado activity in Louisiana occurs during the spring, as it does in the rest of the United States. Nearly one-third of observed tornadoes in the United States occur during April. About half of those in Louisiana, including many of the strongest, occur between March and June. Fall and winter tornadoes are less frequent, but the distribution of tornadoes throughout the year is more uniform in Louisiana than in locations farther north.

Location

While there is a significant tornado record in Plaquemines Parish with locations included, tornadoes in general are a climatological based hazard and have the same approximate probability of occurring throughout the entire area of Plaquemines Parish. Because a tornado has a similar probability of striking anywhere within the planning area for Plaquemines Parish, all areas in the parish are equally at risk for tornadoes.

Previous Occurrences / Extent

The NCEI Storm Events Database reports a total of 28 tornadoes or waterspouts occurring within the boundaries of Plaquemines Parish since 1950 ranging in extent from F0 to F3 under the Fujita Scale and EF0 on the Enhanced Fujita Scale. Plaquemines Parish can expect future tornadoes up to an EF4 under the Enhanced Fujita Scale as a worst case scenario.

The most destructive tornado to impact Plaquemines Parish was a F2 tornado which occurred on October 30, 1967. Five homes and one house trailer were demolished, and the roof was torn off of St. Thomas Church. The pastor's residence next door to the church was demolished and two other homes near the church severely damaged. The tornado was responsible for over $250,000 in property damage and five injuries.

Since the 2015 HMP Update, two tornadoes have occurred within the boundaries of Plaquemines Parish. Below is a list and brief description of the impacts for each event.

Table 2-36: Historical Tornadoes in Plaquemines Parish with Locations since the 2015 Update

Date	Impacts	Property Damage	Location	Magnitude
May 19, 2016	0.05 mile path with a width of 50 yards. Twisted the trunk of a large oak tree and toppled a pecan tree near the Mississippi River on East St. Peters Street.	$0	UNINCORPORATED AREA	EF0
May 4, 2019	0.1 mile path with a width of 25 yards. A waterspout appeared over a marshy area near Delacroix. No damage reported.	$0	UNINCORPORATED AREA	EF0

Frequency / Probability

Tornadoes occur relatively frequently within Plaquemines Parish, with an annual chance of occurrence calculated at 40% based on the records for the past 70 years (1950-2019). *Figure 2-26* displays the density of tornado touchdowns in Plaquemines Parish and neighboring parishes.

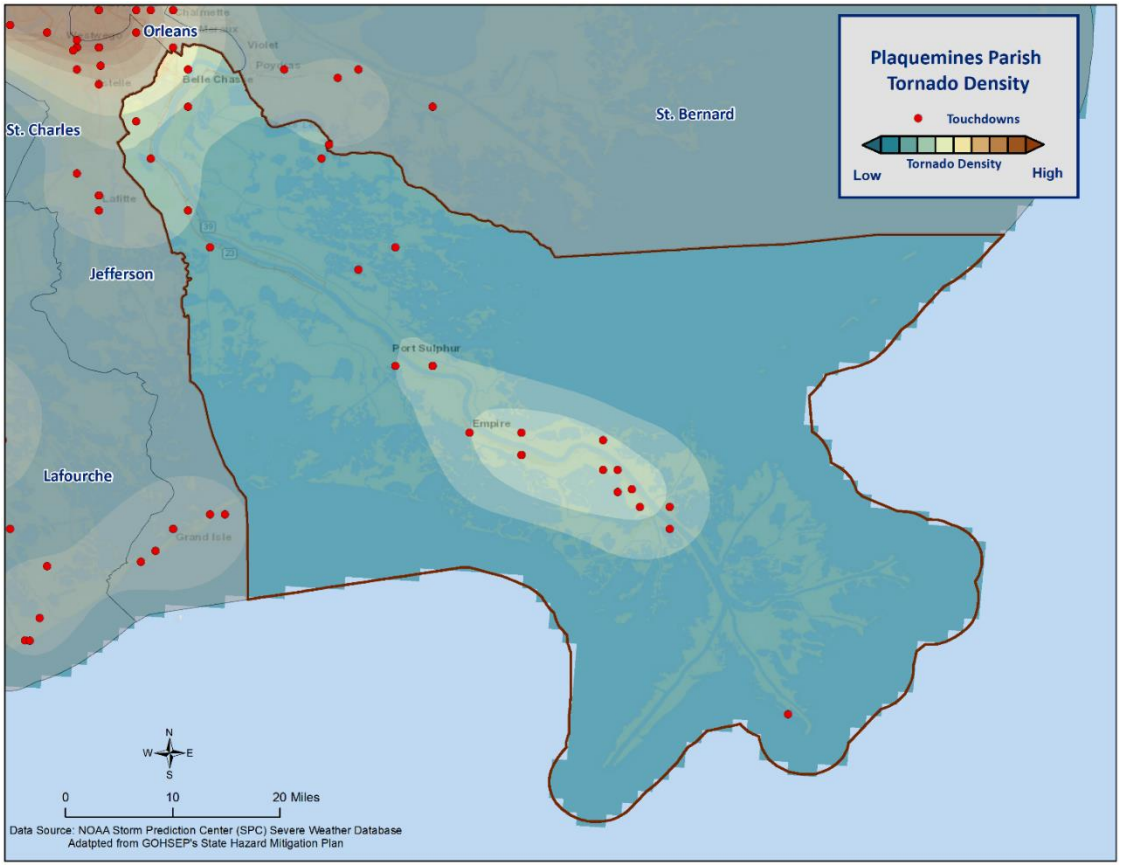


Figure 2-26: Location and Density of Tornadoes to Touchdown in Plaquemines Parish (Source: NOAA/SPC Severe Weather Database)

Estimated Potential Loses

According to the NCEI Storm Events Database, there have been 20 tornadoes that have caused some level of property damage. The total damage from the actual claims for property is approximately $690,000 with an average cost of $24,643 per tornado event. When annualizing the total cost over the 70-year record, total annual loses based on tornadoes are estimated to be $9,857. *Table 2-37* provides an annual estimate of potential losses for Plaquemines Parish.

Table 2-37: Estimated Annual Losses for Tornadoes in Plaquemines Parish

Estimated Annual Potential Losses from Tornadoes for Plaquemines Parish
$24,643

Table 2-38 presents an analysis of building exposure that are susceptible to tornadoes by general occupancy type for Plaquemines Parish along with the percentage of building stock that are mobile homes.

Table 2-38: Building Exposure by General Occupancy Type for Tornadoes in Plaquemines Parish (Source: FEMA's Hazus 2.2)

Building Exposure by General Occupancy Type for Tornadoes Exposure Types ($1,000)							
Residential	Commercial	Industrial	Agricultural	Religion	Government	Education	Mobile Homes (%)
1,691,980	384,300	146,852	10,340	60,057	29,012	21,678	24.3%

Plaquemines Parish has suffered through a total of five days in which tornadoes or waterspouts have accounted for 11 injuries and no fatalities during this 70-year period (*Table 2-39*). The average injury per event for Plaquemines Parish is 0.39 per tornado, with an average of 0.16 per year for the 70-year period.

Table 2-39: Tornadoes in Plaquemines Parish by Magnitude that Caused Injuries and/or Deaths

Date	Magnitude	Deaths	Injuries
March 31, 1957	F1	0	3
March 1, 1965	F2	0	1
October 30, 1967	F2	0	5
October 30, 1967	F2	0	1
March 19, 1986	F0	0	1

In assessing the overall risk to population, the most vulnerable population throughout the parish are those residing in manufacturing housing. Approximately 24.3% of all housing in Plaquemines Parish is comprised of manufactured housing. Based on location data collected in a previous hazard mitigation project, there are 18 known locations where manufactured housing is concentrated. The location and density of manufactured houses can be seen below in Figure 2-27.

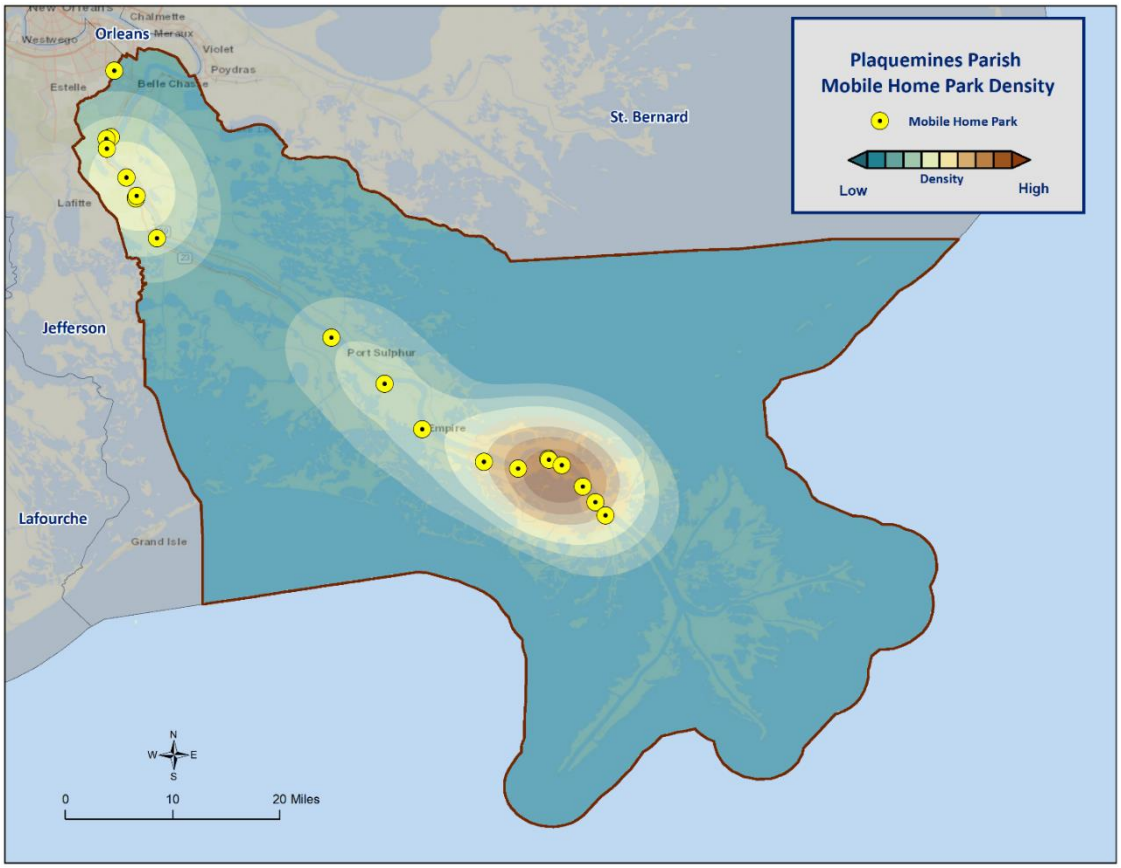


Figure 2-27: Location and Approximate Number of Units in Manufactured Housing Locations throughout Plaquemines Parish

Vulnerability

See Appendix C for parish and municipality building exposure to tornadoes.

Tropical Cyclones

Tropical cyclones are among the worst hazards Louisiana faces, especially in the southern and coastal parishes. These spinning, low-pressure air masses draw surface air into their centers and attain strength ranging from weak tropical waves to the most intense hurricanes. Usually, these storms begin as clusters of oceanic thunderstorms off the western coast of Africa, moving westward in the trade wind flow. The spinning of these thunderstorm clusters begins because of the formation of low pressure in a perturbation in the westerly motion of the storms associated with differential impacts of the Earth's rotation. The west-moving, counterclockwise-spinning collection of storms, now called a tropical disturbance, may then gather strength as it draws humid air toward its low-pressure center. This results in the formation of a tropical depression (defined when the maximum sustained surface wind speed is 38 mph or less), then a tropical storm (when the maximum sustained surface wind ranges from 39 mph to 73 mph), and finally a hurricane (when the maximum sustained surface wind speeds exceed 73 mph). On the next page, the table presents the Saffir-Simpson Hurricane Wind Scale, which categorizes tropical cyclones based on sustained winds.

Table 2-40: Saffir-Simpson Hurricane Wind Scale

Saffir-Simpson Hurricane Wind Scale			
Category	**Sustained Winds**	**Pressure**	**Types of Damage Due to Winds**
Tropical Depression	<39 mph	N/A	N/A
Tropical Cyclone	39-73 mph	N/A	N/A
1	74-95 mph	>14.2 psi	Very dangerous winds will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallow-rooted trees may be toppled, especially after the soil becomes waterlogged. Extensive damage to power lines and poles will likely result in power outages that could last several days.
2	96-110 mph	14-14.2 psi	Extremely dangerous winds will cause extensive damage. Well-constructed frame homes could sustain major roof and siding damage. Many shallow-rooted trees will be snapped or uprooted, especially after the soil becomes waterlogged, and block numerous roads. Near total power loss is expected, with outages that could last from several days to weeks.
3	111-129 mph	13.7 -14 psi	Devastating damage will occur. Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, especially after the soil becomes waterlogged, blocking numerous roads. Electricity and water may be unavailable for several days to weeks after the storm passes.
4	130-156 mph	13.3-13.7 psi	Catastrophic damage will occur. Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted, especially after the soil becomes waterlogged, and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5	157 mph or higher	<13.7 psi	Catastrophic damage will occur. A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks to months.

Many associated hazards can occur during a hurricane, including heavy rains, flooding, high winds, and tornadoes. A general rule of thumb in coastal Louisiana is that the number of inches of rainfall to be expected from a tropical cyclone is approximately 100 divided by the forward velocity of the storm in mph; so a fast-moving storm (20 mph) might be expected to drop five inches of rain while a slow-moving (5 mph) storm could produce totals of around 20 inches. However, no two storms are alike, and such generalizations have limited utility for planning purposes. Hurricane Beulah, which struck Texas in 1967, spawned 115 confirmed tornadoes. In recent years, extensive coastal development has increased the storm surge resulting from these storms so much that this has become the greatest natural hazard threat to property and loss of life in the state. Storm surge is a temporary rise in sea level generally caused by reduced air pressure and strong onshore winds associated with a storm system near the coast. Although storm surge can technically occur at any time of the year in Louisiana, surges caused by hurricanes can be particularly deadly and destructive. Such storm surge events are often accompanied by large, destructive waves (exceeding ten meters in some places) that can inflict a high number of fatalities and economic losses. In 2005, Hurricane Katrina clearly demonstrated the destructive potential of this hazard, as it produced the highest modern-day storm surge levels in the State of Louisiana, reaching up to 18.7 feet near Alluvial City in St. Bernard Parish.

Property can be damaged by the various forces that accompany a tropical cyclone. High winds can directly impact structures in three ways: wind forces, flying debris, and pressure. By itself, the force of the wind can knock over trees, break tree limbs, and destroy loose items, such as television antennas and power lines. Many things can be moved by high winds. As winds increase, so does the pressure against stationary objects. Pressure against a wall rises with the square of the wind speed. For some structures, this force is enough to cause failure. The potential for damage to structures is increased when debris breaks the building “envelope” and allows the wind pressure to impact all surfaces (the building envelope includes all surfaces that make up the barrier between the indoors and the outdoors, such as the walls, foundation, doors, windows, and roof). Mobile homes and buildings in need of maintenance are most subject to wind damage. High winds mean bigger waves. Extended pounding by waves can demolish any poorly or improperly designed structures. The waves also erode sand beaches, roads, and foundations. When foundations are compromised, the building will collapse.

Nine out of ten deaths during hurricanes are caused by storm surge flooding. Falling tree limbs and flying debris caused by high winds have the ability to cause injury or death. Downed trees and damaged buildings are a potential health hazard due to instability, electrical system damage, broken pipelines, chemical releases, and gas leaks. Sewage and water lines may also be damaged. Salt water and fresh water intrusions from storm surge send animals, such as snakes, into areas occupied by humans.

Location

Hurricanes are the single biggest threat to all of South Louisiana. With any single tropical cyclone event having the potential to devastate multiple parishes at once, tropical cyclones are a significant threat to the entire Plaquemines Parish planning area. The worst-case scenario for a tropical cyclone event in Plaquemines Parish is a Category 5 Hurricane.

Previous Occurrences / Extents

Plaquemines Parish has experienced 19 major tropical cyclone events since 1965. Hurricane Katrina has been by far the worst hurricane to impact Plaquemines Parish in recorded history. Katrina’s devastation was compounded with Hurricane Rita just days after. The following table provides a list of tropical cyclones which have impacted Plaquemines Parish since 1965.

Table 2-41: Historical Tropical Cyclone Events in Plaquemines Parish from 1965- 2019

Date	Name	Storm Type At Time of Impact
1965	Hurricane Betsy	Hurricane –Category 3
1969	Hurricane Camille	Hurricane – Category 5
1974	Hurricane Carmen	Hurricane – Category 4
1992	Hurricane Andrew	Hurricane – Category 2
1998	Tropical Storm Frances	Tropical Storm
1998	Hurricane Georges	Hurricane – Category 2
2002	Tropical Storm Isidore	Tropical Storm
2002	Hurricane Lili	Hurricane –Category 1
2004	Hurricane Ivan	Hurricane – Category 3
2005	Tropical Storm Cindy	Tropical Storm
2005	Hurricane Katrina	Hurricane – Category 3
2005	Hurricane Rita	Hurricane – Category 3
2008	Hurricane Gustav	Hurricane – Category 2
2008	Hurricane Ike	Hurricane – Category 4
2011	Tropical Storm Lee	Tropical Storm
2012	Hurricane Isaac	Hurricane – Category 1
2017	Tropical Storm Cindy	Tropical Storm
2017	Hurricane Nate	Hurricane – Category 1
2019	Tropical Storm Barry	Tropical Storm

Since the last Plaquemines Parish HMP update in 2015, there have been three tropical cyclone events which have impacted the parish. Below is a brief description of the three events and the impact they had on Plaquemines Parish.

Tropical Storm Cindy (2017)

Tropical Storm Cindy was the first tropical cyclone to make landfall in Louisiana since Hurricane Isaac in 2012. The third named storm of the 2017 Atlantic hurricane season, Cindy formed out of a broad area of low pressure that developed in the northwestern Caribbean Sea near the Yucatan Peninsula in June 2017. The disturbance gradually organized as it drifted northwards into the Gulf of Mexico before organizing into a tropical storm on June 20, 2017. Tropical Storm peaked with sustained winds of 60 mph on June 21, and weakened slightly prior to making landfall in southwestern Louisiana on June 22. The storm quickly weakened as it moved further inland eventually degenerating into a remnant low on June 23, 2017.

The minimum sea level pressure of 1004.4 mb, along with the highest wind gust, and highest sustained wind in southeast Louisiana were all measured by the New Orleans Lakefront Airport. The highest wind gust recorded was 49 mph, and the highest maximum sustained wind was 44 mph. Tropical storm force winds were primarily experienced in gusts as squalls moved through the area. The winds did cause minor damage to trees, roofs, and power lines. The only known injuries in southeast Louisiana resulted from a tree falling on a mobile home in Houma, Louisiana.

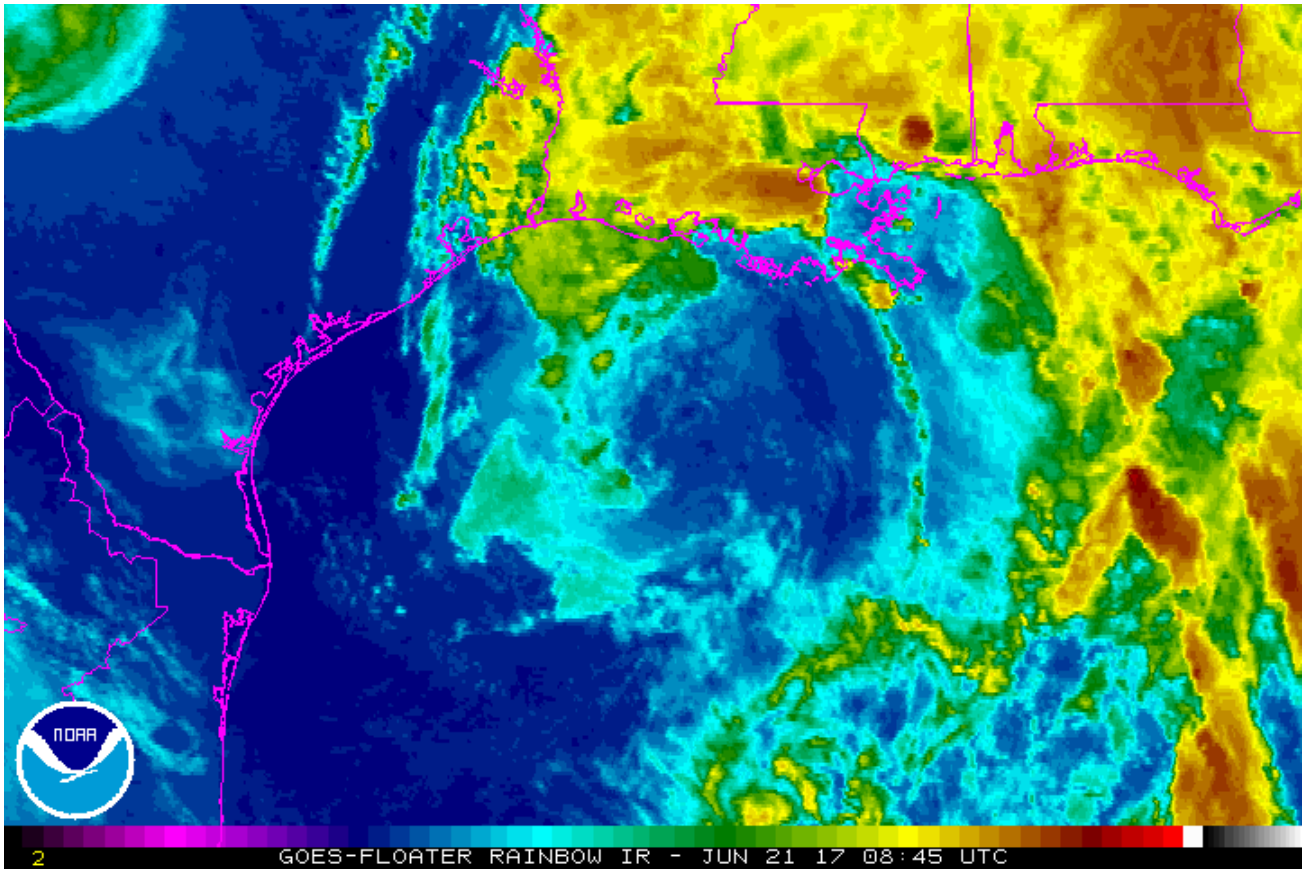


Figure 2-28: Tropical Cyclone Cindy Rain Bands across the Gulf Coast Area
(Source: NOAA)

A storm tide of generally four to six feet occurred along the Gulf Coast of southeast Louisiana, from St. Bernard Parish to Terrebonne Parish. The highest measure storm tide was 6.18 feet NAVD88 at the USCOE gauge near Mandeville, Louisiana. Impacts from storm surge were minor to moderate with flooding occurring in low lying areas and roadways outside of levee systems.

Many areas of southeast Louisiana received three to five inches of rain, with a few measurements in excess of six inches. Maximum storm total rainfall was 6.52 inches measured in St. Bernard Parish. The rainfall resulted in some minor river flooding across portions of the north shore of Lake Pontchartrain.

Figure 2-29: Localized Flooding due to Tropical Storm Cindy in the Myrtle Grove Area of Plaquemines Parish.
(Source: WWLTV Channel 4)

The primary impact in Plaquemines Parish was minor flooding of lowland property and minor roof damage due to winds. Frequent storm force wind gusts were reported at the Belle Chasse Naval Air Station, with the highest gust reported at 37 knots. At the Southwest Pass C-Man Station, the highest wind gust was 47 knots on June 20th at noon with an anemometer height of 38 meters.

Hurricane Nate (2017)

Hurricane Nate began as a tropical depression over the northwest Caribbean Sea on the morning of October 4th. Nate moved fairly rapidly northward, with forward speeds in excess of 20 mph while it gained strength. The storm moved north-northwestward through much of the day on October 7th, eventually turning northward as it approached southeast Louisiana. The storm became asymmetric as it approached southeast Louisiana and coastal Mississippi with the stronger winds primarily on the east side of the system. The storm continued moving to the north and north-northeast as it weakened into a tropical depression near Birmingham, Alabama on October 8, 2017.

Minor impacts due to storm surge flooding were noted over several parishes in southeast Louisiana, while moderate impacts due to strong winds and storm surge were noted over the Mississippi coastal counties. Storm tides of four to eight feet were observed in the coastal counties of Mississippi, varying from two to four feet in the western counties and four to eight feet in the eastern counties. In southeast Louisiana, storm tides from two to five feet were noted, resulting in storm surge of one to three feet. Only minor impacts from storm surge were reported. Rain amounts of three to six inches were common over the Mississippi coastal counties, while Louisiana observed rainfall amounts of two inches or less.

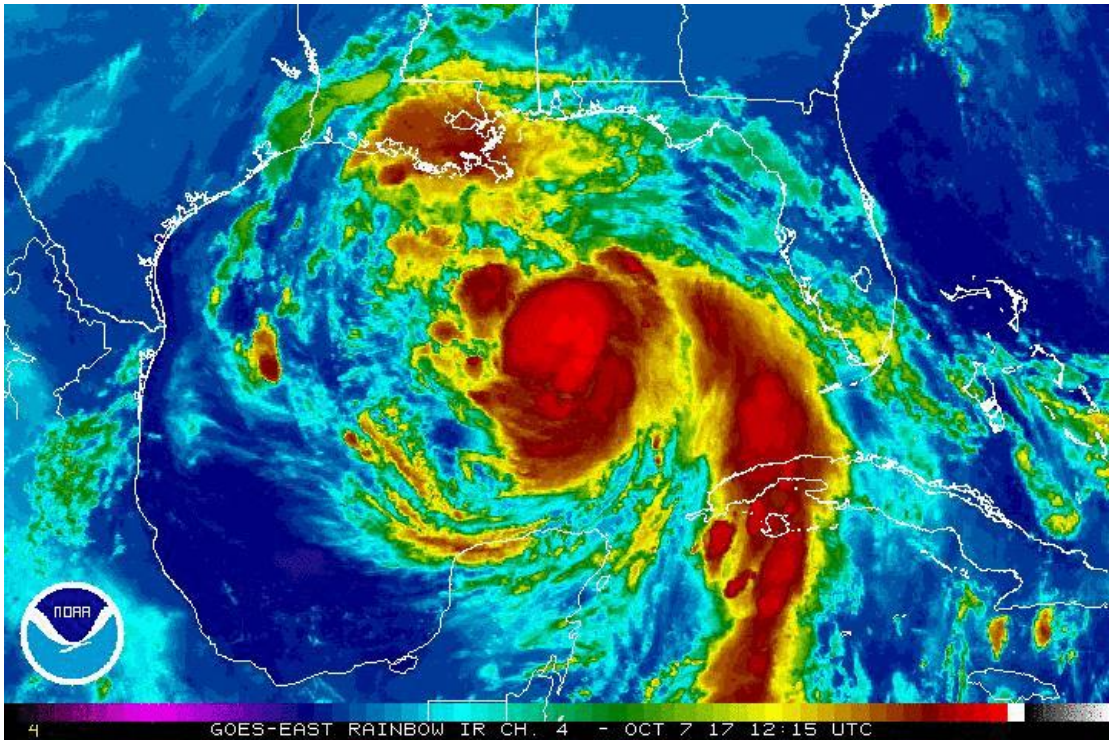


Figure 2-30: Rain Bands associated with Hurricane Nate across the Gulf Coast Area (Source: NOAA)

In Plaquemines Parish, lower end tropical storm force wind gusts were felt throughout the parish, with a wind gust of 40 knots recorded at the Bootheville ASOS station (KBVE) during the evening of October 7th. No significant impacts were noted in Plaquemines Parish. No injuries or fatalities were recorded in Plaquemines Parish as a result of Hurricane Nate.

Figure 2-31: Localized Flooding and Clean Up in Plaquemines Parish after Hurricane Nate (Source: Lafayette Daily Advertiser)

Tropical Storm Barry (2019)

Hurricane Barry initial developed from a disturbance that moved from Georgia southwest to the northeast Gulf of Mexico on July 8-9, 2019. The weak low pressure system continued to move west-southwest and strengthen, and was eventually classified as Tropical Storm Barry on the morning of July 11th, 95 miles south-southeast of the mouth of the Mississippi River. Barry continued to move slowly west then northwest and briefly reached hurricane strength on the morning of July 13th before landfall in south-central Louisiana near Intracoastal City, Louisiana in Vermillion Parish. Tropical storm force winds reached the southeast Louisiana coast by midday on Friday, July 12th and spread slowly northwest reaching the Baton Rouge area during the evening of the 12th. Tropical storm wind impacts had ended across all of southeast Louisiana by midday on July 14th. Tropical storm force winds were primarily measured in gusts across southeast Louisiana. The exception was in Terrebonne and Assumption Parishes, close to the landfall location, where sustained tropical storm force winds and frequent gusts caused more significant power line and tree damage. A few tropical storm wind gusts were recorded in the metro New Orleans area but were not very impactful. No hurricane force wind gusts were recorded in southeast Louisiana.

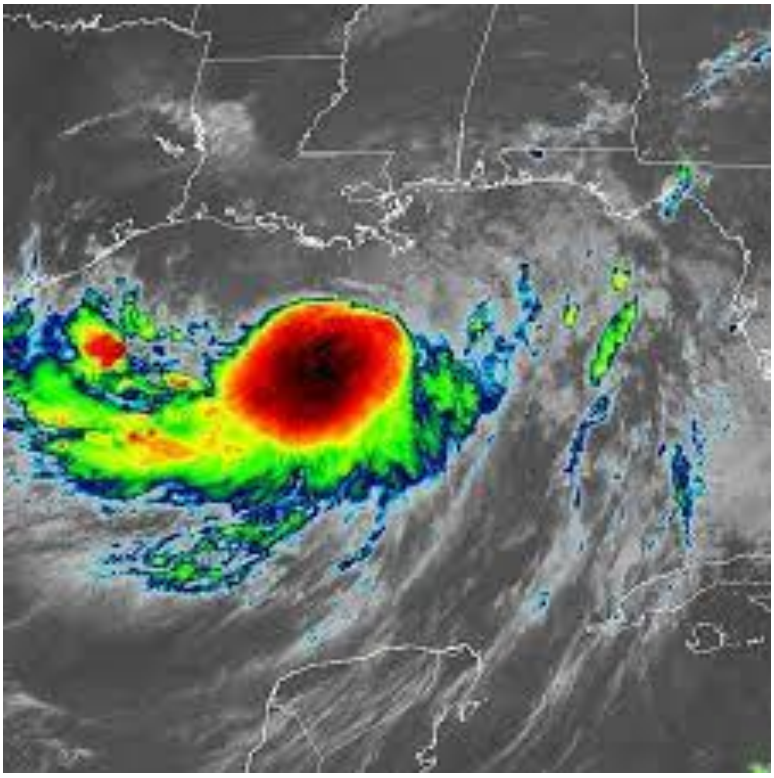


Figure 2-32: Hurricane Barry Rain Bands in the Gulf Coast Area (Source: NOAA)

Mostly minor to moderate storm surge flooding occurred across coastal southeast Louisiana, including Lake Pontchartrain and a small part of the Mississippi Coast. Terrebonne Parish had significant storm surge flooding in the lower portion of the parish, with storm tides of five to eight feet, locally up to nine feet. Several local levees were overtopped on the morning of July 13th, flooding roads and a few homes. The highest storm tide reading was 9.11 feet NAVD88 at a USGS tide gauge at Caillou Lake near Dulac, Louisiana.

Storm total rainfall was generally between four and eight inches with a maximum rainfall of 8.83 inches recorded northeast of Denham Springs, Louisiana in Livingston Parish. Isolated flash flooding of streets and secondary roadways occurred on July 13th in the greater Baton Rouge area, but flash flooding was not

widespread or significant. The lower Mississippi River was at unusually high stages from late August with the state at the New Orleans Carrolton gauge near 16.5 feet. The combination of storm surge entering the lower Mississippi River with very high river stages prompted concern of potential overtopping of levees along the Mississippi River in lower Plaquemines Parish prompting some evacuations of the area.

In Plaquemines Parish, occasional to frequent storm force wind gusts were observed throughout the parish. Storm total rainfall across the parish ranged from less than an inch to 2.36 inches at Belle Chasse Naval Air Station. Storm surge flooding occurred in areas outside of the Hurricane Risk Reduction System. A peak storm surge of around five feet overtopped a local back levee on the West Bank during the early morning hours of the 13th. One secondary road and several lift stations were damaged by the flooding. Louisiana Highway 23 was covered by several inches of water, but was not shut down. Mandatory evacuations resulted in the evacuation of one nursing home (110 residents) and the Davant Detention Center (600 prisoners). One parish shelter was opened, with a peak occupancy of 106 residents.

The following figure displays the wind zones that affect Plaquemine Parish in relation to critical facilities throughout the parish.

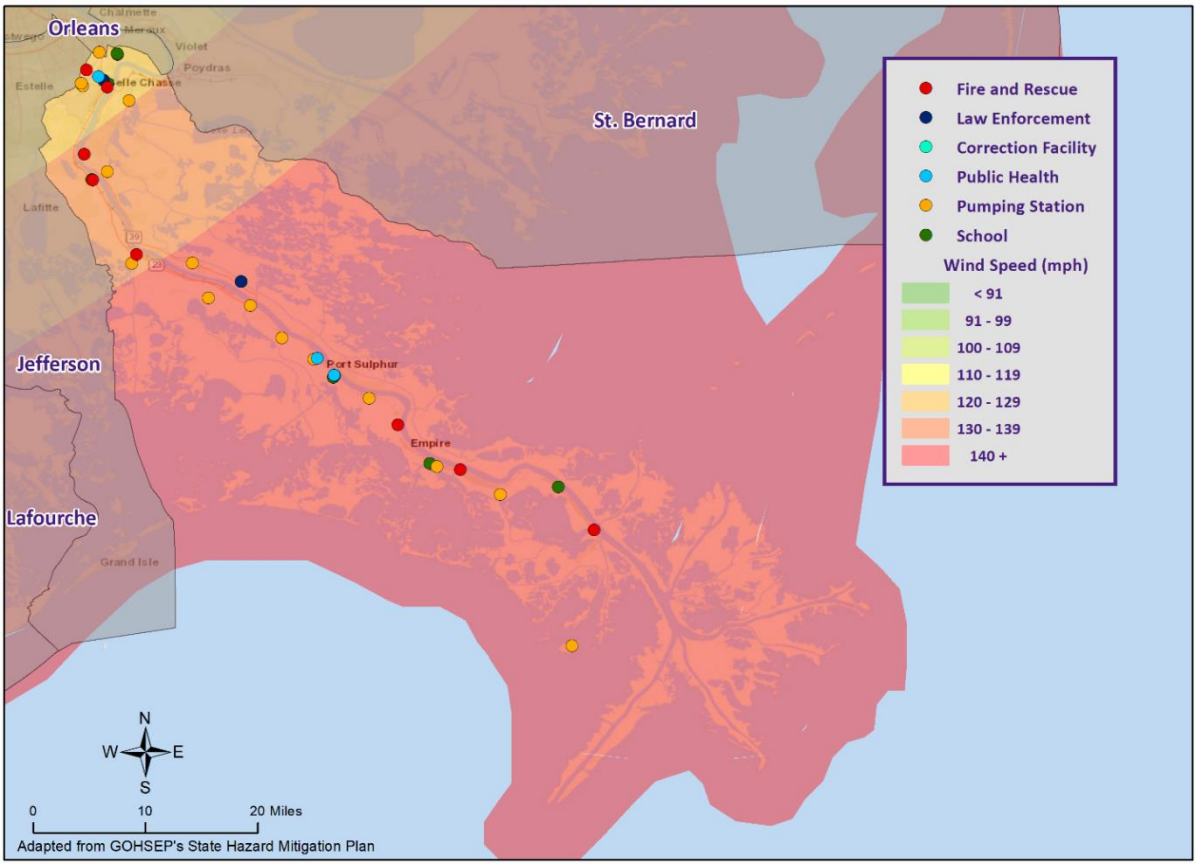


Figure 2-33: Winds Zones for Plaquemines Parish in Relation to Critical Facilities

Frequency / Probability

Tropical cyclones are large natural hazard events that regularly impact Plaquemines Parish. The annual chance of occurrence for a tropical cyclone is estimated at 35% for Plaquemines Parish, with 19 events having occurred within 55 years. The tropical cyclone season for the Atlantic Basin is from June 1st through November 30th, with most of the major hurricanes (Saffir-Simpson Categories 3, 4, & 5) occurring

between the months of August and October. Based on geographical location alone, Plaquemines Parish is highly vulnerable to tropical cyclones. This area has experienced several tropical cyclone events in the past and can expect more in the future.

Estimated Potential Losses

Using Hazus 100-Year Hurricane Model, the 100-year hurricane scenario was analyzed to determine losses from this worst-case scenario. The following table shows the total economic losses that would result from this occurrence.

Table 2-42: Total Estimated Losses for a 100-Year Hurricane Event (Source: Hazus)

Jurisdiction	Estimated Total Losses from 100-Year Hurricane Event
Plaquemines Parish	$562,586,249

Total losses from a 100-year hurricane event for Plaquemines Parish were compared with the total value of assets to determine the ratio of potential damage to total inventory in the table below.

Table 2-43: Ratio of Total Losses to Total Estimated Value of Assets for Plaquemines Parish (Source: Hazus)

Jurisdiction	Estimated Total Losses from 100-Year Hurricane Event	Total Estimated Value of Assets	Ratio of Estimated Losses to Total Value
Plaquemines Parish	$562,586,249	$2,344,219,000	24%

Based on the Hazus Hurricane Model, estimated total losses for Plaquemines Parish were 24% of the total estimated value of all assets.

The Hazus Hurricane Model also provides a breakdown for seven primary sectors (Hazus occupancy) throughout the parish. The losses for Plaquemines Parish by sector are listed in the table below.

Table 2-44: Estimated Losses in Plaquemines Parish for a 100-Year Hurricane Event (Source: Hazus)

Plaquemines Parish	Estimated Total Losses from 100-Year Hurricane Event
Agricultural	$3,766,960
Commercial	$104,874,022
Government	$8,844,104
Industrial	$30,959,142
Religious / Non-Profit	$13,690,937
Residential	$395,069,621
Schools	$5,381,463
Total	**$562,586,249**

Threat to People

The total population within the parish that is susceptible to a hurricane hazard is shown in the table below:

Table 2-45: Number of People Susceptible to a 100-Year Hurricane Event in Plaquemines Parish (Source: Hazus)

Number of People Exposed to Hurricane Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
Plaquemines Parish	23,410	23,410	100%

The Hazus hurricane model was also extrapolated to provide an overview of vulnerable populations throughout Plaquemines Parish. These populations are illustrated in the following table:

Table 2-46: Vulnerable Populations in Plaquemines Parish for a 100-Year Hurricane Event (Source: Hazus)

Plaquemines Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	23,410	100.0%
Persons Under 5 Years	1,618	6.9%
Persons Under 18 Years	4,813	20.6%
Persons 65 Years and Over	2,617	11.2%
White	16,506	70.5%
Minority	6,904	29.5%

Vulnerability

See Appendix C for parish and municipality buildings that are susceptible to tropical cyclones.

3. Capability Assessment

This section summarizes the results of Plaquemines Parish and other agency efforts to develop policies, programs, and activities that directly or indirectly support hazard mitigation. It also provides information on resources and gaps in the parish's infrastructure, as well as relevant changes in its law since the last plan update, in order to suggest a mitigation strategy.

Through this assessment, Plaquemines Parish is able to identify strengths that could be used to reduce losses and reduce risk throughout the communities. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient community before, during and after a hazard event.

Policies, Plans and Programs

Plaquemines Parish capabilities are unique to the parish, including planning, regulatory, administrative, technical, financial, and education and outreach resources. There are a number of mitigation-specific acts, plans, executive orders, and policies that lay out specific goals, objectives, and policy statements which already support or could support pre- and post-disaster hazard mitigation. Many of the ongoing plans and policies hold significant promise for hazard mitigation, and take an integrated and strategic look holistically at hazard mitigation in Plaquemines Parish to propose ways to continually improve it. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. Examples of existing documents in Plaquemines Parish include the following:

Table 3-1: Planning and Regulatory Capabilities

Planning and Regulatory		
Please indicate which of the following plans and regulatory capabilities your jurisdiction has in place.		
	Plaquemines Parish	Comments
Plans	Yes / No	
Comprehensive / Master Plan	Yes	
Capital Improvements Plan	Yes	
Economic Development Plan	Yes	
Local Emergency Operations Plan	Yes	
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	No	
Community Wildfire Protection Plan	No	
Other plans (redevelopment, recovery, coastal zone management)	Yes	
Building Code, Permitting and Inspections	Yes / No	
Building Code	Yes	LSUCC
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	
Fire Department ISO/PIAL rating	Yes	Dist 1 - 5; Dist 2 -4, Dist 3 - 5, Dist 4 - 5, Dist 5 - 6, Dist 6 - 4, Dist 7 - 5
Site plan review requirements	Yes	
Land Use Planning and Ordinances	Yes / No	
Zoning Ordinance	Yes	Local
Subdivision Ordinance	Yes	Local
Floodplain Ordinance	Yes	FEMA
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	No	
Flood Insurance Rate Maps	Yes	Paper & digital
Acquisition of land for open space and public recreation uses	Yes	
Other	No	

Plaquemines Parish will work to expand their capabilities by adding to these plans, as well as work to create new plans that will address a long-term recovery and resiliency framework. In instances where there are no existing plans, there will be a commitment to explore opportunities to create new plans that will address long-term recovery and resiliency framework as parish and local resources allow.

Building Codes, Permitting, Land Use Planning and Ordinances

The Plaquemines Parish Government provides oversight for building permits and codes, land use planning, and all parish ordinances.

As of the 2020 update, Plaquemines Parish and its jurisdictions ensure that all adopted building codes are enforced and in compliance relating to the construction of any structure within the boundaries of the parish. Building permits are required prior to beginning any type of construction or renovation projects, installation of electrical wiring, plumbing or gas piping, moving manufactured/modular or portable buildings, and reroofing or demolitions.

The Plaquemines Parish Government is also responsible for enforcing the parish ordinances related to health and safety, property maintenance standards, and condemnation of unsafe structures.

The Plaquemines Parish Government meets regularly to consider any proposed ordinance changes, and to take final actions on proposed changes.

While local capabilities for mitigation can vary from community to community, Plaquemines Parish as a whole has a system in place to coordinate and share these capabilities through the OHSEP and through this Parish Hazard Mitigation Plan.

Some programs and policies, such as the above described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination among local mitigation policies and programs is essential to hazard mitigation.

Administration, Technical, and Financial

As a community, Plaquemines Parish has administrative and technical capabilities in place that may be utilized in reducing hazard impacts or implementing hazard mitigation activities. Such capabilities include staff, skillset, and tools available in the community that may be accessed to implement mitigation activities and to effectively coordinate resources. The ability to access and coordinate these resources is also important. The table on the following page shows examples of resources in place in Plaquemines Parish.

Table 3-2: Administration and Technical Capabilities

Administration and Technical		
Identify whether your community has the following administrative and technical capabilities. For smaller jurisdictions without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.		
	Plaquemines Parish	Comments
Administration	Yes / No	
Planning Commission	Yes	
Mitigation Planning Committee	No	
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	No	
Mutual Aid Agreements	Yes	
Staff	Yes / No	
Chief Building Official	Yes	ICC Certified Building Official
Floodplain Administrator	Yes	ASFPM Certified Floodplain Manager
Emergency Manager	Yes	
Community Planner	No	
Civil Engineer	Yes	
GIS Coordinator	Yes	
Grant Writer	Yes	
Other		
Technical	Yes / No	
Warning Systems / Service (Reverse 911, outdoor warning signals)	Yes	
Hazard Data & Information	Yes	
Grant Writing	Yes	
Hazus Analysis	No	
Other		

Financial capabilities are the resources that Plaquemines Parish has access to or are eligible to use in order to fund mitigation actions. Costs associated with implementing the actions identified by the parish may vary from little to no cost actions, such as outreach efforts, or substantial action costs such acquisition of flood prone properties.

The following financial resources are available to fund mitigation actions in Plaquemines Parish:

Table 3-3: Financial Capabilities

Financial		
Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.		
	Plaquemines Parish	Comments
Funding Resources	Yes / No	
Capital Improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Stormwater Utility Fee	No	
Community Development Block Grant (CDBG)	Yes	
Other Funding Programs	Yes	

Education and Outreach

A key element in hazard mitigation is promoting a safer, more disaster resilient community through education and outreach activities and/or programs. Successful outreach programs provide data and information that improves overall quality and accuracy of important information for citizens to feel better prepared and educated with mitigation activities. These programs enable the individual communities and the parish as a whole to maximize opportunities for implementation of activities through greater acceptance and consensus of the community.

Plaquemines Parish has existing education and outreach programs to implement mitigation activities, as well as communicate risk and hazard related information to its communities. Specifically, focusing on advising repetitive loss property owners of ways they can reduce their exposure to damage by repetitive flooding remains a priority for the entire parish. The existing programs are as follows:

Table 3-4: Education and Outreach Capabilities

Education and Outreach		
Identify education and outreach programs and methods, already in place that could be used to implement mitigation activities and communicate hazard-related information.		
	Plaquemines Parish	Comments
Program / Organization	Yes / No	
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Yes	
Natural Disaster or safety related school program	Yes	
Storm Ready certification	Yes	
Firewise Communities certification	No	
Public/Private partnership initiatives addressing disaster-related issues	No	
Other		

The communities within Plaquemines Parish rely on Plaquemines OHSEP and/or Plaquemines Parish Government agencies for the above listed planning and regulatory, administrative and technical, financial, and education and outreach capabilities.

As reflected with above existing regulatory mechanisms, programs and resources within the parish, Plaquemines Parish remains committed to expanding and improving on the existing capabilities within the parish. Communities, along with Plaquemines Parish will work together toward increased participation in funding opportunities and available mitigation programs. Should funding become available, the hiring of additional personnel to dedicate to hazard mitigation initiatives and programs, as well as increasing ordinances within the parish, will all enhance and expand risk reduction for all of Plaquemines Parish.

Flood Insurance and Community Rating System

Plaquemines Parish is not currently participating in the Community Rating System (CRS). However, becoming a participant in the CRS was recognized as an eventual goal by the Hazard Mitigation Steering Committee. Participation in the CRS strengthens local capabilities by lowering flood insurance premiums for jurisdictions that exceed NFIP minimum requirements.

The Federal Emergency Management Agency's National Flood Insurance Program (NFIP) administers the Community Rating System (CRS). Under the CRS, flood insurance premiums for properties in participating communities are reduced to reflect the flood protection activities that are being implemented. This program can have a major influence on the design and implementation of flood mitigation activities, so a brief summary is provided here.

A community receives a CRS classification based upon the credit points it receives for its activities. It can undertake any mix of activities that reduce flood losses through better mapping, regulations, public information, flood damage reduction and/or flood warning and preparedness programs.

There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction (see *Figure 3-1*). A community that does not apply for the CRS or that does not obtain the minimum number of credit points is a class 10 community.

CLASS	DISCOUNT	CLASS	DISCOUNT
1	45%	6	20%
2	40%	7	15%
3	35%	8	10%
4	30%	9	5%
5	25%	10	–
SFHA (Zones A, AE, A1–A30, V, V1–V30, AO, and AH): Discount varies depending on class.			
SFHA (Zones A99, AR, AR/A, AR/AE, AR/A1–A30, AR/AH, and AR/AO): 10% discount for Classes 1–6; 5% discount for Classes 7–9.*			
Non-SFHA (Zones B, C, X, D): 10% discount for Classes 1–6; 5% discount for Classes 7–9.			

Figure 3-1: CRS Discounts by Class (Source: FEMA)

As of September 2019, 317 communities in the State of Louisiana participate in the Federal Emergency Management Agency's National Flood Insurance Program (NFIP). Of these communities, 47 (or 15%) participate in the Community Rating System (CRS). Jefferson Parish leads the state with a rating of Class 5, followed by the City of Mandeville in St. Tammany Parish with a Class 6 rating. Of the top fifty Louisiana communities, in terms of total flood insurance policies held by residents, 27 participate in the CRS. The remaining 23 communities present an outreach opportunity for encouraging participation in the CRS.

The CRS provides an incentive not just to start new mitigation programs, but to keep them going. There are two requirements that "encourage" a community to implement flood mitigation activities. Once the parish has obtained a CRS rating and is a participant, the parish will receive CRS credit for this plan when it is adopted. To retain that credit, though, the parish must submit an evaluation report on progress toward implementing this plan to FEMA by October 1 of each year. That report must be made available to the media and the public. Second, the parish must annually recertify to FEMA that it is continuing to implement its CRS credited activities. Failure to maintain the same level of involvement in flood protection can result in a loss of CRS credit points and a resulting increase in flood insurance rates to residents.

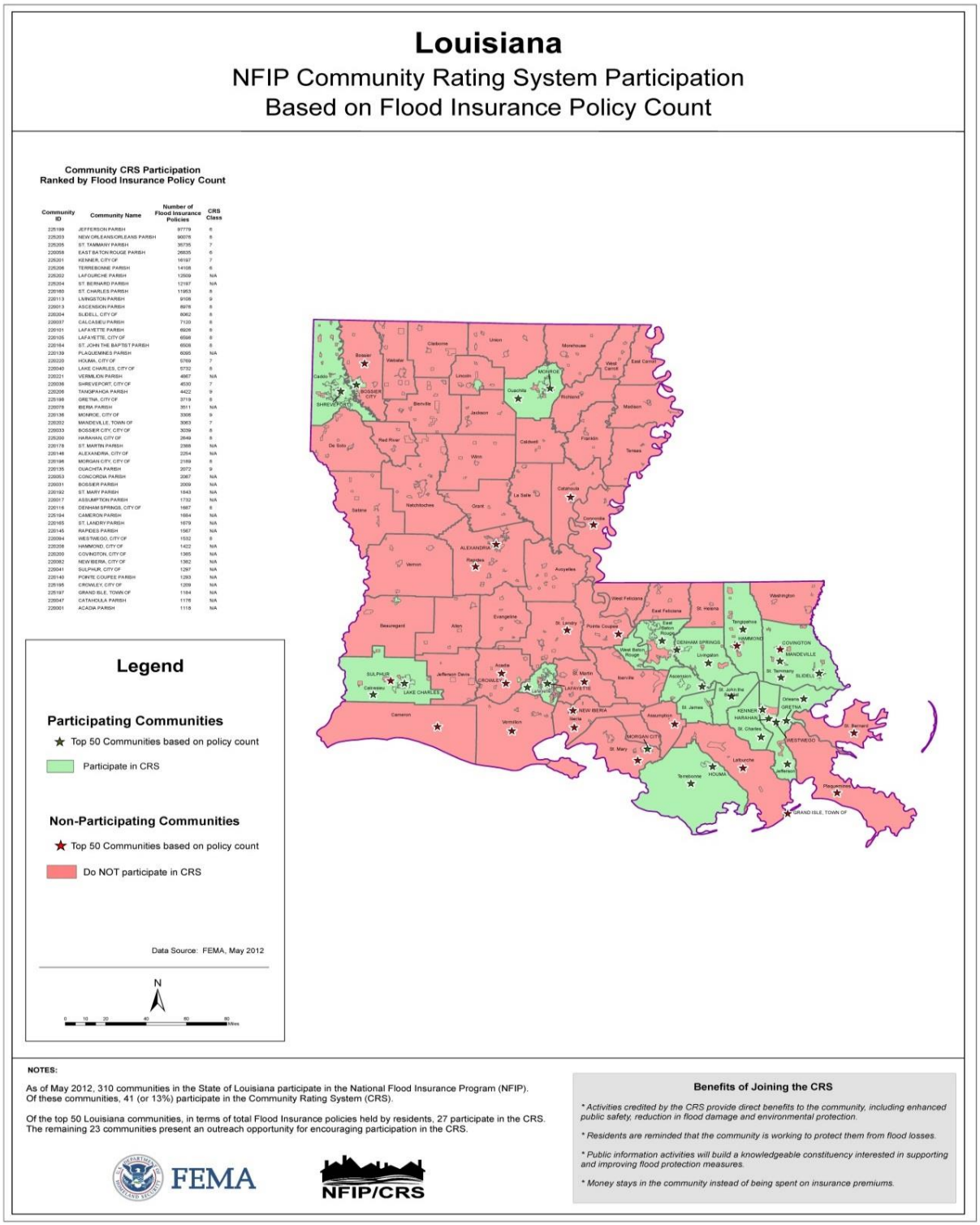
In 2011[1], the National Flood Insurance Program (NFIP) completed a comprehensive review of the Community Rating System (CRS) that resulted in the release of a new CRS Coordinator's Manual. The changes to the 2013 CRS Coordinator's Manual are the result of a multi-year program evaluation that included input from a broad group of contributors to evaluate the CRS and refine the program to meet its stated goals. The changes helped to drive new achievements in the following six core flood loss reduction areas important to the NFIP: (1) reduce liabilities to the NFIP Fund; (2) improve disaster resiliency and sustainability of communities; (3) integrate a Whole Community approach to addressing emergency

[1] https://www.fema.gov/national-flood-insurance-program-community-rating-system

management; (4) promote natural and beneficial functions of floodplains; (5) increase understanding of risk, and; (6) strengthen adoption and enforcement of disaster-resistant building codes.

Since the revision of the 2013 Coordinator's Manual, FEMA released the 2017 CRS Coordinator's Manual which continued the evolution of the CRS program and its mission to reward communities that prioritize mindful floodplain regulations. As with the 2013 manual, the changes made in the 2017 manual impact each CRS community differently. Some communities see an increase in the points they receive since points for certain activities have increased (e.g., Activity 420 Open Space Preservation). Other communities receive fewer points for certain activities (e.g., Activity 320 Map Information Service). It is likely that some communities with marginal CRS Class 9 programs have to identify new CRS credits in order to remain in the CRS class. Most notably, as it relates to this hazard mitigation plan, more credit was made available for Activity 410 Floodplain Mapping.

Typically, CRS communities do not request credit for all the activities they are currently implementing unless it would earn enough credit to advance the community to a higher CRS Class. A community that finds itself losing CRS credit with the 2017 manual could likely identify activities deserving credit they had not previously received. Due to the changes in both activities and CRS points, community CRS coordinators should speak with their ISO/CRS Specialist to understand how the 2017 manual will impact their community and when.



Community ID	Community Name	Number of Flood Insurance Policies	CRS Class
225199	JEFFERSON PARISH	97779	6
225203	NEW ORLEANS/ORLEANS PARISH	96078	6
225205	ST. TAMMANY PARISH	35735	7
220058	EAST BATON ROUGE PARISH	26835	6
225201	KENNER, CITY OF	16197	7
225206	TERREBONNE PARISH	14108	6
225202	LAFOURCHE PARISH	12509	N/A
225204	ST. BERNARD PARISH	12197	N/A
220160	ST. CHARLES PARISH	11953	8
220113	LIVINGSTON PARISH	9108	9
220013	ASCENSION PARISH	8976	8
220094	SLIDELL, CITY OF	8062	8
220037	CALCASIEU PARISH	7130	8
220101	LAFAYETTE PARISH	6626	8
220105	LAFAYETTE, CITY OF	6568	8
220184	ST. JOHN THE BAPTIST PARISH	6508	8
220139	PLAQUEMINES PARISH	6095	N/A
220220	HOUMA, CITY OF	5769	7
220040	LAKE CHARLES, CITY OF	5732	8
220221	VERMILION PARISH	4867	N/A
220036	SHREVEPORT, CITY OF	4530	7
220206	TANGIPAHOA PARISH	4422	9
225196	GRETNA, CITY OF	3719	8
220078	IBERIA PARISH	3511	N/A
220136	MONROE, CITY OF	3306	9
220202	MANDEVILLE, TOWN OF	3063	7
220033	BOSSIER CITY, CITY OF	3039	8
225200	HARAHAN, CITY OF	2649	8
220178	ST. MARTIN PARISH	2388	N/A
220146	ALEXANDRIA, CITY OF	2254	N/A
220196	MORGAN CITY, CITY OF	2189	8
220135	OUACHITA PARISH	2072	9
220053	CONCORDIA PARISH	2067	N/A
220031	BOSSIER PARISH	2009	N/A
220192	ST. MARY PARISH	1843	N/A
220017	ASSUMPTION PARISH	1732	N/A
220116	DENHAM SPRINGS, CITY OF	1667	8
225194	CAMERON PARISH	1664	N/A
220165	ST. LANDRY PARISH	1679	N/A
220145	RAPIDES PARISH	1567	N/A
220094	WESTWEGO, CITY OF	1532	8
220208	HAMMOND, CITY OF	1402	N/A
220200	COVINGTON, CITY OF	1385	N/A
220082	NEW IBERIA, CITY OF	1382	N/A
220041	SULPHUR, CITY OF	1297	N/A
220140	POINTE COUPEE PARISH	1293	N/A
225195	CROWLEY, CITY OF	1209	N/A
225197	GRAND ISLE, TOWN OF	1184	N/A
220047	CATAHOULA PARISH	1176	N/A
220001	ACADIA PARISH	1118	N/A

Figure 3-2: Louisiana CRS Participation
(Source: FEMA[2])

[2] http://www.fema.gov/media-library-data/20130726-2128-31471-9581/ks_ky_la_crs_may_2012_508.zip

In addition to the direct financial reward for participating in the Community Rating System, there are many other reasons to participate in the CRS. As FEMA staff often say, "If you are only interested in saving premium dollars, you're in the CRS for the wrong reason."

The other benefits that are more difficult to measure in dollars include:

1. The activities credited by the CRS provide direct benefits to residents, including:
   – Enhanced public safety
   – A reduction in damage to property and public infrastructure
   – Avoidance of economic disruption and losses
   – Reduction of human suffering
   – Protection of the environment

2. A community's flood programs will be better organized and more formal. Ad hoc activities, such as responding to drainage complaints rather than an inspection program, will be conducted on a sounder, more equitable basis.

3. A community can evaluate the effectiveness of its flood program against a nationally recognized benchmark.

4. Technical assistance in designing and implementing a number of activities is available at no charge from the Insurance Services Office.

5. The public information activities will build a knowledgeable constituency interested in supporting and improving flood protection measures.

6. A community would have an added incentive to maintain its flood programs over the years. The fact that its CRS status could be affected by the elimination of a flood related activity or a weakening of the regulatory requirements for new developments would be taken into account by the governing board when considering such actions.

7. Every time residents pay their insurance premiums, they are reminded that the community is working to protect them from flood losses, even during dry years.

**More information on the Community Rating System can be found at https://www.fema.gov/national-flood-insurance-program-community-rating-system **

NFIP Worksheets

Parish NFIP worksheets can be found in Appendix E: State Required Worksheets.

4. Mitigation Strategy

Introduction

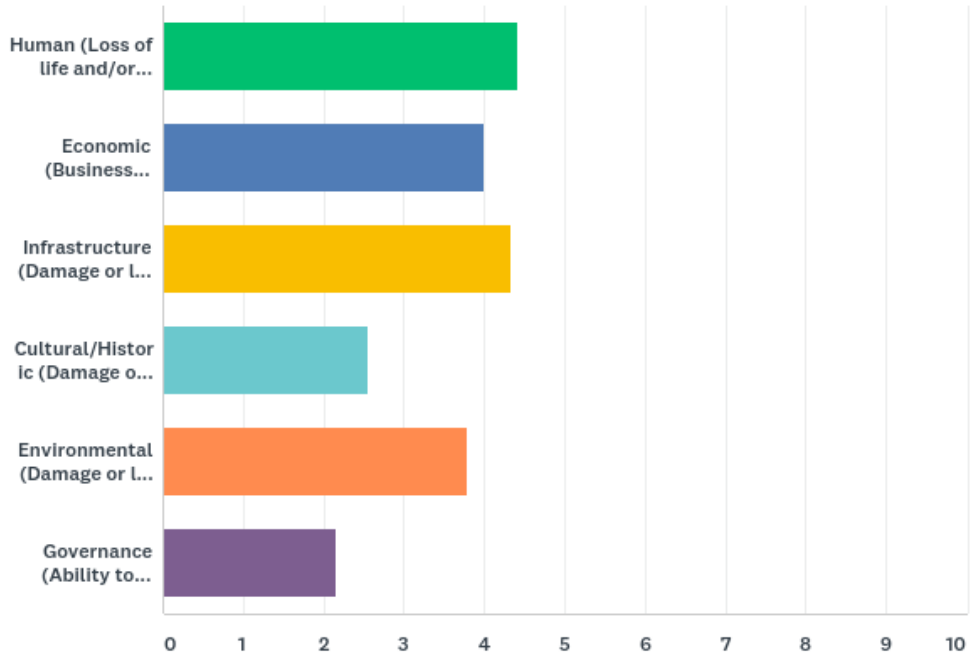
Plaquemines Parish's Hazard Mitigation Strategy has a common guiding principle and is the demonstration of the parish's commitment to reduce risks from hazards. The strategy also serves as a guide for parish and local decision makers as they commit resources to reducing the effects of hazards.

Plaquemines Parish confirmed the goals, objectives, actions and projects over the period of the hazard mitigation plan update process. The mitigation actions and projects in this 2020 HMP update are a product of analysis and review of the Plaquemines Parish Hazard Mitigation Plan Steering Committee under the coordination of the Plaquemines Parish Office of Homeland Security and Emergency Preparedness. The committee was presented a list of projects and actions, new and from the 2015 plan, for review from December 2019 – March 2020.

An online public opinion survey of Plaquemines Parish residents was conducted between January and March 2020. The survey was designed to capture public perceptions and opinions regarding natural hazards in Plaquemines Parish. In addition, the survey collected information regarding the methods and techniques preferred by the respondents for reducing the risks and losses associated with local hazards.

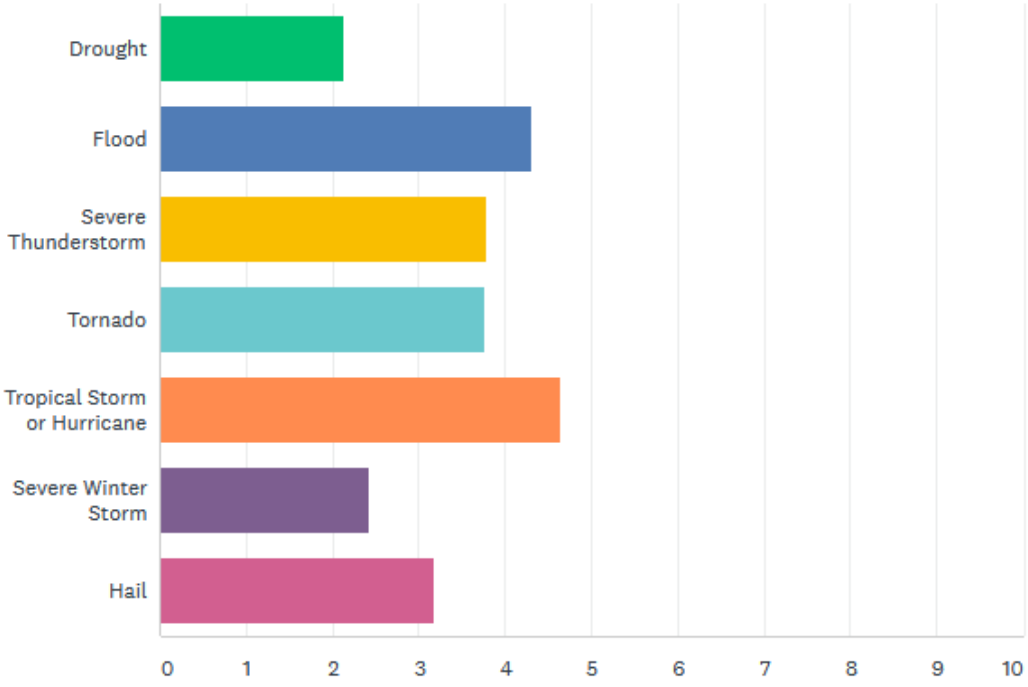
When asked to gauge from a list which categories were most susceptible to impacts caused by natural hazards, the top three categories selected were:

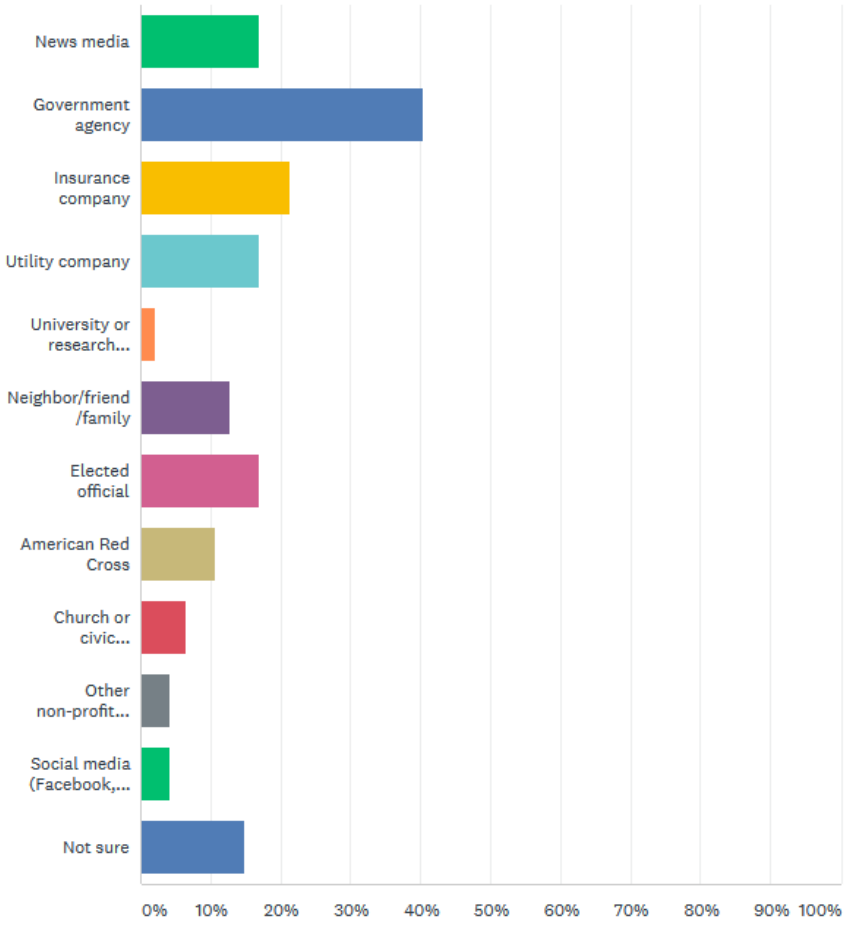
1. Human (Loss of life and/or injuries)
2. Infrastructure (Damage or loss of bridges, utilities, schools, etc.)
3. Economic (Business closures and/or job losses)



The survey results also indicated which natural disasters citizens were *most concerned* with being affected by in Plaquemines Parish. The top three natural disasters selected were:

1. Tropical Storm or Hurricane
2. Flooding
3. Severe Thunderstorm





The results shown above are related to the manner in which the general population receives information on how to make their home safer from natural disasters. These results are encouraging because it shows that the public has high confidence in the information being disseminated by local government agencies. Implementation of the outreach activities put forth by parish officials and offices seem to have been executed in a successful manner

This activity confirms that the goals and action items developed by the Plaquemines Parish Hazard Mitigation Plan Steering Committee are representative of the outlook of the community at large. Full survey results can be found here:

https://www.surveymonkey.com/results/SM-6KQWRB2M7/

Goals

The goals represent the guidelines that the parish and its communities want to achieve with this plan update. To help implement the strategy and adhere to the mission of the Hazard Mitigation Plan, the preceding section of the plan update was focused on identifying and quantifying the risks faced by the residents and property owners in Plaquemines Parish from natural and manmade hazards. By articulating goals and objectives based on the previous plans, the risk assessment results, and intending to address those results, this section sets the stage for identifying, evaluating, and prioritizing feasible, cost effective, and environmentally sound actions to be promoted at the parish and municipal level – and to be

undertaken by the state for its own property and assets. By doing so, Plaquemines Parish can make progress toward reducing identified risks.

For the purposes of this plan update, goals and action items are defined as follows:

- **Goals** are general guidelines that explain what the parish wants to achieve. Goals are expressed as broad policy statements representing desired long-term results.
- **Action Items** are the specific steps (projects, policies, and programs) that advance a given goal. They are highly focused, specific, and measurable.

The current goals of the Plaquemines Parish Hazard Mitigation Plan Update Steering Committee represent long-term commitments by the parish. After assessing these goals, the committee decided that the current remain valid.

The goals are as follows:

1. Reduce losses to existing and future property due to hazards
2. Protect the health and well-being of the people of Plaquemines Parish from negative effects of hazards
3. Ensure the abilities of emergency services providers to continue operating during hazardous events
4. Protect existing public and private infrastructure from damage

The Mitigation Action Plan focuses on actions to be taken by Plaquemines Parish. All of the activities in the Mitigation Action Plan will be focused on helping the parish and its communities in developing and funding projects that are not only cost effective but also meet the other DMA 2000 criteria of environmental compatibility and technical feasibility.

The Hazard Mitigation Plan Steering Committee reviewed and evaluated the potential action and project lists in which consideration was given to a variety of factors. Such factors include determining a project's eligibility for federal mitigation grants as well as its ability to be funded. This process required evaluation of each project's engineering feasibility, cost effectiveness, and environmental and cultural factors.

2020 Mitigation Actions and Update on Previous Plan Actions

The Plaquemines Parish Hazard Mitigation Plan Steering Committee identified new actions that would reduce and/or prevent future damage within Plaquemines Parish and their respective communities. In that effort, the parish focused on a comprehensive range of specific mitigation actions. These actions were identified in thorough fashion by the consultant team and the committee by way of frequent and open communications and meetings held throughout the planning process. The addition of these new actions, coupled with any ongoing and/or carried over projects from their previous update, provide Plaquemines Parish with a solid mitigation strategy through which risk and losses will be reduced throughout the parish and its communities.

As outlined in the Local Mitigation Planning Handbook the following are eligible types of mitigation actions:

- **Local Plans and Regulations –** These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.
- **Structure and Infrastructure Projects –** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area, and also includes projects to construct manmade structures to reduce the impact of hazards.
- **Natural System Protection –** These actions minimize the damage and losses and also preserve or restore the functions of natural systems.
- **Education and Awareness Programs –** These actions inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them.

The established and agreed upon parish actions relative to the parish-wide goals are below. Additionally, action updates from the previous plan updates can be found below the new actions.

Plaquemines Parish Previous Mitigation Actions

Plaquemines Parish Previous Mitigation Actions						
Jurisdiction-Specific Action	**Action Description**	**Funding Source**	**Time**	**Responsible Party, Agency, or Department**	**Hazard**	**Status**
OP1: Levee Maintenance	Maintain and expand existing levee protection to ensure levees do not fail during a storm surge event.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP2: Elevation and Acquisition	Elevate, acquire, or pilot reconstruct all RL and SRL structures in Plaquemines Parish.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP3: Drainage Projects	Widen drainage ditches and upgrade culverts.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Engineering Public Works Dept.	Flooding	Ongoing
OP4: Pump Stations Capacity	Upgrade existing pump station capacity and add new pump stations.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP5: Block Valves for Pump Stations	Upgrade existing pump stations by installing block valves to prevent against backwater flooding.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards	Ongoing
OP6: Wind Retrofit	Wind Retrofit all Critical Facilities against tornadoes and tropical cyclones.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	Ongoing
OP7: Pump Station Fuel Tank Hardening	Upgrade existing pump station fuel tanks to harden against wind and storm surge damage from tornadoes and tropical cyclones.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	Ongoing

Jurisdiction-Specific Action	Action Description	Funding Source	Time	Responsible Party, Agency, or Department	Hazard	Status
OP8: Elevate Pump Stations	Elevate or flood proof existing pump stations.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP9: Floodplain Development Ordinances	Add new Regulations reducing development density in flood plains.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Ongoing
OP10: Community Rating System Participation	Participate in the Community Rating System (CRS).	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Ongoing
OP11: National Flood Insurance Program Participation	Continue Parish participation in the NFIP	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government	Flooding	Ongoing
OP12: NFIP Outreach	Establish a public outreach campaign to ensure all homeowners in floodplains are aware of the various types of coverage options under the NFIP.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding	Ongoing
OP13: Flood Mitigation Outreach	Establish homeowner education program on flood mitigation measures.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding	Ongoing
OP14: Roadway Elevation	Elevate roadways that currently flood to allow proper evacuation routes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP15: All-Hazard Warning System Acquisition	Acquire all-hazard warning system to ensure proper citizen notification of floods, coastal hazards, levee failures, tropical cyclones, tornadoes and sinkholes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP16: All-Hazards Outreach Campaign	Develop a parish wide outreach and educational campaign, to provide educational brochures and other materials to libraries, schools, and other public facilities including mitigation measures for all hazards including floods, coastal hazards, levee failure, tropical cyclones, tornadoes and sinkholes.	HMGP, Local, and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP17: Acquisition of Bottled Water	Ensure adequate amounts of bottled water are available in the event of total saltwater intrusion.	Local and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards	Ongoing

Jurisdiction-Specific Action	Action Description	Funding Source	Time	Responsible Party, Agency, or Department	Hazard	Status
OP18: Alternative Intake Installation and Maintenance	Ensure alternative intakes are ready to take over intakes not available for use due to saltwater intrusion and install additional intakes if necessary.	Local and Regional	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Coastal Hazards	Ongoing
OP19: Marshland Restoration	Restore marshlands in Plaquemines Parish.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Coastal Resources Dept.	Coastal Hazards, Flooding	Ongoing
OP20: Erosion Barrier Creation	Create man-made and natural barriers to coastal erosion.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Coastal Resources Dept.	Coastal Hazards, Flooding	Ongoing
OP21: Community Education and Outreach Program Creation	Support the creation and implementation of a Community Education and Outreach Program.	HMGP, Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP22: Critical Facility Wind Hardening and/or Safe Room Installation	Wind Harden and/or install safe rooms in critical facilities against tornadoes and tropical cyclones.	HMGP	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	Ongoing
OP23: Generator Installation	Install generators in all critical facilities.	HMGP	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Levee Failure, Tornadoes, Tropical Cyclones	Ongoing
OP24: Responsible Development	Ensure that future development does not increase hazard losses.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP25: Responsible Development II	Guide future development away from hazard areas while maintaining other parish goals such as economic development and improving the quality of life.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP26: Building Code Enforcement	Enforce the International Building Code requirements for all new construction to strengthen buildings against high wind damage from tornadoes and tropical cyclones.	No Additional Funding Needed	1-5 Years	Plaquemines Parish Government, Plaquemines Parish Planning & Zoning Dept.	Tornadoes, Tropical Cyclones	Ongoing

Jurisdiction-Specific Action	Action Description	Funding Source	Timeframe	Responsible Party, Agency, or Department	Hazard	Status
OP27: File and Equipment Storage	Provide safe locations for files, records, and computer equipment.	HMGP, FMA	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing
OP28: Environmental Conservation Program Participation	Participate in existing programs at the state and federal levels oriented to environmental enhancement and conservation.	Local, Regional, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Flooding, Coastal Hazards, Levee Failure	Ongoing
OP29: Historic Resource Protection Integration	Integrate historic cultural resource protection into hazard mitigation planning to improve the ability of resources to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.	HMGP, Local, State, and Federal	1-5 Years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Tornadoes, Tropical Cyclones	Ongoing

Plaquemines Parish New Mitigation Actions

Plaquemines Parish New Mitigation Actions						
Jurisdiction-Specific Action	**Action Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Status**
NP1: Building Retrofits	Retrofit public buildings to maintain use during and after storm events. Reduces damage from high winds, and helps assure that the public buildings can be used, occupied and operable during or after storms.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Thunderstorms Tornadoes, Tropical Cyclones	New
NP2: Drainage Improvements	Will relieve flooding problems, reduce flood damage and costs of damage, overtopping of roads with drain water, while also keeping open roadways during periods of high precipitation. Relieves parish or local government and property owners of the continual flooding problems, with closed roadways (loss of function). Saves public funds for road repairs, drainage ditch repairs, sandbagging and blocking of roadways during storm periods.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Tropical Cyclones	New
NP3: Mitigation of Repetitive Loss and Severe Repetitive Loss Properties	Elevation, acquisition-demolition, acquisition-relocations, and reconstruction of repetitive loss or flooding or other hazard prone properties.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish OHSEP	Flooding, Tropical Cyclones	New
NP4: Safe Room Projects	Construction of a safe room for first responders located in Plaquemines Parish. Other locations will be identified based on funding availability.	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Tornadoes, Tropical Cyclones	New
NP5: Education and Outreach	Enhance the public outreach programs for the parish and all communities by increasing awareness of risks and safety for relevant hazards as well as providing information on high risk areas. Informing communities, business and citizens on proper mitigation efforts and activities will create resiliency within the parish and its communities.	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	New
NP6: Generators for Continuity of Operations and Government	Procurement and installation of generators at public facilities to ensure continued operations during and after events.	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Thunderstorms, Tornadoes, Tropical Cyclones	New

Jurisdiction-Specific Action	Action Description	Funding Source	Target Completion Date	Responsible Party, Agency, or Department	Hazard	Status
NP7: Lightning Mitigation	Procurement and Installation of Lightning rods and surge protectors for public buildings to preserve life and property	HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Lightning	New
NP8: Warning Systems	Install/update/upgrade public warning system components throughout Plaquemines Parish as necessary. Install audible and/or reverse 911 warning system(s)	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Sinkholes, Thunderstorms, Tornadoes, Tropical Cyclones	New
NP9: Potable Water	Create redundancy of potable water supply to critical facilities, especially hospitals in Plaquemines Parish, and provide protection of potable water supply by acquisition/installation of backflow preventers at appropriate critical locations.	Local, Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Levee Failure, Tornadoes, Tropical Cyclones	New
NP10: Promote Flood Insurance	Promote the purchase of flood insurance. Advertise the availability, cost, and coverage of flood insurance through the National Flood Insurance Program (NFIP).	FEMA HMGP, Local	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP	Coastal Hazards, Flooding, Tropical Cyclones	New
NP11: Pumping Station Projects	Elevate or flood proof pump stations; upgrade existing pump stations by installing block valves to prevent/protect against backwater	HMGP, Local, and Regional	1-5 years	Plaquemines Parish Government, Plaquemines OHSEP, Plaquemines Parish Engineering & Public Works Dept.	Flooding, Coastal Hazards, Levee Failure	New

Action Prioritization

During the prioritization process, the steering committee considered the costs and relative benefits of each new action. Costs can usually be listed in terms of dollars, although at times it involves staff time rather than the purchase of equipment or services that can be readily measured in dollars. In most cases, benefits, such as lives saved or future damage prevented, are hard to measure in dollars. Therefore, many projects were prioritized with these factors in mind. In addition, prioritization of the mitigation actions was performed based on the following economic criteria: i) whether the action can be performed with the existing parish resources; ii) whether the action requires additional funding from external sources; and iii) relative costs of the mitigation actions.

In all cases, the committee concluded that the benefits (in terms of reduced property damage, lives saved, health problems averted and/or economic harm prevented) outweighed the costs for the recommended action items.

The steering committee prioritized the possible activities that could be pursued. Steering committee members consulted appropriate agencies in order to assist with the prioritizations. The results were items that address the major hazards, are appropriate for those hazards, are cost-effective, and are affordable. The steering committee met internally for mitigation action meetings to review and approve mitigation actions for Plaquemines Parish. On-going actions, as well as actions which can be undertaken by existing parish staff without need for additional funding, were given high priority. The actions with high benefit and low cost, political support, and public support but require additional funding from parish or external sources were given medium priority. The actions that require substantial funding from external sources with relatively longer completion time were given low priority.

Plaquemines Parish will implement and administer the identified actions based off of the proposed timeframes and priorities for each reflected in the portions of this section where actions are summarized. The inclusion of any specific action item in this document does not commit the parish to implementation. Each action item will be subject to availability of staff and funding. Certain items may require regulatory changes or other decisions that must be implemented through standard processes, such as changing regulations. This plan is intended to offer priorities based on an examination of hazards.

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Appendix A: Planning Process

Purpose

The Hazard Mitigation Plan Update process prompts local jurisdictions to keep their hazard mitigation plan current and moving toward a more resilient community. The plan update builds on the research and planning efforts of previous plans while reviewing recent trends. The steering committee followed FEMA's hazard mitigation planning process per the FEMA Local Mitigation Planning Handbook. This planning process assured public involvement and the participation of interested agencies and private organizations. Documentation of the planning process for the updated plan is addressed in this section.

The Plaquemines Parish Hazard Mitigation Plan Update

The Plaquemines Parish Hazard Mitigation Plan Update process began in December 2019 with a series of meetings and collaborations between the contractor (SDMI) and the participating agencies. Update activities were intended to give each participating agency the opportunity to shape the plan to best fit their community's goals. Community stakeholders and the general public were invited to attend and contribute information to the planning process during specific time periods or meetings.

The table below details the meeting schedule and purpose for the planning process:

Date	Meeting or Outreach	Location	Public Invited	Purpose
12/17/2019	Kick Off Meeting	Belle Chasse, LA	No	Discuss with Parish HM Director the expectations and requirements of the project.
1/15/2020	Initial Planning Meeting	Belle Chasse, LA	No	Discuss with the plan Steering Committee expectations and requirements of the project. Assign plan worksheets to Parish.
2/12/2020	Risk Assessment Overview	Belle Chasse, LA	No	Discuss and review the Risk Assessment with the Steering Committee. Discuss and review expectations for Public Meeting.
2/12/2020	Public Meeting	Belle Chasse, LA	Yes	The Public Meeting allowed the public and community stakeholders to participate and provide input into the hazard mitigation planning process. Maps of the Plaquemines Parish communities were provide for the meeting attendees to identify specific areas where localized hazards occur.
Ongoing	Public Survey Tool	Online	Yes	This survey asked participants about public perceptions and opinions regarding natural hazards in St. Bernard Parish. In addition, questions covered the methods and techniques preferred for reducing the risks and losses associated with these hazards. Survey Results: https://www.surveymonkey.com/results/SM-6KQWRB2M7/
2 Week Period	Public Plan Review (Digital)		Yes	Parish Website or other locations determined by Steering Committee

Planning

The plan update process consisted of several phases:

	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6
Plan Revision						
Data Collection						
Risk Assessment						
Public Input						
Mitigation Strategy and Actions						
Plan Review by GOHSEP and FEMA						
Plan Adoption						
Plan Approval						

Coordination

The Plaquemines Parish Office of Homeland Security and Emergency Preparedness (OHSEP) oversaw the coordination of the 2020 Hazard Mitigation Plan Update Steering Committee during the update process. The parish OHSEP was responsible for identifying members for the committee.

The Parish Director and SDMI were jointly responsible for inviting the steering committees and key stakeholders to planned meetings and activities. SDMI assisted the Parish Director with press releases and social media statements for notification to the media and general public for public meetings and public outreach activities.

SDMI was responsible for facilitating meetings and outreach efforts during the update process.

Neighboring Community, Local and Regional Planning Process Involvement

From the outset of the planning process, the steering committee encouraged participation from a broad range of parish entities. The involvement of representatives from the city, state, and regional agencies provided diverse perspectives and mitigation ideas.

Formal participation in this plan includes but is not limited to the following activities:

- Participation in Hazard Mitigation Team meetings at the local and parish level
- Sharing local data and information
- Action item development
- Plan document draft review
- Formal adoption of the Hazard Mitigation Plan document following provisional approval by the State of Louisiana and FEMA

The 2020 Hazard Mitigation Plan Update Steering Committee consisted of representatives from the following parish, municipal or community stakeholders:

- Plaquemines Parish Government
- Plaquemines Office of Homeland Security and Emergency Preparedness
- Plaquemines Parish Public Works
- Plaquemines Parish Fire Department
- St. Bernard Office of Homeland Security and Emergency Preparedness

The St. Bernard Parish OHSEP Director attended the Kick Off, Initial Planning, and Risk Assessment Meetings for Plaquemines Parish in an effort to coordinate mitigation efforts where possible as neighboring communities. The St. Bernard OHSEP Director was invited via email and phone call to participate in an effort to collaborate with neighboring communities. SDMI assisted Plaquemines Parish with encouraging the collaboration with these neighboring communities via email by extending an invitation to the Plaquemines Hazard Mitigation Plan Update Meetings. The participation of the GOHSEP Region 1 Coordinator during the process also contributed to neighboring community representation.

As part of the coordination and planning process, the parish was provided the State Required Hazard Mitigation Plan Update Worksheet. The completed worksheets can be found in Appendix E – State Required Plan Update Worksheets.

Below is a detailed list of the 2020 HMPU Steering Committee:

Plaquemines Parish Hazard Mitigation Planning Committee				
Name	**Title**	**Agency**	**Email**	**Phone**
Patrick Harvey	Director	Plaquemines Parish OHSEP	pharvey@ppgov.net	504-912-1007
Ken Dugas	Chief Engineer	Plaquemines Parish Government	kdugas@ppgov.net	504-934-6115
Jonah Arceneaux	Engineer	Plaquemines Parish Government	jonah@ppgov.net	504-934-6115
Hilda Lott	Grants Administrator	Plaquemines Parish Government	hlott@ppgov.net	504-934-6376
Todd Eppley	Director of Public Service	Plaquemines Parish Government	teppley@ppgov.net	504-432-5448
Jade Duplessis	Public Information Officer	Plaquemines Parish Government	jduplessis@ppgov.net	504-934-6041
Jonathan Butcher	Superintendent	Plaquemines Parish Fire Department	jbutcher@ppgov.net	504-416-8327
Mike Metcalf	Superintendent - Permits	Plaquemines Parish Government	mmetcalf@ppgov.net	504-934-6195
John Rahaim	Director	St. Bernard Parish OHSEP	jrahaim@sbpg.net	504-278-4267
Collins Simoneaux	Regional Coordinator	GOHSEP	collins.simoneaux@la.gov	225-329-4261
Norman Pineda	Regional Coordinator	GOHSEP	norman.pineda@la.gov	225-636-1629

Program Integration

Local governments are required to describe how their mitigation planning process is integrated with other ongoing local and area planning efforts. This subsection describes Plaquemines Parish programs and planning.

A measure of integration and coordination is achieved through the HMPU participation of Steering Committee members and community stakeholders who administer programs such as: floodplain management under the National Flood Insurance Program (NFIP), coastal protection and restoration, parish planning and zoning and building code enforcement.

Plaquemines Parish will continue to integrate the requirements of this Hazard Mitigation Plan into other local planning mechanisms that are to be identified through future meetings of the Parish, and through the five-year review process described in the Plan Maintenance section. Opportunities to integrate the requirements of this Hazard Mitigation Plan into other local planning mechanisms will continue to be identified through future meetings of the Parish and through the five-year review process described in the Plan Maintenance section. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of any individual city/town plans that require specific planning and administrative tasks (e.g. risk assessment, plan amendments, ordinance revisions, capital improvement projects, etc.).

The members of the Plaquemines Parish Hazard Mitigation Steering Committee will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their communities or agencies are consistent with the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability in the Parish. Existing plans, studies, and technical information were incorporated in the planning process. Examples include flood data from FEMA and the U. S. Geological Survey. Much of this data was incorporated into the Risk Assessment component of the plan relative to plotting historical events and the magnitude of damages that occurred. The parish's 2005 Hazard Mitigation Plan was also used in the planning process. Other existing data and plans used in the planning process include those listed below.

- Louisiana Coastal Master Plan
- Parish Emergency Operations Plan
- State of Louisiana Hazard Mitigation Plan
- Flood Insurance Rate Maps

Further information on the plans can be found in the Capabilities Assessment, Section 3.

Meeting Documentation and Public Outreach Activities

The following pages contain documentation of the meetings and public outreach activities conducted during this hazard mitigation plan update for Plaquemines Parish.

Meeting #1: Hazard Mitigation Plan Update Kick-Off

Date: December 17, 2019

Location: Belle Chasse, Louisiana

Purpose: Discuss the expectations and requirements of the hazard mitigation plan update process and establish an initial project timeline with the Parish's OHSEP Director and any additional personnel.

Public Initiation: No

Meeting Invitees:

Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Ken Dugas	Chief Engineer	Plaquemines Parish Government
Jonah Arceneaux	Engineer	Plaquemines Parish Government
Hilda Lott	Grants Administrator	Plaquemines Parish Government
Lauren Morgan	Associate Director	Stephenson Disaster Management Institute
Chris Rippetoe	Program Manager	Stephenson Disaster Management Institute

Meeting #2: Hazard Mitigation Plan Update Initial Planning Meeting

Date: January 15, 2020

Location: Belle Chasse, Louisiana

Purpose: Discuss the expectations and requirements of the hazard mitigation plan update process and establish an initial project timeline with the Parish's Hazard Mitigation Plan Steering Committee. Assign each individual the parish data collection for the plan update.

Meeting Invitees:

Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Ken Dugas	Chief Engineer	Plaquemines Parish Government
Jonah Arceneaux	Engineer	Plaquemines Parish Government
Hilda Lott	Grants Administrator	Plaquemines Parish Government
Todd Eppley	Director of Public Service	Plaquemines Parish Government
Jade Duplessis	Public Information Officer	Plaquemines Parish Government
Jonathan Butcher	Superintendent	Plaquemines Parish Fire Department
Mike Metcalf	Superintendent - Permits	Plaquemines Parish Government
John Rahaim	Director	St. Bernard Parish OHSEP
Collins Simoneaux	Regional Coordinator	GOHSEP
Norman Pineda	Regional Coordinator	GOHSEP

Meeting #3: Risk Assessment Overview

Date: February 12, 2020

Location: Belle Chasse, Louisiana

Purpose: Members of the Plaquemines Parish Hazard Mitigation Plan Update Steering Committee were presented the results of the risk assessment and an overview of the public meeting presentation during this overview. The assessment was conducted based on hazards identified during previous plans and on any newly identified risks.

Public Initiation: No

Meeting Invitees:

Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Ken Dugas	Chief Engineer	Plaquemines Parish Government
Jonah Arceneaux	Engineer	Plaquemines Parish Government
Hilda Lott	Grants Administrator	Plaquemines Parish Government
Todd Eppley	Director of Public Service	Plaquemines Parish Government
Jade Duplessis	Public Information Officer	Plaquemines Parish Government
Jonathan Butcher	Superintendent	Plaquemines Parish Fire Department
Mike Metcalf	Superintendent - Permits	Plaquemines Parish Government
John Rahaim	Director	St. Bernard Parish OHSEP
Collins Simoneaux	Regional Coordinator	GOHSEP
Norman Pineda	Regional Coordinator	GOHSEP

Meeting #4: Public Meeting

Date: February 12, 2020

Location: Belle Chasse, Louisiana

Purpose: The Public Meeting allowed the public and community stakeholders to participate and provide input into the hazard mitigation planning process. Maps of the Plaquemines Parish communities were provided for the meeting attendees to identify specific areas where localized hazards occur.

Public Initiation: Yes

Meeting Invitees:

Name	Title	Agency
Patrick Harvey	Director	Plaquemines Parish OHSEP
Ken Dugas	Chief Engineer	Plaquemines Parish Government
Jonah Arceneaux	Engineer	Plaquemines Parish Government
Hilda Lott	Grants Administrator	Plaquemines Parish Government
Todd Eppley	Director of Public Service	Plaquemines Parish Government
Jade Duplessis	Public Information Officer	Plaquemines Parish Government
Jonathan Butcher	Superintendent	Plaquemines Parish Fire Department
Mike Metcalf	Superintendent - Permits	Plaquemines Parish Government
John Rahaim	Director	St. Bernard Parish OHSEP
Collins Simoneaux	Regional Coordinator	GOHSEP
Norman Pineda	Regional Coordinator	GOHSEP

Outreach Activity #1: Public Opinion Survey

Date: Ongoing throughout planning process
Location: Web survey
Public Initiation: Yes

Outreach Activity #2: Incident Questionnaire

Date: Public Meeting Activity
Location: Public Meeting
Public Initiation: Yes

Outreach Activity #3: Mapping Activities

Public meeting attendees were asked to identify areas on parish and community specific maps provided that were "problem areas." They were also asked to indicate any areas of new development. This activity gave the public an opportunity to interact with SDMI's GIS Mapping division as well as provide valuable input on areas that may flood repeatedly during rain events that may not get reported to local emergency managers as significant events.

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Appendix B: Plan Maintenance

Purpose

The section of the Code of Federal Regulations (CFR) pertaining to Local Mitigation Plans lists five required components for each plan: a description of the planning process; risk assessments; mitigation strategies; a method and system for plan maintenance; and documentation of plan adoption. This section details the method and system for plan maintenance, following the CFR's guidelines that the Plan Update must include (1) "a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle," (2) "a process by which local governments incorporated the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans" and (3) "discussion on how the community will continue public participation in the plan maintenance process."

Monitoring, Evaluating, and Updating the Plan

The Plaquemines Parish Planning Committee will be responsible for monitoring, evaluating, and documenting the plan's progress throughout the year. Part of the plan maintenance process should include a system by which local governing bodies incorporate the HMP into the parish's comprehensive or capital improvement plans. This process provides for continued public participation through the diverse resources of the parish to help in achieving the goals and objectives of the plan. Public participation will be achieved through availability of copies of HMP in parish public library and parish website. This section describes the whole update process which includes the following:

- Responsible parties
- Methods to be used
- Evaluation criteria to be applied
- Scheduling for monitoring and evaluating the plan

Responsible Parties

Plaquemines Parish has designated an entity that will perform a regular review and update of the Hazard Mitigation Plan. This will be the responsibility of the steering committee, which consists of representatives from governmental organizations, local businesses, and private citizens, who will be involved in the process of monitoring, evaluating and updating the plan. All committee members in this plan will remain active in the steering committee.

Although the people filling the positions may change from year to year, the parish and its stakeholders will have representatives on the Steering Committee. The future Steering Committee will continue to be comprised of the same job functions as currently evident in the Steering Committee. However, the decision of specific job duties will be left to the Parish OHSEP Director to be assigned as deemed appropriate.

Methods for Monitoring and Evaluating the Plan and Plan Evaluation Criteria

Plaquemines Parish has developed a method to ensure monitoring, evaluating, and updating of the HMP occurs during the five-year cycle of the plan. The planning committee will become a permanent body and will be responsible for monitoring, evaluating, and updating of the plan. The planning committee meeting

will be held annually in order to monitor, evaluate, and update the plan. The Plaquemines Parish OHSEP Director will be responsible for conducting the annual planning committee meetings. The lead person of the agency responsible for the implementation of a specific mitigation action will submit a progress report to the Plaquemines Parish OHSEP Director at least 30 days prior to the planning committee meeting. The progress report will provide project status monitoring to include the following: whether the project has started; if not started, reason for not starting; if started, status of the project; if the project is completed, whether it has eliminated the problem; and any changes recommended to improve the implementation of the project etc. In addition, the progress report will provide status monitoring on the plan evaluation, changes to the hazard profile, changes to the risk assessment, and public input on the Hazard Mitigation Plan updates and reviews.

Progress on the mitigation action items and projects will be reviewed during the annual planning committee meeting. The criteria that would be utilized in the project review will include the following:

1) Whether the action was implemented and reasons, if the action was not implemented

2) What were the results of the implemented action

3) Were the outcomes as expected, and reasons if the outcomes were not as expected

4) Did the results achieve the stated goals and objectives

5) Was the action cost-effective

6) What were the losses avoided after completion of the project

7) In case of a structural project, did it change the hazard profile

An evaluation of the plan will be conducted in the annual planning committee meeting. The planning committee will review each goal and objective to determine their relevance to changing situations in the parish, as well as changes to state or federal policy, and to ensure that they are addressing current and expected conditions. The planning committee will evaluate if any change in hazard profile and risk in the parish occurred during the past year. In addition, the evaluation will include the following criteria in respect of plan implementation:

1) Any local staffing changes that would warrant inviting different members to the planning committee

2) Any new organizations that would be valuable in the planning process or project implementation need to be included in the planning committee

3) Are there any procedures that can be done more efficiently

4) Are there more ways to gain more diverse and widespread cooperation

5) Are there any different or additional funding sources available for mitigation planning and implementation

The HMP will be updated every five years to remain eligible for continued HMGP funding. The planning committee will be responsible for updating the HMP. The OHSEP Director will be the lead person for the

HMP update. The HMP update process will commence at least one year prior to the expiration of the plan. The HMP will be updated after a major disaster if an annual evaluation of the plan indicates a substantial change in hazard profile and risk assessment in the parish.

Additionally, the public will be canvassed to solicit input to continue Plaquemines Parish's dedication to involving the public directly in review and updates of the Hazard Mitigation Plan. Meetings will be scheduled as needed by the plan administrator to provide a forum for which the public can express their concerns, opinions, and/or ideas about the plan. The plan administrator will be responsible for using parish resources to publicize the annual public meetings and maintain public involvement through the newspapers, radio, and public access television channels. Copies of the plan will be catalogued and kept at all appropriate agencies in the city government, as well as at the Public Library.

The review by the steering committee and input from the public will determine whether a plan update is needed prior to the required five-year update.

2020 Plan Version Plan Method and Schedule Evaluation

For the current plan update, the previously approved plan's method and schedule were evaluated to determine if the elements and processes involved in the required 2015 update were adequate. Based on this analysis, the method and schedule were deemed to be acceptable, and nothing was changed for this update.

Incorporation into Existing Planning Programs

It is the responsibility of the Plaquemines Parish Hazard Mitigation Plan Steering Committee to determine additional implementation procedures when appropriate. This may include integrating the requirements of the Plaquemines Parish Hazard Mitigation Plan into planning documents, processes, or mechanisms as follows:

- Ordinances, Resolutions, Regulations
- Floodplain Ordinances
- Comprehensive Master Plan
- Capital Improvements Plan
- Economic Development Plan
- Emergency Operations Plan
- Transportation Plan

The above referenced ordinances, building codes, and regulations will be amended by a resolution in the parish council in order to incorporate the mitigation actions identified in the HMP.

Opportunities to integrate the requirements of this plan into other local planning mechanisms will continue to be identified through future meetings of the Plaquemines Parish Hazard Mitigation Steering Committee and through the five-year review process described herein. The primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update and implementation of individual plans that require specific planning and administrative tasks (e.g. risk assessment, plan amendments, ordinance revisions, capital improvement projects, etc.). The members of the steering committee will meet with Department Heads to discuss what should be included in the

changes that are necessary before the changes are introduced to the city council or police jury meetings. The members of the steering committee will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their agencies are consistent with the goals and actions of the Plaquemines Parish Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability within the parish.

During the planning process for new and updated local planning documents, such as a Risk Assessment, Comprehensive Plan, Capital Improvements Plan, or Emergency Operations Plan, the parish will provide a copy of the Parish Hazard Mitigation Plan to the appropriate parties and recommend that all goals and strategies of new and updated local planning documents are consistent with and support the goals of the Parish Hazard Mitigation Plan and will not contribute to increased hazards.

Although it is recognized that there are many possible benefits to integrating components of this plan into other parish planning mechanisms, the development and maintenance of this stand-alone Hazard Mitigation Plan is deemed by the steering committee to be the most effective and appropriate method to ensure implementation of parish and local hazard mitigation actions. And while the development and maintenance of this stand-alone plan has been recognized as the most effective course of mitigation action implementation, individual facets of this plan have been used to bolster other planning and mitigation efforts. The following parish plans incorporate requirements of the Plaquemines Parish Hazard Mitigation Plan Update as follows:

- Comprehensive Master Plan – Updated as needed by Plaquemines Parish Government
- Capital Improvements Plan – Updated as needed by Plaquemines Parish Government
- Economic Development Plan – Updated as needed by Plaquemines Parish Government
- Local Emergency Operations Plan – Updated as needed by Plaquemines Parish OHSEP
- Transportation Plan – Updated as needed by Plaquemines Parish OHSEP

Continued Public Participation

Public participation is an integral component of the mitigation planning process and will continue to be essential as this plan evolves over time. Significant changes or amendments to the plan require a public hearing prior to any adoption procedures. Other efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising meetings of the Mitigation Committee in the local newspaper, public bulletin boards, and/or city and county office buildings
- Designating willing and voluntary citizens and private sector representatives as official members of the Mitigation Committee
- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place
- Utilizing city and Parish web sites to advertise any maintenance and/or periodic review activities taking place
- Keeping copies of the plan in appropriate public locations.

Appendix C: Essential Facilities

Plaquemines Parish Essential Facilities

Plaquemines Parish Unincorporated Essential Facilities										
Type	Name	Coastal Hazards	Flooding	Hail	Wind	Lightning	Levee Failure	Sinkhole	Tornadoes	Tropical Cyclones
Fire and Rescue	Belle Chasse Fire Department No. 3	X	X	X	X	X	X		X	X
	Braithwaite Fire Department	X	X	X	X	X	X		X	X
	O'Brien Fire Station	X	X	X	X	X	X		X	X
	Boothville-Venice Volunteer Fire Station	X	X	X	X	X	X		X	X
	Buras Volunteer Fire Department	X	X	X	X	X	X		X	X
	Belle Chasse Volunteer Fire Department	X	X	X	X	X	X		X	X
	Port Sulphur Fire Department	X	X	X	X	X	X		X	X
	Belle Chasse Fire Department	X	X	X	X	X	X		X	X
	Myrtle Grove Fire Station	X	X	X	X	X	X		X	X
	Lake Hermitage Fire Station	X	X	X	X	X	X		X	X
	Pointe a la Hache Fire Station	X	X	X	X	X	X		X	X
	Woodlawn Fire Station	X	X	X	X	X	X		X	X
	Phoenix Fire Substation	X	X	X	X	X	X		X	X
	Belle Chasse Station 5	X	X	X	X	X	X		X	X

Plaquemines Parish Unincorporated Essential Facilities										
Type	**Name**	**Coastal Hazards**	**Flooding**	**Hail**	**Wind**	**Lightning**	**Levee Failure**	**Sinkhole**	**Tornadoes**	**Tropical Cyclones**
Government	Plaquemines Parish Courthouse	X	X	X	X	X	X		X	X
	Plaquemines Parish Government Building	X	X	X	X	X	X		X	X
	Plaquemines Parish Government Annex Building	X	X	X	X	X	X		X	X
	Plaquemines Parish School Board	X	X	X	X	X	X		X	X
	Plaquemines Parish Government Complex	X	X	X	X	X	X		X	X
Law Enforcement	Plaquemines Parish Sheriff's Office	X	X	X	X	X	X		X	X
	PPSO District 2	X	X	X	X	X	X		X	X
Corrections	Plaquemines Parish Detention Center	X	X	X	X	X	X		X	X
Public Health	Plaquemines Parish Health Department	X	X	X	X	X	X		X	X
	Port Sulphur EMS						X			

Plaquemines Parish Unincorporated Essential Facilities										
Type	**Name**	**Coastal Hazards**	**Flooding**	**Hail**	**Wind**	**Lightning**	**Levee Failure**	**Sinkhole**	**Tornadoes**	**Tropical Cyclones**
Schools	Belle Chasse Elementary School	X	X	X	X	X	X		X	X
	Belle Chasse Middle School	X	X	X	X	X	X		X	X
	Belle Chasse High School	X	X	X	X	X	X		X	X
	Boothville-Venice Elementary School	X	X	X	X	X	X		X	X
	South Plaquemines Elementary School	X	X	X	X	X	X		X	X
	South Plaquemines High School	X	X	X	X	X	X		X	X
	Belle Chasse Primary School	X	X	X	X	X	X		X	X
	PPSB Woodland Central Office	X	X	X	X	X	X		X	X
	Plaquemines Parish Learning Center	X	X	X	X	X	X		X	X
	Phoenix High School	X	X	X	X	X	X		X	X
	North Transportation Facility	X	X	X	X	X	X		X	X
	South Transportation Facility	X	X	X	X	X	X		X	X
	Food Service Maintenance Facility	X	X	X	X	X	X		X	X
	Port Sulphur Faculty Housing	X	X	X	X	X	X		X	X
	South Plaquemines Faculty Housing (Buras)	X	X	X	X	X	X		X	X
	South Plaquemines Faculty Housing Annex	X	X	X	X	X	X		X	X
	PPSB Warehouse	X	X	X	X	X	X		X	X
	Plaquemines Parish School Board	X	X	X	X	X	X		X	X

Plaquemines Parish Unincorporated Essential Facilities										
Type	Name	Coastal Hazards	Flooding	Hail	Wind	Lightning	Levee Failure	Sinkhole	Tornadoes	Tropical Cyclones
Pumping Stations	Belle Chasse Pump Station No. 1	X	X	X	X	X	X		X	X
	Belle Chasse Pump Station No. 2	X	X	X	X	X	X		X	X
	Barriere Road Pump Station	X	X	X	X	X	X		X	X
	Braithwaite Pump Station	X	X	X	X	X	X		X	X
	Scarsdale Pump Station	X	X	X	X	X	X		X	X
	Upper Ollie Pump Station	X	X	X	X	X	X		X	X
	Old Lower Ollie Pump Station	X	X	X	X	X	X		X	X
	Belair Pump Station	X	X	X	X	X	X		X	X
	New Lower Ollie Pump Station	X	X	X	X	X	X		X	X
	Bellevue Pump Station	X	X	X	X	X	X		X	X
	Wilkinson Canal Pump Station	X	X	X	X	X	X		X	X
	East Pointe A La Hache Pump Station	X	X	X	X	X	X		X	X
	Pointe Celeste Pump Station	X	X	X	X	X	X		X	X
	West Pointe A La Hache Pump Station	X	X	X	X	X	X	X	X	X
	Diamond Pump Station	X	X	X	X	X	X		X	X
	Hayes Pump Station	X	X	X	X	X	X	X	X	X
	Gainard Woods Pump Station No. 1	X	X	X	X	X	X		X	X
	Gainard Woods Pump Station No. 2	X	X	X	X	X	X		X	X
	Sunrise Pump Station No. 1	X	X	X	X	X	X		X	X
	Sunrise Pump Station No. 2	X	X	X	X	X	X		X	X
	Grand Liard Pump Station	X	X	X	X	X	X		X	X
	Duvic Pump Station	X	X	X	X	X	X	X	X	X

Appendix D: Plan Adoption

RESOLUTION NO. 20-162

On motion of Council Member Guey, seconded by Council Member Arbourgh, and on roll call all members present and voting "YES", except Council Members Black and Blink who were "ABSENT", the following Resolution was adopted:

A Resolution to adopt the Plaquemines Parish Government 2020 Hazard Mitigation Plan; and otherwise to provide with respect thereto.

WHEREAS, the Plaquemines Parish Government recognizes the threat that natural hazards pose to people and property within Plaquemines Parish; and

WHEREAS, the Plaquemines Parish Government has prepared a multi-hazard mitigation plan, hereby known as the 2020 Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS, the 2020 Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Plaquemines Parish from the impacts of future hazards and disaster; and

WHEREAS, adoption by the Plaquemines Parish Government demonstrates our commitment to the hazard mitigation and achieving the goals outlined in the 2020 Hazard Mitigation Plan;

NOW, THEREFORE:

BE IT RESOLVED BY THE PLAQUEMINES PARISH COUNCIL THAT it hereby adopts the Plaquemines Parish Government 2020 Hazard Mitigation Plan.

BE IT FURTHER RESOLVED BY THE PLAQUEMINES PARISH COUNCIL THAT the Secretary of this Council is hereby authorized and directed to immediately certify and release this Resolution and that Parish employees and officials are authorized to carry out the purposes of this Resolution, both without further reading and approval by the Plaquemines Parish Council.

I hereby certify the above and foregoing to be a true and correct copy of a Resolution adopted by the Plaquemines Parish Council at a meeting held in the Pointe-a-la-Hache Courthouse Council Chambers, 18055 Highway 15, Pointe-a-la-Hache, Louisiana, on Thursday, June 25, 2020.

Kim M. Jones

Secretary

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Appendix E: State Required Worksheets

During the planning process (Appendix A) the Hazard Mitigation Plan Update Steering Committee was provided state-required plan update process worksheets to be filled out. The worksheets were presented at the Initial Planning Meeting by SDMI as tools for assisting in the update of the Hazard Mitigation Plan, but also as a State Requirement (Element E) for the update. The plan update worksheets allowed for collection of information such as planning team members, community capabilities, critical infrastructure and vulnerable populations and NFIP information. The following pages contain documentation of the state required worksheets.

Mitigation Planning Team

Plaquemines Parish Hazard Mitigation Planning Committee				
Name	**Title**	**Agency**	**Email**	**Phone**
Patrick Harvey	Director	Plaquemines Parish OHSEP	pharvey@ppgov.net	504-912-1007
Ken Dugas	Chief Engineer	Plaquemines Parish Government	kdugas@ppgov.net	504-934-6115
Jonah Arceneaux	Engineer	Plaquemines Parish Government	jonah@ppgov.net	504-934-6115
Hilda Lott	Grants Administrator	Plaquemines Parish Government	hlott@ppgov.net	504-934-6376
Todd Eppley	Director of Public Service	Plaquemines Parish Government	teppley@ppgov.net	504-432-5448
Jade Duplessis	Public Information Officer	Plaquemines Parish Government	jduplessis@ppgov.net	504-934-6041
Jonathan Butcher	Superintendent	Plaquemines Parish Fire Department	jbutcher@ppgov.net	504-416-8327
Mike Metcalf	Superintendent - Permits	Plaquemines Parish Government	mmetcalf@ppgov.net	504-934-6195
John Rahaim	Director	St. Bernard Parish OHSEP	jrahaim@sbpg.net	504-278-4267
Collins Simoneaux	Regional Coordinator	GOHSEP	collins.simoneaux@la.gov	225-329-4261
Norman Pineda	Regional Coordinator	GOHSEP	norman.pineda@la.gov	225-636-1629

Capability Assessment

Planning and Regulatory		
Please indicate which of the following plans and regulatory capabilities your jurisdiction has in place.		
	Plaquemines Parish	**Comments**
Plans	Yes / No	
Comprehensive / Master Plan	Yes	
Capital Improvements Plan	Yes	
Economic Development Plan	Yes	
Local Emergency Operations Plan	Yes	
Continuity of Operations Plan	No	
Transportation Plan	Yes	
Stormwater Management Plan	No	
Community Wildfire Protection Plan	No	
Other plans (redevelopment, recovery, coastal zone management)	Yes	
Building Code, Permitting and Inspections	Yes / No	
Building Code	Yes	LSUCC
Building Code Effectiveness Grading Schedule (BCEGS) Score	No	
Fire Department ISO/PIAL rating	Yes	Dist 1 - 5; Dist 2 -4, Dist 3 - 5, Dist 4 - 5, Dist 5 - 6, Dist 6 - 4, Dist 7 - 5
Site plan review requirements	Yes	
Land Use Planning and Ordinances	Yes / No	
Zoning Ordinance	Yes	Local
Subdivision Ordinance	Yes	Local
Floodplain Ordinance	Yes	FEMA
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	No	
Flood Insurance Rate Maps	Yes	Paper & digital
Acquisition of land for open space and public recreation uses	Yes	
Other	No	

Administration and Technical		
Identify whether your community has the following administrative and technical capabilities. For smaller jurisdictions without local staff resources, if there are public resources at the next higher level government that can provide technical assistance, indicate so in your comments.		
	Plaquemines Parish	**Comments**
Administration	Yes / No	
Planning Commission	Yes	
Mitigation Planning Committee	No	
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	No	
Mutual Aid Agreements	Yes	
Staff	Yes / No	
Chief Building Official	Yes	ICC Certified Building Official
Floodplain Administrator	Yes	ASFPM Certified Floodplain Manager
Emergency Manager	Yes	
Community Planner	No	
Civil Engineer	Yes	
GIS Coordinator	Yes	
Grant Writer	Yes	
Other		
Technical	Yes / No	
Warning Systems / Service (Reverse 911, outdoor warning signals)	Yes	
Hazard Data & Information	Yes	
Grant Writing	Yes	
Hazus Analysis	No	
Other		

Financial		
Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.		
	Plaquemines Parish	**Comments**
Funding Resources	Yes / No	
Capital Improvements project funding	Yes	
Authority to levy taxes for specific purposes	Yes	
Fees for water, sewer, gas, or electric services	Yes	
Impact fees for new development	Yes	
Stormwater Utility Fee	No	
Community Development Block Grant (CDBG)	Yes	
Other Funding Programs	Yes	

Education and Outreach		
Identify education and outreach programs and methods, already in place that could be used to implement mitigation activities and communicate hazard-related information.		
	Plaquemines Parish	**Comments**
Program / Organization	Yes / No	
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Yes	
Natural Disaster or safety related school program	Yes	
Storm Ready certification	Yes	
Firewise Communities certification	No	
Public/Private partnership initiatives addressing disaster-related issues	No	
Other		

Building Inventory

Plaquemines Parish Owned Building Information									
Plaquemines Parish									
Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
	Belle Chasse Elementary School	School	539 F Edward Hebert Boulevard	Belle Chasse	29.89271091	-89.97442154	$16,645,000	1993	Concrete
	Belle Chasse Middle School	School	13476 LA 23	Belle Chasse	29.73170346	-90.00765911	$17,532,608	1955	Concrete
	Belle Chasse High School	School	8346 LA 23	Belle Chasse	29.855084	-89.986613	$25,282,010	1958	Concrete
	Boothville-Venice Elementary School	School	1 Oiler Drive	Boothville	29.3362089	-89.40614662	$17,955,000	1975	Concrete
	South Plaquemines Elementary School	School	311 Civic Drive	Port Sulphur	29.47702884	-89.69587647	$31,009,059	2014	Concrete
	South Plaquemines High School	School	34121 LA 23	Buras	29.36639048	-89.571664	$42,730,854	2013	Concrete
	Plaquemines Parish Library - Belle Chasse Branch	Library	8442 LA 23	Belle Chasse	29.85288602	-89.98738298	$903,000		Concrete
	Plaquemines Parish Library - Buras Branch	Library	35572 LA 11	Buras	29.35505758	-89.52857848	$3,400,000		Concrete
	Plaquemines Parish Sheriff's Office	Law Enforcement	8022 LA 23	Belle Chasse	29.859967	-89.99271	$3,400,000		Concrete
	Plaquemines Parish Detention Center	Law Enforcement	16801 LA 15	Davant	29.600703	-89.814783	$98,000,000		Concrete
	Plaquemines Parish Government Building	Government	28028 LA 23	Port Sulphur	29.477669	-89.692673	$3,500,000		Concrete
	Belle Chasse Fire Department No. 3	Fire & SAR	13476 LA 23	Belle Chasse	29.73145628	-90.00625335	$266,000		Metal
	Braithwaite Fire Department	Fire & SAR	7163 LA 39	Braithwaite	29.76465048	-90.01681897	$381,000		Metal
	O'Brien Fire Station	Fire & SAR	31725 LA 23	Buras	29.415777	-89.612943	$800,000		Metal
	Boothville-Venice Volunteer Fire Station	Fire & SAR	42661 LA 23	Venice	29.280489	-89.359516	$7,165,000		Concrete

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
	Buras Volunteer Fire Department	Fire & SAR	35410 LA 23	Buras	29.358123	-89.532143	$3,544,000		Concrete
	Belle Chasse Volunteer Fire Department	Fire & SAR	216 Engineers Road	Belle Chasse	29.87322172	-90.01400958	$767,000		Metal
	Port Sulphur Fire Department	Fire & SAR	114 Civic Drive	Port Sulphur	29.47991641	-89.69490782	$6,900,000		Concrete
	Port Sulphur EMS	EMS	114 Civic Drive	Port Sulphur	29.479799	-89.69505			Concrete
	Plaquemines Parish Government Building	Government	8056 LA 23	Belle Chasse	29.859303	-89.991907	$3,152,000		Concrete
	Plaquemines Parish Government Annex Building	Government	301 Main St	Belle Chasse	29.856796	-89.983583	$2,800,000		Metal
	Plaquemines Parish School Board	Government	557 F Edward Hebert Boulevard	Belle Chasse	29.89110976	-89.97524002			Concrete
	Plaquemines Parish Government Complex	Government	333 F Edward Hebert Boulevard	Belle Chasse	29.896769	-89.979355	$20,000,000		Concrete
	Belle Chasse Water Treatment Plant	Water Treatment	107 E Cuevas St	Belle Chasse	29.853973	-89.984769	$2,500,000		Concrete
	Port Sulphur Water Treatment Plant	Water Treatment	228969 Hwy 23	Port Sulphur	29.57171	-89.80426			Concrete
	Boothville Water Treatment Plant	Water Treatment	38903 Hwy 23	Boothville	29.352744	89.440814	$660,000		Concrete
	Dalcour Water Treatment Plant	Water Treatment	170 Water Plant Rd	Braithwaite	29.857895	-89.922159	$500,000		Concrete
	Ponte a la Hache Water Treatment Plant	Water Treatment	17581 Hwy 15	Pointe a la Hache	29.586281	-89.807102	$423,000		Concrete
	Belle Chasse Wastewater Treatment Plant	Wastewater Treatment	126 Sewer Plant Rd	Belle Chasse	29.481758	-90.04915	$661,000		Concrete
	Port Sulphur Wastewater Treatment Plant	Wastewater Treatment	180 Lee Dr.	Port Sulphur	29.48223	-89.701512	$2,300,000		Concrete
	Buras Wastewater Treatment Plant	Wastewater Treatment	120 Eldorado Dr.	Buras	29.34173	-89.516918	$900,000		Concrete

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
	Boothville Wastewater Treatment Plant	Wastewater Treatment	135 Sewer Plant Rd	Boothville	29.315745	-89.385583	$200,000		Concrete
	Davant Wastewater Treatment Plant	Wastewater Treatment	15337 Hwy 15	Davant	29.62163	-89.867127			Concrete
	Braithwaite Wastewater Treatment Plant	Wastewater Treatment	1165 Hwy 39	Braithwaite	29.852986	-89.90943			Concrete
	Ironton Oxidation Pond	Wastewater Treatment	17200 Hwy 23	Ironton	29.637983	-89.970359			
	Myrtle Grove Oxidation Pond	Wastewater Treatment	17200 Hwy 23	Ironton	29.637983	-89.970359			
	Belle Chasse Pump Station No. 1	Pumping Station		Belle Chasse	29.852584	-90.019209	$7,000,000	1964	Metal
	Belle Chasse Pump Station No. 2	Pumping Station		Belle Chasse	29.895858	-89.997646	$7,000,000	1996	Metal
	Barriere Road Pump Station	Pumping Station		Belle Chasse	29.85588	-90.021382			Metal
	Braithwaite Pump Station	Pumping Station					$7,800,000	1974	Metal
	Scarsdale Pump Station	Pumping Station	Scarsdale Rd	Scarsdale	29.833289	-89.959577	$25,000,000	1965	Metal
	Upper Ollie Pump Station	Pumping Station						1950	Metal
	Old Lower Ollie Pump Station	Pumping Station						1950	Metal
	Belair Pump Station	Pumping Station			29.74228	-89.987659	$8,300,000	1965	Metal
	New Lower Ollie Pump Station	Pumping Station						1983	Metal
	Bellevue Pump Station	Pumping Station			29.624337	-89.877504	$15,000,000	1972	Metal
	Wilkinson Canal Pump Station	Pumping Station			29.623869	-89.955972			Metal

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
	East Pointe A La Hache Pump Station	Pumping Station						1972	Metal
	Pointe Celeste Pump Station	Pumping Station		Davant	29.579174	-89.856994			Metal
	West Pointe A La Hache Pump Station	Pumping Station		West Pointe A La Hache	29.569438	-89.803144		1981	Metal
	Diamond Pump Station	Pumping Station		Port Sulphur	29.527785	-89.762578	$7,000,000	1978	Metal
	Hayes Pump Station	Pumping Station		Port Sulphur	29.500574	-89.720974	$14,000,000	1963	Metal
	Gainard Woods Pump Station No. 1	Pumping Station	Levee Rd	Port Sulphur	29.450094	-89.649558	$10,800,000	1960	Metal
	Gainard Woods Pump Station No. 2	Pumping Station						1986	Metal
	Sunrise Pump Station No. 1	Pumping Station	LA 23	Buras	29.362406	-89.562122	$7,700,000		Metal
	Sunrise Pump Station No. 2	Pumping Station							Metal
	Grand Liard Pump Station	Pumping Station		Triumph	29.326501	-89.480765	$22,000,000	1971	Metal
	Duvic Pump Station	Pumping Station	Duvic Pump Rd	Venice	29.131588	-89.388209	$17,000,000	1976	Metal
	Belle Chasse Primary School	School	601 F. Edward Hebert	Belle Chasse	29.89401	-89.975007	$26,421,265	2019	Concrete
	Plaquemines Parish Courthouse	Government	Hwy 15	Pointe a la Hache	29.578909	-89.795218	$13,000,000		Concrete
	PPSO District 2	Law Enforcement	Civic Drive	Port Sulphur	29.479616	-89.694431	$4,500,000		Concrete
	Belle Chasse Fire Department	Fire & SAR	104 New Orleans St	Belle Chasse	29.850807	-89.987438	$6,500,000		Concrete
	Myrtle Grove Fire Station	Fire & SAR	Hwy 23	Port Sulphur	29.635418	-89.949476	$3,500,000		Concrete
	PPSB Woodland Central Office	School		Belle Chasse	29.901093	-89.984817	$1,160,000		Metal

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
	Lake Hermitage Fire Station	Fire & SAR	2766 Lake Heritage Rd	Port Sulphur			$1,000,000		Concrete
	Plaquemines Parish Learning Center	School	26880 Hwy 23	Port Sulphur	29.500379	-89.717697	$7,800,000	2010	
	Phoenix High School	School	12700 Hwy 39	Braithwaite	29.64444	-89.928816	$27,654,000	2014	
	North Transportation Facility	School					$2,163,058	2014	
	South Transportation Facility	School					$2,434,000	2012	
	Food Service Maintenance Facility	School					$2,480,600	2017	
	Port Sulphur Faculty Housing	School					$3,164,000	2016	
	South Plaquemines Faculty Housing (Buras)	School					$9,500,000	2012	
	South Plaquemines Faculty Housing Annex	School					$1,658,628	2012	
	PPSB Warehouse	School	106 Jarrell Dr.		29.900742	-89.985386	$304,000		
	Plaquemines Parish School Board	School	557 F Edward Hebert Blvd	Belle Chasse	29.891115	-89.975237	$1,010,000	1993	
	Pointe a la Hache Fire Station	Fire & SAR			29.57994	-89.795855			
	Woodlawn Fire Station	Fire & SAR			29.764647	-90.016765			
	Phoenix Fire Substation	Fire & SAR			29.641791	-89.930144			
	Belle Chasse Station 5	Fire & SAR			29.895381	-89.976477			
	Plaquemines Parish Health Department	Public Health	3706 Main St.	Belle Chasse	29.885210	-89.971093			Masonry

Vulnerable Populations

Vulnerable Populations Worksheet – Plaquemines Parish					
All Hospitals (Private or Public)	**Address**	**City**	**Zip Code**	**Latitude**	**Longitude**
Ochsner Health Center	7772 Hwy 23	Belle Chasse	70037	29.86423231	-89.99895747
Plaquemines Medical Center	27136 Hwy 23	Port Sulphur	70083	29.50187156	-89.71671523
Nursing Homes (Private or Public)	**Address**	**City**	**Zip Code**	**Latitude**	**Longitude**
Riverbend Nursing Home	13735 Hwy 23	Belle Chasse	70037	29.727619	-89.999352
Mobile Home Parks	**Address**	**City**	**Zip Code**	**Latitude**	**Longitude**
Unknown Mobile Home Park	22 Trey Ln	Belle Chasse	70037	29.81908564	-90.01086919
Unknown Mobile Home Park	106 River Oaks Dr	Belle Chasse	70037	29.79899265	-90.02124789
Unknown Mobile Home Park	116 Badalamenti Ln	Belle Chasse	70037	29.78500612	-90.02381692
Unknown Mobile Home Park	126 W. Oak Grove Ln.	Belle Chasse	70037	29.7693862	-90.02917996
Unknown Mobile Home Park	114 Naomi Dr.	Belle Chasse	70037	29.70309472	-89.99058251
Unknown RV Park	110 Windmill Ln.	Belle Chasse	70037	29.70196911	-89.98995373
Unknown RV Park	14723 Hwy 23	Belle Chasse	70037	29.70599175	-89.98906184
Unknown Mobile Home Park	123 Timber Ridge St.	Belle Chasse	70037	29.87476098	-90.01899906
Pelicans Point	29574 Hwy 23	Port Sulphur	70083	29.45227407	-89.65437445
Gauthier's Get-Away	Nearby: 29820-29828 Louisiana 23	Port Sulphur	70083	29.45068322	-89.64590788
J-Bar Sportsman Lodge and RV Park	32798 Hwy 11	Buras	70041	29.39090492	-89.60352639
Danos Mobile Home Rentals	R P Ln.	Buras	70041	29.33814858	-89.47413114
Kimberly's Kourt	Nearby: 101-199 Moaks Lane	Buras	70041	29.34334807	-89.46689513
Goodman's Trailer Park	Nearby: 100-168 Goodman Lane	Buras	70041	29.35115966	-89.43342838
Unknown Mobile Home Park	121 Ostrica Ln.	Buras	70041	29.34242469	-89.41484151
Jim's RV Sites	Nearby: 41180-41198 Louisiana 23	Buras	70041	29.31389041	-89.38668352
Unknown Mobile Home Park	Yvonnes Ln.	Buras	70041	29.31251698	-89.38603406
Delta Dragon RV Park	42101 Highway 23	Buras	70041	29.2926355	-89.36978482
Stumpfs RV Park	113 Stump Ln.	Venice	70091	29.27499962	-89.35613672
Targa RV Park	193 Sooner Ln.	Venice	70091	29.2724111	-89.3560175
Phi Boothville Housing	100 Ernies Ln.	Boothville	70041	29.33294787	-89.40202936
C&H Mobile Home Park	26180 Hwy 23	Port Sulphur	70083	29.51456901	-89.72609282

National Flood Insurance Program (NFIP)

National Flood Insurance Program (NFIP)	
Plaquemines Parish	
Insurance Summary	
How many NFIP polices are in the community? What is the total premium and coverage?	5,365 policies, $4,108,854 Premiums, $1,510,369,700 coverage
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	4614 claims paid, $354,516,002.84 amount paid, 2649 substantial damage claims
How many structures are exposed to flood risk with in the community?	As with all communities, all structures are subject to flood risk
Describe any areas of flood risk with limited NFIP policy coverage.	None
Staff Resources	
Is the Community FPA or NFIP Coordinator certified?	Yes, Certified Floodplain manager
Is flood plain management an auxiliary function?	No (full time)
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	All of those listed above
What are the barriers to running an effective NFIP program in the community, if any?	None
Compliance History	
Is the community in good standing with the NFIP?	Yes
Are there any outstanding compliance issues(i.e., current violations)?	No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact(CAC)?	2016 (CAV)
Is a CAV or CAC scheduled or needed? If so when?	Not due at this time
Regulation	
When did the community enter the NFIP?	1985
Are the FIRMs digital or paper?	Both
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	Regulations are in compliance with the National Floodplain Ordinance
Community Rating System (CRS)	
Does the community participate in CRS?	No
What is the community's CRS Class Ranking?	N/A
Does the plan include CRS planning requirements?	N/A