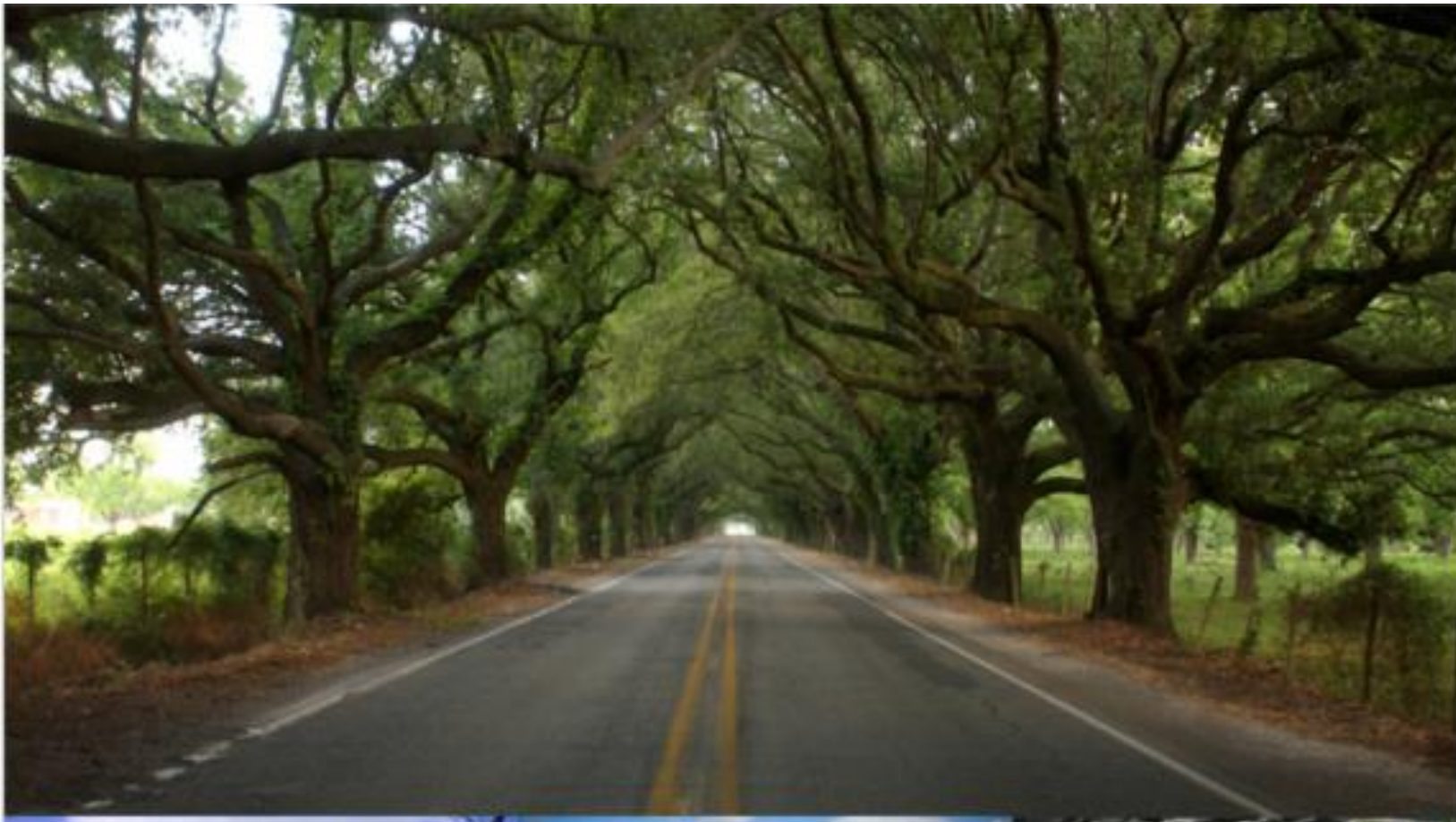

ST. BERNARD

PARISH HAZARD MITIGATION UPDATE - 2015

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ST. BERNARD PARISH
HAZARD MITIGATION PLAN UPDATE

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St. Bernard Parish

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ACKNOWLEDGMENTS

This 2015 St. Bernard Parish Hazard Mitigation Plan Update was coordinated by the St. Bernard Parish Hazard Mitigation Plan Update Steering Committee, in collaboration with community stakeholders and the general public.

Special thanks is directed to all of those who assisted in contributing feedback and expertise on this document, especially the St. Bernard Parish Office of Homeland Security and Emergency Management. These combined efforts have made this project possible. The Parish Steering Committee consists of the following individuals, who are credited in the creation of this document:

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The 2015 St. Bernard Parish Hazard Mitigation Plan Update was written by the Stephenson Disaster Management Institute, Louisiana State University. Further comments should be directed to the St. Bernard Parish Office of Homeland Security and Emergency Preparedness: 8201 W. Judge Perez Dr., Chalmette, LA 70043 (504)278-4268, jrahaim@sbpg.net .

Contents

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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 St. Bernard 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 St. Bernard Parish less vulnerable and more disaster resistant. It also includes mitigation project scoping to further identify scopes of work, estimated costs, 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 St. Bernard Parish Hazard Mitigation Plan is a single jurisdictional plan that covers the unincorporated communities of Arabi, Chalmette, Meraux, Poydras, and St. Bernard. 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 St. Bernard 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 described at the end of this chapter.

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 the Parish and its communities with a blueprint for reducing the impacts of these natural hazards on people and property.

Location, Demography and Economy

St. Bernard Parish is located in the southeast portion of Louisiana. The parish is bordered to the north by Orleans Parish and Lake Borgne, to the east by the Chandeleur Sound, to the south by Breton Sound, and to the west by Plaquemines Parish and the Mississippi River. St. Bernard Parish has an area of 1,793 square miles (or 1,147,520 acres), of which 465 square miles (or 297,600 acres) is land and 1,328 square miles or 850,350 acres is water (See *Figure 1-1*).

Figure 1-1: St. Bernard Parish

The geography of St. Bernard Parish varies from the north to the south. In the north, the landscape is mostly flat, used for agricultural purpose. Toward the south, around the bayous, lakes and salt marshes that characterize the coastal areas, water and low lands dominate the terrain. Of the 1,790 square miles of the parish, over 1,300 square miles are accounted for by water. Elevation throughout the parish averages 5 feet above sea level.

Approximately 90% of the total land area of St. Bernard Parish is located within FEMA's 100-year floodplain. The only significant area outside the 100-year floodplain is the land around Highway 46, which is in the 500-year floodplain.

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

Population

The population of St. Bernard Parish is estimated at 44,409 (2014 estimate) with a population percent change from April 1, 2010 – July 1, 2014 of 23.7%.

Table 1-1: St. Bernard Parish Population
(Source: US Census)

	2010 Census	2013 Census	(Current Year) Estimate	Percent Change 2010 - 2014
Total Population	35,897	43,480	44,409	23.7%
Population Density (Pop/Sq. Mi)	95.1	-------	-------	-------
Total Households	-------	13,714	-------	-------

Table 1-2: St. Bernard Parish Business Patterns
(Source: censtats.census.gov)

Business Description	Number of Employees	Number of Establishments	Annual Payroll
Retail Trade	1,726	135	$39,088
Agriculture, Forestry, Fishing and Hunting	0-19	5	n/a
Manufacturing	1,224	31	$114,923
Health Care, Social Assistance	957	57	$26,911
Mining, Quarrying, and Oil and Gas Extraction	40	7	$3,134
Transportation / Warehousing	601	38	$29,751
Construction	645	96	$29,506
Administration, Support, Waste Management, Remediation Services	2,248	27	$9,202
Real Estate, Rental, Leasing	20-99	20	$2,223
Educational	24	5	$146
Information	20-99	1	n/a
Wholesale Trade	219	27	$8,778
Other Services (except Public Administration)	352	56	$7,728
Accommodation, Food Services	988	81	$12,660
Financial and Insurance	158	32	$1,343
Professional, Scientific, Technical Services	138	37	$5,041
Utilities	20-99	3	n/a
Management of Companies and Enterprises	20-99	2	n/a
Arts, Entertainment, Recreation	20-99	11	$1,739
Industries not classified	1	3	n/a

Transportation

The main transportation arteries through St. Bernard Parish are Louisiana State Highways 39, 46, and 47. Highways 39 and 46 connect the parish to New Orleans. Highway 46 runs parallel to Highway 39, but continues on southward to Yscloskey and Shell Beach. Highway 300 connects Delacroix to the rest of the parish. All of these roadways are significant evacuation routes for St. Bernard Parish, as well as surrounding parishes during states of emergency.

Norfolk Southern Railroad serves St. Bernard Parish. The railroad runs west through the parish to connect with other carriers in New Orleans, then it turns south to connect with industries in Plaquemines Parish. Rail rates in Louisiana for many commodities tend to be lower than those in the other states because of the competition from barge carriers.

The New Orleans International Airport services St. Bernard Parish, and is located 25 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.

The New Orleans Lakefront Airport is a general aviation facility only ten minutes from St. Bernard Parish. It is a full service airport with three runways that can support any type of flight craft. It is used by more Fortune 500 companies than any other airport in the state.

The St. Bernard Parish Port is an international port with a depth of 45 feet. The closest shallow draft port facility is located 58 miles to the north at the Port of Manchac, with a channel depth of 8 feet and 25 barge terminals.

Hazard Mitigation

To fully understand hazard mitigation efforts in St. Bernard 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 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 2015 St. Bernard Parish Hazard Mitigation Plan (HMP) maintains much of the information from the 2006 and 2010 plan versions, but it now reflects the order and methodologies of the 2014 Louisiana State Hazard Mitigation Plan.

The sections in the 2010 St. Bernard HMP were as follows:

- Section One Introduction
- Section Two St. Bernard Parish Profile
- Section Three Plan Organization and Preparation
- Section Four Planning Process
- Section Five Risk Assessment
- Section Six Vulnerability Assessment
- Section Seven Mitigation Strategy
- Section 8 Mitigation Plan
- Section 9 Planning Pilot Grant Program
- Section 10 Plan Maintenance Procedures

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 St. Bernard 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.

2015 Plan Update

This 2015 plan update proceeds with the previous goals of the St. Bernard Parish Hazard Mitigation Plan. The current goals are as follows:

1. Identify and pursue preventative measures that will reduce future damages from hazards
2. Enhance public awareness and understanding of disaster preparedness
3. Reduce repetitive flood losses in the parish
4. Facilitate sound development and rebuilding in the parish so as to reduce or eliminate the potential impacts of hazards

This plan update makes a number of textual changes throughout, with the most obvious changes being data related and structural. First, the Spatial Hazard Events and Losses Database for the United States (SHELDUS) was used as a data source for hazard identification because it incorporates all storm event data from the National Climatic Data Center (NCDC) Storm Events Database used in previous plans, as well as storm event data from other sources including the NOAA Storm Prediction Center, National Hurricane Center, and U.S. Fire Administration. 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 2015 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: 2015 Plan Update Crosswalk

2010 Plan	Revised Plan (2015)
Section 1: Introduction	Section 1: Introduction
Section 2: St. Bernard Parish Profile	Section 1: Introduction
Section 3: Plan Organization and Preparation	Appendix A: Planning Process ; Appendix D: Plan Adoption
Section 4: Planning Process	Appendix A: Planning Process
Section 5: Risk Assessment	Section 2: Hazard Identification and Parish wide Risk Assessment
Section 6: Vulnerability Assessment	Section 2: Hazard Identification and Parish wide Risk Assessment; Appendix C: Essential Facilities
Section 7: Mitigation Strategy	Section 4: Mitigation Strategy
Section 8: Mitigation Plan	Section 4: Mitigation Strategy
Section 9: Planning Pilot Grant Program	*Not included in 2015 HMP update
Section 10: Plan Maintenance Procedures	Appendix B: Plan Maintenance
List of Tables/Figures; Appendices	Appendix E: State Required Worksheets

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 St. Bernard Parish and its communities. The extent of this risk is dictated primarily by its geographic location. Most significantly, St. Bernard Parish remains at high risk of water inundation from various sources, including flooding, tornadoes 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 St. Bernard 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 St. Bernard 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 St. Bernard Parish Hazard Mitigation plan published in 2009, as well as the hazards that were identified in the state's 2014 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 2015 Update
Coastal Land Loss			
Drought			
Earthquakes			
Expansive Soils			
Fog			
Floods	X	X	X
Extreme Heat			
Sinkhole		X	X
Subsidence/Salt Water Intrusion	X	X	X
Termites			
Thunderstorms (Hail, Lightning & Wind)	X	X	X
Tornado	X	X	X
Tropical Cyclones	X	X	X
Wildfires			
Winter Storm			

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 sinkholes.

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

a) Flooding (backwater, storm surge, riverine, localized storm water event)
b) Land Subsidence/Saltwater Intrusion
c) Sinkholes
d) Thunderstorms (hail, lightning, and wind)
e) Tornadoes
f) Tropical Cyclones (flooding and high winds)

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

- Flooding from rivers and waterways, rain storms, tropical storms, and hurricanes in the following forms:
  a) Storm water
  b) Riverine
  c) Surge
  d) Backwater flooding (as the result of river flooding and surge)
- High wind damage most commonly resulting from hurricanes, thunderstorms and tornadoes
- Property and crop damage resulting from drought, excessive heat, and wildfires

The potential destructive power of a tropical cyclone was determined to be the most prevalent and the most frequent hazard to the parish. Sixteen of the twenty-two Presidential Declarations that St. Bernard Parish has received have resulted from tropical cyclones, which validates this as the most significant hazard. Therefore, the issue of hurricanes will 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 assess non-storm surge flooding as well. Since 1972, St. Bernard Parish has received five Presidential Declarations as a result of flooding.

Hurricanes, tropical storms, tornadoes, 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 St. Bernard is included in the hurricane risk assessment.

Previous Occurrences

Table 2-2 summarizes federal disaster declarations for St. Bernard Parish since 1965. Information includes the disaster declaration number, date, and types of disaster.

Table 2-2: St. Bernard Parish Major Disaster Declarations

Disaster Declaration Number	Date	Type of Disaster
208	9/10/1965	TROPICAL CYCLONE - HURRICANE BETSY
272	8/19/1969	TROPICAL CYCLONE - HURRICANE CAMILLE
374	4/27/1973	SEVERE STORMS & FLOODING
556	5/9/1978	SEVERE STORMS & FLOODING
616	4/9/1980	SEVERE STORMS & FLOODING
679	4/20/1983	SEVERE STORMS & FLOODING
752	11/1/1985	TROPICAL CYCLONE - HURRICANE JUAN
956	8/26/1992	TROPICAL CYCLONE - HURRICANE ANDREW
1049	5/10/1995	SEVERE STORMS AND FLOODING
1246	9/23/1998	TROPICAL CYCLONE - HURRICANE GEORGES/TS FRANCES
1380	6/11/2001	TROPICAL CYCLONE - TROPICAL STORM ALLISON
1435	9/27/2002	TROPICAL CYCLONE - TROPICAL STORM ISIDORE
1437	10/3/2002	TROPICAL CYCLONE - HURRICANE LILI
3172	2/1/2003	LOSS OF SPACE SHUTTLE COLUMBIA
1548	9/15/2004	TROPICAL CYCLONE - HURRICANE IVAN
1601	8/23/2005	TROPICAL CYCLONE - TROPICAL STORM CINDY
1603	8/29/2005	TROPICAL CYCLONE - HURRICANE KATRINA
1607	9/24/2005	TROPICAL CYCLONE - HURRICANE RITA
1786	9/2/2008	TROPICAL CYCLONE - HURRICANE GUSTAV
1792	9/13/2008	TROPICAL CYCLONE - HURRICANE IKE
4041	10/28/2011	TROPICAL CYCLONE - TROPICAL STORM LEE
4080	8/29/2012	TROPICAL CYCLONE - HURRICANE ISAAC

Probability of Future Hazard Events

The probability of a hazard event occurring in St. Bernard Parish is estimated below. 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 assess 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 Spatial Hazards Events and Losses Database (SHELDUS) which provides historical hazard data from 1960 to 2014. In staying consistent with the state plan, the SHELDUS database was evaluated for the last twenty five years (1989 – 2014) in order to determine future probability of a hazard occurring. While the twenty-five year record used by the state was adopted for the purpose of determining the overall probability, to assist with determining estimated losses, unless otherwise stated the full 54 year record was used when HAZUS-HM was not available to determine losses. This full record was used to provide a more extensive record to determine losses. All assessed damages were adjusted to inflation to reflect the equivalent amount of damages with the value of the U.S. dollar today. In addition, the National Climatic Data Center (NCDC) was also used to help identify hazard data specific to the municipalities as it contains specific data for cities, whereas SHELDUS is limited to parishes.

The following table shows the annual probability for each hazard occurring across the parish.

Table 2-3: Probability of Future Hazard Reoccurrence

Hazard	Probability
	St. Bernard Parish
Flooding	36%
Sinkholes	<1%
Thunderstorm - Hail	4%
Thunderstorm - Lightning	12%
Thunderstorm - Winds	72%
Tornadoes	28%
Land Subsidence/Salt Water Intrusion	100%
Tropical Cyclones	68%

As shown in *Table 2-3*, land subsidence and salt water intrusion have the highest chance of occurrence in the parish (100%), followed by thunderstorm winds (72%) and tropical cyclones (68%). Flooding was determined to have a 36% annual chance of occurrence within St. Bernard Parish, while tornadoes have a 28% annual occurrence. Thunderstorm lightning and hail have lower chances of occurring annually at 12% and 4% respectively. The hazard of sinkholes has less than a 1% chance of occurring annually.

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 the use of field data collected by the GOHSEP on critical infrastructure from a previous hazard mitigation project.

Within the entire planning area there is an estimated value of $3,740,400,000 in structures throughout the parish. The table below provides the total estimated value for each structure by occupancy.

Table 2-4: Estimated Total of Potential Losses throughout St. Bernard Parish

Occupancy	St. Bernard Parish
Agricultural	$7,948,000
Commercial	$636,612,000
Government	$14,960,000
Industrial	$136,346,000
Religion	$72,002,000
Residential	$2,819,334,000
Education	$53,198,000
Total	$3,740,400,000

Essential Facilities of the Parish.

The following pages contain maps which show the locations and names of the essential facilities within the parish.

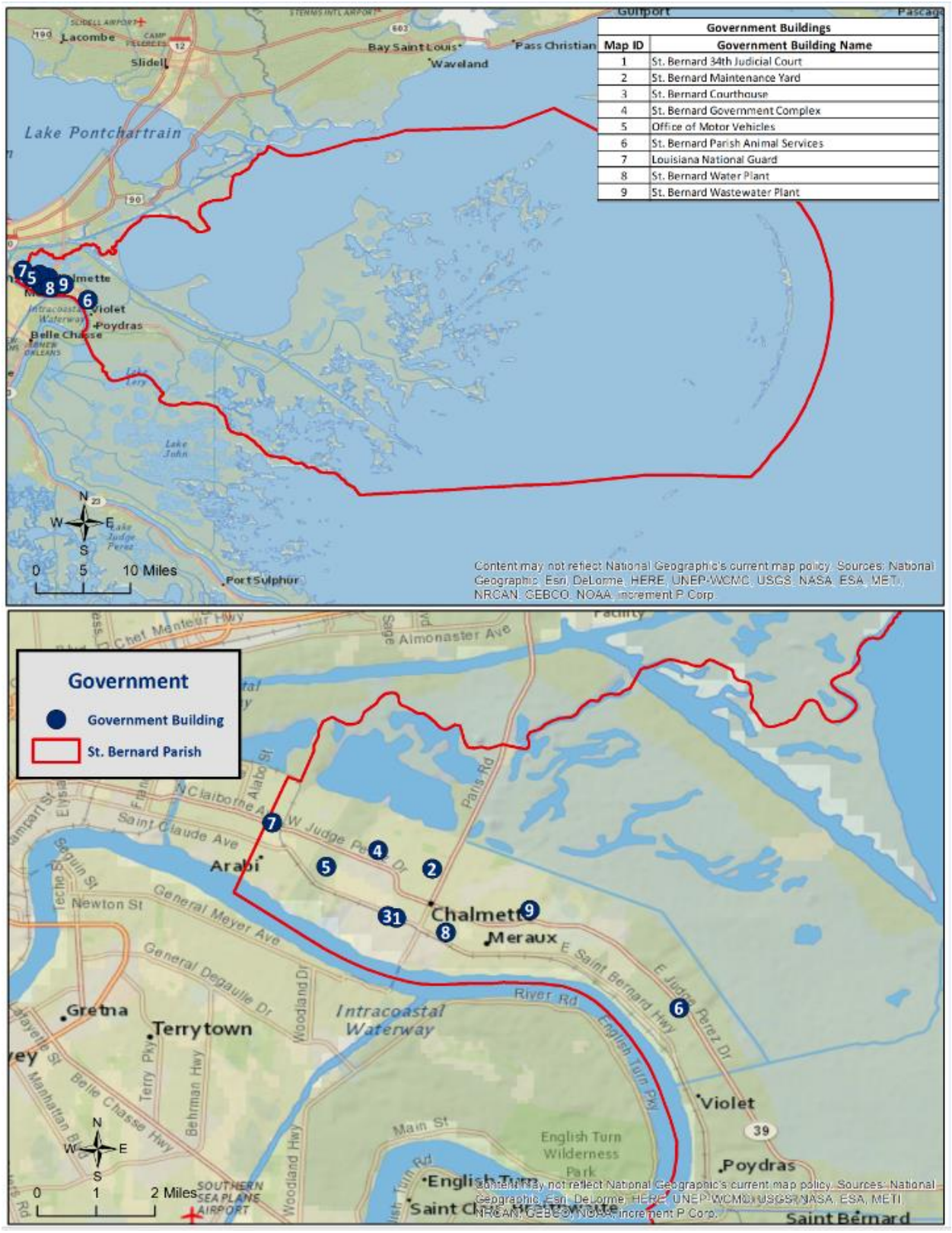

Figure 2-1: Government Buildings throughout St. Bernard Parish

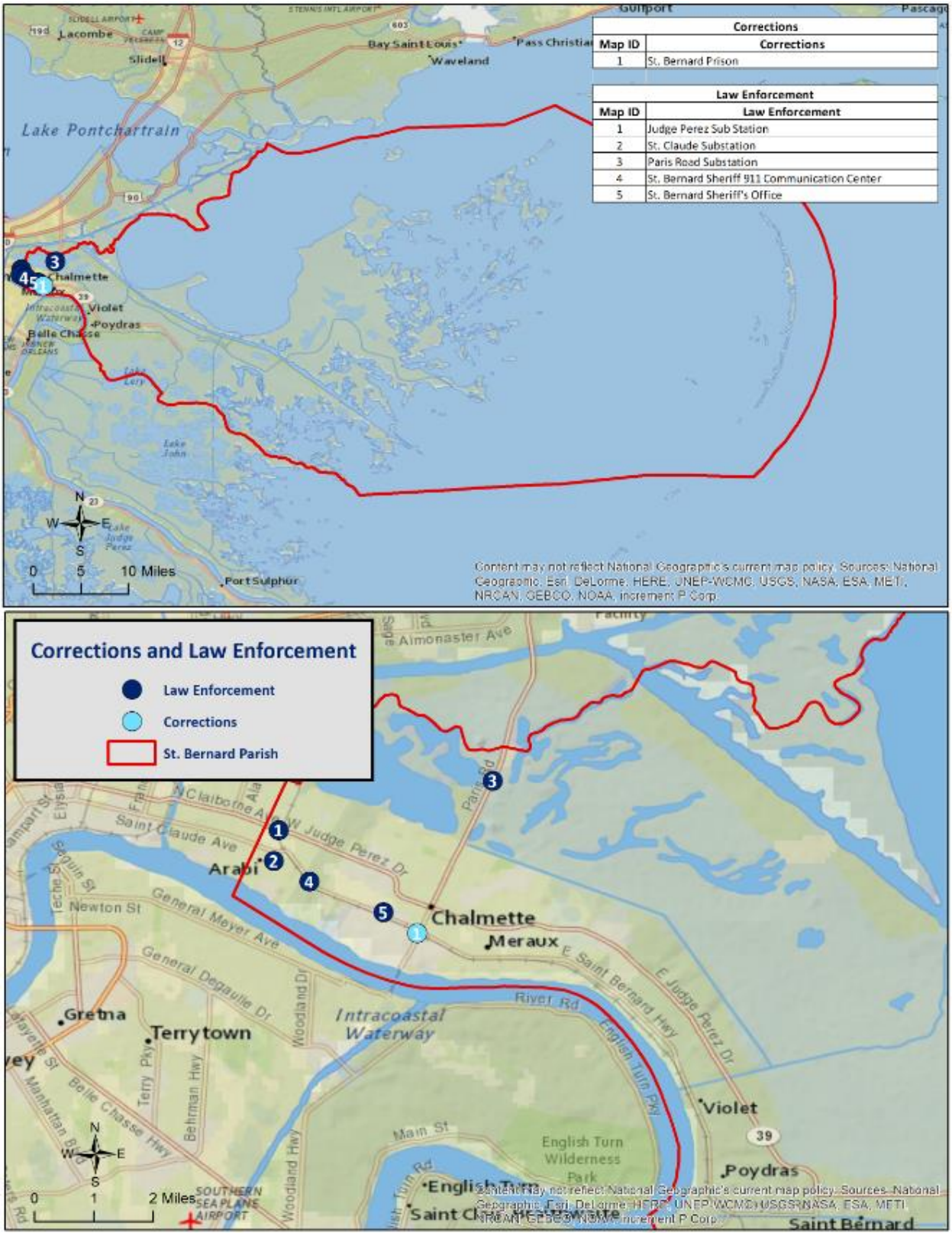

Figure 2-2: Law Enforcement facilities throughout St. Bernard Parish

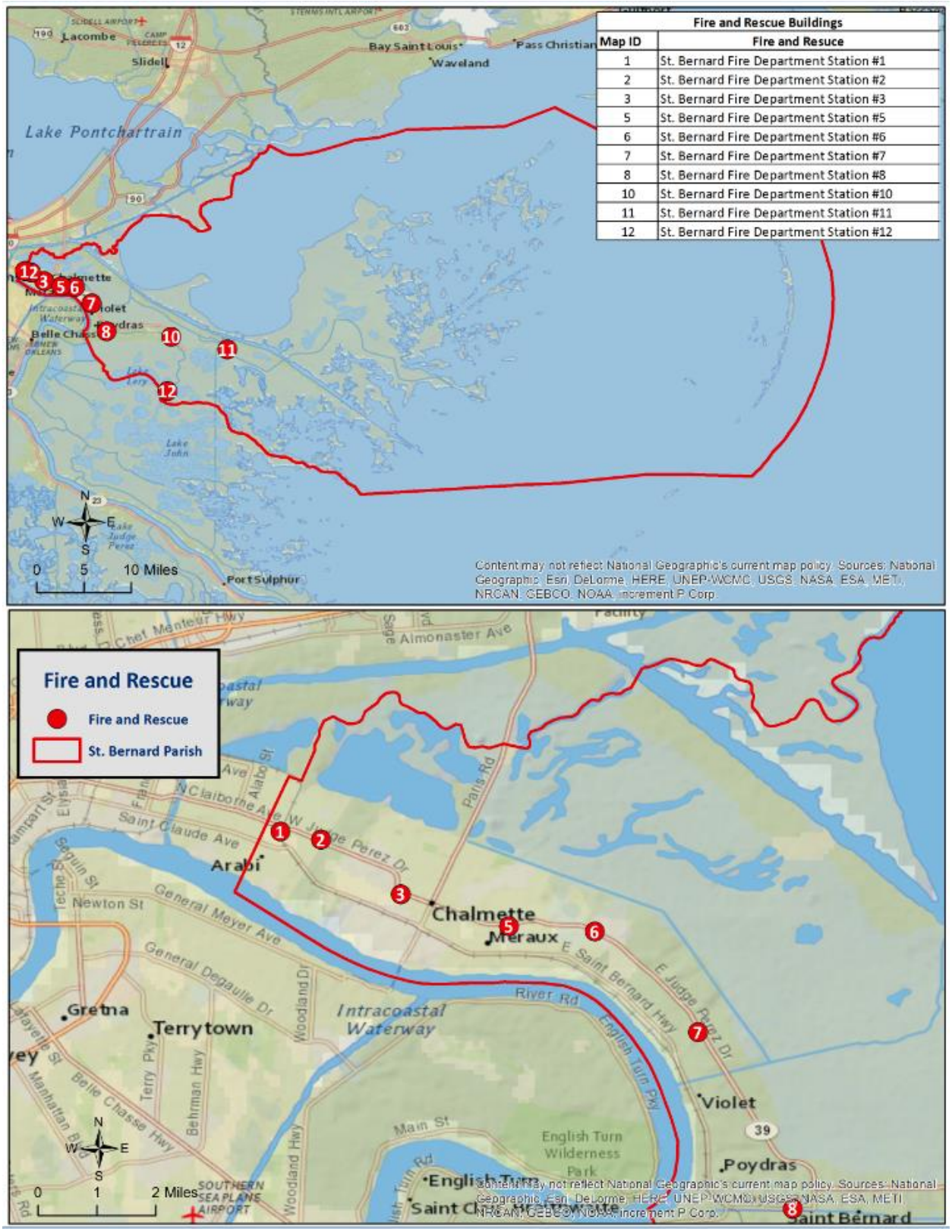

Figure 2-3: Fire Station Facilities in St. Bernard Parish

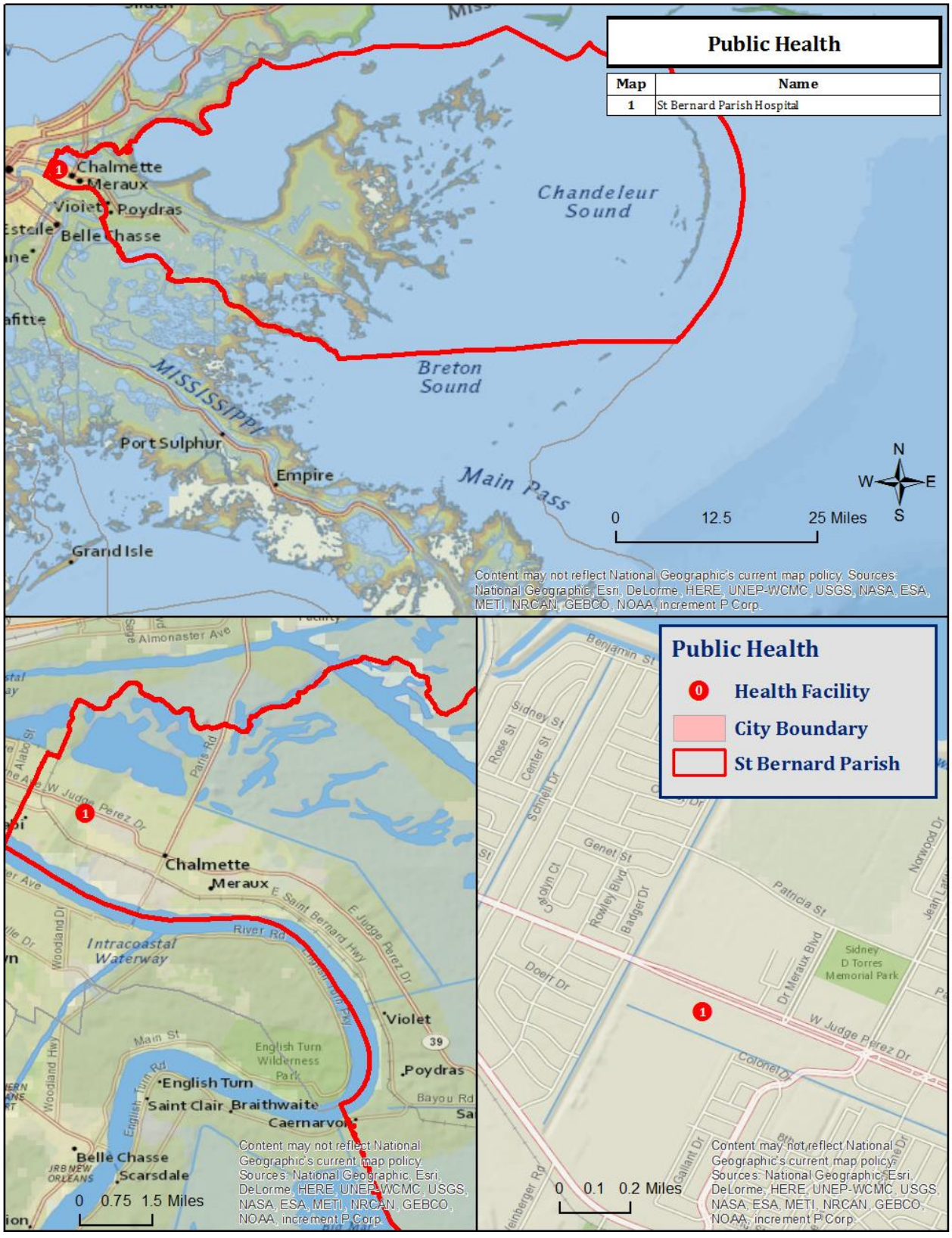

Figure 2-4: Public Health Facilities in St. Bernard Parish

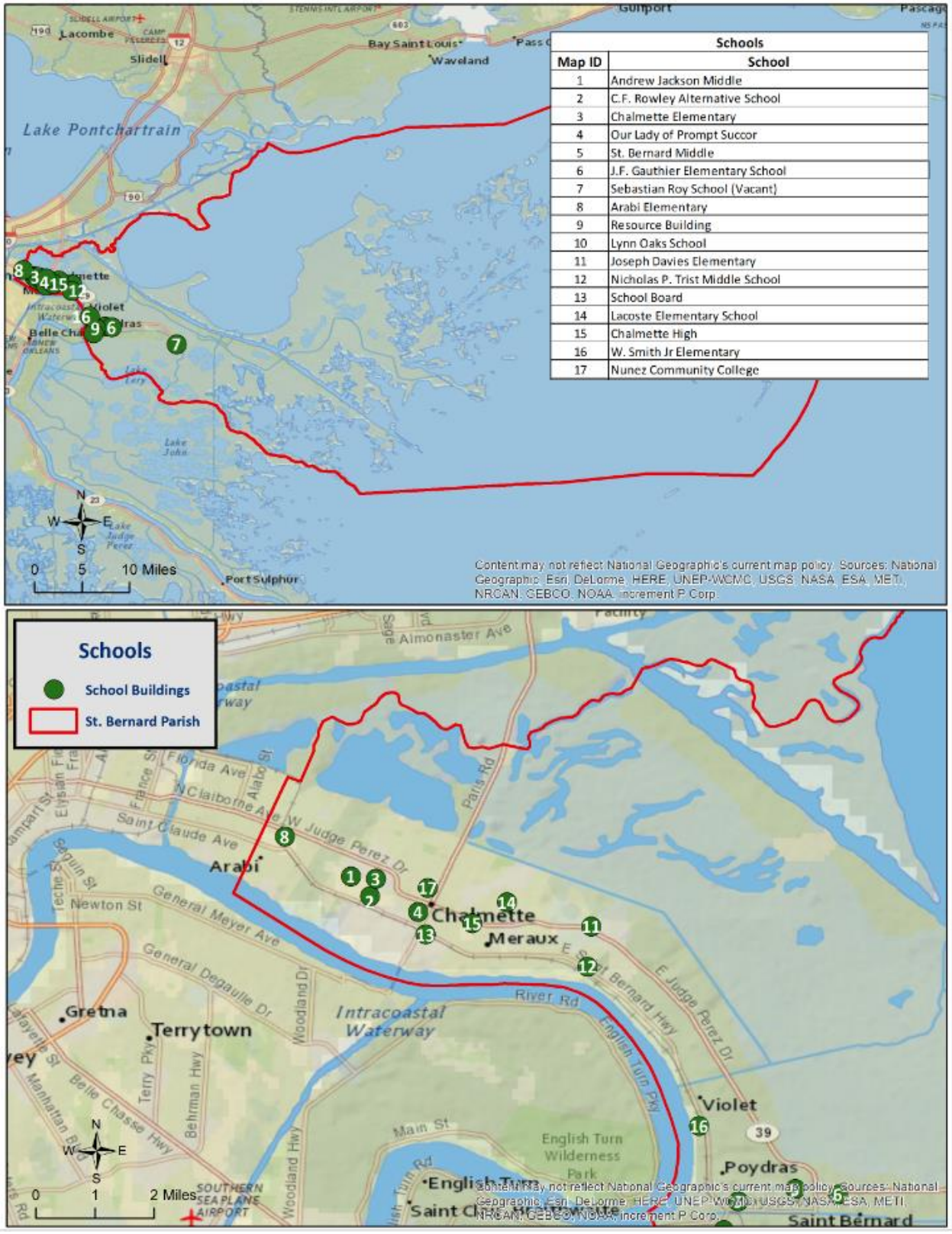

Figure 2-5: Educational Facilities in St. Bernard Parish

Future Development Trends

St. Bernard Parish has experienced a significant hurricane event that drastically shaped both population and housing numbers during the 2000's. Hurricane Katrina in 2005 damaged or destroyed most of the buildings in St. Bernard Parish. Because of this event, St. Bernard Parish has experienced a significant decline in both population and housing numbers from 2000 to 2013. The parish's population has decreased by over 46% between the years of 2000 and 2010, going from a population of 67,229 to 35,897. The annual growth rate for this time period was -4.7%. From 2010 to 2013, the annual growth improved significantly at 2.74%. The future population and number of buildings can be estimated using U.S. Census Bureau housing and population data. The tables below show population and housing unit estimates from 2000 to 2013.

Table 2-5: Population Growth Rate for St. Bernard Parish

Total Population	St. Bernard Parish
1-Apr-00	67,229
1-Apr-10	35,897
1-Jul-13	38,850
Population Growth between 2000 – 2010	-46.6%
Average Annual Growth Rate between 2000 – 2010	-4.7%
Population Growth between 2010 – 2013	8.2%
Average Annual Growth Rate between 2010 – 2013	2.74%

Table 2-6: Housing Growth Rate for St. Bernard Parish

Total Housing Units	St. Bernard Parish
1-Apr-00	26,790
1-Apr-10	16,794
1-Jul-13	16,774
Housing Growth between 2000 – 2010	-37.3%
Average Annual Growth Rate between 2000 – 2010	-3.7%
Housing Growth between 2010 – 2013	-0.1%
Average Annual Growth Rate between 2010 – 2013	0.0%

As shown in *Table 2-5* and *Table 2-6*, St. Bernard Parish population and housing were in a sharp decline from the years 2000 to 2010. Population growth rates have increased significantly from 2010 to 2013 and

parish population is growing at an annual rate of 2.74%. The housing declines experienced from 2000 to 2010 have slowed significantly from the years 2010 to 2013.

Future Hazard Impacts

Hazard impacts were estimated for five years and ten years in the future (2019 and 2024). Yearly population and housing growth rates were applied to parish inventory assets for composite flood and tropical cyclones. Average growth rates were estimated at 0.1% for housing and 2.7% for population based on recent growth rates in the parish, which have recovered slightly since Hurricane Katrina. A summary of estimated future impacts is shown in the table below. Dollar values are expressed in future costs and assume an annual inflation rate of 1.02%.

Table 2-7: Estimated Future Impacts, 2019-2024
(Source: HAZUS, US Census Bureau)

Hazard / Impact	Total in Parish (2014)	Hazard Area (2014)	Hazard Area (2019)	Hazard Area (2024)
Flood Damage				
Structures	16,791	3,600	3,618	3,640
Value of Structures	$3,782,330,632	$810,898,308	$857,380,501	$916,689,490
# of People	39,915	8,557	9,797	11,523
Tropical Cyclone				
Structures	16,791	16,791	16,875	16,976
Value of Structures	$3,782,330,632	$3,782,330,632	$3,999,140,831	$4,275,779,967
# of People	39,915	39,915	45,696	53,749

Land Use

The St. Bernard Parish Land Use table is provided below. Residential, commercial and industrial areas account for only 3% of the parish's land use. Water at 901,212 acres is by far the largest category accounting for 65% of the parish. Wetlands at 430,823 acres is the second largest category accounting for 31% of parish land. The parish also consists of forest land (1%) and agricultural land (< 1%).

Table 2-8: St. Bernard Parish Land Use
(Source: USGS Land Use Map)

Land Use	Acres	Percentage
Agricultural Land, Cropland, and Pasture	953	0%
Wetlands	430,823	31%
Forest land (not including forested wetlands)	1,717	1%
Urban/Development	14,466	3%
Water	901,212	65%

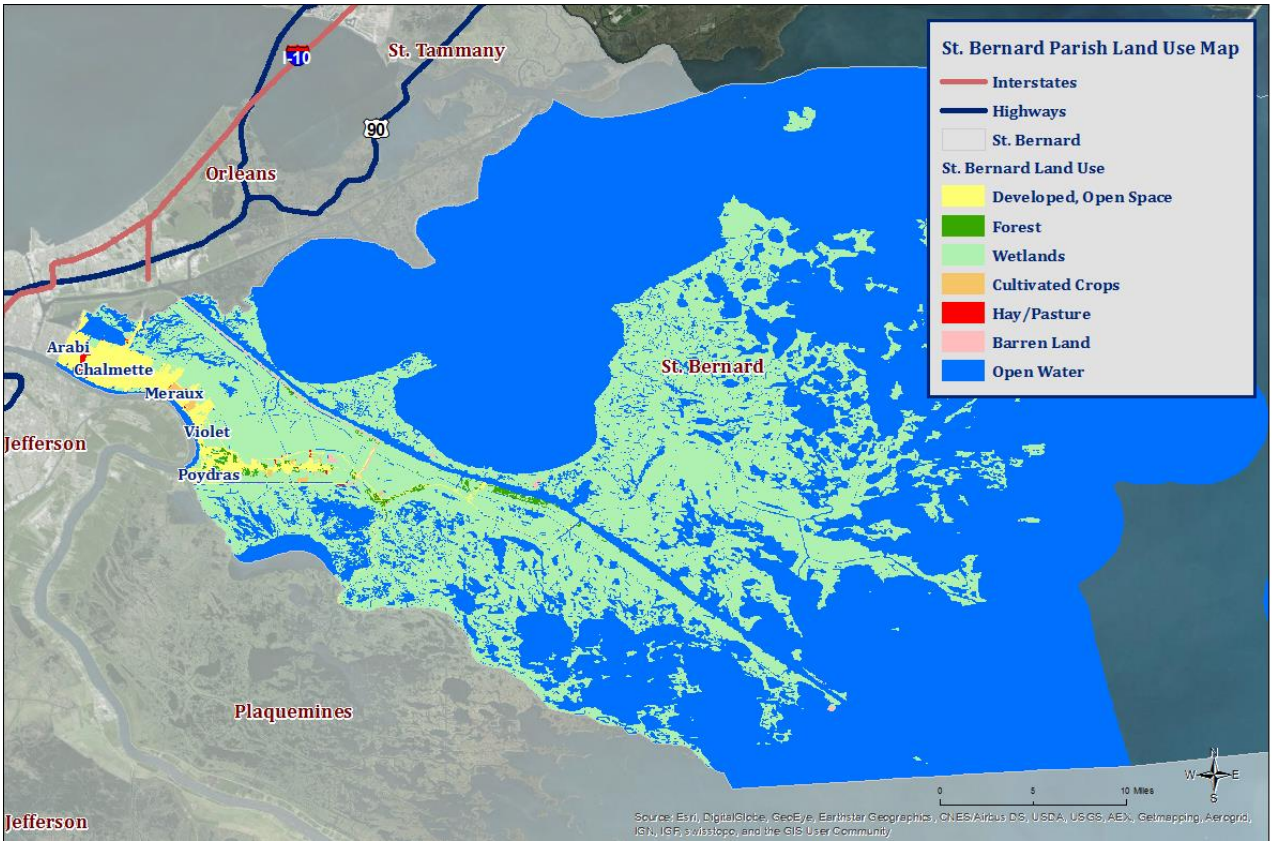

Figure 2-6: St. Bernard Parish Land Use Map
(Source: USGS Land Use Map)

Hazard Identification

Flooding

A flood is the overflow of water onto land that is usually not inundated. The National Flood Insurance Program (NFIP) 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 (e.g., 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, and low-lying, poorly drained areas are particularly prone to flooding during these months.

In Louisiana, six specific types of floods 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 and the shape and land cover of its drainage basin. The smaller the river, the faster 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, 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, tsunami, and gradual sea level rise.

In St. Bernard Parish, all six types of flooding 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 floods:

- **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 hydro meteorological 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 just 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 lay population to understand, the Association of State Floodplain Managers (ASFPM) promotes the use of more tangible expressions of flood probability. The ASFPM also expresses the 100-year flood event has 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 events 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, but they can also be different along any given river. A 100-year event upstream is different from one downstream due to the variation 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 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 (NFIP) Rate Maps. The NFIP and FEMA suggest insurance rates based on Special Flood Hazard Areas (SFHAs), as diagrammed in *Figure 2-7*.

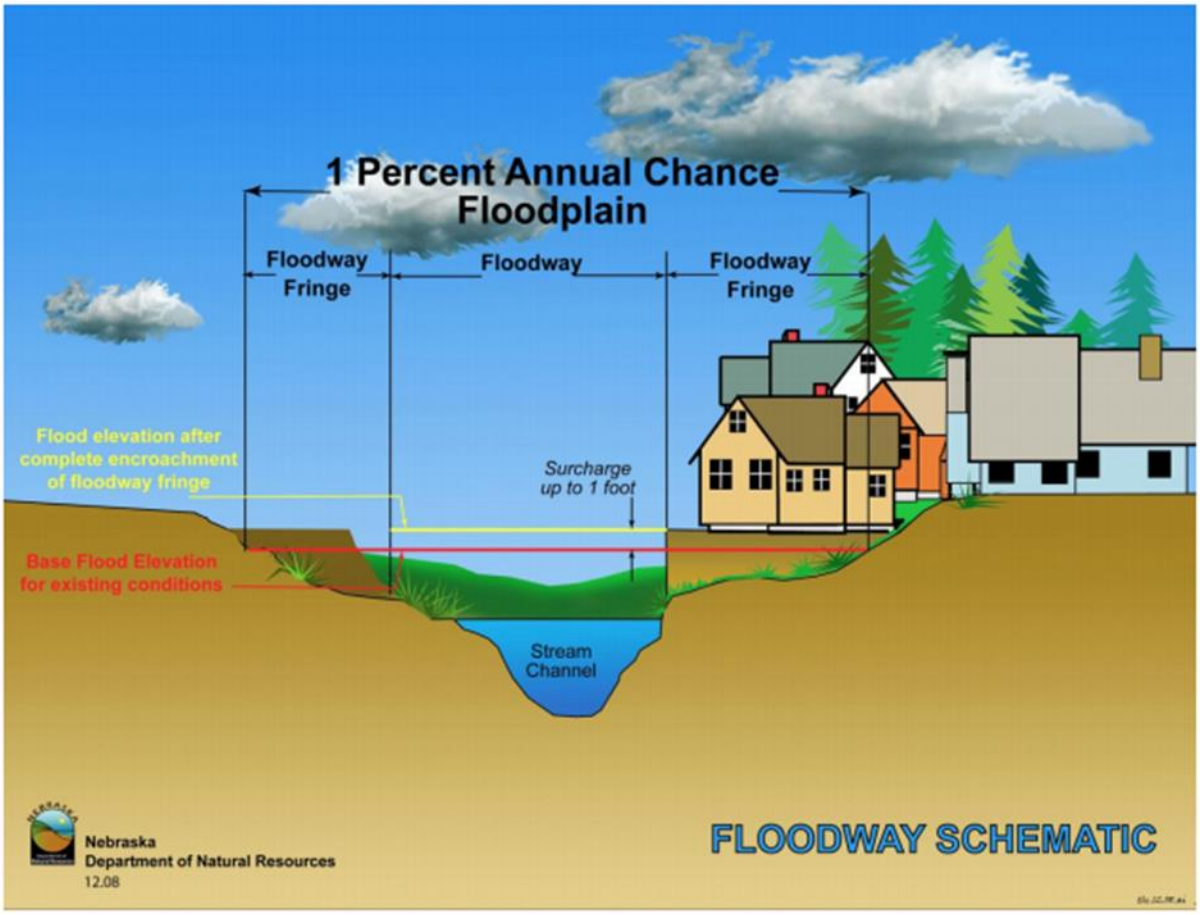

Figure 2-7: Schematic of 100 year Floodplain. The Special Flood Hazard Area (SFHA) extends to the end of the floodway fringe.
(Source: Nebraska Department of Natural Resources)

A SFHA is the land area covered by the floodwaters of the base flood (red line in *Figure 2-7*), 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 a few situations, deep and fast moving waters will 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 to 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 the 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 was 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. Is covered under a contract for flood insurance made available under the NFIP; and
b. 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.

Repetitive loss properties for St. Bernard Parish are provided below:

Table 2-9: Repetitive Loss Structures for St. Bernard Parish

Jurisdiction	Number of Structures	Residential	Commercial	Government	Total Claims	Total Claims Paid	Average Claim Paid
St. Bernard Parish	1,207	1,176	27	4	4,084	$160,345,645	$39,262

Of the 1,207 repetitive loss structures, 1,196 were able to be geocoded to provide an overview of where the repetitive loss structures were located throughout the parish. *Figure 2-8* shows the approximate location of the 1,196 structures, while *Figure 2-9* shows where the highest concentration of repetitive loss structures are located. Through the density map, it is clear that the primary concentrated area of repetitive loss structures are focused in the western and southern portions of St. Bernard Parish.

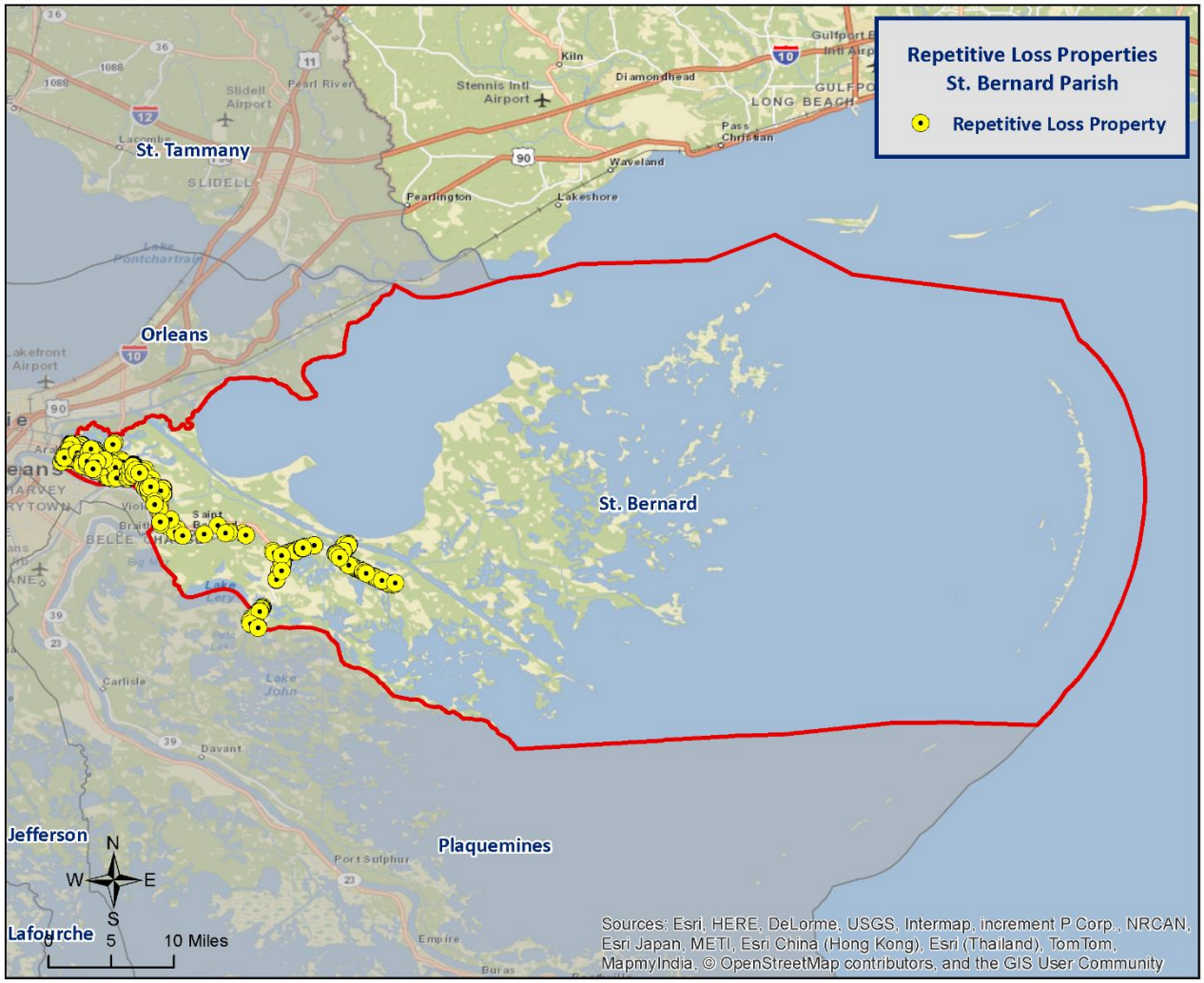

Figure 2-8: Repetitive Loss Properties in St. Bernard Parish

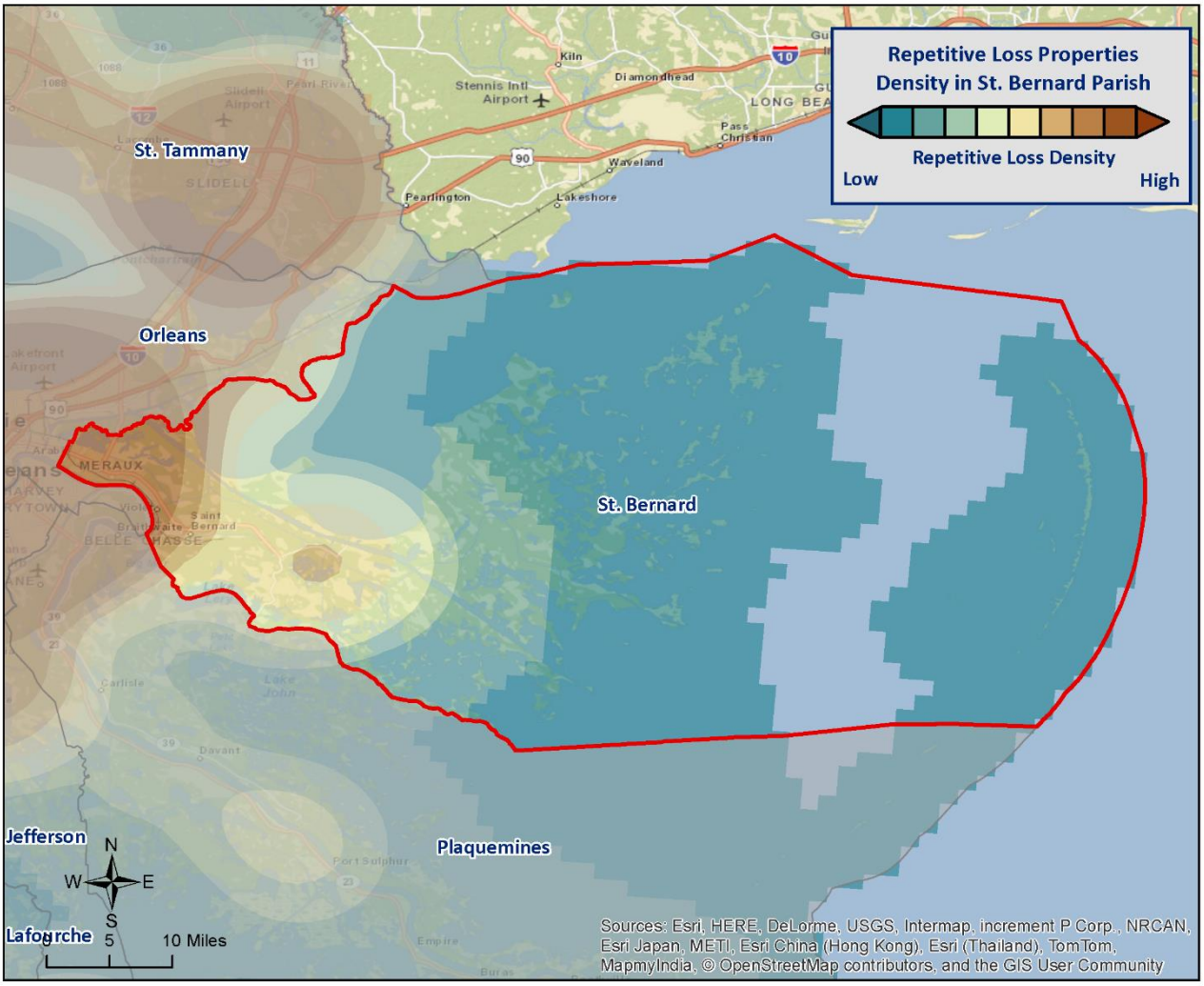

Figure 2-9: Repetitive Loss Property Densities in St. Bernard Parish

National Flood Insurance Program

Flood insurance statistics indicate that St. Bernard Parish has 11,247 flood insurance policies with the NFIP with total annual premiums of approximately $2 billion. St. Bernard Parish and each of the incorporated jurisdictions will continue to adopt and enforce floodplain management requirements, including regulating new construction in Special Flood Hazard Areas, and will continue to monitor activities including local requests for map updates. Flood insurance statistics and additional NFIP participation details for St. Bernard Parish is provided in the tables to follow.

Table 2-10: Summary of NFIP Policies for St. Bernard Parish

Location	No. of Insured Structures	Total Insurance Coverage Value	Annual Premiums Paid	No. of Insurance Claims Filed Since 1978	Total Loss Payments
St. Bernard Parish	11,247	$3,087,026,200	$7,256,613	23,608	$2,238,822,121

Table 2-11: Summary of Community Flood Maps for St. Bernard Parish

CID	Community Name	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Date Joined the NFIP	Tribal
225204#	St. Bernard Parish	3/13/1970	8/31/1973	3/4/1987	3/13/1970	No

According to the Community Rating System (CRS) list of eligible communities dated June 1, 2014, St. Bernard Parish does not participate in the Community Rating System (CRS).

Threat to People

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 the 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. Floodwaters 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. Floodwaters can also infiltrate sewer lines and inundate wastewater treatment plants, causing sewage to backup and create a breeding ground for dangerous bacteria. This infiltration may also cause water supplies to become contaminated and undrinkable.

Flooding in St. Bernard Parish

By definition, flooding is caused by more water than the drainage system can convey. Below is a brief synopsis of the types of flooding events that affect St. Bernard Parish.

Riverine: Overbank flooding of rivers and streams occur in the relatively flat floodplain areas of the parish, and these areas may remain inundated for days or even weeks.

Flash: Characterized by a rapid rise in water level, high velocity, and large amounts of debris. Flash floods are capable of tearing out trees, undermining bridges and buildings, and coursing new channels. Major factors in flash flooding are the high intensity and short duration of rainfall.

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.

Fluctuating Lake Levels: Water levels in lakes can fluctuate on a short-term, seasonal basis or on a long-term basis over periods of months or years. Heavy seasonal rainfall can cause high lake levels for short periods of time. Not only does this cause levels to rise, but it prevents natural drainage and causes flooding. An example of this is Lakes Maurepas and Pontchartrain, as well as Lac des Allemands.

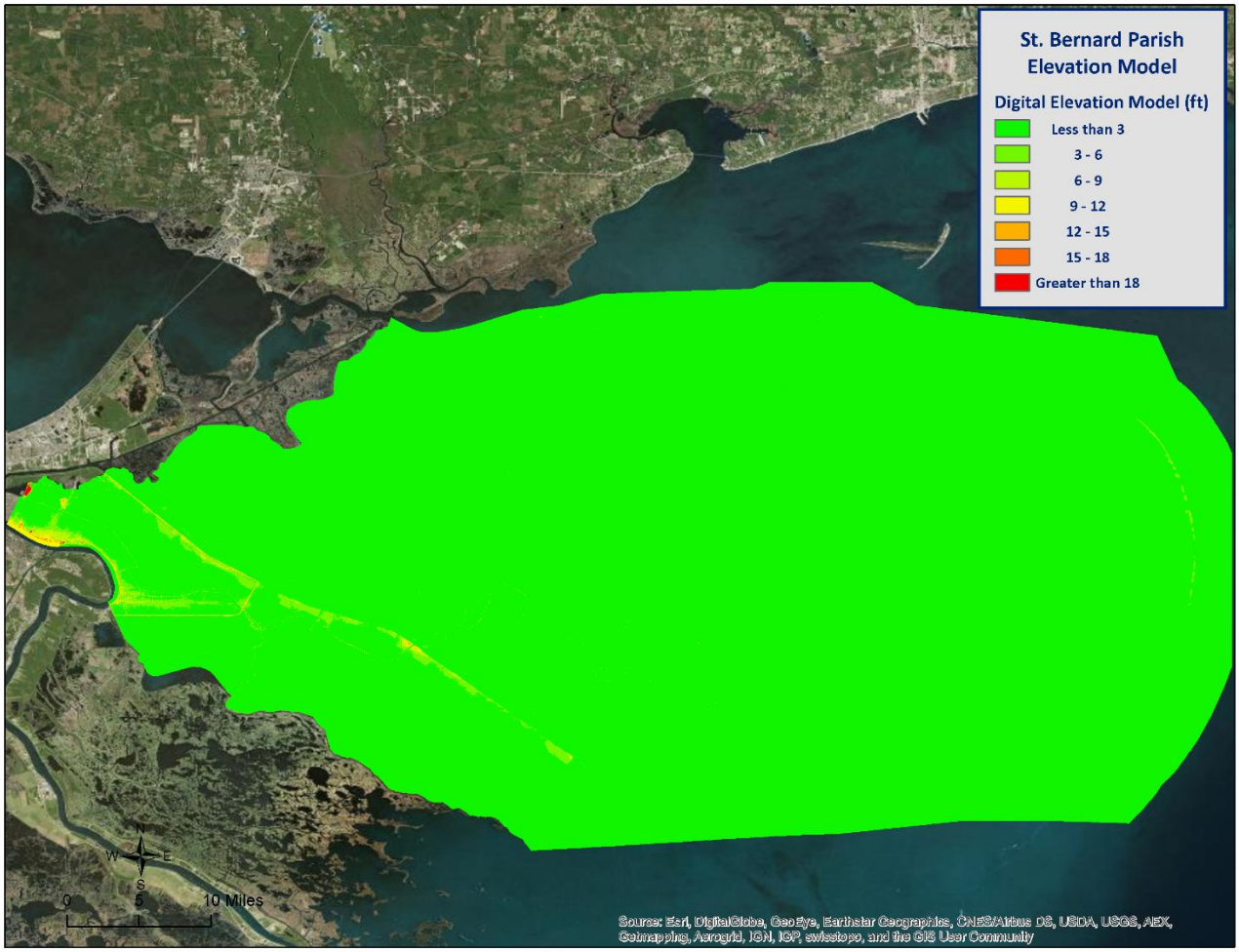

Figure 2-10: Elevation throughout St. Bernard Parish

Looking at the digital elevation model (DEM) in *Figure 2-10* for St. Bernard Parish is instructive in visualizing where the low lying and risk areas are for the parish. The parish is dominated by water and low-lying areas. The average elevation throughout the parish is approximately five feet. Elevation increases slightly in the western portions of the parish, but the remainder of the parish has an elevation of less than six feet.

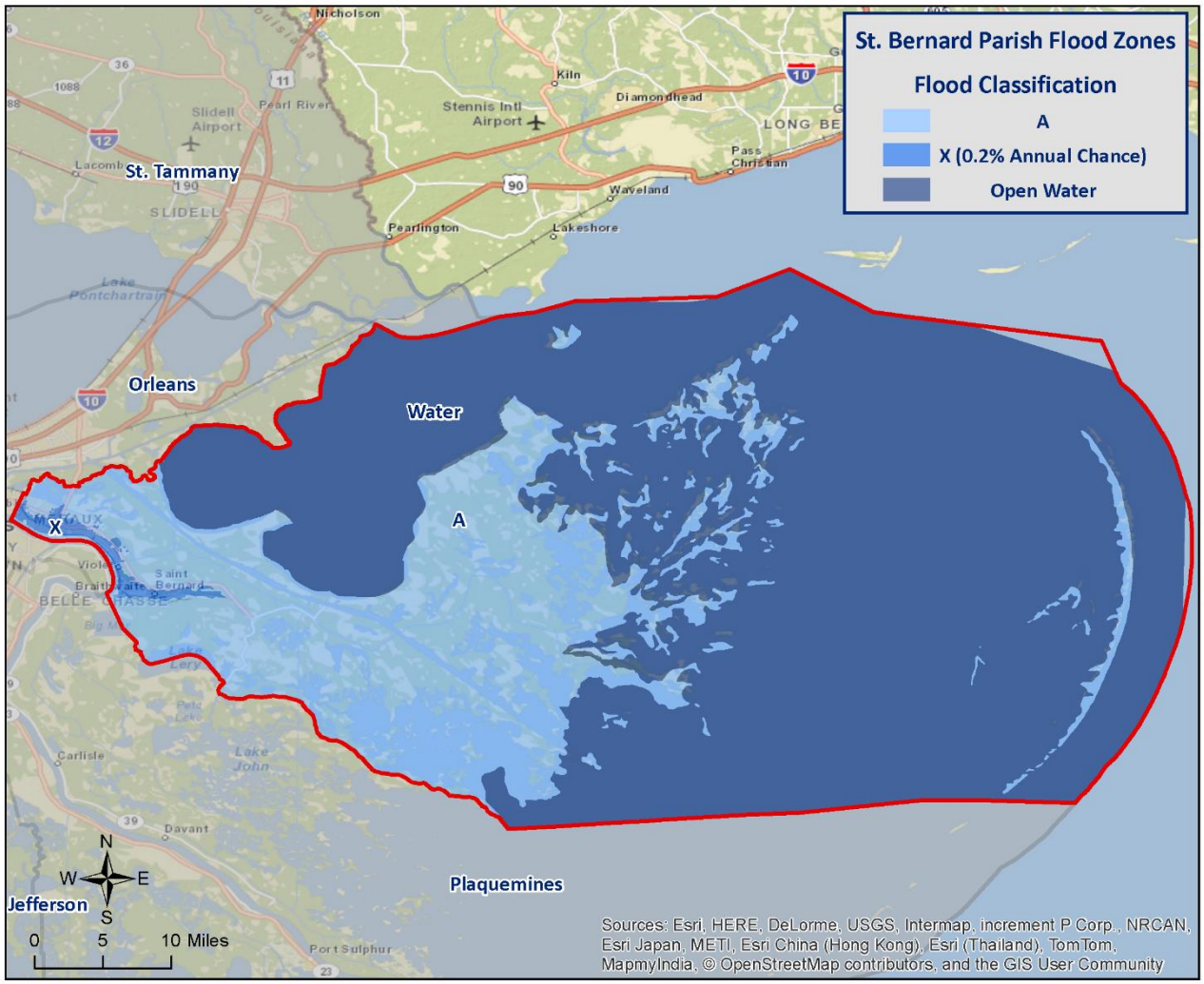

Figure 2-11: The 100-Year Floodplain for St. Bernard Parish

Location

St. Bernard Parish has experienced significant flooding in its history and can expect more in the future. St. Bernard Parish is susceptible to several different types of flooding due to its geographical location, including riverine, flash, and storm surge.

Previous Occurrences and Extents

Historically, there have been nine flood events that have created significant flooding in St. Bernard Parish between 1989 and 2014. The following pages contain a brief synopsis of the nine flooding events over the last 25 years, including each flooding event that has occurred since the parish's last planning update.

Table 2-12: Historical Floods in St. Bernard Parish with Locations from 1989 - 2014

Date	Extents	Type of Flooding	Estimated Damages	Location
November 14, 1989	Heavy rains caused minor street flooding, and one home was flooded.	Flash Flood	$9,393	LOWER PORTION OF PARISH
May 4, 1990	Heavy rains caused minor street flooding in the parish.	Flash Flood	$891	LOWER PORTION OF PARISH
October 5, 1996	Coastal flooding resulted from a sustained period of strong east winds. At Bayou Bienvenue, near Lake Borgne, a maximum tide of approximately 5.5 feet occurred from the mid-morning hours of the 5th through October 6th.	Coastal Flood	$742,374	PARISH-WIDE
May 19, 1997	Heavy rain occurred over the upper portion of St. Bernard Parish. Approximately 5 inches of rain fell during the afternoon and early evening. Much greater rainfall amounts were experienced in the Arabi area, where several homes were flooded and streets were impassable due to flooding.	Coastal Flood	$14,514	ARABI
January 7, 1998	Three to six inches of rain fell during the night and morning hours across southeast Louisiana. Substantial flooding occurred in St. Bernard Parish. Twenty-four homes were flooded in the Arabi area due to flood waters.	Flood	$142,918	PARISH-WIDE
June 11, 2001	Remnants of Tropical Storm Allison moved across southeast Louisiana, producing between 5 and 10 inches of rain. This overwhelmed local drainage and numerous streets were flooded. Approximately 80 homes and businesses were reported flooded.	Flash Flood	$263,080	ARABI
June 30, 2003	Rainfall from Tropical Storm Bill caused flash floods in the parish.	Flash Flood	$164,589	PARISH-WIDE

Date	Extents	Type of Flooding	Estimated Damages	Location
August 16, 2012	Heavy rainfall occurred in the afternoon hours, causing several streets to flood and become impassable, including portions of Judge Perez Drive, Norton Street, and Doerr Drive.	Flash Flood	$0	ARABI
September 5, 2014	Street flooding occurred when heavy rains occurred in the late morning and afternoon hours. Paris Road and Judge Perez Drive intersection reported up to 1 foot of water. Two cars stalled due to flooding.	Flash Flood	$0	CHALMETTE

The worst-case scenarios are based on several different types of flooding events. Storm water excesses primarily affects the low lying areas of the parish, and flood depths of up to four to six feet can be expected in the low lying areas of the parish. The worst-case scenario for storm surge is a depth of fourteen to seventeen feet throughout the parish, as witnessed when Hurricane Katrina devastated the parish in 2005.

Frequency / Probability

Based on historical record, the overall probability for the entire St. Bernard Parish Planning area is 36%, with nine events occurring over a 25 year period. Based on the state's Hazard Mitigation Plan and the amount of significant flood events that have taken place throughout the parish, the St. Bernard Parish planning area can anticipate having a significant flooding event less than once every two years.

Estimated Potential Losses

Using Hazus-MH Flood Model, along with the Parish DFIRM, the 100-year flood scenario was analyzed to determine losses from this worst-case scenario. *Table 2-13* shows the total economic losses that would result from this occurrence.

Table 2-13: Estimated Losses in St. Bernard Parish from a 100-Year Flood Event

Jurisdiction	Estimated Total Losses from 100-Year Flood Event
St. Bernard Parish	$3,100,000

The Hazus-MH Flood Model also provides a breakdown for seven primary sectors (Hazus occupancy) throughout the parish. The losses by sector are listed in the tables below.

Table 2-14: Estimated 100-Year Flood Losses for St. Bernard Parish by Sector (Source: HAZUS-MH)

St. Bernard Parish	Estimated total Losses from 100 Year Flood Event
Agricultural	$0
Commercial	$605,000
Government	$109,000
Industrial	$682,000
Religious / Non-Profit	$218,000
Residential	$969,000
Schools	$517,000
Total	$3,100,000

Threat to People

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

Table 2-15: Vulnerable Populations Susceptible to a 100-Year Flood Event (Source: HAZUS-MH)

Number of People Exposed to Flood Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
St. Bernard Parish	**35,897**	**7,696**	**21.4%**

The HAZUS-MH Flood Model was also extrapolated to provide an overview of vulnerable populations throughout the parish in the table below:

Table 2-16: Vulnerable Populations Susceptible to a 100-Year Flood Event in St. Bernard Parish (Source: HAZUS-MH)

St. Bernard Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	7,696	21.4%
Persons Under 5 Years	623	8.1%
Persons Under 18 Years	2,047	26.6%
Persons 65 Years and Over	716	9.3%
White	5,618	73.0%
Minority	2,078	27.0%

Vulnerability

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

Land Subsidence/Saltwater Intrusion

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 decade. 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. 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 between 10-12 inches per century, while future sea level rise could be within the range of 1-4 feet 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.

Saltwater intrusion is one of the major causes of subsidence and marshland loss. Saltwater intrusion refers to the movement of saltwater into freshwater aquifers, or to the encroachment of saline water into freshwater estuaries. This intrusion flows into streams discharging into the Gulf of Mexico as well as the marsh areas, subsequently into freshwater streams. Intrusion of saltwater causes the loss of fresh and intermediate vegetation, which results in rapid erosion of marsh soils and the ultimate conversion of the area to open water.

Location

Historic areas of coastal land loss and gain (*Figure 2-12*) and subsidence rates *(Figure 2-13*) have been quantified for St. Bernard 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 three mi^2, resulting in a net loss of 32 mi^2 per year. Land loss is primarily currently occurring on the eastern and western shores of Calcasieu Lake, as well as the southeastern portion of the coastline along the Gulf of Mexico in St. Bernard Parish (*Figure 2-12*). Subsidence is occurring in the majority of the parish.

Previous Occurrences / Extent

Coastal land loss is an ongoing process, including discrete (hurricanes) and continuous (subsidence and sea level rise) processes. While historic flood loss data undoubtedly include 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.

One of the main causes of coastal land loss is saltwater intrusion. In the late 1950's, the Mississippi River-Gulf Outlet (MRGO) shipping channel was dredged. As a result, massive amounts of saltwater entered the Lake Pontchartrain Basin system, killing vegetation and causing erosion of the wetlands. Over 5,000 acres of productive coastal wetlands have been lost in the Lake Pontchartrain Basin due to saltwater intrusion from the MRGO.

The combination of natural processes and human intervention has allowed salt water to enter the basins. Much of the fresh and intermediate marsh that occurred in the upper basins earlier this century has either converted to more saline habitats or has become open water as a result of sediment and nutrient deprivation brought about by the construction of flood protection levees and saltwater intrusion caused by the dredging of oil and gas access canals through and between the natural distributary ridges.

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.).

Table 2-17: Annual Probability of Coastal Land Loss in St. Bernard Parish

Coastal Land Loss Probability St. Bernard Parish
100%

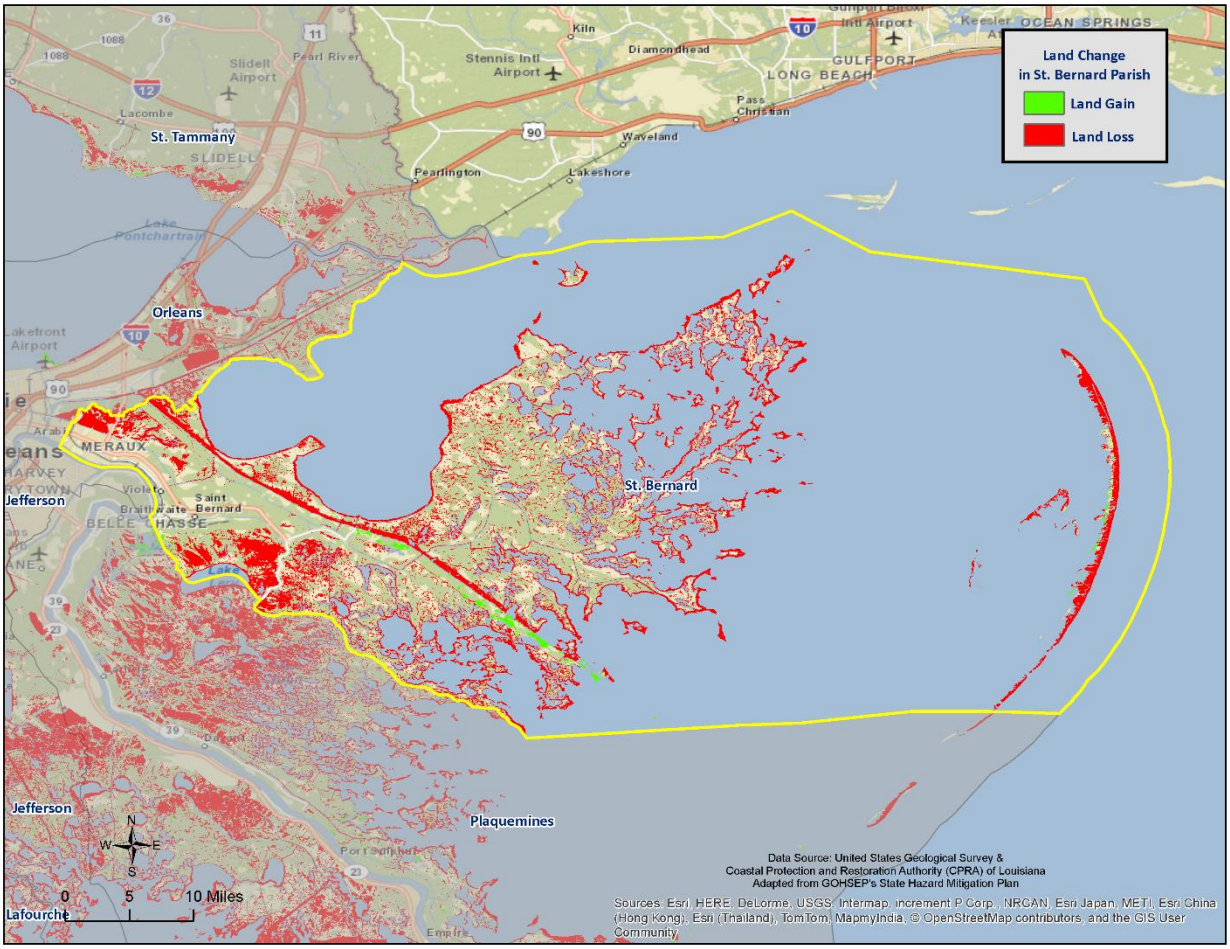

Figure 2-12: Historical Areas of Land Loss and Gain between 1932 and 2010 (Source: State of Louisiana Hazard Mitigation Plan)

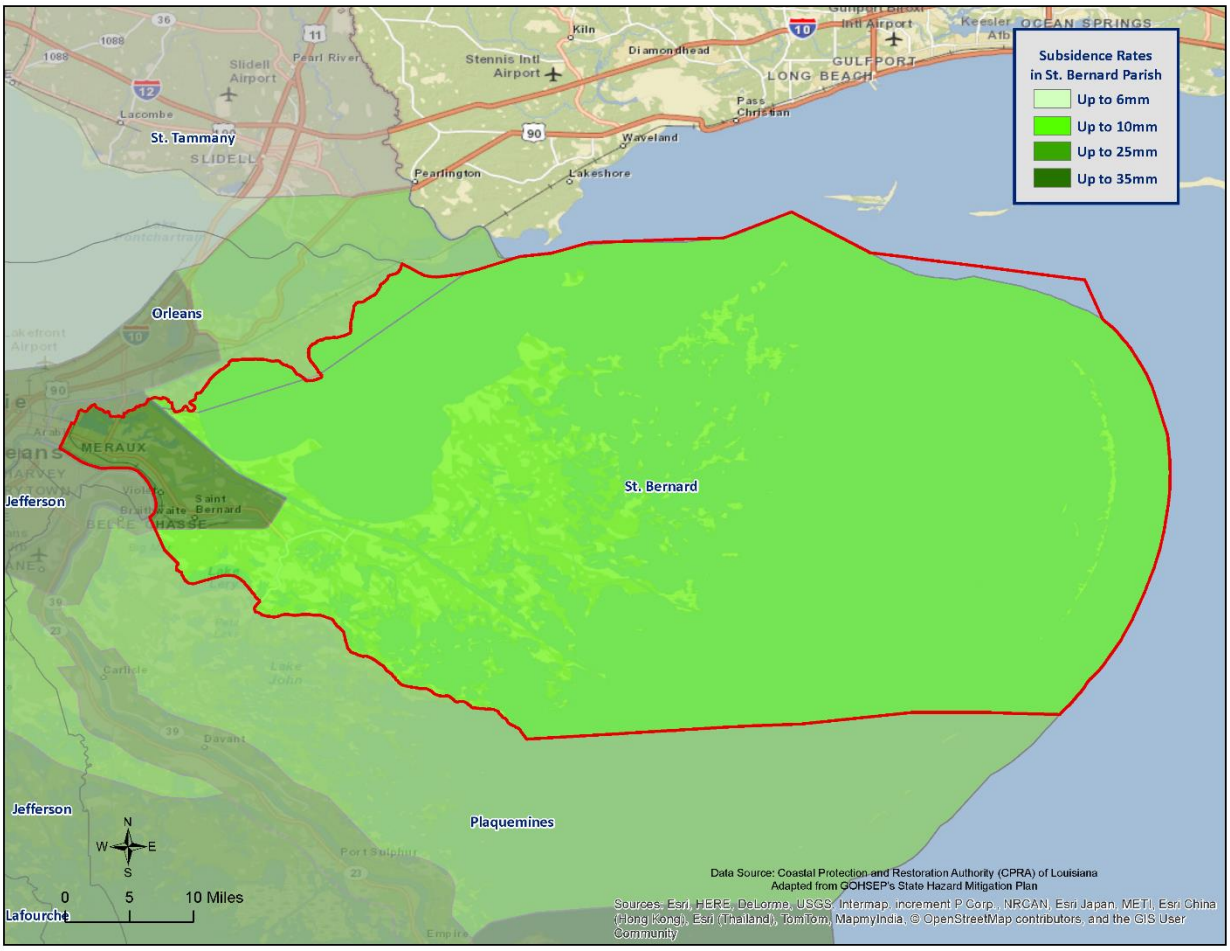

Figure 2-13: Maximum Annual Subsidence Rates based on Subsidence Zones in Coastal Louisiana (Source: State of Louisiana Hazard Mitigation Plan)

Estimated Potential Losses

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 ten 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 ten 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 ten 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 feet sea level rise] – [Current Land Elevation – Subsidence]). Hazus-MH was used to calculate economic loss for the current and future depth grids.

Figure 2-14 shows the projected increase in total flood loss resulting from a SLOSH Category 1 MOM in the year 2014, 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 2-15*).

To determine annual potential loss estimates for coastal land loss, increased exposure estimates over the next ten years calculated using Hazus-MH were annualized at the parish level (*Figure 2-16*). 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 2-18* provides an estimate of annual potential losses for St. Bernard Parish.

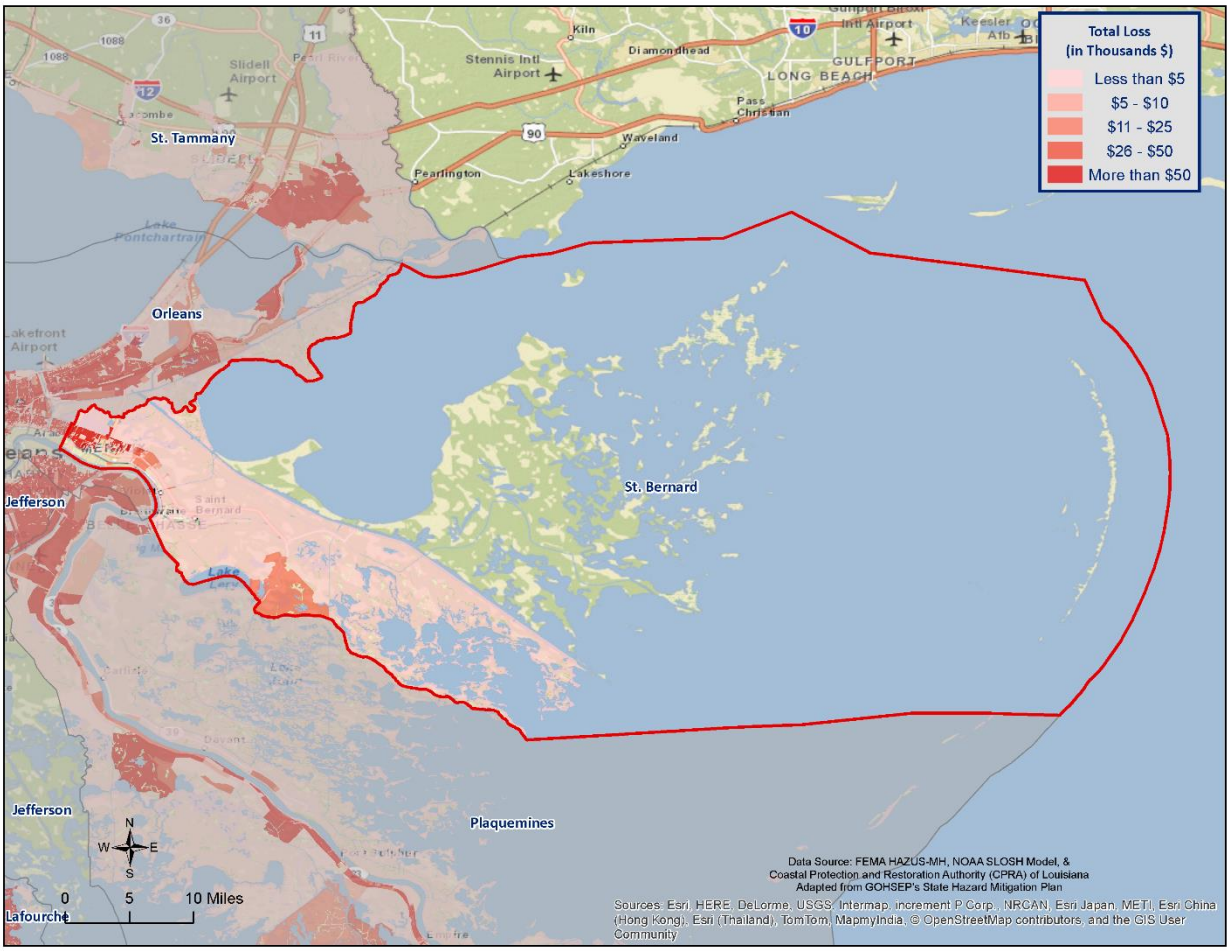

Figure 2-14: Increase in Total Loss Estimates in 2024 by Census Block Group based on the HAZUS-MH Flood Model and NOAA SLOSH Model
(Source: State of Louisiana Hazard Mitigation Plan)

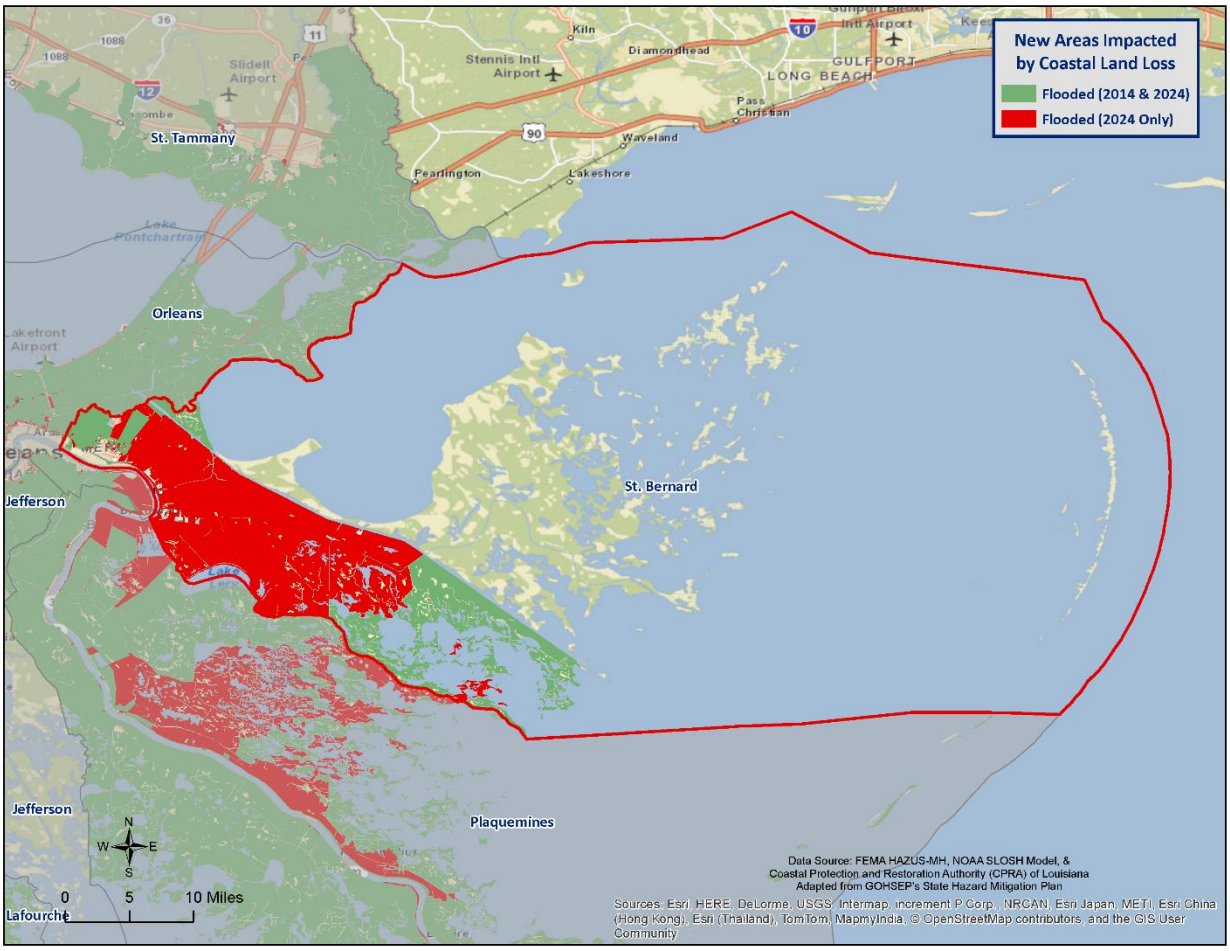

Figure 2-15: Census Block Groups not Currently Impacted by Category 1 Hurricane Storm Surge but Expected to be Impacted in 2024 are Shown in Red (Source: State of Louisiana Hazard Mitigation Plan)

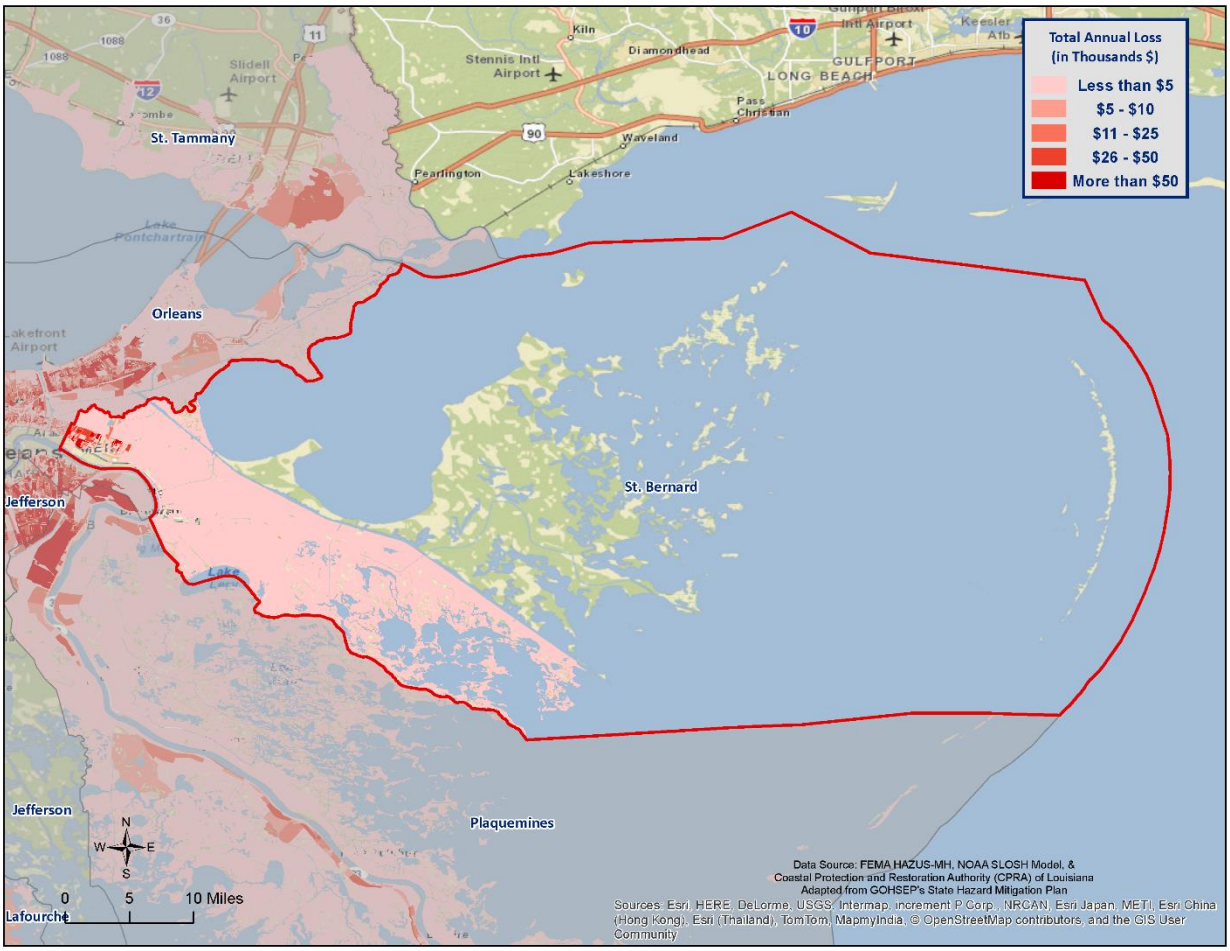

Figure 2-16: Estimated Annual Losses for Coastal Land Loss by Census Block Group

Table 2-18: Estimated annual losses for coastal land loss in St. Bernard Parish (Source: HAZUS-MH)

Coastal Land Loss Estimated Annual Potential Losses for St. Bernard Parish
$3,909,700

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 *Table 2-19*.

The HAZUS-MH Hurricane Model was used to identify populations vulnerable to coastal land loss throughout the jurisdictions in the tables below:

Table 2-19 Population Vulnerable by Jurisdiction in St. Bernard Parish

Number of People Exposed to Flood Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
St. Bernard Parish	**35,897**	**21,244**	**59.2%**

Table 2-20: Population Vulnerable to Coastal Land Loss in St. Bernard Parish (Source: HAZUS-MH)

St. Bernard Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	21,244	59.2%
Persons Under 5 Years	1,721	8.1%
Persons Under 18 Years	5,651	26.6%
Persons 65 Years and Over	1,976	9.3%
White	15,508	73.0%
Minority	5,736	27.0%

Vulnerability

See Appendix C for parish buildings that are susceptible to land subsidence.

Sinkholes

Sinkholes are areas of ground with no natural external surface drainage. They can vary in size from a few square feet to hundreds of acres, and can reach depths of more than 100 feet. 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. 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. 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 in 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 is one identifiable salt dome location in St. Bernard Parish. *Figure 2-17* displays the location of the salt dome which can be seen in the western section of St. Bernard Parish.

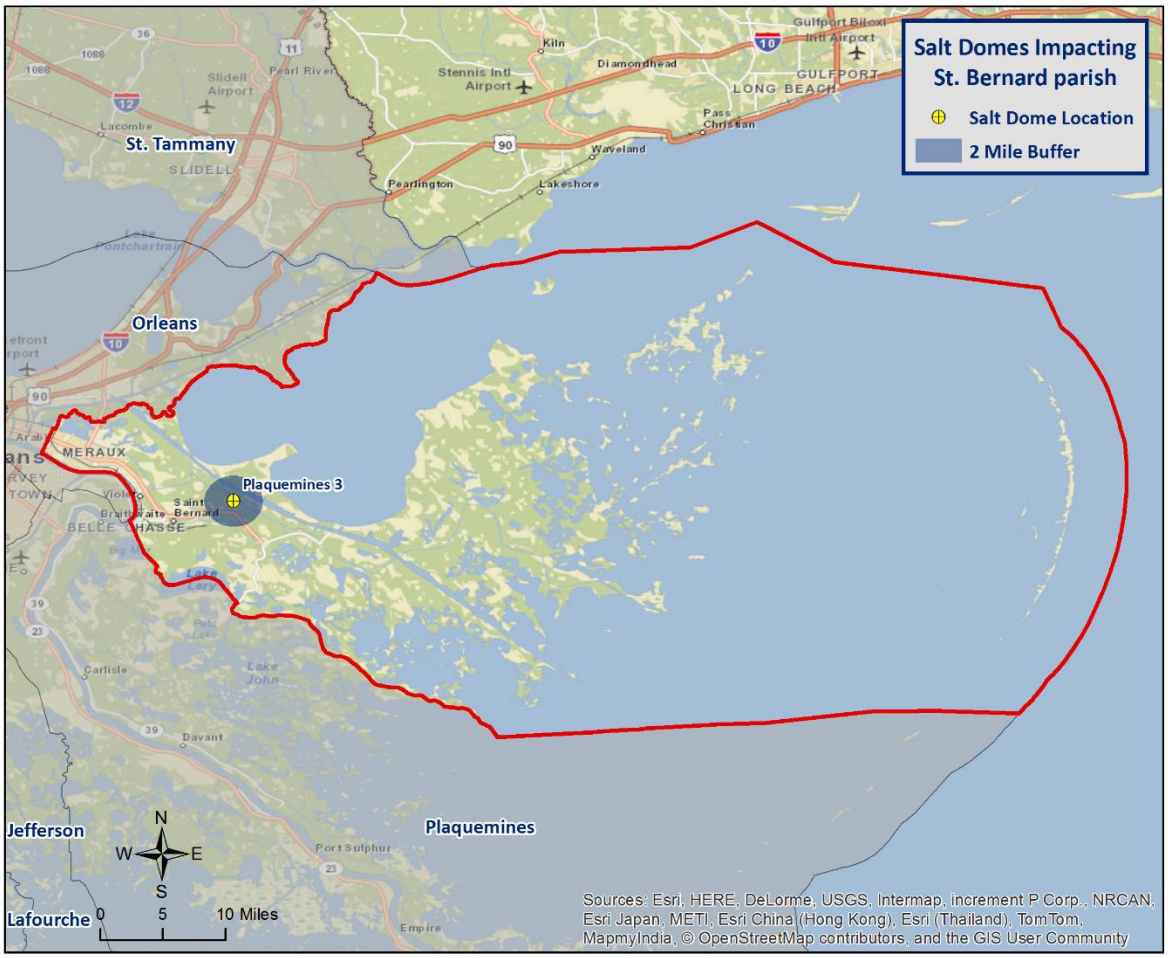

Figure 2-17: Salt Dome Locations in St. Bernard Parish

Previous Occurrences / Extent

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

Frequency / Probability

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

Estimated Potential Losses

The salt dome was 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 following page is based on conducting 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-2.2 was used to estimate a total loss of all facilities that were within two miles of the salt dome.

Table 2-21: Estimated Potential Losses from a Sinkhole Formation
(Source: U.S. 2010 Census Data and Hazus-2.2)

Salt Dome Name	Total Building Exposure	Critical Infrastructure Exposure	Number of People Exposed	Number of Houses Exposed
Plaquemines 3	$19,210,000	0	361	148

The Plaquemines 3 Salt Dome is the only salt dome located within St. Bernard Parish. It contains a total of 148 homes and 361 people within its two mile buffer. Total building exposure is approximately $19 million, and there is no critical infrastructure located within the two mile buffer.

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 types 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. Consequently, the air masses 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, multi-cell, 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 multi-cell 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, which warms the 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, along 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 parishes (counties).

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 one 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 initially develops in the upper atmosphere as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface. They then fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, and then get caught in another updraft, whereupon re-freezing and deposition grows another concentric layer of ice. After several trips up and down the cloud, they develop enough weight to fall. The size of hailstones varies depending on the severity and size of the thunderstorm. Higher surface temperatures generally mean stronger updrafts, which allow more massive hailstones to be supported by updrafts, leaving them suspended longer. This longer suspension time results in larger hailstone sizes. The tables on the following page display the TORRO Hailstorm Intensity Scale, as well as a spectrum of hailstone diameters and their everyday equivalents.

Table 2-22: 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 2-23: 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. 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 2-24*.

Table 2-24: 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 wind**s** 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 mountainous 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 2-25 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 2-25: 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 which is a measurement of lightning activity.

Table 2-26: 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

Because hailstorms are a climatological based hazard, the entire planning area for St. Bernard Parish is equally at risk for hailstorms.

Previous Occurrences / Extents

The SHELDUS database reports one significant hailstorm event occurring within the boundaries of St. Bernard Parish between the years of 1989-2014. According to the National Climatic Data Center, the hailstorm diameters experienced in St. Bernard Parish have ranged from 0.75 inches to 1.75 inches over the 25 year period. The most frequently recorded hail sizes have been 0.75 inch diameter. *Figure 2-18* displays the density of hailstorms in St. Bernard Parish and adjacent parishes. *Table 2-27* provides an overview of hail storms that have impacted the St. Bernard Parish Planning area since 2009 based on the National Climatic Data Center dataset. St. Bernard Parish can expect to experience hail up to 1.75 inches in diameter for future events.

Table 2-27: Previous Occurrences of Hailstorms in St. Bernard Parish. (Source: NCDC)

Date	Recorded Hail Size (inches)	Location
March 29, 2011	1	CHALMETTE
March 29, 2011	1.75	DELACROIX
February 24, 2013	1.5	VIOLET
February 24, 2013	0.88	CHALMETTE
April 8, 2014	0.75	MERAUX

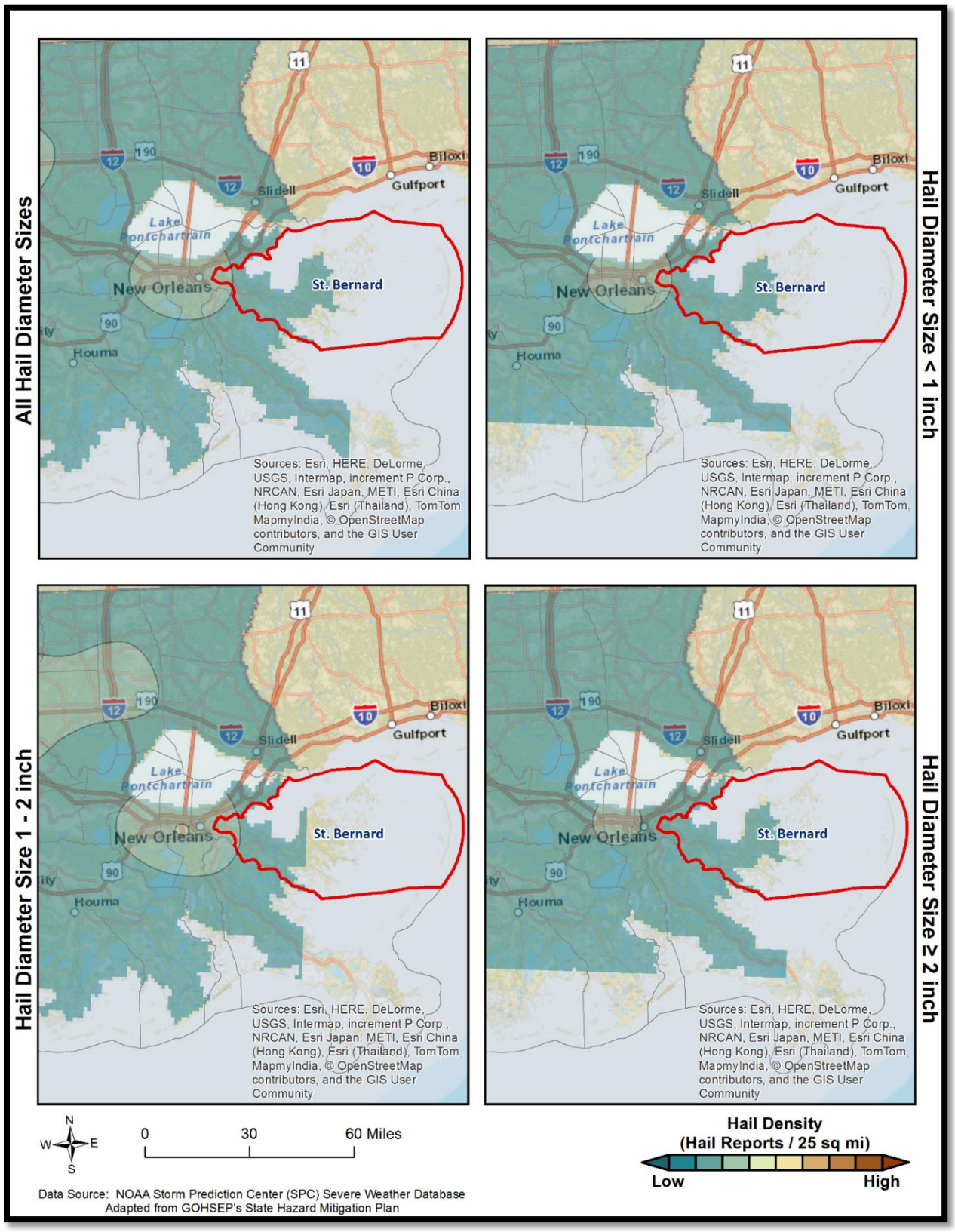

Figure 2-18: Density of Hailstorms by Diameter from 1950-1964
(Source: State of Louisiana Hazard Mitigation Plan 2014)

Frequency

The State of Louisiana Hazard Mitigation plan estimated the probability of occurrence at approximately 4%, with a return frequency of less than one event every eight years. The probability was determined based on a review of significant hail data that has caused damages in the last twenty five years, in which St. Bernard Parish has had one recorded event.

Estimated Potential Losses

According to the SHELDUS database, property damage due to hailstorms in St. Bernard Parish have totaled approximately $1,036 since 1989. A list of total damages by event can be found in *Table 2-28*. To estimate the potential losses of a severe weather event on an annual basis, the total damages recorded for hailstorms was divided by the total number of years of available hailstorm data in SHELDUS (1960 – 2014). This provides an annual estimated potential loss of $41. The following tables provide an estimate of potential property losses for St. Bernard Parish:

Table 2-28: Property Damage Caused by Hailstorms in St. Bernard Parish (Source: SHELDUS)

Date	Property Damage
March 29, 2011	$1,036

Table 2-29: Estimated Annual Property Losses in St. Bernard Parish from Hailstorms

Estimated Annual Potential Losses from Hailstorms for St. Bernard Parish
$41

The parish has suffered no deaths or injuries due to hailstorms from 1989 – 2014.

Vulnerability

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

High Winds

Location

Because high winds are a climatological based hazard, the entire planning area for St. Bernard Parish is equally at risk for high winds.

Previous Occurrences / Extents

The SHELDUS database reports a total of eighteen thunderstorm wind events occurring within the boundaries of St. Bernard Parish between the years of 1989-2014. The significant thunderstorm wind events experienced in St. Bernard Parish have ranged from a wind speed of 58 mph to 81 mph. St. Bernard Parish can expect to receive winds up to 81 mph for future high wind events.

Table 2-30: Previous Occurrences for Thunderstorm High Wind Events

Location	Date	Recorded Wind Speeds (mph)	Property Damage	Crop Damage
CHALMETTE	June 4, 2010	81	$5,000	$0
CHALMETTE	February 21, 2014	64	$0	$0
MERAUX	February 21, 2014	64	$10,000	$0
DOCVILLE	February 21, 2014	64	$5,000	$0
ARABI	April 25, 2015	63	$0	$0

Frequency

High winds are a fairly common occurrence within St. Bernard Parish, with an annual chance of occurrence calculated at 72%. According to the State Hazard Mitigation Plan, St. Bernard Parish has a future probability of experiencing less than one wind event annually.

Estimated Potential Losses

Since 1989, there have been eighteen significant wind events that have resulted in property damages according to the SHELDUS database. The total property damages associated with those storms have totaled $410,982. 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 SHELDUS (1989 – 2014). This provides an annual estimated potential loss of $16,439. The following table provides an estimate of potential property losses for St. Bernard Parish:

Table 2-31: Estimated Annual Property Losses in St. Bernard Parish Resulting from Wind Damage

Estimated Annual Potential Losses from Thunderstorm Winds for St. Bernard Parish
$16,439

There have been no reported injuries or fatalities as a result of a wind event over the 25 year record.

Vulnerability

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

Lightning

Location

Like hail and high winds, lightning is a climatological based hazard and has the same probability of occurring throughout the entire planning area for St. Bernard Parish.

Previous Occurrences / Extent

The SHELDUS database reports three lightning event occurring within the boundaries of St. Bernard Parish between the years of 1989-2014. The SHELDUS database only records lightning events that cause death, injuries, crop damage, and/or property damage, so these numbers do not accurately reflect the number of lightning events in St. Bernard Parish, which occur on a nearly monthly basis. The table below provides an overview of significant lightning strikes over the last twenty-five years.

Table 2-32: Previous Occurrences of Significant Lightning Strikes in St. Bernard Parish from 2009 – 2014 (Source: NCDC and SHELDUS)

Location	Date	Summary	Property Damage
CHALMETTE	May 28, 1997	Lightning struck a woman when she was attempting to exit her vehicle in Chalmette.	$0
DELACROIX	September 4, 2004	Lightning struck a boat near Delacroix, killing an 18 year old man.	$0
CHALMETTE	July 3, 2005	Lightning struck a grocery store, causing a loading dock to catch on fire in Chalmette.	$500
MERAUX	July 3, 2006	Lightning struck a gasoline storage tank at an oil refinery, causing a small fire.	$0

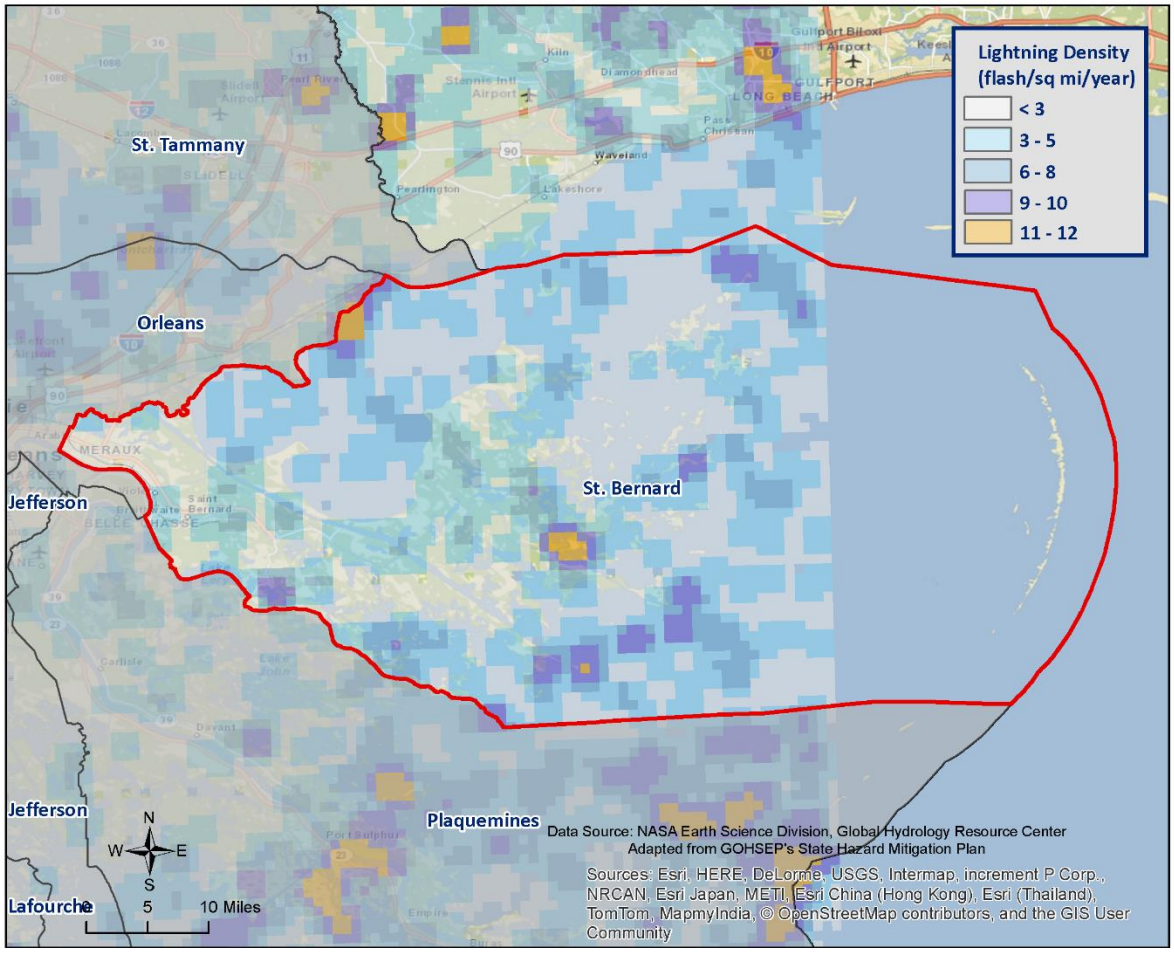

Figure 2-19: Lightning Density Reports for St. Bernard Parish

Frequency

Lightning can strike anywhere and is produced by every thunderstorm, so the chance of lightning occurring in St. Bernard Parish is high. However, lightning that meets the definition that is used by SHELDUS and the NCDC that actually results in damages to property and injury or death to people is a less likely event. According to the State Hazard Mitigation Plan, a major lightning strike in St. Bernard Parish is likely to occur less than once every eight years. This is consistent with SHELDUS, which has three lightning events that have caused property damages or injuries over the last 25 years, establishing an annual probability of 12%.

Estimated Potential Losses

Since 1989, there has been one significant lightning event that has resulted in property damages, according to the SHELDUS database. The total property damages associated with storms have totaled $596. 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 SHELDUS (1989 – 2014). This provides an annual estimated potential loss of $24. The table on the following page provides an estimate of potential property losses for St. Bernard Parish.

Table 2-33: Estimated Annual Property Losses in St. Bernard Parish Resulting from Lightning Damage

Estimated Annual Potential Losses from Lightning for St. Bernard Parish
$24

There have been two significant lightning events that have resulted in one injury and one fatality over the 25 year record.

Vulnerability

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

Tornadoes

Tornadoes (also called twisters or 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. This usually results 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, along 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 Doppler 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 with 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

Because tornadoes are a climatological based hazard, the entire planning area for St. Bernard Parish is equally at risk for tornadoes.

Previous Occurrences / Extent

SHELDUS reports a total of seven tornadoes or waterspouts occurring within the boundaries of St. Bernard Parish between the years of 1989-2014. The tornadoes experienced in St. Bernard Parish have ranged EF0 to EF1 on the EF scale and ranged from F0 to F2 on the F scale. The worst case scenario St. Bernard Parish can expect in the future is an EF2 tornado.

The tornado that caused the most damage to property occurred on May 8, 1995. The F2 tornado was responsible for over $300,000 in damage. The tornado touched down briefly near Arabi, overturning eight railroad tank cars and heavily damaging several commercial buildings. There have been no fatalities or injuries in St. Bernard Parish as a result of tornadoes.

Table 2-36: Historical Tornadoes in St. Bernard Parish with Locations from 1989-2014

Date	Impacts	Property Damage	Location	Magnitude
May 27, 1990	0.2 mile path with a width of 20 yards. Overturned a mobile home and damaged a crane at a sugar factory.	$8,912	UNINCORPORATED AREA	F1
May 8, 1995	0.8 mile path with a width of 40 yards. Overturned 8 railroad tank cars and heavily damaged several commercial buildings.	$382,147	ARABI	F2
June 30, 2003	0.2 mile path with a width of 30 yards. Destroyed a boat house.	$6,330	DELACROIX	F0
April 6, 2005	2 mile path with a width of 40 yards. Caused significant tree damage in the parish before dissipating.	$11,928	UNINCORPORATED AREA	F1
March 29, 2011	0.6 mile path with a width of 25 yards. A vacant 3 story government building lost its top two floors, and suffered a collapse of north and east facing brick veneer. Five unstrapped RV trailers were flipped.	$207,129	DELACROIX	EF1
September 3, 2011	0.5 mile path with a width of 50 yards. Caused significant damage to a trailer and snapped several large tree branches.	$10,356	VERRET	EF1
May 23, 2012	0.24 mile path with a width of 33 yards. 10 homes received minor wind damage and extensive damage was sustained by a carport.	$20,293	ARABI	EF0

Since 2010, the year the last update to this hazard mitigation plan was written, St. Bernard Parish has had three tornado touch downs. The following is a brief synopsis of these events:

March 29, 2011 – EF1 Tornado in Delacroix

An upper level disturbance moved over a very warm and unstable air mass producing a tornado that touched down near Delacroix. A vacant three story government building lost its two top floors, and suffered a collapse of north and east facing brick veneer. Five unstrapped RV trailers were flipped, and two of the trailers rolled for 45 yards. Estimated wind speeds were approximately 105 mph.

September 3, 2011 – EF1 Tornado near Verret

A tornado spawned from Tropical Storm Lee and touched down near the intersection of Pilate Lane and Bayou Road. The tornado caused significant damage to one trailer, separating the roof from the walls. The tornado caused extensive tree damage, downed a wooden fence, and destroyed a wooden shed. Near Bayou Road, the tornado caused minor damage to a brick home and snapped an eighteen inch diameter tree near the base. Maximum sustained winds were estimated at approximately 100 mph.

May 23, 2012 – EF0 Tornado in Arabi

A stationary frontal boundary aided in the development of a tornado in St. Bernard Parish. The damage path started near the corner of Puma and Chinchilla Streets and extended northeast to the intersection of Bear Street and Cougar Drive. Approximately ten homes received minor damage. The most extensive damage was one carport that was destroyed. Winds were estimated at approximately 70 mph.

Frequency / Probability

Tornadoes are a sporadic occurrence within St. Bernard Parish, with an annual chance of occurrence calculated at 28% based on the records for the past 25 years (1989-2014). *Figure 2-20* displays the density of tornado touch downs in St. Bernard Parish and neighboring parishes.

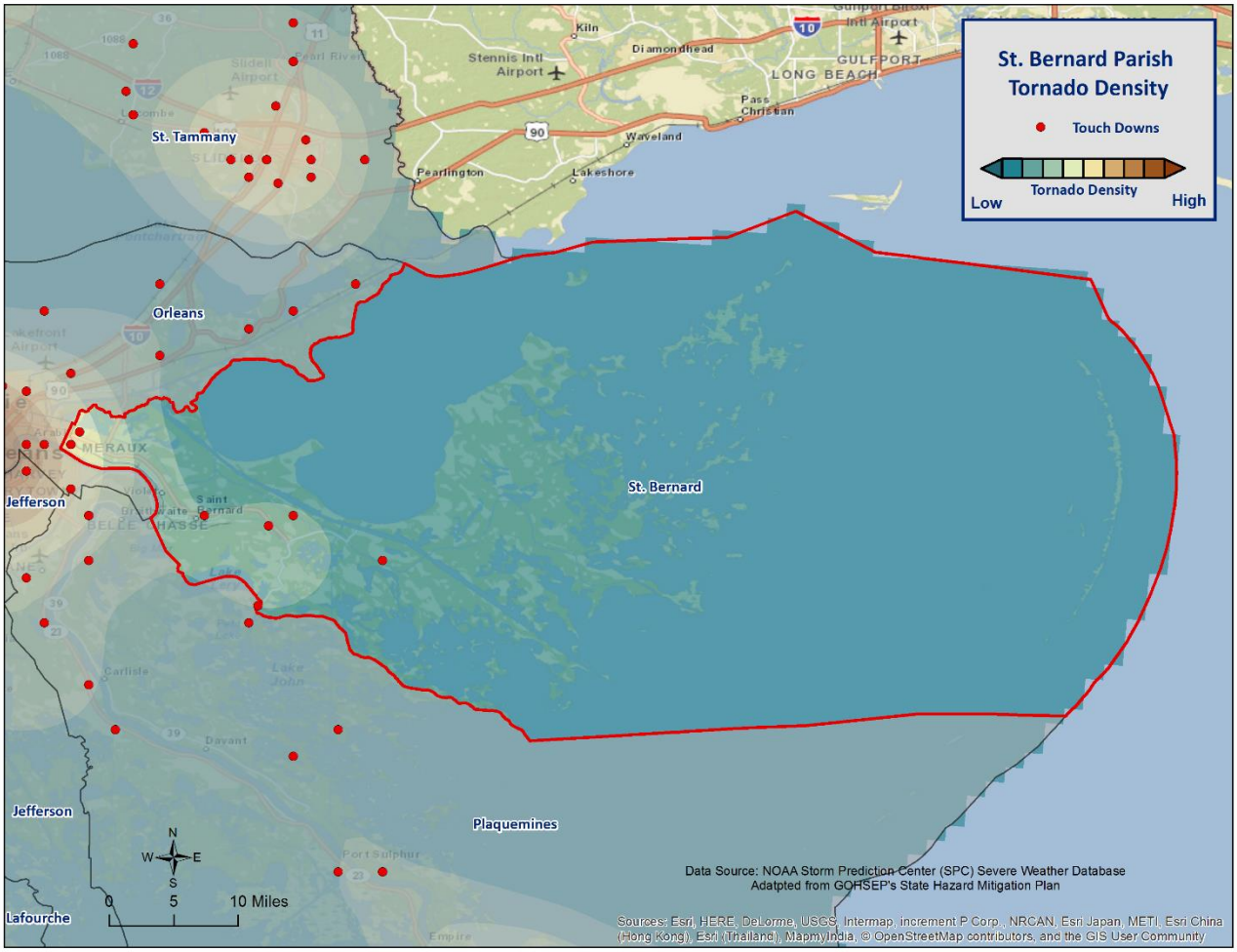

Figure 2-20: Location and Density of Tornadoes to Touchdown in St. Bernard Parish (Source: NOAA/SPC Severe Weather Database)

Estimated Potential Loses

According to the SHELDUS database, there have been seven tornadoes that have caused some level of property damage. The total damage from the actual claims for property is $647,096, with an average cost of $92,442 per tornado strike. When annualizing the total cost over the 25 year record, total annual loses based on tornadoes are estimated to be $25,884.

Table 2-*37* provides an annual estimate of potential losses for St. Bernard Parish.

Table 2-37: Estimated Annual Losses for Tornadoes in St. Bernard Parish

Estimated Annual Potential Losses from Tornadoes for St. Bernard Parish
St. Bernard Parish
$25,884

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

Table 2-38: Building Exposure by General Occupancy Type for Tornadoes in St. Bernard 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 (%)
2,819,334	636,612	136,346	7,948	72,002	14,960	53,198	14.4%

St. Bernard Parish has experienced no recorded injuries or fatalities from tornadoes or waterspouts.

In assessing the overall risk to population, the most vulnerable populations throughout the parish are those residing in manufacturing housing. Approximately 14.4% of all housing in St. Bernard Parish consists of manufactured housing. Based on location data collected in a previous hazard mitigation project, there are twelve known locations where manufactured housing is concentrated. Those twelve locations have an overall number of manufactured houses ranging from 20 to 122. The location and density of manufactured houses can be seen in *Figure 2-21*.

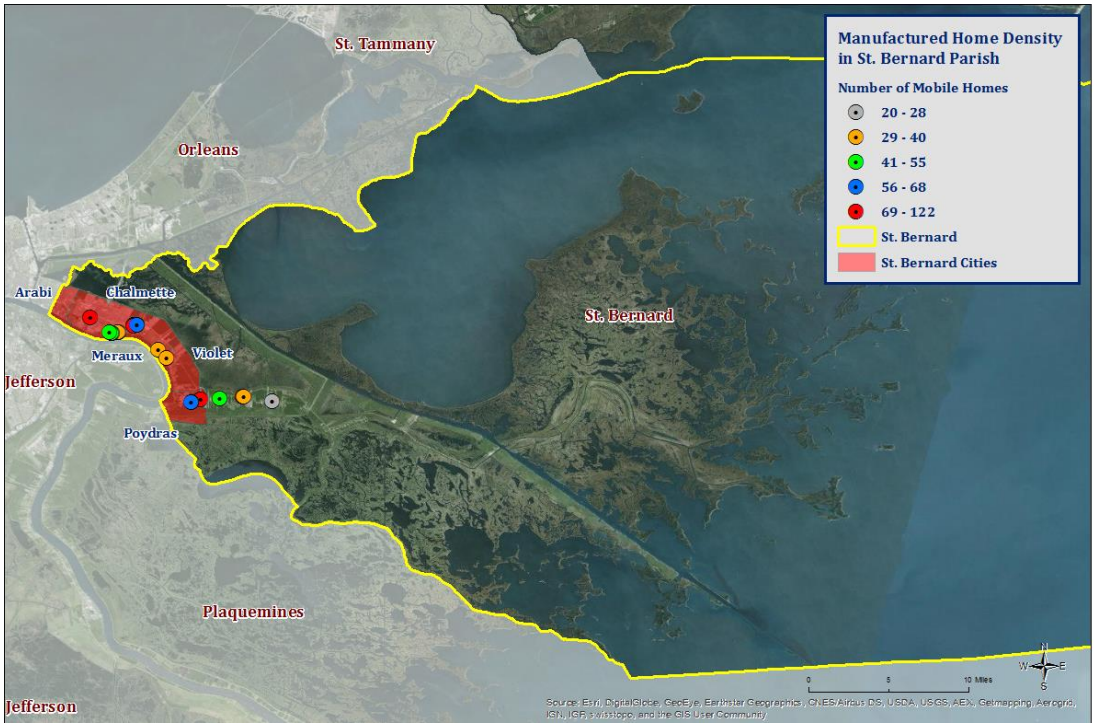

Figure 2-21: Location and Approximate Number of Units in Manufactured Housing Locations throughout St. Bernard Parish

Vulnerability

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

Tropical Cyclones

Tropical cyclones are among the worst hazards that Louisiana faces. 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, and move 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, forming 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). *Table 2-39* presents the Saffir-Simpson Hurricane Wind Scale, which categorizes tropical cyclones based on sustained winds.

Table 2-39: 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 Storm	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 likely will 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 will 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 twenty 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 damage amounts from storm surge so much that it 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 10 meters in some places that can inflict high numbers 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 storm. 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 objects are capable of being 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 pressures 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 home and buildings in need of maintenance are most subject to wind damage. In addition, high winds often result in the formation of larger sized waves. Extended pounding by waves can demolish any structure not properly designed. The waves are also capable of eroding sand beaches, roads, and foundations. When foundations are undermined, 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 hurricane having the potential to devastate multiple parishes during a single event, the risk of a tropical cyclone has the probability of impacting anywhere within the planning area for St. Bernard Parish.

Previous Occurrences / Extent

The central Gulf of Mexico coastline is among the most hurricane-prone locations in the United States, and hurricanes can affect every part of the state. The SHELDUS database reports a total of seventeen tropical cyclone events occurring within the boundaries of St. Bernard Parish between the years 2002-2014 (*Table 2-40*). The tropical cyclone events experienced in St. Bernard Parish include depressions, storms, and hurricanes. As a worst case scenario, St. Bernard Parish can expect to experience hurricanes at the Category 4 level in the future.

Table 2-40: Historical Tropical Cyclone Events in St. Bernard Parish from 2002- 2014 (Source: SHELDUS)

Date	Name	Storm Type While Impacting Parish Name Parish
August 4, 2002	Bertha	Tropical Storm
September 14, 2002	Hanna	Tropical Storm
September 25, 2002	Isidore	Tropical Storm
October 2, 2002	Lili	Hurricane – Cat 1
June 30, 2003	Bill	Tropical Storm
September 15, 2004	Ivan	Hurricane – Cat 1
October 9, 2004	Matthew	Tropical Storm
June 5, 2005	Cindy	Hurricane
June 10, 2005	Dennis	Tropical Storm
August 28, 2005	Katrina	Hurricane – Cat 3
September 23, 2005	Rita	Tropical Storm
August 24, 2008	Fay	Tropical Depression
September 1, 2008	Gustav	Hurricane – Cat 1
September 11, 2008	Ike	Tropical Storm
November 9, 2009	Ida	Tropical Storm
September 2, 2011	Lee	Tropical Storm
August 28, 2012	Isaac	Tropical Storm

Hurricane Betsy (1965)

Hurricane Betsy made landfall as a Category 4 hurricane near Grand Isle on September 10, 1965. Winds exceeding 125 mph were felt throughout the parish. Arabi Park, St. Claude Heights, Chalmette Vista, and Carolyn Park sub-divisions were the hardest hit areas. Areas in the rear of Arabi-St. Claude Heights and Carolyn Park sub-division were under eight to ten feet of water. Water rose quickly without advanced warning. Residents were evacuated by boats to southern railroad tracks in Arabi. The office of the St.

Bernard Voice was severely damaged. An estimated 4,000 people were evacuated to the Kaiser Plant. Schools in St. Bernard Parish suffered a total loss of approximately $2 million. All buildings suffered some form of wind or water damage. The lower portion of the parish was virtually destroyed. Only three homes out of approximately 175 survived the damage in the area from Reggio to Delacroix Island. Several homes were displaced from their foundation and were found on the highway.

Hurricane Camille (1969)

Hurricane Camille made landfall as a Category 5 hurricane near Bay St. Louis/Pass Christian, Mississippi on August 18, 1969. Areas in the southern part of the parish were the hardest hit. Flood waters poured into the homes in Reggio, Florissant, Hopedale, Shell Beach, and Delacroix Island. Many trailers which replaced homes lost during Hurricane Betsy were turned over and severely damaged. A home in Yscloskey was broken in half by powerful winds. Winds were measured in excess of 93 mph in the upper portion of the parish. Several thousands of people from lower St. Bernard Parish sought shelter in the upper portion of the parish. Evacuation orders were issues for residents in Arabi and Chalmette due to flood waters seeping under the Orleans levees on both sides of the industrial canal. Ninety-four vessels were sunk or grounded in the Mississippi River.

Hurricane Andrew (1992)

Hurricane Andrew came ashore in Louisiana on August 26, 1992, as a Category 3 storm. In St. Bernard Parish, Hurricane Andrew caused flooding in low-lying areas. Roads were covered in debris and over 5,000 telephone lines were out of service. Numerous homes sustained roof damage due to the high winds, and over 3,000 people were evacuated.

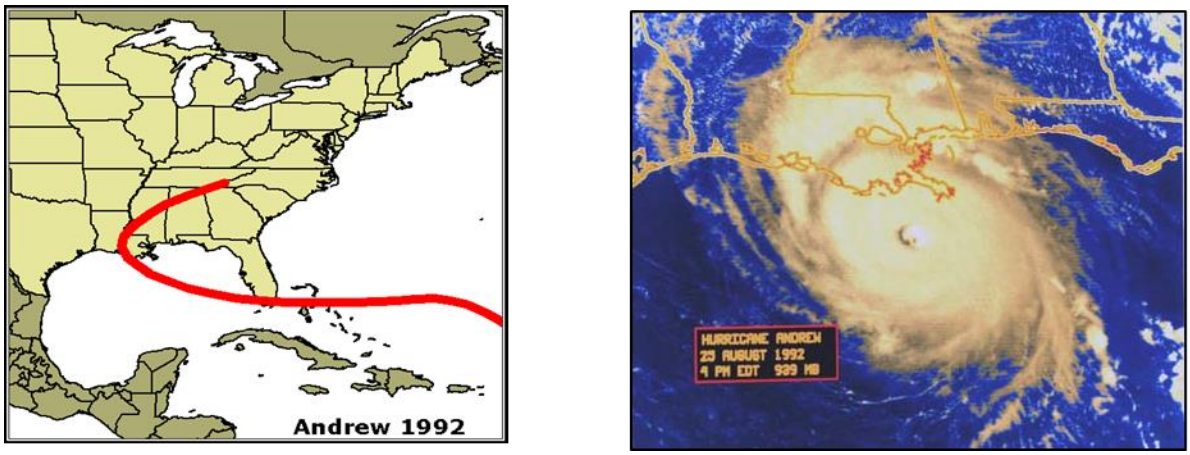

Figure 2-22: Hurricane Andrew Path and Satellite Image taken on 25 August 1992

Tropical Storm Allison (2001)

In June 2001, Tropical Storm Allison made landfall in the state of Texas and moved across Louisiana, causing extensive flood damage. Over five inches of rainfall in a two hour period was recorded at the Lake Borgne Basin Levee District's pump station in Chalmette. At Meraux Pump Station, over three inches of rainfall was recorded in the same time period. Pump stations removed the rain water continuously for more than ten hours.

Tropical Storm Isidore (2002)

Tropical Storm Isidore made landfall in Grand Isle, Louisiana on September 27, 2002. Tropical Storm Isidore had a large circulation with high force winds extending several hundreds of miles from its center. This caused significant storm surge over a large area, specifically on Lake Pontchartrain, where storm surges of four to five feet above normal were measured. Low lying areas, roadways, and some non-elevated structures on the lake were flooded. Rain bands associated with Tropical Storm Isidore produced heavy rainfall in a wide area prior to and shortly after landfall. Total rainfall amounts from the storm equaling ten to fifteen inches were common across southeast Louisiana. Most areas recorded sustained winds of 35 to 45 mph, with some gusts to fifty mph in squalls. The Louisiana Office of Emergency Preparedness reported approximately 2,500 people sought refuge in approximately forty shelters in the state.

St. Bernard Parish experienced sustained winds of 35 to 45 mph. A total rainfall of ten to fifteen inches occurred as a result of the storm. Four to eight inches of rain fell within six hours, overwhelming the drainage system. Numerous streets, automobiles, and homes were flooded.

Hurricane Lili (2002)

In October 2002, Hurricane Lili made landfall on October 3, 2002, along the west shore of Vermilion Bay in South Central Louisiana as a Category 2 hurricane. During the day, the hurricane made steady progress northward and by 2pm, Lili was downgraded to a tropical storm. Flooding of roadways and low-lying structures in the coastal areas outside the hurricane protection levee occurred due to storm surge. Strong winds resulted in downed trees and branches.

Hurricane Katrina (2005)

Hurricane Katrina was one of the strongest and most destructive hurricanes on record to impact the coast of the United States. The National Hurricane Center ranked Katrina as the costliest storm (both before and after adjusting for inflation) and the third deadliest in the U.S. since 1851. The hurricane initially made landfall in Plaquemines Parish on August 29, 2005, as a Category 3 storm and continued on a north northeast track, with a second landfall occurring near the Louisiana-Mississippi border.

In St. Bernard Parish, hurricane protection levees were overtopped and breached, resulting in widespread and deep flooding of homes and businesses throughout the parish. Nearly all of St. Bernard Parish flooded due to storm surge. Thousands of people were stranded by the flood waters in buildings and on rooftops for several days, requiring rescue by helicopter. St. Bernard Parish experienced the western portion of the hurricane eye wall, with wind gusts up to 120 to 125 mph. Post-storm high water surveys conducted by FEMA indicated a storm surge of fourteen to seventeen feet in the parish.

Although determined to be a Category 3 hurricane, Katrina produced a Category 5 storm surge and winds in excess of 125 mph when it made landfall in St. Bernard Parish. As the storm surge traveled across Lake Borgne and up the MRGO, it overtopped the levee along the northern edge of the urbanized area of St. Bernard Parish, and breached the levee on the Industrial Canal in New Orleans' Lower 9th Ward. Water from both levee breaks flooded most of the parish inside the levees to depths of up to fourteen feet. Flood waters remained for approximately three weeks. A flood related breach of a tank at the Murphy Oil Company refinery released about a million gallons of crude oil, further damaging approximately 1,800 homes and polluting area canals. Fishing communities in the eastern areas of the parish outside of the levee system were destroyed. In all, 127 St. Bernard residents died,

approximately 68,000 people were displaced, and 100 percent of the parish housing stock was either destroyed or damaged sufficiently enough to make them uninhabitable. All parish businesses and government buildings, and most utility systems, were similarly damaged or destroyed.

At the St. Rita Nursing Home in Poydras, thirty people died as a result of flooding from the hurricane. Another 22 people were found dead in a Violet subdivision. Three thousand people were evacuated to the St. Bernard Port's Chalmette Slip for further evacuation across the river by ferry. Flooding of all parish buildings forced officials to use make-shift facilities to conduct rescue and recovery operations. Fire fighters worked from the Bell South building, and the Parish Council set up temporary quarters at the Exxon-Mobile Chalmette Refining. The Sheriff's Office operated from the Cajun Queen river boat that was moored next to the Domino's sugar refinery in Arabi, and the local prison was turned into a make shift medical center until the wounded and sick could be flown outside the parish. Standing water with decomposing bodies and chemicals presented a serious health hazard to the residents who remained trapped in the parish.

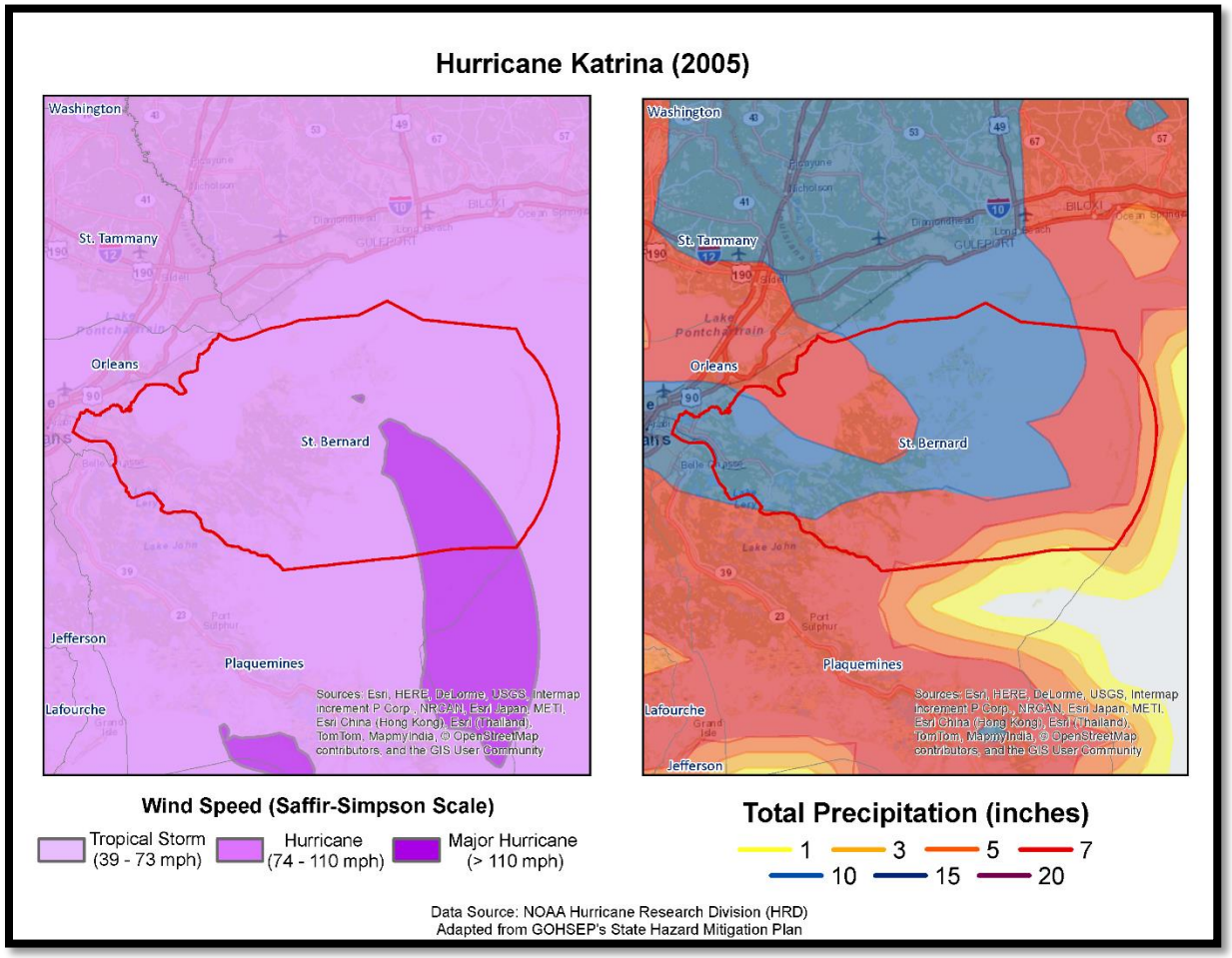

Figure 2-23: Wind Speed and Precipitation Totals in St. Bernard Parish for Hurricane Katrina

Hurricane Rita (2005)

While Hurricane Katrina and resulting levee failures captured headlines worldwide, lesser known (but just as destructive) Hurricane Rita wreaked havoc on southwestern Louisiana less than a month later. The storm made landfall as a Category 3 hurricane in Cameron Parish. Across southeast Louisiana, the main effect from Hurricane Rita was the substantial storm surge flooding that occurred in low lying communities across coastal areas of southern Terrebonne, southern Lafourche, and southern Jefferson Parishes, where numerous homes and businesses were flooded. Some of the most substantial damage occurred in southern Terrebonne Parish, where storm surge of 5 to 7 feet above normal overtopped or breached local drainage levees, inundating many small communities. Newspaper accounts indicated approximately 10,000 structures were flooded in Terrebonne Parish. Lafitte and other communities in lower Jefferson Parish also suffered extensive storm surge flooding. Storm surge flooding also occurred in areas adjacent to Lake Pontchartrain and Lake Maurepas, affecting homes and businesses from Slidell to Mandeville and Madisonville. Approximately 1,500 structures were reported as flooded in Livingston Parish near Lake Maurepas. Repaired levees damaged by Hurricane Katrina in late August were overtopped or breached along the Industrial Canal in New Orleans, resulting in renewed flooding in adjacent portions of New Orleans and St. Bernard Parish. However, the flooding was much more limited in scope than during Hurricane Katrina.

Hurricane Rita produced an eight foot storm surge in St. Bernard Parish. Combined with six to twelve inches of rain, the hurricane caused widespread flooding throughout the parish. Easterly winds from Hurricane Rita pushed water through Lake Borgne and MRGO into the Gulf Intercoastal Waterway and Industrial Canal, where it topped repaired levee breaches, resulting in the flooding of Lower Ninth Ward in New Orleans and Arabi in St. Bernard Parish.

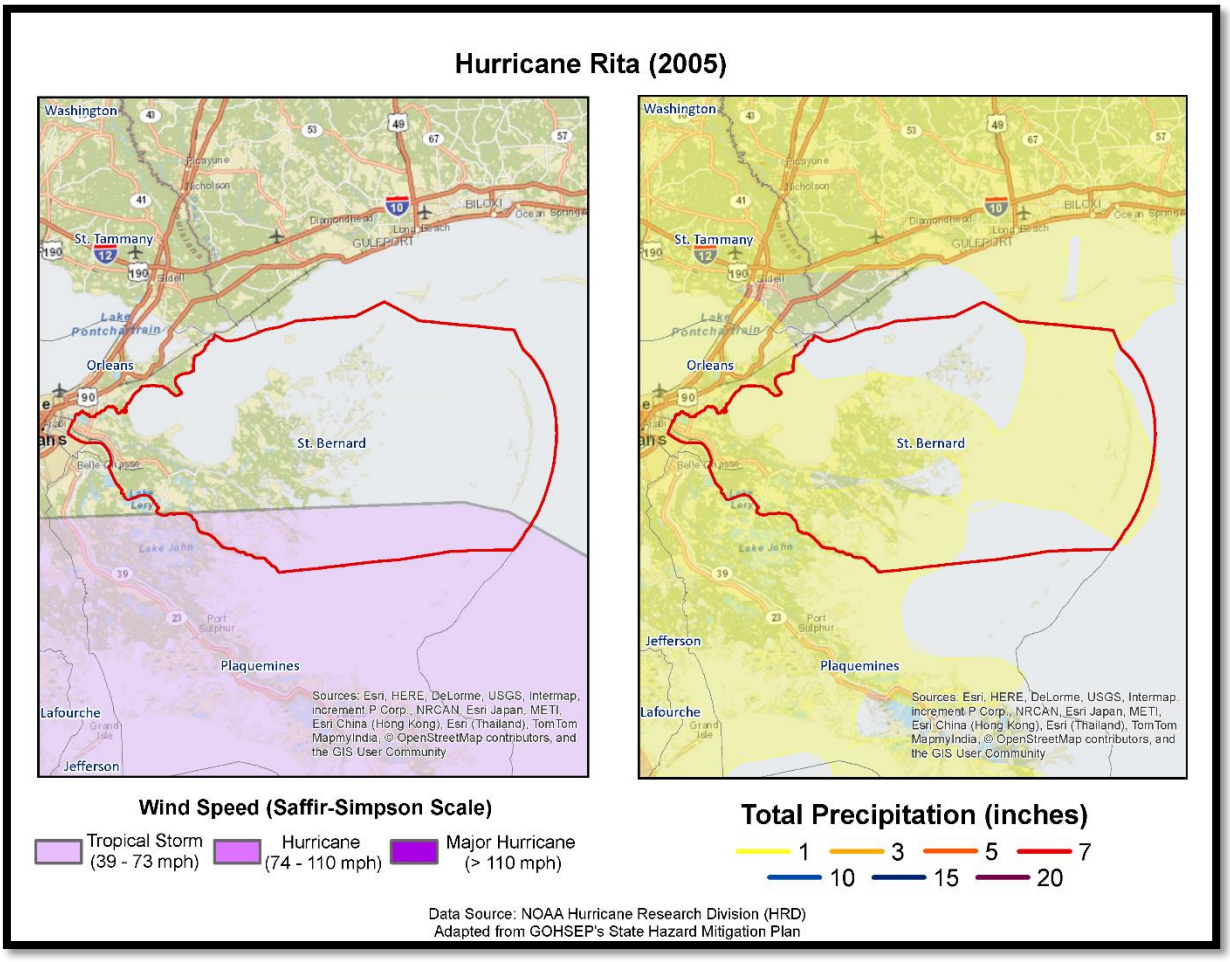

Figure 2-24: Wind Speed and Precipitation Totals in St. Bernard Parish for Hurricane Rita

Hurricane Gustav (2008)

Hurricane Gustav emerged into the southeast Gulf of Mexico as a major Category 3 hurricane on August 31 after developing in the Caribbean Sea and moving across western Cuba. Gustav tracked northwestward across the Gulf toward Louisiana and made landfall as a Category 2 hurricane near Cocodrie, Louisiana during the morning of September 1st. Gustav continued to move northwest across south Louisiana and weakened to a Category 1 storm over south central Louisiana later that day. The storm diminished to a tropical depression over northwestern Louisiana on September 2nd.

The highest wind gust recorded was 117 mph (102 knots) at a USGS site at the Houma Navigational Canal, and at the Pilot Station East C-MAN near the Southwest Pass of the Mississippi River. The highest sustained wind of 91 mph was recorded at the Pilot Station East C-MAN site. However, due to the failure of equipment at some observation sites during the storm, higher winds may have occurred. The minimum sea level pressure measured was 951.6 millibars at a USGS site at Caillou Lake, southwest of Dulac, and 954.5 millibars at the LUMCON facility near Dulac. Rainfall varied considerably across southeast Louisiana, ranging from around 4 inches to just over 11 inches.

Gustav produced widespread wind damage across southeast Louisiana, especially in the area from Houma and Thibodaux through the greater Baton Rouge area. Hurricane force wind gusts occurred across the inland areas, through the Baton Rouge area and surrounding parishes. A peak wind gust of 91 mph was

recorded at the Baton Rouge (Ryan Field) Airport at 1:12 PM CST. This was only one mph less than the highest wind gust recorded during Hurricane Betsy in 1965. After the storm, the electric utility serving most of southeast Louisiana reported 75 to 100 percent of utility customers were without power, in areas ranging from Lafourche and Terrebonne Parishes northwest through the Baton Rouge area to southwest Mississippi and central Louisiana. Considerable damage occurred to many houses and structures as large tree limbs and trees were toppled by the hurricane force winds. Preliminary estimates from the American Red Cross indicated that around 13,000 single family dwellings were damaged by the hurricane in southeast Louisiana, and several thousand more apartments and mobile homes. Early estimates from Louisiana Economic Development indicated that Gustav caused at least $4.5 billion in property damage in Louisiana, including insured and uninsured losses.

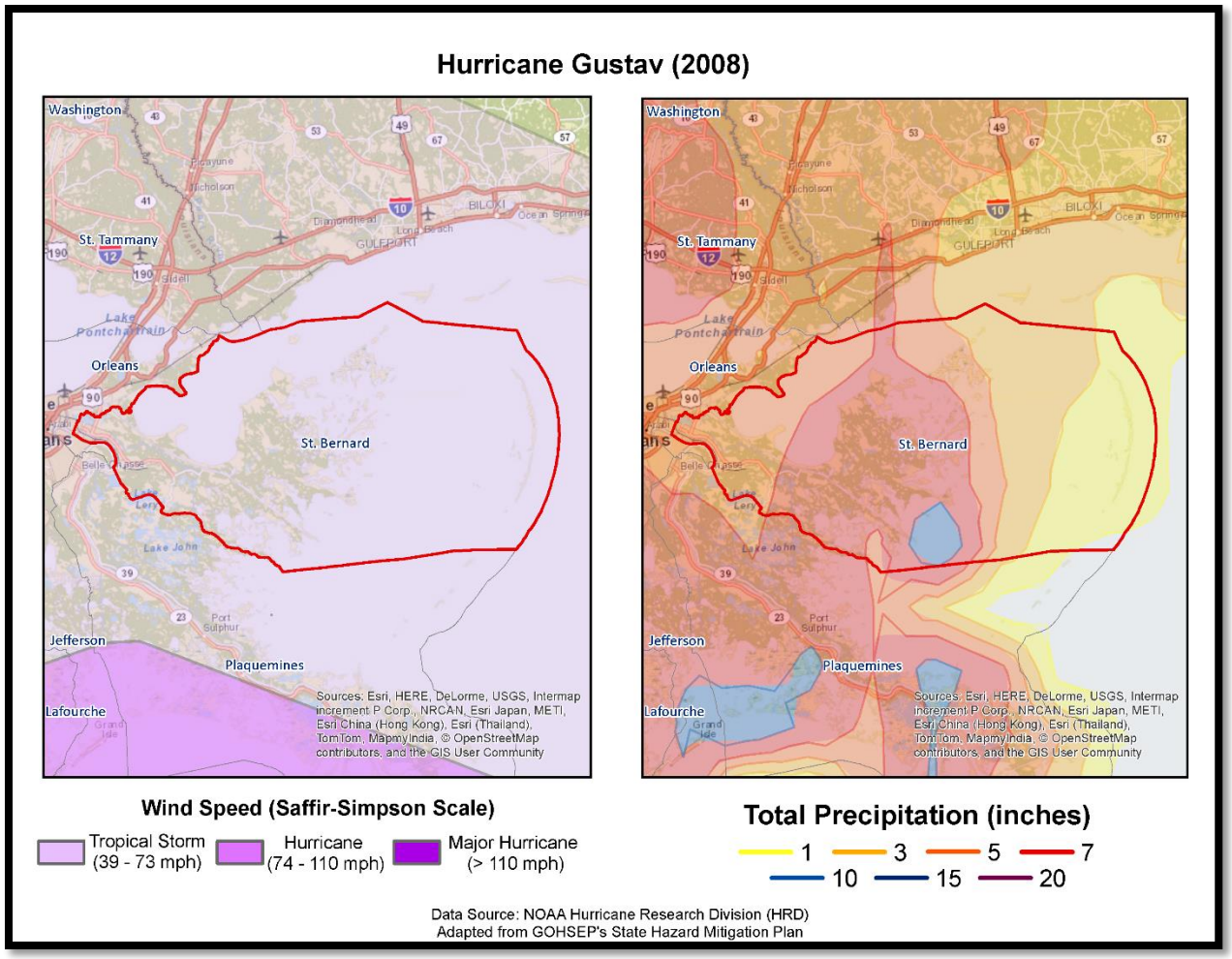

Figure 2-25: Wind Speed and Precipitation Totals in St. Bernard Parish for Hurricane Gustav

A mandatory evacuation was ordered in St. Bernard Parish and most of the residents, except for 500 to 1,000 people, evacuated the parish. The Sheriff's Office enforced a 24-hour curfew and lock-down in the parish. All drainage pumps were in operation and no water collected inside the hurricane protection system. At Shell Beach and Yscloskey, water flooded roadways. During the storm St. Bernard Parish experienced sustained winds of up to 70 mph. At least 4,000 homes and nearly all of the public schools in the parish experienced power outages during the storm.

Hurricane Ike (2008)

Hurricane Ike caused wind damage, storm surge flooding, and tornadoes across southwest Louisiana. Ike made landfall near Galveston, TX early in the morning on September 13th as a strong Category 2 hurricane. Sustained hurricane force winds were confined to extreme western Cameron Parish. The highest recorded winds in southwest Louisiana were at Lake Charles Regional Airport, with sustained winds of 46 kts (53 mph) and gusts of 67 kts (77 mph). The lowest pressure reading of 994.6 mb occurred at Southland Field near Sulphur, LA. Several tornadoes were reported across southwest Louisiana. The most significant tornado struck near Mamou, where one home lost its roof, and another ten to fifteen homes were damaged. Storm surge was a significant event during Hurricane Ike. Water levels ranged from fourteen feet in western Cameron Parish to eight feet in St. Mary Parish. This resulted in widespread flooding of the same areas that flooded during Hurricane Rita in 2005. Most of Cameron Parish was under water - over 3,000 homes were flooded. Flooding extended north into Calcasieu Parish, where another 1,000 homes flooded in Lake Charles, Westlake, and Sulphur. In Vermilion Parish, at least 1,000 homes flooded in Pecan Island, Forked Island, Intracoastal City, and Henry. Flooding also extended east into Iberia Parish, where another 1,000 homes flooded south of Highway 14 and Highway 90. In St. Mary Parish, some of the worst flooding occurred in Franklin, where a man-made levee failed and resulted in the flooding of over 450 homes. Maximum storm total rainfall ranged from six to eight inches across Cameron, Calcasieu, and Beauregard Parishes. No fatalities were reported in southwest Louisiana. Total property damages, however, were high. Losses are estimated to be almost $420 million dollars across southwest Louisiana. Agricultural losses were over 225 million dollars.

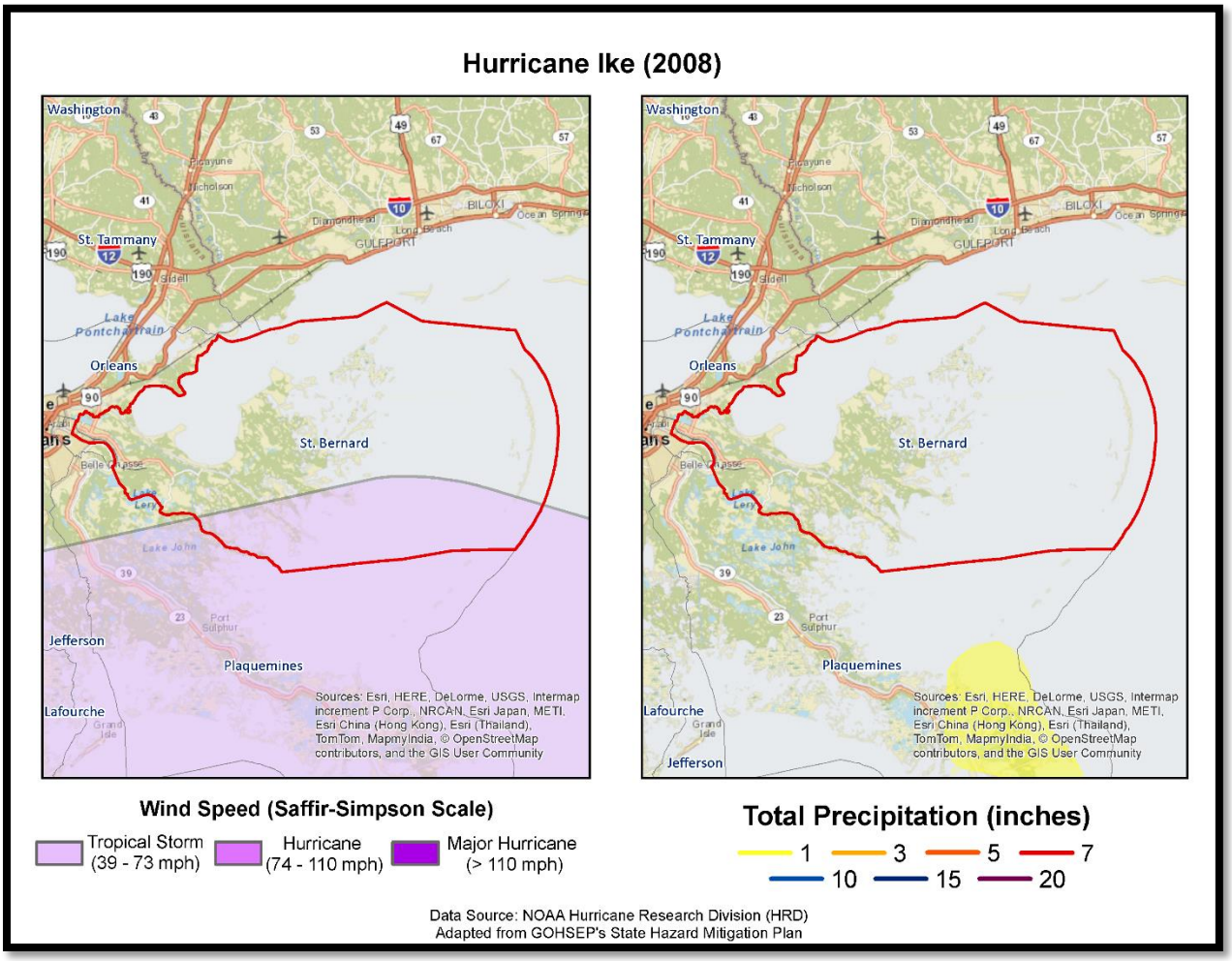

Figure 2-26: Wind Speed and Precipitation Totals in St. Bernard Parish for Hurricane Ike

In St. Bernard Parish, a voluntary evacuation was ordered for the lower St. Bernard Parish outside of the hurricane protection levee system. The hurricane caused a storm surge of four to six feet in the parish. Widespread flooding occurred at Shell Beach, Yscloskey, Alluvial City, Delacroix, and Hopedale, where water levels reached heights of two to six feet. The West St. Bernard Highway was closed from the lower end of the highway to the Yscolskey Bridge.

Tropical Storm Lee (2011)

Tropical Storm Lee initially developed as Tropical Depression Thirteen in the middle of the Gulf of Mexico on Thursday evening September 1, 2011. The depression moved slowly north and gradually strengthened, eventually reaching tropical storm strength just south of the Louisiana coast on Friday afternoon September 2, 2011. Tropical Storm Lee made only slow and haltingly northward progress over the next 24 hours, eventually moving onshore the Louisiana coast Saturday night, September 3, 2011, with a maximum sustained wind estimated around 60 mph. Lee moved slowly inland to the north of Baton Rouge late Sunday September 4, 2011, and eventually weakened to a tropical depression Sunday evening.

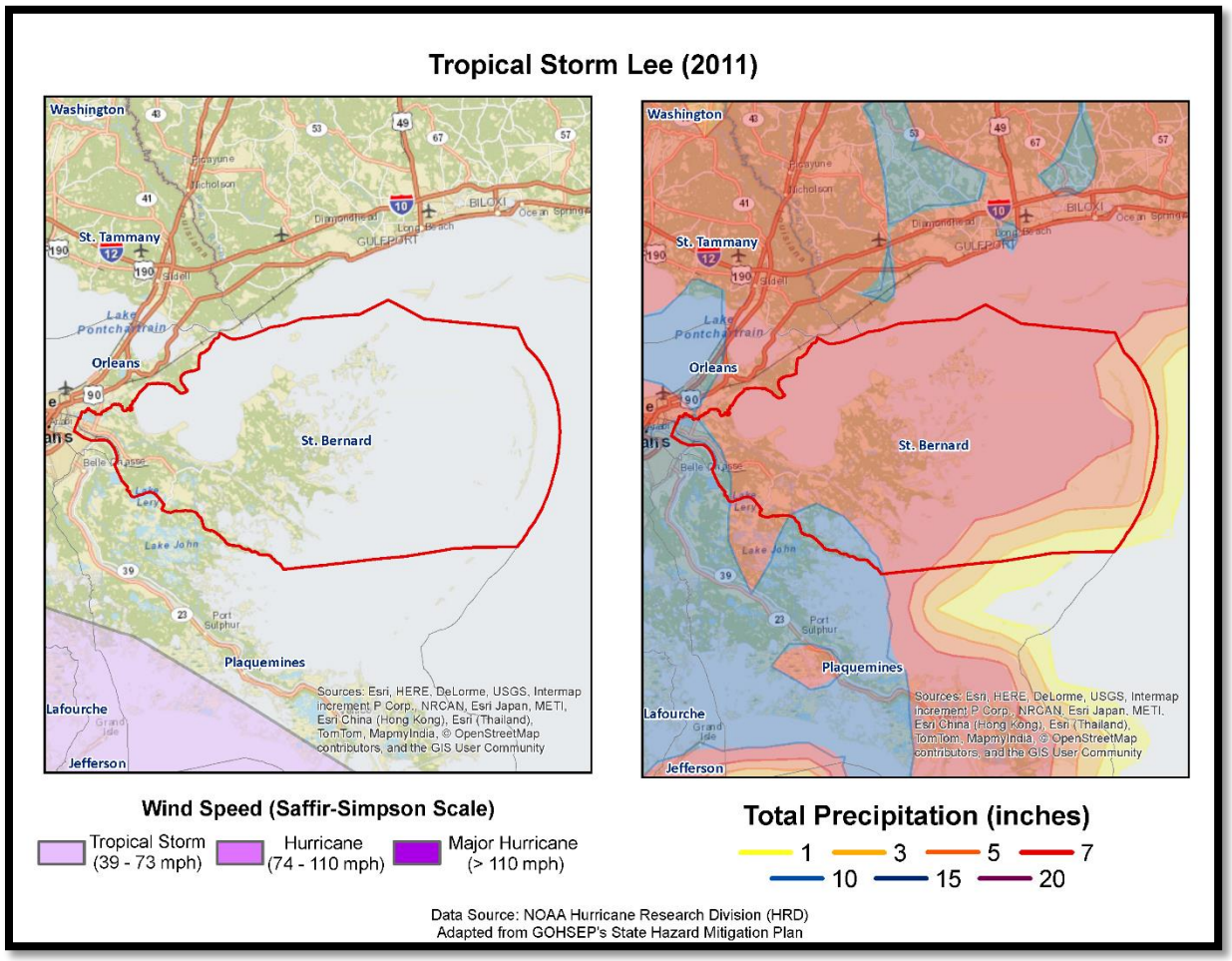

Figure 2-27: Wind Speed and Precipitation Totals in St. Bernard Parish for Tropical Storm Lee

Tropical Depression Lee then steadily moved northeast throughout Monday, September 5, 2011, taking on extra-tropical characteristics over the next 24 hours as it interacted with an upper level disturbance moving through the region. The maximum winds observed in Louisiana was a southerly wind of forty knots (46 mph) sustained, fifty knots (58 mph) gust at New Orleans Lakefront Airport on September 4, 2012 at 05:28 CST. The lowest minimum central pressure was 993.2 mb at Baton Rouge Ryan Field at September 4, 2012 at 09:59 CST. As Tropical Depression Lee was moving northeast and taking on mid-latitude characteristics, strong northerly winds were experienced across the region, occasionally gusting to higher levels than experienced when Lee was characterized as a tropical storm. No fatalities or injuries were associated with any Tropical Storm Lee hazards.

The main impacts associated with Tropical Storm Lee were associated with storm surge and rainfall. Both of these impacts were related to its slow forward speed as it crossed the region, which allowed the circulation to linger over the area for several days. Storm surge associated with Lee caused storm tides three to five feet above normal, causing lowland flooding. Additional detailed information about Tropical Storm Lee's storm surge is contained in the separate storm surge report. Four day total rainfall ranged between seven and fifteen inches across the area. A maximum of 15.48 inches was recorded near Holden in Livingston Parish. Due to dry antecedent conditions, river flooding was minimal for the amount of rainfall that occurred. Wind impacts were generally minimal due to only tropical storm strength winds

being recorded, resulting in tree limbs being blown down, and weak trees toppling, causing power outages.

Effects from the landfall of Tropical Storm Lee were felt in different areas throughout St. Bernard Parish. According to the National Weather Service, storm surge was approximately six feet along the IHNC Surge Barrier East near the Orleans/St. Bernard Parish border. Most of the damage from Tropical Storm Lee in St. Bernard Parish was the result of storm surge.

Hurricane Isaac (2012)

Isaac entered the Gulf of Mexico as a tropical storm on August 26, 2012, moving northwest after crossing Haiti, Cuba, and the Florida Straits. Isaac strengthened into a hurricane on the morning of the 28th when it was 75 miles south-southeast of the mouth of the Mississippi River. Isaac made landfall in Plaquemines Parish as a Category 1 Hurricane near Southwest Pass of the Mississippi River on the evening of the 28th. A second landfall occurred near Port Fourchon the following morning. The storm weakened to a tropical storm on the afternoon of the 29th about 50 miles west southwest of New Orleans, and weakened further to a tropical depression on the afternoon of the 30th near Monroe, Louisiana.

The highest wind gust recorded on land in Louisiana was 86 mph (75 knots), measured on the evening of August 28 by a Texas Tech University portable weather station located near Buras. The maximum sustained winds in Louisiana were 75 mph (65 knots), recorded at the same portable weather station near Buras on the evening of August 28. There were several marine observations near the coast that had slightly higher wind readings, but their observation heights were generally 80 feet or higher.

Due to Isaac's very large size and slow forward speed, tropical storm force winds lasted in excess of 48 hours in many areas of coastal southeast Louisiana. Occasional hurricane gusts of 70 to 85 mph were recorded across southeast Louisiana, especially south of Lake Pontchartrain, during the night of the Aug 28th and early on the 29th. Interior areas of southeast Louisiana such as around Baton Rouge and northward experienced tropical storm force winds. Widespread power outages occurred across the area. Local utility companies reported over 700,000 customers were without power at the peak of the storm in southeast Louisiana. Generally, most of the wind damage was limited to downed trees and power lines, and roof damage caused by wind and falling trees and tree limbs.

Significant impacts also occurred around Lakes Pontchartrain and Maurepas, with a storm tide of five to nine feet. Five to ten thousand homes were flooded in low lying areas of that border these lakes of the following parishes: St. Tammany, Tangipahoa, Livingston, Ascension, St James and St John the Baptist. LaPlace in St. John the Baptist was especially hard hit with over 5,000 homes flooded by storm surge. An additional storm surge fatality occurred in St. Tammany Parish on the morning of the 30th when a 75 year old man drove his car into a storm surge filled ditch. Storm surge flooding also affected areas south and southwest of New Orleans with a storm tide of four to seven feet. Roadways and low lying property were flooded. Local levees around Lafitte and Myrtle Grove were overtopped and/or breached, resulting flooding of numerous houses and property in this area.

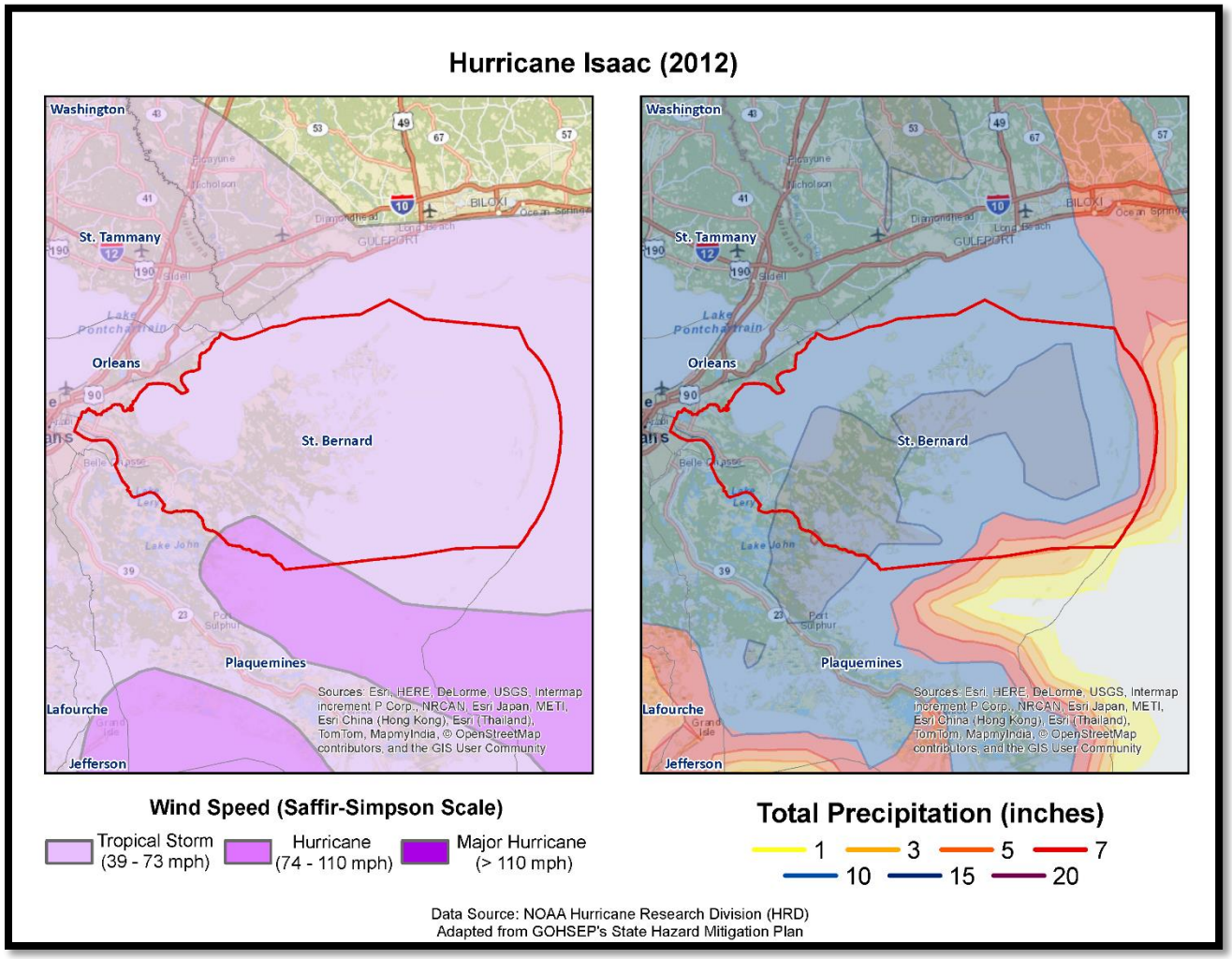

Figure 2-28: Wind Speed and Precipitation Totals in St. Bernard Parish for Hurricane Isaac

Many areas of southeast Louisiana received eight to twelve inches of rain with a few locations having fifteen inches of rain or more. Maximum storm total rainfall was 20.66 inches at the New Orleans Carrollton gauge on the Mississippi River. Rainfall run-off produced moderate to major flooding on the Tangipahoa, Tchefuncte, Tickfaw, Amite, Pearl, Bogue Chitto and Bogue Falaya Rivers. Storm surge and high tides restricted outflow of the rivers near the coast and lakes exacerbating flooding in those areas.

Overall impacts of Isaac resulted in at least $600 million in damages in southeast Louisiana, three direct fatalities, and two indirect fatalities. Storm surge flooding accounted for the bulk of damage, estimated around $500 million, and the three direct storm surge fatalities in Louisiana. Winds accounted for a much lesser amount of slightly more than a $100 million.

Figure 2-29 displays the wind zones that affect St. Bernard Parish in relation to critical facilities throughout the parish.

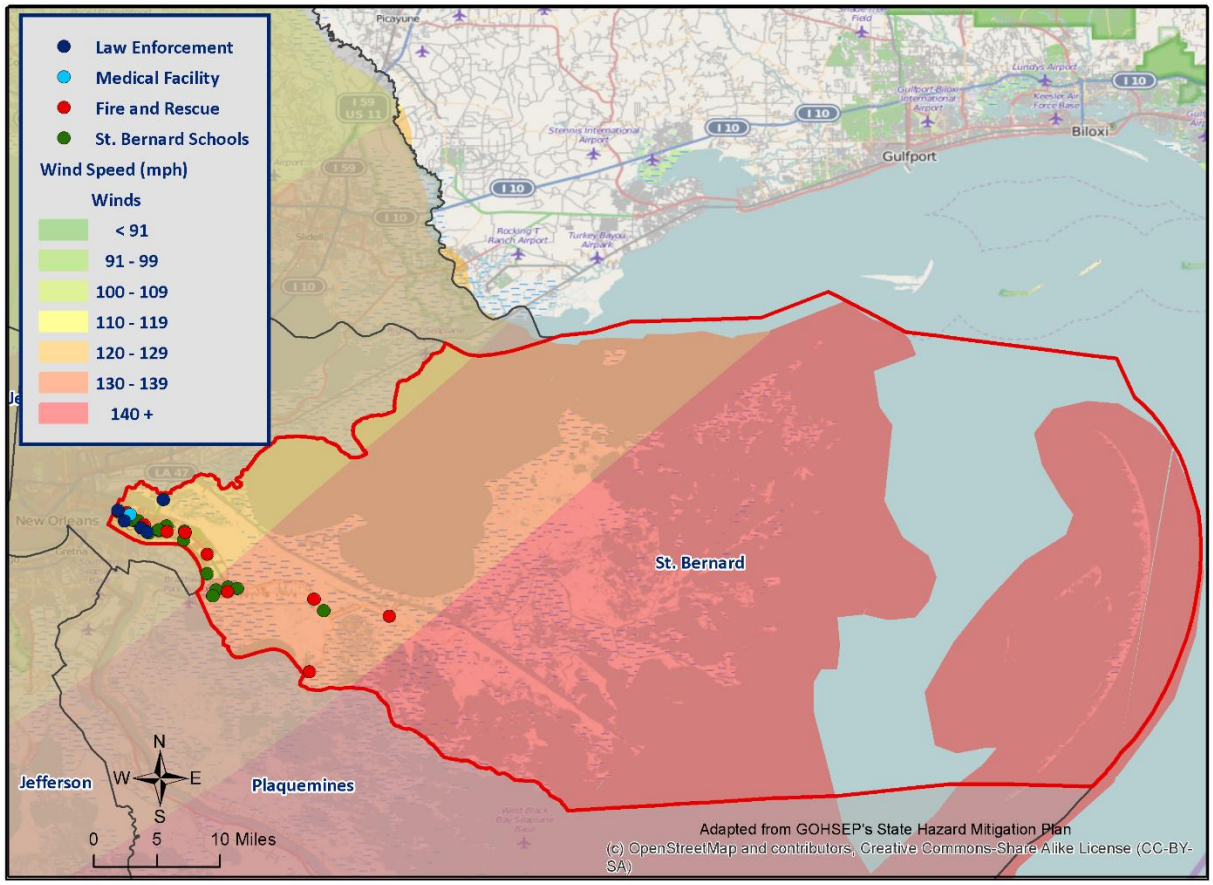

Figure 2-29: Winds Zones for St. Bernard Parish in Relation to Critical Facilities

Frequency / Probability

Tropical cyclones are large natural hazard events that occur regularly within St. Bernard Parish. The annual chance of occurrence for a tropical cyclone occurrence is estimated at 68% for St. Bernard Parish and its municipalities.

The tropical cyclone season for the Atlantic Basin is from June 1 through November 30, 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, St. Bernard 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. Based on historical record, the probability of future occurrence of tropical cyclones in St. Bernard Parish is approximately one event every one to two years.

Estimated Potential Losses

Using the Hazus-MH 100-year hurricane model, the 100-year hurricane scenario was analyzed to determine losses from this worst-case scenario. *Table 2-41* shows the total economic losses that would result from this occurrence.

Table 2-41: Total Estimated Losses for a 100-Year Hurricane event (Source: Hazus)

Jurisdiction	Estimated total Losses from 100-Year Hurricane Event
St. Bernard Parish	$200,652,248

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

Table 2-42: Estimated Losses in St. Bernard Parish for a 100-Year Hurricane Event (Source: Hazus MH)

St. Bernard Parish	Estimated Total Losses from 100-Year Hurricane Event
Agricultural	$644,910
Commercial	$3,818,870
Government	$687,477
Industrial	$5,641,699
Religious / Non-Profit	$2,500,099
Residential	$185,405,020
Schools	$1,954,172
Total	$200,652,248

Threat to People

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

Table 2-43: Number of People Susceptible to a 100-Year Hurricane Event in St. Bernard Parish (Source: Hazus MH)

Number of People Exposed to Hurricane Hazards			
Location	**# in Community**	**# in Hazard Area**	**% in Hazard Area**
St. Bernard Parish	**35,897**	**35,897**	**100%**

The HAZUS-MH Hurricane Model was also extrapolated to provide an overview of vulnerable populations throughout the parish in the table on the following page.

Table 2-44: Vulnerable Populations in St. Bernard Parish for a 100 -Year Hurricane Event (Source: Hazus MH)

St. Bernard Parish		
Category	**Total Numbers**	**Percentage of People in Hazard Area**
Number in Hazard Area	35,897	100.0%
Persons Under 5 years	2,908	8.1%
Persons Under 18 years	9,549	26.6%
Persons 65 Years and Over	3,338	9.3%
White	26,205	73.0%
Minority	9,692	27.0%

Vulnerability

See Appendix C for parish buildings that are susceptible to hurricanes.

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3 Capability Assessment

This section summarizes the results of St. Bernard 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, St. Bernard 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

St. Bernard 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 St. Bernard 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 St. Bernard 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.		
	St. Bernard Parish	Comments
Plans	**Yes / No**	
Comprehensive / Master Plan	Y	n/a
Capital Improvements Plan	N	n/a
Economic Development Plan	Y	n/a
Local Emergency Operations Plan	Y	2015
Continuity of Operations Plan	Y	2015
Transportation Plan	Y	2015
Stormwater Management Plan	In-Progress	Estimated completion in 9 months
Community Wildfire Protection Plan	N/A	n/a
Other plans (redevelopment, recovery, coastal zone management)	ALL THREE	n/a
Building Code, Permitting and Inspections	**Yes / No**	
Building Code	Y	2012
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	n/a
Fire Department ISO/PIAL rating	Y	n/a
Site plan review requirements	Y	n/a
Land Use Planning and Ordinances	**Yes / No**	
Zoning Ordinance	Y	n/a
Subdivision Ordinance	Y	n/a
Floodplain Ordinance	Y	n/a
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	N	n/a
Flood Insurance Rate Maps	Y	n/a
Acquisition of land for open space and public recreation uses	Y	n/a
Other	n/a	n/a

St. Bernard 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

As of the 2015 update, St. Bernard Parish ensures that all building codes adopted are enforced and in compliance relating to the construction of any within the boundaries of the parish. St. Bernard Parish follows the Louisiana Uniform Construction Code (LCC), and will require all building, mechanical, gas, electrical, and plumbing work to comply. Additional referenced codes and ordinances for St. Bernard Parish include the following: St. Bernard Parish Floodplain Ordinance, St. Bernard Parish Building Code Ordinance, and the St. Bernard Parish Zoning Ordinance (guides land use in the parish). Some examples of leveraging these capabilities within the parish are seen in *Table 3-1*.

While local capabilities for mitigation can vary from community to community, St. Bernard 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, St. Bernard 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 St. Bernard 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.		
	St. Bernard Parish	Comments
Administration	Yes / No	
Planning Commission	Y	n/a
Mitigation Planning Committee	Y	n/a
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	Y	n/a
Mutual Aid Agreements	Y	n/a
Staff	Yes / No;	
Chief Building Official	4/FT	n/a
Floodplain Administrator	4/FT	n/a
Emergency Manager	4/FT	n/a
Community Planner	4/FT	n/a
Civil Engineer	4/FT	n/a
GIS Coordinator	4/FT	n/a
Grant Writer	1	CONTRACTOR
Other		n/a
Technical	Yes / No	
Warning Systems / Service (Reverse 911, outdoor warning signals)	Y	n/a
Hazard Data & Information	Y	n/a
Grant Writing	Y	n/a
Hazus Analysis	Y	n/a
Other	n/a	n/a

Financial capabilities are the resources that St. Bernard 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 St. Bernard 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.		
	St. Bernard Parish	Comments
Funding Resource	Yes / No	
Capital Improvements project funding	Y	n/a
Authority to levy taxes for specific purposes	N	n/a
Fees for water, sewer, gas, or electric services	Y	n/a
Impact fees for new development	Y	n/a
Stormwater Utility Fee	Y	n/a
Community Development Block Grant (CDBG)	Y	n/a
Other Funding Programs	N	n/a

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.

St. Bernard 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.		
	St. Bernard 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.	Y	LEPC
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Y	LEPC
Natural Disaster or safety related school program	N	n/a
Storm Ready certification	Y	2015
Firewise Communities certification	N/A	n/a
Public/Private partnership initiatives addressing disaster-related issues	Y	n/a
Other	n/a	n/a

The communities within St. Bernard Parish rely on St. Bernard OHSEP and/or St. Bernard 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, St. Bernard remains committed to expanding and improving on the existing capabilities within the parish. Communities, along with St. Bernard 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 St. Bernard Parish.

Flood Insurance and Community Rating System

St. Bernard Parish is not a current participant in the Community Rating System (CRS). However, becoming a participant in the CRS was recognized as a high priority by the Hazard Mitigation Steering Committee. The parish is currently working towards obtaining CRS certification. 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.

* In determining CRS Premium Discounts, all AR and A99 Zones are treated as non-SFHAs.

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

During the last update, thirty-eight Louisiana communities participated in the CRS. As of the 2015 update, Jefferson, East Baton Rouge, and Terrebonne Parishes all lead the state with best classifications, class 6.

As of May 2012, 310 communities in the State of Louisiana participate in the Federal Emergency Management Agency's National Flood Insurance Program (NFIP). Of these communities, 41 (or 13%) participate in the Community Rating System (CRS). 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 will result 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

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

included input from a broad group of contributors to evaluate the CRS and refine the program to meet its stated goals. The upcoming changes will 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 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.

The 2013 CRS Coordinator's Manual changes will impact each CRS community differently. Some communities will see an increase in the points they receive since points for certain activities have increased (e.g., Activity 420 Open Space Preservation). Other communities will 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 will have to identify new CRS credits in order to remain in the CRS.

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 2013 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 2013 manual will impact their community and when.

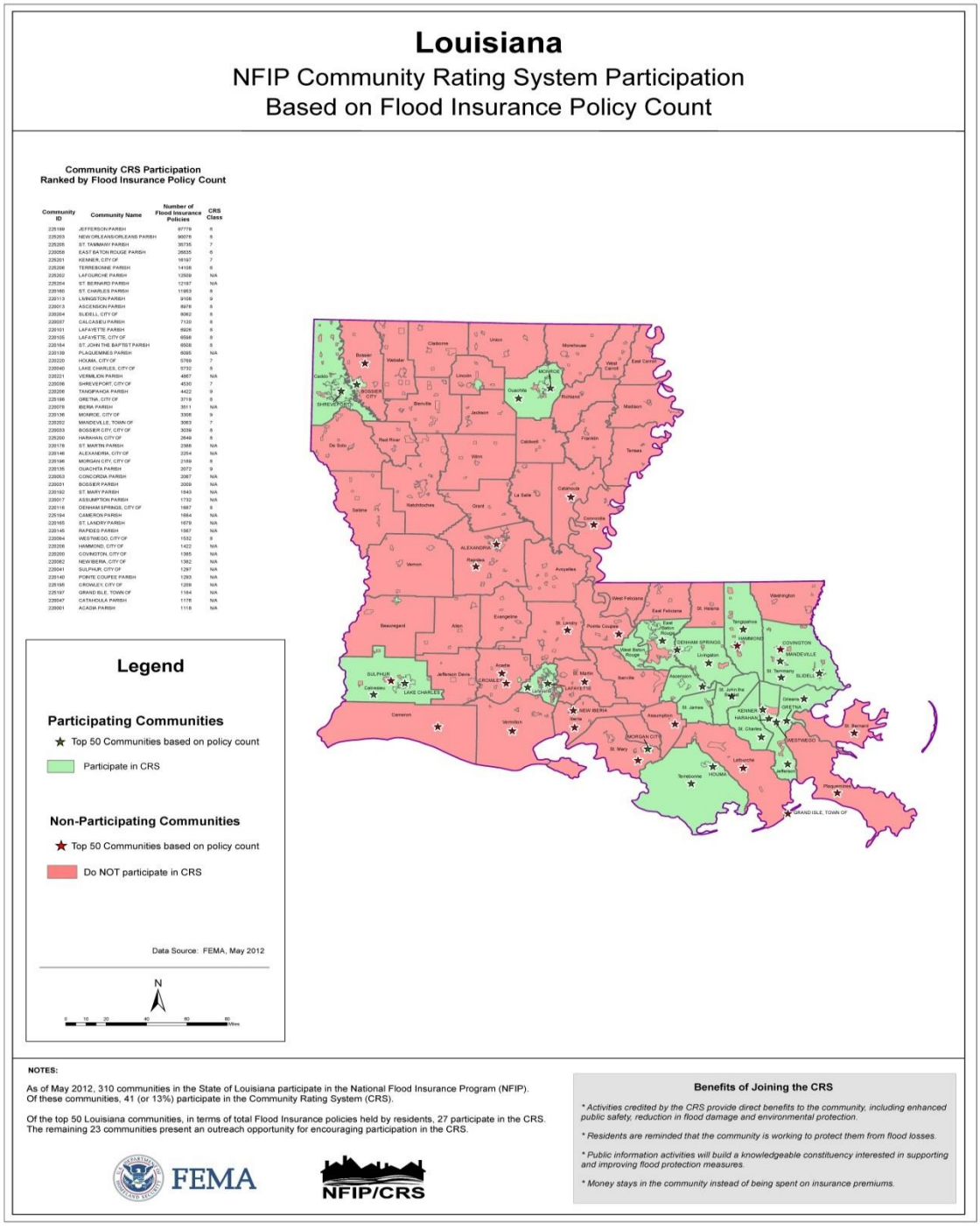

Figure 3-2: Louisiana CRS Participation
(Source: FEMA[2])

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."

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

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 www.fema.gov/nfip/crs.shtm

NFIP Worksheets

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

4 Mitigation Strategy

Introduction

St. Bernard 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.

St. Bernard 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 2015 HMP update are a product of analysis and review of the St. Bernard Parish Hazard Mitigation Plan Steering Committee under the coordination of the St. Bernard Parish Office of Homeland Security and Emergency Preparedness. The committee was presented a list of projects and actions, new and from the 2011 plan, for review from July 2015 – August 2015.

An online public opinion survey was conducted of St. Bernard Parish residents in July and August 2015. The survey was designed to capture public perceptions and opinions regarding natural hazards in St. Bernard 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.

During the public meeting, the committee provided a status of the projects from 2011 and the proposed actions for the 2015 update. Committee members then agreed on the submission of each project based on feasibility for funding, ease of completion and other community specific factors. The actions were later prioritized.

This activity confirms that the goals and action items developed by the St. Bernard 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-P757DBFY/ .

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 St. Bernard 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, St. Bernard 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 St. Bernard 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. Identify and pursue preventative measures that will reduce future damages from hazards

2. Enhance public awareness and understanding of disaster preparedness

3. Reduce repetitive flood losses in the parish

4. Facilitate sound development and rebuilding in the parish so as to reduce or eliminate the potential impacts of hazards.

The Mitigation Action Plan focuses on actions to be taken by St. Bernard 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.

2015 Mitigation Actions and Update on Previous Plan Actions

The St. Bernard Parish Hazard Mitigation Plan Steering Committee identified actions that would reduce and/or prevent future damage within St. Bernard 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.

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.

St. Bernard Parish Mitigation Actions

Table 4-1: St. Bernard Parish Unincorporated

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
SB1: Harden/Retrofit New and Existing Public Buildings	Emergency generators; back-up communications systems; storm shutters; roof tie-downs and additional storm protection features.	Parish Budget, Grant funds (HMGP, PDM, FMA)	Jun-17	St. Bernard Parish Public Works	Thunderstorms - High Wind and Hail, Tropical Cyclones	1, 4	In-Progress/50% complete
SB2: Harden/Retrofit New and Existing Critical Infrastructure	Emergency generators; back-up communications systems; storm shutters; roof tie downs and additional storm protection features.	Parish Budget, Grant funds (HMGP, PDM, FMA)	Jun-17	St. Bernard Parish Public Works, OHSEP	Thunderstorms - High Wind and Hail, Tropical Cyclones	1, 4	In-Progress/50% complete

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
SB3: Flood Proof Existing and New Public Buildings	Create a more disaster resistant structure, which will prevent interruption of services in times of emergencies. Reduce the losses due to flooding.	Parish Budget, Grant funds (HMGP, PDM, FMA)	As per available funding	St. Bernard Parish Public Works	Flooding, Tropical Cyclones	1, 3, 4	New
SB4: Flood Proof Existing and New Critical Infrastructure	Provide berms/floodwalls to protect existing and new critical infrastructure and to create a more disaster resistant structure, which will prevent interruption of services in times of emergencies. Reduce the losses due to flooding.	Parish Budget, Grant funds (HMGP, PDM, FMA)	As per available funding	St. Bernard Parish Public Works	Flooding, Tropical Cyclones	1, 3, 4	New
SB5: Drainage Upgrade Projects	Widen the canals; stabilize the canal banks to reduce the street flooding and the number of flooded structures by increasing the volume of water pumped out by the drainage pumps. Upgrade the drainage pump stations:	Parish Budget, Grant funds (HMGP, PDM, FMA)	Jun-17	St. Bernard Parish Public Works	Flooding, Tropical Cyclones	1, 3, 4	In-Progress/30% completed

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
	elevate the pump station building, generator, control panel, transformers etc.						
SB6: Saltwater Intrusion Prevention	Install screw gates for crossings under LA 624 to prevent salt water intrusion into Hopedale Basin	Grant funds (HMGP, PDM)	As per available funding	St. Bernard Parish Public Works	Land subsidence/Saltwater Intrusion	1, 4	New
SB7: Participate and Pursue Projects to Result in Increased CRS Scores and Protect Homeowners	Promote the purchase of flood insurance. Conduct fairs and open houses to advertise the NFIP. Maintain a library of flood insurance maps for public review. Benefits: Enables homeowners to financially recover from the devastating effects of flooding as rapidly as possible. Improves CRS score and lower the flood insurance	Parish funding	On-Going	St. Bernard Parish Director of Community Development	Flooding, Tropical Cyclones	1, 2	On-Going

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
	premiums. Implement programs for participation in the CRS program to decrease the flood insurance premiums in the parish.						
SB8: Pursue Elevation Projects for Repetitive Loss Structures	Benefits: Losses due to flooding is reduced considerably as the repetitive loss structures account for majority of the NFIP payments.	Grant funds (HMGP, PDM, FMA, SRL)	Dec-16	St. Bernard Parish Director of Community Development	Flooding, Tropical Cyclones	1, 3	In-Progress/23 of 40 structures completed
SB9: Pursue Acquisition Projects for Repetitive Loss Structures	Benefits: Losses due to flooding is reduced considerably as the repetitive loss structures account for majority of the NFIP payments.	Grant funds (HMGP, PDM, FMA, SRL)	Dec-16	St. Bernard Parish Director of Community Development	Flooding, Tropical Cyclones	1, 3	In-Progress/25% completed
SB10: Amend the Floodplain Ordinance and Adopt Updated Flood Insurance Rating Maps for New Structures Upon Their Issuance by FEMA	Benefits: Ensure continued compliance for NFIP participation. Reduce flood losses to new structures.	Parish funding	Jun-16	St. Bernard Parish Director of Community Development	Flooding, Tropical Cyclones	1, 3	On-Going

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
SB11: Hazard Mitigation Outreach and Education	Conduct public education and outreach programs. Distribute flyers and brochures regarding hazards, special hazard areas, and potential mitigation measures using public service announcements, local newspaper, utility bill inserts, phone books, and parish website. Benefits: An informed public is better able to respond and protect themselves in times of hazards.	Parish funding	On-Going	St. Bernard Parish OHSEP Director	Flooding, Land Subsidence/Saltwater Intrusion, Sinkholes, Thunderstorms - High Wind, Hail, and Lightning, Tropical Cyclones	1, 2	New
SB12: Construct Safe Rooms in Critical Facilities	Benefit: Protect from loss of life and injury due high wind events	Parish Budget, School Board Budget, Grant funds (HMGP, PDM)	As per available funding	St. Bernard Parish OHSEP Director, Public Works Director, School Board Superintendent	Thunderstorms - High Wind, Tornado, Tropical Cyclones	1, 4	New
SB13: Lightning Protection Projects	Installation of lightning rods and surge protectors for governmental buildings and critical facilities	Parish funding	On-Going	St. Bernard Parish OHSEP Director	Thunderstorms - Lightning	1,4	New

St. Bernard Parish - Unincorporated							
Jurisdiction-Specific Action	**Description**	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
SB14: Communication Systems Upgrade	Upgrade and install as necessary updated warning communications systems such as reverse 911	Parish funding	As per available funding	St. Bernard Parish OHSEP Director	Tornado, Sinkhole	1, 4	New

St. Bernard Parish Mitigation Action Update

Table 4-2: St. Bernard Parish Unincorporated - Completed Actions

St. Bernard Parish - Unincorporated						
Jurisdiction-Specific Action	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
Upgrade the culverts: replace with larger pipes and box culverts; provide floodgates. Benefits: Reduce the street flooding and the number of flooded structures by increasing the volume of water pumped out by the drainage pumps.	Parish Budget, Grant funds (HMGP, PDM, FMA)	On-Going	St. Bernard Parish Public Works	Flooding, Tropical Cyclones	1, 3, 4	Completed
Provide safe rooms in schools and public buildings. Benefit: Protect from loss of life and injury due high wind events	Parish Budget, School Board Budget, Grant funds (HMGP, PDM)	Completed	OHSEP Director, Public Works Director, School Board Superintendent	Thunderstorms, Tropical Cyclones	1, 4	Completed
Amend building code regulations. Adopt the updated Louisiana Uniform Construction Code as per State Law. Benefits: Reduce the losses to new structures from natural hazards.	Parish funding	On-Going	Director of Community Development	Flooding, Tropical Cyclones, Thunderstorms	1, 4	Completed
Amend the land use and zoning regulations. Benefits: Reduce the losses to new structures from natural hazards.	Parish funding	On-Going	Director of Community Development	Flooding, Tropical Cyclones, Sinkholes	1, 4	Completed
Harden/Retrofit new and existing Public Buildings	Parish Budget, Grant funds (HMGP, PDM, FMA)	Jun-17	St. Bernard Parish Public Works	Thunderstorms - High Wind and Hail, Tropical Cyclones	1, 4	In-Progress/50% complete
Harden/Retrofit new and existing critical infrastructure	Parish Budget, Grant	Jun-17	St. Bernard Parish Public Works, OHSEP	Thunderstorms - High Wind and	1, 4	In-Progress/50% complete

St. Bernard Parish - Unincorporated						
Jurisdiction-Specific Action	**Funding Source**	**Target Completion Date**	**Responsible Party, Agency, or Department**	**Hazard**	**Goal**	**Status**
	funds (HMGP, PDM, FMA)			Hail, Tropical Cyclones		
Drainage upgrade projects	Parish Budget, Grant funds (HMGP, PDM, FMA)	Jun-17	St. Bernard Parish Public Works	Flooding, Tropical Cyclones	1, 3, 4	In-Progress/30% completed

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 St. Bernard mitigation actions. 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.

St. Bernard 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 St. Bernard Parish Hazard Mitigation Plan Update

The St. Bernard Parish Hazard Mitigation Plan Update process began in June 2015 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
6/15/2015	Coordination Conference Call	Telephone	No	Discuss with Parish HM Coordinator and any Steering Committee members expectations and requirements of the project.
6/23/2015	Kick-Off Meeting	St. Bernard OHSEP, Chalmette, LA	No	Discuss with the plan Steering Committee expectations and requirements of the project. Assign plan worksheets to Parish.
8/13/2015	Risk Assessment overview	St. Bernard OHSEP, Chalmette, LA	No	Discuss and review the Risk Assessment with the Steering Committee. Discuss and review expectations for Public Meeting.
8/13/2015	Public Meeting	St. Bernard OHSEP, Chalmette, 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 St. Bernard 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-P757DBFY/
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	Month 7	Month 8
Plan Revision								
Data Collection								
Risk Assessment								
Public Input								
Mitigation Strategy and Actions								
Plan Review by GOHSEP and FEMA								
Plan Adoption								
Plan Approval								

Coordination

The St. Bernard Parish Office of Homeland Security and Emergency Preparedness (OHSEP) oversaw the coordination of the 2015 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 2015 Hazard Mitigation Plan Update Steering Committee consisted of representatives from the following parish, municipal or community stakeholders:

- St. Bernard Parish Government
- St. Bernard Office of Homeland Security and Emergency Preparedness
- St. Bernard Parish Public Works
- St. Bernard Parish Fire Department
- St. Bernard Parish Law Enforcement
- St. Bernard Parish Council
- Plaquemines Parish Government
- The City of New Orleans
- Industrial Partners

The St. Bernard Parish OHSEP staff attended the Kickoff meeting for Plaquemines Parish in an effort to coordinate mitigation efforts where possible as neighboring communities. The Parish of Plaquemines OHSEP staff was invited to participate in an effort to collaborate with neighboring communities as well as representatives from the City of New Orleans, and members of the industrial community. SDMI assisted St. Bernard with encouraging the collaboration with these neighboring communities via email by extending an invitation to the St. Bernard 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 2015 HMPU Steering Committee:

Name	Title and Organization	Responsibility
David Peralta	President St. Bernard Parish	Chairman, Public Participation
Mike Hunnicutt	St. Bernard Parish Hazard Mitigation Program Manager Department	Lead Person for HMP Development. Planning and Coordination of plan development, committee meetings and public meetings.
John Rahaim, Jr.	Deputy Director, St. Bernard Parish OHSEP	Review hazard profiles and risk assessment data, develop mitigation strategy.
Jason Stopa	Director, St. Bernard Parish Community Development	Review risk assessment data, provide permitting and development data, provide repetitive loss structure data, develop mitigation strategy.
Hillary Nunez	Director, St. Bernard Parish Public Works Department	Provide information on parish buildings, flooding issues, identify public works mitigation projects.
Thomas Stone	Chief, St. Bernard Parish Fire Department	Review hazard profiles and risk assessment data.
Jimmy Pohlmann	Sheriff, St. Bernard Parish Sheriff's Office	Review hazard profiles and risk assessment data.
Guy Laigast	Director, Plaquemines Parish OHSEP	Neighboring community.
Aaron Miller	Deputy Director, New Orleans OHSEP	Neighboring community.
Darryl Delatte	Region 1 GOHSEP Coordinator	GOHSEP
Jack Merrill	Valero	Stakeholder
Patrick Trahan	ExxonMobil	Stakeholder
Doris Vortier	School Board	Stakeholder
George Cavignac	Council Chair	Stakeholder
Chamber of Commerce	Chamber of Commerce	Stakeholder
Jaylynn Bergeron Turner	Assessor	Stakeholder
Nick Cali	LBBLD	Review hazard profiles and risk assessment data.

Chris Hiestand	ATMOS	Public Utility
Toni Green	ENTERGY	Public Utility
Jerry Graves Sr.	St. Bernard Port	Stakeholder
Paul Bartlett	Domino Sugar	Stakeholder
William McGoey	Legal	Review hazard profiles and risk assessment data.
Charlie Lindell	St. Bernard Parish Hospital	Stakeholder

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 St. Bernard 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.

St. Bernard Parish as well as its incorporated jurisdictions 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 Jurisdictions, 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 St. Bernard 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
- Parish Continuity of Operations Plan.

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 St. Bernard Parish.

Meeting #1: Hazard Mitigation Plan Update Kick-Off

Date: June 23, 2015

Location: Chalmette, 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.

Public Initiation: No

MEETING INVITEES:

Name	Title and Organization
David Peralta	President, St. Bernard Parish
Mike Hunnicutt	St. Bernard Parish Hazard Mitigation Program Manager
John Rahaim, Jr.	Deputy Director, St. Bernard Parish OHSEP
Jason Stopa	Director, St. Bernard Parish Community Development
Hillary Nunez	Director, St. Bernard Parish Public Works Department
Thomas Stone	Chief, St. Bernard Parish Fire Department
Jimmy Pohlmann	Sheriff, St. Bernard Parish Sheriff's Office
Guy Laigast	Director, Plaquemines Parish OHSEP
Aaron Miller	Deputy Director, New Orleans OHSEP
Darryl Delatte	Region 1 GOHSEP Coordinator
Jack Merrill	Valero
Patrick Trahan	ExxonMobil
Doris Vortier	School Board
George Cavignac	Council Chair
Chamber of Commerce	Chamber of Commerce
Jaylynn Bergeron Turner	Assessor
Nick Cali	LBBLD
Chris Hiestand	ATMOS
Toni Green	ENTERGY
Jerry Graves Sr.	St. Bernard Port
Paul Bartlett	Domino Sugar
William McGoey	Legal
Charlie Lindell	St. Bernard Parish Hospital

Meeting #3 Risk Assessment Overview

Date: August 13, 2015

Location: Chalmette, LA

Purpose: Members of the St. Bernard 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 and Organization
David Peralta	President, St. Bernard Parish
Mike Hunnicutt	St. Bernard Parish Hazard Mitigation Program Manager
John Rahaim, Jr.	Deputy Director, St. Bernard Parish OHSEP
Jason Stopa	Director, St. Bernard Parish Community Development
Hillary Nunez	Director, St. Bernard Parish Public Works Department
Thomas Stone	Chief, St. Bernard Parish Fire Department
Jimmy Pohlmann	Sheriff, St. Bernard Parish Sheriff's Office
Guy Laigast	Director, Plaquemines Parish OHSEP
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Nick Cali	LBBLD
Chris Hiestand	ATMOS
Toni Green	ENTERGY
Jerry Graves Sr.	St. Bernard Port
Paul Bartlett	Domino Sugar
William McGoey	Legal
Charlie Lindell	St. Bernard Parish Hospital

Meeting #4: Public Meeting

Date: August 13, 2015

Location: Chalmette, LA

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

Public Initiation: Yes

MEETING INVITEES:

Name	Title and Organization
David Peralta	President, St. Bernard Parish
Mike Hunnicutt	St. Bernard Parish Hazard Mitigation Program Manager
John Rahaim, Jr.	Deputy Director, St. Bernard Parish OHSEP
Jason Stopa	Director, St. Bernard Parish Community Development
Hillary Nunez	Director, St. Bernard Parish Public Works Department
Thomas Stone	Chief, St. Bernard Parish Fire Department
Jimmy Pohlmann	Sheriff, St. Bernard Parish Sheriff's Office
Guy Laigast	Director, Plaquemines Parish OHSEP
Aaron Miller	Deputy Director, New Orleans OHSEP
Darryl Delatte	Region 1 GOHSEP Coordinator
Jack Merrill	Valero
Patrick Trahan	ExxonMobil
Doris Vortier	School Board
George Cavignac	Council Chair
Chamber of Commerce	Chamber of Commerce
Jaylynn Bergeron Turner	Assessor
Nick Cali	LBBLD
Chris Hiestand	ATMOS
Toni Green	ENTERGY
Jerry Graves Sr.	St. Bernard Port
Paul Bartlett	Domino Sugar
William McGoey	Legal
Charlie Lindell	St. Bernard Parish Hospital

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 St. Bernard 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.

St. Bernard 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 St. Bernard Parish Director of Community Development 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 St. Bernard Parish Director of Community Development 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 Director of Community Development 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 indicate a substantial change in hazard profile and risk assessment in the parish.

Additionally, the public will be canvassed to solicit public input to continue St. Bernard 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.

2015 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. 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 St. Bernard Parish Hazard Mitigation Plan Steering Committee to determine additional implementation procedures when appropriate. St. Bernard Parish has the following mechanisms available to incorporate and implement recommended mitigation actions:

1) St. Bernard Parish Floodplain Ordinance

2) St. Bernard Parish Building Code Ordinance

3) St. Bernard Parish Zoning Ordinance

4) St. Bernard Parish Long Term Recovery Plan

5) St. Bernard Parish Master Drainage Plan

6) St. Bernard Parish Emergency Operations 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 St. Bernard 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 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 St. Bernard 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 Management 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. The following parish and local plans incorporate requirements of the Hazard Mitigation Plan Update as follows, for the St. Bernard Parish Unincorporated areas:

- Comprehensive Master Plan – Updated as annually, St. Bernard Parish Community Development is the responsible agency
- Economic Development Plan – Updated as annually, St. Bernard Parish Economic Development Commission is the responsible agency
- Local Emergency Operations Plan – Updated annually, St. Bernard Parish OHSEP is the responsible agency

- Continuity of Operations Plan – Updated annually, St. Bernard Parish OHSEP is the responsible agency
- Transportation Plan – Updated annually, St. Bernard Parish OHSEP is the responsible agency
- Storm Water Management Plan – *In process of being developed,* St. Bernard Parish Public Works is the responsible agency Redevelopment Plan
- Redevelopment Plan – Updated annually, St. Bernard Parish Community Development is the responsible agency
- Recovery Plan – Updated annually, St. Bernard Parish Recovery Department and St. Bernard Parish OHSEP are the responsible agencies
- Coastal Zone Management Plan – Updated annually, St. Bernard Parish Coastal Zone Manager (Community Development) is the responsible agency

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

St. Bernard Parish

St Bernard Unincorporated Essential Facilities									
Type	Name	Flood	Land Subsidence/Saltwater Intrusion	Sinkhole	Hail	Wind	Lightning	Tornadoes	Tropical Cyclones
Fire and Rescue	St Bernard Fire Department Station 1	X	X		X	X	X	X	X
	St Bernard Fire Department Station 2	X	X		X	X	X	X	X
	St Bernard Fire Department Station 3	X	X		X	X	X	X	X
	St Bernard Fire Department Station 5	X	X		X	X	X	X	X
	St Bernard Fire Department Station 6	X	X		X	X	X	X	X
	St Bernard Fire Department Station 7	X	X		X	X	X	X	X
	St Bernard Fire Department Station 8	X	X		X	X	X	X	X
	St Bernard Fire Department Station 10	X	X		X	X	X	X	X
	St Bernard Fire Department Station 11	X	X		X	X	X	X	X
	St Bernard Fire Department Station 12	X	X		X	X	X	X	X
Government	Office Of Motor Vehicles	X	X		X	X	X	X	X
	St Bernard Courthouse	X	X		X	X	X	X	X
	St Bernard Port, Harbor, and Terminal District	X	X		X	X	X	X	X
	St Bernard Parish Govt. Complex	X	X		X	X	X	X	X
	St. Bernard 34th Judicial Court	X	X		X	X	X	X	X
	St. Bernard Parish Animal Services	X	X		X	X	X	X	X
Law Enforcement	Arabi Sub Station	X	X		X	X	X	X	X
	Louisiana National Guard	X	X		X	X	X	X	X
	St Bernard Sheriff's Office	X	X		X	X	X	X	X
	St. Bernard Sheriff 911 Communication Center	X	X		X	X	X	X	X
	Parish Road Sub-Station	X	X		X	X	X	X	X

St Bernard Unincorporated Essential Facilities									
Type	Name	Flood	Land Subsidence/Saltwater Intrusion	Sinkhole	Hail	Wind	Lightning	Tornadoes	Tropical Cyclones
Corrections	St Bernard Prison	X	X		X	X	X	X	X
Public Health	St Bernard Parish Hospital	X	X		X	X	X	X	X
Schools	Arabi Elementary	X	X		X	X	X	X	X
	Andrew Jackson Middle	X	X		X	X	X	X	X
	C. F. Rowley Alternative School	X	X		X	X	X	X	X
	Chalmette Elementary	X	X		X	X	X	X	X
	Chalmette High	X	X		X	X	X	X	X
	J F Gauthier Elementary School	X	X		X	X	X	X	X
	Joseph Davies Elementary	X	X		X	X	X	X	X
	Lynn Oaks School	X	X		X	X	X	X	X
	Lacoste Elementary	X	X		X	X	X	X	X
	Nicholas P. Trist Middle School	X	X		X	X	X	X	X
	Our Lady of Prompt Succor	X	X		X	X	X	X	X
	Sebastian Roy School (vacant)	X	X		X	X	X	X	X
	St Bernard Middle	X	X		X	X	X	X	X
	W. Smith, Jr Elementary	X	X		X	X	X	X	X

Appendix D: Plan Adoption

St. Bernard Parish Council
8201 West Judge Perez Drive Chalmette, Louisiana, 70043
(504) 278-4228 Fax (504) 278-4209
www.sbpg.net

#13

EXTRACT OF THE OFFICIAL PROCEEDINGS OF THE COUNCIL OF THE PARISH OF ST. BERNARD, STATE OF LOUISIANA, TAKEN AT A REGULAR MEETING HELD IN THE COUNCIL CHAMBERS OF THE ST. BERNARD PARISH GOVERNMENT COMPLEX, 8201 WEST JUDGE PEREZ DRIVE, CHALMETTE, LOUISIANA ON NOVEMBER 4, 2015 AT SEVEN O'CLOCK P.M.

On motion of Mr. Lewis, seconded by Mr. Lauga, it was moved to **adopt** the following resolution:

RESOLUTION SBPC #1408-11-15

A RESOLUTION ADOPTING THE PARISH - WIDE HAZARD MITIGATION PLAN.

WHEREAS, the St. Bernard Parish Government has received grant funds from the Federal Emergency Management Agency, through the Governor's Office of Homeland Security and Emergency Preparedness, for the preparation of a hazard mitigation plan and;

WHEREAS our community has participated in the process to prepare a DMA compliant Hazard Mitigation Plan based on the FEMA guidance available in the How to Guides;

WHEREAS our community wishes to participate in the Hazard Mitigation Plan prepared by the St. Bernard Parish government under the oversight of a Steering Committee comprised of Parish- wide representatives;

WHEREAS, St. Bernard Parish has participated in the mitigation planning process;

WHEREAS appropriate opportunity for input by public and community officials has been provided through press releases, open meetings and availability of draft documents;

WHEREAS the Plan has been recommended for adoption by the Steering Committee;

WHEREAS adoption of the Plan is required prior to further consideration for FEMA funding under the following programs:

- Pre-Disaster Mitigation
- Hazard Mitigation Grant Program
- Flood Mitigation Assistance Program

St. Bernard Parish Council
8201 West Judge Perez Drive Chalmette, Louisiana, 70043
(504) 278-4228 Fax (504) 278-4209
www.sbpg.net

The above and foregoing having been submitted to a vote, the vote thereupon resulted as follows:

YEAS: Lauga, Lewis, Montelongo

NAYS: None

ABSENT: Gorbaty, McInnis, Cavignac

The Chairman, Mr. Hunnicutt, cast his vote as **YEA.**

And the motion was declared **adopted** on the 4th day of November, 2015.

CERTIFICATE

I HEREBY CERTIFY that the above and foregoing is a true and correct copy of a motion adopted at a Regular Meeting of the Council of the Parish of St. Bernard, held at Chalmette, Louisiana, on Wednesday, November 4, 2015.

Witness my hand and the seal of the Parish of St. Bernard on this 4th day of November, 2015.

Roxanne Adams
ROXANNE ADAMS
CLERK OF COUNCIL

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 Kickoff 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

Name	**Title and Organization**	**Responsibility**
David Peralta	President St. Bernard Parish	Chairman, Public Participation
Mike Hunnicutt	St. Bernard Parish Hazard Mitigation Program Manager	Lead Person for HMP Development. Planning and Coordination of plan development, committee meetings and public meetings.
John Rahaim, Jr.	Deputy Director, St. Bernard Parish OHSEP	Review hazard profiles and risk assessment data, develop mitigation strategy.
Jason Stopa	Director, St. Bernard Parish Community Development	Review risk assessment data, provide permitting and development data, provide repetitive loss structure data, develop mitigation strategy.
Hillary Nunez	Director, St. Bernard Parish Public Works Department	Provide information on parish buildings, flooding issues, identify public works mitigation projects.
Thomas Stone	Chief, St. Bernard Parish Fire Department	Review hazard profiles and risk assessment data.
Jimmy Pohlmann	Sheriff, St. Bernard Parish Sheriff's Office	Review hazard profiles and risk assessment data.

Guy Laigast	Director, Plaquemines Parish OHSEP	Neighboring community.
Aaron Miller	Deputy Director, New Orleans OHSEP	Neighboring community.
Darryl Delatte	Region 1 GOHSEP Coordinator	GOHSEP
Jack Merrill	Valero	Stakeholder
Patrick Trahan	ExxonMobil	Stakeholder
Doris Vortier	School Board	Stakeholder
George Cavignac	Council Chair	Stakeholder
Chamber of Commerce	Chamber of Commerce	Stakeholder
Jaylynn Bergeron Turner	Assessor	Stakeholder
Nick Cali	LBBLD	Review hazard profiles and risk assessment data.
Chris Hiestand	ATMOS	Public Utility
Toni Green	ENTERGY	Public Utility
Jerry Graves Sr.	St. Bernard Port	Stakeholder
Paul Bartlett	Domino Sugar	Stakeholder
William McGoey	Legal	Review hazard profiles and risk assessment data.
Charlie Lindell	St. Bernard Parish Hospital	Stakeholder

Capability Assessment

Planning and Regulatory		
Please indicate which of the following plans and regulatory capabilities your jurisdiction has in place.		
	St. Bernard Parish	Comments
Plans	**Yes / No**	
Comprehensive / Master Plan	Y	n/a
Capital Improvements Plan	N	n/a
Economic Development Plan	Y	n/a
Local Emergency Operations Plan	Y	2015
Continuity of Operations Plan	Y	2015
Transportation Plan	Y	2015
Stormwater Management Plan	In-Progress	Estimated completion in 9 months
Community Wildfire Protection Plan	N/A	n/a
Other plans (redevelopment, recovery, coastal zone management)	ALL THREE	n/a
Building Code, Permitting and Inspections	**Yes / No**	
Building Code	Y	2012
Building Code Effectiveness Grading Schedule (BCEGS) Score	N	n/a
Fire Department ISO/PIAL rating	Y	n/a
Site plan review requirements	Y	n/a
Land Use Planning and Ordinances	**Yes / No**	
Zoning Ordinance	Y	n/a
Subdivision Ordinance	Y	n/a
Floodplain Ordinance	Y	n/a
Natural Hazard Specific Ordinance (stormwater, steep slope, wildfire)	N	n/a
Flood Insurance Rate Maps	Y	n/a
Acquisition of land for open space and public recreation uses	Y	n/a
Other	n/a	n/a

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.		
	St. Bernard Parish	Comments
Administration	Yes / No	
Planning Commission	Y	n/a
Mitigation Planning Committee	Y	n/a
Maintenance programs to reduce risk (tree trimming, clearing drainage systems)	Y	n/a
Mutual Aid Agreements	Y	n/a
Staff	Yes / No;	
Chief Building Official	4/FT	n/a
Floodplain Administrator	4/FT	n/a
Emergency Manager	4/FT	n/a
Community Planner	4/FT	n/a
Civil Engineer	4/FT	n/a
GIS Coordinator	4/FT	n/a
Grant Writer	1	CONTRACTOR
Other		n/a
Technical	Yes / No	
Warning Systems / Service (Reverse 911, outdoor warning signals)	Y	n/a
Hazard Data & Information	Y	n/a
Grant Writing	Y	n/a
Hazus Analysis	Y	n/a
Other	n/a	n/a

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	St. Bernard Parish: Yes / No	Comments
Capital Improvements project funding	Y	n/a
Authority to levy taxes for specific purposes	N	n/a
Fees for water, sewer, gas, or electric services	Y	n/a
Impact fees for new development	Y	n/a
Stormwater Utility Fee	Y	n/a
Community Development Block Grant (CDBG)	Y	n/a
Other Funding Programs	N	n/a

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.

Program / Organization	St. Bernard Parish: Yes / No	Comments
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	LEPC
Ongoing public education or information program (responsible water use, fire safety, household preparedness, environmental education)	Y	LEPC
Natural Disaster or safety related school program	N	n/a
Storm Ready certification	Y	2015
Firewise Communities certification	N/A	n/a
Public/Private partnership initiatives addressing disaster-related issues	Y	n/a
Other	n/a	n/a

Building Inventory

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Administration	Aycock Barn Office Bldg, Covered Area and Storage Facility	409 Aycock St.,	Arabi	29° 57' 3.8268"	-90° 0' 20.6676"	$ 1,220,505.00	2010	Fire Resistive
Y	Fire	Fire Station #1	1500 Aycock St.	Arabi	29° 57' 36.756"	-90° 0' 4.0428"	$ 500,000.00	1991/2008	Metal Stud
Y	Fire	Fire Station #2	7639 W. Judge Perez Dr.	Arabi	29° 57' 28.426"	-89° 59' 23.8744"	$ 1,150,000.00	2010	Metal
Y	Housing & Redev.	Housing & Redev. (Formerly St. Louise Rectory)	6800 Patricia St.	Arabi	29° 58' 0.4102"	-89° 59' 57.7986"	$ 500,000.00	2010	wood
Y	Recreation	First Ward Old Jail - Museum	242 Hernandez st.	Arabi	29° 56' 56.6855"	-90° 0' 21.7109"	$ 400,000.00	1909/2012	Brick
	Recreation	Edward Kattengall Gymnasium	801 Community St.	Arabi	29° 57' 10.2964"	-90° 0' 5.791"	$ 650,000.00	1937	Wood
Y	Administration	Gov't Complex & Equipment	8201 W. Judge Perez Dr.	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 10,000,000.00	1977/2008	Fire Resistive
	Administration	Torres Park Boat House	8201 W Judge Perez Dr	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 75,000.00	2011	Wood
	Administration	Torres Park Gazebo 30'	8201 W. Judge Perez Drive	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 70,000.00	2011	Wood
	Administration	Torres Park Gazebo 24'	8201 W. Judge	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 135,000.00	2011	Wood

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
			Perez Druve						
	Administration	Torres Restroom Facility	8201 W. Judge Perez Druve	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 150,000.00	1995	Wood
Y	Auditorium	Auditorium & Cultural Center & Equipment	8245 W. Judge Perez Dr.	Chalmette	29° 55' 20.3347"	-89° 54' 22.725"	$ 6,700,000.00	1972/2009	Fire Resistive
	Auditorium	Auditorium Marquee/Electronic Sign	8245 W. Judge Perez Dr.	Chalmette	29° 55' 20.3347"	-89° 54' 22.725"	$ 370,000.00	2009	
Y	Auditorium	Grand Ballroom (Behind Auditorium)	8245 W. Judge Perez Dr.	Chalmette	29° 55' 20.3347"	-89° 54' 22.725"	$ 2,000,000.00	2008	
Y	Council on Aging	Council on Aging	8201 W. Judge Perez Dr. ("B)	Chalmette	29° 57' 22.4467"	-89° 58' 56.5115"	$ 2,500,000.00	2009	Fire Resistive
Y	Courthouse	Courthouse Annex - Drug Court Adm. Off.	1009 W. Moreau St.	Chalmette	29° 56' 26.2561"	-89° 58' 21.5083"	$ 800,000.00	1964/2009	Brick
Y	Courthouse	34th Courthouse & Equipment	1101 W. St. Bernard Hwy.	Chalmette	29° 56' 22.9765"	-89° 58' 21.9335"	$ 13,500,000.00	1939/2013	Fire Resistive
Y	Courthouse	Sheriff's Office New Annex & Equipment	#2 Courthouse Sq.,	Chalmette	29° 56' 28.918"	-89° 58' 22.9912"	$ 2,300,000.00	2011	Fire Resistive
Y	Courthouse	Courthouse Square & Equipment	2118 Jackson Blvd.	Chalmette	29° 56' 26.7338"	-89° 58' 25.3132"	$ 3,050,000.00	2012	Fire Resistive

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Fire	Fire Station #5	2000 East Judge Perez Drive	Chalmette	29° 56' 14.95"	-89° 56' 40.646"	$ 1,250,000.00	2010	Steel
Y	Fire	Fire Station #6	4119 East Judge Perez Drive	Chalmette	29° 56' 10.9194"	-89° 55' 26.7744"	$ 1,375,000.00	2010	Steel
Y	Jail	Jail Complex	1900 Paris Rd	Chalmette	29° 55' 57.8168"	-89° 58' 5.655"	$ 7,500,000.00	1985	Fire Resistive
	Library	Main Library	2600 Palmisano Blvd.	Chalmette	29° 56' 18.6295"	-89° 57' 8.1263"	$ -	Leased to parish	n/a
Y	Nine- 911	911 Building & Equipment	8001 W. St. Bernard Hwy.	Chalmette	29° 56' 42.54"	-89° 59' 9.7631"	$ 1,100,000.00	2003/2010	Masonry NC
Y	Public Works	Road Maintenance & Transit Dept.	120 W.Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 600,000.00	1988/2010	Non Combustible
Y	Public Works	Road Maintenance Bay/Shed (open car ports/bays)	120 W.Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 175,000.00	2010	steel
Y	Public Works	Public Works Administrative Office (Old Library)	1125 E. St. Bernard Hwy.	Chalmette	29° 55' 55.9189"	-89° 57' 27.8726"	$ 650,000.00	1964/2010	Non Combustible
Y	Public Works	Public Works/Main Yard New Road Office	120 W.Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 1,400,000.00	2011	Metal Stud
Y	Public Works	Public Work Leased Storage Building (Vicknair Bldg)	109 W. Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ -	1975	Iron

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Public Works	Public Work Leased Storage Building (Vicknair Bldg)	111 W. Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ -	1975	Iron
Y	Recreation	Paul Noel Gym	Moreau St. @ Tournefort	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 650,000.00	1983/2009	Masonry NC
Y	Recreation	Buccaneer Villa Gym	8600 Victory	Chalmette	29° 57' 37.0058"	-89° 58' 13.3608"	$ 500,000.00	1974	steel
Y	Recreation	Val Riess Multi-Plex	3900 Palmisano Blvd.	Chalmette	29° 57' 6.592"	-89° 56' 43.116"	$ 7,317,788.00	2014	Non-Combustible
	Recreation	Val Riess Concession Stand, Phase I	3900 Palmisano Blvd.	Chalmette	29° 57' 6.592"	-89° 56' 43.116"	$ 2,000,000.00	2009	Non-Combustible
	Recreation	Val Riess Concession Stand, Phase II	3900 Palmisano Blvd.	Chalmette	29° 57' 6.592"	-89° 56' 43.116"	$ 2,500,000.00	2010	Non-Combustible
	Recreation	Val Riess Support Facilities (covered pavillion area, bleachers, etc.	3900 Palmisano Blvd.	Chalmette	29° 57' 6.592"	-89° 56' 43.116"	$ 250,000.00	2010	Non-Combustible
	Recreation	Benjamin Street Boat House	8300 Benjamin Street	Chalmette	29° 57' 49.5029"	-89° 58' 30.1202"	$ 183,000.00	2015	Wood
Y	Transit	Transit Car Wash	120 W.Agriculture St.	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 117,633.00	2014	Metal
Y	Water	Water Treatment Administrative Office Building	1111 E. St. Bernard Hwy	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 900,000.00	1940/2010	masonry

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Water	Water Treatment Plant #1 & Equipment, Generator System	1111 E. St. Bernard Hwy	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 1,900,000.00	2010	
Y	Water	Water Treatment Plant #2 & Equipment, Generator System	1111 E. St. Bernard Hwy (rear)	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 1,850,500.00	2010	
Y	Water	Dravo Electrical Building & Equipment	4020 Jean Lafitte Blvd.,	Chalmette	29° 57' 52.087"	-89° 58' 29.5972"	$ 2,000,000.00	1987/2012	Concrete
Y	Water	Raw Water Pump Station & Equipment	Mobil Oil Access Rd # 1	Chalmette	29° 56' 34.0188"	-89° 57' 48.6583"	$ 1,750,000.00	2012	Concrete CMU
Y	Water	Red Cross Building - Storage	2200 Palmisano Blvd.	Chalmette	29° 56' 0.762"	-89° 57' 16.5265"	$ 175,000.00	1980	
Y	Water	Control Building & Pipe Gallery & Equipment	1111 E. St. Bernard Hwy (Palmisano Blvd. Entrance)	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 7,957,032.79	2015	Concrete
Y	Water	Chemical Building & Equipment	1111 E. St. Bernard Hwy (Palmisano Blvd. Entrance)	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 4,137,485.48	2015	Concrete
Y	Water	Three Clarifier Tanks	1111 E. St. Bernard Hwy	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 7,384,705.16	2015	Concrete

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
			(Palmisano Blvd. Entrance)						
Y	Water	Clear well Pump Station	1111 E. St. Bernard Hwy (Palmisano Blvd. Entrance)	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 2,051,647.00	2015	Concrete enclosure
Y	Water	Waste Transfer Pump Station & Equipment	1111 E. St. Bernard Hwy (Palmisano Blvd. Entrance)	Chalmette	29° 55' 56.1922"	-89° 57' 28.3738"	$ 2,265,099.00	2015	Concrete
Y	Fire	Fire Station #3	9240 W. Judge Perez Dr.	Chalmette	29° 56' 48.0728"	-89° 58' 19.2371"	$ 2,010,356.00	2013	Non Combustible
Y	Fire	Fire Station #7	5680 East Judge Perez	Meraux	29° 54' 43.0182"	-89° 53' 53.344"	$ 1,850,000.00	2009	Steel
Y	Recreation	Cypress Garden Gym	2900 Bloomquist	Meraux	29° 56' 18.2627"	-89° 55' 17.8928"	$ 1,450,000.00	2009	steel
Y	Recreation	Hannan Bldg.	2501 Archbishop Hannan Blvd.	Meraux	29° 56' 3.2168"	-89° 55' 23.3447"	$ 250,000.00	1990/2009	Steel/Stucco
	Recreation	Hannan Concession Stand	2501 Archbishop Hannan Blvd.	Meraux	29° 56' 3.2168"	-89° 55' 23.3447"	$ 150,000.00	1990/2009	

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
	Recreation	Hannan Bleachers & Score House	2501 Archbishop Hannan Blvd.	Meraux	29° 56' 3.2168"	-89° 55' 23.3447"	$ 250,000.00	1990/2009	
Y	Water	Munster Plant-Entire Plant Site & Equipment	3300 Munster Blvd - plant site	Meraux	29° 56' 40.731"	-89° 55' 44.1311"	$ 40,000,000.00	2012	
Y	Fire	Fire Station #8	613 Bayou Road	St. Bernard	29° 52' 4.2672"	-89° 52' 31.7503"	$ 1,500,000.00	2011	Steel
Y	Fire	Fire Station #10	3901 Bayou Road	St. Bernard	29° 51' 43.5665"	-89° 46' 48.2963"	$ 500,000.00	1995/2013	Steel
Y	Fire	Fire Station #11	2424 Florissant Hwy.	St. Bernard	29° 50' 27.0449"	-89° 41' 24.5645"	$ 935,000.00	2009	Steel
Y	Fire	Fire Station #12	4623 Delacroix Hwy	St. Bernard	29° 48' 4.3708"	-89° 46' 1.4794"	$ 885,837.00	2010	Steel
Y	Public Works	North Florissant Pump Station & Equipment	North Florissant: Located 900 feet east of LA Highway 46 on the North Florissant Levee	St. Bernard	29° 52' 2.3318"	-89° 51' 32.0472"	$ 805,000.00	2009	steel
Y	Public Works	South Florissant Pump Station & Equipment	South Florissant: Located	St. Bernard	29° 50' 51.6548"	-89° 44' 14.537"	$ 815,000.00	2009	steel

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
			1,150 feet south of 840 Florissant Highway on South Florissant Levee						
Y	Public Works	Reggio Drainage Pump Station & Equipment	Parcel of Land in Section 96, T-14-S, R-14-E Delacroix	St. Bernard	29° 45' 41.7539"	-89° 47' 27.2281"	$ 235,000.00	2010	steel
Y	Public Works	Alluvial City Drainage Station & Equipment	2200 Maple St.	St. Bernard	29° 50' 37.1857"	-89° 41' 27.3696"	$ 260,000.00	2010	steel
Y	Public Works	Jacks Canal Drainage Station & Equipment	4352 Delacroix Hwy., St. Bernard (closest municipal address in the area)	St. Bernard	29° 48' 26.7718"	-89° 45' 51.4631"	$ 260,000.00	2010	steel
Y	Public Works	Delacroix Pump Station & Equipment	Lat. 29-46-05.55; Long: 89-47-20.28, St. Bernard	St. Bernard	29° 46' 05.5513"	-89° 47' 20.2854"	$ 598,500.00	2010	steel

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Public Works	Woodlake Drainage Stations & Equipment	4352 Delacroix Hwy., St. Bernard (closest municipal address in the area) N 479036.0460; E3778873.6090	St. Bernard	29° 50' 37.1857"	-89° 41' 27.3696"	$ 280,000.00	2010	steel
Y	Recreation	Gauthier Gym/Kenilworth	2214 Bobolink	St. Bernard	29° 52' 13.2082"	-89° 53' 17.1614"	$ 1,850,500.00	2009	steel
Y	Recreation	Ducros Museum	1345 Bayou Road	St. Bernard	29° 52' 2.9946"	-89° 51' 37.1545"	$ 350,000.00	1800/2010	Wood
Y	Recreation	Islenos Multi-Purpose Bldg.	1357 A Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 480,000.00	2010	Wood
	Recreation	Cresap/Caserta	1357 E. Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 95,000.00	1900/2010	Wood
	Recreation	Mesa/Coconut Hut	1357 B Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 75,000.00	1900/2010	Wood
	Recreation	Trapper Shack	1357 F Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 70,000.00	2010	Wood
Y	Recreation	Los Islenos Museum	1357 Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 510,000.00	2009	Wood

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Recreation	Esteves House	1357 F Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 80,000.00	1890/2010	wood
Y	Recreation	Estopinal-Salles House	1367 C Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 205,000.00	2010	Wood
Y	Recreation	Estopinal-Salles Kitchen	1357 C Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 75,000.00	2010	wood
	Recreation	Islenos Food Court and Pavilions	1357 Bayou Road	St. Bernard	29° 52' 4.1977"	-89° 51' 34.1438"	$ 250,000.00	2010	n/a
Y	Recreation	PGT Beauregard Historic Courthouse & Equipment Bldg.	1201 Bayou Road	St. Bernard	29° 52' 4.9138"	-89° 51' 53.9507"	$ 5,525,000.00	1916/2012	Brick
Y	Animal Control	Animal Control Shelter	5455 East Judge Perez Drive	Violet	29° 54' 55.1243"	-89° 53' 58.1471"	$ 805,000.00	2010	Steel
Y	Public Works	Violet Pump Station & Equipment	3400 Stacie Drive	Violet	29° 54' 56.1442"	-89° 53' 28.4233"	$ 1,200,000.00	2008	Non-Combustible
Y	Public Works	Area 4 Administration Bldg.	7715 East Judge Perez Drive	Violet	29° 54' 39.677"	-89° 53' 51.1166"	$ 100,000.00	2011	metal
	Public Works	Area 4 Storage Bldg.	7715 East Judge Perez Drive	Violet	29° 54' 39.677"	-89° 53' 51.1166"	$ 45,000.00	2011	metal
	Public Works	Area 4 Guard Building	7715 East Judge Perez Drive	Violet	29° 54' 39.677"	-89° 53' 51.1166"	$ 156,000.00	2011	metal

Critical Facility (If Yes, Mark X)	Name of Building	Purpose of Building	Address	City	Latitude	Longitude	Assessed Value	Date Built	Construction Type
St. Bernard Unincorporated									
Y	Public Works	Mosquito Control Office Adm. Bldg.	3400 Stacie Drive	Violet	29° 54' 56.1442"	-89° 53' 28.4233"	$ 410,000.00	2011	wood
Y	Public Works	Mosquito Control Garage/Warehouse	3400 Stacie Drive	Violet	29° 54' 56.1442"	-89° 53' 28.4233"	$ 220,000.00	2011	Metal Stud
	Recreation	Violet Park #2 Concession Stand	6609 E. St. Bernard Hwy	Violet	29° 53' 37.4647"	-89° 53' 57.1524"	$ 100,000.00	2013	Cinder Block, metal
Y	Public Works	Violet Pump Station Electrical Room & Equipment	3400 Stacie Drive	Violet	29° 54' 56.1442"	-89° 53' 28.4233"	$ 260,000.00	2008	Non-Combustible
Y	Water	Water Treatment Plant #3:	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Critical Facilities and Vulnerable Populations

Vulnerable Populations

St. Bernard Parish

Name	Address	Street	City	Zip Code	Latitude	Longitude
All Hospitals (Private or Public)						
St. Bernard Parish Hospial	8000	W. Judge Perez Dr.	Chalmette	70043	[illegible]	-89° 59' 10.117"

Nursing Homes (Private or Public)	Address	Street	City	Zip Code	Latitude	Longitude
* There are no Nursing Homes located in St. Bernard Parish						

Mobile Home Parks	Address	Street	City	Zip Code	Latitude	Longitude
Chalmette Trailer Park	3224	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 55'
Colonial Trailer Park	5600	E. St. Bernard Hwy.	Violet	70092	29° 54'	-89° 54'
Fanz Mobile Park	2237	Bayou Rd.	St. Bernard	70085	29° 52'	-89° 50'
Henley's Trailer Park	5012	E. St. Bernard Hwy.	Violet	70092	29° 54'	-89° 54'
Lind's Trailer Park	348	Bayou Rd.	St. Bernard	70085	29° 52'	-89° 52'
Liccardi's Trailer Park	2817	E. St. Bernard Hwy.	Meraux	70075	29° 55'	-89° 56'
Mary Ann Trailer Park	2813	E. St. Bernard Hwy.	Meraux	70075	29° 55'	-89° 56'
Myrtle Grove Trailer Park	2821	E. St. Bernard Hwy.	Meraux	70075	29° 55'	-89° 56'
Packenham Trailer Park	1408	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 57'
Paup's Trailer Park	1800	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 56'
Richard's Trailer Park	350	Bayou Rd.	St. Bernard	70085	29° 51'	-89° 52'
Riveredge Trailer Park	2020	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 56'
Seelos Trailer Park #1	1300	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 57'
Seelos Trailer Park #2	1400	E. St. Bernard Hwy.	Chalmette	70043	29° 55'	-89° 57'
Sidlenie Trailer Park	209	E. Urquhart St.	Chalmette	70043	29° 56'	-89° 57'

NFIP

ELEMENT F: STATE REQUIREMENT

National Flood Insurance Program (NFIP)

Jurisidction: St. Bernard Unincorporated

Insurance Summary		Comments
How many NFIP polices are in the community? What is the total premium and coverage?	POLICIES: 11,557; PREMIUMS: $7,592,884; COVERAGE: $3,196,598,8000	n/a
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?	CLAIMS PAID: 23,604; TOTAL PAID: $2,238,822,210; SUBS DAMAGE: 0.	n/a
How many structures are exposed to flood risk with in the community?	15375%	n/a
Describe any areas of flood risk with limited NFIP policy coverage.	None	n/a
Staff Resources		**Comments**
Is the Community FPA or NFIP Coordinator certified?	3 CFMs	n/a
Is flood plain management an auxiliary function?	PRIMARY	n/a
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	ALL	n/a
What are the barriers to running an effective NFIP program in the community, if any?	n/a	n/a
Compliance History		**Comments**
Is the community in good standing with the NFIP?	YES	n/a
Are there any outstanding compliance issues(i.e., current violations)?	NO	n/a
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact(CAC)?	2014	n/a
Is a CAV or CAC scheduled or needed? If so when?	On-going	n/a
Regulation		**Comments**
When did the community enter the NFIP?	1970	n/a
Are the FIRMs digital or paper?	PAPER	n/a
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	EXCEED; 18' FREEBOARD	n/a
Community Rating System (CRS)		**Comments**
Does the community participate in CRS?	NO; IN THE PROCESS OF GETTING STARTED	n/a
What is the community's CRS Class Ranking?	In-progress	n/a
Does the plan include CRS planning requirements?	In-progress	n/a