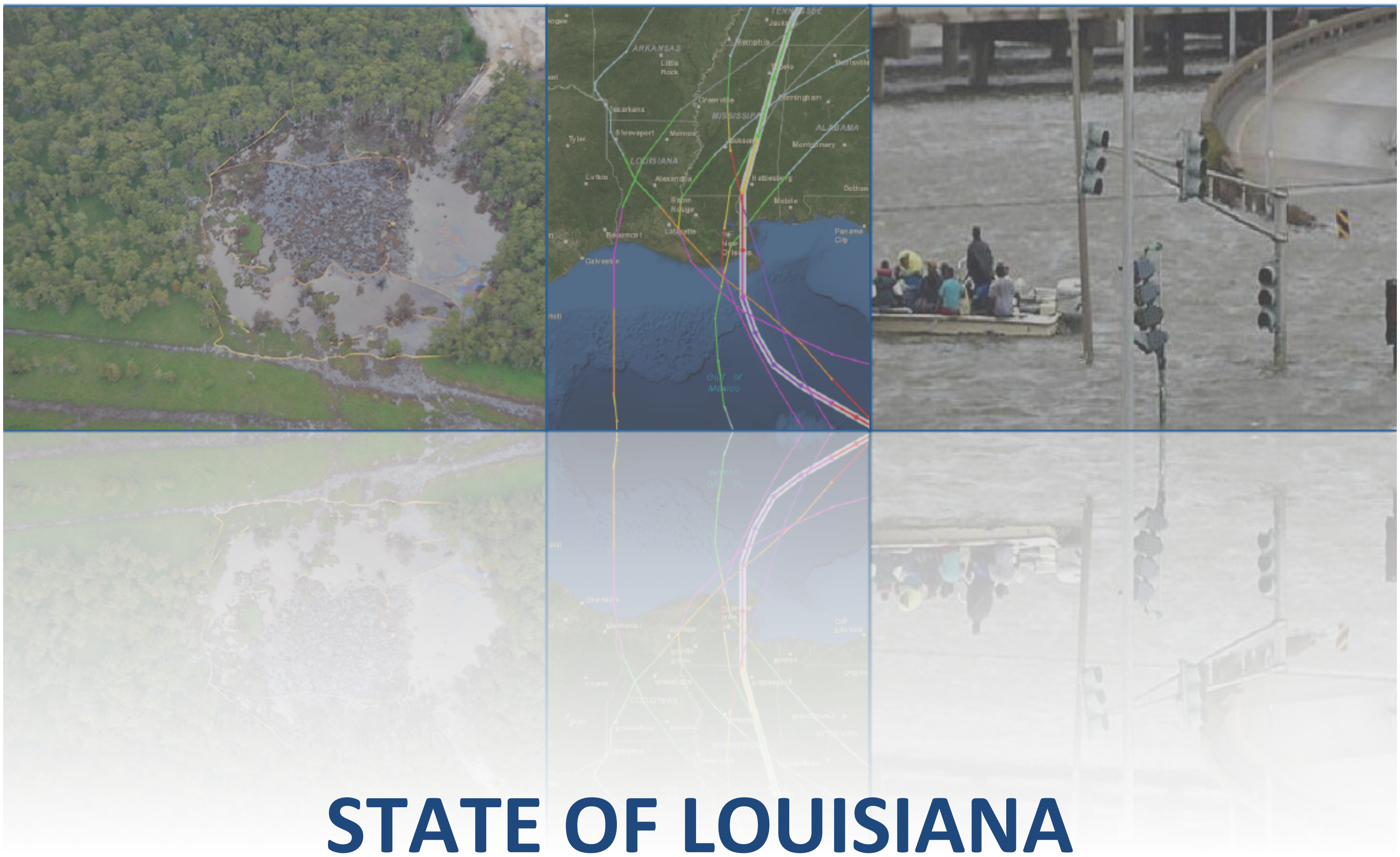

STATE OF LOUISIANA HAZARD MITIGATION PLAN

2014 UPDATE

GOVERNOR'S OFFICE

HOMELAND SECURITY &
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ACKNOWLEDGMENTS

This 2014 State Hazard Mitigation Plan Update was coordinated by the State Hazard Mitigation Planning Committee (SHMPC) in collaboration with faculty, staff, and students at Louisiana State University and East Tennessee State University. The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) and its director, Kevin Davis, wish to thank all of the members of the entire State Hazard Mitigation Planning Committee (SHMPC) for their work on plan. Particularly, State Hazard Mitigation Officer Jeffrey Giering's vision for a mitigation plan that is readable and useful to the public inspired the whole development of this Update. Finally, GOHSEP would like to thank the wide range of stakeholder representatives from federal, state, and local levels of government who provided feedback and expertise on this document, as well as personnel from non-governmental organizations. This document is the richer for such inclusive help.

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Table of Contents

Acknowledgments i

Table of Contents iv

1. Introduction 1-1
Location and Hazard Risk 1-1
Hazard Mitigation 1-2
General Strategy 1-4
The 2014 Plan Update 1-5

2. Hazard Identification and Statewide Risk Assessment 2-1
Local Risk Assessments 2-1
State Profile 2-5
Geography 2-5
Climate 2-7
History 2-8
Changes in Development Through Land Cover Change Detection 2-13
Climatological Hazards 2-15
Drought 2-17
Extreme Heat 2-22
Flooding 2-27
Thunderstorms 2-65
Tornadoes 2-108
Tropical Cyclones 2-130
Wildfires 2-176
Winter Weather 2-197
Geological/Human-Influenced Hazards 2-217
Coastal Hazards 2-218
Dam Failure 2-244
Earthquake 2-257
Levee Failure 2-261
Sinkholes 2-273
Summary of Risk Assessments 2-292
Coastal Parishes 2-293
Inland Southern Parishes 2-294
Central Parishes 2-294
Northwest Parishes 2-295

3. State Historical Properties Risk Assessment 3-1

4. Capability Assessment 4-1
State Policies and Programs 4-1
Policies 4-1
Programs 4-5

Hazard Management Capabilities 4-17
Personnel Capability 4-17
Technical Capability 4-19
Financial Capability 4-20
Local Capability Assessment 4-36
Coordination of Local Planning 4-38
Local Plan Review Process 4-41
Prioritizing Parish and Municipal Assistance 4-41
Maximizing Benefits According to Benefit-Cost Review of Local Projects 4-43
Prioritization of Parishes to Receive HMGP Funding 4-44

5. Mitigation Strategy 5-1
Goals 5-1
Actions 5-2
Mitigation Monitoring and Review 5-11

6. Mitigation in Action 6-1
Louisiana Mitigation Projects 6-2
Community Education Outreach 6-2
City of Slidell 6-81
Parish Mitigation Projects 6-87
Town of Jean Lafitte 6-93

APPENDICES

A. Planning Process A-1
Purpose A-1
Planning A-1
Coordination Among Agencies A-5
Program Integration A-7
Documentation A-9
Meeting #1 .... A-10
Meeting #2 .... A-19
Meeting #3 .... A-23
Meeting #4 .... A-25
Meeting #5 .... A-31
Meeting #6 .... A-35

B. Plan Maintenance B-1
Purpose B-1
Monitoring, Evaluating and Updating the Plan B-1
Responsible Parties B-1
Methods for Monitoring and Evaluating the Plan B-2
Plan Evaluation Criteria B-3
Updating the Plan B-3
2011 Plan Method and Schedule Evaluation B-4

C. Mapping Methodology C-1
State Information C-1
Population C-1
State Property C-1
Land Cover C-2
Climatological Hazards C-3
Droughts C-3
Extreme Heat C-3
Flooding C-4
Thunderstorms C-5
Tornadoes C-6
Tropical Cyclones C-6
Wildfires C-9
Winter Weather C-9
Geological/Human-Influenced Hazards C-9
Coastal Hazards C-10
Dam Failure C-10
Earthquake C-11
Levee Failure C-11
Sinkholes C-11
Risk and Vulnerability C-11

D. Plan Adoption D-1

E. Endnotes E-1

1. Introduction

Location and Hazard Risk

Louisiana is located on the coast of the hurricane-prone Gulf of Mexico, as well as at the mouth of the Mississippi River watershed—which drains over 40% of the continental United States. The natural forces that cause coastal storms and flooding are inevitable. Moreover, such threats are compounded by the state's historic reliance on engineered flood-protection measures such as levees and floodwalls, in addition to elaborate systems of canals, pipes, and pumps (i.e., forced drainage systems). But these measures provide a thin defense against flood hazards and create a false sense of security. When they fail, the results can be catastrophic. In particular, the combination of failed engineered flood-protection measures and the constant presence of human-influenced and natural hazards have made flood events more common and the impacts more severe in Louisiana. For various reasons, parts of southern Louisiana are subsiding at rates fast enough to be observed within decades or even years; coastal wetlands are eroding due to the combined effects of subsidence, severe weather, lack of new alluvial sediments, and saltwater intrusion via navigation and oil and gas industry channels; and climate change is causing warmer oceans and rising sea levels, which is likely to produce more frequent extreme weather events and compound coastal land loss. These circumstances are narrowing the natural buffers between the Gulf of Mexico and Louisiana's population centers, reducing protection from high wind and storm surges (which are the highest natural hazard risks to the state), and augmenting already significant risks to the state.

As suggested above, Louisiana is not only particularly prone to certain natural and human-influenced hazards, but it is also more vulnerable because measures taken to protect against certain hazards (i.e., engineered flood-protection measures) have compounded the threats posed by nature. Similarly, other human actions involving natural resource extraction in Louisiana have also contributed to the state's susceptibility to hazards.

In light of these challenges, Louisiana has been learning from its experiences with hazards to reduce the impacts of future hazard events. In 2004, the state embarked on a comprehensive program to markedly improve its hazard mitigation efforts, resulting in the State of Louisiana Hazard Mitigation Strategy document (completed in 2005). Following the 2005 hurricane season, Louisiana began updating its State Hazard Mitigation Plan (completed in 2008). A required Plan Update, as per the Code of Federal Regulations (CFR), was approved in 2011. This present Plan Update follows in that vein, but with a number of notable changes.

HAZARD MITIGATION

To fully understand Louisiana's hazard mitigation efforts, it is first critical 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., floodproofing 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 1.1 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 1.1 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.

Figure 1.1. The four phases of emergency management and their relation to future hazard mitigation (source: FEMA).

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.

Katrina and Rita had profound impacts on emergency management and hazard mitigation in Louisiana. As detailed later in this document, significant funding has been made available to the State of Louisiana 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

The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), with the assistance and cooperation of the State Hazard Mitigation Planning Committee (SHMPC), developed the comprehensive 2005 *State of Louisiana Hazard Mitigation Strategy*, documented in four volumes:

I. *State of Louisiana Hazard Mitigation Plan*
II. *State of Louisiana Hazard Mitigation Plan Appendix*
III. *State of Louisiana Hazard Mitigation Program*
IV. *State of Louisiana Administrative Guidelines and Procedures*

During the 2005 Plan Update process, Katrina and Rita made landfall in Louisiana, requiring that all staff and resources be committed to response efforts. Many of the recommendations in the 2005 Plan Update were not implemented due to the intensity of the response efforts. As part of the 2011 Plan Update, and as described in the 2008 Strategy, 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. As a result, the Strategy was broadened to include the following documents by reference:

- *State of Louisiana Emergency Operations Plan* (July 2009)
- *State of Louisiana GOHSEP Continuity of Operations Plan (2009)*
- Regional and community-based long-term recovery plans (various dates from 2005 through 2009)

The 2011 Plan Update maintained the organization of the 2005 and 2008 Plans, loosely paralleling the order of requirements listed in the CFR. It contained the following sections in this order:

- Section One Introduction
- Section Two Plan Adoption
- Section Three Planning Process
- Section Four Hazard Identification and Profiles
- Section Five Statewide Risk Assessment
- Section Six Risk Assessment for State-Owned Assets
- Section Seven Capability Assessment

- Section Eight Mitigation Action Plan
- Section Nine Coordination with Local Mitigation Planning
- Section Ten Plan Maintenance Process

Most of these sections were written in summary form with appendices related to each section that provided full, detailed discussions of methodologies and complete results.

While these updates have been necessary and beneficial, after three revisions the Plan (at nearly 1700 pages) had become too unwieldy for constructive use. At its first meeting in March 2013 the entire SHMPC decided to renovate the Plan to make it (1) more accessible to the general public and (2) more efficient for state and local governmental use (see Appendix A for details on the planning process). Consequently, this Plan Update now also coheres with the recent 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 is 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 SHMPC was not ignorant or dismissive of the successful analysis and mitigation planning executed in the 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.

THE 2014 PLAN UPDATE

Although the SHMPC has made drastic revision to the text, this 2014 Plan Update still proceeds with the five current goals of the state's hazard mitigation teams, which represent long-term commitments by the State of Louisiana. Four of those goals are from the 2011 Plan Update, while a fifth goal was added as an amendment in May 2013 as part of a programmatic agreement between the State Historic Preservation Office (SHPO), GOHSEP, and FEMA. The goals are as follows:

Goal 1: **The State of Louisiana will improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact.**

Goal 2: **The State of Louisiana will improve data collection, use and sharing to reduce the impacts of hazards.**

Goal 3: **The State of Louisiana will improve capabilities and coordination at the municipal, parish, regional and state level to plan and implement hazard mitigation projects.**

Goal 4: **The State of Louisiana will continue to pursue opportunities to reduce impacts to the State's manmade and natural environment through mitigation of repetitive and severe repetitive loss properties and other appropriate construction projects and related activities.**

Goal 5: **The State of Louisiana will improve on the protection of its Historic Structures/Buildings, Traditional Cultural Properties and Archaeological Sites from natural and human-constructed hazards.**

This Plan Update makes a number of textual changes throughout. But the most obvious changes are 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 sections and twelve appendices, the present Plan Update has six sections and five appendices. The most significant changes are the newly developed hazard profiles and risk assessments, the removal of much repetition between sections from the previous Plan Updates, and the incorporation of a new section: the SHPO Risk Assessment. The 2014 Plan Update is organized generally as follows:

- Section One Introduction
- Section Two Hazard Identification and Statewide Risk Assessment
- Section Three State Historical Properties Risk Assessment
- Section Four Capability Assessment
- Section Five Mitigation Strategy
- Section Six Mitigation in Action

- Appendix A Planning Process
- Appendix B Plan Maintenance
- Appendix C Mapping Methodology
- Appendix D Plan Adoption
- Appendix E Endnotes

From the first plan, the Plan Adoption was moved from Section Two to an appendix. The Planning Process, previously comprising Section Three, was also moved to an appendix, and it was edited to explain better the process used to update the Plan.

The Hazard Identification and Profile was moved from Section Four to Section Three in the present Update. It was also synthesized with the Risk Assessments for statewide and state-owned assets for each hazard. Additionally, new hazards (Sinkholes, Saltwater Intrusion, and Sea Level Rise) were added, while other hazards were moved. Extreme Heat was profiled separately from Winter Weather, and Extreme Cold and Snow were profiled under Winter Weather. Lightning, Hail, and High Wind were all profiled under Thunderstorms, and Tropical Cyclones (Hurricanes) and Tornadoes were profiled fully, as opposed to their previous profiling as only High Wind Tornado and High Wind Hurricane. Furthermore, Storm Surge was profiled as a subcategory of Tropical Cyclones.

The Statewide Risk Assessment (previously comprising Section Five) and the Risk Assessment for State-Owned Assets (previously comprising Section Six) were consolidated within Section Two of the present Update. In addition, this Update changes the methodology for composite ranking between parishes in the Statewide Risk Assessment (see the Mapping Methodology in Appendix D), as well as the methodology used in the Risk Assessment for State-Owned Assets to reflect current data on damage.

The Capability Assessment of the previous plan's Section Seven was moved to become Section Four of the present Update. The federal funding data was revised, and non-federal funding information was added. The Land Use section was expanded, and the surveys from the previous plan were omitted due to minimal response. Section Nine of the old plan (Coordination of Local Planning) also became a part of Section Four (Capability Assessment) of this Plan Update.

The Mitigation Action Plan that made up Section Eight of the old plan became Section Five in this Plan Update. It was revised to reflect the process used in this Plan Update, as well as the results from the SHMPC evaluation and ranking of hazards. New actions were added.

Lastly, Section Ten (Plan Maintenance) was moved to an appendix in this document.

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 the State of Louisiana. The extent of this risk is dictated primarily by geographic location. Most significantly, the entire state remains at high risk of water inundation from various sources, including storm surge caused by tropical storms and hurricanes; riverine and backwater flooding; and failure of levees, floodwalls, and forced drainage systems. All of Louisiana is also at high risk of damages from high winds and wind-borne debris—caused by various meteorological phenomena. Other hazards threaten the state, too, although not to such great degrees and not in such widespread ways. For instance, while hail and winter weather pose notable danger, they mainly threaten the northern parishes. Similarly, although all parishes may be affected by tropical storms and hurricanes, southern parishes are far more threatened by them than other parishes due to their proximity to the Gulf of Mexico. In all cases, the relative social vulnerability of areas threatened and affected plays a significant role in how governmental agencies prepare for and respond to disasters.

Mitigation efforts related to particular hazards are highly individualized by jurisdiction. Flexibility in response and planning is essential. Indeed, although funding for relief from major disasters has been available and ample, funds are not always directed effectively to the appropriate areas due to relatively poor communication between federal, state, and local authorities. 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.

Based on interactions with local plan owners, GOHSEP has discovered that most local jurisdictions are not managing their plans on a routine basis, despite varying levels of ongoing mitigation activities. Moreover, in many cases, local jurisdictions do not know the point of contact for their plan. Consequently, GOHSEP has committed to support the updating of FEMA-approved, DMA 2000-compliant jurisdictional plans. Between October 2014 and December 2017, the 64 parish plans are due for updating and approval. Of these, three parishes have already secured pre-disaster mitigation (PDM) funding for their next plan. To prepare for the 61 other updates, GOHSEP has allocated funding from the Hurricane Isaac FEMA Hazard Mitigation Grant Program to support a three-year planning effort that will update plans in a framework that facilitates future updates and provides a degree of uniformity across jurisdictions. Thus, all plans will use similar, appropriate data sources and data processing steps. This coordination allows comparisons between parishes for the first time, which will foster more consistent mitigation planning within the state.

2. HAZARD IDENTIFICATION AND STATEWIDE RISK ASSESSMENT

This section assesses various hazard risks Louisiana 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 occurrence. First, we profile the state in terms of its geography, climate, and history, and then proceed to identify and assess the major hazards that threaten it.

LOCAL RISK ASSESSMENTS

As part of the hazard identification and risk assessment process, parish plans were reviewed to identify profiled hazards that were consistent with the SHMPC's evaluation of the most serious natural hazard threats to the state. Some hazards identified in parish and municipal plans are not directly addressed in the Plan Update. Generally, these hazards appear in a small number of parish and municipal plans and were not consistent with the SHMPC's evaluation of the most serious natural hazard threats to the state.

Members from the SHMPC and the LSU Advisory Team reviewed each of the 64 parish plans that are current in the State to identify the hazards that were profiled in each plan in order to (1) determine the frequency with which each was addressed and (2) to determine if sufficient consistency between the local plans existed to systematically integrate the data, methods, and results into the Plan Update. Table 2.1 lists the hazards profiled in the existing 64 parish plans for each of the hazards (or sub-hazard) included in this Plan Update. The hazard most often addressed by parish plans was tropical cyclones, with 62 of the 64 parishes including them in the hazard profile. None of the existing parish plans profiled sinkhole hazards and only two parish plans profiled sea level rise as a hazard. Of the 20 hazards (or sub-hazards) included in this plan update, parish plans included 11 of these on average. The Iberville Parish plan considers the fewest of the hazards profiled in this plan update (4 hazards), while five parish plans (Assumption, Claiborne, Lincoln, Orleans, and Red River) consider 15 of the 20 hazards profiled in this plan.

Overall, the parish plans and the Plan Update were found to be consistent in identifying natural hazards that affect areas of the state. Although the identified hazards were largely consistent, the parish plans vary widely in key characteristics, including hazard identification definitions, risk assessment data, risk assessment methodologies, and economic loss estimation. The primary commonality among the plans is the inclusion of Hazus Level 1 analyses. This Update includes Level 1 flood, wind, and combined wind and flood model results. Thus, the risk assessments for these very prevalent hazards are consistent among the parish and state plans.

Table 2.1. Summary of hazards included in the State Plan Update that are profiled in current parish plans.

Hazards Included in State Plan Update Profiled in Parish Plans																				
Parish	Coastal Erosion	Dam Failure	Drought	Earthquake	Extreme Heat	Flooding	Hail	High Wind	Tropical Cyclones	Lightning	Levee Failure	Saltwater Intrusion	Sea Level Rise	Sinkholes	Storm Surge	Subsidence	Thunderstorm	Tornadoes	Wildfire	Winter Weather
Acadia			X			X	X	X	X	X						X	X	X		X
Allen		X				X		X	X	X							X	X	X	X
Ascension						X		X	X	X	X				X		X	X		
Assumption		X	X			X	X	X	X	X	X		X		X	X	X	X	X	X
Avoyelles		X				X		X	X		X							X		
Beauregard		X	X		X	X	X		X								X	X	X	
Bienville		X	X	X	X	X	X		X	X								X	X	X
Bossier		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Caddo		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Calcasieu		X	X		X	X	X	X	X	X	X						X	X	X	X
Caldwell		X	X	X		X	X		X		X						X	X	X	X
Cameron	X		X			X	X	X	X						X	X	X	X	X	
Catahoula		X	X			X	X	X		X	X						X	X		X
Claiborne		X	X	X	X	X	X	X	X	X	X				X		X	X	X	X
Concordia		X	X	X	X	X	X	X	X	X	X						X	X	X	
De Soto		X	X	X	X	X	X	X	X	X	X						X	X	X	X
East Baton Rouge		X	X	X		X	X	X	X	X	X					X	X	X	X	X
East Carroll		X	X	X		X	X		X		X						X	X	X	X
East Feliciana		X	X	X		X	X		X	X	X					X	X	X	X	X
Evangeline						X		X	X	X							X	X		X
Franklin		X	X		X	X	X	X	X	X	X						X	X		X
Grant		X	X			X	X	X	X	X	X						X	X	X	X
Iberia	X	X	X			X	X	X	X	X	X				X		X	X		
Iberville						X			X		X								X	
Jackson		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Jefferson	X		X	X		X	X	X	X	X					X	X		X	X	X
Jefferson Davis	X		X	X		X	X		X	X	X				X		X	X	X	
La Salle		X	X			X	X		X	X	X						X	X	X	X
Lafayette		X	X	X		X	X	X	X	X	X					X	X	X	X	X
Lafourche	X								X		X					X		X		
Lincoln		X	X	X	X	X	X	X	X	X	X	X					X	X	X	X
Livingston						X			X						X			X	X	
Madison						X	X		X		X							X		X
Morehouse		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Natchitoches		X	X			X	X	X	X	X	X						X	X	X	X
Orleans	X	X	X			X	X	X	X	X	X		X		X	X	X	X		X
Ouachita		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Plaquemines	X					X		X	X		X	X			X			X		
Pointe Coupee	X	X	X	X		X	X		X		X						X	X	X	X

Parish	Coastal Erosion	Dam Failure	Drought	Earthquake	Extreme Heat	Flooding	Hail	High Wind	Tropical Cyclones	Lightning	Levee Failure	Saltwater Intrusion	Sea Level Rise	Sinkholes	Storm Surge	Subsidence	Thunderstorm	Tornadoes	Wildfire	Winter Weather
Hazards Included in State Plan Update Profiled in Parish Plans																				
Rapides		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Red River		X	X	X	X	X	X	X	X	X	X					X	X	X	X	X
Richland		X	X			X	X		X		X						X	X		X
Sabine		X	X	X	X	X	X	X	X	X	X						X	X	X	X
St. Bernard						X	X	X	X	X	X	X			X	X	X	X	X	
St. Charles	X		X		X	X	X	X	X		X	X				X	X	X		X
St. Helena			X			X	X	X	X	X							X	X	X	X
St. James		X	X			X	X	X	X	X	X				X	X	X	X	X	X
St. John the Baptist		X	X		X	X	X	X	X	X	X					X	X	X		X
St. Landry			X			X	X	X	X	X						X	X	X	X	X
St. Martin						X		X	X		X							X		
St. Mary	X					X		X	X		X				X			X		
St. Tammany		X	X	X		X	X	X	X		X					X		X	X	X
Tangipahoa			X		X	X	X	X	X	X		X				X	X	X	X	X
Tensas		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Terrebonne						X		X	X		X	X			X	X		X		
Union		X	X	X		X	X	X	X		X						X	X	X	X
Vermilion	X					X		X	X		X				X			X		
Vernon		X	X	X	X	X	X	X	X	X	X						X	X	X	X
Washington		X	X		X	X		X	X	X	X					X	X	X	X	X
Webster		X	X	X	X	X	X	X	X	X	X						X	X	X	X
West Baton Rouge			X	X	X	X	X	X	X	X	X					X	X	X	X	X
West Carroll		X	X			X	X		X	X	X						X			X
West Feliciana		X				X	X	X	X	X	X					X	X	X	X	X
Winn			X			X		X		X							X	X	X	
TOTALS	**11**	**42**	**49**	**27**	**24**	**63**	**50**	**50**	**62**	**45**	**52**	**6**	**2**	**0**	**15**	**21**	**51**	**62**	**45**	**47**

GOHSEP considers the risk assessment included in this Plan Update to be more complete and detailed than many parish plans because of the technical expertise and input of the SHMPC, the SHMPC LSU Advisory Team, and the SHMP Agencies. Parishes generally have not had the means or capability to provide detailed analysis, and methodologies differ widely. As a means to facilitate adoption of common methodologies to define and measure the hazards, describe their geographical extents, document previous occurrences, and evaluate the future likelihood of occurrence, mapping methodologies utilized in the Update are provided in Appendix C.

The variations in data and methodologies were noted in the 2011 update and continue to make comparative analysis of parish plans difficult. As a result, the Plan Update relies primarily on consistent national and statewide datasets for hazard identification and risk assessment, although parish-specific data were utilized for more localized hazards (e.g. sinkholes). The majority of parish plans rely on hazard information from the NCDC database. This Plan Update primarily utilizes the SHELDUS dataset, which is considered an improvement over parish plan data, as SHELDUS integrates data from NCDC with additional data from the NOAA Storm Prediction Center, National Hurricane Center, and U.S. Fire Administration.

GOHSEP and the SHMT are committed to meaningfully incorporate the results of parish hazard mitigation plans into the State Plan. Therefore, this Plan Update is intended to serve as a framework that will facilitate parish and municipal updates and provide a degree of uniformity across jurisdictions. Such updates will be implemented between October 2014 and December 2017, when the 64 parish plans are due for updating and approval. Thus, it is the intent of GOHSEP that all plans will use similar, appropriate data sources and data processing steps to facilitate more effective integration for future plan updates. This coordination will enable comparisons between parishes for the first time, which will foster more consistent mitigation planning within the state.

Additionally, to address the data format, collection, and processing inconsistencies that to date have precluded integration of local plans with the State Plan, a currently funded project through the CEO program will provide a mechanism for state planners to collect and exchange hazard and risk data. GOHSEP is partnering with University of Louisiana at Lafayette's NIMSAT Institute to develop a web-based, password-protected risk data collection portal. NIMSAT will collect and ground truth hazard and risk data from parishes and municipalities, then filter and return the data to local communities for concurrence. As the project progresses, these data will be made available for updating risk assessment in both the state and local mitigation plans. The NIMSAT project will help make data from local plans in the future more practical through the development of:

- a validated database of historical disasters, indexed by address, zip code, and/or census tract;
  - a statewide "Risk Index" based upon the above data and valid, uniform risk assessment methodologies;
  - a web portal offering general public and business-level access;
  - a secure-access web portal for governmental stakeholders (development version); and
  - ongoing support including communications, data management, tutorials, and web-hosting.

STATE PROFILE

Geographically, climatologically, and historically, Louisiana (Map 2.1) is one of the most complicated states in the United States.

GEOGRAPHY

The state is situated entirely within the Gulf Coastal Plain, and as such, vertical relief is subtle across its distance. Although the divisions are not always very distinct, the state has three major physiographic regions: hills, terraces, and lowlands. And while it is flush with numerous waterways of a diverse nature, including an extensive alluvial region along the Mississippi and other major rivers, Louisiana is also largely composed of forested regions. These regions are not mutually exclusive.

As the vertical relief topography of Map 2.1 reveals, the state's hill country is mostly located north and west of a line running roughly from the western Sabine River border to Monroe. Elevations there are the highest in the state (topping 500 ft. in a few places). The lower, shallower terraces that meet Louisiana's waters sit south of its hills, the more recent formations resulting from alluvial deposits. Louisiana has two major terrace zones, the first in the Florida Parishes, the other across southwestern Louisiana, just inland from the Gulf of Mexico.

One of the more pronounced characteristics of the state, as Map 2.1 illustrates, is its extensive water and marsh region in the southern-most parishes. These lowlands are comprised of river floodplains and marsh lying south of the terraces. They include two major components: (1) the Chenier Plain of southwestern Louisiana, and (2) the Deltaic Plain, which includes the Atchafalaya Basin and almost everything south and east of metropolitan Baton Rouge, including metropolitan New Orleans and Houma/Thibodaux. Except along natural or artificial river levees, vertical relief is subtle in the lowlands, with absolute elevations rarely surpassing 20 ft.

In the metropolitan New Orleans area, elevations are even below sea level. As a result, flooding in this part of the state can inundate much of the coastal area, although one specific cause cannot be identified due to varying combinations of riverine and coastal effects—including overflow (or backwater) flooding from the Mississippi and Atchafalaya Rivers, their tributaries, and other waterways throughout the state, as well as high tides and storm surges from tropical storms in the Gulf of Mexico. Ultimately, this diversity of geography has sometimes been responsible for the state's tumultuous economic, political, cultural, and climatological history.

Map 2.1. Natural land covers of Louisiana (map by East Tennessee State University [ETSU] student Hannah Miltier).[i]

CLIMATE

Given its proximity to the Gulf of Mexico, in addition to its subtropical latitude and low elevations, Louisiana's warm and humid climate contributes significantly to its inclination to disaster. Average annual temperatures range from the mid- to upper-60°s F across the state, and its precipitation average (approximately 58 in.) is the highest among the 48 conterminous states. During the spring, temperatures warm faster over Louisiana than in inland areas, creating surface fronts that spawn frequent rain and severe thunderstorms, which can include high winds, hail, lightning, and tornadoes. Rainfall totals can exceed 10 in. over a short period of days. Moreover, soils tend to be near saturation at this time of year, and thus spring is typically the period of maximum streamflow. The highest precipitation totals are in the southeastern part of the state, where the lowlands also leave the state most vulnerable to flooding. Moreover, due to the large number of tributaries that feed the Mississippi, which in turn are affected by the snowmelt and precipitation in the central region of the country, the state's vulnerability to flooding is increased by certain climatological factors independent of the state itself. In fact, Louisiana itself contributes virtually nothing to the Mississippi flow. In fact, on average, 70% of the volume along the Lower Mississippi comes from drainage from the Ohio River.[ii] Snowmelt from winters with unusually high snowfall in the Ohio River Basin leads to significant increases in streamflow in the Lower Mississippi.

In the summer months, warm and moist air from the Gulf results in a relatively consistent climate regime. Daily maximum temperatures generally range from 85° F to 95° F, but they may increase over the next century. Frontal systems are infrequent, but the steady inflow of moist, unstable Gulf air masses promotes frequent development of showers and thundershowers, particularly across the southern parishes. Nevertheless, severe weather events tend to be somewhat less frequent and less violent than in spring. For instance, tornado activity is diminished, particularly over the southern half of the state. Drought is possible in the summer, as subsiding air from weak high pressure and associated upper-level ridges locked in place over the central United States can inhibit the development of convective showers for weeks. Most significantly, summer marks the start of the Atlantic tropical cyclone (hurricane and tropical storm) season, and Louisiana is susceptible to such systems fueled by the warm Gulf waters.

Autumn is a period of moderating temperatures, but tropical cyclone activity also reaches its peak at this time. Fortunately, the duration of such events tends to only be a few days. In the periods between such tropical storms, daytime humidity tends to be somewhat lower than other times of the year. Continental and Gulf air masses confront each other minimally in the autumn, resulting in weak frontal activity, which produces little or no rainfall. Thus, autumn is the driest season of the year for Louisiana.

Winters in Louisiana are characterized by a strong thermal gradient across the state. On average, northern Louisiana is 10 F° colder than its southern counterpart. Cold Canadian air can reach into the state, and at least one hard freeze per season is typical, except on the extreme coastal margins. Such freezing events seldom last for longer than a week, even in northern Louisiana. Most precipitation arrives as rain, but modest accumulations of snow do occur, particularly in the north. Despite its relative infrequency, freezing rain and ice storms can create significant problems across the state.

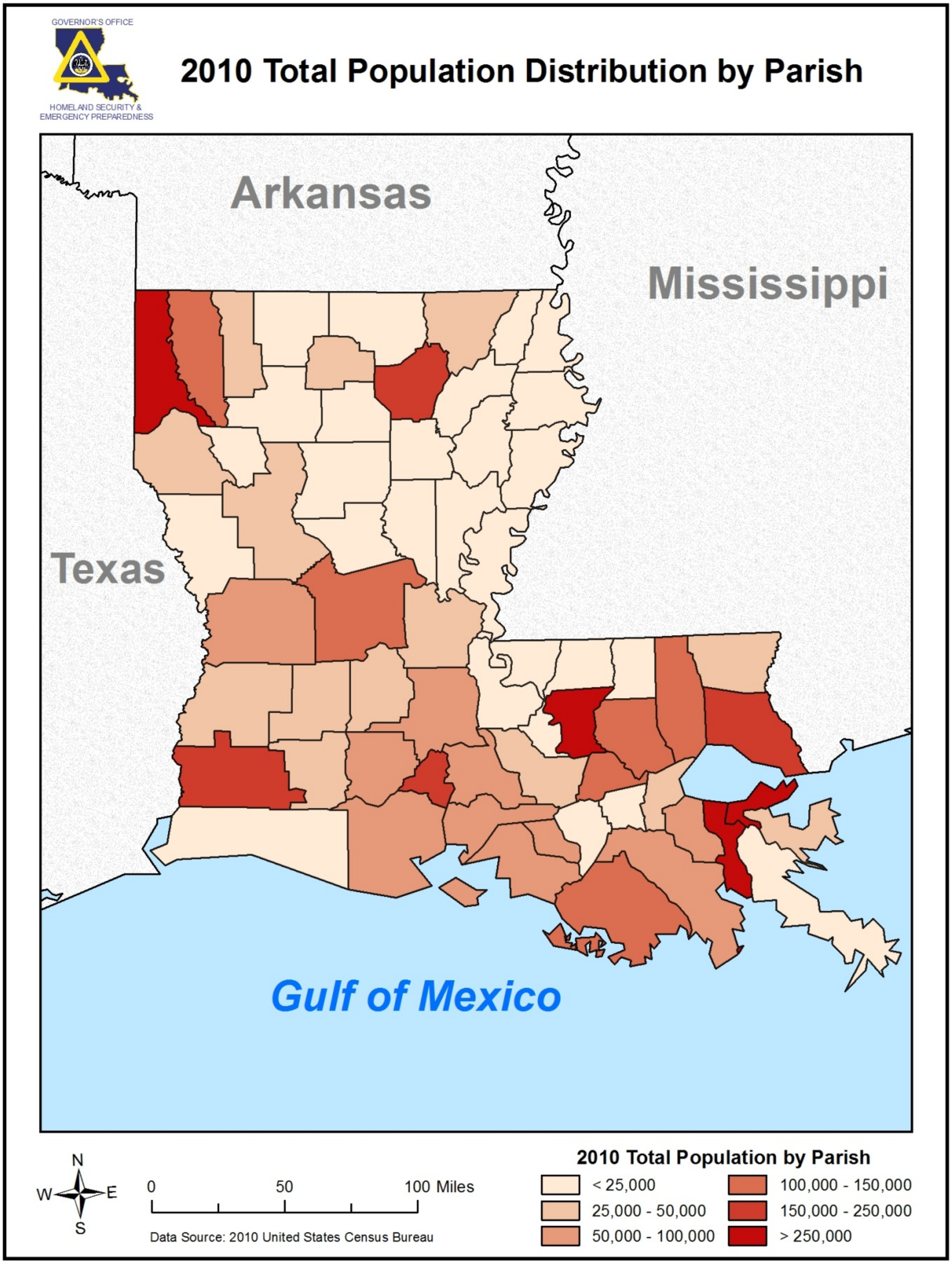
History

Like the rest of the United States, Native Americans inhabited Louisiana prior to the arrival of the Europeans. According to the 2010 census, roughly 55,000 American Indians still reside in Louisiana, but ubiquitous testaments to their presence survive through the state's many historical burial mounds (such as the Watson Brake site and Poverty Point), but also through the names of various places, including parishes (e.g., Caddo, Calcasieu, Tangipahoa, and Natchitoches) and the state's capital (Baton Rouge).

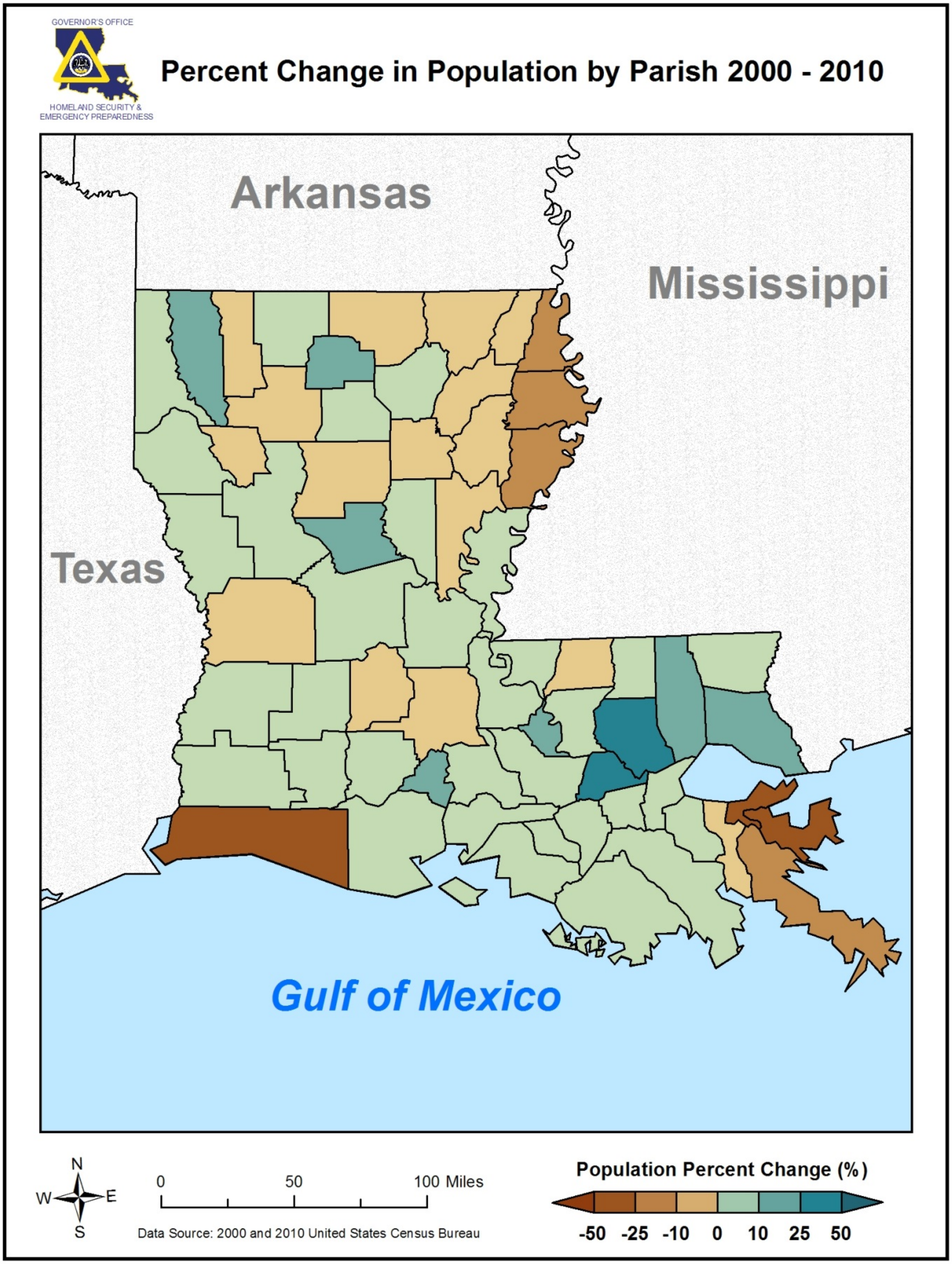
Louisiana was explored by a succession of European powers, beginning with the Spanish in the sixteenth century, followed by the French in the seventeenth century. The explorer Robert Cavalier de La Salle gave the area its current name in honor of King Louis XIV, but it also included parts or all of present-day Mississippi, Arkansas, Oklahoma, Missouri, Kansas, Nebraska, Iowa, Illinois, Indiana, Michigan, Wisconsin, Colorado, Wyoming, Montana, Minnesota, North Dakota, South Dakota, and New Mexico. Over time, New Orleans became the default capital of the region, due to its control of the strategically significant mouth of the Mississippi River. Having already ceded more eastern territory to Great Britain in the French and Indian War—and following a period of about 40 years of Spanish rule ended by Napoleon—the French sold the remainder of Louisiana to the newly formed United States in 1803. Its sale doubled the size of the young nation overnight.

At present, roughly 4.6 million residents populate Louisiana, of whom 60.3% are non-Hispanic white American, 32% black American, and 2.3% white Hispanic.[iii] A variety of other races and ethnicities—the largest portion including Native Americans, multiracial Americans, and a number of Asian ethnicities—comprise the remaining 5.4%. Map 2.2 illustrates the state's current population density, while Map 2.3 illustrates the changes in population from 2000 to 2010. The greatest concentration of people in Louisiana still reside in the southern, lowland regions of the state (those areas most vulnerable to flooding and hurricane disaster), but significant, isolated population concentrations can be found in central and northern Louisiana. There was a slight overall population increase from 2000 to 2010.

Although this fact seems irrelevant at first, as of 2011, 49% of Louisianians under the age of one are non-white, indicating drastic shifts in the demographics of the state.[iv] Such demographic changes must be used with relation to hazard mitigation. The University of South Carolina's Hazards and Vulnerability Research Institute (HVRI) has established a Social Vulnerability Index (SoVI®) that (1) maps variations in vulnerable populations and (2) acts as an indicator to determine variations in recovery through a combination of thirty socioeconomic factors, which social research suggests contribute to a community's ability to "prepare for, respond to, and recover from hazards." Ultimately, seven factors (race and poverty; wealth; elderly residents; Hispanic ethnicity; special needs individuals; Native American ethnicity; and service industry employment) explain 72% of the variance in the data, which reveal uneven capacities



Map 2.2. 2010 population density of Louisiana by parish (source: United States Census Bureau).



Map 2.3. Percent change in population from 2000 to 2010 (map from United States Census Bureau).

for preparedness and response, and thus indicate where resources can be used more effectively to reduce pre-existing vulnerability. Three important implications of SoVI® data should be noted. First, social vulnerability can shift drastically in a relatively short amount of time. Second, the social vulnerability in regions that suffer greater economic losses due to environmental hazards should be monitored closely for even more rapid shifts in vulnerability. Map 2.4 demonstrates the particular vulnerability of the coastal parishes in this respect through economic loss since that region of the state has suffered considerably between 1960 and 2009. Last, SoVI® data only provides data at the county or parish level, even though social vulnerability can vary greatly even within a single neighborhood. Since the state's overall population is shifting toward a larger minority population, which is often more vulnerable to environmental hazards according to the SoVI®, any mitigation of hazards in present-date Louisiana should account for the increasing vulnerability of the state's population. The changing racial and ethnic demographics of the state have already played a significant role historically both in the management of major disasters and in their aftermath and must be considered in terms of mitigation.

Given past experience and present data, social vulnerability should play a significantly greater role in mitigation in future plans. In 2011, the *Journal of Homeland Security and Emergency Management* published an article by a number of authors from the Center for Disease Control that describes the use of the SoVI® for emergency management, specifically exploring Hurricane Katrina's impact on Louisiana's population as an example of the necessity of including social vulnerability in hazard mitigation and preparation.[v]

Historically, a relatively high percentage of the people of Louisiana have tended to work in jobs related to the state's natural resources and geographic location, including mining (leading the nation in salt and sulfur production), drilling (with major production of crude petroleum and natural gas), agriculture of a wide variety (such as sweet potatoes, rice, and sugarcane), fishing (including shrimp and oysters), fur-trapping, and transportation (with the major national ports of New Orleans, Baton Rouge, Lake Charles, Plaquemines, and South Louisiana, which is along the Mississippi River between Baton Rouge and New Orleans). In recent years, tourism has become a larger portion of the state's economy, as has the income related to the film industry's increasing use of the state due to its recent generous tax credits.

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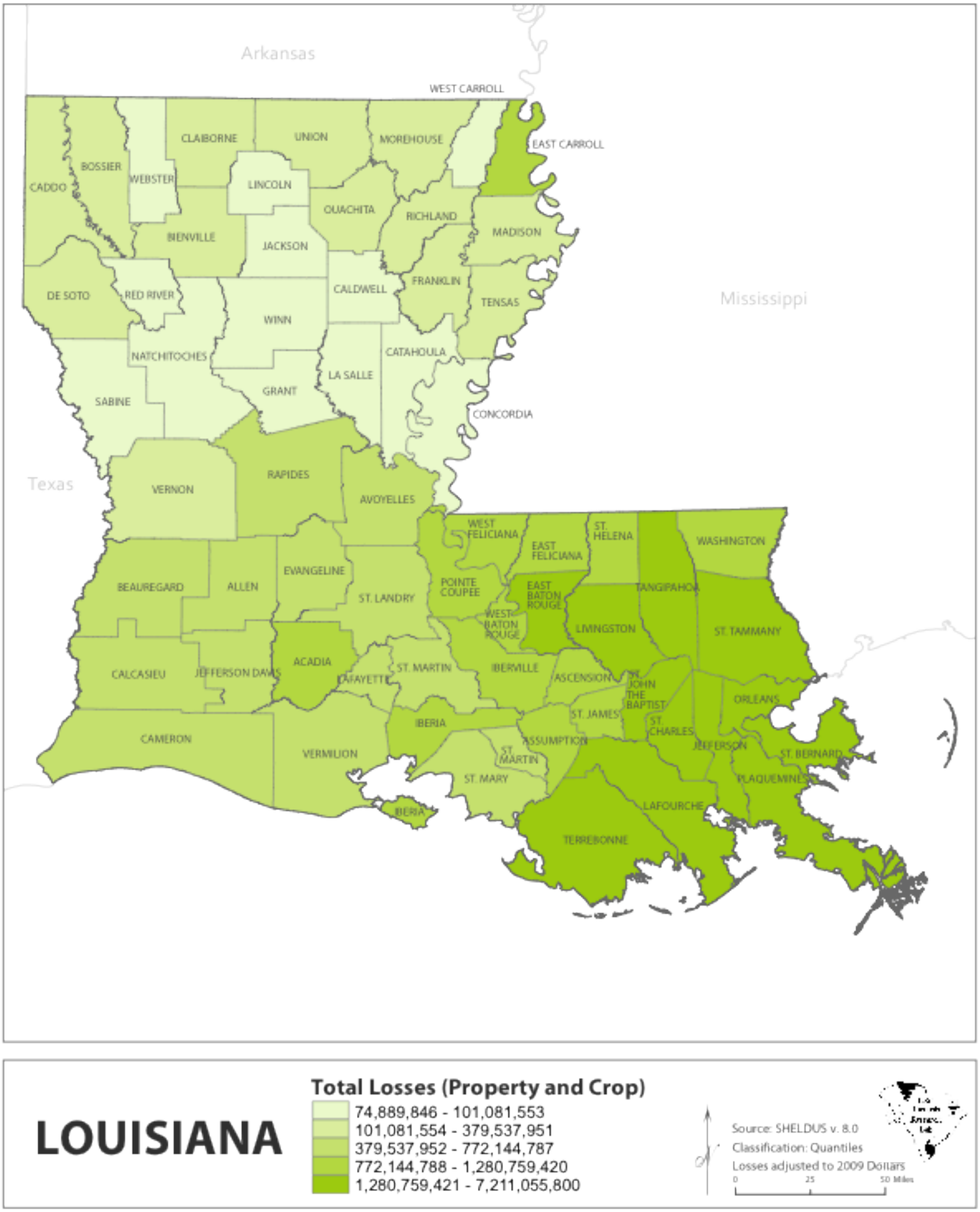
Economic Losses from Hazard Events, 1960-2009



Map 2.4. Cumulative economic (property and crop) losses from 1960 to 2009 (source: HVRI).

Changes in Development Through Land Cover Change Detection

Land cover change detection provides a powerful method to evaluate several changes in development that influence hazard prone areas. Land cover has changed in many areas throughout the state over the past two decades (Map 2.5), but the reasons for these changes vary greatly. In high population growth parishes including Ascension, Livingston, Tangipahoa, and St. Tammany (refer to Map 2.3), most land cover change is related to new construction and development. These parishes, along with every other parish in Louisiana, are part of the National Flood Insurance Program (NFIP) and new development must meet NFIP standards. Consequently, new growth and development occurs above base flood elevation (BFE), but some development does encroach on areas that are adjacent to wetlands or areas that often flood. This potentially increases the flood risks for new developments, while simultaneously altering the flood risks for other surrounding areas since the topography and hydrology of the area may be altered. Some new construction occurs in areas that are below BFE and must be "filled-in." New construction standards require a net zero change in elevation across a development and retention ponds or wetlands are constructed to offset this imbalance.

Elsewhere in the state where population changes have not occurred at as rapid a pace as in the areas north and northwest of Lake Pontchartrain, land cover change can mostly be attributed to agricultural and/or forestry changes. Many of these areas in western and northern Louisiana are areas of heavy timber harvesting and agricultural production, thus the land cover is in a constant state of flux as it transitions between crops and between forest and cut-over/open land.

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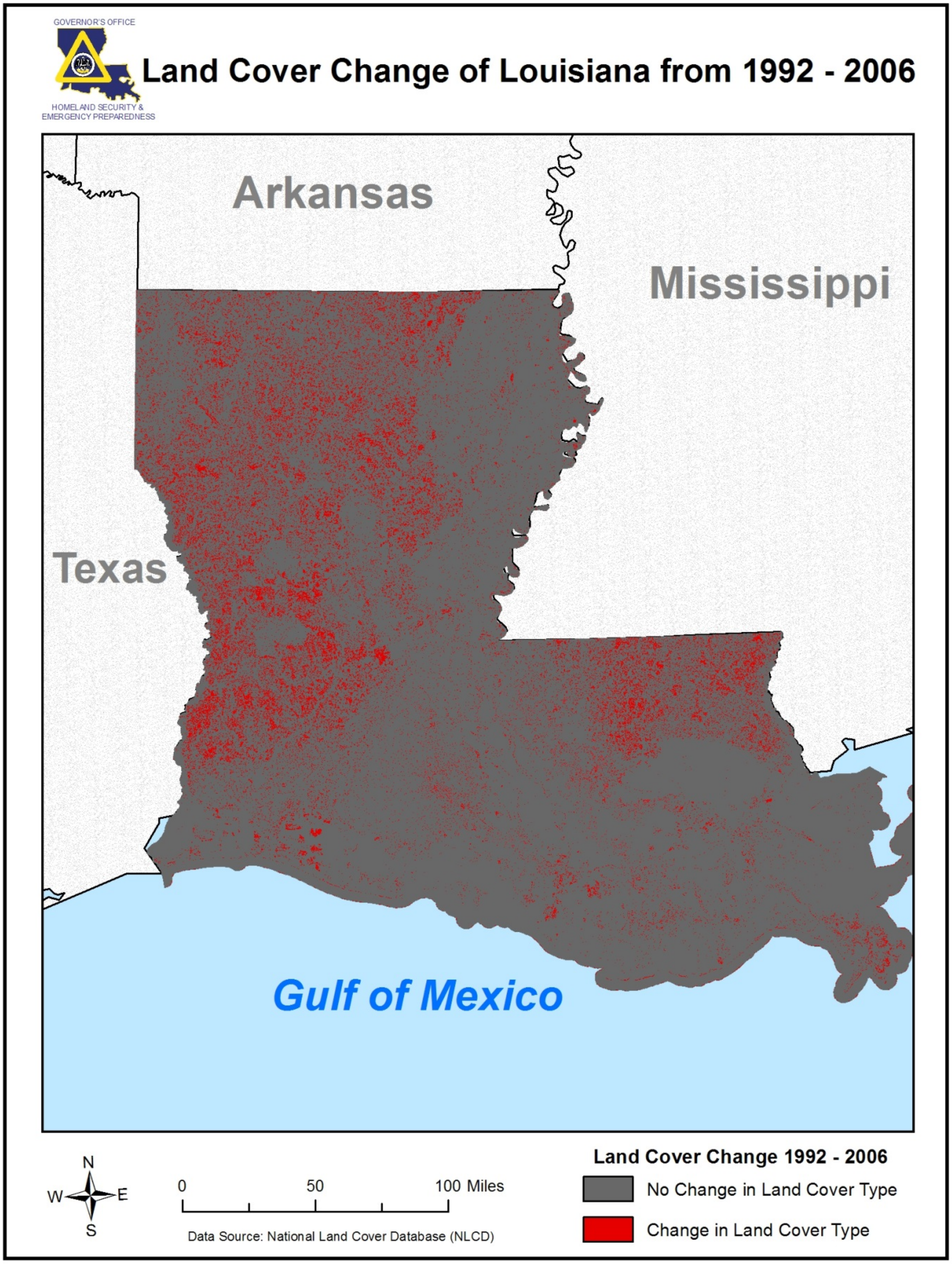


Map 2.5. Land cover change of Louisiana from 1992 to 2006.

CLIMATOLOGICAL HAZARDS

Louisiana has endured significant losses to life and property from disasters throughout its history. Moreover, the state profile (page 2-5) indicates that the worst of these disasters have affected largely the lowland areas of the state—although this plan will also specify the ways in which the rest of the state has suffered climatological, geographic, and human-influenced hazards. Thus, in accordance with federal requirements,[vi] the hazards identified and assessed for the Louisiana State Hazard Mitigation Plan are organized into two categories: **climatological hazards** and **geological/human-influenced hazards**. The categories are comprised by the following disasters:

- Climatological Hazards
  - Droughts
  - Extreme Heat
  - Flooding (including Riverine, Flash, Backwater, and Urban, as well as Ponding)
  - Thunderstorms (Hail, High Wind, and Lightning)
  - Tornadoes
  - Tropical Cyclones (i.e., Hurricanes and Tropical Storms, including Storm Surges)
  - Wildfires
  - Winter Weather (including Extreme Cold, Ice Storms, and Snow)
- Geological/Human-Influenced Hazards
  - Coastal Hazards
    - Coastal Erosion
    - Saltwater Intrusion
    - Sea Level Rise
    - Subsidence
  - Dam Failure
  - Earthquake
  - Levee Failure
  - Sinkhole

The remainder of this section will describe the previous occurrences of these disasters, their location and extent, and their annual likelihood of recurrence. Likelihood is measured as **Low**, **Medium**, or **High** through a percentage scale (0–30%, 31–70%, 71–100%, respectively) based on previous occurrences over the past 25 years. A relatable, everyday comparison will also be included for all likelihood measurements. So if a hazard occurs 20 times over the course of 25 years, its likelihood is measured at 80% (**High**), which translates to an occurrence of once every 15 months. Unless otherwise specified, only hazards with **Medium** or **High** likelihood will be considered for vulnerability analysis, which will follow immediately. In each of those risk analyses, this Plan Update describes the vulnerability of the state in terms of those jurisdictions most threatened by the hazard profiled. The data are evaluated for consideration of vulnerability in each local jurisdiction (i.e. the parish) by the following criteria: (1) number of hazard events; (2) economic damage; (3) human injuries; (4) human fatalities; (5) probability of future occurrence; and (6) previously damaged state assets. This Plan Update also relies on FEMA's Hazus-MH 2.1 software to estimate potential losses from disasters. Hazus is a national, standard methodology using models to estimate potential losses from earthquakes, floods, and hurricanes. It relies on Geographic Information Systems (GIS) technology to estimate the physical, economic, and social impacts of disasters by visualizing the spatial relationship between high-risk disaster locations and nearby populations.

In determining future likelihood, recent trends in global climate information must also be taken into account. Temperature and precipitation averages always fluctuate with time, but in recent years both have tended to increase. For instance, the historical record shows that since the mid-1970s there have been fewer days per year (between 4–7 days) than the long-term average when the temperature has been below freezing in the Southeast region. Some parts of western Louisiana have experienced more than 20 fewer freezing days. This upward trend is expected to continue, and will have significant impacts on weather-related hazards in Louisiana.[vii] Of vital importance, then, is understanding as fully as possible the state's climatological system in order to optimize efforts in mitigating the hazards it produces. As such, climate change amplification is a new addition to this Plan Update, and it will be incorporated in the profiles and risk assessments.

In Louisiana, natural hazards tend to follow seasonal and spatial patterns. In the winter and early spring, the state experiences frequent cold frontal passages, bringing considerable rainfall as well as occasional winter storms (including ice and snowfall) and tornadoes. In the summer, Louisiana is prone to afternoon thunderstorms, ranging from brief, weak storms to violent multi-day occurrences. Among the biggest threats to the state are tropical cyclones, flooding, and tornadoes. We will profile first the climatological hazards, then the geological/human-influenced hazards, proceeding alphabetically through each category.

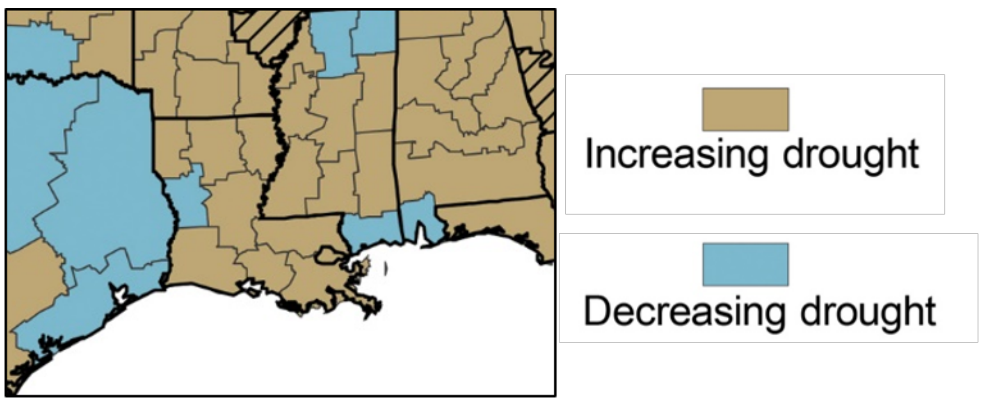
Drought

A drought is a deficiency in water availability over an extended period of time, caused by precipitation totals and soil water storages that do not satisfy the environmental demand for water either by evaporation or transpiration through plant leaves. It is important to note that the lack of precipitation alone does not constitute drought; the season during which the precipitation is lacking has a major impact on whether drought occurs. For example, a week of no precipitation in July, when the solar energy to evaporate water and vegetation's need for water to carry on photosynthesis are both high, may trigger a drought, while a week of no precipitation in January may not initiate a drought.

Drought is a unique and insidious hazard. Unlike other natural hazards, no specific threshold of "dryness" exists for declaring a drought. In addition, the definition of drought depends on stakeholder needs. For instance, the onset (and demise) of agricultural drought is quick, as crops need water every few days; once they get rainfall, they improve. But hydrologic drought sets in (and is alleviated) only over longer time periods. A few dry days will not drain a reservoir, but a few rain showers cannot replenish it, either. Moreover, different geographical regions define drought differently based on the deviation from local, normal precipitation. And drought can occur anywhere, triggered by changes in the local-to-regional-scale atmospheric circulation over an area or by broader-scale circulation variations such as the expansion of semi-permanent oceanic high-pressure systems or the stalling of an upper-level atmospheric ridge in place over a region. The severity of a drought depends upon the degree and duration of moisture deficiency, as well as the size of the affected area. Periods of drought tend to be associated with other hazards such as wildfires and/or heat waves as well. Lastly, drought is a slow onset event, causing less direct—but tremendous indirect—damage. Depletion of aquifers, crop loss, and livestock and wildlife mortality rates are examples of direct impacts. Since the groundwater found in aquifers is the source of about 38% of all county and city water supplied to households (and comprises 97% of the water for all rural populations that are not already supplied by cities and counties), droughts can potentially have direct, disastrous effects on human populations.[viii] The indirect consequences of drought such as unemployment, reduced tax revenues, increased food prices, reduced outdoor recreation opportunities, higher energy costs as water levels in reservoirs decrease and consumption increases, and water rationing are not often fully known. This complex web of impacts causes drought to affect people and economies well beyond the area physically experiencing the drought.

This hazard is often measured using the Palmer Drought Severity Index (PDSI, also known operationally as the Palmer Drought Index). The PDSI, first developed by Wayne Palmer in a 1965 paper for the U.S. Weather Bureau, measures drought through recent precipitation and temperature data with regard to a basic supply-and-demand model of soil moisture. It is most effective in long-term calculations. Three other indices used to measure drought are the Palmer Hydrologic Drought Index (PHDI); the Crop Moisture Index (CMI), which is derived from the PDSI; and the Keetch-Byram Drought Index (KBDI), created by John Keetch and George Byram in 1968 for the U.S. Forest Service. The KBDI is used mainly for predicting likelihood of wildfire outbreaks and will be discussed further with regard to that hazard. As a compromise, the PDSI is used most often for droughts since it is a medium-response drought indicator. Due to the varying types and severities of drought that rely on different indicators, great caution should be exercised in interpreting and inferring from the results of the PDSI maps shown here.

As Map 2.6 shows, results from the PDSI indicate that the drought risk across most of Louisiana increased, although not significantly from a statistical perspective, between 1958 and 2007. The PDSI best measures the duration and intensity of drought-inducing circulation patterns at a somewhat long-term time scale, although not as long term as the PHDI. Long-term drought is cumulative, so the intensity of drought during the current month is dependent on the current weather patterns plus the effects of cumulative patterns of previous months—or longer. Based on Map 2.6, the entire state, with the exception of a small portion below Shreveport, has experienced increasing drought conditions since 1958.



Trends in end-of-summer drought as measured by the Palmer Drought Severity Index from 1958 to 2007 in each of 344 U.S. climate divisions. Hatching indicates significant trends. Image Reference: Guttman, N. B., and R. G. Quayle. "A Historical Perspective of U.S. Climate Divisions." Bulletin of the American Meteorological Society 77, no. 2 (1996): 293-303.

Map 2.6. Observed drought trends between 1958 and 2007. Source: *Global Climate Change Impacts in the United States* (U.S. Global Change Research Program).

Although weather patterns can change almost literally overnight from a long-term drought pattern to a long-term wet pattern, as a medium-response indicator, the PDSI responds relatively rapidly.[ix] Map 2.7 indicates the severity of drought conditions in Louisiana at the time this Plan went to publication using data compiled by the National Drought Mitigation Center.

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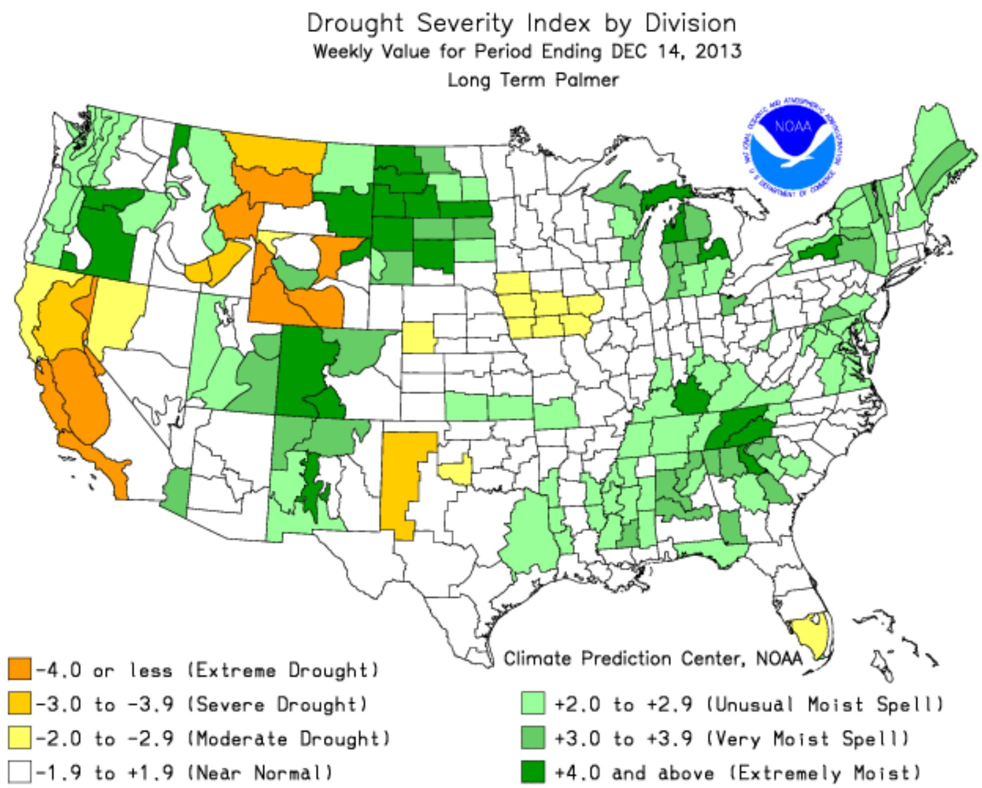

Map 2.7. Palmer Drought Severity Index and categories by climate division, December 14, 2013 (source: National Drought Mitigation Center).

The experimental “Long-Term Blend” (shown in Map 2.8) approximates drought-related impacts (such as reservoir stores, irrigated agriculture, groundwater levels, and well water depth) that respond to precipitation on time scales ranging from several months to a few years by blending data from those time scales. Map 2.8 also details the data input used and the percentile at which they are used for the indicator.

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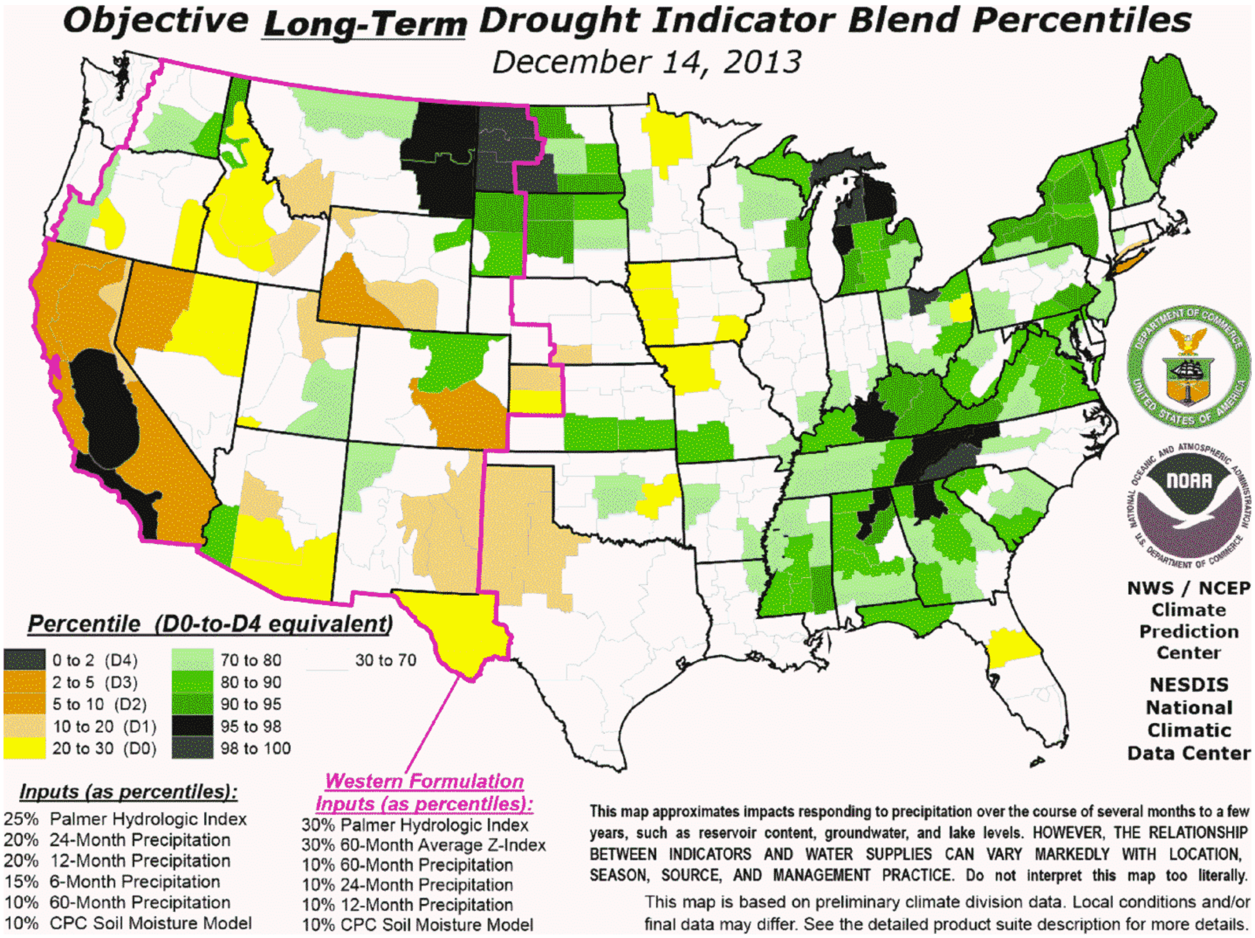

Map 2.8. Long-term drought prediction by climate division.

DROUGHT PROFILE

Louisiana contains a diversity of landscapes heavily reliant on its abundant water supply. Consequently, droughts have the potential to cause economic losses to water-intensive sectors of the economy, including agriculture, ranching, forestry, and fisheries. While data from SHELDUS do not show a history of extreme droughts in Louisiana, a severe drought would affect those industries appreciably. However, drought is an expected and anticipated hazard in those industries, and those susceptible continuously take steps to prepare for and mitigate against its effects. Crop insurance assures that should drought negatively affect those industries, they have effective means to recover.

Drought can affect every jurisdiction of Louisiana, but the SHELDUS dataset shows that it has caused no fatalities, no injuries, and no property damage in the past 25 years. In fact, a federal disaster declaration due to drought has only occurred once—in association with the Great Western Drought of 1977. Even then, Louisiana did not experience the same levels of drought as many states west of the Mississippi. Between 1987 and 2012, no Louisiana parish has experienced more than seven discrete drought events, leading to a future likelihood of roughly one drought every four years. Future likelihood for droughts is thus considered **Low**. Based on the results of the hazard profiling for this Plan Update, drought is not considered significant by the SHMPC in comparison to the other profiled hazards. Therefore, a technical risk assessment is not included.

Although drought is not a significant threat at this time, it should be noted that future changes in rainfall totals for the southeastern region of the United States, including Louisiana, are still highly uncertain.[x] It is projected that the amount of total available water will decline, perhaps even if precipitation increases.

EXTREME HEAT

In the same way that there is no single operational drought threshold, there is no operational definition for defining heat or a heat wave. Heat waves are the consequence of the same weather pattern as drought and therefore both hazards often occur concurrently. A heat wave is an extended period of oppressive and above normal temperatures over a given period of time. The World Meteorological Organization recommends the declaration of a heat wave when the daily maximum temperature exceeds the average maximum temperatures by 9 F° and lasts for a period of at least five days.

However, temperature alone is insufficient to describe the stress placed on humans (as well as flora and fauna) in hot weather. It is crucial to consider the effect of relative humidity since it is essential to the body's ability to perspire and cool. Once air temperature reaches 95° F, perspiration becomes a very significant biophysical mechanism to ensure heat loss. Perspiration is ineffective as a cooling mechanism if the water cannot evaporate (i.e., sweating in high relative humidity is reduced as compared to during dry conditions). To communicate this relationship between temperature and humidity, the National Weather Service (NWS) developed the Heat Index (HI), which provides a warning system based on a combination of air temperature and relative humidity. The HI is presented in Table 2.2. The NWS devised the index for shady, light wind conditions, and thus advises that the HI value can be increased by as much as 15 F° if a person is in direct sunlight, and that strong winds of hot, dry air can be extremely hazardous.[xi]

Table 2.2. Heat Index advisory based on air temperature (° F) and relative humidity (source: National Weather Service).

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution   Extreme Caution   Danger   Extreme Danger

Most heat disorders (e.g., sunburn, heat cramps, heat exhaustion, and heat stroke) occur because the victim has been overexposed to heat or has over-exercised considering age and physical condition. Other circumstances that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality. Seniors and children are most at risk from adverse heat effects. Extreme heat can also damage roads, bridges, pipelines, utilities, and railroads. High temperatures can be partially responsible for deflection of rails and related railroad accidents.

EXTREME HEAT PROFILE

According to NOAA, extreme heat is the leading weather-related cause of deaths in the United States.[xii] And while heat-related deaths in Louisiana are not common, due in part to the consistency and predictability of high seasonal temperatures, they do occur, and are still very intense and dangerous. Such deaths happen in a variety of circumstances, often in ways that are not easily categorized because they are unexpected. For instance, although exposure to heat is higher at the beach than usual, NOAA does not track heat-related deaths there because such deaths happen infrequently. Instead, heat-related deaths are characterized by highly individual circumstances. In June of 2010, the *Beauregard Daily News* reported that a two year-old boy died of heat exhaustion in Hineston after he climbed into an unlocked car and became trapped for less than one hour in the afternoon. The heat index in the area (recorded at Alexandria International Airport) had a value of 110° F, given a high of 99° F and a dew point of 72° F. In August of 2011, a roof worker in Houma was overcome by heat and died in a heat index near 105° F. In September of 2012, with temperatures in the mid-90°s F across southeastern Louisiana and power outages there from Hurricane Isaac, several cases of heat exhaustion were reported, causing at least one fatality from heat stroke.

Although all of Louisiana is vulnerable to extreme heat, summer temperatures can often exceed 100° F in the northern parishes, particularly during dry spells when clear skies allow increased solar radiation to reach the surface; afternoon highs there have occasionally reached 110° F, with an all-time extreme of 114° F recorded in Plain Dealing (Bossier Parish) on August 10, 1936, during the 1936 North American Heat Wave.[xiii] Extreme heat events tend to affect the northern parishes with greater severity due to a reduced moderation of temperatures by the Gulf (see Map 2.9 for average July maximum daily temperatures in the state by parish). Moreover, temperatures are actually recorded at a height of 1.5 meters, in a “Stevenson screen.” Thus, certain conditions—such as beneath heat-absorbent clothing or on large, sunlight-exposed surfaces—undoubtedly lead to higher actual temperatures.

One of the worst extreme heat events occurred in 1998, with 27 days of temperatures over 100° F, causing 20 deaths. According to the United States Global Change Research Program[xiv], assuming that fossil fuel emissions increase temporally, Louisiana can expect a significant increase in the number of days per year with peak temperature over 90° F over the next decades. Furthermore, the number of very hot days is predicted to rise at a greater rate than the average temperature.[xv] See Map 2.10 for a comparison of the number of days over 90° F between the recent past (1961–1979) and 70–80 years from now. The average annual temperature in the Southeast is likely to increase by 4–8 F°. Temperatures in inland areas will likely increase more than those along the coast by 1–2 F°.[xvi] The increasing frequency of very hot days can have serious consequences for human health, drought, available water, energy production, and wildfires, among other things. Overall, between 1995 and 2008, 47 deaths occurred in the state as a result of extreme heat.[xvii]

Based on historical record and projections for the future, the probability of future occurrences of extreme heat is **High**. However, high temperatures and extreme heat are such a pervasive fact of life in Louisiana that their hazardous potential is rarely overestimated. The state's citizens are habituated to heat and its negative effects and have developed lifestyles to accommodate its omnipresence. Moreover, everyone has access to a building equipped with air conditioning units since all public buildings have them, and most private buildings have long been equipped with them as well. Based on the results of the hazard profiling for this plan update, as well as the population's relative readiness to handle this hazard, extreme heat is not considered significant by the SHMPC in comparison to the other profiled hazards. Therefore, a technical risk assessment is not included. Nevertheless, other agencies and private stakeholders should take any action possible to minimize the negative effects of extreme heat.

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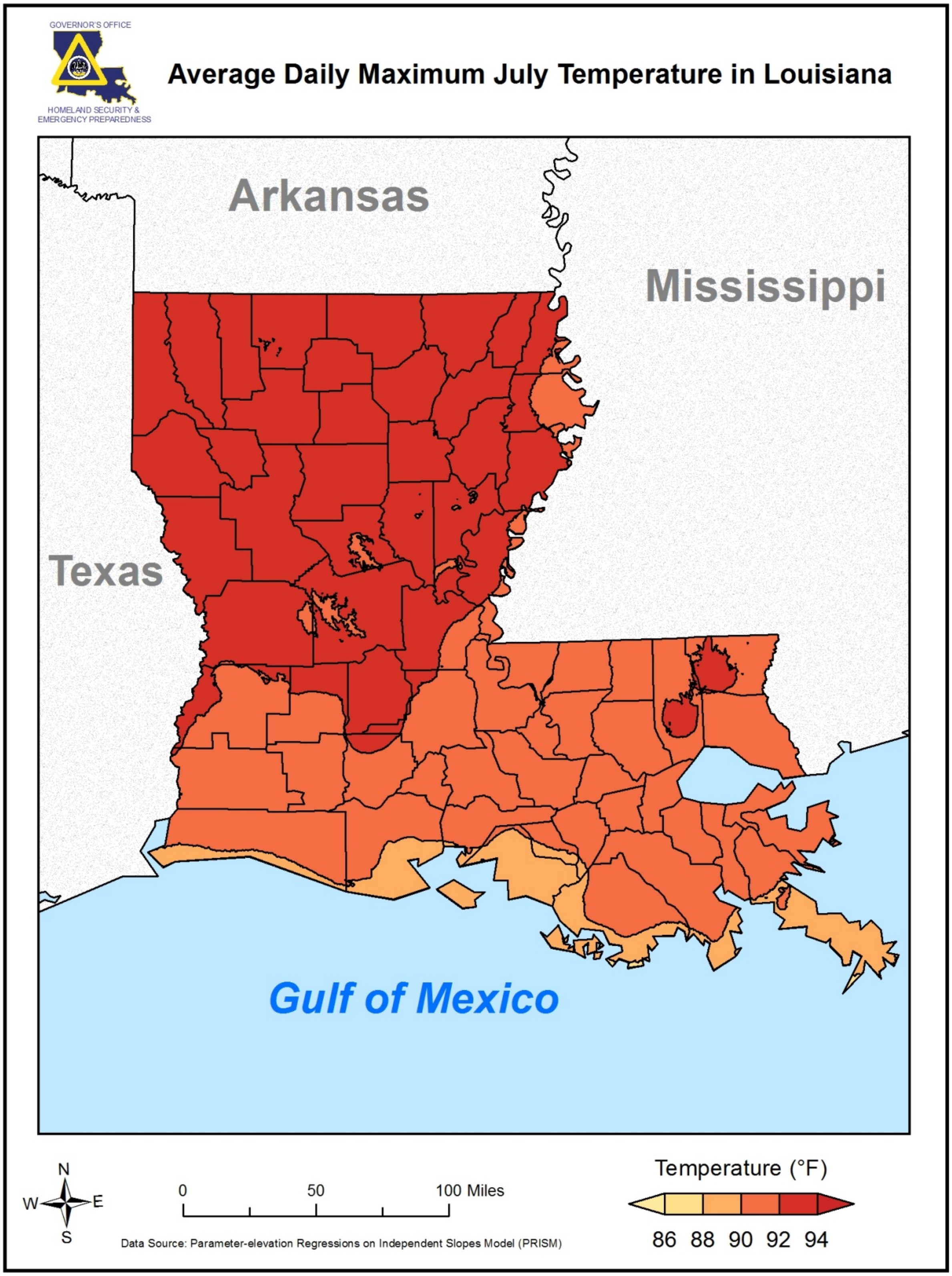
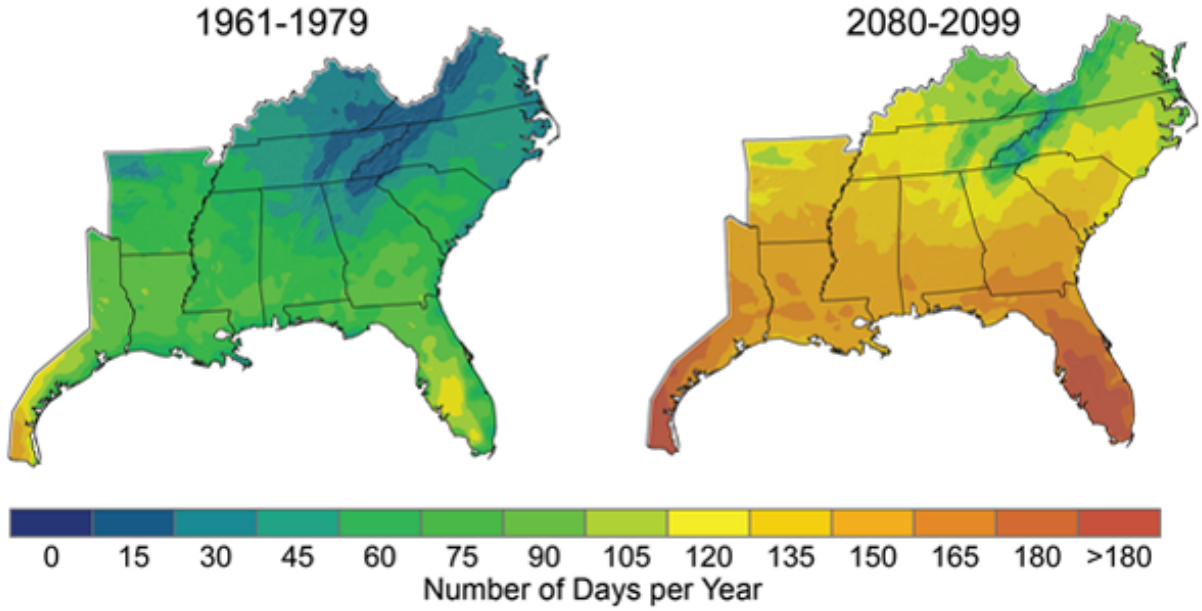


Map 2.9. Average daily maximum temperature in July in Louisiana, by parish.



Map 2.10. Number of days per year with peak temperatures over 90° F, under higher emissions scenario (map courtesy of Global Climate Change 2009 Report).

Flooding

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

> [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.[xviii]

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 more overwhelmingly of the flash flood variety, as opposed to the slower-developing river floods caused by heavy streamflow during the cooler months.

In those 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 10 in. 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 streamflow across the state. Together, then, these characteristics increase the potential for high water; low-lying, poorly drained areas are particularly prone to flooding during these months.[xix]

In Louisiana, five specific types of floods are of main concern: riverine, flash, ponding, backwater, and urban.

- **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 bankfull 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 a locally intense precipitation inundates an area in a short amount of time, resulting in local streamflow 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. Although the town was protected by a levee on the side facing the Mississippi, floodwaters from Lake Maurepas 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 sea water, 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). These direct causes come from storm surges, tsunami, and gradual sea level rise.

Based on stream gauge levels and precipitation forecasts, the NWS posts flood statements watches and warnings. The NWS issues the following weather statements with regard to floods[xx]:

- Flood Categories
    - Minor Flooding - minimal or no property damage, but possibly some public threat.
    - Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations.
    - Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
    - Record Flooding - flooding which equals or exceeds the highest stage or discharge at a given site during the period of record keeping.
- Flood Warning
    - Issued along larger streams when there is a serious threat to life or property.
- Flood Watch
    - Issued when current and developing hydrometeorological conditions are such that there is a threat of flooding, but the occurrence is neither certain nor imminent.

Floods are measured mainly by probability of occurrence. A 10-yr flood event, for example, is an event of small magnitude (in terms of streamflow or precipitation) but with a relatively high annual probability of recurrence (10%). A 100-yr flood event is larger in magnitude, but it has a smaller chance of recurrence (1%). A 500-yr flood is significantly larger than both a 100-yr event and a 10-yr 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*-yr 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. As such, the ASFPM also expresses the 100-yr flood event has having a 25% chance of occurring over the life of a 30-yr mortgage.[xxi]

It is essential to understand that the magnitude of an *x*-yr 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-yr flood events can have very different impacts. The 100-yr 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-yr event for the Mississippi River means something completely different in terms of discharge values (ft^3/s) than, for example, for the Amite River. Not only are the magnitudes of 100-yr events different between rivers, they can be different along any given river. A 100-yr event upstream is different from one downstream since river characteristics (volume, discharge, and topography) change. As a result, the definition of what constitutes a 100-yr 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 streamflow, 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-yr 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 2.1.

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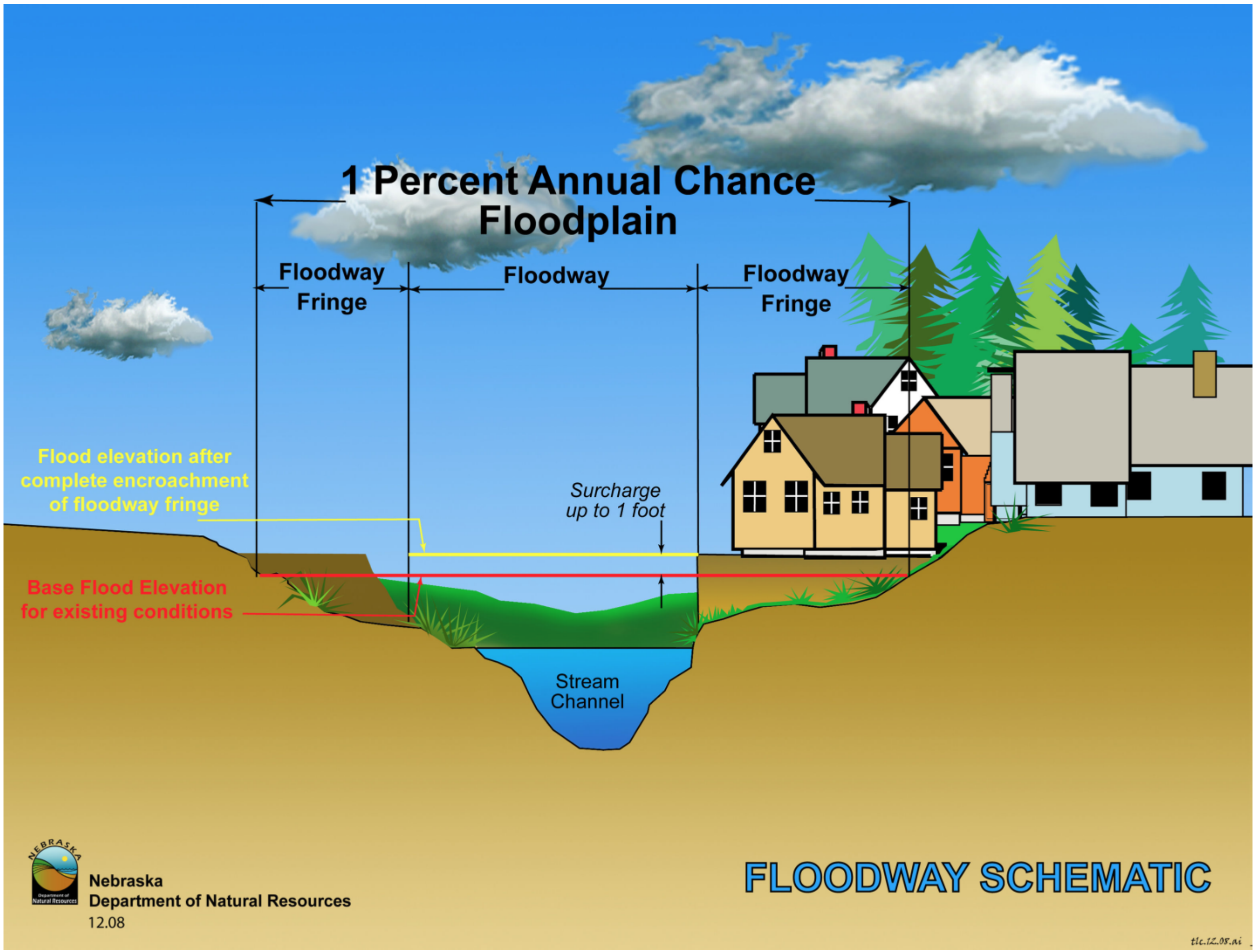


Figure 2.1. Schematic of 100-yr floodplain. The special flood hazard area (SFHA) extends to the end of the floodway fringe (source: Nebraska Department of Natural Resources Desk Reference).

A SFHA is the land area covered by the floodwaters of the base flood (the red line), where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies.[xxii]

Flooding Profile

Louisiana has experienced significant flooding in its history and can expect more in the future with the effects of climate change and coastal erosion.[xxiii] In recent years, Louisiana has experienced major flooding, often due to the tropical cyclones that have affected the state. Rainfall has contributed significantly, too. The past decade alone has experienced the most days of heavy precipitation per year than any decade in the past century.[xxiv] For instance, just a bit over a decade ago, Tropical Storm Allison caused severe flooding throughout the state in 2001, inundating thousands of homes and streets with rain, reaching levels of 30 in. in some places. The Bogue Falaya, Amite, and Comite Rivers all reached record and near-record flood levels.

Damage from the flooding resulted in losses around $30 million with disaster declarations in 27 parishes. The flooding effects of Hurricane Katrina (2005) were extremely deadly, but as they largely resulted from levee breaching, that kind of disaster will be covered in the Levee Failure Risk Assessment.

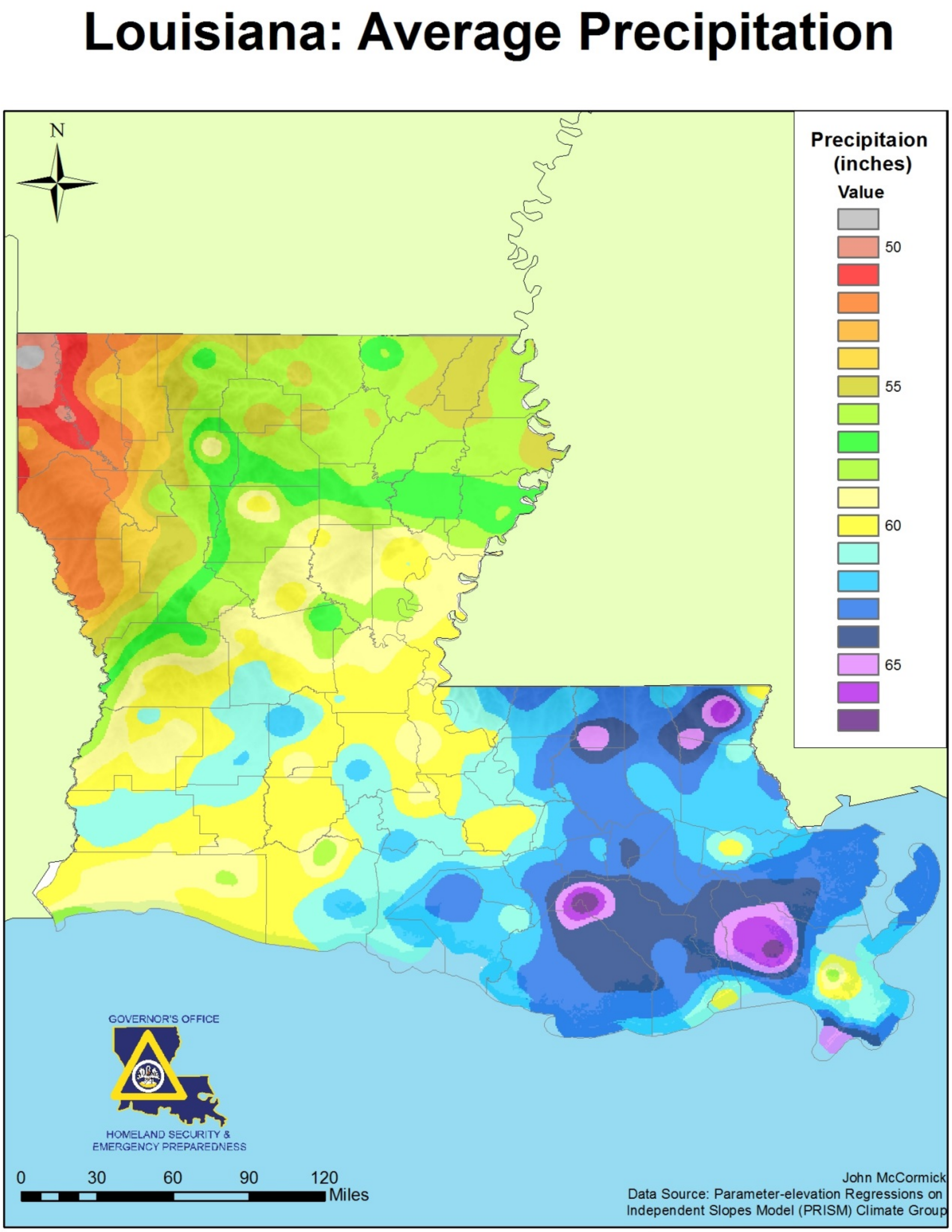
Louisiana has of course experienced disastrous flooding through non-cyclone-initiated floods, most of which have occurred along the Mississippi River. Table 2.3 details years that experienced major floods along the Lower Mississippi. Such floods are so significant due to the great size of the river. And as indicated in the CLIMATE overview of this section, since there is virtually no contribution to the Mississippi River from Louisiana itself, the effects from precipitation and snowmelt from the Ohio and Missouri Rivers have a significant impact on the Mississippi's streamflow throughout Louisiana.

Table 2.3. Years with major Lower Mississippi River flooding from 1700-2013 (source: Vega, Grymes, Rohli 136).

YEARS OF MAJOR FLOODS ON THE LOWER MISSISSIPPI (1700-PRESENT)	
1700s	1718, 1735, 1770, 1782, 1785, 1791, 1796, 1799
1800s	1809, 1811, 1813, 1815, 1816, 1823, 1824, 1828, 1844, 1849, 1850, 1851, 1858, 1859, 1892, 1893
1900s	1903, 1907, 1908, 1912, 1913, 1916, 1920, 1922, 1923, 1927, 1929, 1932, 1936, 1937, 1945, 1950, 1957, 1958, 1973, 1974, 1975, 1979, 1983, 1984, 1993, 1997
2000s	2011

While Table 2.3 indicates one year of historic Mississippi flooding in the past decade, Louisiana has certainly experienced other kinds of major floods in that time. In December 2009, for instance, nine Louisiana parishes received a FEMA Disaster Declaration for flooding, tornadoes, and severe storms. Most of these parishes were in northern and central Louisiana. A series of heavy rainfall events and severe storms throughout the state led to rivers and creeks overflowing their banks, causing widespread flood damages. Map 2.11 shows the average annual precipitation totals in Louisiana (using data from 1961 to 1990), indicating where the most rainfall tends to occur.

The floods of the 2011 water year—which extends from October 1 of the previous calendar year to the following September 30—were indeed historic. The NWS reported in its 2011 Flood Loss Report that direct flood damages that year totaled $8.73 billion (2013 USD), with 108 flood-related deaths (61 were vehicle related and 71 were flash-flood related). Many of the nation's largest rivers (Missouri, Ohio, and Mississippi) experienced record flood events. The most significant instigating factor was the meltwater from heavy snow in 2010, which caused unavoidable flooding throughout the Mississippi River basin. Record spring rainfalls from Tulsa to Cincinnati contributed to the snowmelt-induced flooding. Nearly half of the annual damages came from Ohio and Lower Mississippi River flooding.[xxv] Of this damage, Louisiana experienced



Map 2.11. Average annual precipitation totals, 1981-2010 (map by ETSU undergraduate John McCormick).

one direct fatality and about $3.5 billion in damages. Louisiana's population and (still significant) economic losses due to the historic flooding were probably mitigated mainly by the opening of the Morganza Spillway to avoid levee breaching and further flooding in Baton Rouge and New Orleans. Louisiana experienced a relatively major flood event recently, in early January 2013, when a stalled frontal boundary produced an extended period of rainfall, thunderstorms, and a few tornadoes. Massive flooding occurred along the Mermentau River, where rainfall exceeded 1 ft. in some locations.[xxvi]

Although general flooding can happen anywhere in the state, areas along the major rivers and in the coastal region are at the greatest risk of flooding. Map 2.12 shows the extent of 100-yr floodplains—and thus FEMA's flood zones. Map 2.13 reveals that a much greater percentage of the southern parishes than the northern parishes are located in Flood Insurance Rate Map (FIRM) flood zones, and Map 2.14 shows that larger percentages of parish populations are located in flood zones in those parishes. Floods along the lower half of the major north–south flood axis along the Mississippi and Atchafalaya Rivers in Map 2.12 (i.e., from southwestern corner of Mississippi to the Gulf of Mexico) more often result from upstream runoff (riverine floods) rather than local rainfall (flash floods).[xxvii] Flooding in this region can have significant economic and emergency response impacts. The combination of major ports there—the Ports of New Orleans, Baton Rouge, Plaquemines, and South Louisiana—also increases boating activity, including casinos, and may have repercussions for emergency response operations. Flooding that triggers emergency response may have to be adjusted to allow additional time for responders to deal with additional traffic, potential property damage, and at-risk tourist population. Frequent flooding of any kind is of particular concern in areas of active real estate growth and development. Additionally, even if a developer accounts for flooding in planning and provides adequate drainage for a home, newly developed land upstream might make the initially adequate drainage insufficient, through no fault of the developer or homeowner.

In all, the primary focus in Louisiana for flood mitigation is on repetitive losses (RLs). The National Flood Insurance Act (NFIA) defines RLs as properties that are currently insured under the NFIP and have had two or more claims greater than $1,000 paid by the NFIP within any 10-yr period. The NFIA defines severe repetitive flood loss properties (SRLs) as a subset of repetitive loss properties that have experienced even greater damage. They have had at least four claims payments of over $5,000 paid by the NFIP with at least two occurring within a ten-yr period, the cumulative amount exceeding $20,000, or with at least two separate claims that exceed the value of the home when combined.[xxviii] The State of Louisiana has a defined process for maintaining up-to-date repetitive flood loss data; GOHSEP receives an updated listing of RLs and SRLs from FEMA Region VI on a monthly basis. These data are stored following very specific protocols to ensure that the most recent data are consistently available and that Privacy Act regulations are followed.

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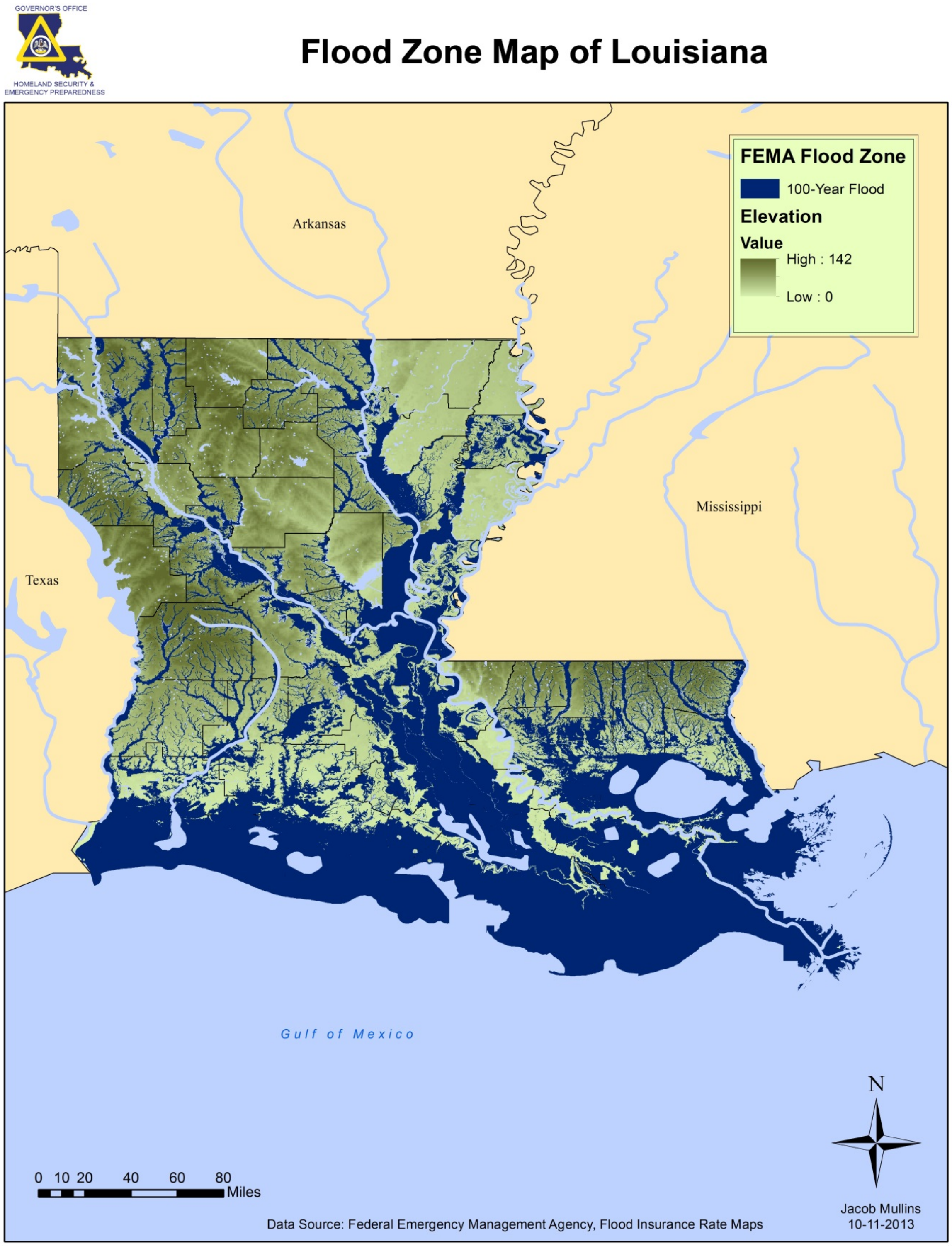
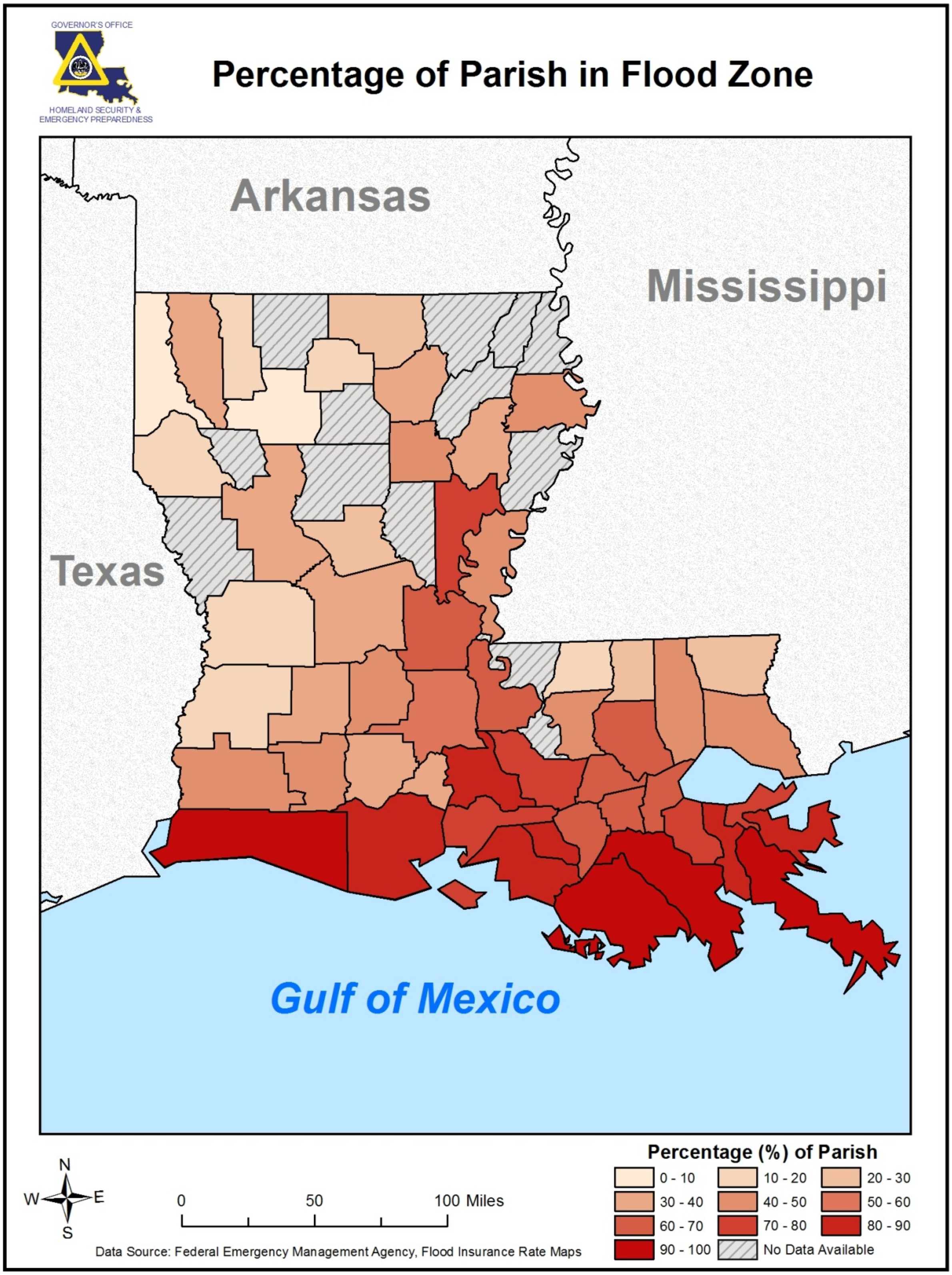
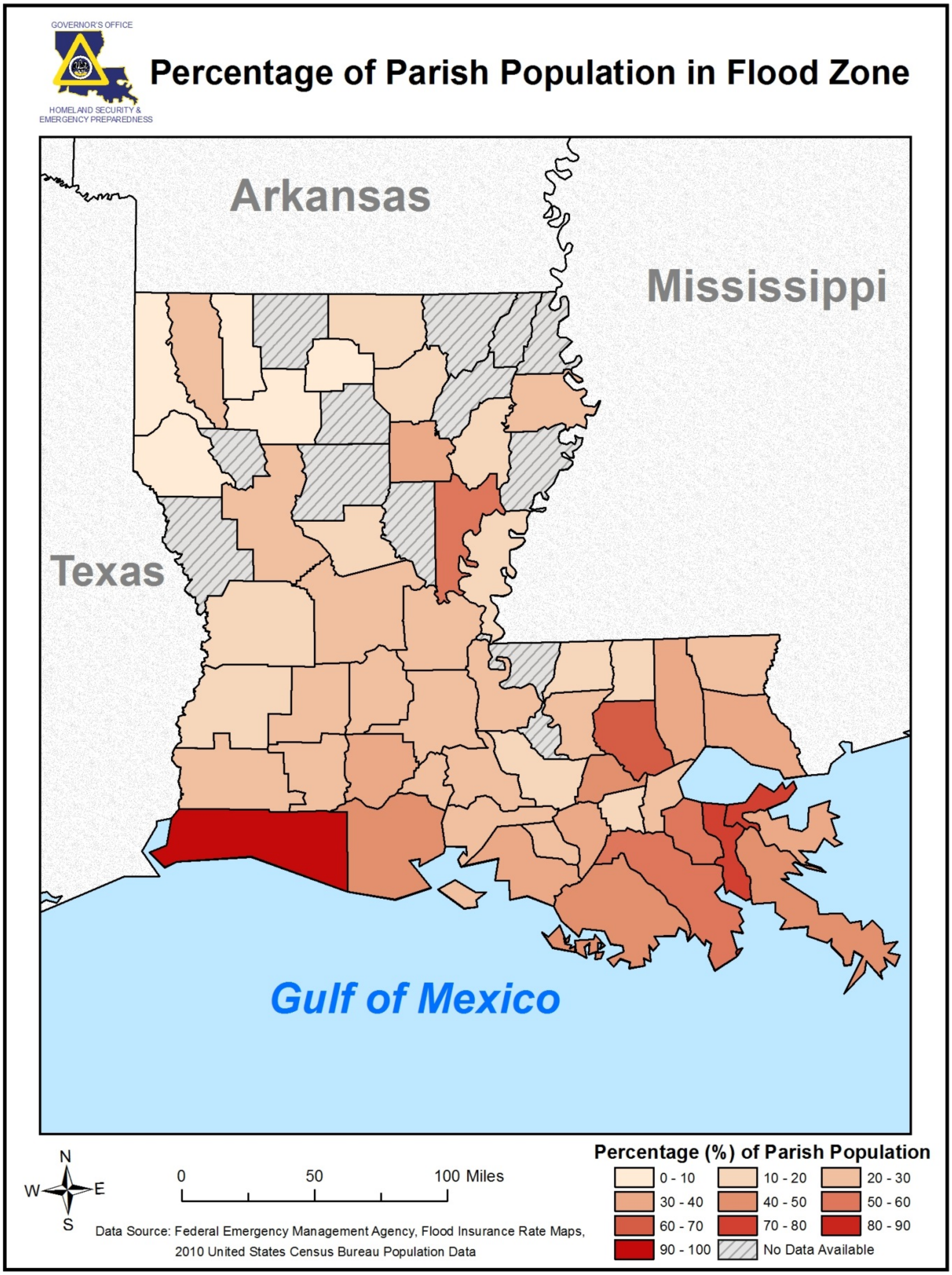


Map 2.12. Extent of 100-yr floodplains (areas with 1% chance on average of being inundated in any given year) in Louisiana (map by ETSU undergraduate Jacob Mullins).



Map 2.13. Percentage of Louisiana parishes located in Flood Insurance Rate Map (FIRM) flood zones.



Map 2.14. Percentage of population located in Flood Insurance Rate Map (FIRM) flood zones, by Louisiana parish.

Livingston, Tangipahoa, and St. Tammany parishes are at high risk (greater than 2.0 composite risk score) to flooding and have experienced significant population increases of more than 10% since 2000 with Livingston parish experiencing a greater than 20% increase in population (see Map 2.3). As a result, the vulnerability of these parishes to flooding has increased. No parishes that are at high risk to flooding experienced a significant population decrease of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability to flooding has not decreased measurably in any part of the state.

Flood studies identify floodplain areas and associate possible flood elevations in the floodplains with probabilities of occurrence. But it should be noted that the Advisory Base Flood Elevations (ABFEs) released for southeastern Louisiana do not fully account for the possibility of catastrophic flooding as a result of levee failure. Instead, they represent a compromise between projected flood levels based on stormwater drainage and the inundation levels reached following Hurricane Katrina. Other areas of the state have outdated ABFEs that do not take into account significant changes in drainage patterns due to development. Additionally, FIRMs are only estimates of flood levels. Floodwaters rarely stop exactly at the line drawn on the map.

Flooding Risk Assessment

Generally, floods with higher flood stages have lower chances of occurring. Minor flooding is virtually a yearly occurrence for a number of rivers and tributaries, and major floods occur regularly in Louisiana. Since one-third of Louisiana's parishes have experienced floods on average more than once every 20 months (60% likelihood)—with other parishes experiencing them on average more than once every six months—the probability of flooding in Louisiana is **High**, and are thus subject in this Plan to vulnerability and impact analyses. Map 2.15 suggests the probability of future occurrence based on past data. While the whole state is subject to flooding at least once every couple of years, Calcasieu and Beauregard Parishes, along with Caddo, Morehouse, and Rapides Parishes, suggest the greatest probability of more extensive future flooding: about 1–2 times per year.

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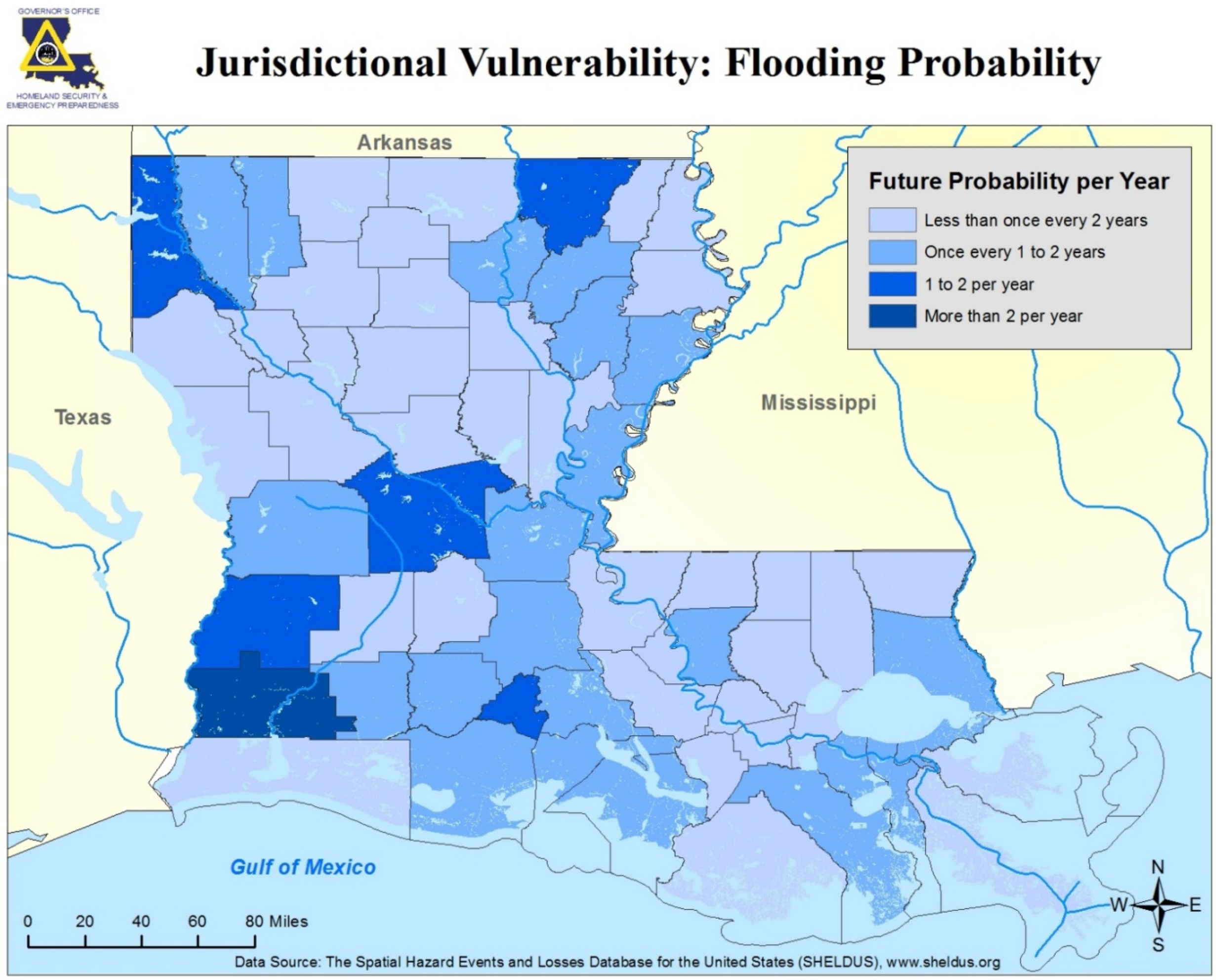
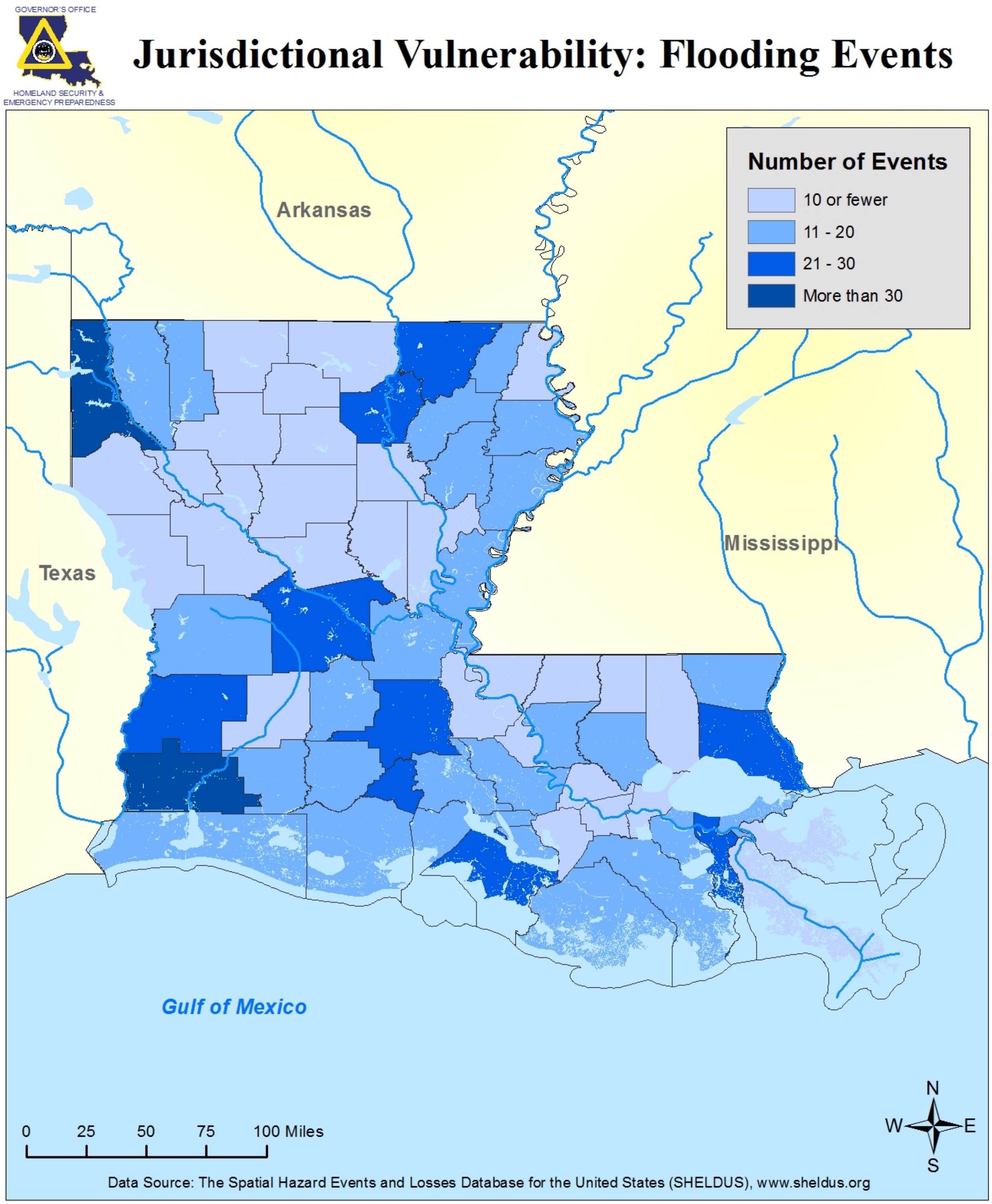
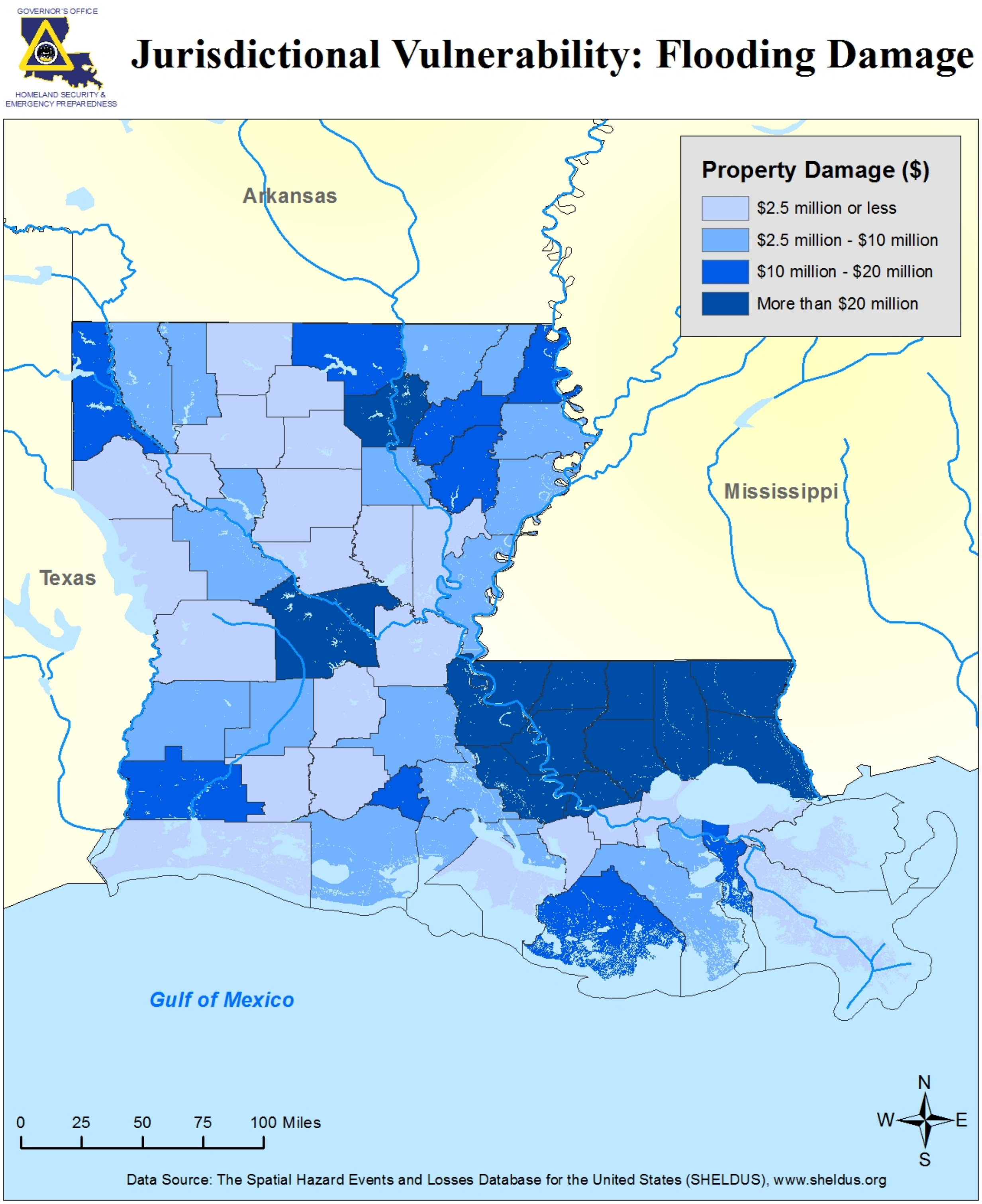


Map 2.15. Probability of flooding in Louisiana by parish based on data from 1987–2012.

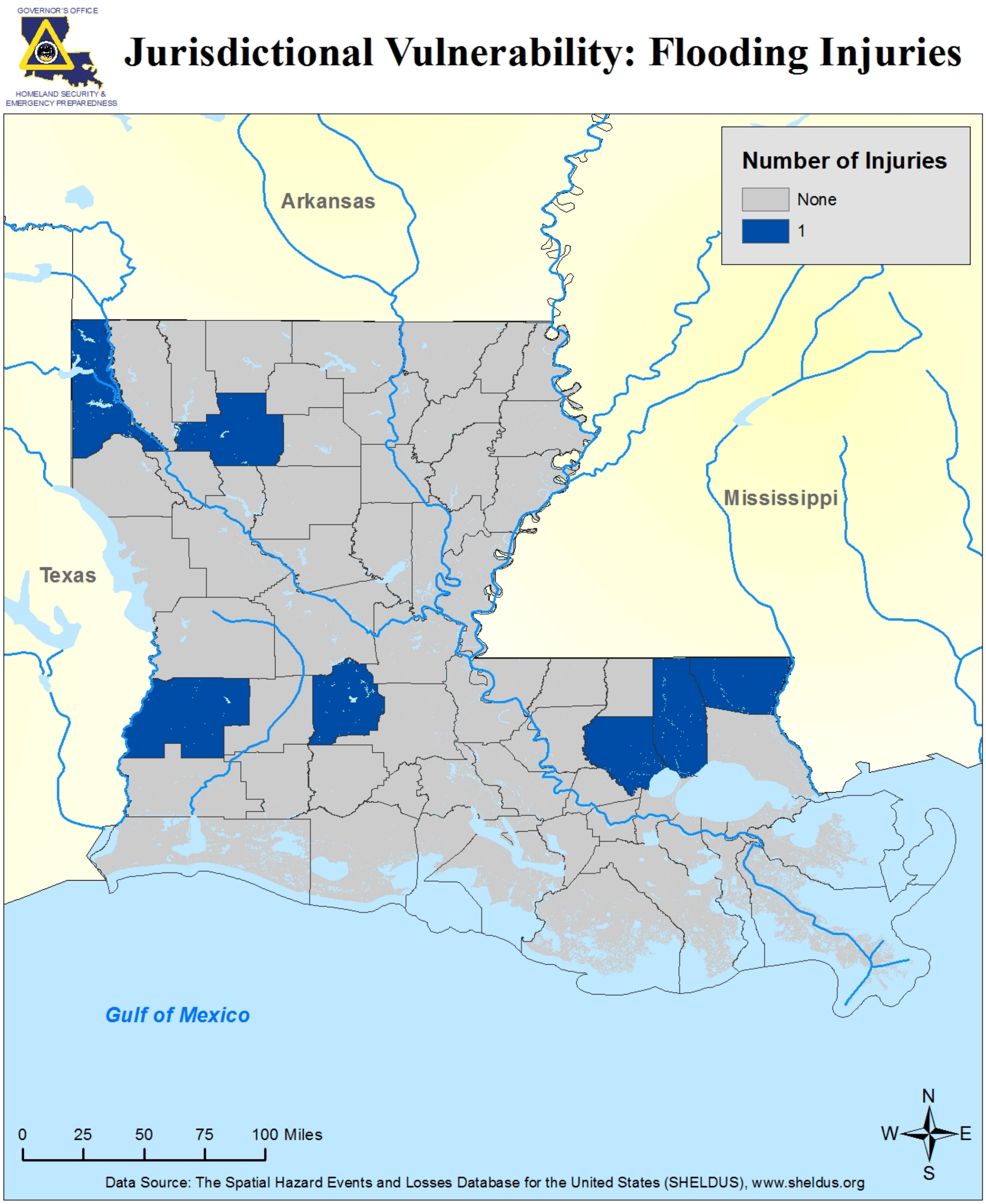
Maps 2.16, 2.17, 2.18, 2.19 identify how floods have affected the parishes of Louisiana from 1987 to 2012 in terms of total events, economic damage, injuries, and fatalities, respectively. Based on the data represented, each section of the state has its own riverine hazards associated with flooding. In the northeastern parishes, the Ouachita River and the rivers feeding with it and the Tensas River down into the Atchafalaya seem to threaten the most flooding. In the northwestern region, the Red River and its tributaries are a major threat, contributing significantly to the state's fatalities and damages from flooding. In the southwestern parishes, the area around the Calcasieu River and the tributaries that feed into Calcasieu Lake, along with the Sabine River on the Texas border, are associated with that region's flooding. In the southeastern parishes, where flooding is rampant and especially destructive, the Mississippi, Tangipahoa, and Bogue Chitto Rivers as they flow into the wetlands and Gulf seem to cause that region's major flooding. Livingston, Tangipahoa, and St. Tammany Parishes are at high risk (greater than 2.0 composite risk score) to flooding and have experienced significant population increases of more than 10% since 2000 with Livingston parish experiencing a greater than 20% increase in population (see Map 2.3). As a result, the vulnerability of these parishes to flooding has increased. No parishes that are at high risk to flooding experienced a significant population decrease of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability to flooding has not decreased measurably in any part of the state.



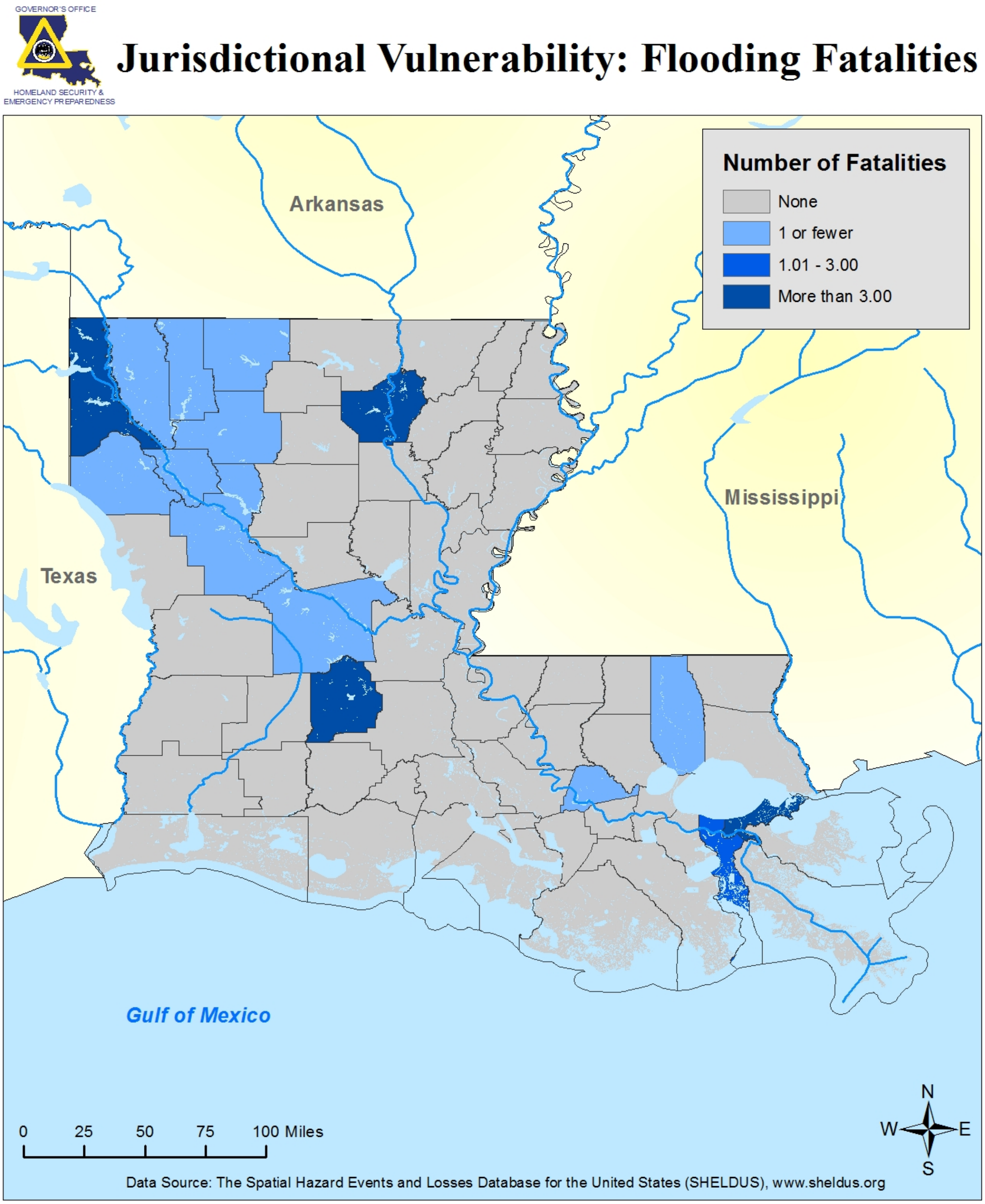
Map 2.16. Louisiana jurisdictional vulnerability for flooding events based on data from 1987–2012.



Map 2.17. Louisiana jurisdictional vulnerability for damage from flooding based on data from 1987–2012.



Map 2.18. Louisiana jurisdictional vulnerability for injury from flooding based on data from 1987–2012.



Map 2.19. Louisiana jurisdictional vulnerability for fatalities from flooding based on data from 1987–2012.

Map 2.20 locates Louisiana's state assets previously damaged by floods in terms of the state's 100-yr flood zones. State-owned critical facilities located in areas affected by flooding are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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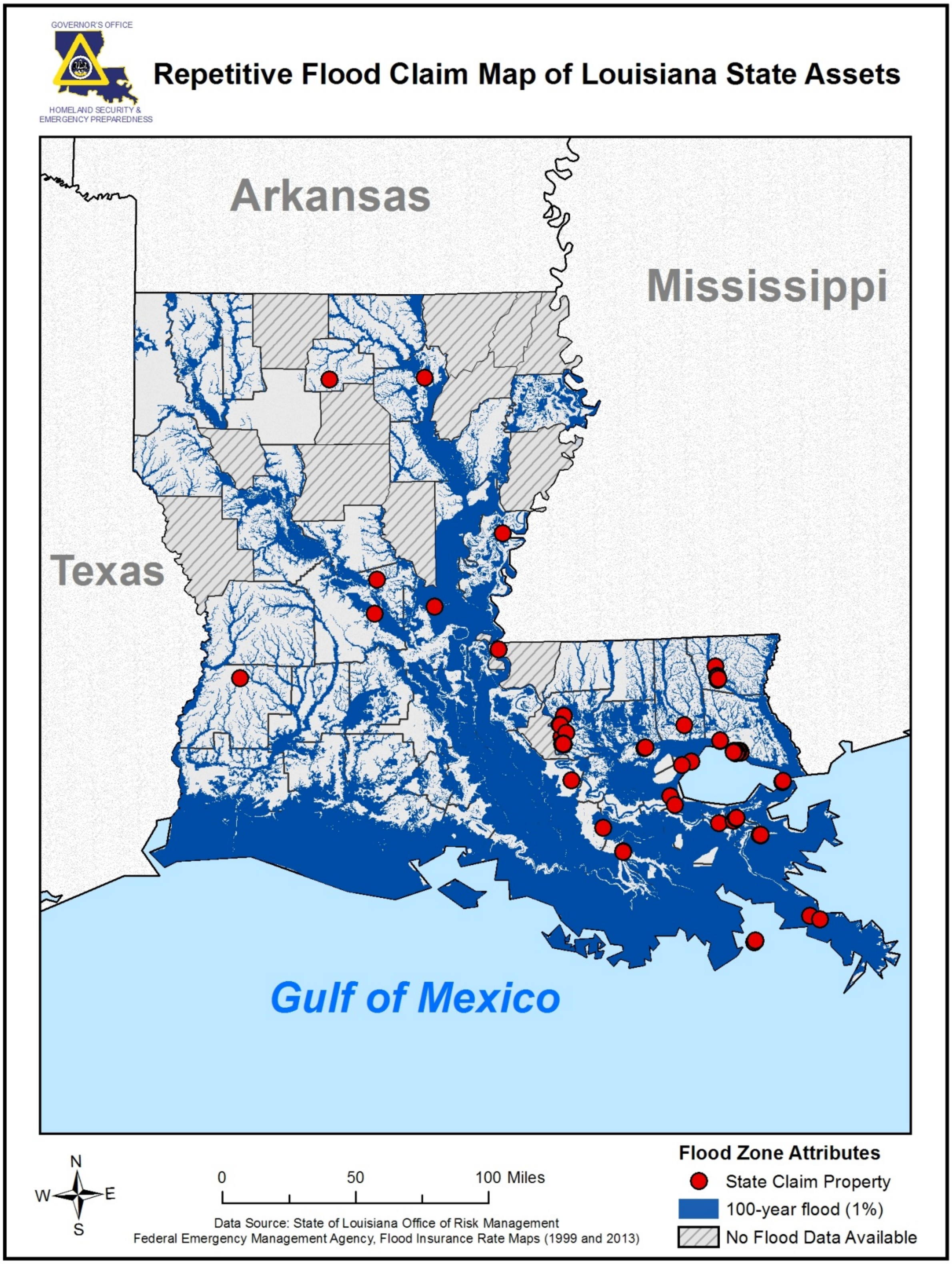

Map 2.20. Louisiana state assets with paid repetitive claims for flooding.

Tables 2.4 and 2.5 list the top 10 flood-damaged assets, without and within a leveed area, respectively.

Table 2.4. Top 10 paid claims for flood-damaged state assets not in a leveed area.[xxix]

Top 10 Paid Claims for Flood-Damaged State Assets Not in a Leveed Area				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Flood)
S12850	New Orleans Center for the Creative Arts - Building C	New Orleans	$93,663	1
S07952	McCall Dining Hall - Grambling University	Grambling	$76,339	1
S03525	Armory Building	Franklinton	$57,096	1
S12852	New Orleans Center for the Creative Arts - Building E	New Orleans	$52,739	1
S08887	Malone Football Stadium - University of Louisiana-Monroe	Monroe	$32,340	1
S02145	Sewage Pump #2 - Southern University	Baton Rouge	$19,016	1
S00910	Bath House - Fontainebleau State Park	Mandeville	$18,586	2
S02009	New State Capitol	Baton Rouge	$16,635	1
S22026	Area 1 Meeting Room - Fontainebleau State Park	Mandeville	$15,486	2
S22030	Area 1 Dorm 1 - Fontainebleau State Park	Mandeville	$15,199	1

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Table 2.5. Top 10 paid claims for flood-damaged state assets in a leveed area (source: Louisiana Office of Risk Management).

Top 10 Paid Claims for Flood-Damaged State Assets in a Leveed Area				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Flood)
S12850	New Orleans Center for the Creative Arts - Building C	New Orleans	$93,663	1
S12852	New Orleans Center for the Creative Arts - Building E	New Orleans	$52,739	1
S08887	University of Louisiana-Monroe - Auxiliary Services	Monroe	$35,340	1
S02009	New State Capitol	Baton Rouge	$16,635	1
S14331	Southeastern Louisiana University - General Operations	Hammond	$7,119	1
S04453	Southeastern Louisiana University - Turtle Cove Guest House	Hammond	$5,697	1
S11984	Board of Medical Examiners - Eli Lily Building	New Orleans	$2,199	1
S10015	LSU Alexandria (Abrams Hall & Student Center)	Alexandria	$492	2
S04283	Nicholls State University - Peltier Hall	Thibodaux	$423	1
S12849	New Orleans Center for the Creative Arts - Building B	New Orleans	$65	3

Map 2.21 shows the composite jurisdictional risk for Louisiana based on the preceding data. Livingston, Tangipahoa, Washington, Evangeline, and Caddo Parishes have the greatest risk of flood events (very high).

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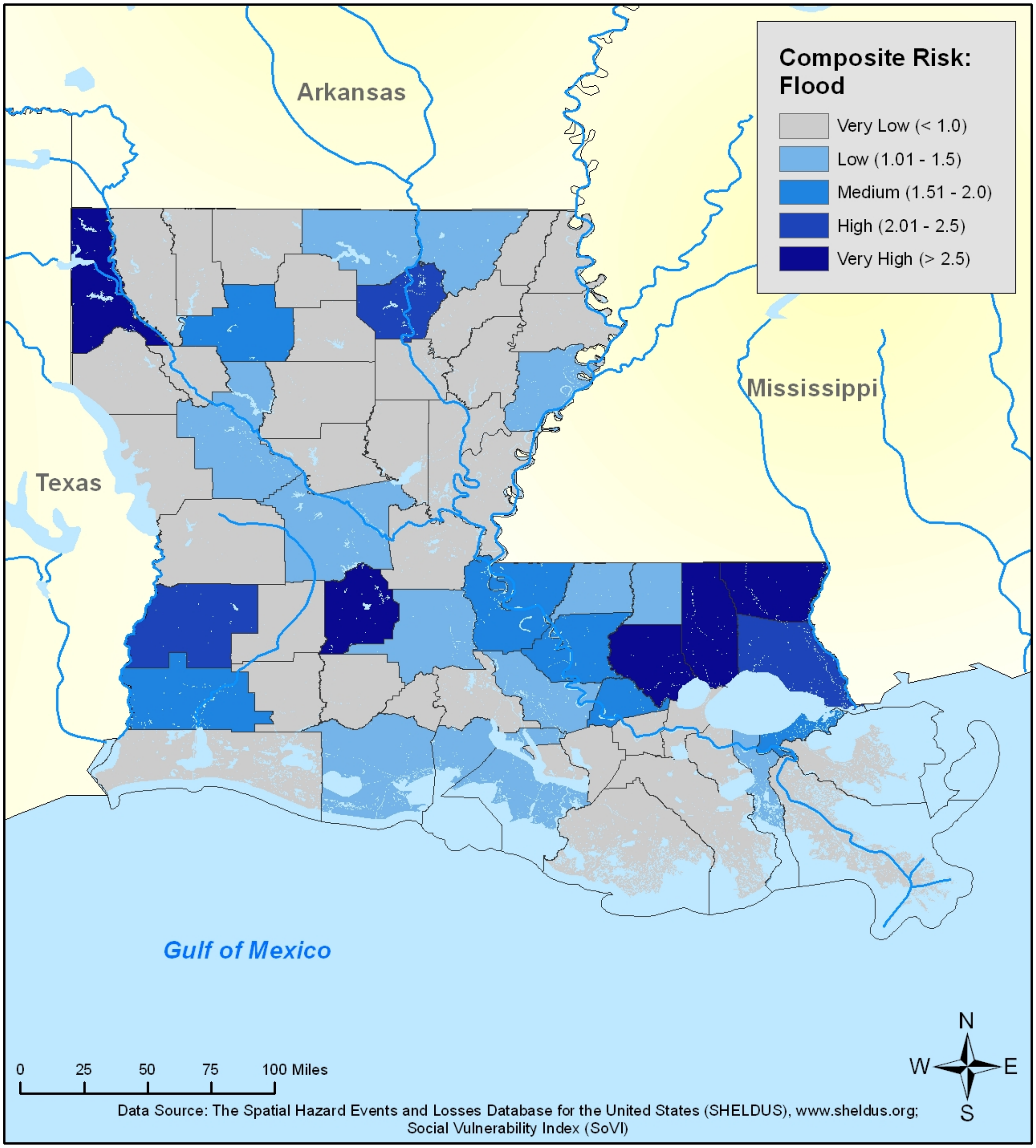
Jurisdictional Vulnerability: Flood Composite Risk



Map 2.21. Composite risk map for flood events showing parishes with the highest historical and highest potential risks.

STATE OF LOUISIANA HAZARD MITIGATION PLAN 2-47

Potential Economic Loss

Because Digital Flood Insurance Rate Maps (DFIRMs) are not yet available for the entire State of Louisiana, and many are pending adoption, FEMA's Hazus-MH flood model was used to generate the 100-yr flood depth grid and boundary files based on USGS 30-m digital elevation model (DEM) data. A Level 1 Hazus analysis was performed using default inventory datasets for General Building Stock and Essential Facilities. Hazus hydrologic and hydraulic analyses were performed using 40 mi^2 areas for the majority of the state. For locations where riverine analyses could not be completed, further refinement of the stream network was performed, using 1 mi^2 analysis. Some errors were encountered during the flood analysis, including poor definition of the stream network in the Atchafalaya Basin and coastal wetland areas, and failure of the software to complete analysis of the Mississippi River corridor from Baton Rouge to South Pass. Because of the complexity of the state's riverine network and limited vertical relief, it is recommended that Level 2 Hazus analysis be conducted to refine the analysis results. Level 2 analysis incorporates improved elevation data and refined building stock dataset, beyond a standard Level 1 analysis.

Table 2.6 summarizes the economic loss results of the 100-yr Hazus flood analysis by parish, including the modeled population (based on 2000 census data), total building exposure (in thousands), total economic loss (in thousands), total number of damaged buildings, total building loss (in thousands), short-term shelter needs, and economic loss resulting from damage to the transportation infrastructure. All transportation losses estimated by Hazus were the result of economic losses to bridges.

Table 2.6. Summary results of 100-yr Hazus flood analysis by parish. Includes modeled population (based on 2000 census data), total building exposure (in thousands), total economic loss (in thousands), total number of damaged buildings, total building loss (in thousands), short-term shelter needs, and transportation losses.

Summary of Hazus Flood Model for 100-yr Flood in Louisiana by Parish							
Parish	Hazus Modeled Population (2000)	Total Building Exposure ($1,000)	Total Economic Loss ($1,000)	Total Damaged Buildings	Building Loss ($1,000)	Short Term Shelter Needs	Transportation Infrastructure Economic Loss ($)
Acadia	58,861	3,359,777	87,240	397	47,811	2,198	29,515
Allen	25,440	1,295,592	95,485	644	53,820	1,793	44,784
Ascension	76,627	4,898,707	201,846	1,544	112,467	6,075	98,220
Assumption	23,388	1,253,610	19,227	199	11,359	1,182	12,757
Avoyelles	41,481	2,131,433	163,285	1,172	82,461	5,159	1,851
Beauregard	32,986	1,864,083	82,055	409	46,161	1,219	25,714
Bienville	15,752	861,313	20,316	125	11,126	305	14,888
Bossier	98,310	6,454,615	261,099	1,374	127,726	5,340	758
Caddo	252,161	16,833,151	266,510	850	106,386	4,869	8,305

SUMMARY OF HAZUS FLOOD MODEL FOR 100-YR FLOOD IN LOUISIANA BY PARISH							
Parish	Hazus Modeled Population (2000)	Total Building Exposure ($1,000)	Total Economic Loss ($1,000)	Total Damaged Buildings	Building Loss ($1,000)	Short Term Shelter Needs	Transportation Infrastructure Economic Loss ($)
Calcasieu	183,577	11,927,017	317,406	1,904	165,353	8,056	57,550
Caldwell	10,560	566,360	41,221	213	21,942	774	6,978
Cameron	9,991	746,172	42,522	233	18,045	1,515	10,358
Catahoula	10,920	548,174	70,533	467	33,266	2,647	76,371
Claiborne	16,851	889,712	15,138	119	8,502	173	10,943
Concordia	20,247	1,085,572	25,606	200	14,355	623	14,416
De Soto	25,494	1,316,230	24,664	93	12,755	322	1,352
East Baton Rouge	412,852	32,382,054	805,850	4,669	421,628	22,721	41,762
East Carroll	9,421	400,903	645	1	348	13	19,904
East Feliciana	21,360	1,713,143	32,267	154	16,944	488	3,888
Evangeline	35,434	1,755,144	53,178	212	26,330	890	0
Franklin	21,263	1,086,076	15,617	30	5,563	445	2,242
Grant	18,698	944,365	48,009	242	26,123	663	31,988
Iberia	73,266	4,405,058	85,893	383	39,325	2,411	0
Iberville	33,320	1,800,313	145,475	1,007	66,635	6,866	0
Jackson	15,397	963,397	15,119	74	8,175	226	6,510
Jefferson	455,466	35,684,176	65	1	41	1	0
Jefferson Davis	31,435	1,842,635	82,800	519	46,160	1,803	0
La Salle	190,503	772,883	25,679	870	103,563	680	5,755
Lafayette	89,974	14,227,704	218,440	275	15,781	4,749	17,226
Lafourche	14,282	5,730,667	29,542	145	14,357	5,842	55,540
Lincoln	42,509	2,539,621	9,560	28	5,385	74	58,682
Livingston	91,814	5,245,226	352,345	2,246	195,753	8,195	65,787
Madison	13,728	675,033	7,758	27	3,916	85	7,986
Morehouse	31,021	1,606,460	8,104	12	3,963	182	56,239
Natchitoches	39,080	2,224,690	46,482	177	24,090	567	0
Orleans	484,674	35,117,466	260	1	156	6	15,568
Ouachita	147,250	9,717,268	667,897	2,981	276,063	13,924	17,956
Plaquemines	26,757	1,714,703	28,492	195	13,362	1,851	43,366
Pointe Coupee	22,763	1,392,561	46,006	311	23,058	1,089	14,483
Rapides	126,337	8,380,764	1,516,137	6,817	645,810	26,495	875
Red River	9,622	461,984	23,938	137	13,197	634	12,705
Richland	20,981	1,045,694	5,609	15	2,877	139	7,939
Sabine	23,459	1,411,859	16,532	46	7,641	146	16,304
St. Bernard	67,229	4,449,262	629	10	397	57	3,369
St. Charles	48,072	3,434,466	11,147	85	5,344	510	42,340

Summary of Hazus Flood Model for 100-yr Flood in Louisiana by Parish							
Parish	Hazus Modeled Population (2000)	Total Building Exposure ($1,000)	Total Economic Loss ($1,000)	Total Damaged Buildings	Building Loss ($1,000)	Short Term Shelter Needs	Transportation Infrastructure Economic Loss ($)
St. Helena	10,525	496,825	36,412	178	19,167	498	68,667
St. James	21,216	1,235,643	5,324	55	3,046	367	24,357
St. John the Baptist	43,044	2,793,689	4,484	40	2,513	213	15,338
St. Landry	87,700	4,540,764	234,539	1,757	123,364	6,870	0
St. Martin	48,583	2,641,889	139,804	1,131	77,221	5,195	61,047
St. Mary	53,500	3,287,539	1,090,524	293	518,073	19,843	12,633
St. Tammany	191,268	13,611,715	614,121	2,994	314,480	11,922	26,235
Tangipahoa	100,588	5,311,687	193,966	1,172	103,431	5,115	28,935
Tensas	6,618	405,232	2,283	4	1,079	0	16,413
Terrebonne	104,503	7,275,577	144,295	513	50,395	8,877	33,200
Union	22,803	1,245,082	69,729	370	40,458	1,039	3,979
Vermilion	53,807	3,173,547	108,995	423	49,640	3,345	26,398
Vernon	52,531	2,774,419	52,917	174	28,225	760	9,969
Washington	43,926	2,182,384	99,848	533	47,911	1,717	28,247
Webster	41,831	2,325,744	36,233	182	20,197	612	15,156
West Baton Rouge	21,601	1,401,587	9,107	8	2,881	188	47,985
West Carroll	12,314	639,035	1,104	1	592	3	14,640
West Feliciana	15,111	692,252	31,097	122	14,989	1,822	5,495
Winn	16,894	886,087	35,756	181	19,730	530	14,165
TOTALS	**4,468,976**	**296,077,790**	**8,944,166**	**41,741**	**4,322,912**	**212,918**	**1,416,033**

Table 2.7 summarizes the counts of essential facilities damaged by the 100-yr flood.

(Continued on Next Page)

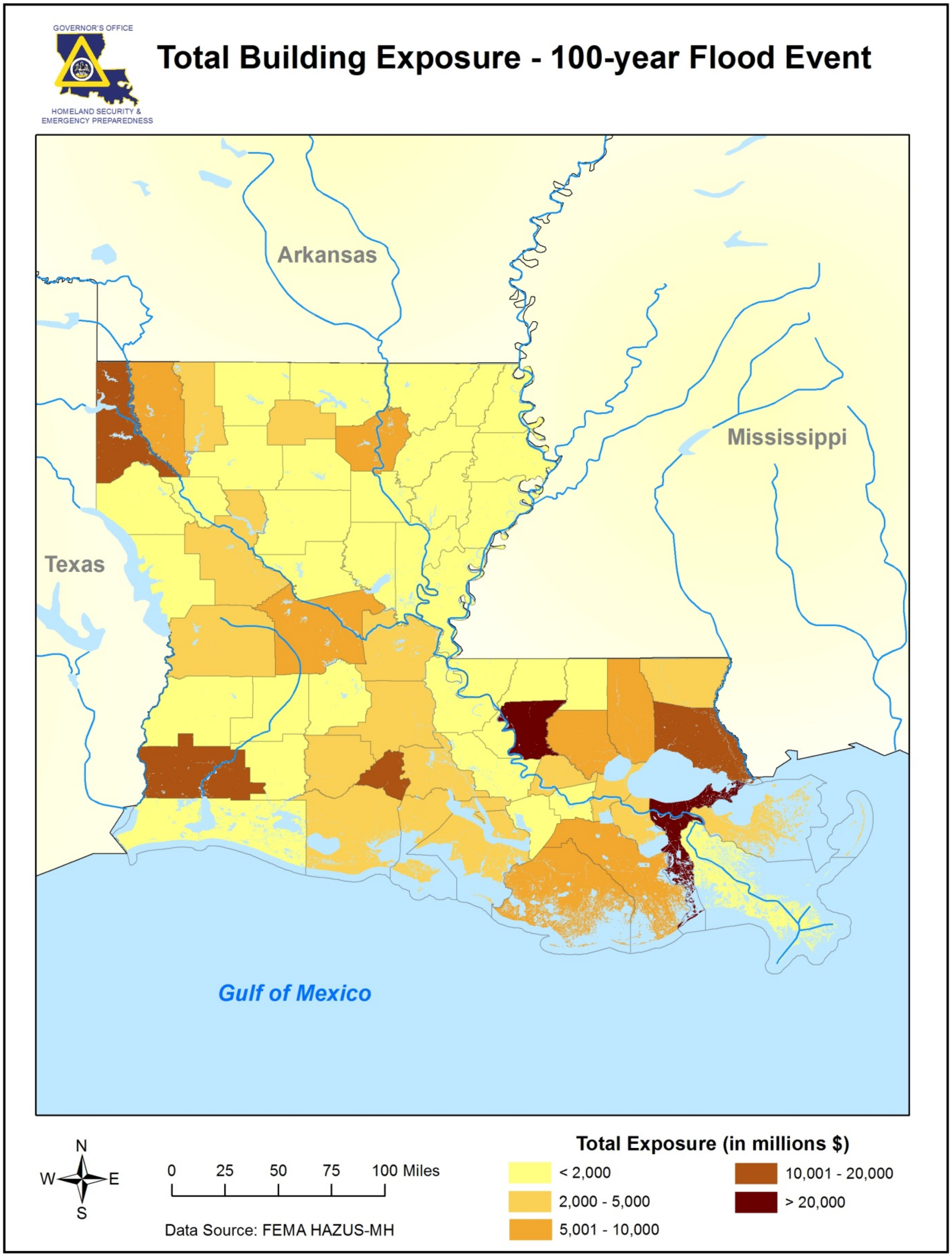
Table 2.7. Total essential buildings damaged by 100-yr flood.

Counts of Essential Facilities Damaged by the 100-Year Flood					
Parish	Damaged Essential Facilities by Parish				
	Fire Stations	Police Stations	Hospitals	Schools	Total Facilities
Acadia	0	2	0	1	3
Allen	0	0	0	0	0
Ascension	0	0	0	0	0
Assumption	0	0	0	0	0
Avoyelles	1	1	0	1	3
Beauregard	0	0	0	0	0
Bienville	1	0	0	0	1
Bossier	0	0	0	2	2
Caddo	0	1	0	1	2
Calcasieu	0	0	0	1	1
Caldwell	0	0	0	0	0
Cameron	0	3	0	2	5
Catahoula	1	0	0	5	6
Claiborne	1	0	0	1	2
Concordia	0	1	0	0	1
De Soto	0	0	0	0	0
East Baton Rouge	2	0	0	4	6
East Carroll	0	0	0	0	0
East Feliciana	0	0	0	0	0
Evangeline	0	0	0	0	0
Franklin	0	0	0	0	0
Grant	0	1	0	0	1
Iberia	0	0	0	0	0
Iberville	1	0	0	2	3
Jackson	0	0	0	0	0
Jefferson	0	0	0	0	0
Jefferson Davis	1	0	0	1	2
Lafayette	0	0	0	0	0
Lafourche	0	1	0	1	2
La Salle	0	0	0	0	0
Lincoln	0	0	0	0	0
Livingston	1	0	0	3	4
Madison	0	0	0	0	0
Morehouse	0	0	0	0	0
Natchitoches	1	0	0	0	1
Orleans	0	0	0	0	0
Ouachita	1	5	1	10	17

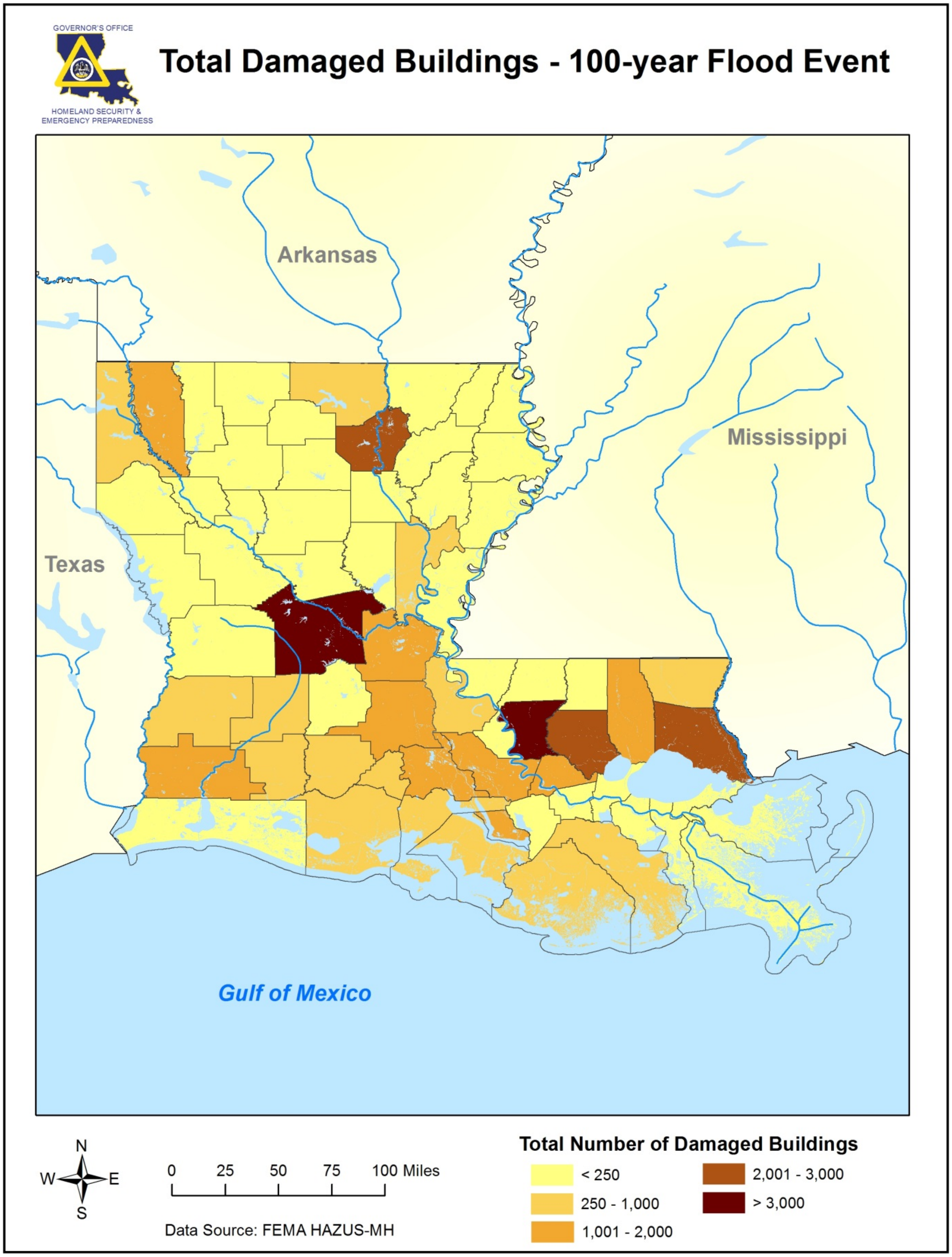
Counts of Essential Facilities Damaged by the 100-year Flood					
Parish	Damaged Essential Facilities by Parish				
	Fire Stations	Police Stations	Hospitals	Schools	Total Facilities
Plaquemines	0	0	0	1	1
Pointe Coupee	0	1	0	0	1
Rapides	2	12	2	18	34
Red River	0	0	0	0	0
Richland	0	0	0	0	0
Sabine	0	0	0	0	0
St. Bernard	0	0	0	0	0
St. Charles	0	0	0	0	0
St. Helena	0	0	0	0	0
St. James	0	0	0	0	0
St. John the Baptist	0	0	0	0	0
St. Landry	0	4	0	6	10
St. Martin	0	1	0	1	2
St. Mary	4	8	1	17	30
St. Tammany	2	3	0	3	8
Tangipahoa	0	1	0	0	1
Tensas	0	0	0	0	0
Terrebonne	1	1	0	1	3
Union	0	0	0	0	0
Vermilion	0	0	0	1	1
Vernon	0	1	0	0	1
Washington	0	1	0	1	2
Webster	0	0	0	0	0
West Baton Rouge	0	0	0	0	0
West Carroll	0	0	0	0	0
West Feliciana	0	0	0	0	0
Winn	0	0	0	0	0
TOTALS	**20**	**48**	**4**	**84**	**156**

Maps 2.22 through 2.29 provide information regarding 100-yr flood events in Louisiana as modeled using Hazus-MH 2.1. Map 2.22 models flood depth in relation to digitized elevation in Louisiana. Map 2.23 shows the ratio of total economic loss to total building exposure by parish. Map 2.24 shows estimated building loss by parish, while Maps 2.25 and 2.26 reveal total estimated economic losses by parish and by census block group. Maps 2.27 and 2.28 illustrates the estimated displaced population and shelter needs by parish, and Map 2.29 locates the density of damaged essential facilities by parish.

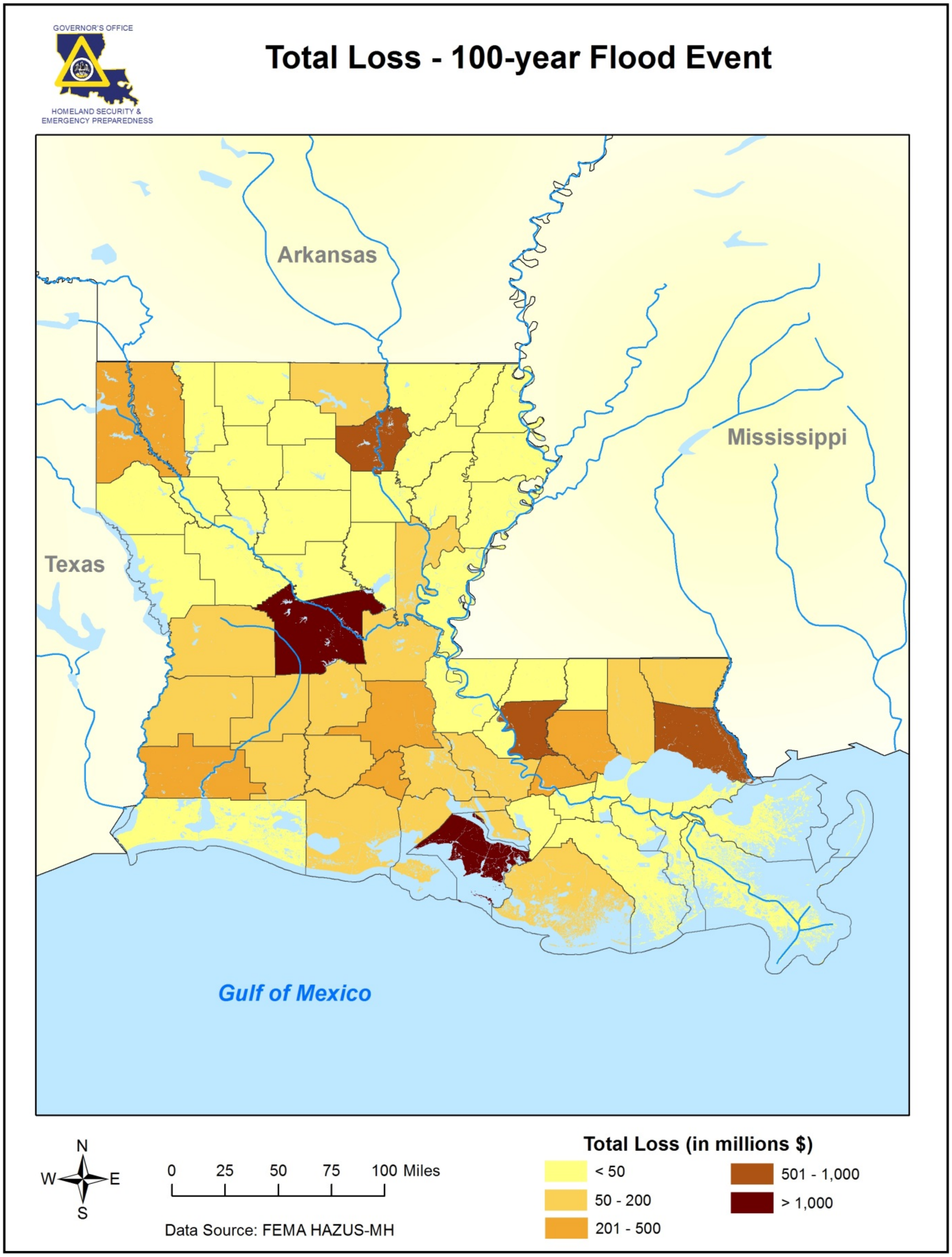
Map 2.22. 100-yr flood depth surface (from Hazus), overlain on study area digital elevation model.



Map 2.23. Total building exposure by parish (in millions) from default Hazus database.

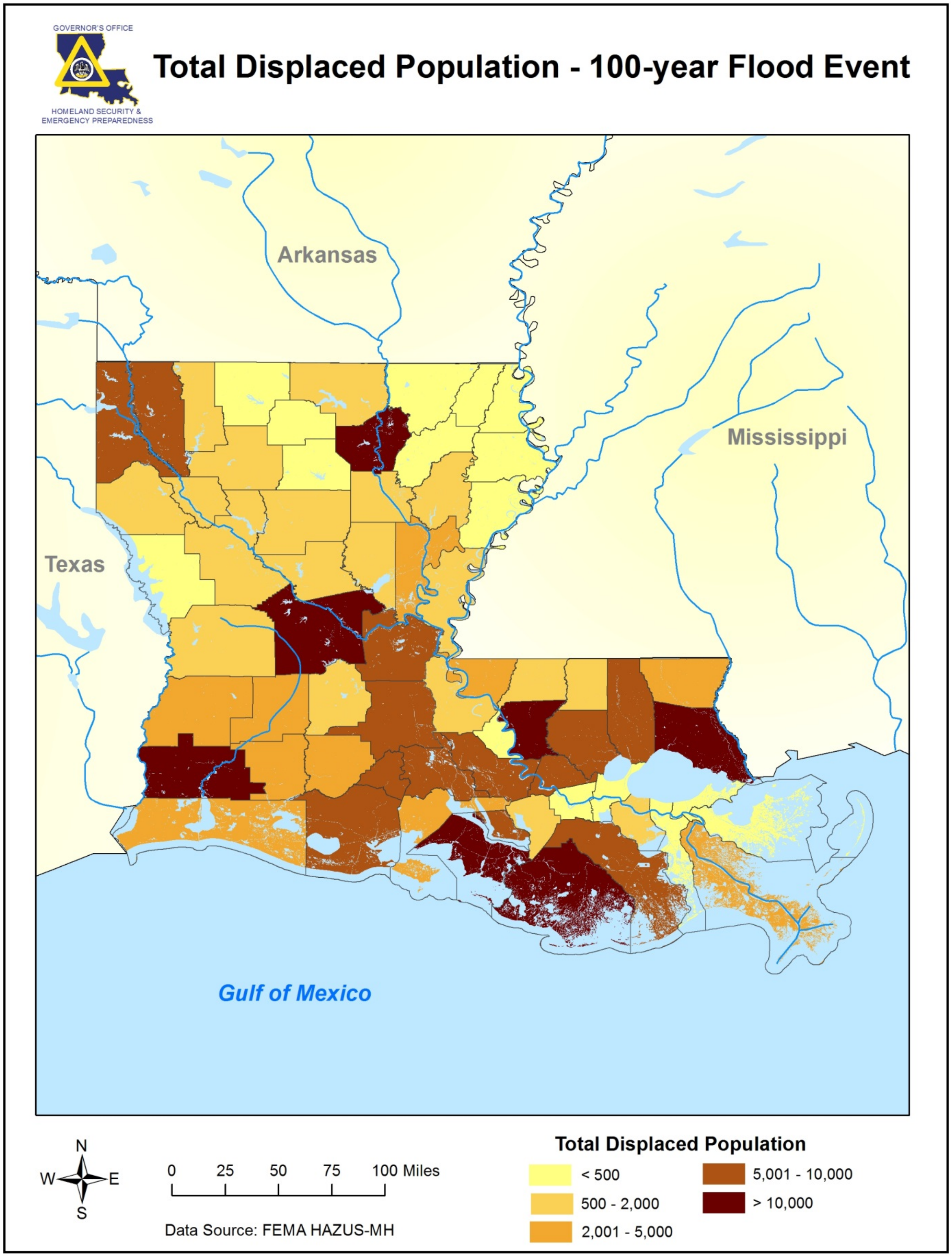


Map 2.24. Total damaged buildings by 100-yr flood event per parish.

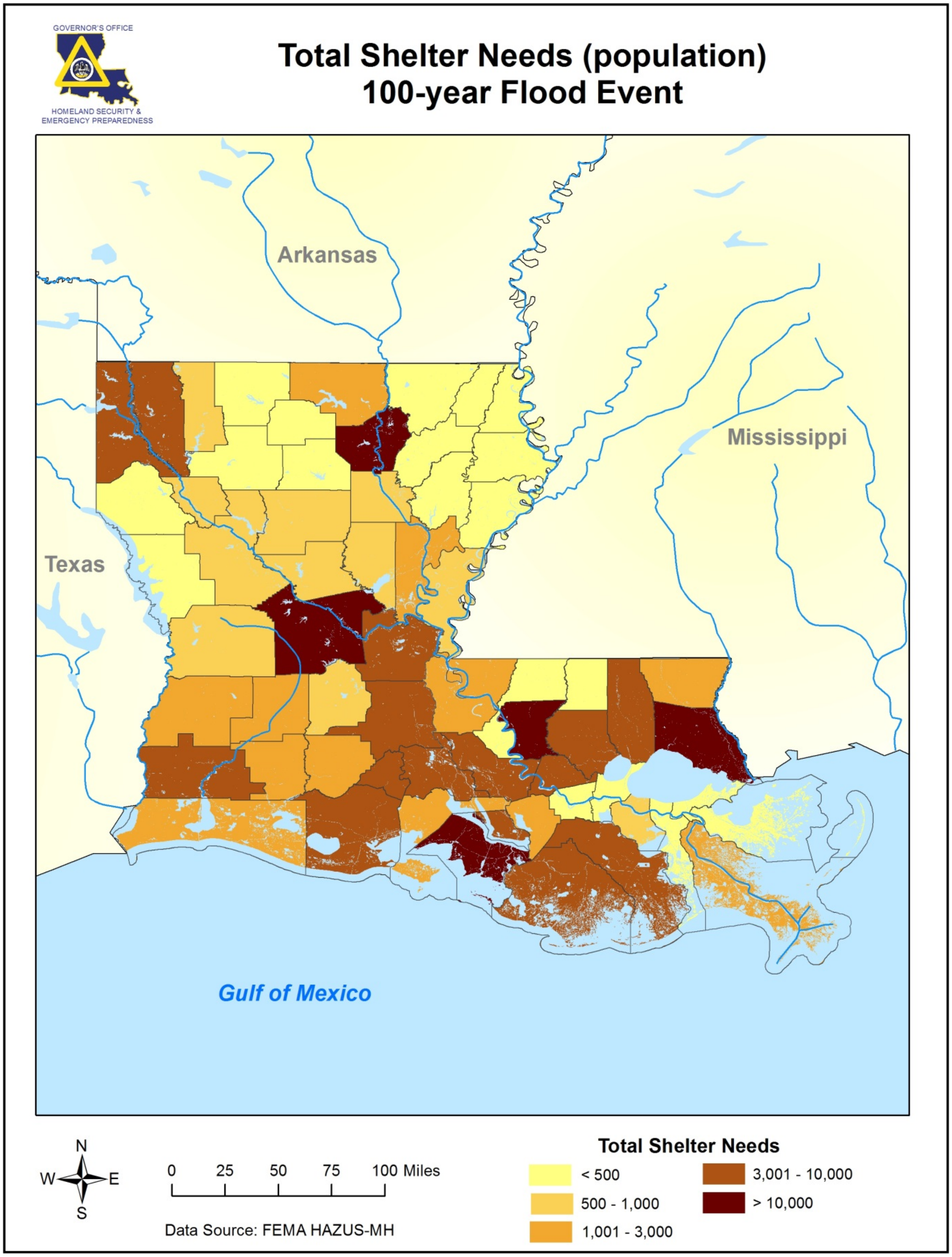


Map 2.25. Total economic loss by parish (in millions) resulting from a 100-yr flood event.

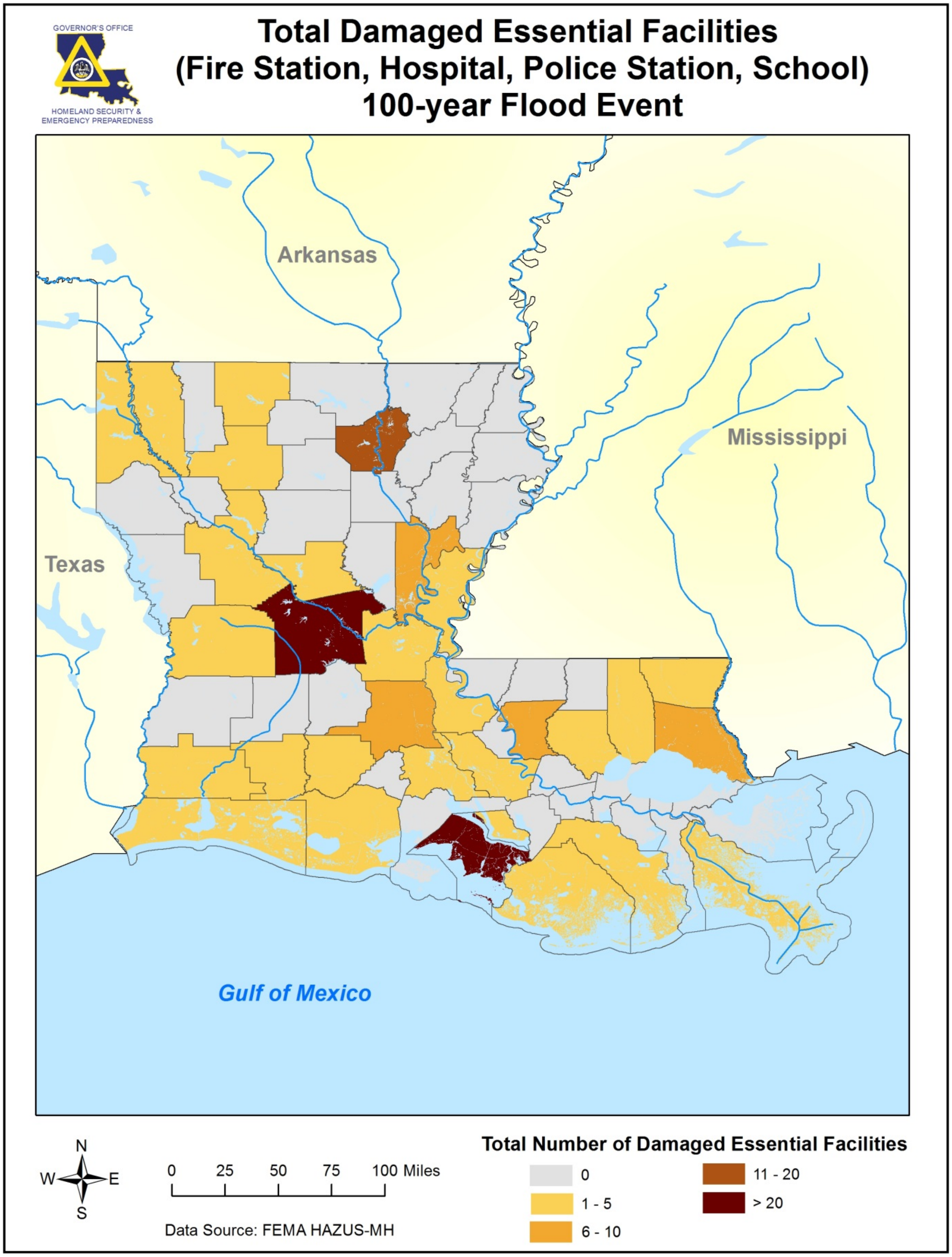
Map 2.26. Total economic loss by census block group (in millions) resulting from a 100-yr flood event.



Map 2.27. Total displaced population by parish resulting from a 100-yr flood event.



Map 2.28. Total shelter needs by parish resulting from a 100-yr flood event.



Map 2.29. Total damaged essential facilities by parish resulting from a 100-yr flood event.

To determine potential loss estimates from flooding, the available historical loss data was annualized to determine future loss potential (see Map 2.30). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.

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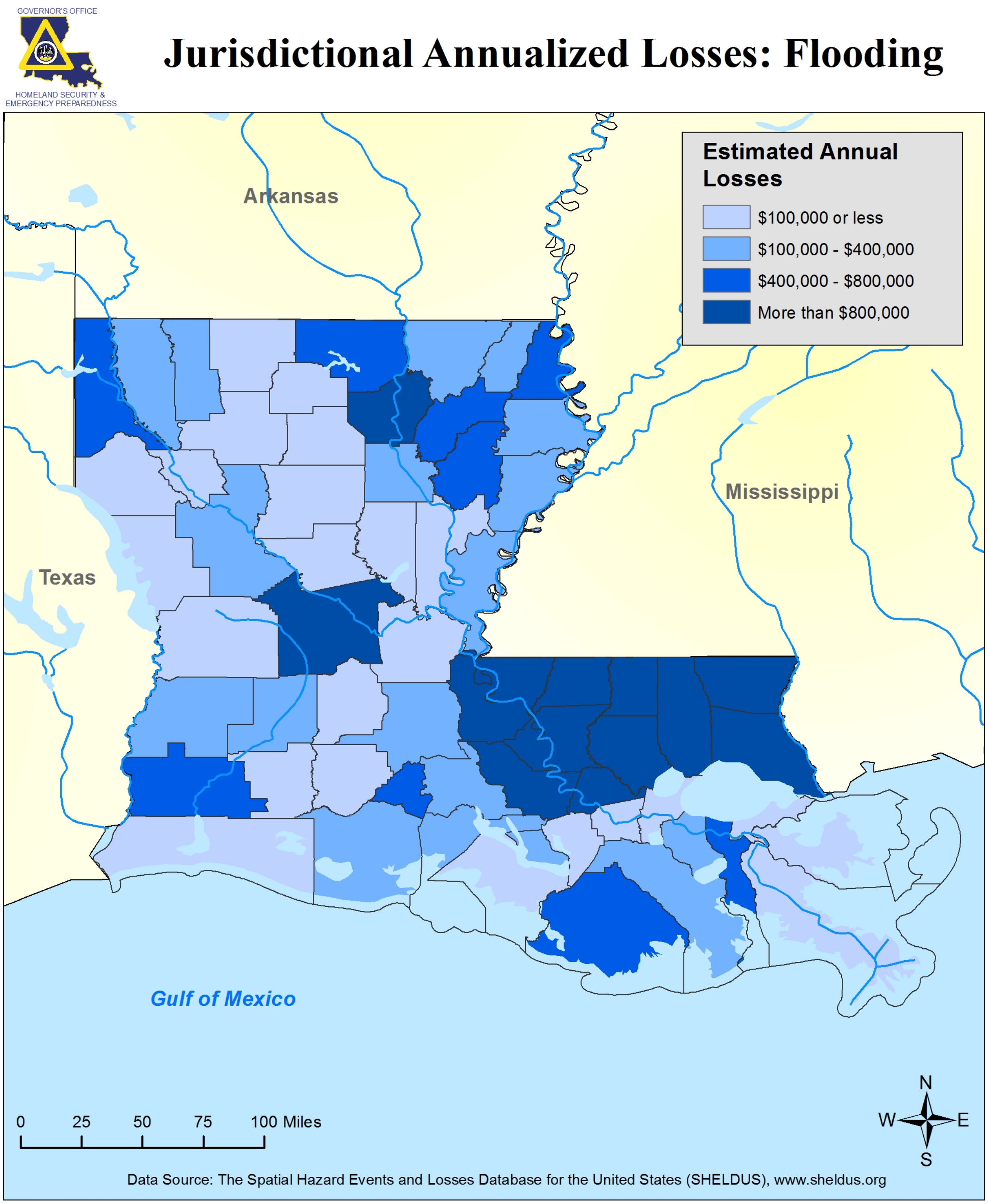


Map 2.30. Jurisdictional annualized loss due to flooding.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: Flooding occurs throughout the state, but Livingston, Tangipahoa, Washington, Evangeline, and Caddo Parishes have the greatest risk of flood events (very high). Most parishes are vulnerable to riverine flooding, but coastal (southern) parishes are confronted with the additional risk of various types of coastal flooding.

Changes in jurisdictional population levels impact each parish across the state disparately. In the parishes where flood vulnerability has increased because of increases in population (Livingston, Tangipahoa, and St. Tammany), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure in areas that are already impacted by both riverine and coastal flooding. Since all parishes participate in the National Flood Insurance Program (NFIP), new development must meet base flood elevations (BFE) and wetlands that are in-filled to meet the BFE are offset elsewhere in new developments through the construction of retention ponds and other projects that create a net-zero topographic change. Consequently, changes in new development may impact previously built areas elsewhere.

Of all assessed hazards, flooding is most impacted by changes in development and flooding will be greatly exacerbated in parishes where populations have substantially increased. No high-risk parishes for flooding experienced a significant decrease in population and, consequently, no other parishes will experience a measurable change in loss estimates based on development trends.

POTENTIAL LOSSES OF STATE FACILITIES

The flood hazard vulnerability assessment of state-owned buildings was based on the parish-level composite risk score, which incorporates the total number of flooding events, injuries, fatalities, and property damages as well as the social vulnerability of impacted parishes. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.8.

Table 2.8. Flood Vulnerability Criteria and Ranking Results.

FLOOD VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Composite risk score greater than 2.0
Medium	Composite risk score between 1.5 and 2.0
Low	Composite risk score less than 1.5
None	Insufficient data

The flood loss estimate ranges are derived from the 2011 state hazard mitigation plan and inflation-adjusted to 2013 dollars. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Flood Hazard Vulnerability Ranking
- Average Flood Depth
- Average Building Type
- Depth-Damage Functions

Table 2.9. Flood Loss Estimate Ranges and Ranking Results.

Flood Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$21,376 - $160,320,000	1219
Medium	$268 - $21,376	2664
Low	$0 - $267 (including facilities with insufficient data	4802

THUNDERSTORMS

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

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

Thunderstorms are common all year in Louisiana, but occur more frequently in the summer months because intense sunshine heats the Earth's surface more frequently and powerfully. Fortunately, even though single-cell storms are the most common thunderstorm type everywhere, Louisiana has an even more disproportionate share of its thunderstorms as single-cell thunderstorms than most places. As a result, even though Louisiana experiences frequent severe weather, the non-tropical severe weather that does occur is seldom of record-breaking proportions, such as the recent tornado outbreaks in Tuscaloosa, Alabama; Joplin, Missouri; and Moore, Oklahoma; though record-breaking severe weather outbreaks certainly are possible in Louisiana.

The life of a thunderstorm proceeds through three stages: the **developing** (or cumulus) stage, the **mature** stage, and the **dissipation** stage. Figure 2.2 depicts these three stages and indicates their major characteristics. During the **developing stage**, the unstable air mass is lifted as an *updraft* into the atmosphere. This sudden lift rapidly cools the moisture in the air mass, releasing latent heat as condensation and/or deposition occurs, and warming the surrounding environment, thus making it less dense than the surrounding air. This process intensifies the updraft and creates a localized lateral rush of air from all directions into the area beneath the thunderstorm to feed continued updrafts. At the **mature stage**, the rising air is accompanied by *downdrafts* caused by the shear of falling rain (if melted completely), or hail, freezing rain, sleet, or snow (if not melted completely). The **dissipation stage** is characterized by the dominating presence of the downdraft as the hot surface that gave the updrafts their buoyancy is cooled by precipitation. During the dissipation stage, the moisture in the air mass largely empties out.

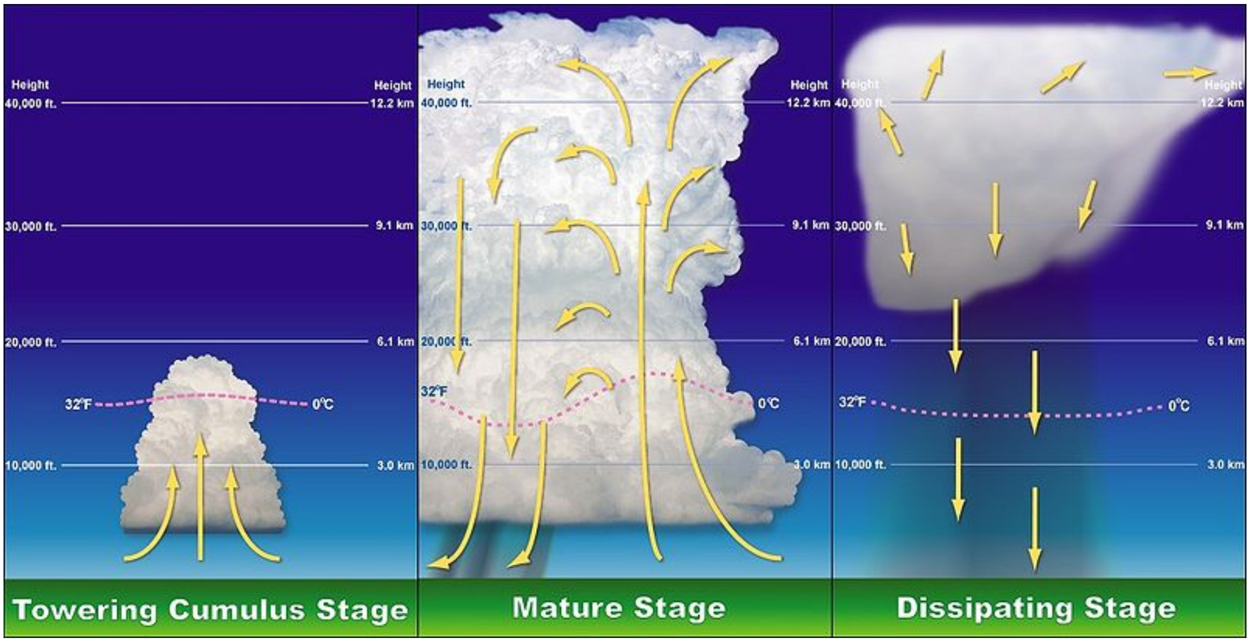


Figure 2.2. Figure illustrating the three stages of a basic thunderstorm (map from Vega, Grymes, and Rohli; source: NOAA).

THUNDERSTORM PROFILE

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, NOAA characterizes a thunderstorm as *severe* when it produces one or more of the following:

- **hail** of 1 in. in diameter or larger
- **wind gusts** to 58 mph or greater
- one or more **tornadoes**

Lightning and heavy rain can be devastating, but their ubiquitous presence in thunderstorms precludes their use in *distinguishing* among types of thunderstorms. For the purpose of profiling this hazard, this plan focuses on three hazards that occur in thunderstorms: hail, high wind, and lightning. These hazards are defined below and each given a risk assessment in the Thunderstorm Risk Assessment. Flooding and tornadoes will be considered as separate hazards.

Hailstorms are severe thunderstorms in which balls or chunks of ice fall along with rain. Hail develops in the upper atmosphere initially as ice crystals that are bounced about by high-velocity updraft winds. The ice crystals grow through deposition of water vapor onto their surface, fall partially to a level in the cloud where the temperature exceeds the freezing point, melt partially, get caught in another updraft whereupon re-freezing and deposition grows another concentric layer of ice, and fall after developing enough weight, sometimes after several trips up and down the cloud. The size of hailstones varies depending on the severity and size of the thunderstorm. Higher surface temperatures generally mean stronger updrafts, which allows more massive hailstones to be supported by updrafts, leaving them suspended longer. This longer time means larger hailstone sizes. Table 2.10 displays a spectrum of hailstone diameters and their everyday equivalents.

Because of this cycle, hailstorms generally occur more frequently during the late spring and early summer—a period of extreme variation between ground surface temperatures and upper atmospheric temperatures. Hailstorms can cause widespread damage to homes and other structures, automobiles, and crops. While the damage to individual structures or vehicles is often minor, the cumulative cost to communities, especially across large metropolitan areas, can be quite significant. Hailstorms can also be devastating to crops. Thus, the severity of hailstorms depends on the size of the hailstones, the length of time the storm lasts, and where it occurs.

Table 2.10. Spectrum of hailstone diameters and their everyday description (source: NWS).

Spectrum of Hailstone Diameters	
Hail Diameter Size	Description
1/4"	Pea
1/2"	Plain M&M
3/4"	Penny
7/8"	Nickel
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

In general, high winds can occur in a number of different ways, within and without thunderstorms. FEMA distinguishes these as shown in Table 2.11.

The only high winds of present concern are **thunderstorm winds** and **downbursts**. Straight-line winds are common but are a relatively insignificant hazard (on land) compared to other high winds. Downslope winds are common but relatively insignificant in the mountainous areas 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 2.12 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.

Map 2.31 reveals that Louisiana is located mainly in two distinct FEMA Wind Zones: Zones III and IV. Zone III (with peak winds up to 200 mph) includes southern Louisiana and the other hurricane-susceptible regions of the country. Northern Louisiana is in Zone IV, described by an area of the United States that can experience sustained winds of up to 250 mph. This area is highly susceptible to tornadoes.

Louisiana's wind-zone location indicates the severity that such storms can produce. Major damage can occur especially when downdrafts become constricted during the dissipation phase of a thunderstorm.[xxx] Constriction of a downdraft increases pressure within the storm by preventing any pressure release outside the system. Such downbursts can cause damage that is similar to a tornado, even leading to some classification confusion between the two when damage due to a thunderstorm is assessed.

Table 2.11. High winds categorized by source, frequency, and duration (source: *Making Critical Facilities Safe from High Wind*, FEMA).

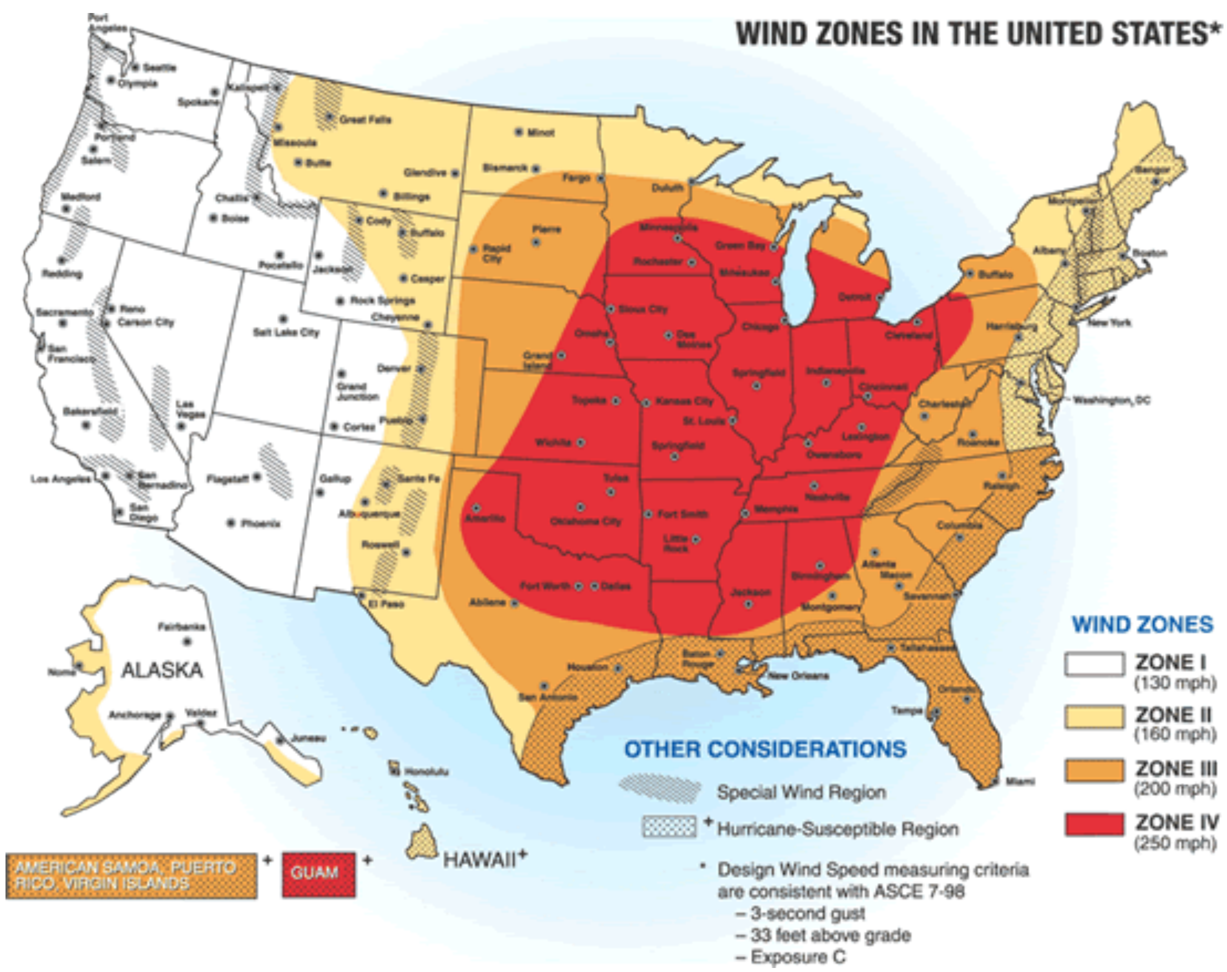
High Winds Categories			
High Wind Type	Description	Relative Frequency in Louisiana	Relative Maximum Duration in Louisiana
Straight-line Winds	Wind blowing in straight line; usually associated with intense low-pressure area	**High**	Few minutes–1 day
Downslope Winds	Wind blowing down the slope of a mountain; associated with temperature and pressure gradients	**N/A** (high in mountainous regions)	N/A (continuous in mountainous regions)
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)	Wind blowing due to cyclonic storm off the east coast of North America; associated with	**N/A** (medium along east	N/A (several days along

High Winds Categories			
High Wind Type	Description	Relative Frequency in Louisiana	Relative Maximum Duration in Louisiana
Winds	temperature and pressure gradients between the Atlantic and land	coast of U.S.)	coast)
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

Table 2.12. Beaufort Wind Scale, indicating relative destruction appearance on land for a spectrum of wind speeds (source: NOAA's SPC).[xxxi]

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	*64-73*	Violent Storm	
12	*74+*	Hurricane	

Although major damage directly due to thunderstorm winds is relatively rare, minor damage is common and pervasive, and most noticeable when it contributes to power outages. These power outages can have major negative impacts, including health risks for those requiring electric medical equipment and/or air conditioning; 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. Since much of Louisiana falls within FEMA's special hurricane zone, these wind speeds are specifically for the hurricane wind zones and do not necessarily relate to potential thunderstorm or tornado wind speeds.



Map 2.31. Wind zone map from FEMA.

The action of rising and descending air in a thunderstorm, and the presence of ice particles in high parts of clouds and liquid water in others, cause a separation of positively and negatively charged ions, with lightning resulting from the discharge of current between positive and negative charge areas. In only a few millionths of a second, the air near a lightning strike is heated to an estimated 50,000° F, a temperature much hotter than the surface of the Sun.

Thunder is the sound of air colliding after the very rapid expansion of the heated air near the lightning strike creates a momentary vacuum.

An average of 20 million cloud-to-ground flashes are detected annually in the continental United States, about half of which have more than one ground-strike point. Cloud-to-cloud flashes are estimated to occur nearly five to ten times more frequently than cloud-to-ground flashes.[xxxii] Given its energy and extent, lightning is one of the most frequent causes of death by natural hazard, along with extreme heat and flooding. Reportedly, around 100 deaths and 500 injuries occur annually due to lightning, though the number could be much higher since many lightning deaths and injuries probably go unreported as current travels through numerous other paths, including power lines, telephone lines, and electric appliances. Moreover, it often starts fires, which may cause death and injury not ultimately attributed to lightning. On a national scale, the Louisiana is second only to Florida in terms of "flash density"—the number of lightning flashes per area per year—and is 12th in the nation in terms of lightning fatalities per capita.[xxxiii] A map of the density of lightning strikes accompanies the Thunderstorm Risk Assessment section.

THUNDERSTORM RISK ASSESSMENT

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. Due to the high potential for significant personal injury and property damage for the state, and due to insufficient data to determine future likelihood, this hazard is included in the Risk Assessments and is addressed in the Mitigation Action Plan. For the purposes of hazard mitigation, this plan is considering the April 26, 2011, severe thunderstorm that affected 16 parishes in Louisiana as its bellwether for the largest likely extent of future damages from this hazard. The storm produced straight-line winds up to 111 mph and spawned multiple weak-to-moderate tornadoes. Hail was reported in a number of parishes, ranging up to 2.75 in. in diameter. In all, the storm resulted in 2 deaths, 2 injuries, and $16.6 million in damages (2013 USD).[xxxiv]

In assessing the state's vulnerability by jurisdiction, this Plan examines the hazards of hail, high winds, and lightning as parts of the thunderstorm category. Each hazard will still be given thorough risk assessment. Maps 2.32, 2.33, and 2.34 illustrate the jurisdictional probability of hail, high wind, and lightning (respectively).

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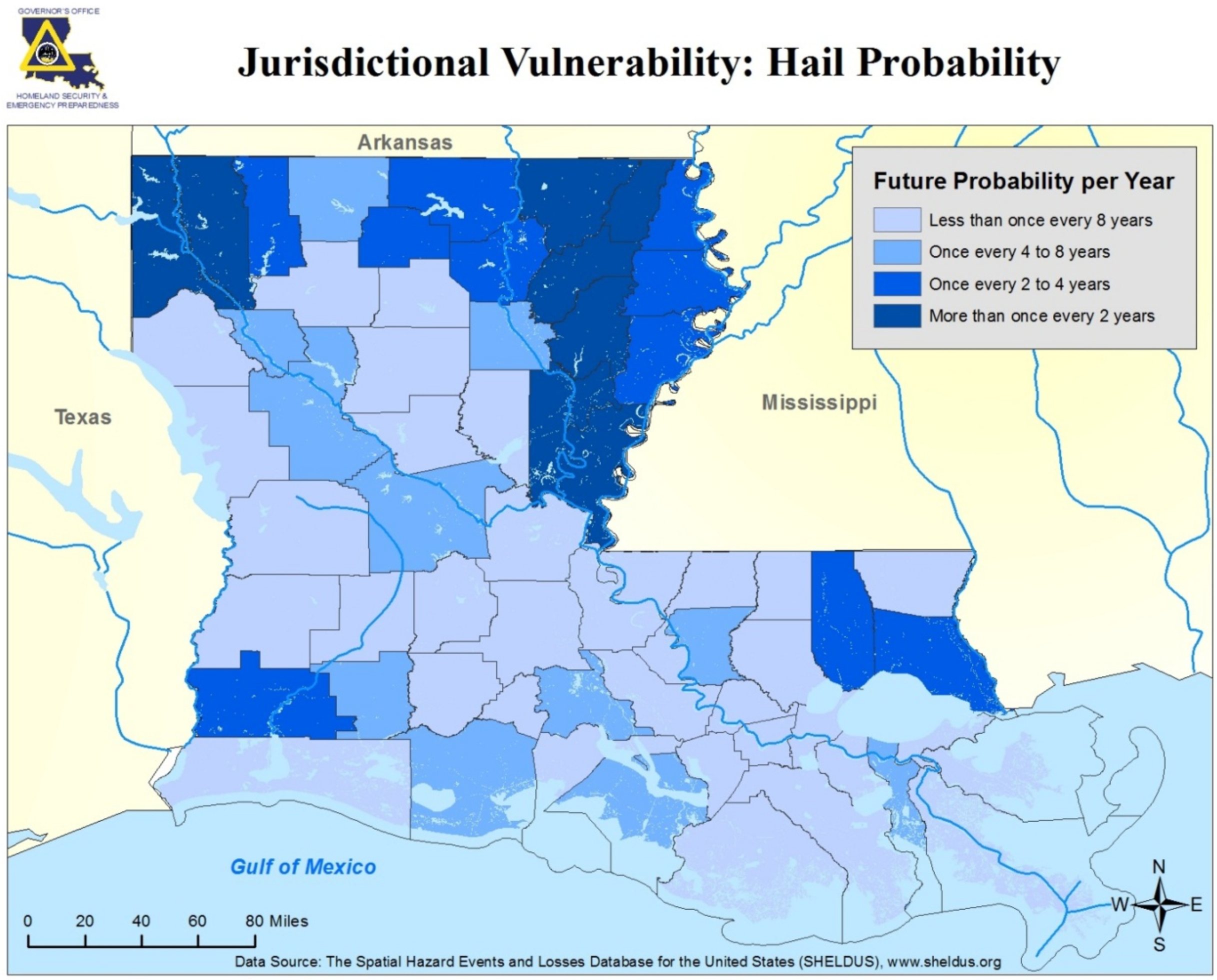

Map 2.32. Probability of hail in Louisiana by parish based on data from 1987–2012.

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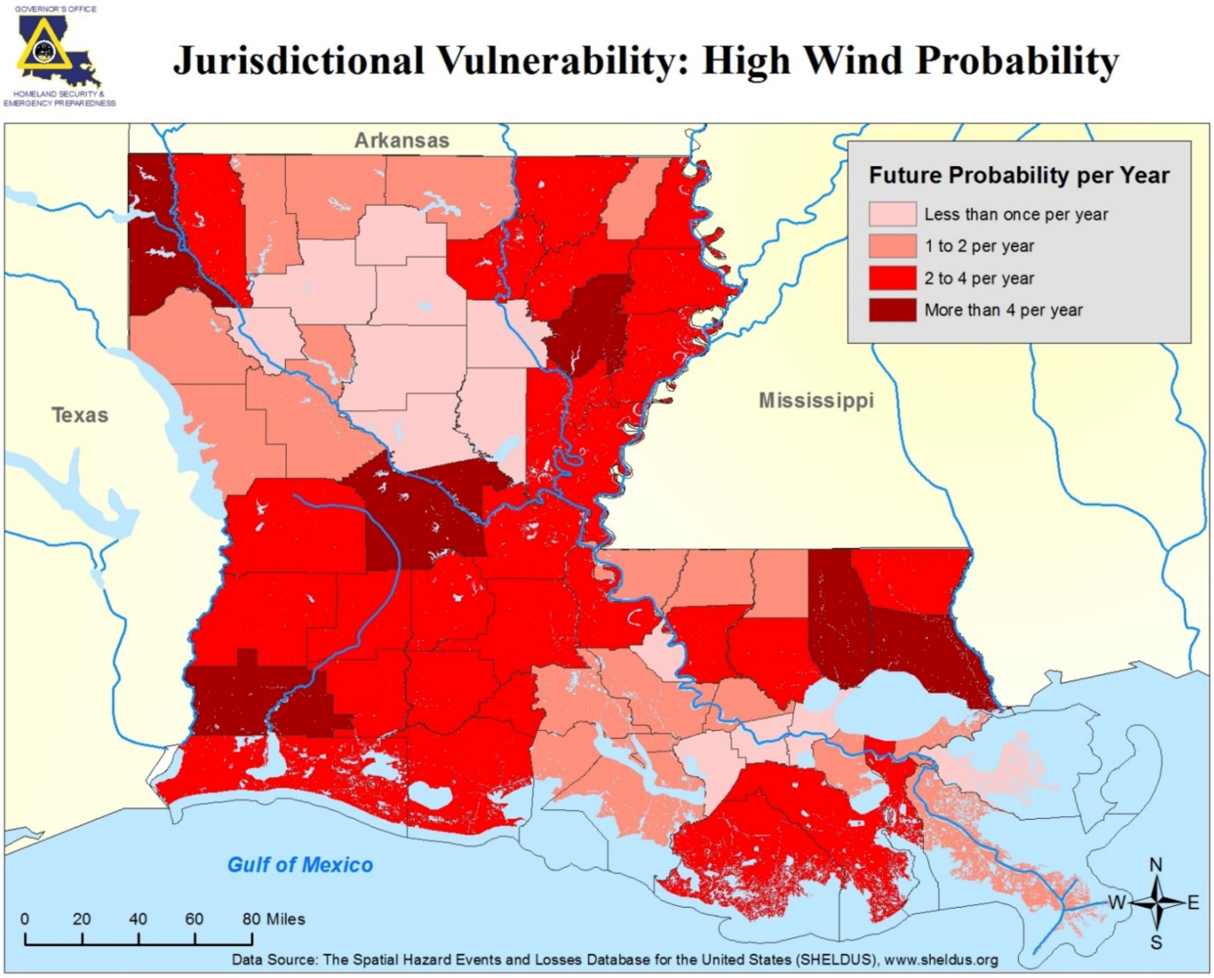

Map 2.33. Probability of high winds in Louisiana by parish based on data from 1987–2012.

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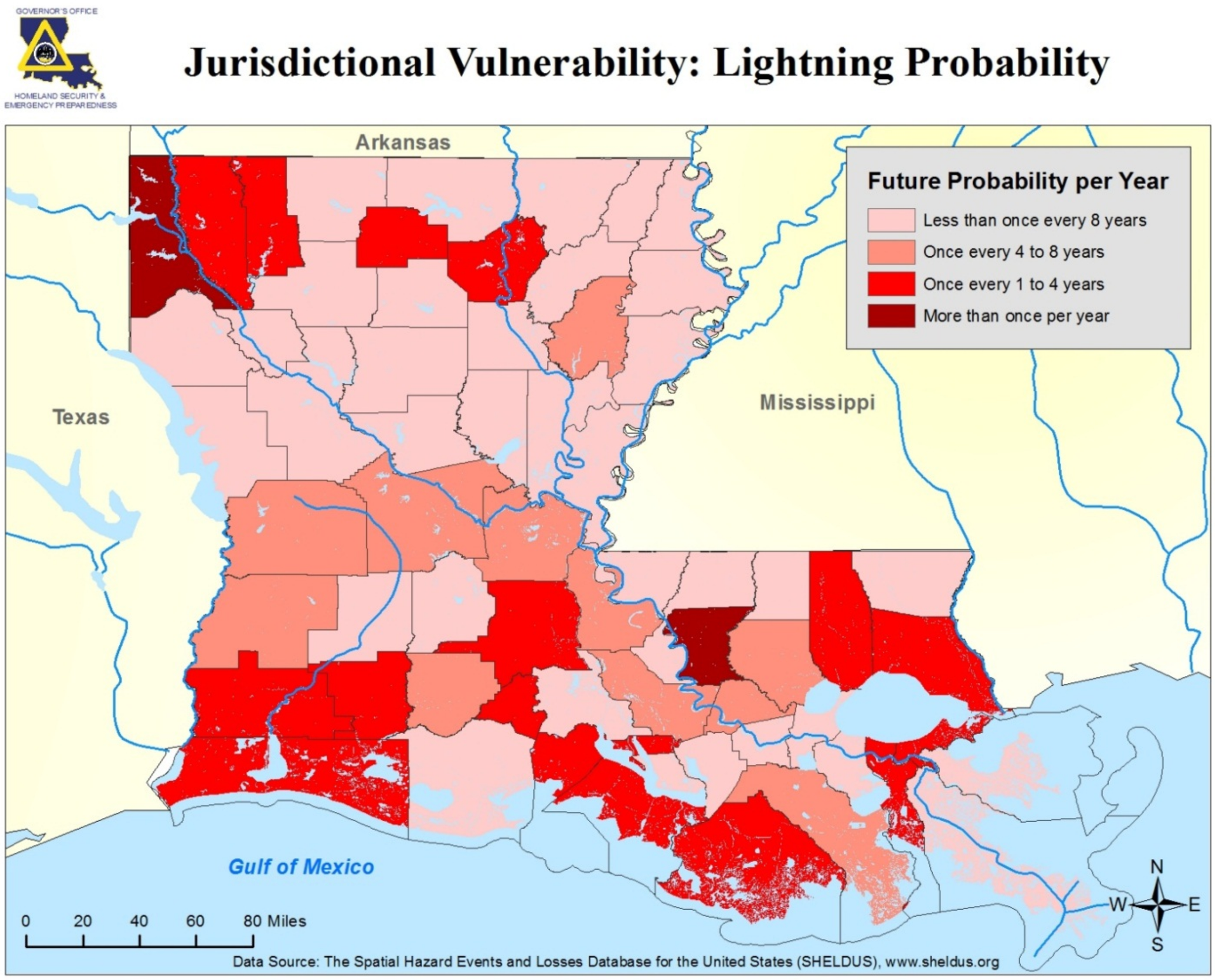

Map 2.34. Probability of lightning strikes in Louisiana by parish based on data from 1987–2012.

HAIL

Compared to other states, Louisiana has a moderate frequency of hailstorms. Between 1955 and 2009, Louisiana experienced a total of 4,469 recorded hailstorm events, with a maximum hail size of 4.5 in. These events vary widely in terms of damage. On May 12, 2007, 4-in. hail was reported in Sterlington (Ouachita Parish), although the event did not cause any significant damage or injuries. On March 27, 2009, in Reeves (Allen Parish), hail was again measured at 4 in. in diameter, causing $10,000 in property damages. On April 22, 1995, however, the Shreveport metropolitan area experienced a hailstorm with hailstones as large as 4.5 in. in diameter, resulting in $50 million in property damages.

According to the University of Louisiana at Monroe, and based on past occurrence of hailstorm events, Louisiana parishes experience between 2 and 29 hail events per year per 1000 mi^2.[xxxv] Map 2.35 illustrates the relative density of hail events based on various diameters of hailstones.

The map suggests a high occurrence of hailstorm events near Shreveport (81% of reported events), but the reason for this anomaly is uncertain. This uncertainty renders any estimates of probability based upon the data suspect. Better data collection on hailstorms would significantly improve the probability of mitigation of those storms.

Hail seems to be most probable and destructive among the northern parishes, particularly on the western and eastern sides of the state. Still, it can affect the whole state and has had a notable impact on the coastal parish of Vermilion. Maps 2.36, 2.37, 2.38, and 2.39 indicate the total events, economic damage, injuries, and fatalities (which were none) associated with hailstorms. Bossier Parish is at high risk (greater than 2.0 composite risk score) to hail events and has experienced a significant population increase of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of Bossier parish to hail has increased. No parishes that are at high risk to hail experienced a significant population decrease of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability to hail has not decreased measurably in any part of the state.

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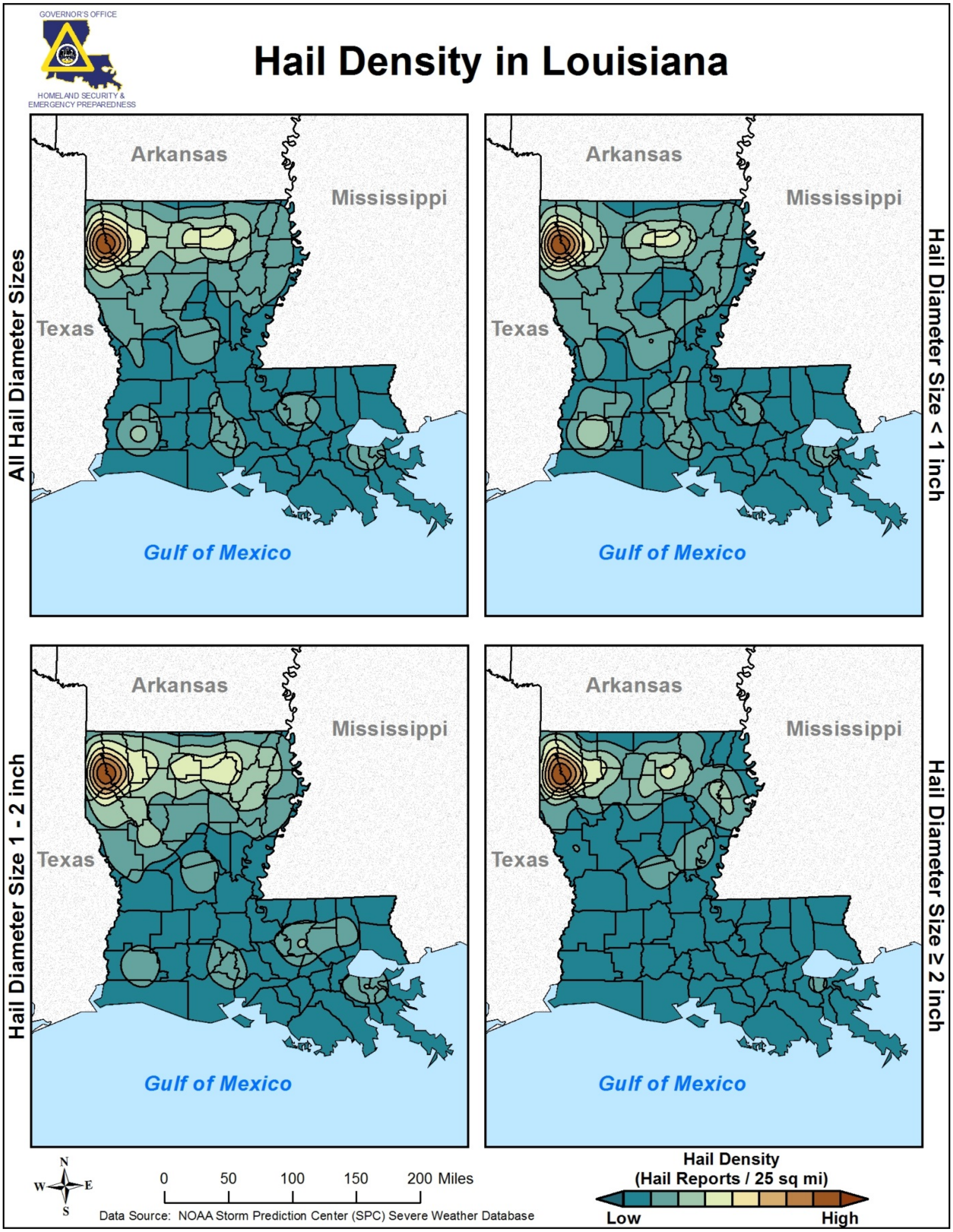
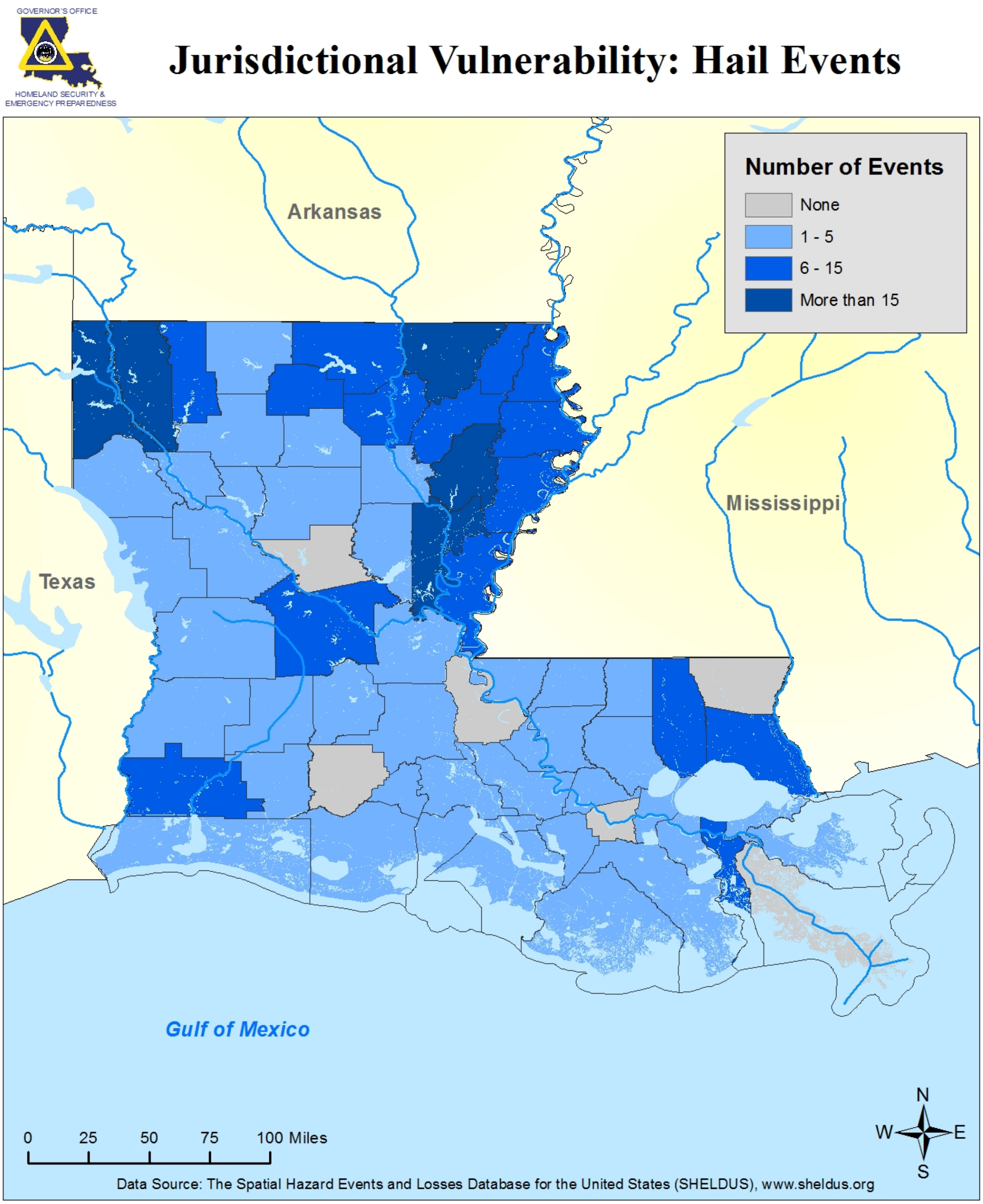
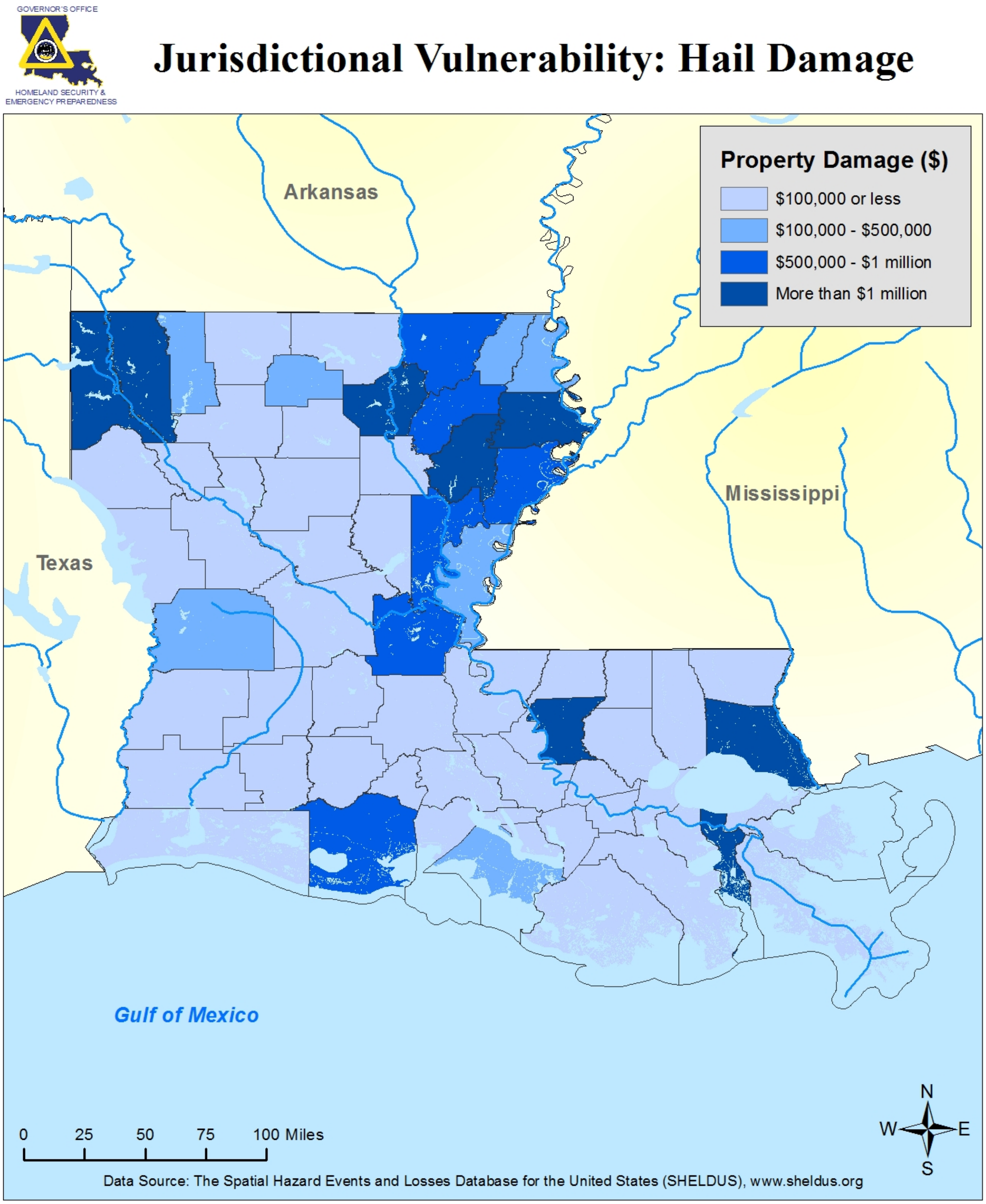


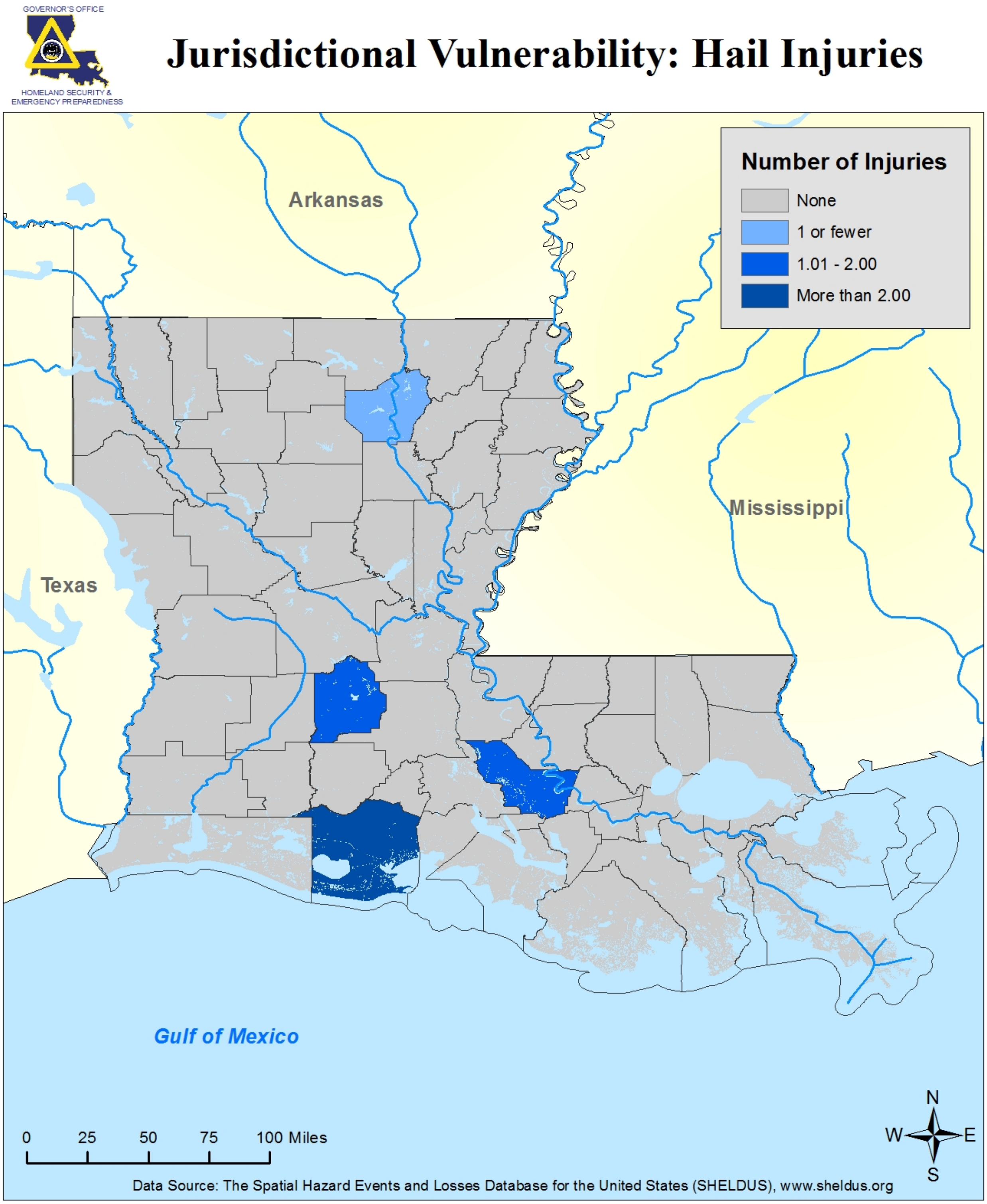
Map 2.35. Hail density across Louisiana for hail of (a) all diameters (top left), (b) < 1 in. in diameter (top right), (c) 1-2 in. in diameter (bottom left), (d) and ≥ 2 in. in diameter (bottom right).



Map 2.36. Louisiana jurisdictional vulnerability for hail events based on data from 1987–2012.



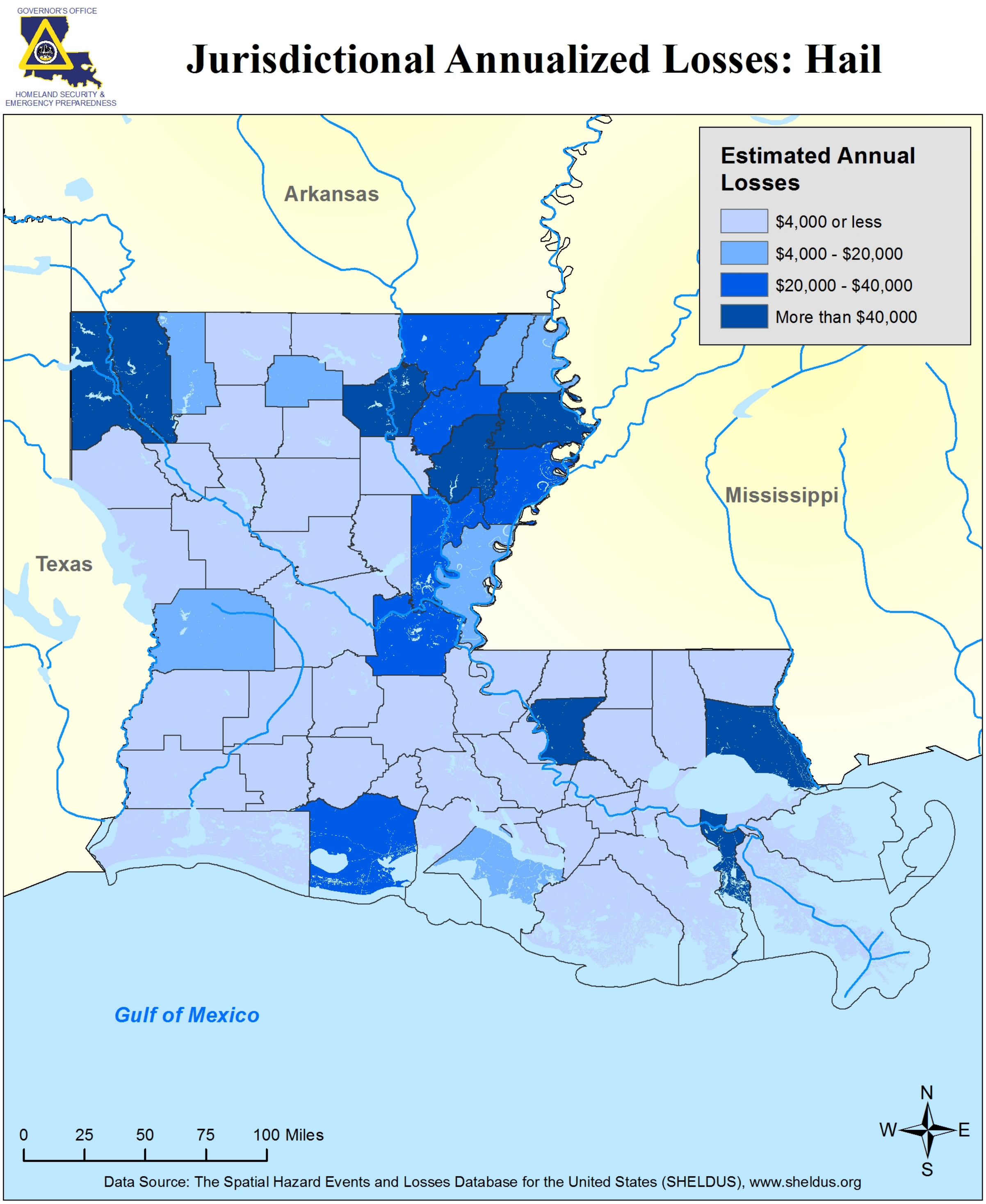
Map 2.37. Louisiana jurisdictional vulnerability for damage from hail based on data from 1987–2012.



Map 2.38. Louisiana jurisdictional vulnerability for injury from hail based on data from 1987–2012.

Map 2.39. Louisiana jurisdictional vulnerability for fatalities from hail based on data from 1987–2012.

To determine potential loss estimates from hail, the available historical loss data was annualized to determine future loss potential (see Map 2.40). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.



Map 2.40. Jurisdictional annualized loss due to hail.

Earlier, Map 2.32 suggested the future likelihood of hailstorms in Louisiana, which is somewhat low. At most, records from the northern parishes indicate that hailstorm events may happen more than once every two years, while the rest of Louisiana might expect it no more than once every two to four years, and likely much less often. The top 10 state assets damaged by hail are profiled at the end of the high winds subsection.

HIGH WINDS

Maps 2.41, 2.42, 2.43, 2.44 show the number of high wind events along with the economic damage, injuries, and fatalities associated with them. Since severe thunderstorms affect the whole state, the effects of dangerous high winds have been extensive, although such effects have been comparatively minimal in the central parishes between the Red River and the Ouachita River. Similarly, as Map 2.33 indicated earlier, the future likelihood of high wind events is quite high, but is at its lowest (one per year) in those central parishes. The parishes at high risk (greater than 2.0 composite risk score) to high wind events (Washington, Calcasieu, and East Baton Rouge) did not experience significant population increases or decreases of more than 10% since 2000 (see Map 2.3). As a result, vulnerability to high wind has not changed measurably across the state.

Map 2.45 shows Louisiana's state assets that have had repetitive claims for both hail and high wind events. Table 2.13 lists the top 10 wind and hail-damaged state asset properties that were paid toward loss claims. State-owned critical facilities located in areas affected by hail and high winds are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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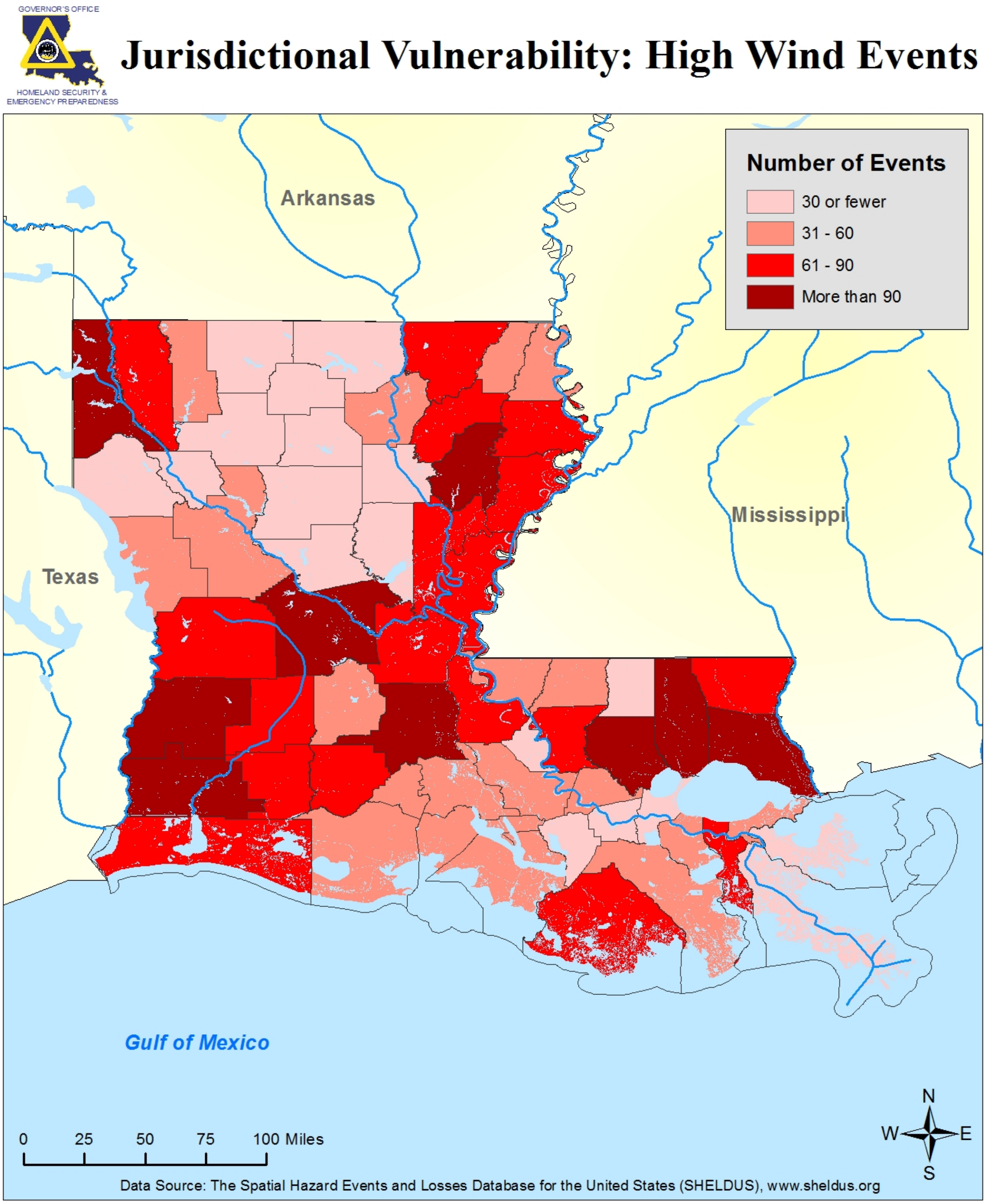
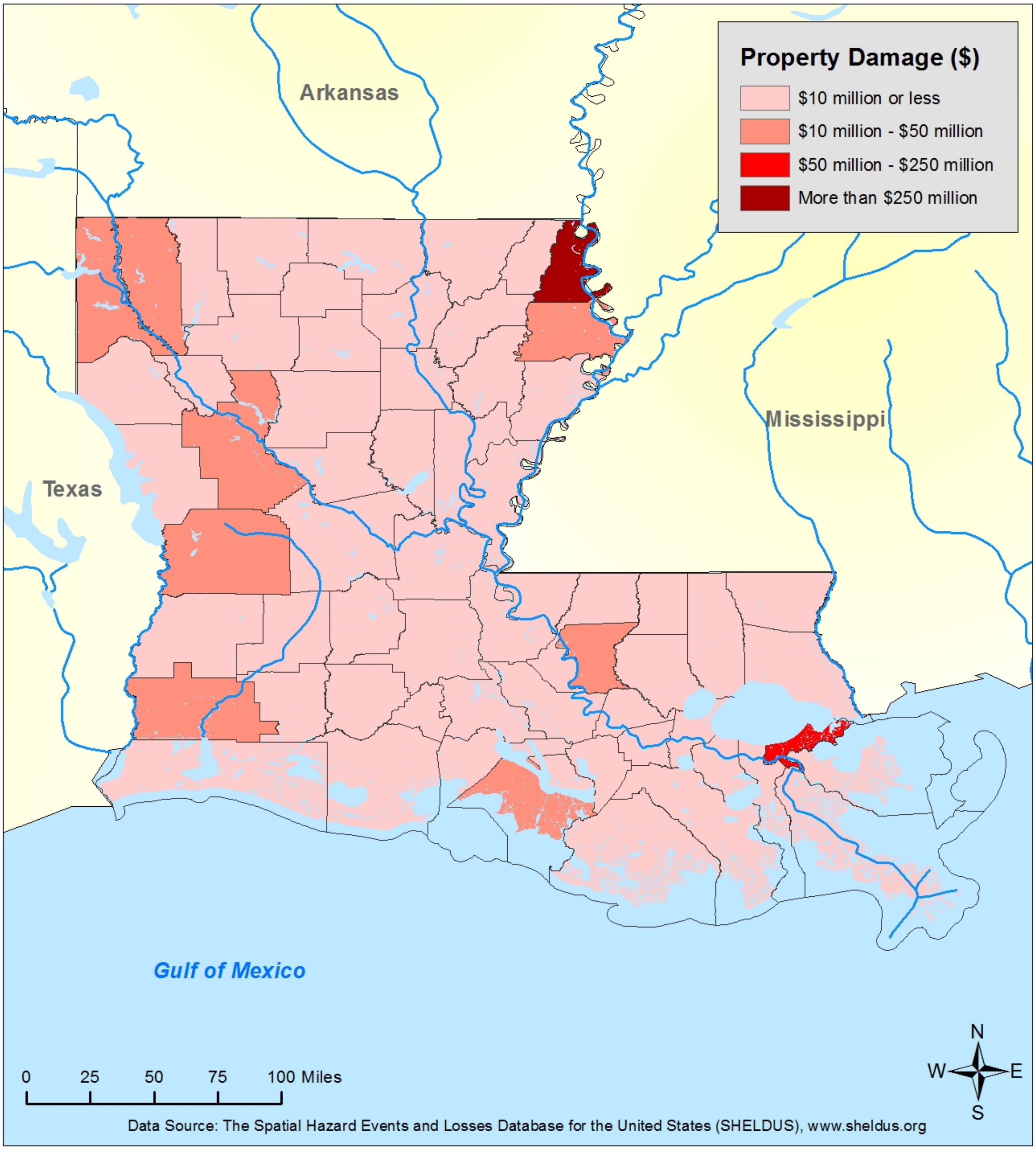


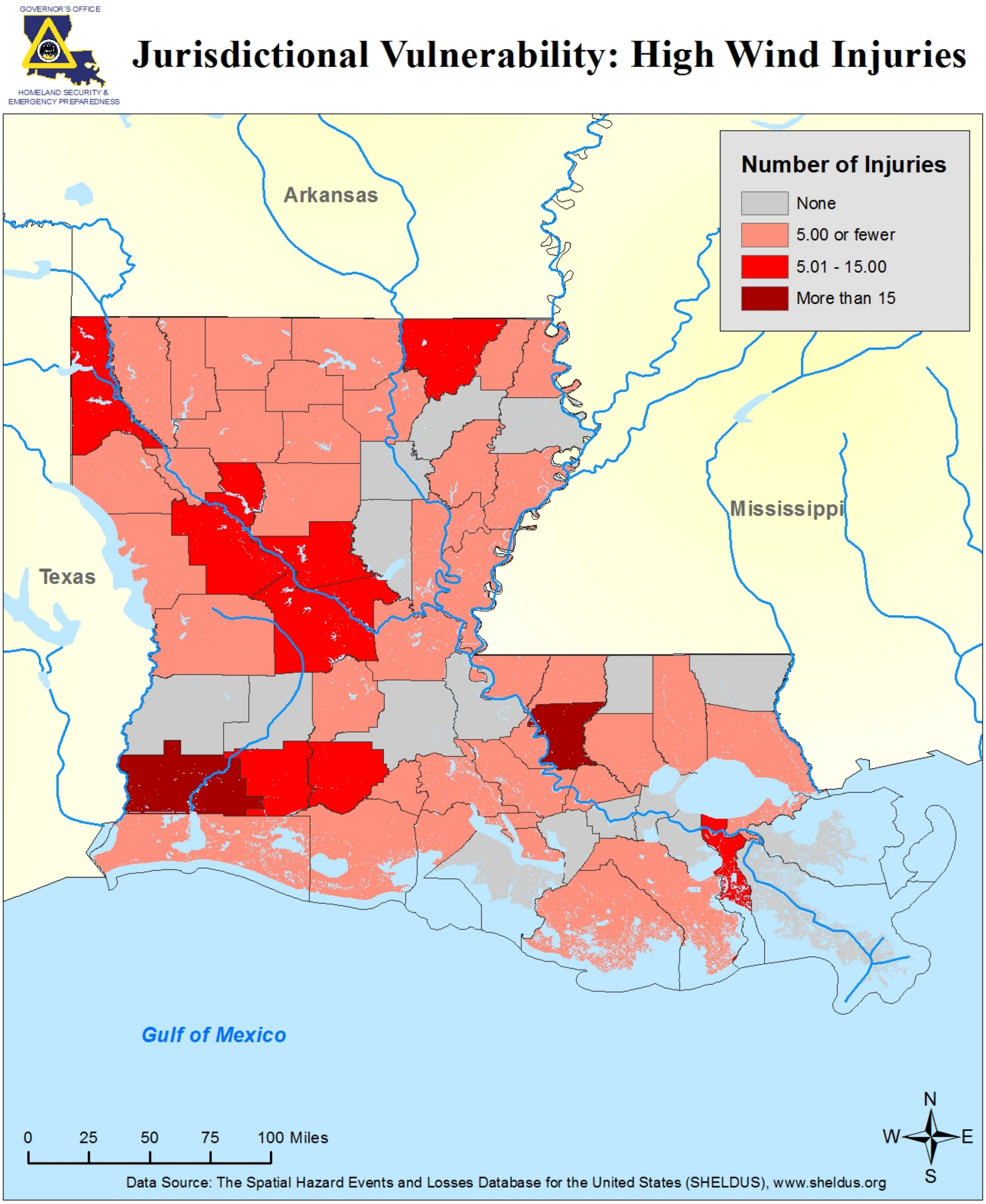
Map 2.41. Louisiana jurisdictional vulnerability for high wind events based on data from 1987–2012.

GOVERNOR'S OFFICE
HOMELAND SECURITY & EMERGENCY PREPAREDNESS

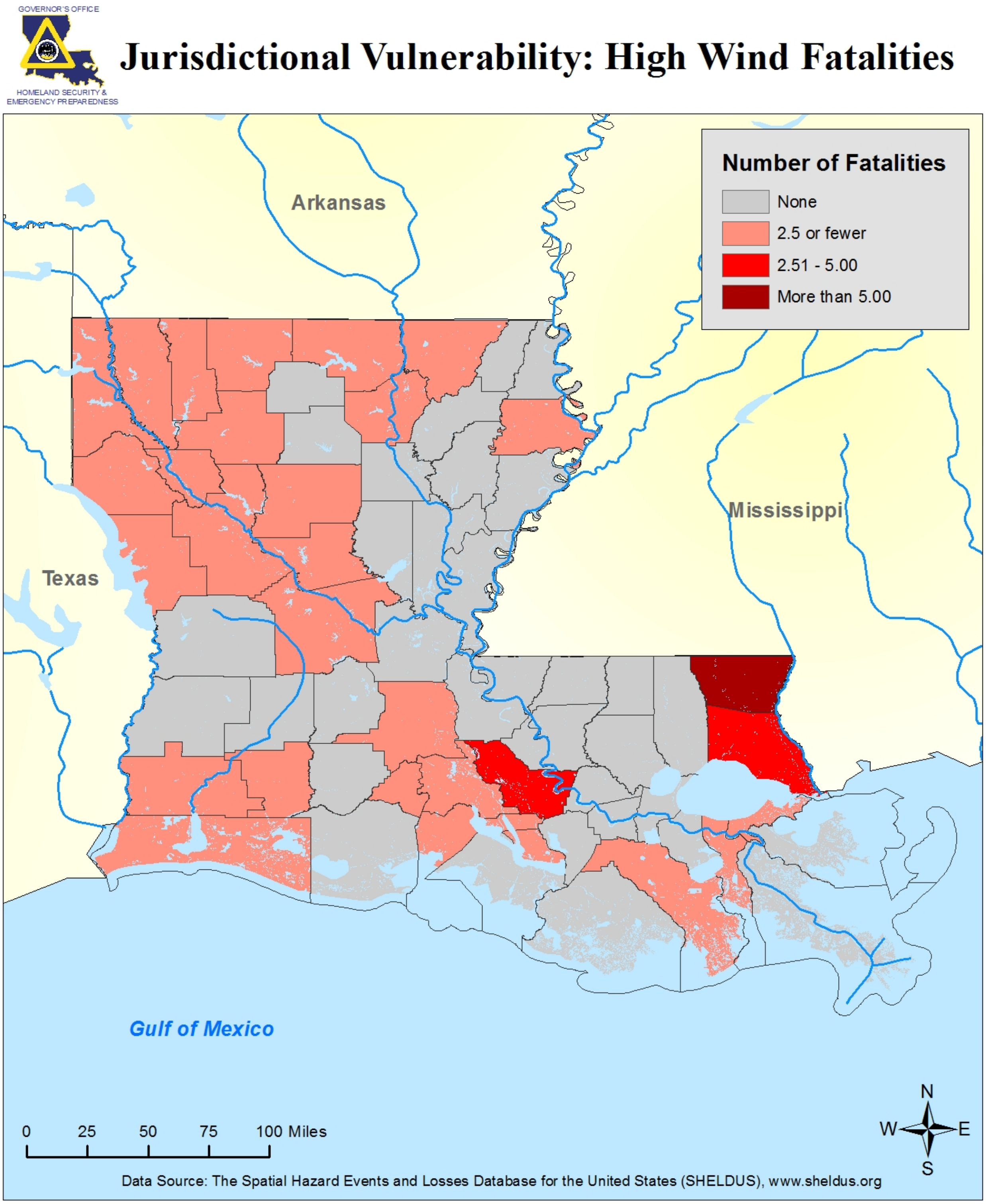
Jurisdictional Vulnerability: High Wind Damage



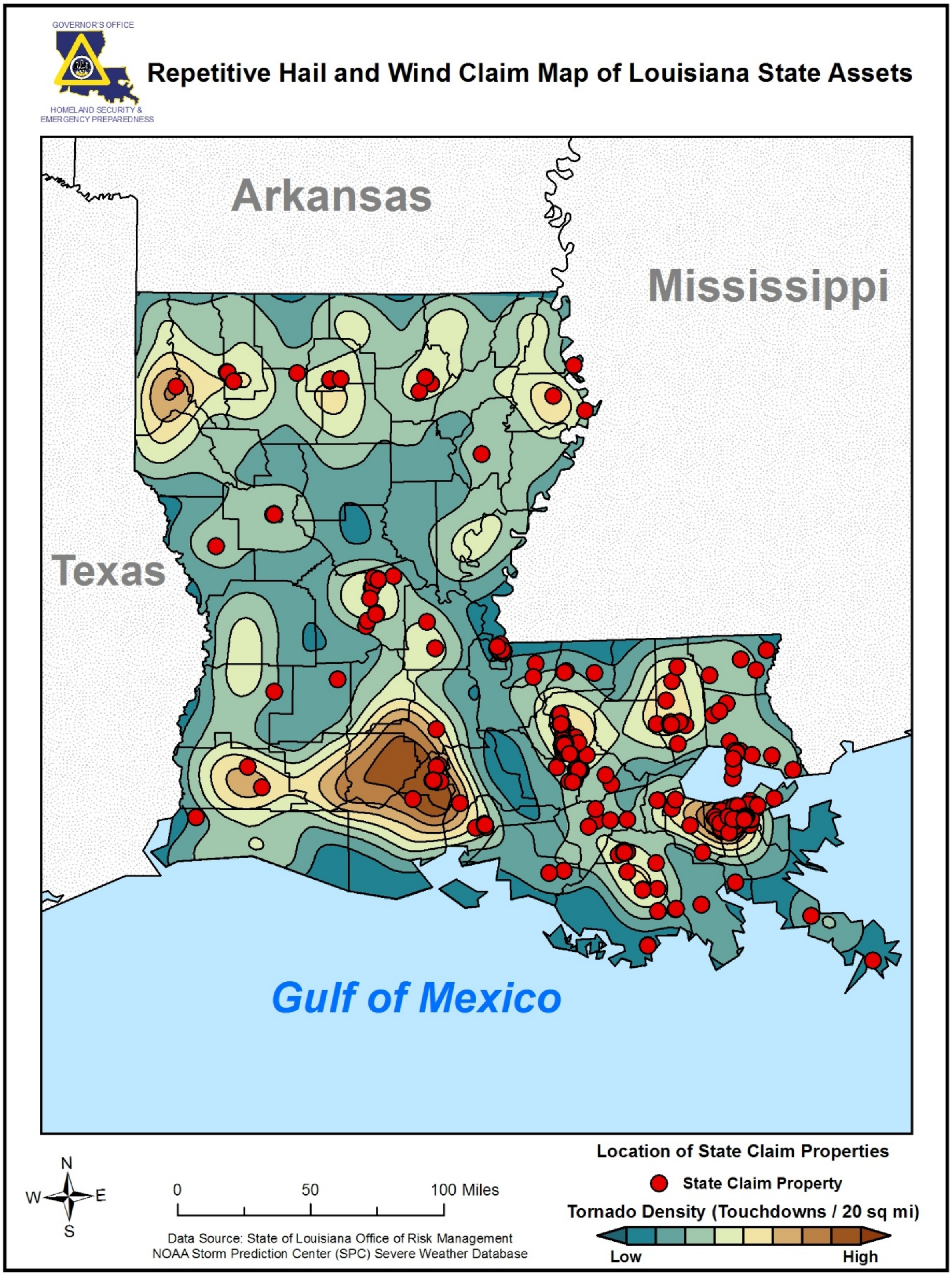
Map 2.42. Louisiana jurisdictional vulnerability for damage from high winds based on data from 1987–2012.



Map 2.43. Louisiana jurisdictional vulnerability for injuries from high winds based on data from 1987–2012.



Map 2.44. Louisiana jurisdictional vulnerability for fatalities from high winds based on data from 1987–2012.



Map 2.45. State assets with repetitive claims for hail and wind damage.

Table 2.13. Top 10 paid claims for wind- and hail-damaged state assets (source: Louisiana Office of Risk Management).

Top 10 Paid Claims for Wind- and Hail-Damaged State Assets				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Wind/Hail)
L13850	Pride Hall - Southeastern University	Hammond	$84,549	1
L14162	Central Mechanical Plant - Baton Rouge Community College	Baton Rouge	$127,760	1
L14648	Albert Wicker Elementary	New Orleans	$102,222	1
S00519	The Louisiana Superdome	New Orleans	$91,598	1
S12595	Jefferson Baseball Stadium	Metairie	$321,196	1
S12799	LaSalle Building	Baton Rouge	$37,204	1
S12851	New Orleans Center for the Creative Arts - Building F	New Orleans	$45,791	1
S12852	New Orleans Center for the Creative Arts - Building E	New Orleans	$40,243	1
S13487	State Printing and Forms Management	Baton Rouge	$86,830	1
S13692	Visitor Processing Center - LA State Penitentiary	Angola	$443,340	1

To determine potential loss estimates from high wind, the available historical loss data was annualized to determine future loss potential (see Map 2.46). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.

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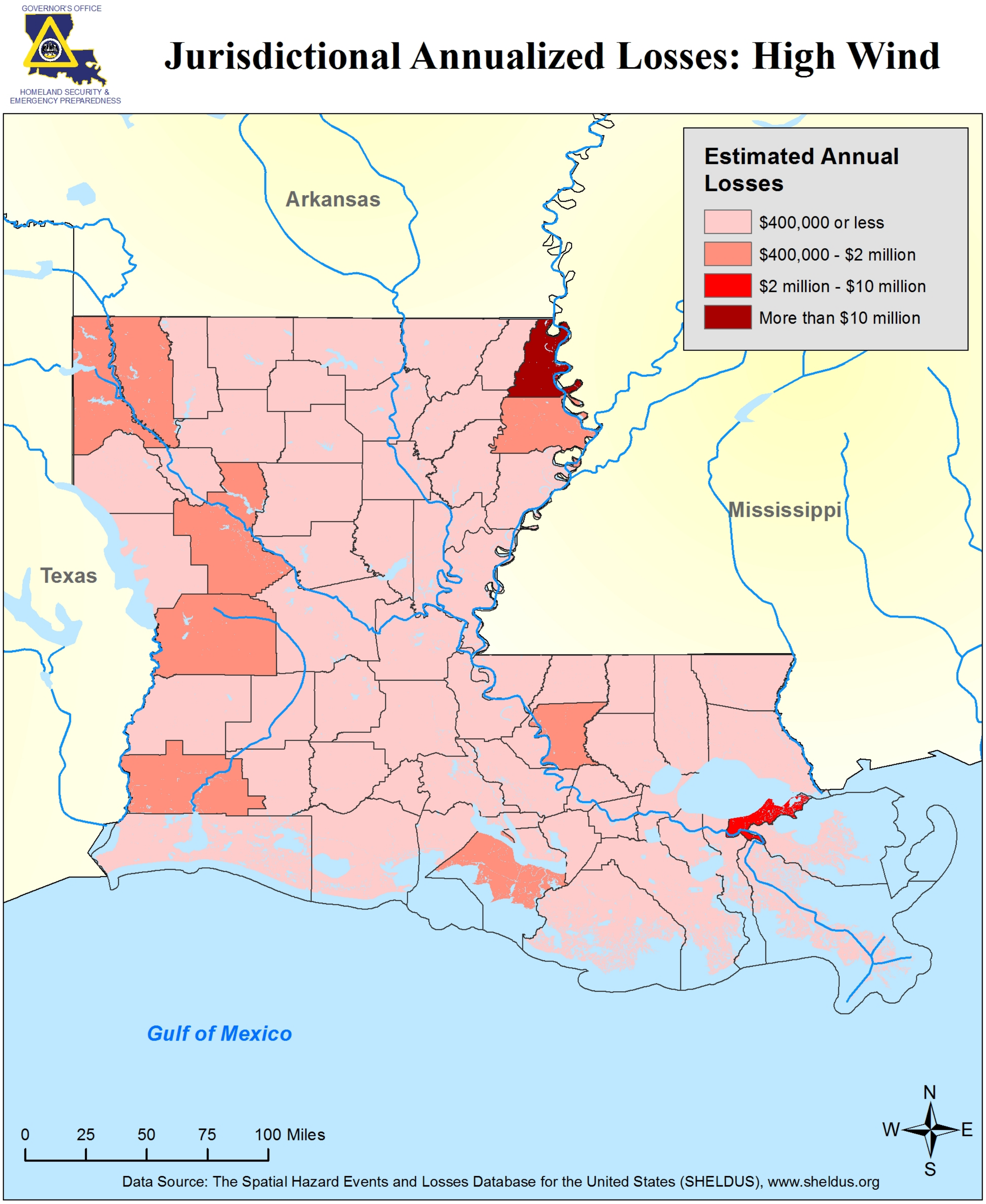

Map 2.46. Jurisdictional annualized loss due to high wind.

Lightning

High winds, rainfall, and a darkening cloud cover are the warning signs for possible cloud-to-ground lightning strikes. While many lightning casualties happen at the beginning of an approaching storm, more than half of lightning deaths occur *after* a thunderstorm has passed. The lightning threat diminishes after the last sound of thunder, but still may persist for more than 30 minutes. When thunderstorms are in the area, but not overhead, the lightning threat can exist when skies are clear. Lightning has been known to strike more than ten mi. from the storm in an area with clear sky above.

Due to the frequency and geographic scope of lightning strikes in Louisiana, the probability of future events is 100%. Lightning strikes most frequently between June and August, with 70% of all lightning fatalities occurring in those months. July alone contains 35% of all fatalities. Most deaths and injuries from lightning occur in the afternoon, and mostly on the weekend. This is the case because many more people are spending time outside, involved in leisure activities that make them vulnerable to lightning strikes.[xxxvi] Map 2.47 shows the density of lightning flashes (per mi^2 per year) in Louisiana.

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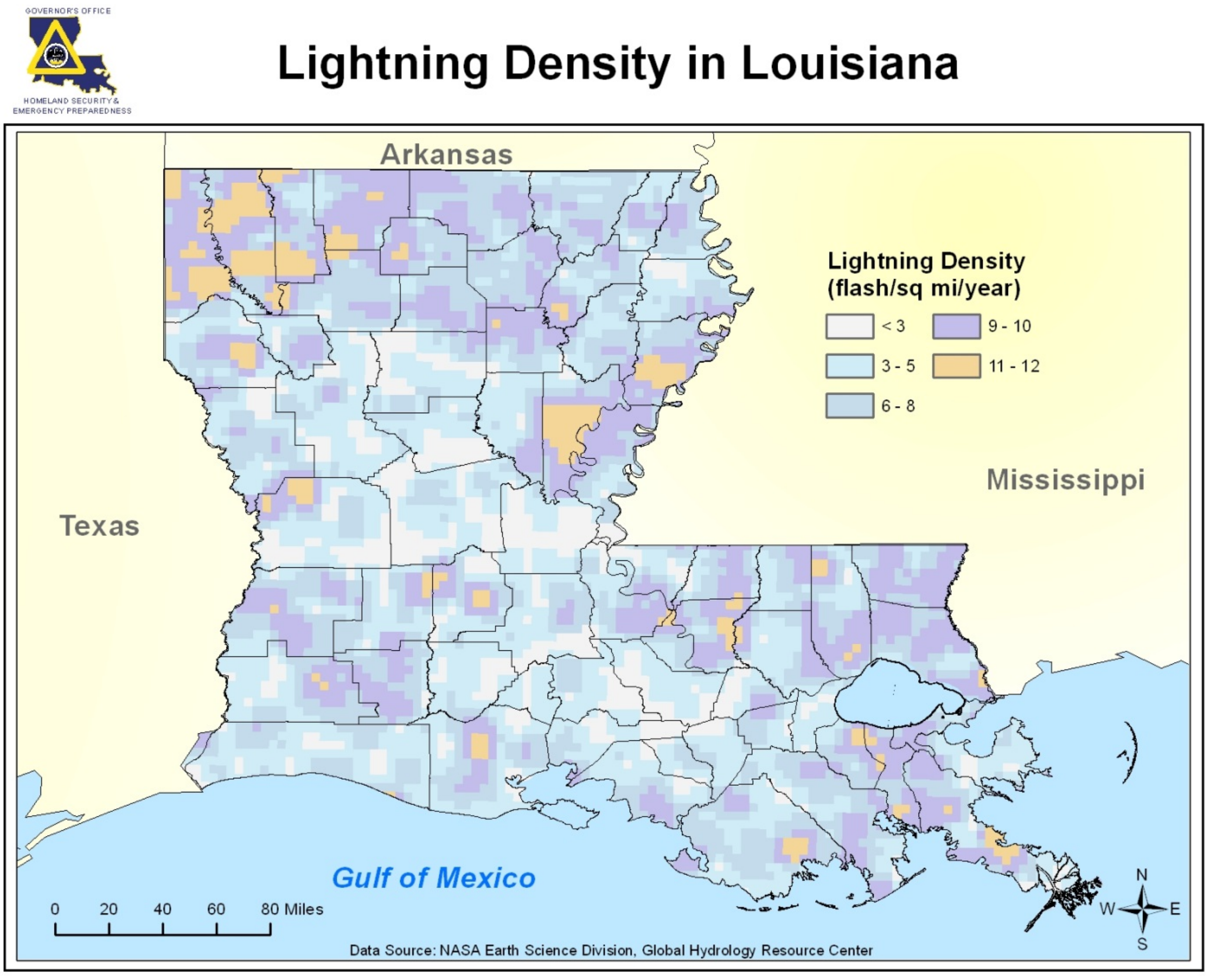
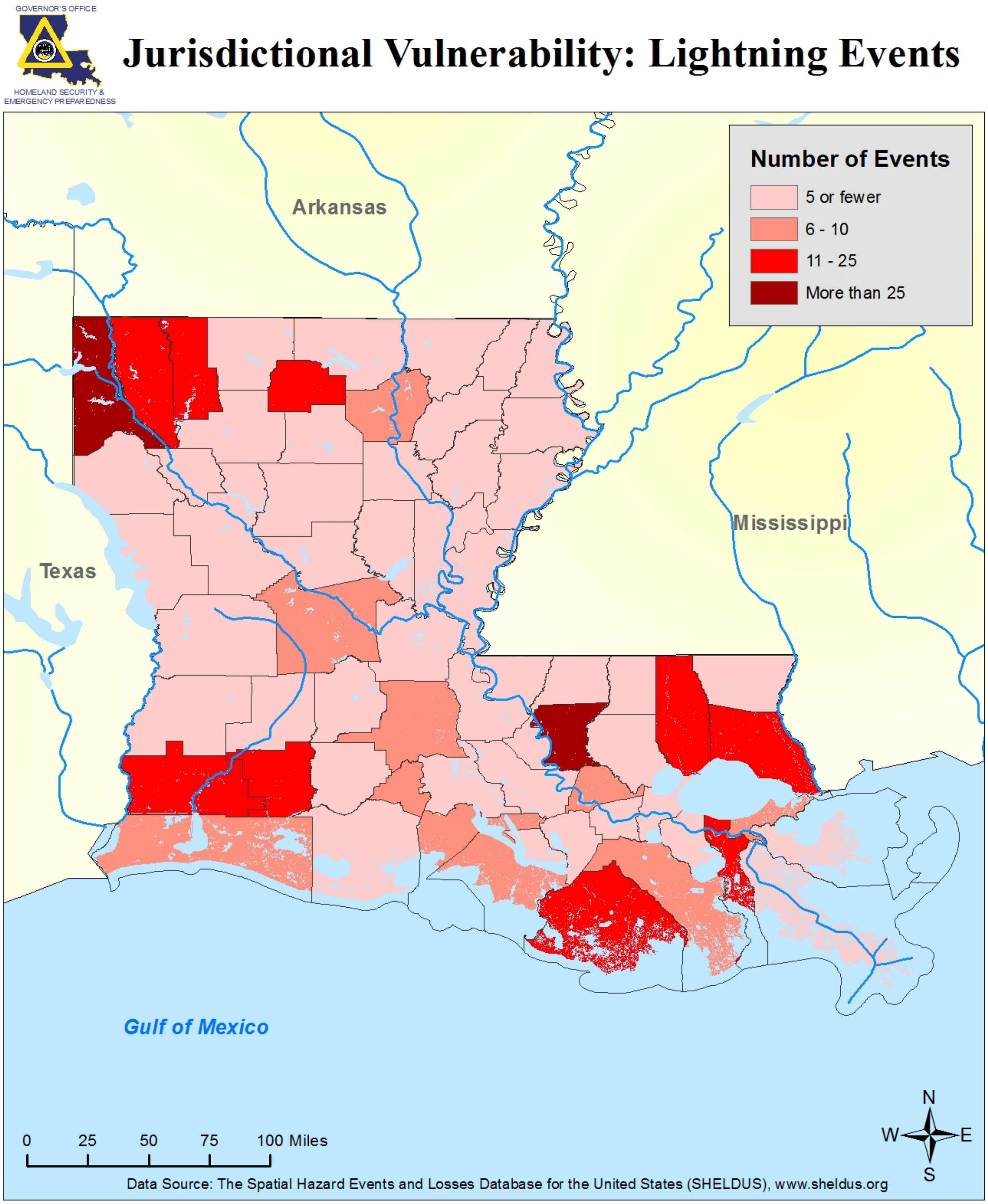
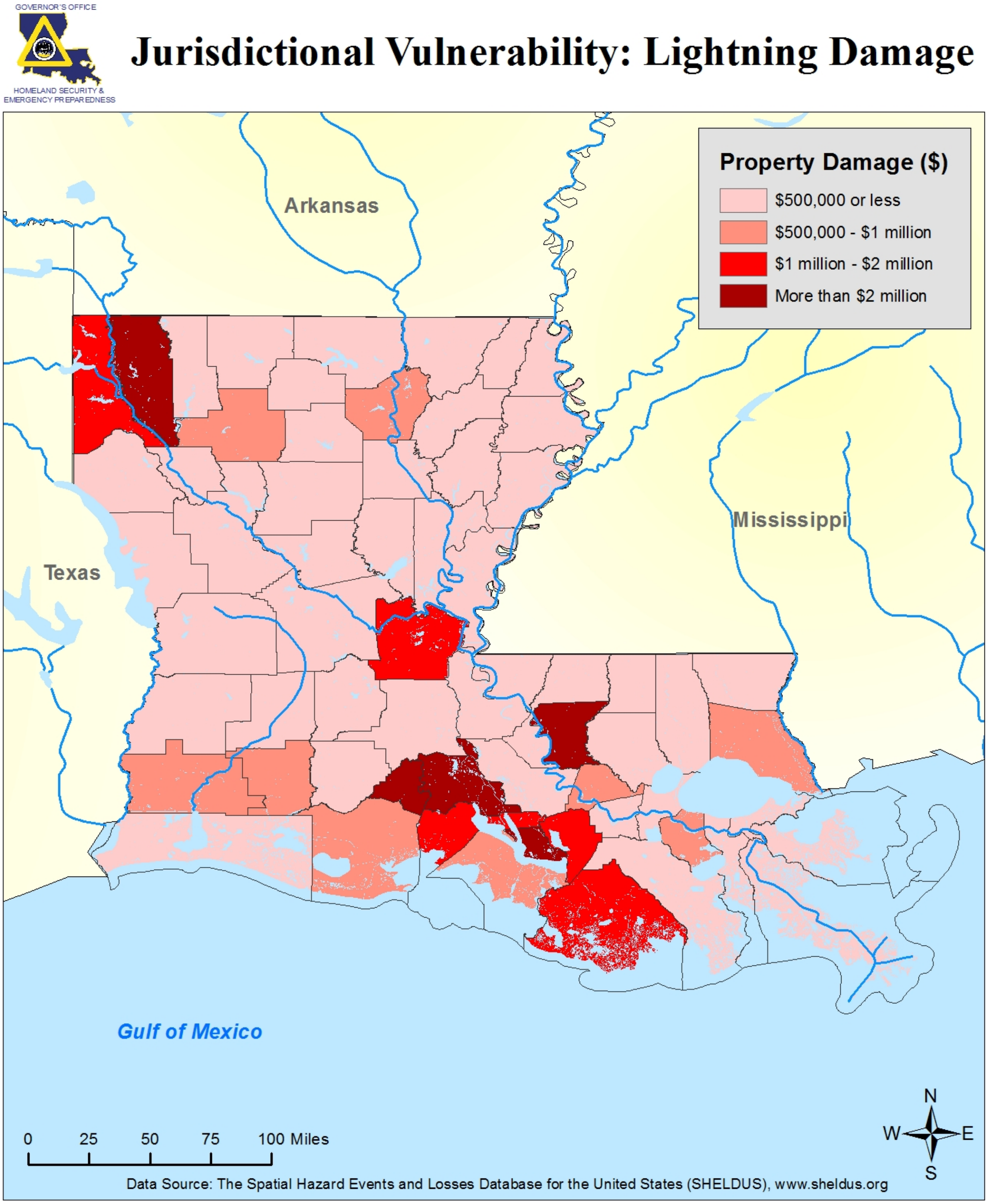


Map 2.47. Density of lightning strikes in Louisiana parishes by flash per square mile per year.

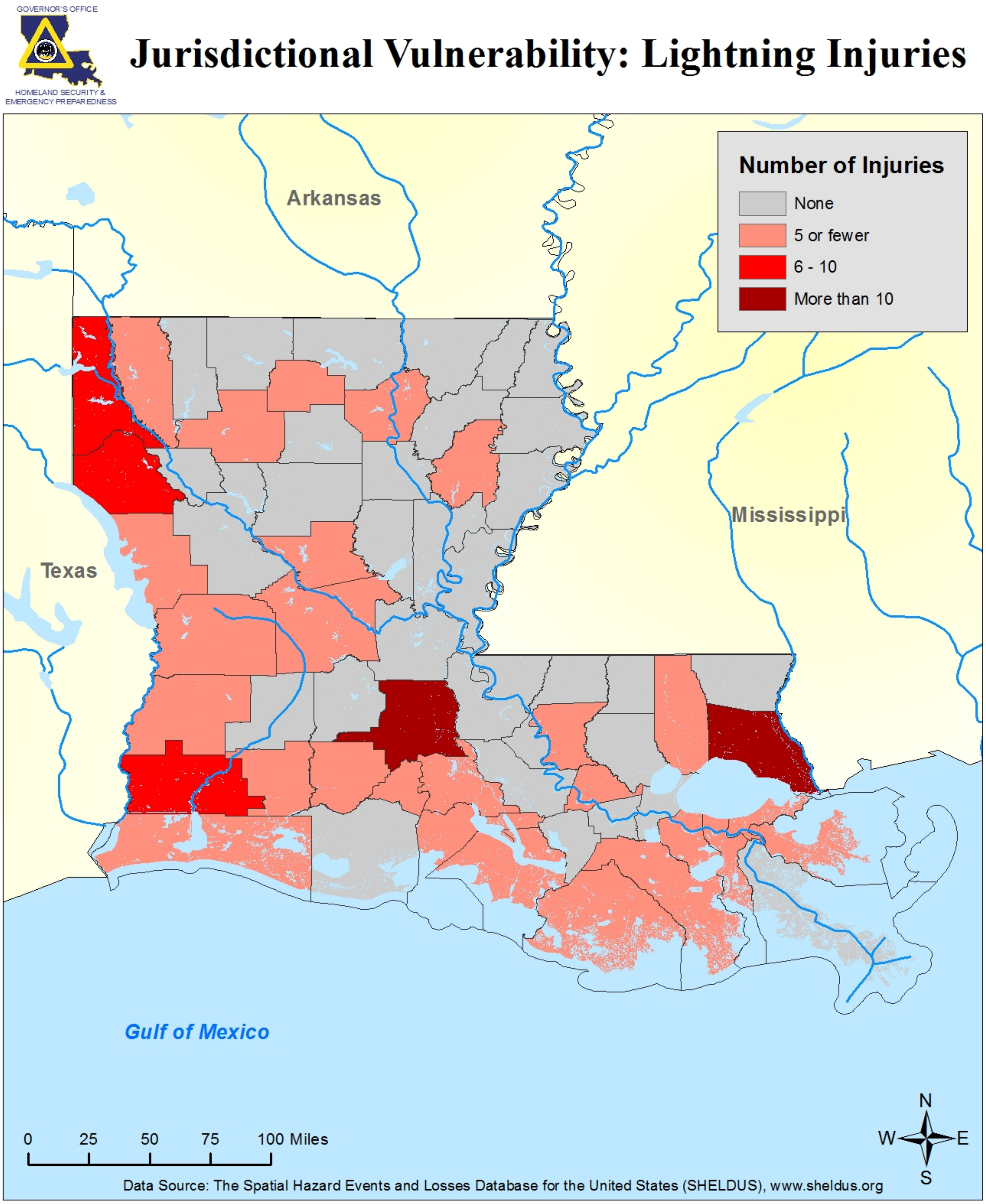
The state's vulnerability to lightning is illustrated through Maps 2.48, 2.49, 2.50, and 2.51, which indicate the total lightning events, as well as the damages, injuries, and fatalities attributed to lightning. Although lightning can strike anywhere, the data reported for lightning will generally reflect a greater incidence of lightning events in (1) areas with higher population densities and (2) areas located in close proximity to the Gulf. Thus, Caddo and East Baton Rouge Parishes have a greater number of events than many other parishes, and all of the parishes along the Gulf have a relatively high probability of future occurrence. Nevertheless, certain areas had unusual damage, injury, and death due to a high incidence of lightning. Terrebonne Parish, while sparsely populated areas of the state, even while located along the Gulf, still seemed to have a higher incidence of lightning strikes, along with the damage and personal injury and death associated with such strikes. Most notably, Terrebonne Parish, which has a population of 111,860 people over 2,080 mi^2.[xxxvii] Two reasons for the relatively high incidence of lightning strikes in Terrebonne are its proximity to the Gulf (and its subsequent vulnerability to more thunderstorms) and its large land mass (it is the second largest parish in area in Louisiana).



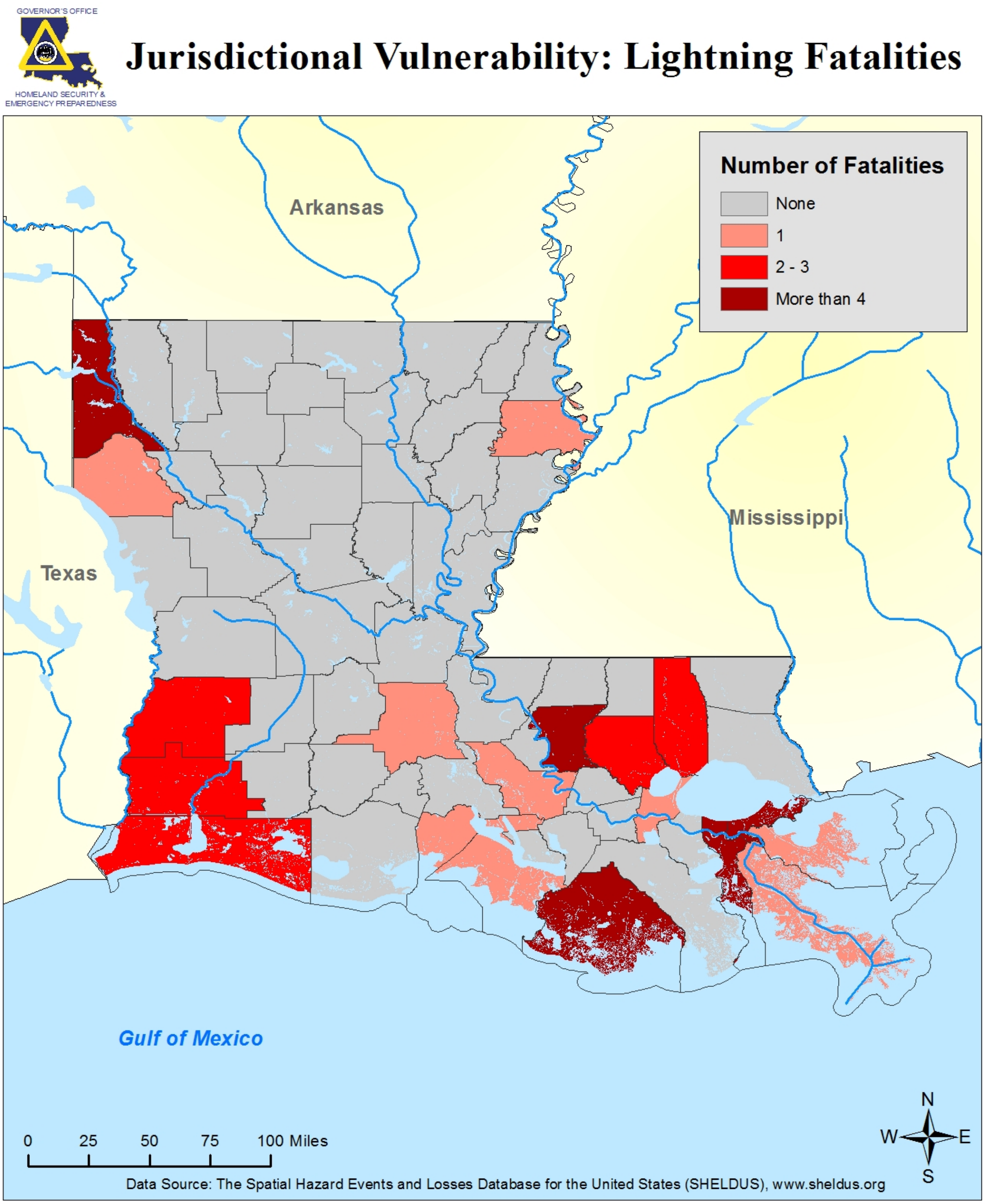
Map 2.48. Louisiana jurisdictional vulnerability for lightning strikes based on data from 1987–2012.



Map 2.49. Louisiana jurisdictional vulnerability for damage from lightning strikes based on data from 1987–2012.



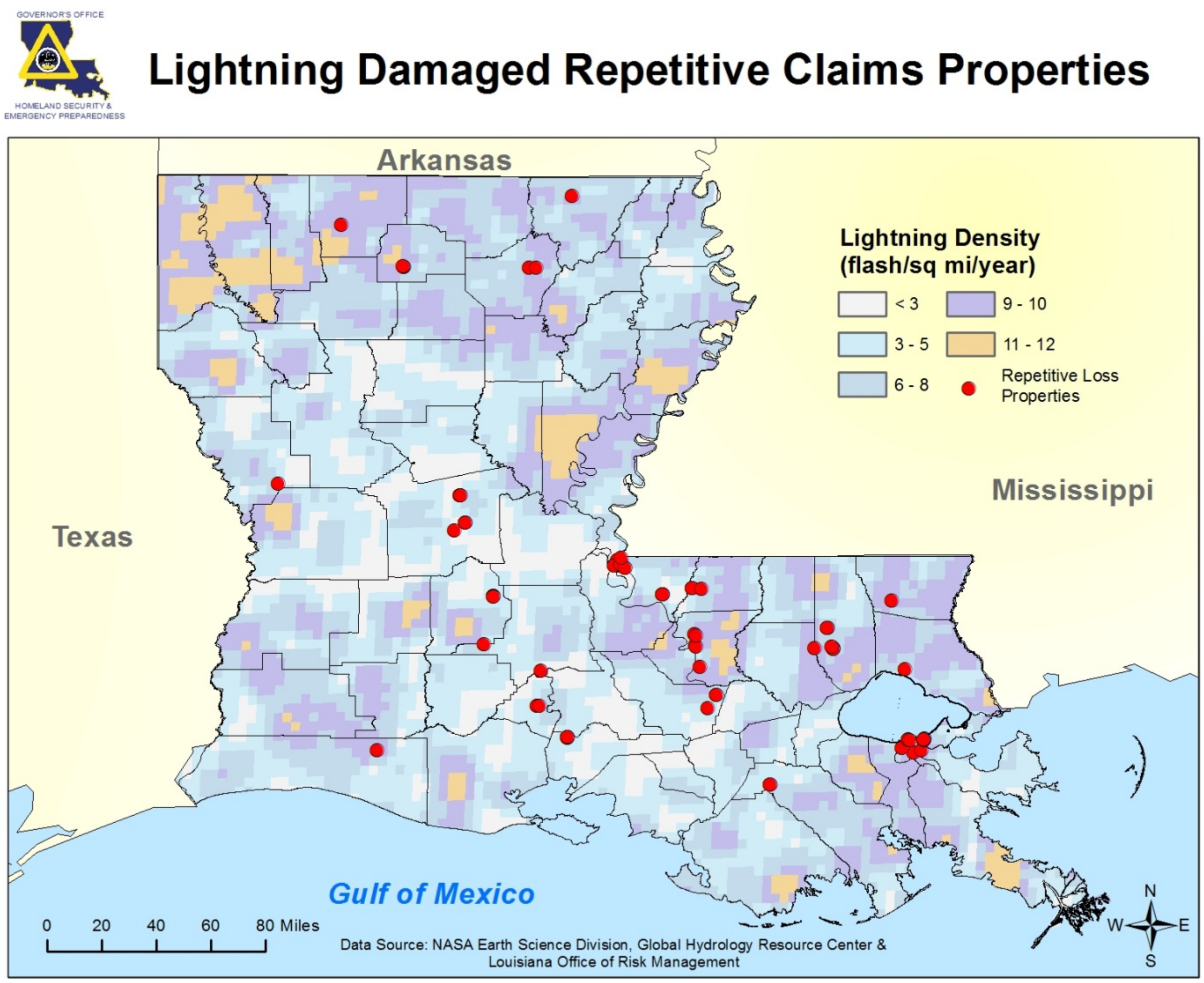
Map 2.50. Louisiana jurisdictional vulnerability for injury from lightning strikes based on data from 1987–2012.



Map 2.51. Louisiana jurisdictional vulnerability for fatalities from lightning strikes based on data from 1987–2012.

Earlier, Map 2.34 indicated the future probability of lightning strikes in Louisiana by parish, suggesting that parishes with urban areas were in greater danger than more rural parishes. Again, lightning strikes tend to be reported more frequently in heavily populated areas and along the Gulf Coast where thunderstorms are more prevalent.

Map 2.52 locates previously damaged state asset properties against the density of lightning strikes over the past 25 years. Table 2.14 lists the top 10 lightning-damaged state asset properties. State-owned critical facilities located in areas affected by lightning are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.



Map 2.52. State assets with repetitive claims for lightning damage.

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Table 2.14. Top 10 paid claims for lightning-damaged state assets (source: Louisiana Office of Risk Management).

Top 10 Paid Claims for Lightning-Damaged State Assets				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Lightning)
L22008	Millennium Apartment Buildings - Southern University	Baton Rouge	$78,998	1
S02553	Center Building - Eastern LA Mental Health System	Jackson	$48,028	1
S03160	Main Hospital - Lallie Kemp Regional Medical Center	Independence	$33,806	1
S03186	Generator Room - Lallie Kemp Regional Medical Center	Independence	$46,291	1
S08879	Walker Hall - University of Louisiana-Monroe	Monroe	$1,738,587	1
S10101	Utilities Plant - Louisiana State University-Alexandria	Alexandria	$23,582	1
S12282	Building 34 - University of Louisiana-Lafayette	New Iberia	$42,472	1
S14400	Building 52 - University of Louisiana-Lafayette	New Iberia	$27,255	1
S14401	Building 53 - University of Louisiana-Lafayette	New Iberia	$26,255	1
S16016	Farm Services Building - Southern University	Baker	$43,914	1

Maps 2.53, 2.54, and 2.55 show the composite jurisdictional risk for hail, high winds, and lightning in Louisiana based on the preceding data. Caddo and Bossier Parishes have the greatest risk of hail events (high); East Baton Rouge, Calcasieu, and Washington Parishes have the greatest risk of high wind events (high); and East Baton Rouge and Caddo Parishes have the greatest risk of lightning events (very high and high, respectively). The parishes at high risk (greater than 2.0 composite risk score) to lightning (Caddo and East Baton Rouge) did not experience significant population increases or decreases of more than 10% since 2000 (see Map 2.3). As a result, vulnerability to lightning has not changed measurably across the state.

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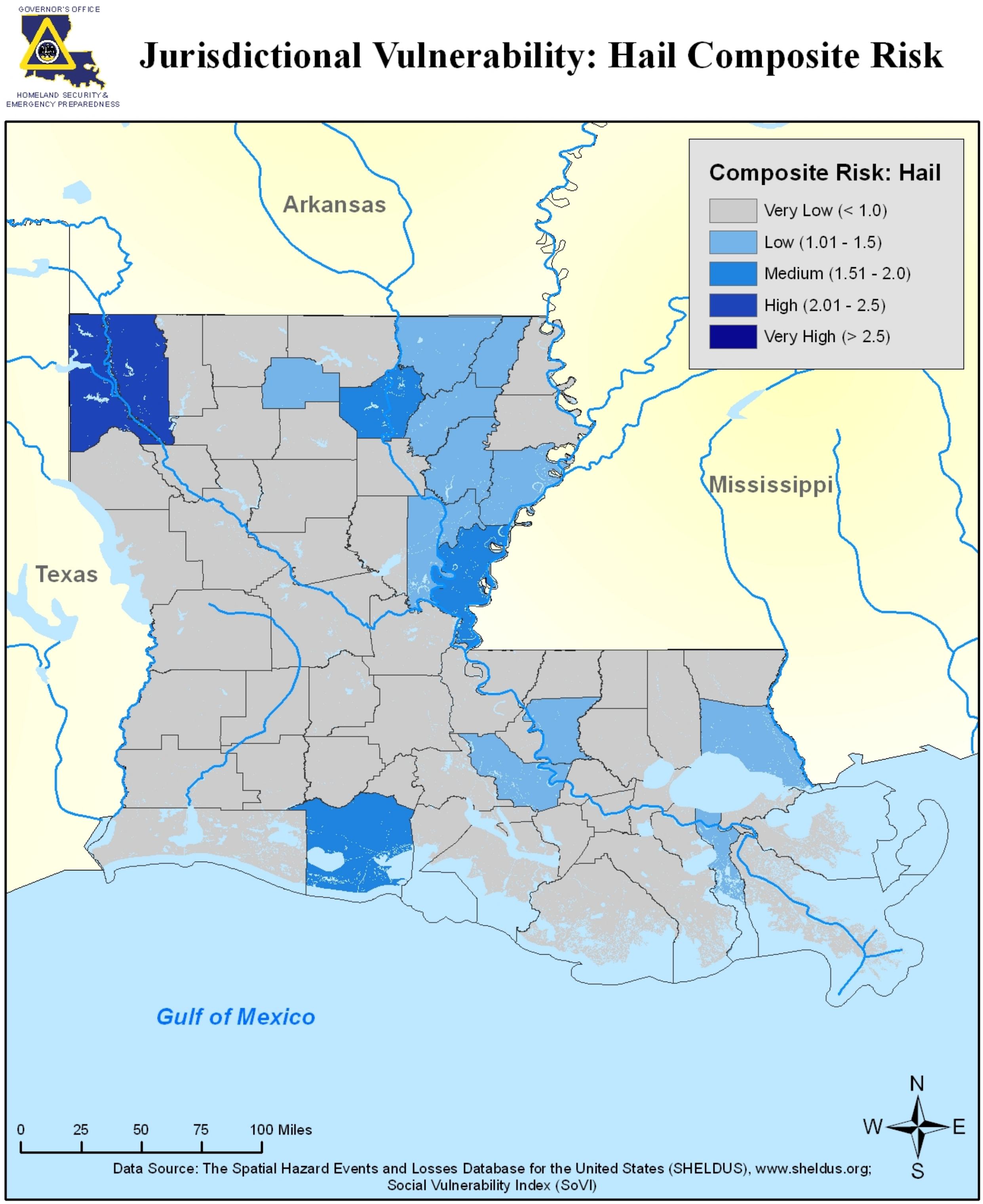
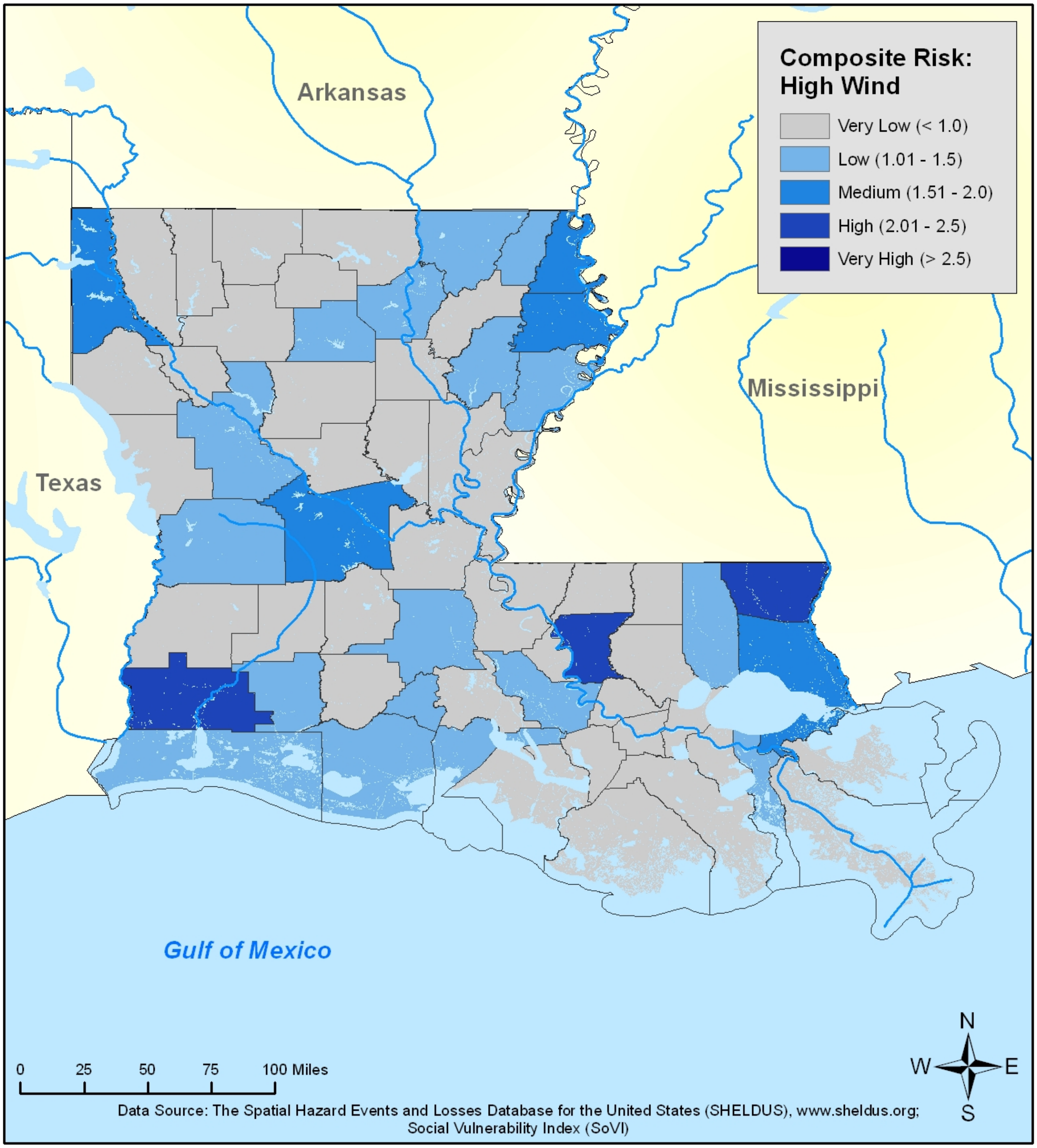


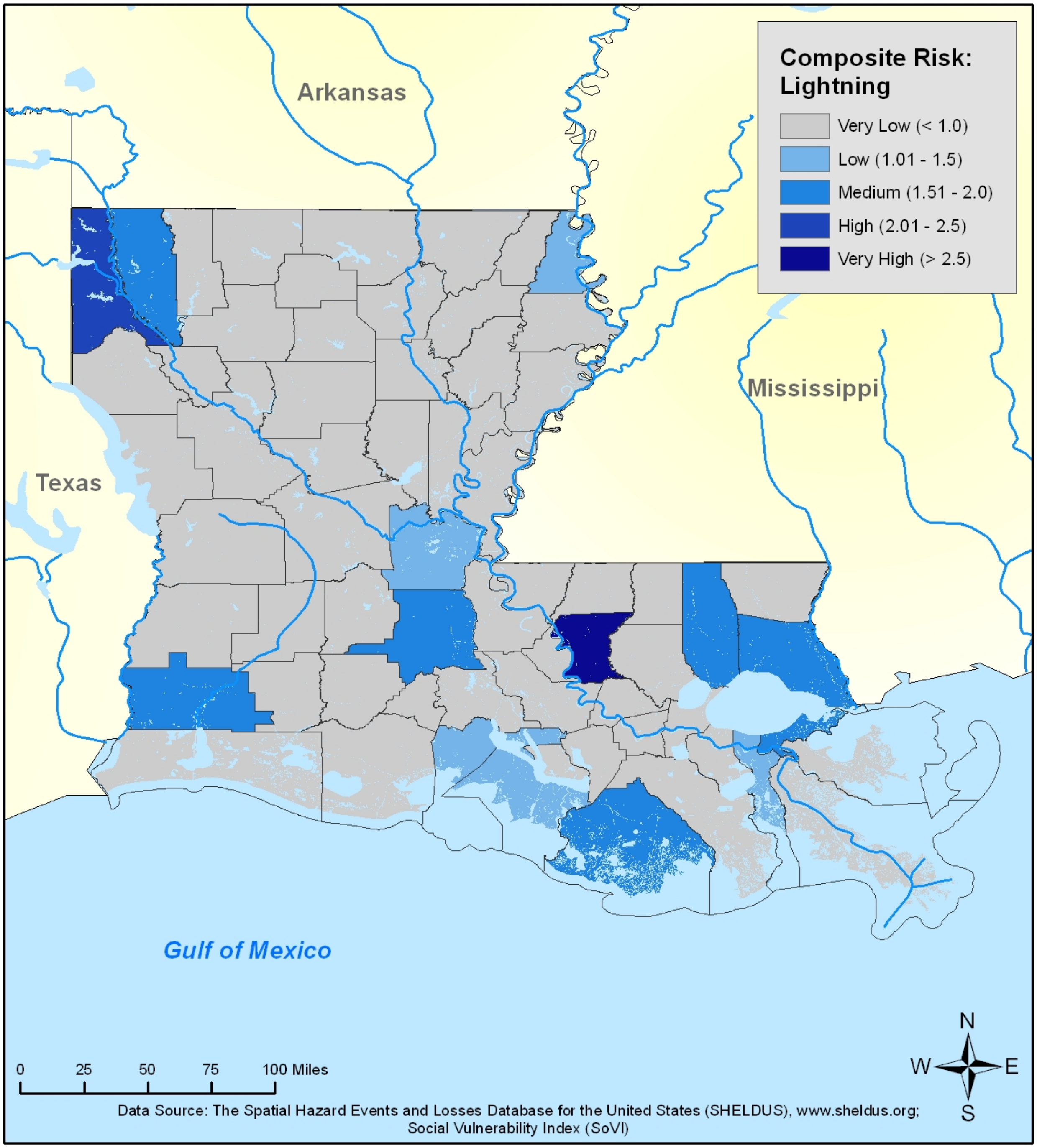
Map 2.53. Composite risk map for hail events showing parishes with the highest historical and highest potential risks mostly in northern Louisiana.

Jurisdictional Vulnerability: High Wind Composite Risk



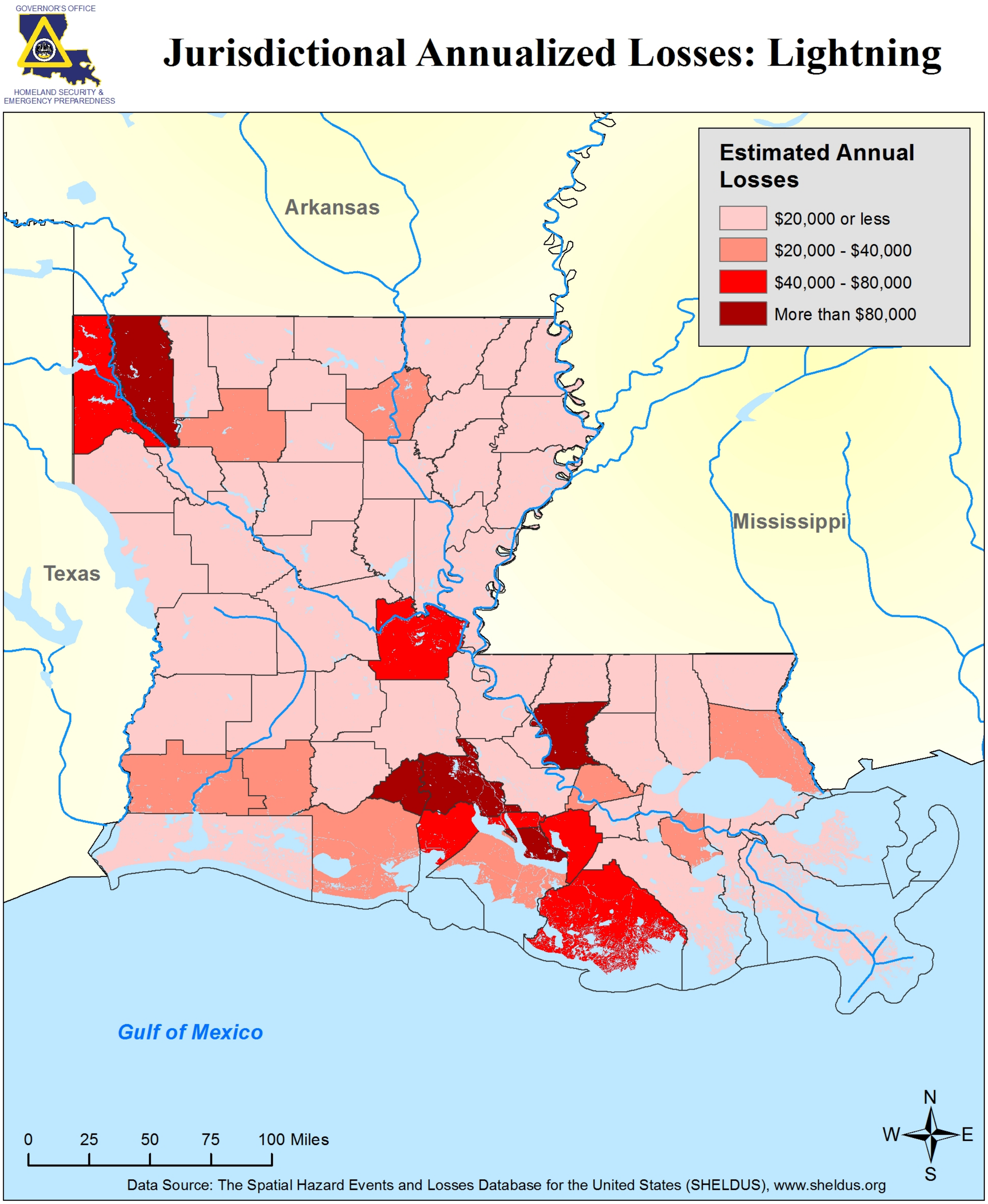
Map 2.54. Composite risk map for high wind events showing parishes with the highest historical and highest potential risks scattered across Louisiana.

Jurisdictional Vulnerability: Lightning Composite Risk



Map 2.55. Composite risk map for lightning events showing parishes with the highest historical and highest potential risks scattered across Louisiana.

To determine potential loss estimates from lightning, the available historical loss data was annualized to determine future loss potential (Map 2.56). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.



Map 2.56. Jurisdictional annualized loss due to lightning.

Potential Economic Loss

Based on multiple sources (e.g., SHELDUS, NOAA, NCDC), the following parishes are most likely to be affected by thunderstorms: Bossier, Caddo, Calcasieu, Cameron, Catahoula, Concordia, East Baton Rouge, East Carroll, Franklin, Jefferson, Jefferson Davis, Madison, Morehouse, Orleans, Ouachita, Richland, St. Tammany, Tangipahoa, Tensas, Washington, and West Carroll. Among these parishes, Bossier, Caddo, Calcasieu, East Baton Rouge, Jefferson, Orleans, Ouachita, St. Tammany, and Tangipahoa Parishes have populations of over 80,000 and have the highest infrastructure dollar exposures within Louisiana. These nine parishes are considered to have the highest vulnerability to thunderstorms within the state.

Table 2.15 shows the overall exposure for high-risk parishes based on Hazus-MH 2.1 inventory databases and the percentage of residences comprising mobile home structures in each parish. Similar to their vulnerability to tornadoes (although not as extreme), mobile home structures are vulnerable to the various hazards associated with thunderstorms and particularly to high wind since they are not built to withstand high wind speeds.

Table 2.15. Overall exposure for high-risk parishes.

Exposure Data for Parishes with Highest Thunderstorm Risk			
Parish	Population (2010)	Total Exposure ($1,000)	Mobile Homes (%)
Bossier	116,979	$16,148,468	15.5
Caddo	254,969	$34,345,146	9.3
Calcasieu	192,768	$21,704,525	16.1
Cameron	6,839	$5,497,935	36.0
Catahoula	10,407	$4,153,475	25.3
Concordia	20,822	$3,928,603	22.6
East Baton Rouge	440,171	$62,537,076	3.2
East Carroll	7,759	$2,430,145	18.3
Franklin	20,767	$3,818,331	18.7
Jefferson	432,552	$68,890,600	1.6
Jefferson Davis	31,594	$8,082,036	18.4
Madison	12,093	$2,712,688	14.4
Morehouse	27,979	$6,391,012	16.9
Orleans	343,829	$71,111,981	1.6
Ouachita	153,720	$19,349,689	13.7
Richland	20,725	$4,905,466	17.7
St. Tammany	233,740	$31,411,675	8.6
Tangipahoa	121,097	$13,106,990	22.4
Tensas	5,252	$2,158,271	10.0
Washington	47,168	$6,658,683	22.6
West Carroll	11,604	$2,412,695	24.0
TOTALS	**2,512,834**	**$391,755,490**	**16.0 (Average)**

Based on the geographic extents determined in the hazard profile and the jurisdictional vulnerability assessments, the parishes in blue in Map 2.57 have the highest risk factor with respect to thunderstorms. The corridors outlined in red mark the extent of each high-risk area.

This Plan Update also utilizes Hazus-MH 2.1 for the analysis of building exposure in each of the most vulnerable parishes by general occupancy type, which is detailed in Table 2.16.

Table 2.16. Building exposure for thunderstorms in most vulnerable parishes by general occupancy type.

Building Exposure in Most Vulnerable Parishes for Thunderstorms							
Parish	Exposure Type ($1,000)						
	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education
Bossier	11,891,551	2,709,321	761,501	59,494	432,384	192,803	101,414
Caddo	24,028,899	6,808,440	1,781,362	103,056	1,140,772	226,850	255,767
Calcasieu	15,879,101	3,805,841	1,011,908	58,492	576,612	150,541	222,030
Cameron	4,209,736	691,929	393,622	37,564	90,194	38,602	36,288
Catahoula	3,057,422	629,752	138,779	63,292	153,556	57,673	53,001
Concordia	2,901,139	621,577	96,944	55,674	151,576	51,342	50,351
East Baton Rouge	44,435,690	12,153,263	2,615,210	137,030	1,511,136	960,722	724,025
East Carroll	1,686,708	359,608	121,147	56,672	127,054	39,850	39,106
Franklin	2,797,175	530,282	139,622	72,966	183,488	48,884	45,914
Jefferson	50,104,392	13,418,248	3,024,142	114,922	1,204,366	437,819	586,711
Jefferson Davis	6,364,838	911,215	320,585	64,622	239,620	75,342	105,814
Madison	1,993,179	379,309	109,226	59,224	118,460	25,696	27,594
Morehouse	4,880,603	788,741	239,143	83,610	272,078	61,893	64,944
Orleans	50,691,672	12,784,835	2,595,764	77,762	1,980,374	984,070	1,997,504
Ouachita	12,968,015	4,382,733	938,805	80,576	616,220	181,698	181,642
Richland	3,420,917	774,645	265,348	90,184	234,316	67,130	52,926
St. Tammany	23,583,443	5,750,413	927,918	111,050	565,620	246,405	226,826
Tangipahoa	9,581,467	2,226,918	520,534	67,496	435,132	101,324	174,119
Tensas	1,490,623	421,817	63,506	52,738	70,438	30,406	28,743
Washington	5,129,019	819,489	254,003	64,838	266,440	55,916	68,978
West Carroll	1,722,320	287,341	107,687	76,142	144,518	41,231	33,456
TOTALS	**282,817,909**	**71,255,717**	**16,426,756**	**1,587,404**	**10,514,354**	**4,076,197**	**5,077,153**

Map 2.57. High risk areas for thunderstorms with specific sub-hazard types listed.

Based on the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to thunderstorms is listed in Table 2.17.

Table 2.17. Regional vulnerability to thunderstorms.

Regional Vulnerability to Thunderstorms	
Vulnerable Locations	Number of Records
Louisiana Parishes	21
Dams	297
Airports	59
Communication Towers/Facilities	266
Electricity Providers/Facilities	48
Emergency Response Centers	15
Fire Stations	321
Hospitals	127
Nuclear Plants	0
Police Stations	443
Elementary/Secondary Schools	1341
Universities/Colleges	28

Louisiana has a very high frequency of thunderstorms annually. Collectively, the three thunderstorm-associated sub-hazards of hail, high wind, and lightning cause hundreds of thousands of dollars of damage to property every year. All forms of occupancy types are susceptible to thunderstorms and a severe storm can have many of the same effects as tornadoes including the disruption of traffic flow and the impediment of police, fire, and medical personnel during response and recovery efforts. Power outages are commonly caused by high winds that cause downed trees and power lines and can impact entire communities and jurisdictions for long periods of time depending on the severity. Hail can cause widespread damage, especially to homes and automobiles. Lightning can disrupt communication towers, start fires, and harm technology-intensive devices.

Substantial damage could be incurred by state, local, and federal facilities. The damage to infrastructure could be widespread with lost power, water, sewer, gas, and communications. Road and technology (e.g., internet, communications) networks can be severely impacted by thunderstorms. And people who work outdoors are most susceptible to the multi-pronged impacts of thunderstorms. Lightning, hail, and high wind have been the cause of multiple injuries and fatalities in Louisiana, with lightning being a major cause of fatality.

Potential Losses by Jurisdiction

Overview & Analysis of Potential Losses: Overall, most of Louisiana is vulnerable to thunderstorms, but there are certain parishes that are more vulnerable to specific thunderstorm sub-hazards than others. High wind and lightning are major concerns in south Louisiana, while hail appears to be a bigger issue in northern parishes. Similarly with tornadoes, poorly constructed or older homes and mobile home parks are at highest risk of sustaining the greatest damage during thunderstorms.

Changes in development are expected to impact loss estimates for thunderstorms since any new development represents an increase in the number of structures that are vulnerable to the effects of thunderstorms. Areas of increased population growth and development, especially those in the parishes of southeast Louisiana, will experience an increase in losses from thunderstorms (i.e., hail, high winds, and lightning).

Changes in jurisdictional population levels impact each parish across the state disparately. In Bossier parish where hail vulnerability has increased because of an increase in population, concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. No high-risk parishes for hail experienced a significant decrease in population and, consequently, no other parishes will experience a measurable change in loss estimates based on development trends.

When considering high wind, no high-risk parishes experienced a significant increase or decrease in population and, consequently, minimal changes in development are expected. Loss estimates for high wind will not experience a measurable change based on development trends.

When considering lightning, no high-risk parishes experienced a significant increase or decrease in population and, consequently, minimal changes in development are expected. Loss estimates for lightning will not experience a measurable change based on development trends.

Potential Losses of State Facilities

The thunderstorm hazard vulnerability assessment of state-owned buildings was based on the parish-level composite risk scores for all three thunderstorm-related hazards, which incorporate the total number of hail, lightning, and high wind events, injuries, fatalities, and property damages as well as the social vulnerability of impacted parishes. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Tables 2.18 and 2.19.

Table 2.18. Thunderstorm Vulnerability Criteria and Ranking Results.

THUNDERSTORM VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Composite risk score greater than 2.0 for one or more thunderstorm-related hazard
Medium	Composite risk score between 1.5 and 2.0 for one or more thunderstorm-related hazard
Low	Composite risk score less than 1.5 for one or more thunderstorm-related hazard

The thunderstorm loss-estimate ranges are derived from the 2011 state hazard mitigation plan and inflation-adjusted to 2013 dollars. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Hailstorm, Lightning, and High Wind Hazard Vulnerability
- Average Building Type
- Hailstorm Damage Functions

Table 2.19. Thunderstorm Loss Estimate Ranges and Ranking Results.

THUNDERSTORM LOSS ESTIMATE RANGES AND RANKING		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$5,344 to $53,440	1876
Medium	$535 to $5,344	2574
Low	$0 to $534	4235

TORNADOES

Tornadoes (also called twisters and cyclones) are rapidly rotating funnels of wind extending between storm clouds and the ground. For their size, tornadoes are the most severe storms, and 70% of the world's reported tornadoes occur within the continental United States, making them one of the most significant hazards Americans face.[xxxviii] When they exist over water, they are considered waterspouts.[xxxix] Tornadoes and waterspouts form during severe weather events, such as thunderstorms and hurricanes, when cold air overrides a layer of warm air, causing the warm air to rise rapidly, which usually occurs in a counterclockwise direction in the northern hemisphere. The updraft of air in tornadoes always rotates because of *wind shear* (differing speeds of moving air at various heights), and it can rotate in either a clockwise or counterclockwise direction; clockwise rotations (in the northern hemisphere) will always result in near-immediate demise, but counterclockwise 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 tornadoes. The EF Scale classifies **tornadoes based on their damage pattern, not 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 2.20 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 will be used. Adjustment to the EF Scale can be made using Table 2.20.

Table 2.20. Comparison of Fujita (F) Scale to Enhanced Fujita (EF) Scale.

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

TORNADO PROFILE

From data over the past 60 years, Louisiana ranks 11th among the states in frequency of tornado occurrences, 13th for tornado-related deaths, 16th for tornado-related injuries, and 15th for damage costs. When considering total tornado frequency per mi^2, Louisiana ranks 5th in frequency, 11th in deaths, 12th in injuries, and 10th for costs. The very high frequency per unit area is compensated somewhat by the fact that an even higher percentage of Louisiana's tornadoes have been EF0 and EF1s than in other states.[xl] Since 1900, Louisiana has suffered through eight days in which 10 or more people have died in tornadoes.

Table 2.21 details the dates and locations of observed tornadoes in Louisiana that resulted in more than three deaths. Tornadoes also cause a significant amount of property damage. According to the National Climatic Data Center, the average annual economic loss due to tornadoes in Louisiana is $38.8 million, but in 1953, 1971, and 1983, that figure topped $209 million each (in 2013 USD).[xli]

Table 2.21. Louisiana tornadoes resulting in >3 deaths (source: Vega, Grymes, Rohli 171; data provided by NOAA/Storm Prediction Center (SPC))

Most Fatal Louisiana Tornadoes			
Date/Time	Location	Deaths	Injuries
24 April 1908 (5 a.m.)	Concordia Parish	39	150
24 April 1908 (11:45 a.m.)	Amite Parish	47	270
13 May 1908 (5:30 a.m.)	Caddo (Gilliam), Bossier Parishes	49	135
4 April 1923 (6 p.m.)	Alexandria and Pineville	15	150
1 May 1933 (4 p.m.)	Minden	28	400
17 February 1938 (9:40 p.m.)	Rodessa	21	50
31 December 1947 (4 p.m.)	Shreveport, Cotton Valley	18	225
3 December 1953 (4:30 a.m.)	Vernon (Leander), Rapides, Grant Parishes	7	50
22 January 1957 (10:50 a.m.)	Bossier Parish, Princeton	3	9
7 November 1957 (8:55 p.m.)	Alexandria, Boyce	3	35
7 November 1957 (9:30 a.m.)	Acadia Parish	4	12
12 September 1961 (1 p.m.)	Hodge (from Hurricane Carla)	5	37
3 October 1964 (6:30 a.m.)	Larose (from Hurricane Hilda)	22	165
21 February 1971 (2:50 p.m.)	Madison Parish	10	400
8 April 1993 (1:20 p.m.)	Grand Isle (from waterspout)	3	39
3 April 1999 (4:03 p.m.)	Benton	7	90

Two Louisiana tornadoes are among the ten deadliest tornadoes in American history. On May 7, 1840, the second-deadliest tornado in United States history struck Concordia Parish before moving into neighboring Adams County, Mississippi, resulting in 317 deaths and 109 injuries. On April 24, 1908, another tornado moved through Louisiana and Mississippi, killing 143 people and injuring 770 in Amite Parish, as well as Pine and Purvis Counties in Mississippi.[xlii]

In recent years, Louisiana has continued to experience numerous devastating tornado events. On April 3, 1999, several F3 and F4 tornadoes touched down in Bossier, Caddo, Claiborne, and DeSoto Parishes, killing seven people, injuring 103, and causing more than $12 million in damages, resulting in a Presidential Disaster Declaration. In February 2006 and 2007, several F2 tornadoes struck Orleans and Jefferson Parishes, touching down in Westwego, New Orleans, and Gentilly. The 2007 tornadoes cause over $5 million in damages, hitting areas still devastated from Hurricanes Katrina and Rita.

The 2008 and 2009 tornado seasons proved to be as deadly and as costly as in previous years, producing approximately 164 recorded tornadoes in Louisiana that resulted in 6 deaths, 32 injuries and $41.6 million in damages. Over the past three years, residents across 56 parishes in Louisiana have observed 107 tornadoes, resulting in 1 death, 47 injuries, $87.5 million in property damage, and $1.5 million in crop damage in the course of a total of 58 days.[xliii] On April 24, 2010, a long-track tornado touched down west of Tallulah (Madison Parish) and crossed into Mississippi where it became the 4th-longest-track tornado in Mississippi history, traveling 149 mi. The tornado produced mainly EF3 and EF2 damage across Madison Parish with maximum winds around 155 mph. On March 5, 2011, one supercell thunderstorm produced four tornadoes in Jefferson Davis and Acadia Parishes, ultimately causing one fatality and 11 injuries. According to the Louisiana State Fire Marshal's Office, 42 houses were destroyed; 48 sustained major damage, 79 sustained moderate damage, and another 514 sustained minor damage. Louisiana experienced a total of $15 million in property damage.

Despite the fact that Louisiana is now generally better prepared for tornadoes than in previous years, the state has experienced an increase in the rate of tornado touchdowns over the past 40 years. However, this increase could be due to improved observation techniques and increases in population density.[xliv] Tornadoes have been observed in every parish of Louisiana (indeed, they have been witnessed in every state in the United States). Map 2.58 shows the densities of tornado touchdowns in Louisiana from 1950 to 2012. The highest densities of tornado touchdowns are in urban areas (specifically, Lafayette, New Orleans, Shreveport), with the highest occurrences in Crowley (near Lafayette). This bias is typical since higher population densities ensure a greater likelihood of tornado observation. Despite these densities, however, the length of the tracks of these tornadoes is not similarly distributed. Map 2.59 shows the density of the longest tornado tracks in Louisiana from 1950–2012, where higher density reflects a higher concentration of longer-track tornadoes. Map 2.60 reveals the tracks of the EF/F3, EF/F4, and EF/F5 tornadoes that have struck the state from 1950 to 2012. Both Map 2.59 and Map 2.60 indicate that long-track tornadoes are more frequent near Shreveport. Furthermore, most long-track tornadoes tend to move from southwest to northeast, which is presumed to be along the pre-cold frontal squall line, a location particularly prone to severe weather.

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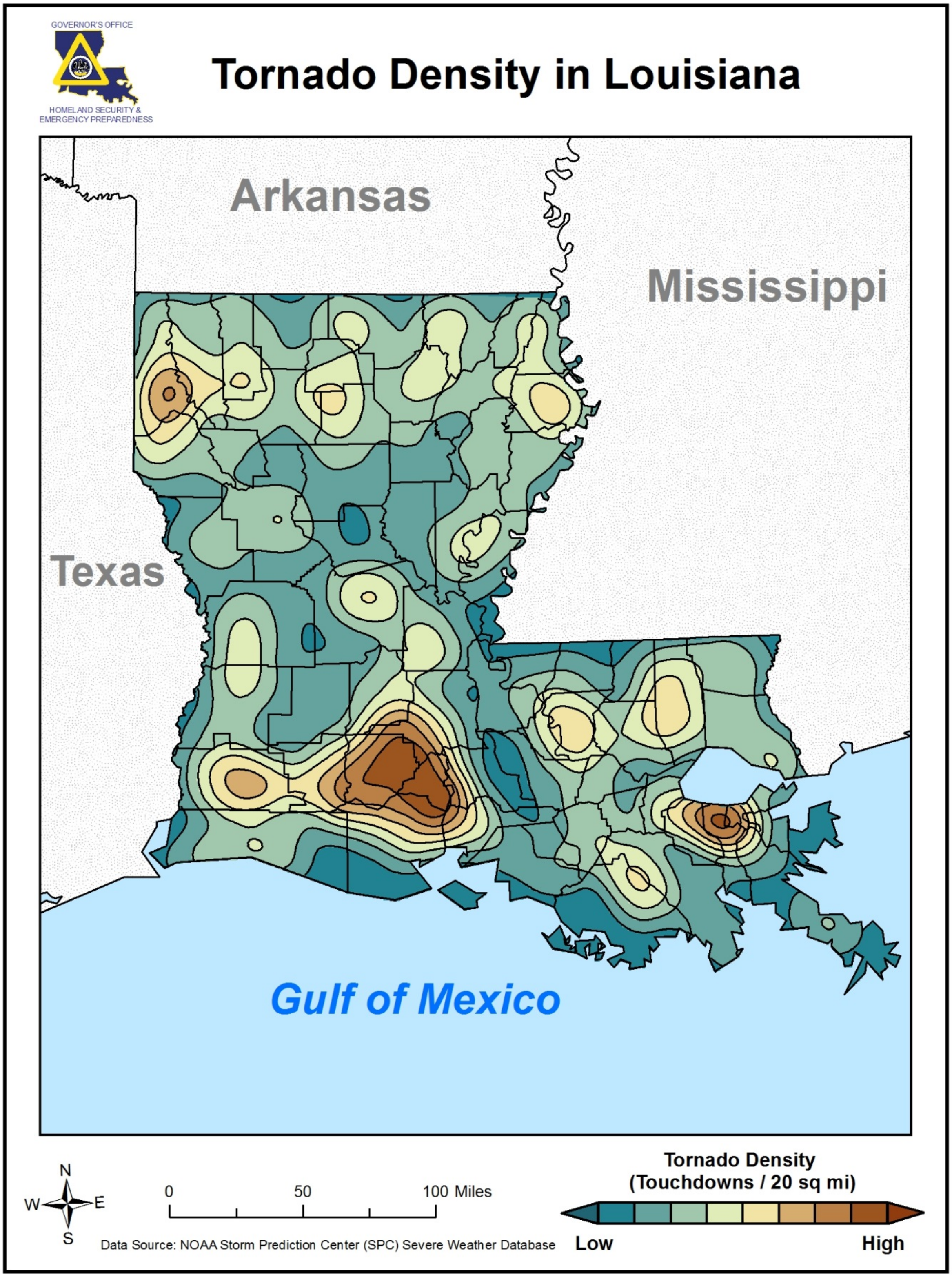
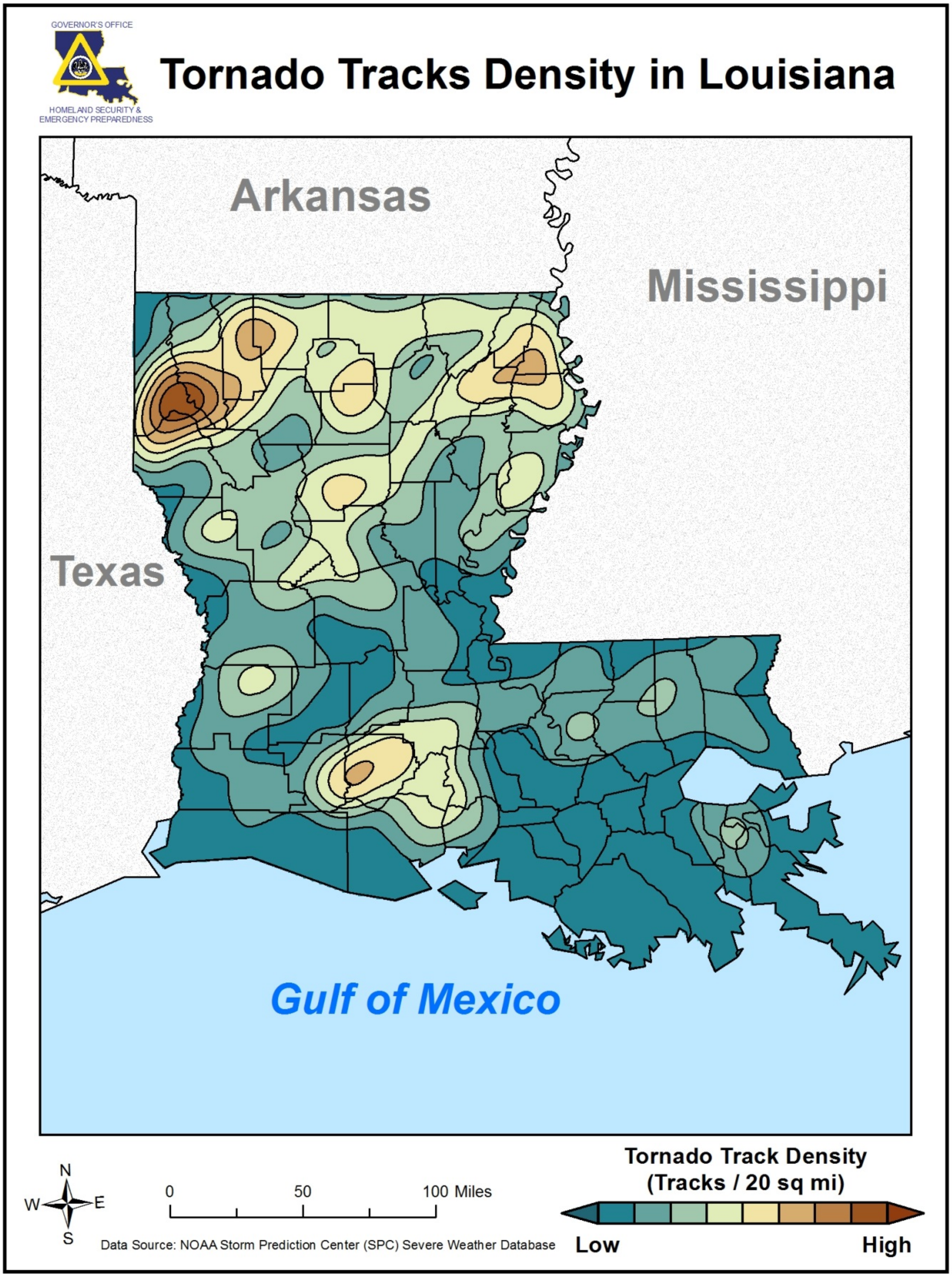
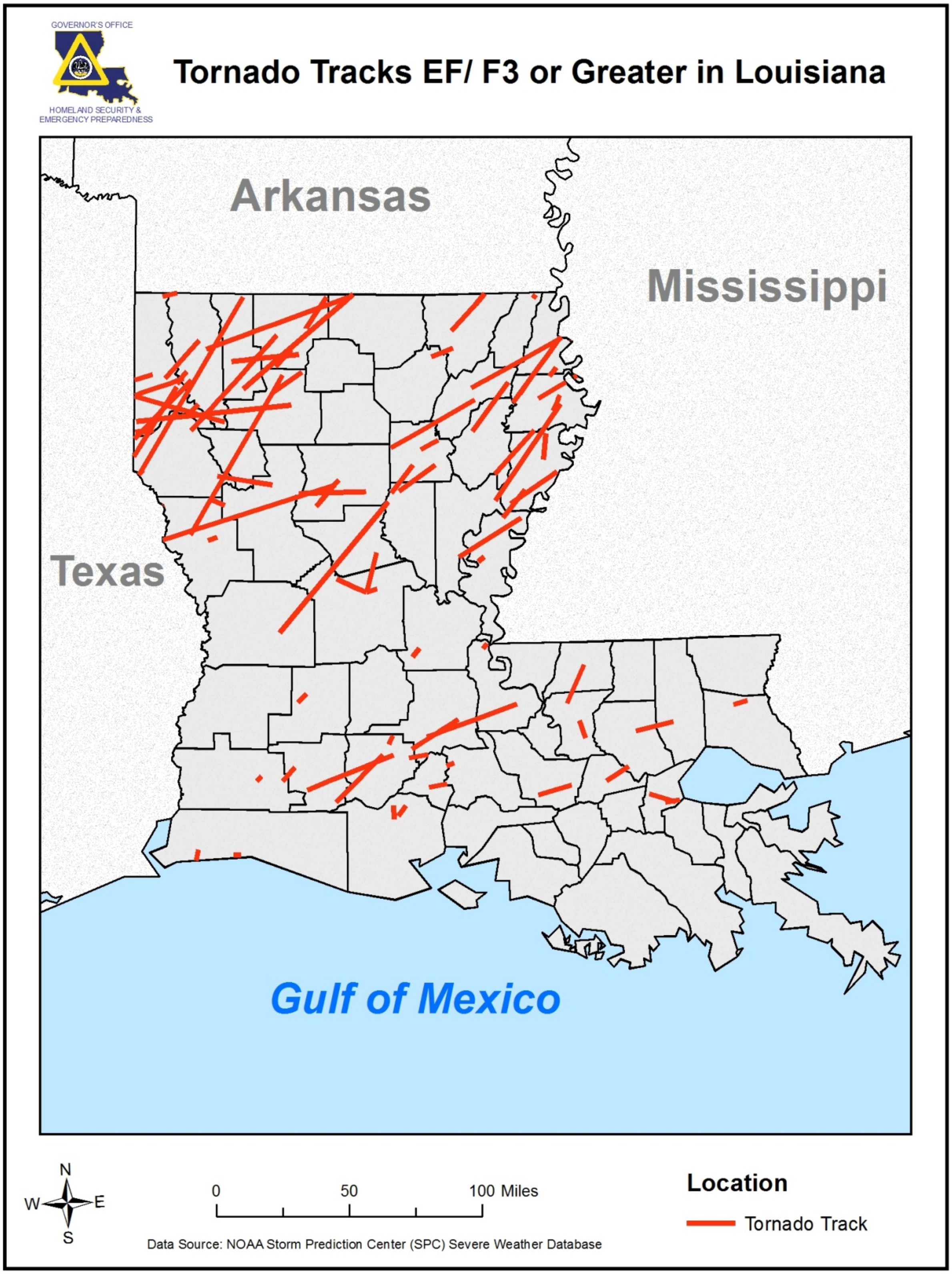


Map 2.58. Density of tornado touchdowns in Louisiana from 1950–2012 (source: NOAA/SPC Severe Weather Database).



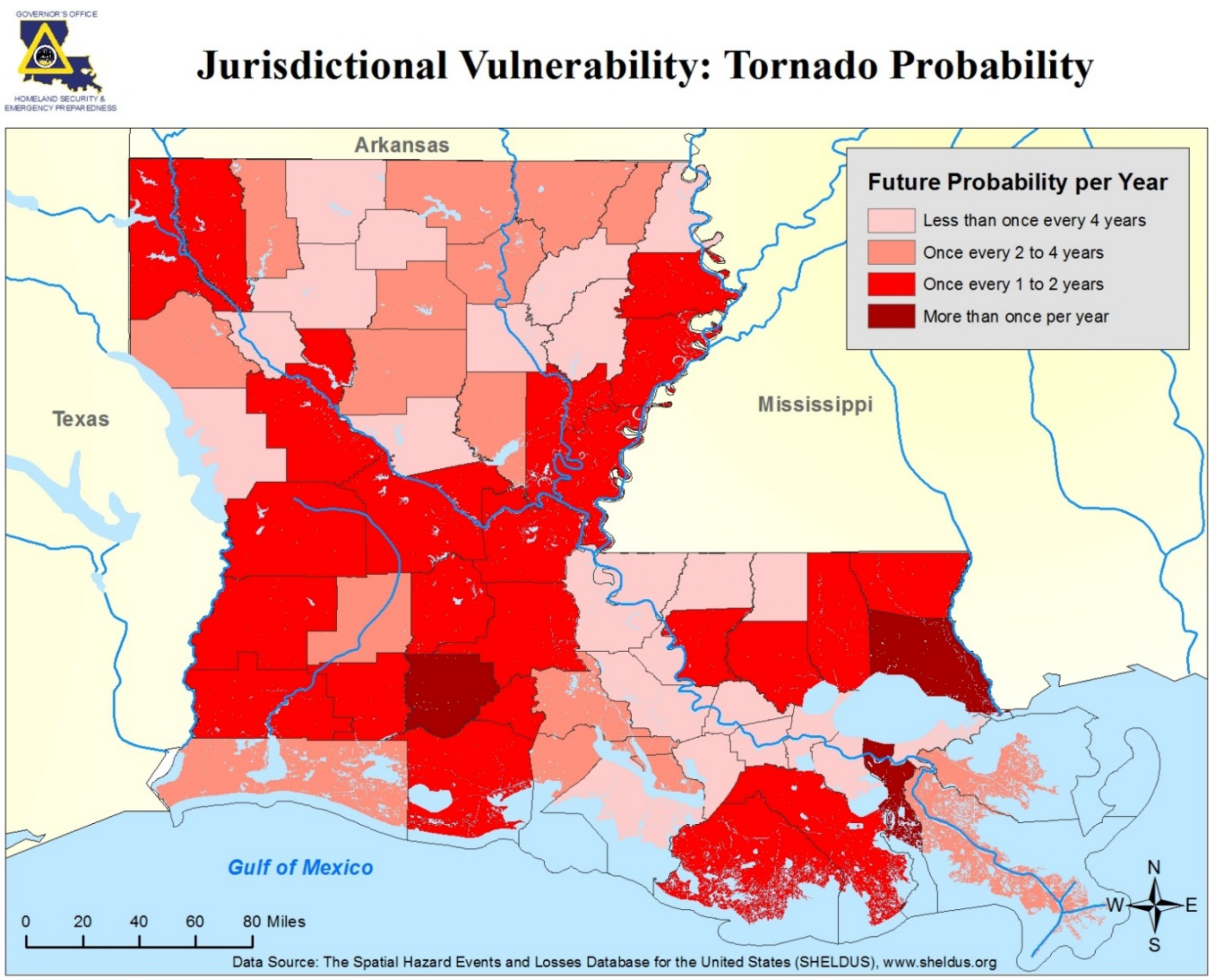
Map 2.59. Density of longest tornado tracks in Louisiana from 1950–2012. Higher density reflects a higher concentration of longer tracks (source: SPC Severe Weather Database).



Map 2.60. Tracks of EF/F3 tornadoes in Louisiana, 1950–2012 (source: SPC Severe Weather Database).

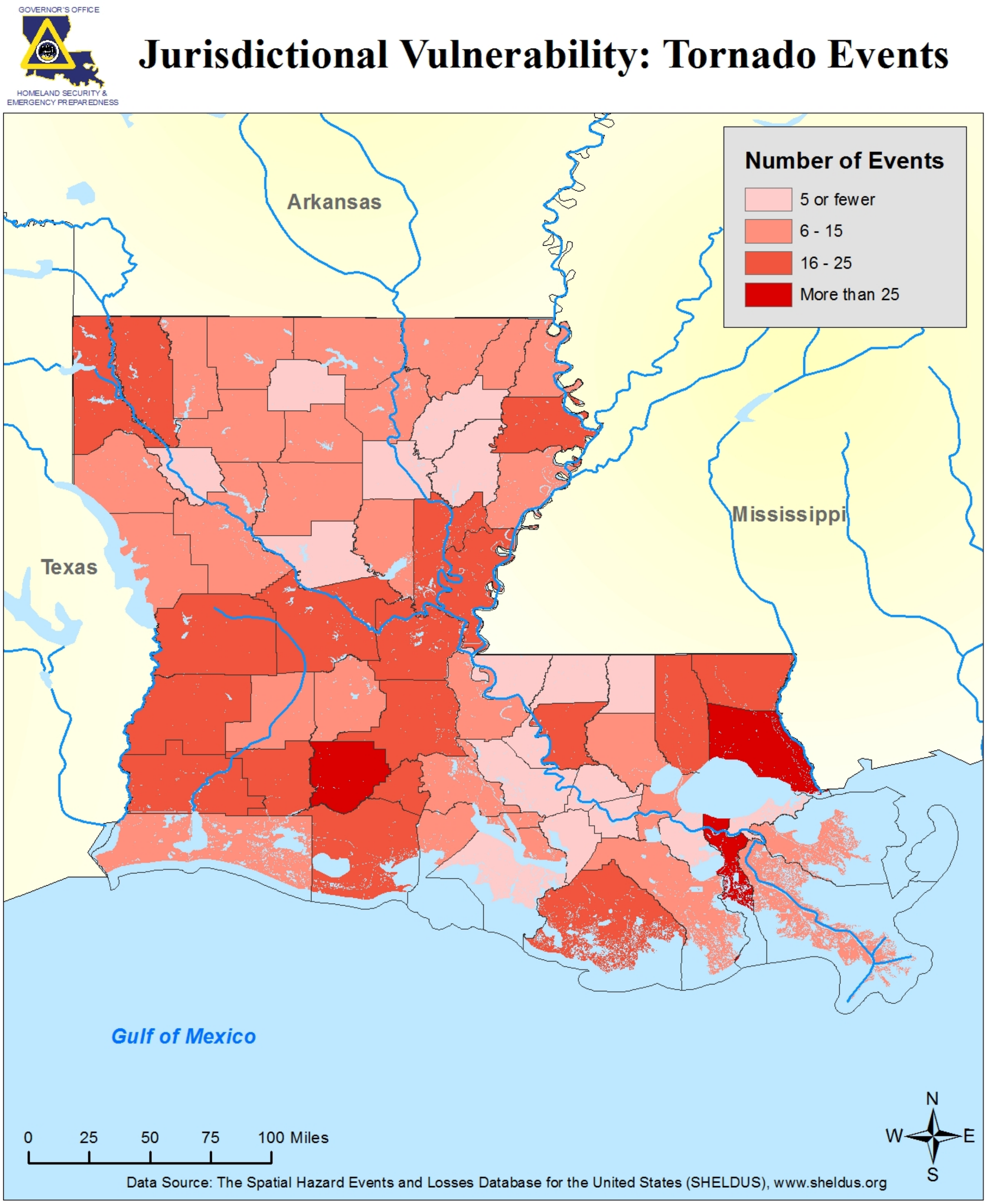
TORNADO RISK ASSESSMENT

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 U.S. occur during April and May. 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. Based on historical record, illustrated in Map 2.61, the probability of future occurrence of tornadoes is **High**, and so this Plan Update provides a Risk Assessment of this hazard.

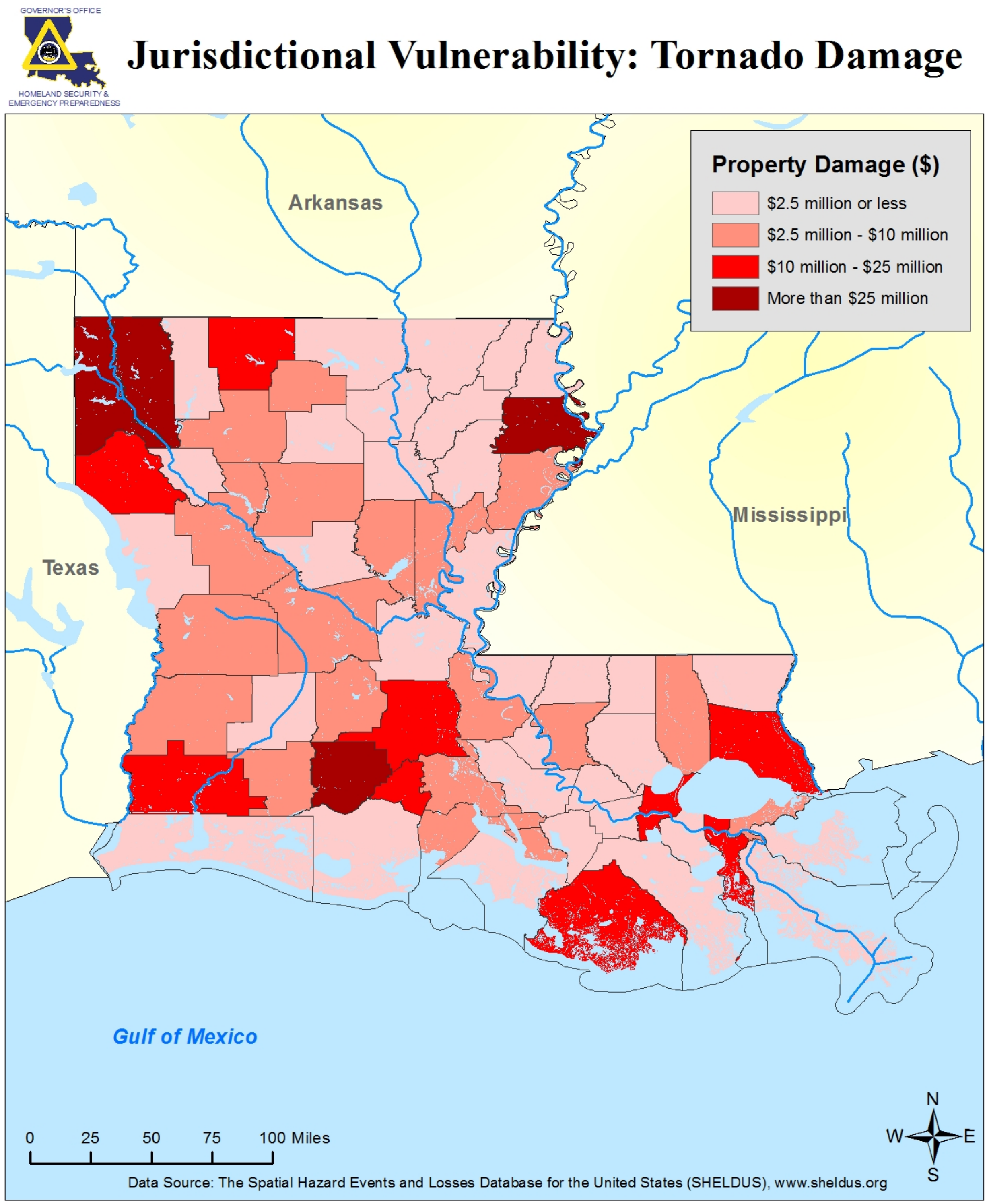


Map 2.61. Probability of tornado events in Louisiana by parish based on data from 1987–2012.

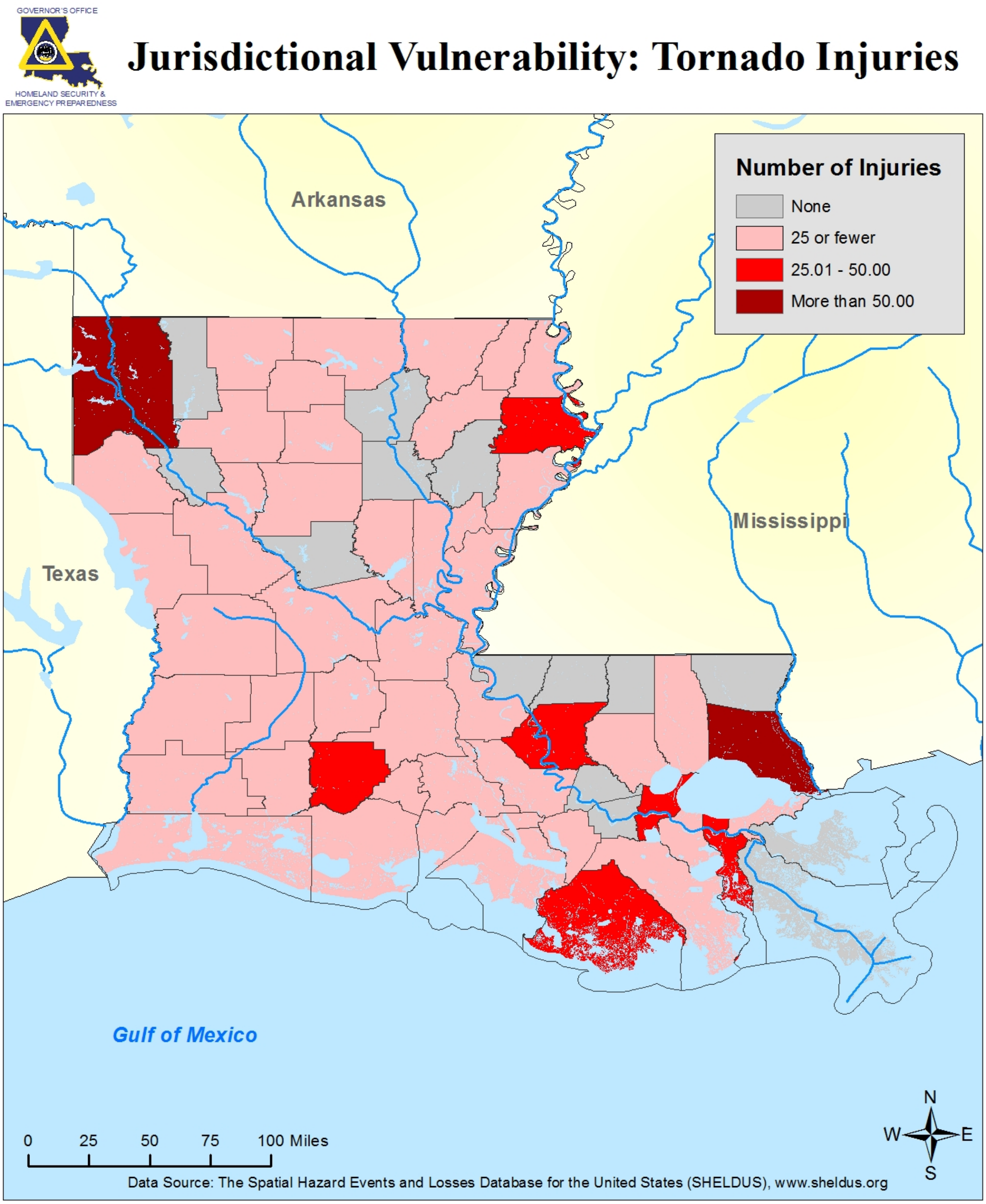
Maps 2.62, 2.63, 2.64, and 2.65 illustrate the tornado events, along with the damage, injuries, and fatalities they caused, between 1987 and 2012. Bossier Parish is at high risk (greater than 2.0 composite risk score) to tornadoes and has experienced a significant population increase of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of Bossier Parish to tornadoes has increased. Madison Parish is at a high risk to tornadoes, but has experienced a significant population decrease of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of Madison Parish to tornadoes has decreased.



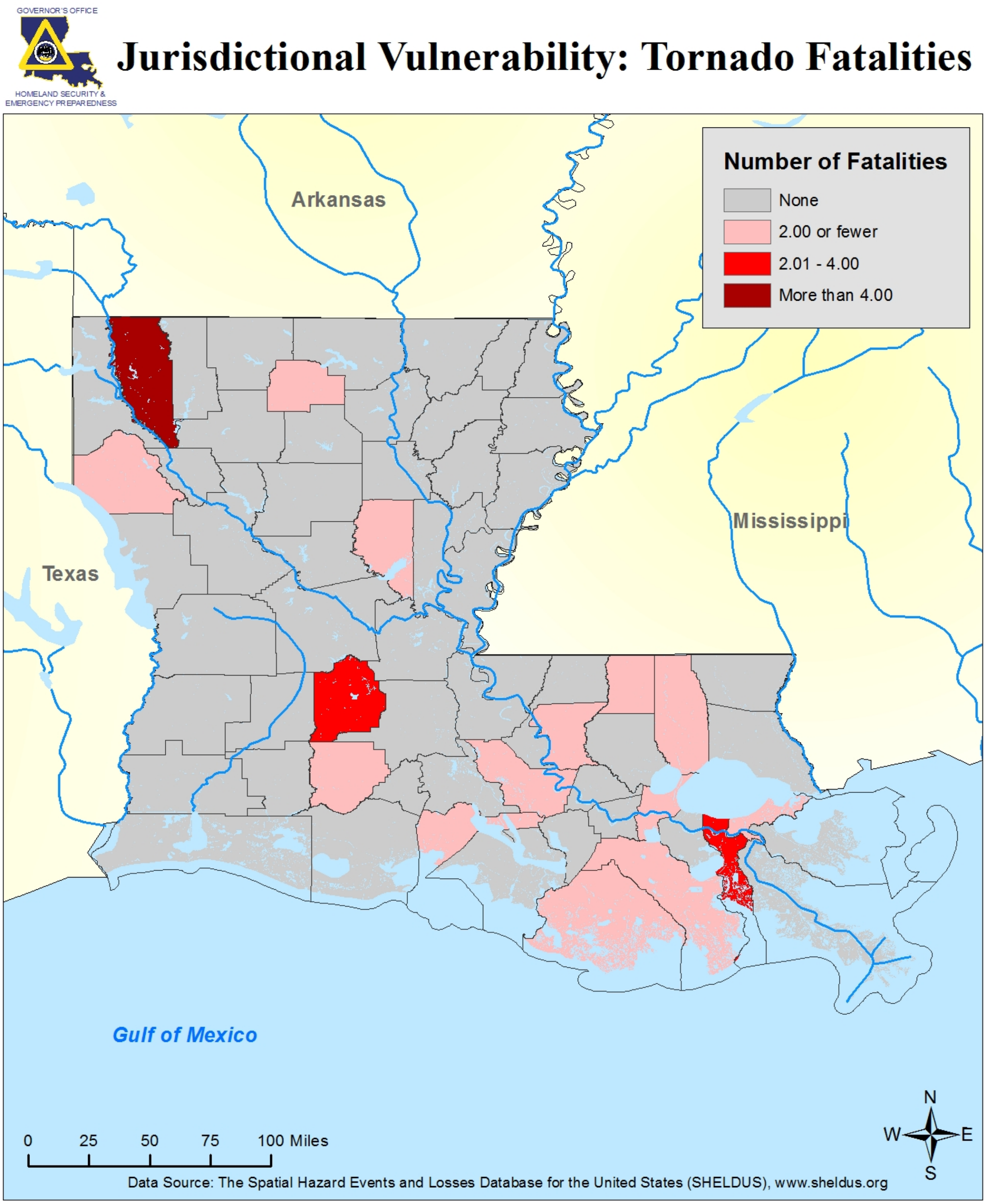
Map 2.62. Louisiana jurisdictional vulnerability for tornado events based on data from 1987–2012.



Map 2.63. Louisiana jurisdictional vulnerability for damage from tornadoes based on data from 1987–2012.



Map 2.64. Louisiana jurisdictional vulnerability for injuries from hail based on data from 1987–2012.



Map 2.65. Louisiana jurisdictional vulnerability for fatalities from hail based on data from 1987–2012.

Map 2.66 indicates the composite jurisdictional risk of tornadoes in Louisiana based on the preceding data. Much of the state is vulnerable, with tornadoes likely to recur at least once every two to four years in most parishes. In Acadia, Bossier, St. Tammany, Caddo, and Jefferson Parishes, past occurrence suggests tornadoes may recur more than once per year.

Table 2.22 details the top 10 state asset properties paid for claims from potential tornado damage. These data are based on the wind/hail-damaged claims listed earlier. State-owned critical facilities located in areas affected by tornadoes are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

Table 2.22. Top 10 paid claims for tornado-damaged state assets (source: Louisiana Office of Risk Management).

Top 10 Paid Claims for Tornado-Damaged State Assets				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Wind/Hail)
S12595	Jefferson Baseball Stadium	Metairie	$321,196	1
L14648	Albert Wicker Elementary	New Orleans	$102,222	1
S00519	The Louisiana Superdome	New Orleans	$91,598	1
S12851	New Orleans Center for the Creative Arts - Building F	New Orleans	$45,791	1
S12852	New Orleans Center for the Creative Arts - Building E	New Orleans	$40,243	1
S12816	Alario Center	Westwego	$37,106	1
S12088	Crescent City Connection Bridge	New Orleans	$16,664	1
S10958	LSU Health Services Center - Boiler	New Orleans	$12,977	1
S11071	LSU Health Services Center - Physical Plant	New Orleans	$10,859	2
L16375	Lord Beaconsfield Landry High School	Algiers	$9,587	1

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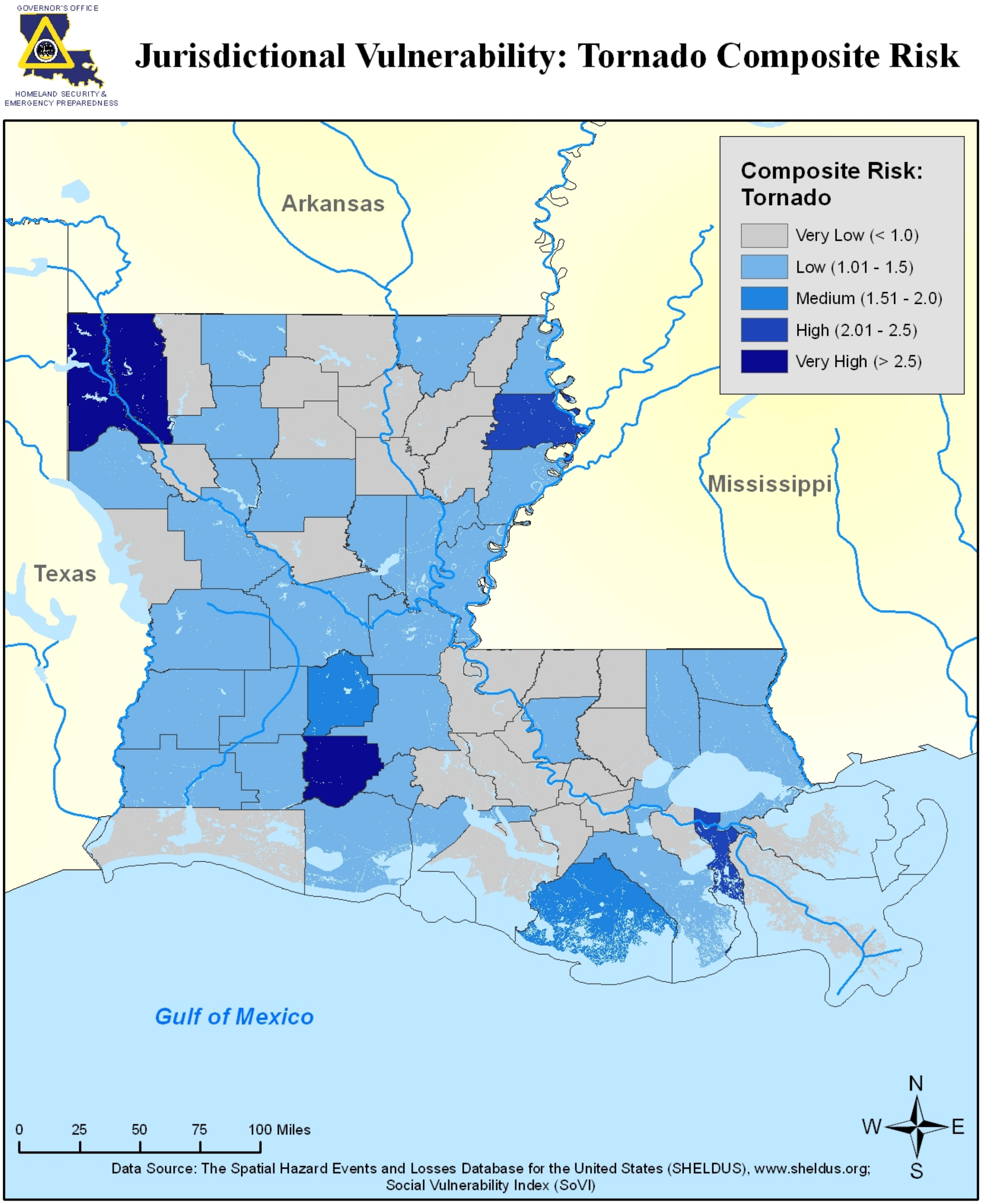


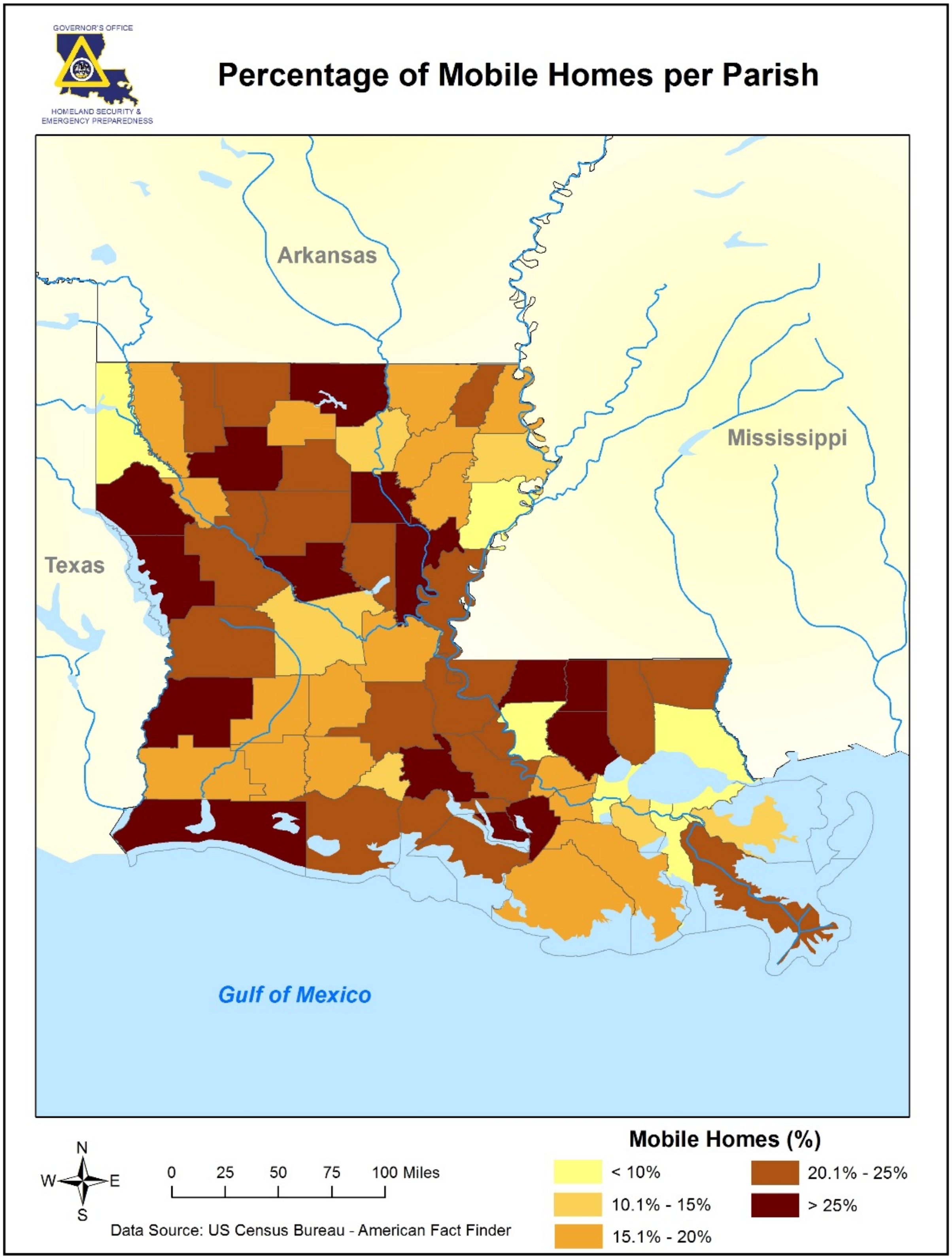
Map 2.66. Composite risk map for tornadoes showing parishes with the highest historical and highest potential risks across Louisiana.

Table 2.23 shows the overall exposure for high-risk parishes based on the Hazus-MH 2.1 inventory database, and the percentage of residences comprising mobile home structures in each parish. Mobile home structures are particularly vulnerable to tornadoes since they often lack a foundation and can be more easily moved and destroyed by high wind since they are not built to withstand high wind speeds.

Table 2.23. Exposure data for high-risk parishes.

Exposure Data for Parishes with Highest Tornado Risk			
Parish	Population (2010)	Total Exposure ($1,000)	Mobile Homes (%)
Acadia	61,773	$10,551,833	17.7
Bossier	116,979	$16,148,468	15.5
Caddo	254,969	$34,345,146	9.3
Calcasieu	192,768	$21,704,525	16.1
Cameron	6,839	$5,497,935	36.0
De Soto	26,656	$5,177,055	30.0
East Baton Rouge	440,171	$62,537,076	3.2
East Carroll	7,759	$2,430,145	18.3
Jackson	16,274	$6,573,859	22.5
Jefferson	432,552	$68,890,600	1.6
Jefferson Davis	31,594	$8,082,036	18.4
Lafayette	221,578	$30,145,227	11.3
Lincoln	46,735	$7,424,222	17.6
Madison	12,093	$2,712,688	14.4
Morehouse	27,979	$6,391,012	16.9
Orleans	343,829	$71,111,981	1.6
Ouachita	153,720	$19,349,689	13.7
Plaquemines	23,042	$9,583,932	24.1
Richland	20,725	$4,905,466	17.7
St. Bernard	35,897	$9,052,282	11.3
St. Charles	52,780	$11,391,140	10.1
St. Landry	83,384	$14,242,451	21.0
Tangipahoa	121,097	$13,106,990	22.4
Union	22,721	$5,591,013	27.1
Vermilion	57,999	$10,828,531	22.6
Webster	41,207	$7,109,218	20.5
West Carroll	11,604	$2,412,695	24.0
TOTALS	**2,864,724**	**$467,297,215**	**17.2 (Average)**

Map 2.67 shows the percentage of building stock comprising mobile homes by parish. Since mobile homes lead to an increase in structural vulnerability to tornadoes, greater density of mobile homes in a parish lead to an increase in jurisdictional vulnerability.



Map 2.67. Mobile homes as a percentage of homes, by parish.

Table 2.24 presents a list of parishes with more than a quarter (25%) of their building stock comprised of mobile homes.

Table 2.24. Percentage of parish buildings that are mobile homes.

PERCENTAGE (>25%) OF PARISH BUILDING STOCK COMPRISING MOBILE HOMES	
Parish	Mobile Homes (%)
Catahoula	25.3
Bienville	25.6
Grant	25.9
St. Martin	26.9
Union	27.1
Beauregard	28.4
Livingston	28.6
East Feliciana	29.6
De Soto	30.0
Caldwell	30.5
Assumption	31.4
Cameron	36.0
St. Helena	38.3
Sabine	39.7

Based on the geographic extents determined in the hazard profile and the jurisdictional vulnerability assessments, the parishes in blue in Map 2.68 have the highest risk factor with respect to tornadoes. The corridors outlined in red indicate the extent of each high risk area.

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Map 2.68. High risk areas for tornadoes.

This Plan Update also utilizes Hazus-MH 2.1 for the analysis of building exposure in each of the most vulnerable parishes by general occupancy type, detailed in Table 2.25.

Table 2.25. Building exposure by occupancy type for tornadoes.

Building Exposure by General Occupancy Type for Tornadoes							
Parish	Exposure Type ($1,000)						
	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education
Acadia	7,979,614	1,419,342	563,874	148,772	237,546	56,573	146,112
Bossier	11,891,551	2,709,321	761,501	59,494	432,384	192,803	101,414
Caddo	24,028,899	6,808,440	1,781,362	103,056	1,140,772	226,850	255,767
Calcasieu	15,879,101	3,805,841	1,011,908	58,492	576,612	150,541	222,030
Cameron	4,209,736	691,929	393,622	37,564	90,194	38,602	36,288
De Soto	4,099,351	547,708	210,562	28,702	199,404	45,114	46,214
East Baton Rouge	44,435,690	12,153,263	2,615,210	137,030	1,511,136	960,722	724,025
East Carroll	1,686,708	359,608	121,147	56,672	127,054	39,850	39,106
Jackson	5,186,884	670,191	304,068	29,986	256,162	37,219	89,349
Jefferson	50,104,392	13,418,248	3,024,142	114,922	1,204,366	437,819	586,711
Jefferson Davis	6,364,838	911,215	320,585	64,622	239,620	75,342	105,814
Lafayette	20,352,559	6,720,522	2,019,583	101,370	430,730	219,274	301,189
Lincoln	5,441,177	1,083,517	388,514	45,284	275,472	45,226	145,032
Madison	1,993,179	379,309	109,226	59,224	118,460	25,696	27,594
Morehouse	4,880,603	788,741	239,143	83,610	272,078	61,893	64,944
Orleans	50,691,672	12,784,835	2,595,764	77,762	1,980,374	984,070	1,997,504
Ouachita	12,968,015	4,382,733	938,805	80,576	616,220	181,698	181,642
Plaquemines	7,797,736	1,087,148	385,252	20,648	170,950	52,157	70,041
Richland	3,420,917	774,645	265,348	90,184	234,316	67,130	52,926
St. Bernard	7,159,720	1,160,684	438,162	13,074	149,344	51,617	79,681
St. Charles	8,318,110	1,948,898	717,882	25,498	204,072	96,946	79,734
St. Landry	11,074,652	1,981,588	525,532	84,532	312,906	112,478	150,763
Tangipahoa	9,581,467	2,226,918	520,534	67,496	435,132	101,324	174,119
Union	4,533,455	594,390	197,758	32,350	166,228	26,885	39,947
Vermilion	8,196,283	1,596,191	631,852	69,528	161,172	57,631	115,874
Webster	5,530,603	790,119	376,432	29,676	271,698	41,297	69,393
West Carroll	1,722,320	287,341	107,687	76,142	144,518	41,231	33,456
TOTALS	**339,529,232**	**82,082,685**	**21,565,455**	**1,796,266**	**11,958,920**	**4,427,988**	**5,936,669**

Using the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to tornadoes was chronicled in Table 2.26.

Table 2.26. Regional vulnerability to tornadoes.

Regional Vulnerability to Tornadoes	
Vulnerable Locations	Number of Records
Louisiana Parishes	27
Dams	369
Airports	84
Communication Towers/Facilities	355
Electricity Providers/Facilities	74
Emergency Response Centers	13
Fire Stations	384
Hospitals	147
Nuclear Plants	1
Police Stations	517
Elementary/Secondary Schools	1624
Universities/Colleges	34

Louisiana has a relatively high frequency of tornadoes annually. Tornadoes cause hundreds of thousands of dollars of damage to property per year. Houses, businesses, and government infrastructure often suffer extensive damage many fatalities can be attributed to tornadoes. Disruption of traffic flow occurs not only for citizen's day-to-day traffic but also critical services such as emergency police, fire, and medical. School bus and mail routes are also disrupted due to damaged or destroyed roads and bridges. Power outages impede response and recovery times and also cause sanitation issues for communities. Schools, hospitals, grocery stores, and other critically needed and economically important facilities are damaged and closed for extended periods. Employment can also be impacted in various ways due to tornado damage.

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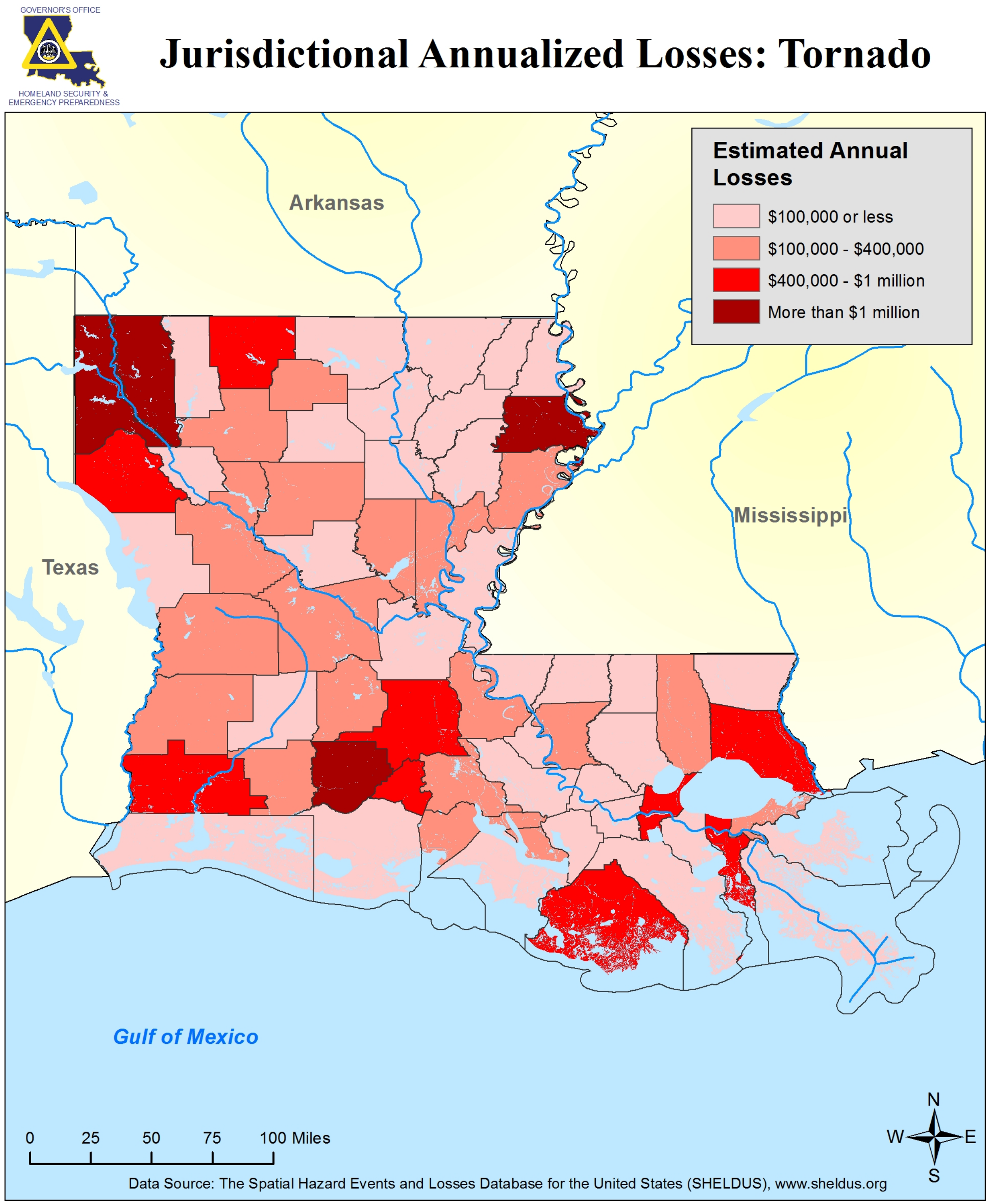
To determine potential loss estimates from tornadoes, the available historical loss data was annualized to determine future loss potential (see Map 2.69). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.



Map 2.69. Jurisdictional annualized loss due to tornadoes.

Even with advances in meteorology, warning times may be short or sometimes not possible. Overall, all of Louisiana is vulnerable to tornadoes, but northern and southwestern parishes experience the most tornadoes, while southeast Louisiana also experiences several tornadoes per year.

Poorly constructed or older homes and mobile home parks are at highest risk to sustain the greatest damage during a tornado. The direct impact of a very strong (EF3 or higher) tornado hitting a major metropolitan area could be catastrophic (as in the cases of Joplin, Missouri, and Tuscaloosa, Alabama).

Substantial damage could be incurred by state, local, and federal facilities. The damage to infrastructure would be enormous with lost power, water, sewer, gas, and communications. Roads and bridges could be damaged or at the least blocked and cluttered with debris. Continuity of government could be severely limited and emergency response would be greatly hindered. Many people could lose their homes and be displaced from their primary residence with high numbers of injuries and fatalities possible.

Potential Losses by Jurisdiction

Overview & Analysis of Potential Losses: Overall, all of Louisiana is vulnerable to tornadoes, but certain parishes are more vulnerable than others. Based on multiple sources (e.g., SHELDUS, NOAA, NCDC), the following parishes are most likely to be affected by tornadoes: Acadia, Bossier, Caddo, Calcasieu, Cameron, De Soto, East Baton Rouge, East Carroll, Jackson, Jefferson, Jefferson Davis, Lafayette, Lincoln, Madison, Morehouse, Orleans, Ouachita, Plaquemines, Richland, St. Bernard, St. Charles, St. Landry, Tangipahoa, Union, Vermilion, Webster, and West Carroll.

Among these parishes, Bossier, Caddo, Calcasieu, East Baton Rouge, Jefferson, Lafayette, Orleans, Ouachita, St. Landry, and Tangipahoa Parishes all have populations of over 80,000 and have the highest infrastructure dollar exposures within Louisiana. These ten parishes are considered to have the highest vulnerability to tornadoes within the state.

Changes in development are expected to impact loss estimates for tornadoes since any new development represents an increase in the number of structures that are vulnerable to the effects of tornadoes. Changes in jurisdictional population levels impact each parish across the state disparately. Areas of increased population growth and development, especially those in the parishes of southeast Louisiana, will experience an increase in losses from tornadoes. Although southeast Louisiana has seen the most population growth, any parish with population increases will experience greater loss. For instance, in Bossier parish, where tornado vulnerability has increased because of an increase in population, concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In Madison parish, where tornado vulnerability has decreased because of a decrease in population, concomitant changes in development have impacted loss estimates and will cause decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The tornado wind hazard vulnerability assessment of state-owned buildings was based on the parish-level composite risk scores from Map 2.62. The criteria used to determine specific vulnerability rankings for each parish are shown in Table 2.27.

Table 2.27. High Wind Vulnerability Criteria and Ranking Results.

HIGH WIND VULNERABILITY CRITERIA AND RANKING		
Ranking	Criteria	Number of Parishes
High	Map 2.62 Composite Ranking of 2.0+	5
Medium	Map 2.62 Composite Ranking of 1.0-2.0	30
Low	Map 2.62 Composite Ranking of <1.0	29

The tornado loss estimate ranges are derived from a ratio based on the expected annual losses in parishes with high, medium, and low vulnerability rankings. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of State-owned buildings in Louisiana involved an analysis of the following parameters:

- Tornado Wind Hazard Vulnerability
- Previous Losses and Annual Loss Estimations

Table 2.28. Tornado Loss Estimate Ranges and Ranking Results.

TORNADO LOSS ESTIMATE RANGES AND RANKING		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$37,500 to $375,000	611
Medium	$3,750 to $37,500	89
Low	$0 to $3,750	7985

Tropical Cyclones

Tropical cyclones are among the worst hazards 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, moving westward in the trade wind flow.[xlv] 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 speed ranges from 39 mph to 73 mph), and finally a hurricane (when the maximum sustained surface wind speeds exceed 73 mph). Table 2.29 presents the Saffir–Simpson Hurricane Wind Scale, which categorizes tropical cyclones based on sustained winds.

Many associated hazards can occur during a hurricane, including heavy rain, flooding, high winds, and tornadoes.[xlvi] 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 5 in. of rain while a slow-moving (5 mph) storm could produce totals of around 20 in. However, no two storms are alike, and such generalizations have limited utility for planning purposes. Hurricane Beulah, which struck Texas in 1967, spawned 115 confirmed tornadoes. In recent years, extensive coastal development has increased the *storm surge* resulting from these storms so much that this has become the greatest natural hazard threat to property and loss of life in the state. Storm surge is a temporary rise in sea level generally caused by reduced air pressure and strong onshore winds associated with a storm system near the coast. Although storm surge can technically occur at any time of the year in Louisiana, surges caused by hurricanes can be particularly deadly and destructive. Such storm surge events are often accompanied by large, destructive waves exceeding 10 m 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 ft. in St. Bernard Parish, near Alluvial City.[xlvii]

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Table 2.29. Saffir–Simpson Hurricane Wind Scale.

Saffir–Simpson Hurricane Wind Scale			
Category	Sustained Winds	Pressure	Types of Damage Due to Hurricane Winds
Tropical Depression	< 39 mph	N/A	
Tropical Storm	39-73 mph	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 (major)	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 (major)	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 (major)	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 or months.

Tropical Cyclone Profile

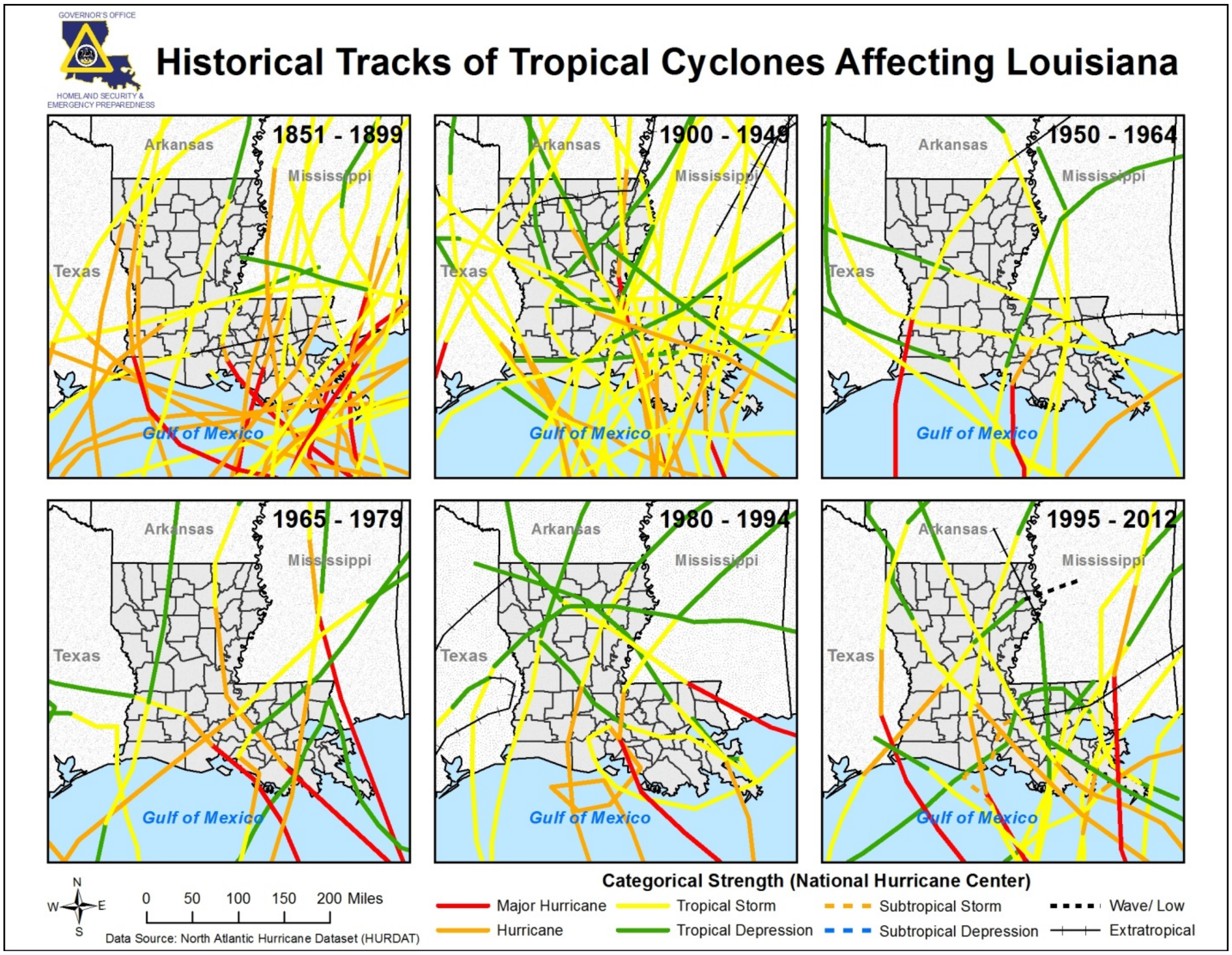
The central Gulf of Mexico coastline is among the most hurricane-prone locations in the United States, and hurricanes can affect every part of the state. Table 2.30 presents the total landfalls by tropical cyclones in Louisiana since 1900.

Table 2.30. Frequency of Louisiana Tropical Cyclones by Saffir-Simpson Category, 1900–2012 (source: NOAA/National Hurricane Center).

Total Number of Tropical Cyclones Affecting Louisiana (1900–2012)		
Strength	Coastal Landfalls	Inland Strikes[xlviii]
Tropical Storm	47	3
Category 1	18	—
Category 2	6	—
Category 3	12	—
Category 4	1	—
Category 5	1	—

Map 2.70 illustrates the tracks of tropical cyclones from 1851 to the present through a series of maps that breaks down the tracks by various periods in Louisiana history: 1851–1899, 1900–1945, 1950–1964, 1965–1979, 1980–1994, and 1995–2012. Because the time periods are not all even, trends in cyclone activity are not immediately apparent. Louisiana experienced a very active period between 1851 and 1899, illustrated by the number of major hurricanes (red lines) that tracked across the state. The period from 1900 to 1945 was much less active. While the period from 1950 to 1994 was more active than the first 50 years of the twentieth century, the second half was still a relatively quiet period of tropical cyclone activity. During the twentieth century, the state experienced a time of greater coastal development, somewhat buoyed by the fact that the coast was experiencing fewer cyclones than before or after. The period between 1995 and 2012, though, had a relatively active—and severe—period of cyclone activity in Louisiana, and coastal development sustained severe damage. As Map 2.70 illustrates, Louisiana has experienced significant tropical cyclone activity over the past 25 years. Table 2.31 lists the major storms that have affected the state from 1988 to 2002.

In the past ten years, though, Louisiana has experienced truly paradigm-shifting storms. Before discussing the storms of 2005 that have changed how the United States approaches disaster management, a review of some of the other major storms from the past ten years is warranted. Early in the hurricane season of 2003, Tropical Storm Bill made landfall near Cocodrie (Terrebonne Parish), causing widespread but minor damage, with losses reaching $38 million (2013 USD). In 2004, both Hurricane Ivan and Tropical Storm Matthew struck the state, the first in September, the second in October. Ivan was a major storm, reaching Category 5 before landfall, but dying down to a tropical depression when it made first landfall in Alabama. However, Ivan looped back into the Gulf and strengthened into a tropical storm before landing near Cameron, Louisiana (Cameron Parish). Overall, the storm caused 25 deaths in the United States and resulted in $16 billion (2013 USD) in damages. Perhaps most significantly, Ivan was a precursor of the catastrophes that occurred during the 2005 hurricane season. Roughly one-third of New Orleans' residents evacuated before Ivan struck, with major traffic jams blocking the few routes out of the city.



Map 2.70. Tropical cyclone paths across Louisiana by sub-periods from 1851 to 2012.

In September 2007, Hurricane Humberto formed quickly over the northwestern Gulf of Mexico, becoming the fastest-forming hurricane ever. Although Humberto made official landfall in Texas, his wind field was expansive enough that he delivered hurricane-force winds across southwestern Louisiana, although he ultimately caused relatively little damage. In 2008, a series of significant storms struck Louisiana. The season began with the smaller Tropical Storm Edouard, which caused some storm surge activity in Cameron Parish. In late August, though, Hurricane Gustav made landfall near Cocodrie as a strong Category 2 hurricane, spurring millions of residents to evacuate. He tracked northwest across the state, leaving significant wind damage and heavy rain (see Maps 2.73 and 2.74 for the geographic extent of precipitation totals and wind speeds, respectively). The high winds caused three deaths and spawned tornadoes in the state, and storm surge was a major problem. Indeed, for many communities across the state, including Baton Rouge, Gustav was the most severe hurricane in memory. Ultimately, 48 deaths were attributed to the storm.

Table 2.31. Features of Louisiana's major tropical cyclones: 1988-2012 (source: David Roth's *Louisiana Hurricane History* [Camp Springs, MD: National Weather Service, 2010], http://www.hpc.ncep.noaa.gov/research/lahur.pdf).

Information on Tropical Cyclones Affecting Louisiana (1988–2012)				
Tropical Cyclone Name	Date	Highest Category	Louisiana Deaths[xlix]	Louisiana Damages (2013 USD)
Hurricane Florence	9 Sept. 1988	1	0	~$5 million
Hurricane Andrew	26 Aug. 1992	5	2	~$1.6 billion
Hurricane Opal	4 Oct. 1995	4	0	~$307,000
Tropical Storm Josephine	5–8 Oct. 1996	Tropical Storm	0	~$8.2 million
Hurricane Danny	18 July 1997	1	0	~$2.2 million
Hurricane Earl	31 Aug.–3 Sept. 1998	2	0	~$170,000
Tropical Storm Frances	8–13 Sept. 1998	Tropical Storm	1	~$712 million
Hurricane Georges	15 Sept.–1 Oct. 1998	4	0	~$25 million
Tropical Storm Allison	5–17 June 2001	Tropical Storm	1	~86 million
Tropical Storm Bertha	4–9 Aug. 2002	Tropical Storm	0	~$195,000
Hurricane Isidore	14–27 Sept. 2002	3	1	~$429 million
Hurricane Lili	21 Sept.–4 Oct. 2002	4	2	~$1 billion

Just after Gustav struck, Hurricane Ike affected Louisiana in a unique but important way: he never made landfall in Louisiana, but had a severe impact on the state from his widespread winds, intense rainfall, and extensive storm surge (see Maps 2.73 and 2.74 for the geographic extent of precipitation totals and wind speeds, respectively). In fact, Ike is the only hurricane on record to have produced storm surge for every coastal parish in the state. Moreover, Ike re-flooded a number of areas that had only recently been flooded by Gustav. A year after Gustav and Ike, Hurricane Ida closed out a quiet 2009 hurricane season, barely reaching Louisiana and only peripherally affecting the state, but still making history as the first tropical storm on record to affect Louisiana in November.

As disastrous as the storms of 2008 were, the tropical cyclones of 2005 have had an even more significant and lasting legacy on national views on disaster management. Of course, the risks of natural and human-caused disasters that could create catastrophic incidents in Louisiana were well known prior to 2005, but the impact of that hurricane season on the Gulf Coast brought about a new level of planning and engagement related to disaster response, recovery, and hazard mitigation, perhaps akin to the Great Mississippi Flood of 1927. Actually, the whole 2005 North Atlantic hurricane season was historic, as it produced more tropical storms and hurricanes than any in recorded history.[l] In terms of the state, though, the season confirmed fears about Louisiana's extreme exposure to natural disasters and the compounding effects of engineered flood-protection solutions. Moreover, Hurricanes Katrina and Rita hit three weeks apart, together causing damage estimated between $104 and $162 billion (2013 USD), making the two events the first and third costliest natural disasters in U.S. history, respectively.[li] Nearly 1600 individuals in and around New Orleans perished when area levees and floodwalls failed. Officially, 1836 deaths in states affected by the storm have been attributed to Katrina, and 705 others remain missing. On the second anniversary of Katrina, New Orleans' population remained one-third lower than before the storm and more than 200,000 people remained displaced.[lii] Like Katrina, Rita was also a truly catastrophic event, and the two storms highlighted a hurricane season that was unparalleled in U.S. history.

For Louisiana, the season actually began in early July with Hurricane Cindy, a storm that was originally classified as a tropical storm on landfall, but later upgraded to a Category 1 hurricane for a brief period through post-seasonal analysis.[liii] Cindy landed near Grand Isle (Jefferson Parish) and tracked across southeastern Louisiana, Mississippi, and Alabama, finally moving up the Atlantic coast. The worst discomfort for most Louisianians in the path of Cindy was flooding and an extended blackout in New Orleans.

In late August, Hurricane Katrina began as a broad area of low pressure and became a Category 1 hurricane moving across southern Florida. She weakened over Florida, but once in the Gulf waters, she strengthened quickly. The storm reached Category 3 status by the 27th, having also grown in size. This change resulted in slower wind speeds, which consequently led to a lower internal pressure. Early in the hours of the 28th, Katrina was upgraded to Category 4 and was upgraded again only hours later to Category 5. A mandatory evacuation of New Orleans was ordered—the first in history.[liv]

Katrina made landfall on the morning of the 29th, moving in as a weak Category 4 storm.[lv] Storm surges were recorded as being between 18 and 22 ft., with some regions experiencing surges up to 28 ft. See Map 2.71 for the geographic extent and qualitative reach of peak wind gusts and surge depth during Katrina, and see Map 2.72 for estimated losses due to both wind gusts and storm surge by census block group.

It was after the storm veered away from the city that levees began to breach around the city, leaving 80% of the city under water. In addition to the tragic loss of human life, the extensive mixing of water with raw sewage, bacteria, metal, pesticides, and other chemicals has led to ecosystem damage in the New Orleans area that could last for decades.[lvi]

Only six weeks later, Hurricane Rita tracked into the Gulf, quickly achieving Category 5 status. She had dropped to a Category 3 as she neared landfall in Louisiana. Nevertheless, the storm surges Rita produced reached 15 ft. in Cameron and around 8 ft. at Grand Lake and Calcasieu Lake (all in Cameron Parish). Such surges occurred even farther inland, in Vermilion, Iberia, and St. Mary Parishes—areas that had recently been flooded by Katrina. In Jefferson, Terrebonne, and Orleans Parishes, levees were overtopped; in New Orleans, several levees that were damaged by (but had survived) Katrina finally succumbed to storm-surge stress, keeping most of the city flooded until early October.[lvii] The extensive surge damage was exacerbated by winds of 105–115 mph (and some ninety tornadoes), as well as rainfall amounting to 9–15 in. all across the southern parishes (see Maps 2.73 and 2.74 for the geographic extent of the precipitation totals and wind speeds). Due to great evacuation efforts and the fact that the hardest-hit regions were sparsely populated, the storm only resulted in seven deaths. Economic losses amounted to about $12 billion (2013 USD).[lviii]

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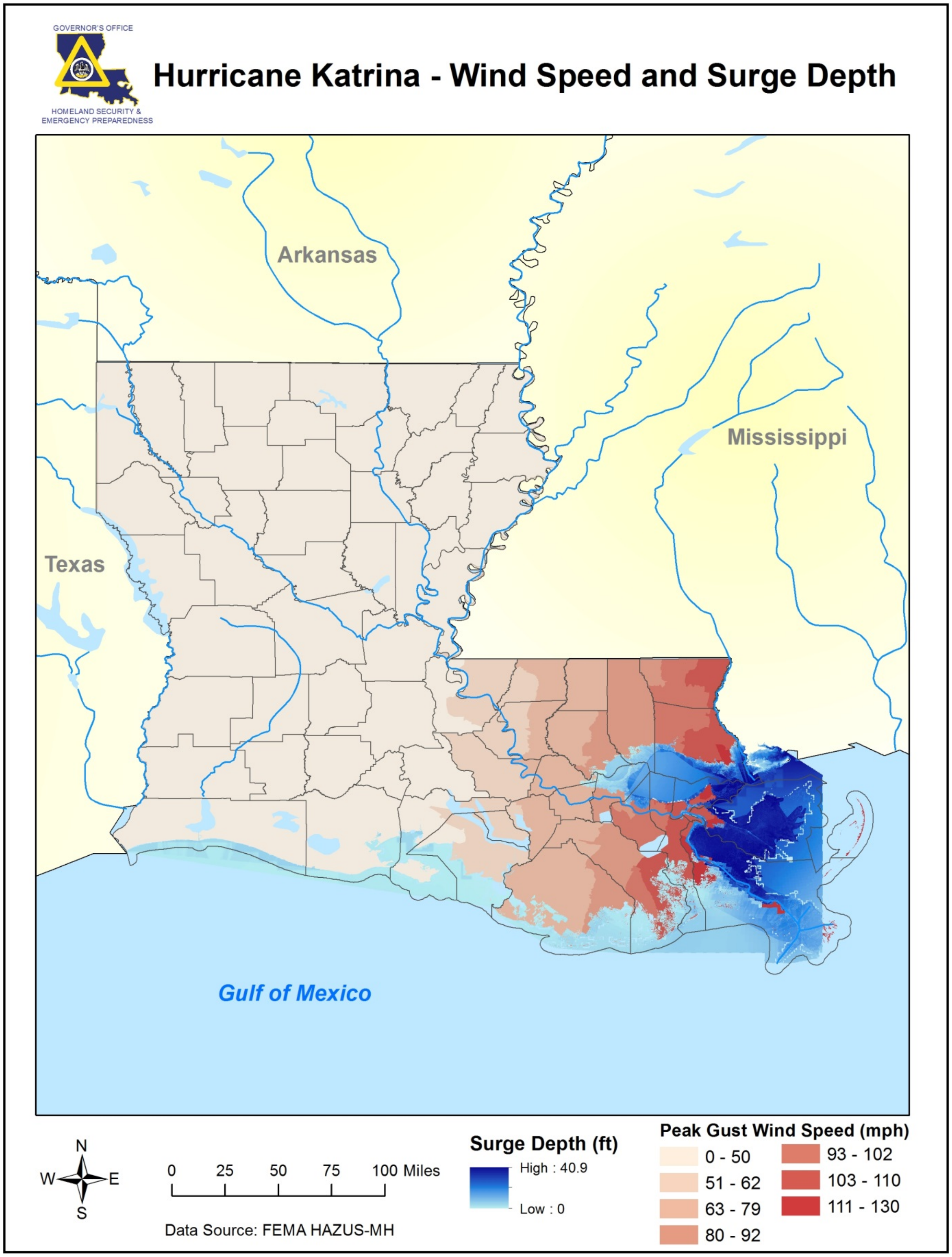
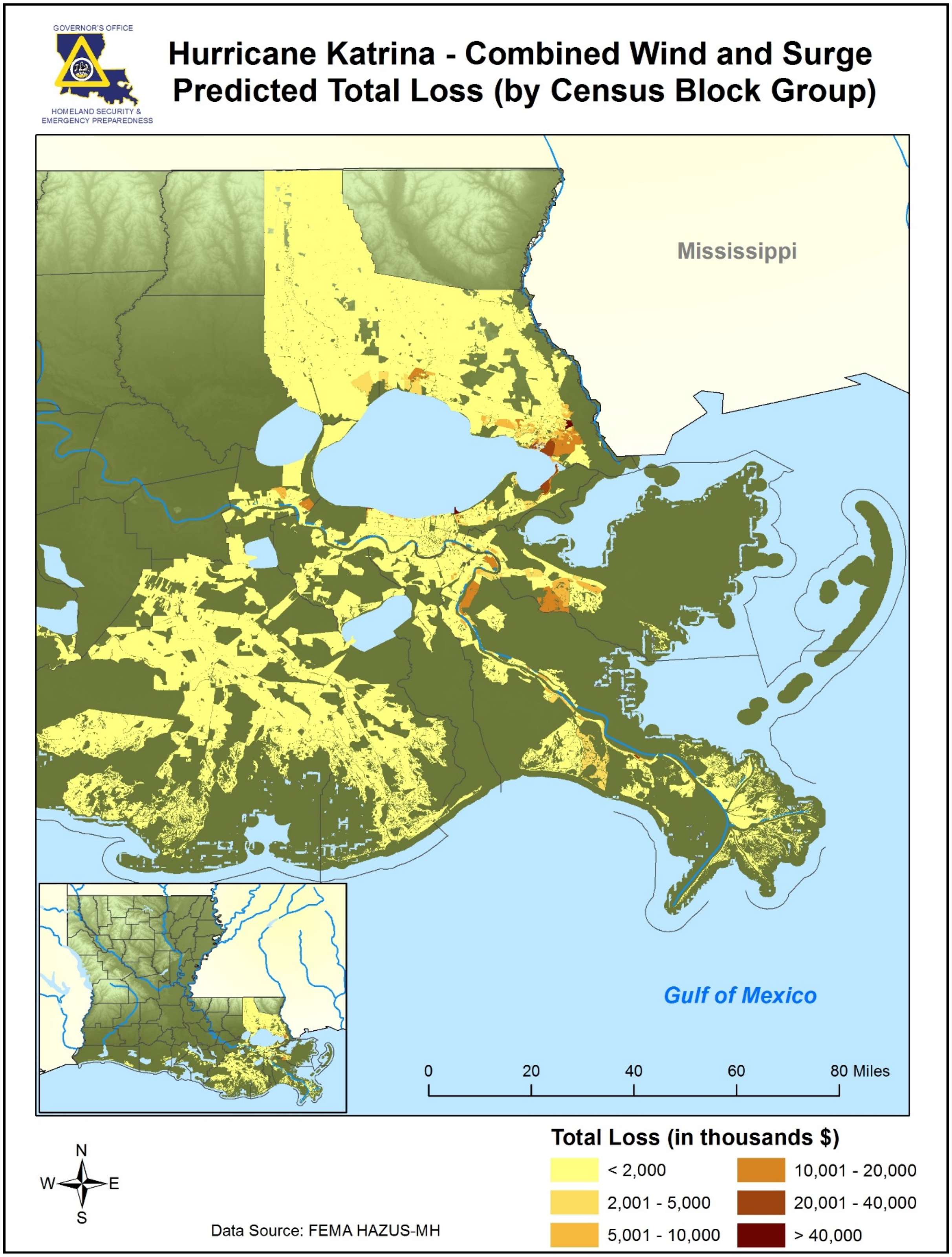
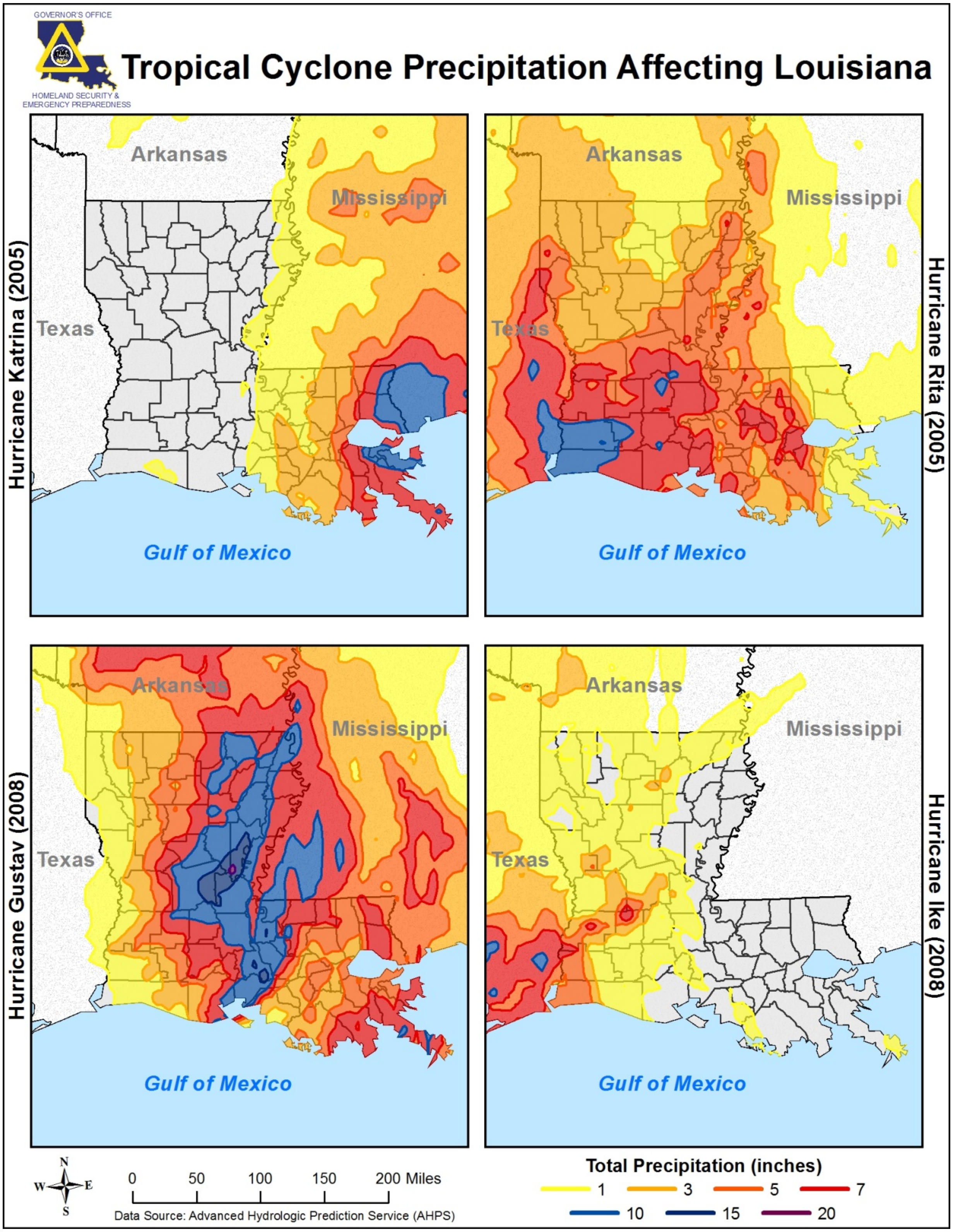


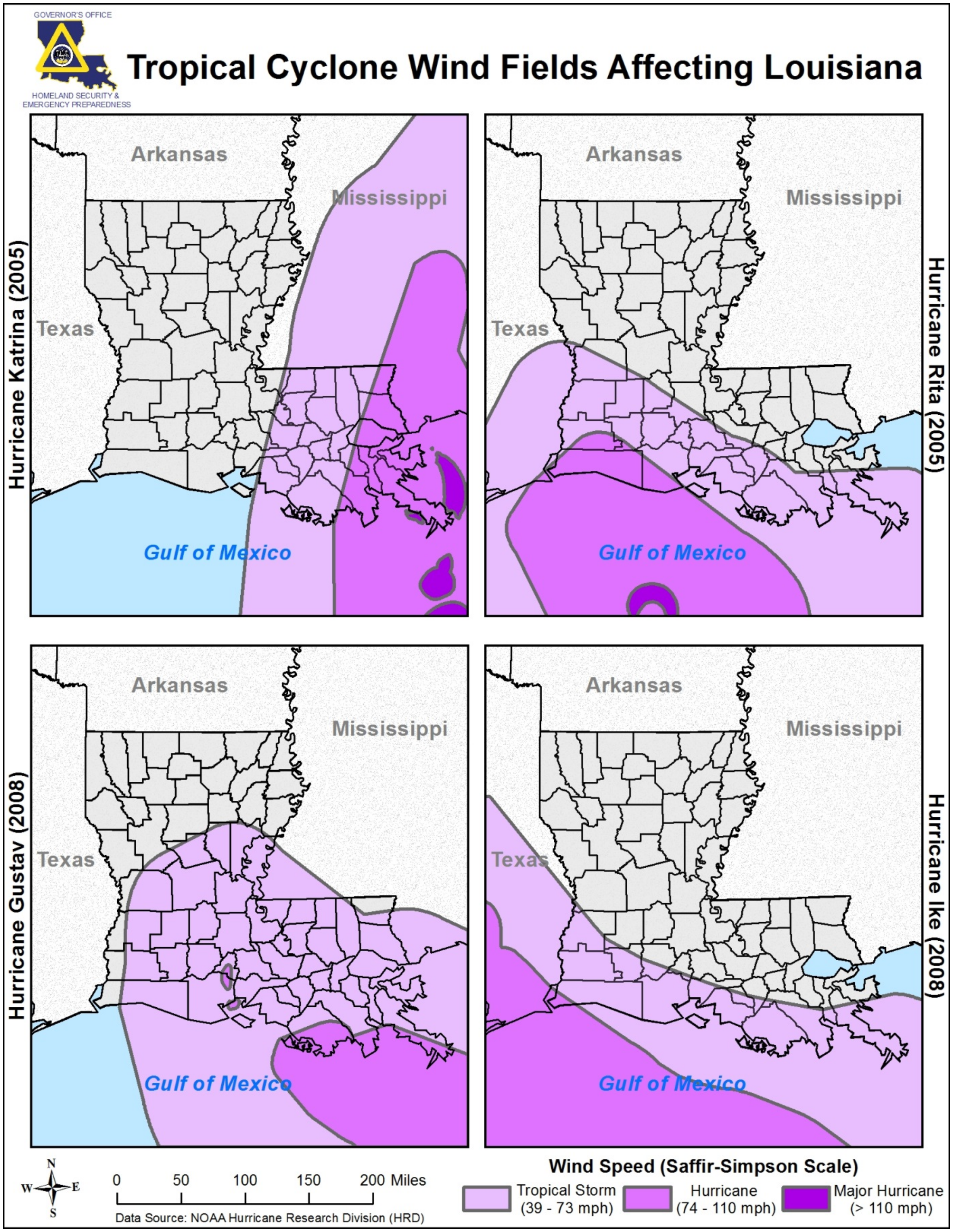
Map 2.71. Peak gust wind speeds and maximum storm surge depths for Hurricane Katrina; modeled using Hazus Combined Wind and Coastal Flooding Model.



Map 2.72. Combined wind and storm surge losses for areas affected by *both* wind and storm surge (by census block group) during Hurricane Katrina; calculated using the Hazus Wind and Coastal Flood Model.



Map 2.73. Precipitation totals due to major hurricanes, 2003–2013.



Map 2.74. Wind speeds due to major hurricanes, 2003–2013.

TROPICAL CYCLONE RISK ASSESSMENT

While the 2005 hurricane season dwarfs most seasons (even 2008) in every category, Louisiana has continued to experience memorable storms over the past three years. While 2010's Tropical Storm Bonnie was a relatively weak system, it still caused enough destruction to total $867,000 (2013 USD) in damages to the state from flooding and wind damage.[lix] Tropical Storm Lee dumped rain of 1–5 in. across most of Louisiana, with up to 10–15 in. in some southern parishes.[lx] The storm's effect in Texas, as well as the mid-Atlantic and northeastern United States, helpfully illustrates the strange interrelation of environmental hazards across disparate geographic regions. Lee's rains did not end up mitigating the drought conditions in Texas, but his high winds ironically contributed to major wildfire outbreaks. Furthermore, in a number of northern and mid-Atlantic states (Pennsylvania, New York, New Jersey, Connecticut, Virginia, and Maryland), Lee caused extensive, disastrous, unexpected flooding. In all, Lee caused 21 deaths and $1.35 billion in damages throughout the whole United States.[lxi]

One of the most unusual hurricanes for Louisiana in recent memory was the slow-moving Hurricane Isaac, which resulted in five deaths and $622 million (2013 USD).[lxii] The storm produced very large storm surges, leading to three of the total deaths attributed to the storm. Rainfall was extensive, peaking at 23 in., and leading to flash and riverine flooding (see Maps 2.75 and 2.76 for the geographic extent of precipitation totals and wind speeds from the storm).

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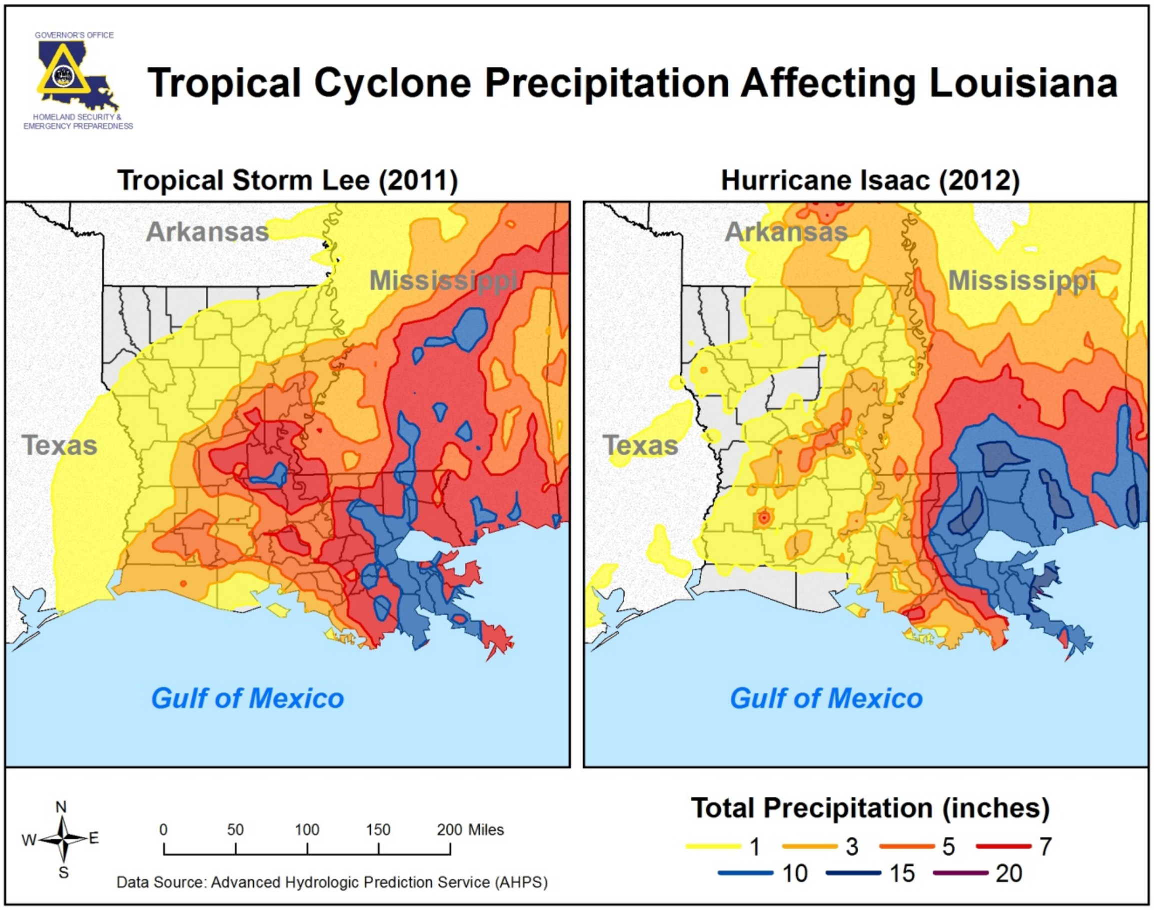

Map 2.75. Precipitation totals from Tropical Storm Lee and Hurricane Isaac.

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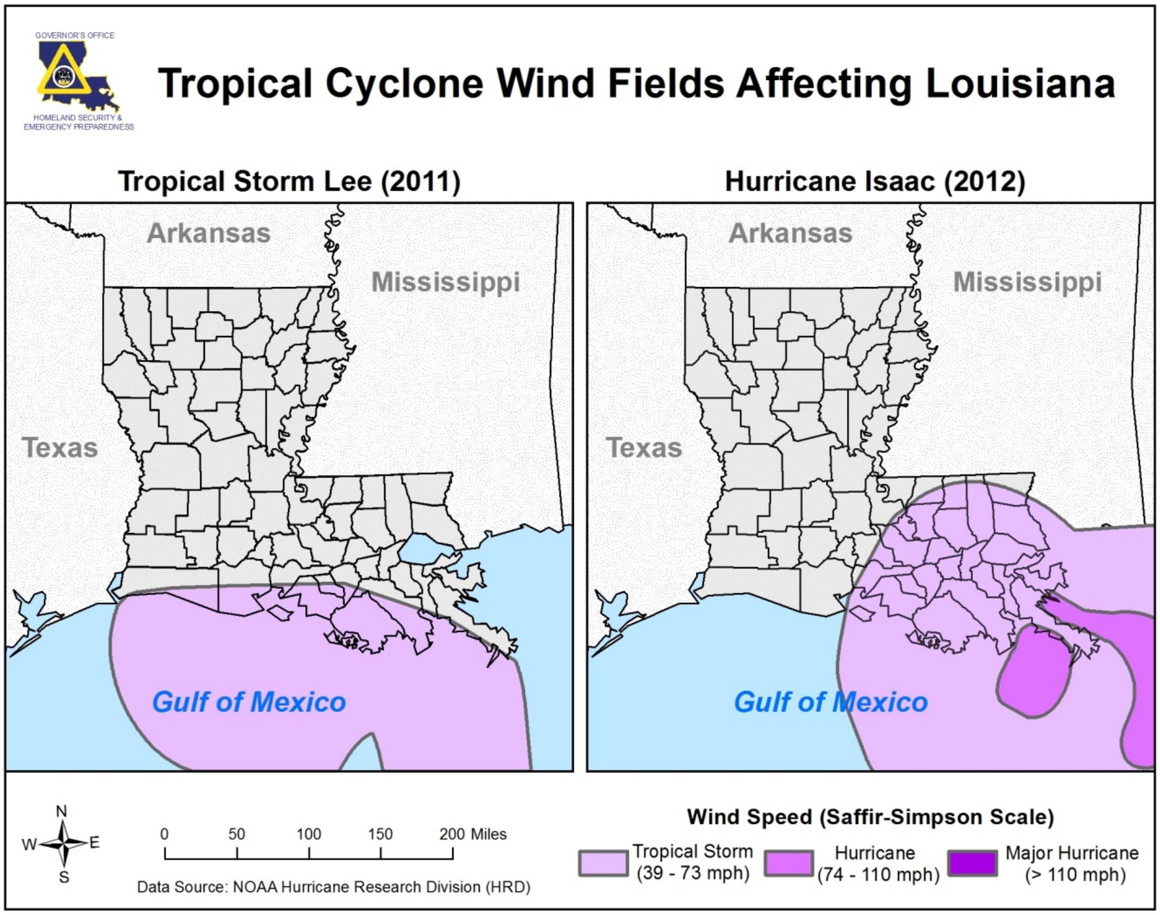

Map 2.76. Wind speeds from Tropical Storm Lee and Hurricane Isaac.

Based on previous occurrences, and as Map 2.77 indicates, the probability of future likelihood for a hurricane hitting Louisiana is **Medium**, however, the impacts can be catastrophic, as this section has shown.

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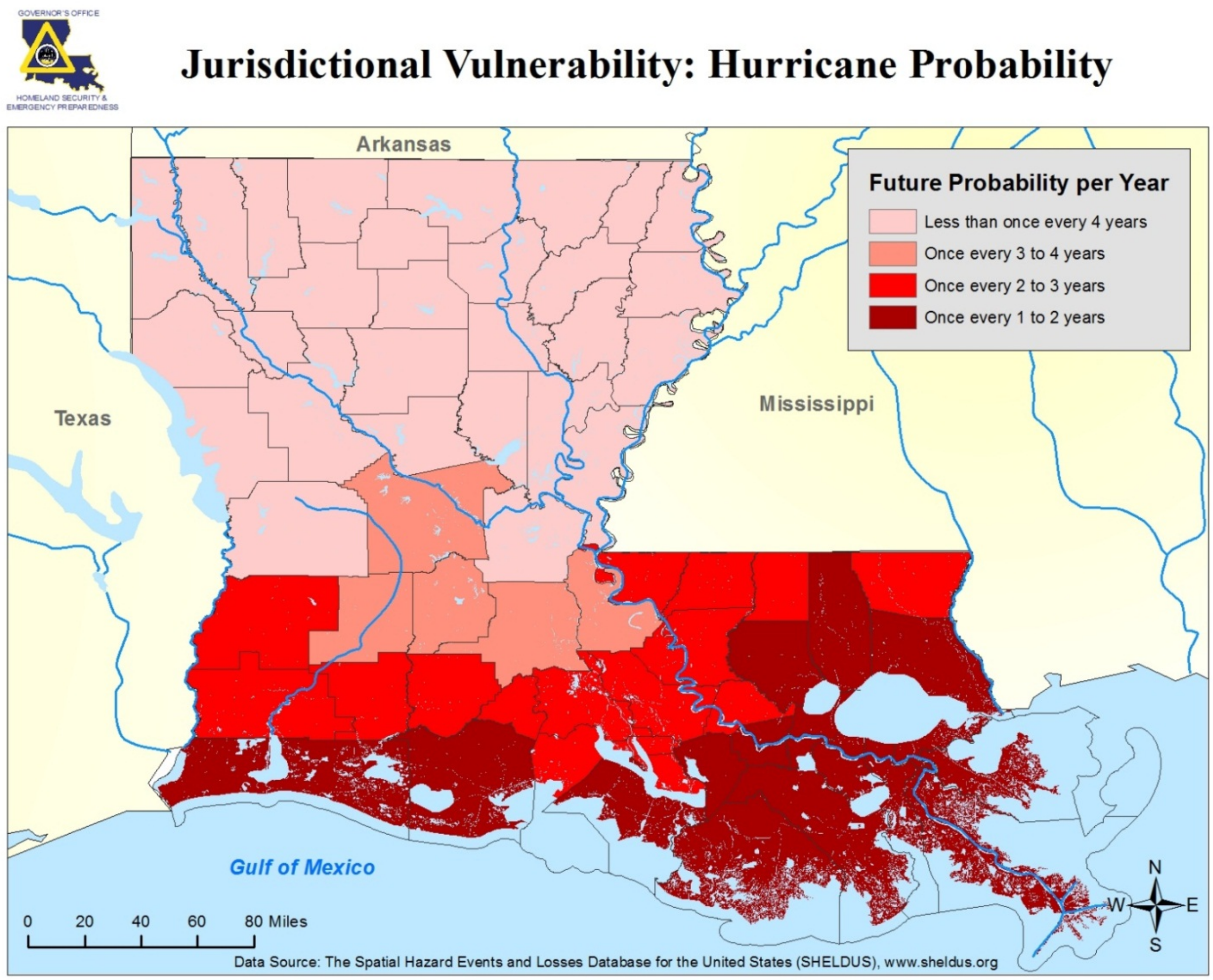

Map 2.77. Probability of future tropical cyclone events in Louisiana by parish based on data from 1987–2012.

Potential Economic Loss

To estimate damage and economic loss for the state of Louisiana due to tropical cyclones, this Plan draws on data from a level 1 analysis using FEMA's Hazus-MH 2.1 economic loss modeling software in order to evaluate both historical record and probability of future occurrence. The analysis uses the default "general building stock" and "essential facility" databases that are built into the model. These databases are derived from national-level data sources for (1) building square footage, (2) building value, (3) population characteristics, (4) costs of building repair, and (5) economic data. Direct economic and social losses associated with the general building stock are computed, as are estimates of essential facility functionality, short-term shelter need, and debris. Damages and economic loss are modeled by building type and occupancy for Hurricanes Katrina and Isaac, and Tropical Storm Lee. Hazus-MH 2.1 estimates losses of approximately $3.559 billion for Katrina, $446.3 million for Isaac, and $105.6 million for Lee. Table 2.32 details these estimations.

Table 2.32. Direct economic loss for residential buildings modeled with Hazus-MH.

Direct Economic Losses by Residential Buildings from Recent Tropical Cyclones								
Event	Total Loss	Building Damage Loss	Content Damage Loss	Inventory Loss	Relocation Loss	Coastal Related Loss	Wages Loss	Rental Income Loss
Katrina	$3,559,050,000	$2,441,778,000	$603,803,000	$4,831,000	$274,090,000	$32,190,000	$56,223,000	$146,134,000
Isaac	$446,344,000	$353,128,000	$69,301,000	$15,000	$11,950,000	$1,267,000	$989,000	$9,694,000
Lee	$105,691,000	$81,673,000	$23,689,000	$0	$148,000	$0	$0	$181,000

Wind speed, extent of damage, impacted critical facilities, and total building losses can be generated using the analysis results for each hurricane. Maps 2.78 and 2.79 show peak wind gusts and total residential building losses (in thousands of dollars) after Hurricane Katrina, as given by the Hazus analysis results. Maps 2.80 and 2.81 show peak wind gusts and total residential building losses after Hurricane Isaac, and Maps 2.82 and 2.83 show peak wind gusts and total residential building losses after Tropical Storm Lee.

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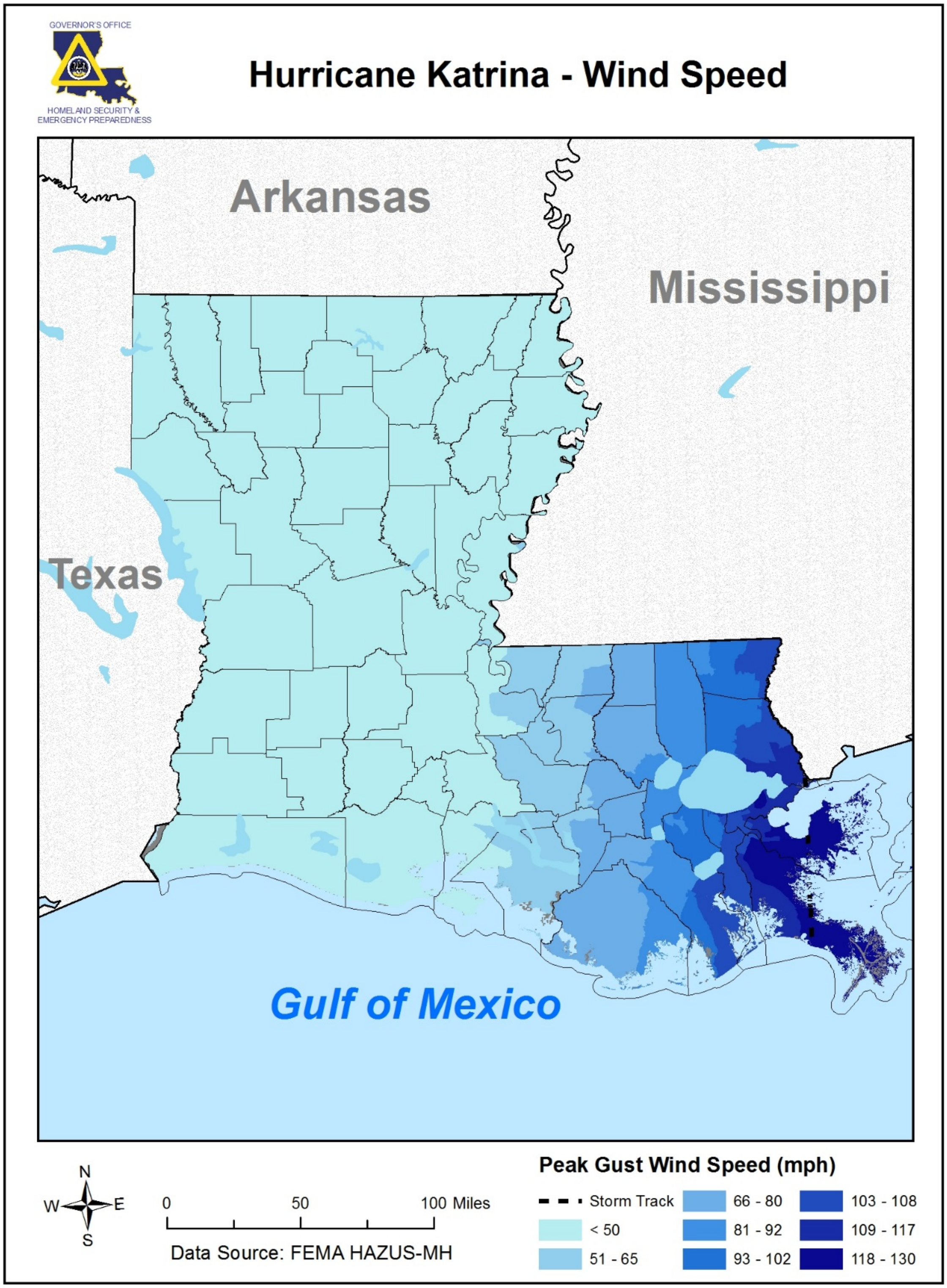
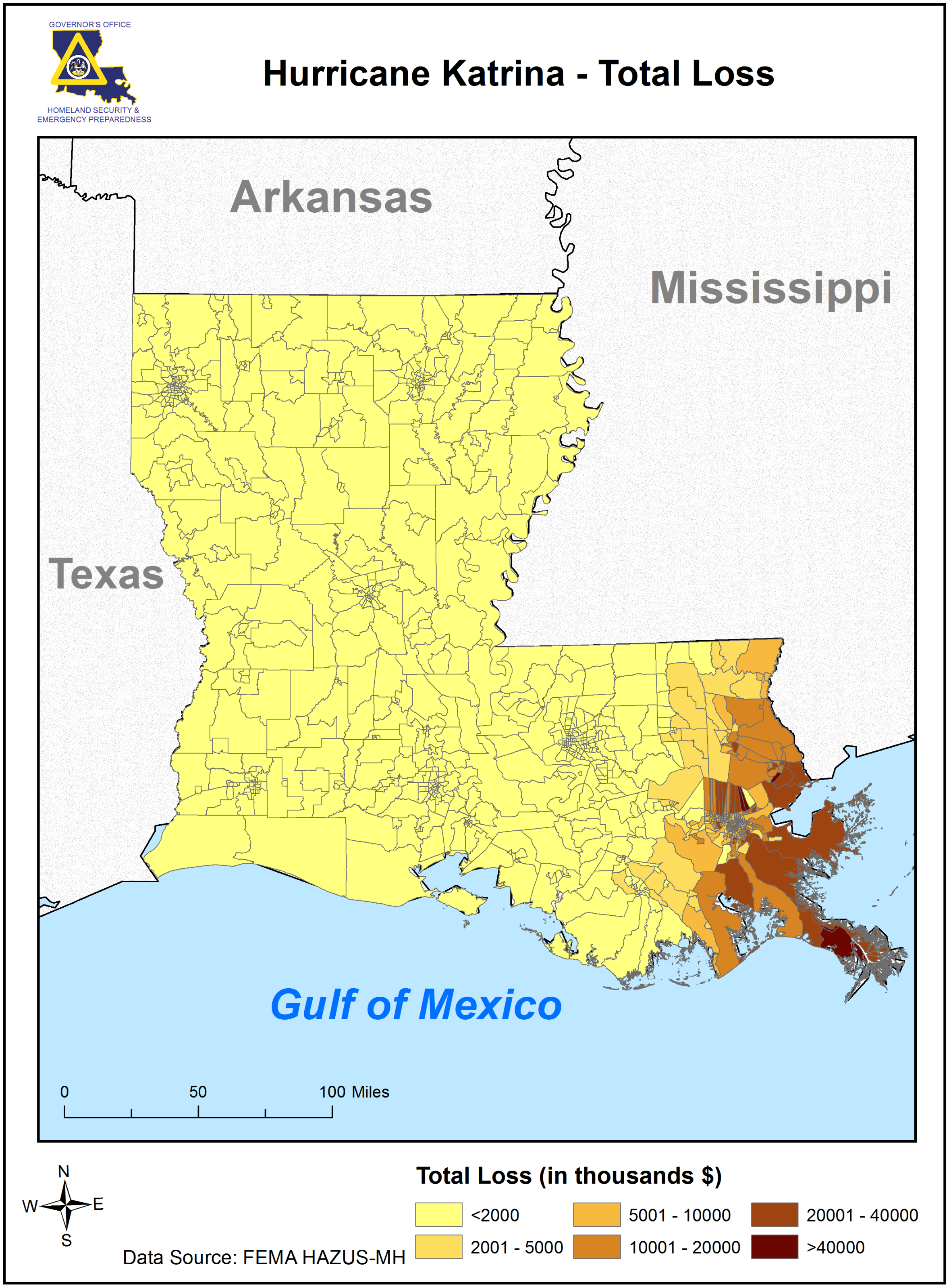
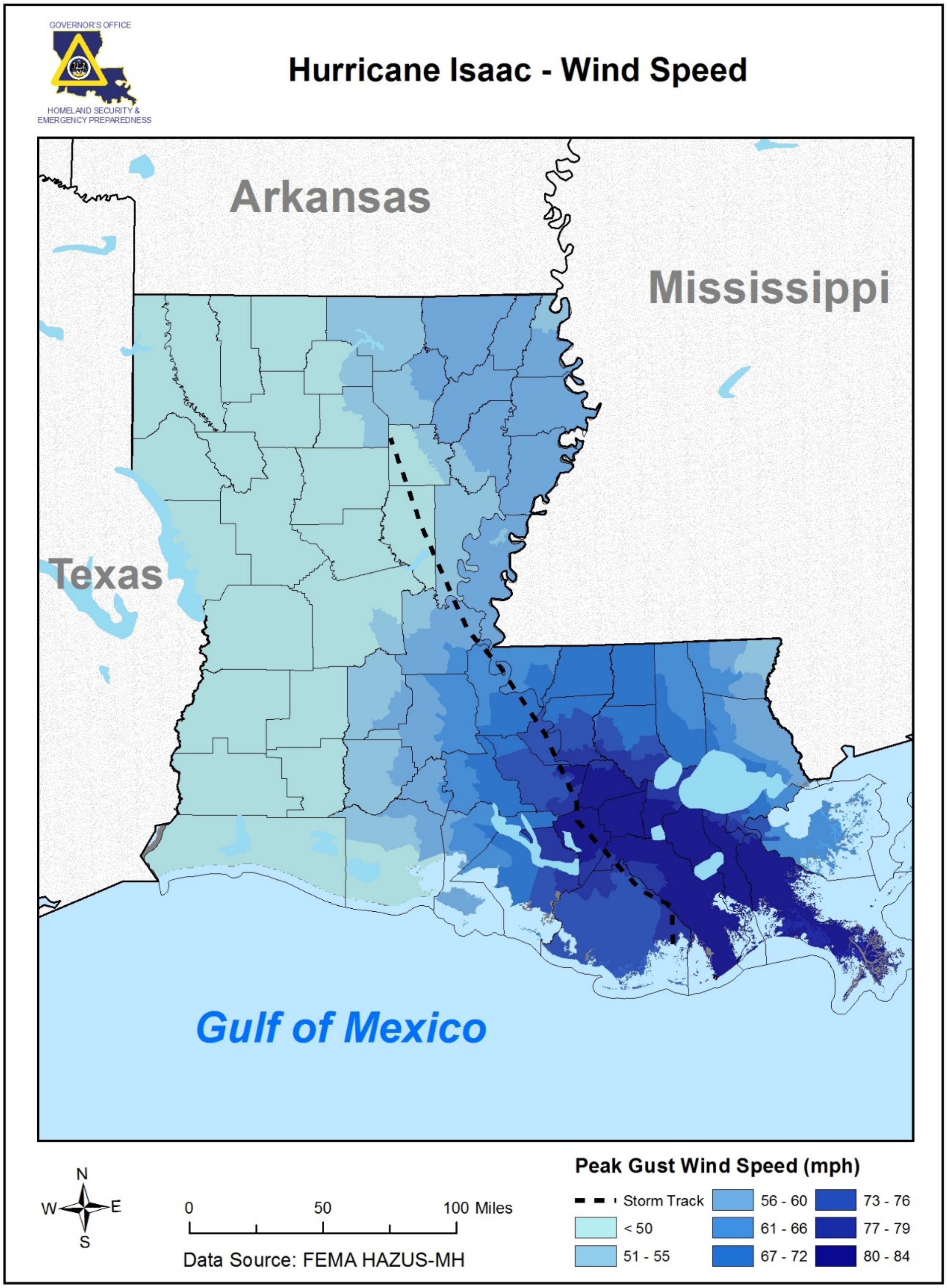


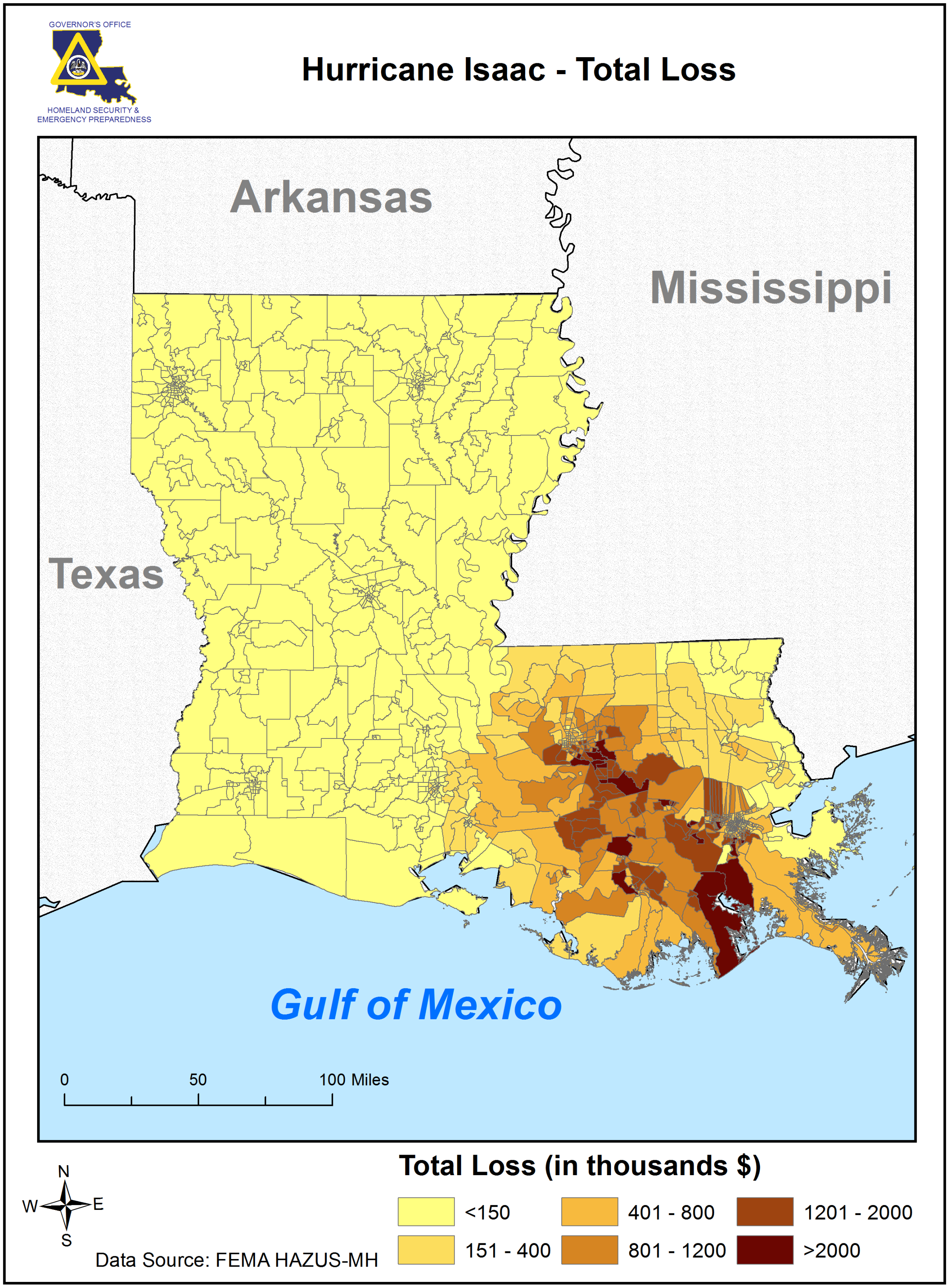
Map 2.78. Peak wind gusts during Hurricane Katrina based on Hazus modeling.



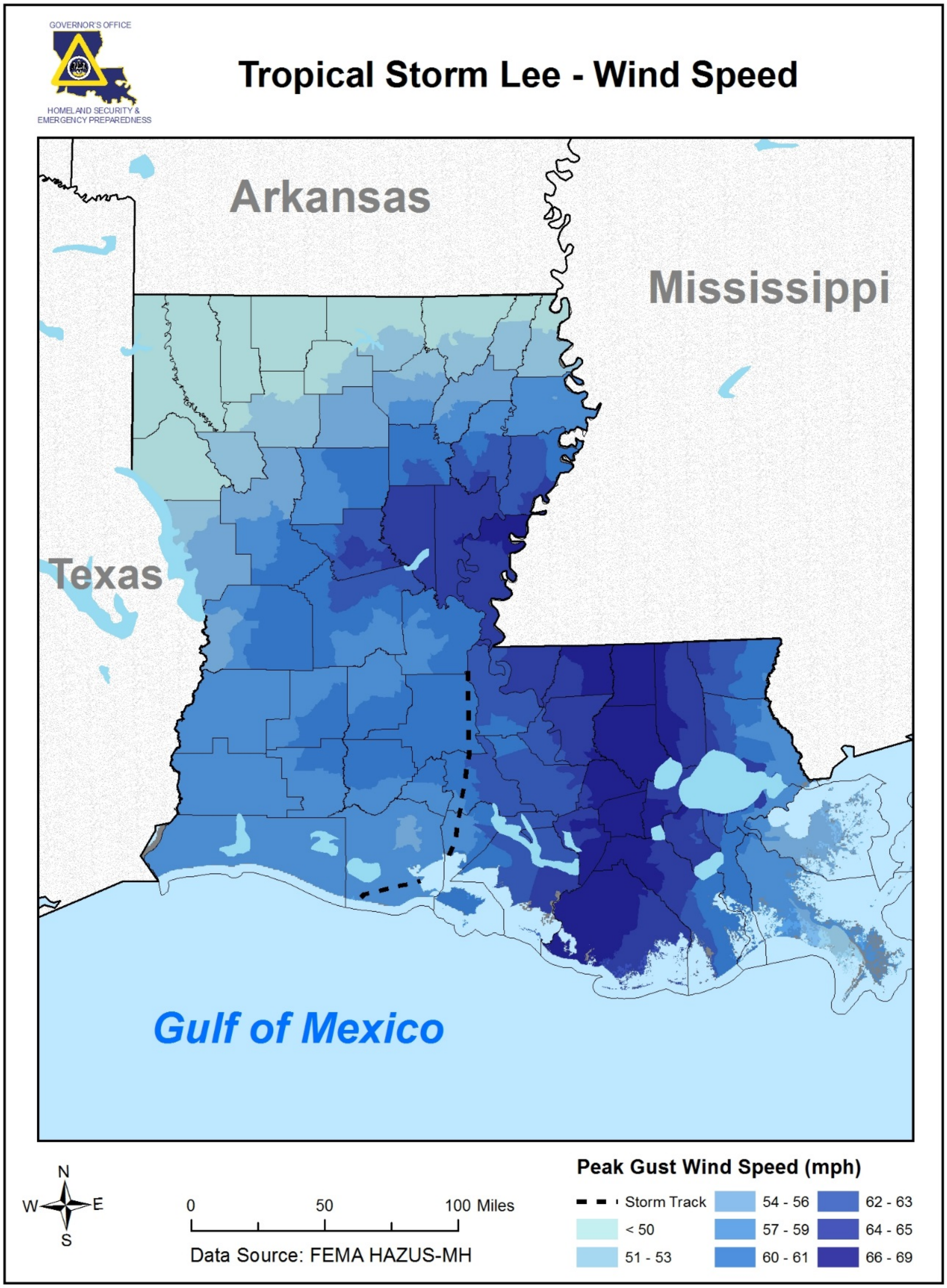
Map 2.79. Total residential building losses after Hurricane Katrina based on Hazus modeling.



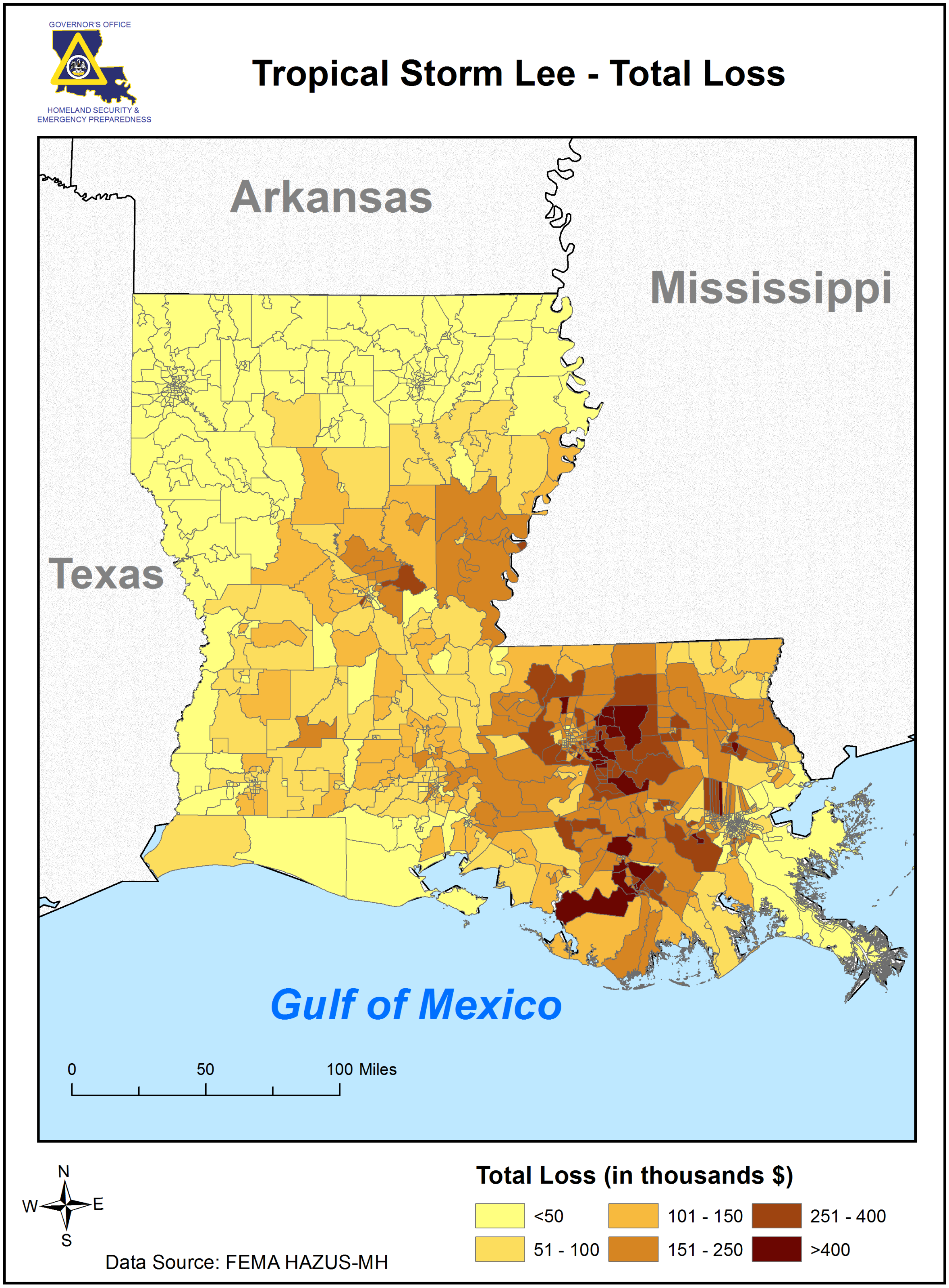
Map 2.80. Peak wind gusts during Hurricane Isaac based on Hazus modeling.



Map 2.81. Total residential building losses after Hurricane Isaac based on Hazus modeling.



Map 2.82. Peak wind gusts during Tropical Storm Lee based on Hazus modeling.



Map 2.83. Total residential building losses after Tropical Storm Lee based on Hazus modeling.

Possible future damage and economic loss are modeled by building type and occupancy for 10-, 50-, 100-, and 500-yr return period storms. Hazus-MH estimates losses of approximately $751.5 million for a 10-yr return period storm, $9.6 billion for a 50-yr, $19.1 billion for a 100-yr and $53.1 billion for a 500-yr hurricane event for the entire state. Table 2.33 details these estimations.

Table 2.33. Projected direct economic loss ($1,000) for residential buildings for 10-, 50-, 100-, 500-yr hurricane events.

Projected Economic Loss ($1,000) for Residential Buildings in Various Tropical Cyclone Events								
Event	Total Loss	Building Damage Loss	Content Damage Loss	Inventory Loss	Relocation Loss	Capital Related Loss	Wages Loss	Rental Income Loss
10-yr	$751,506	$533,421	$138,028	$2,000	$45,990	$5,092	$7,943	$19,032
50-yr	$9,643,209	$5,791,507	$2,337,131	$32,678	$895,703	$108,815	$137,915	$339,461
100-yr	$19,096,732	$11,264,910	$4,857,973	$82,156	$1,703,026	$248,625	$304,191	$635,851
500-yr	$53,132,249	$30,792,164	$14,231,400	$150,744	$4,219,211	$872,389	$1,043,856	$1,853,570

Wind speed, extent of damage, impacted critical facilities, and total building losses can be generated using the analysis results for 10-, 50-, 100- and 500-yr hurricane events. The following maps show the projected (1) peak wind gusts, (2) moderate damage and impacted critical facilities, and (3) residential building losses. In Hazus, police stations, medical offices, and fire stations are presumed to be able to continue operating with some temporary rearrangement and departmental relocation after sustaining moderate damage. The location of police stations, medical offices, and fire stations in damaged areas during the storm are shown on the maps. Maps 2.84, 2.85, 2.86 show the projected peak wind gusts, moderate damage and impacted critical facilities, and residential building losses for a 10-yr hurricane event. State-owned critical facilities located in areas affected by tropical cyclones are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

Maps 2.87, 2.88, 2.89 show the projected peak wind gusts, moderate damage and impacted critical facilities, and residential building losses for a 50-yr hurricane event.

Maps 2.90, 2.91, 2.92 show the projected peak wind gusts, moderate damage and impacted critical facilities, and residential building losses for a 100-yr hurricane event.

Maps 2.93, 2.94, 2.95 show the projected peak wind gusts, moderate damage and impacted critical facilities, and residential building losses for a 500-yr hurricane event.

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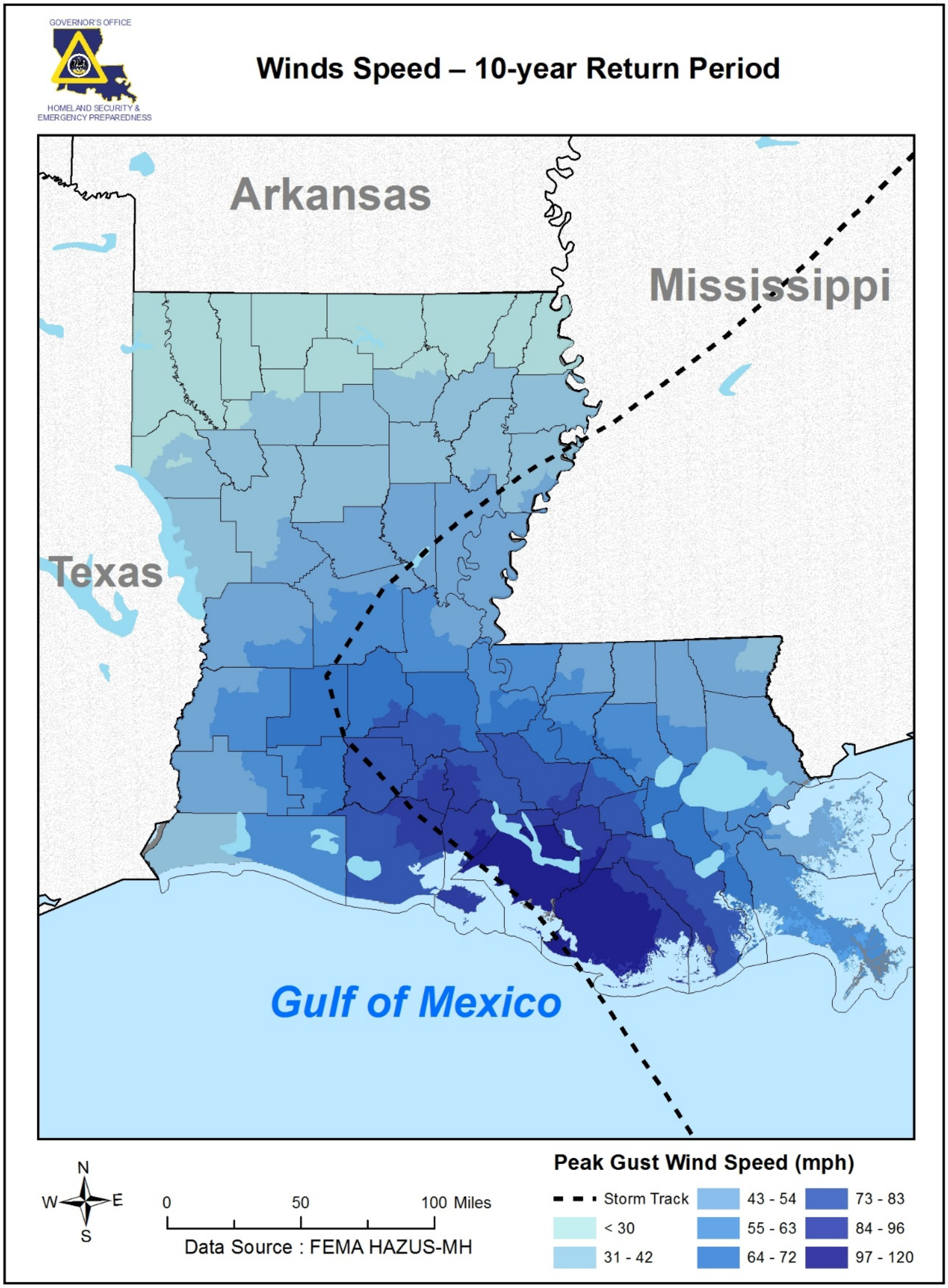
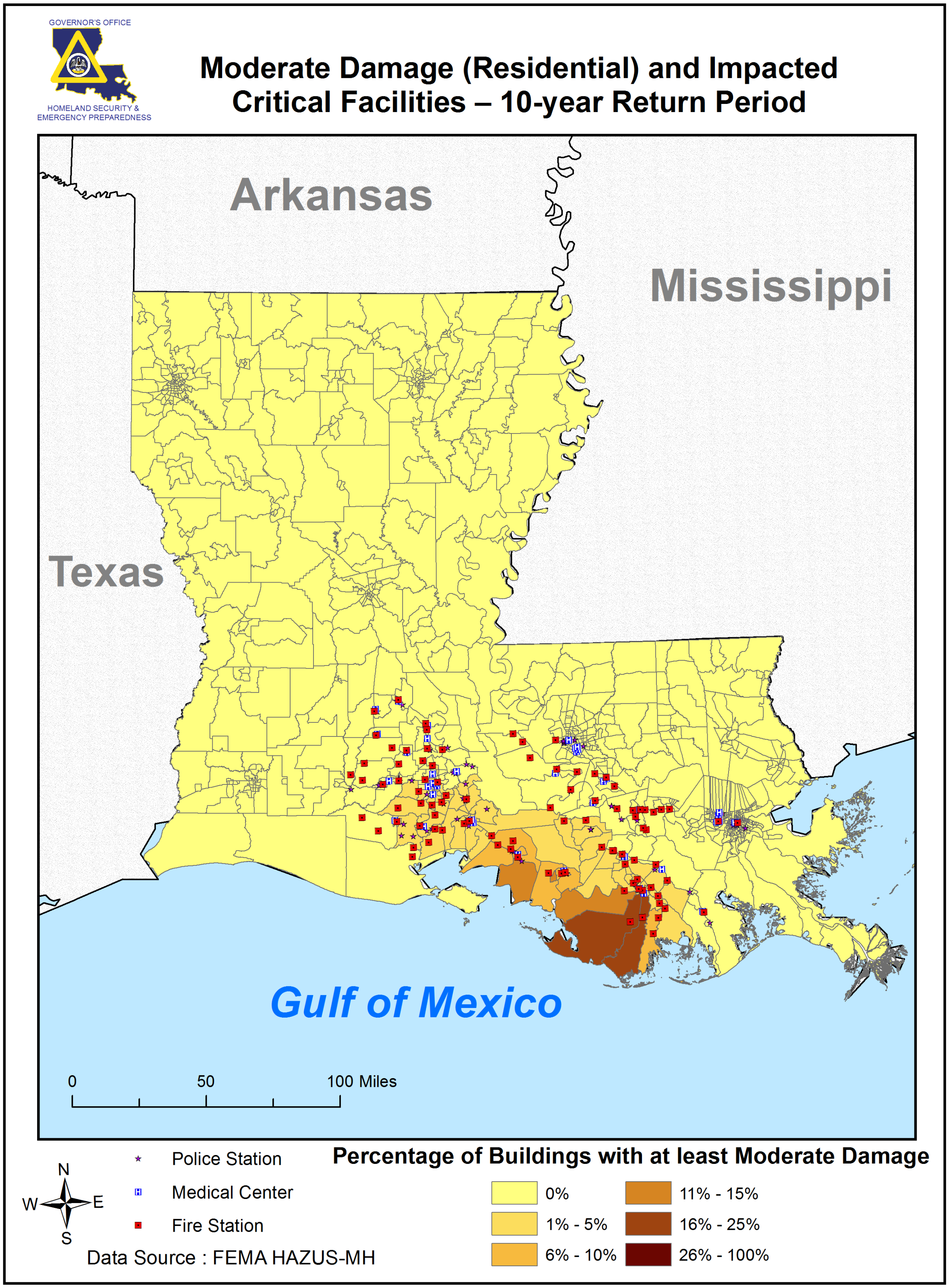
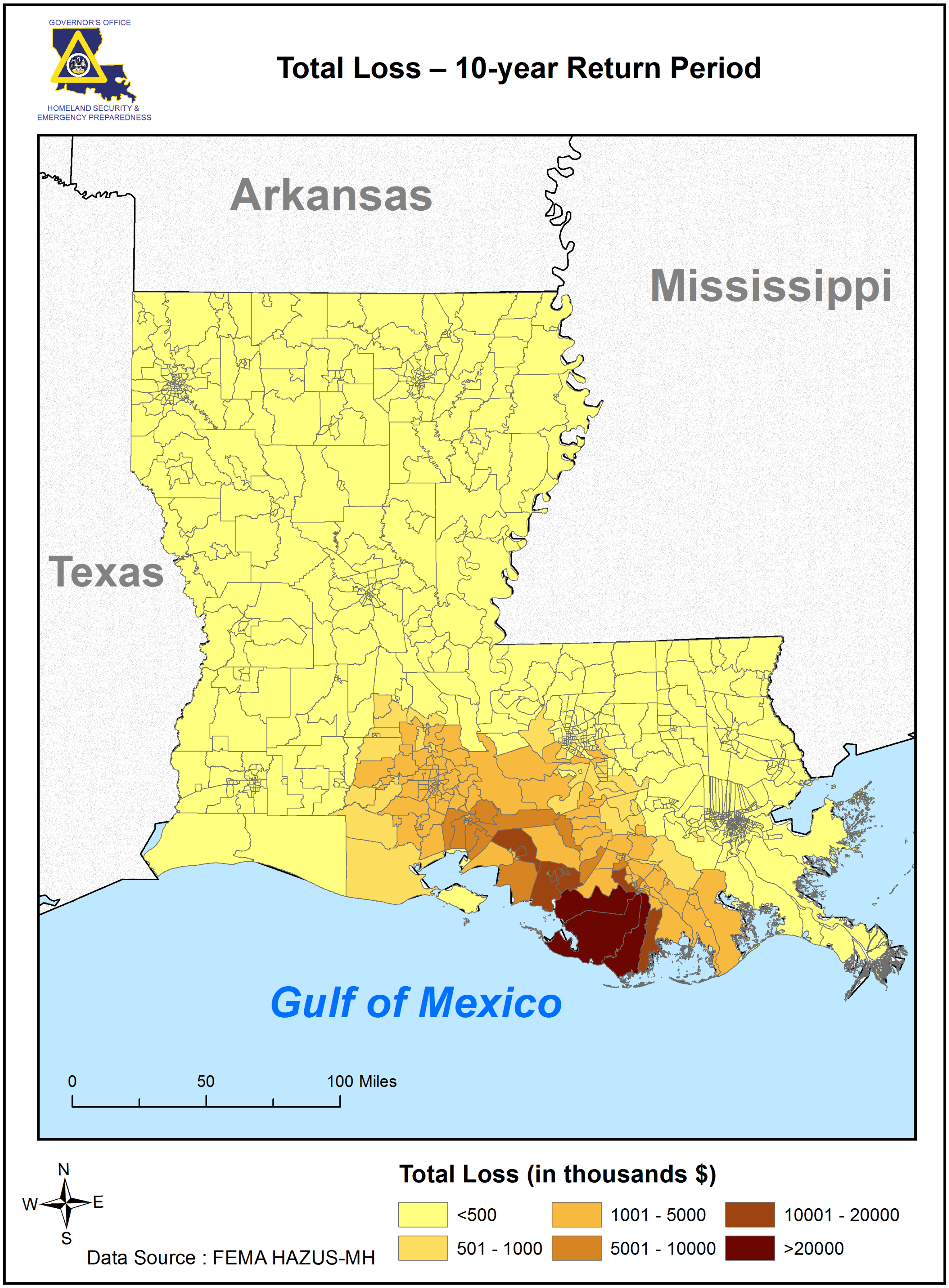


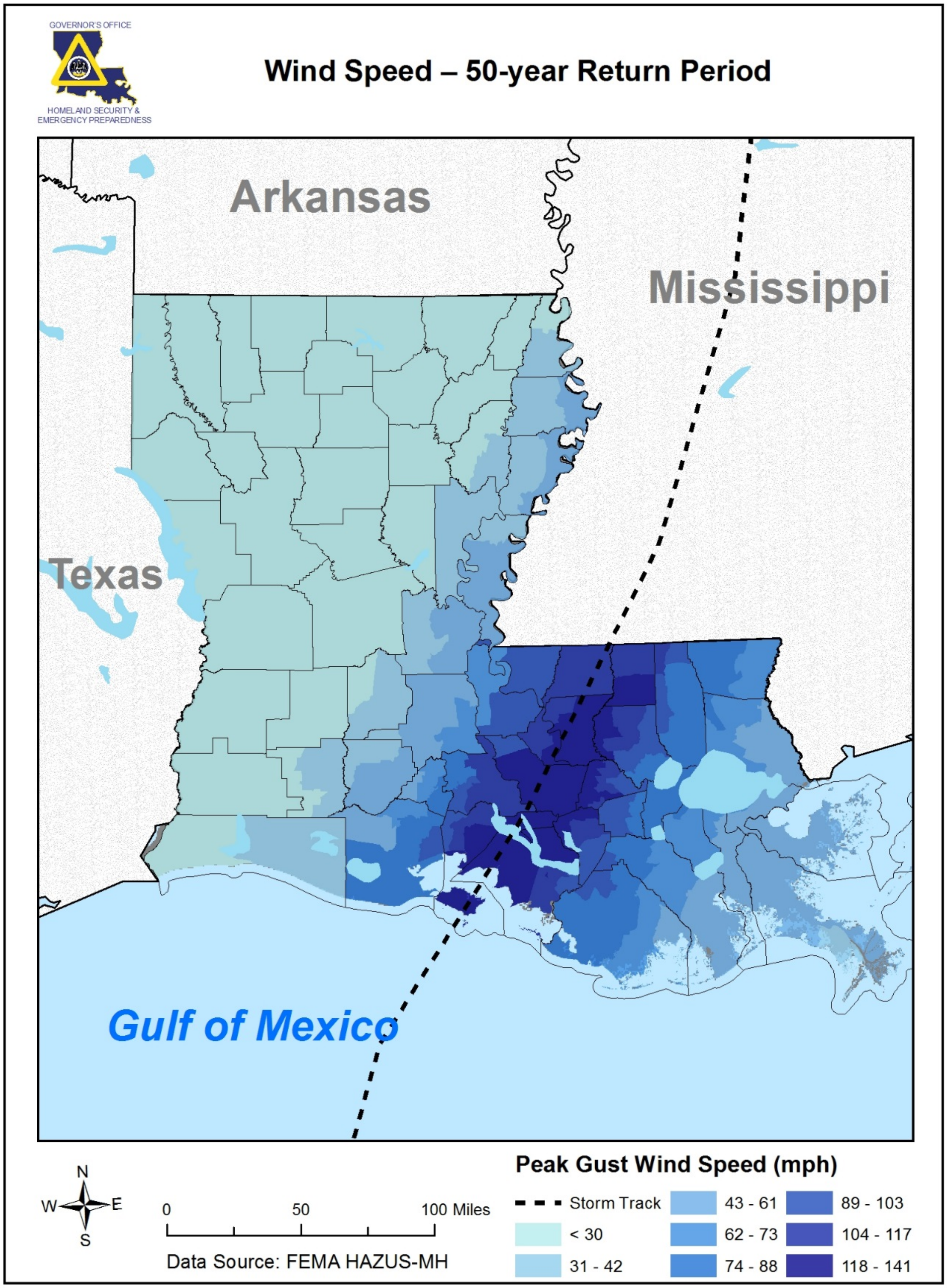
Map 2.84. Projected peak wind gusts during a 10-yr hurricane event, based on Hazus modeling.



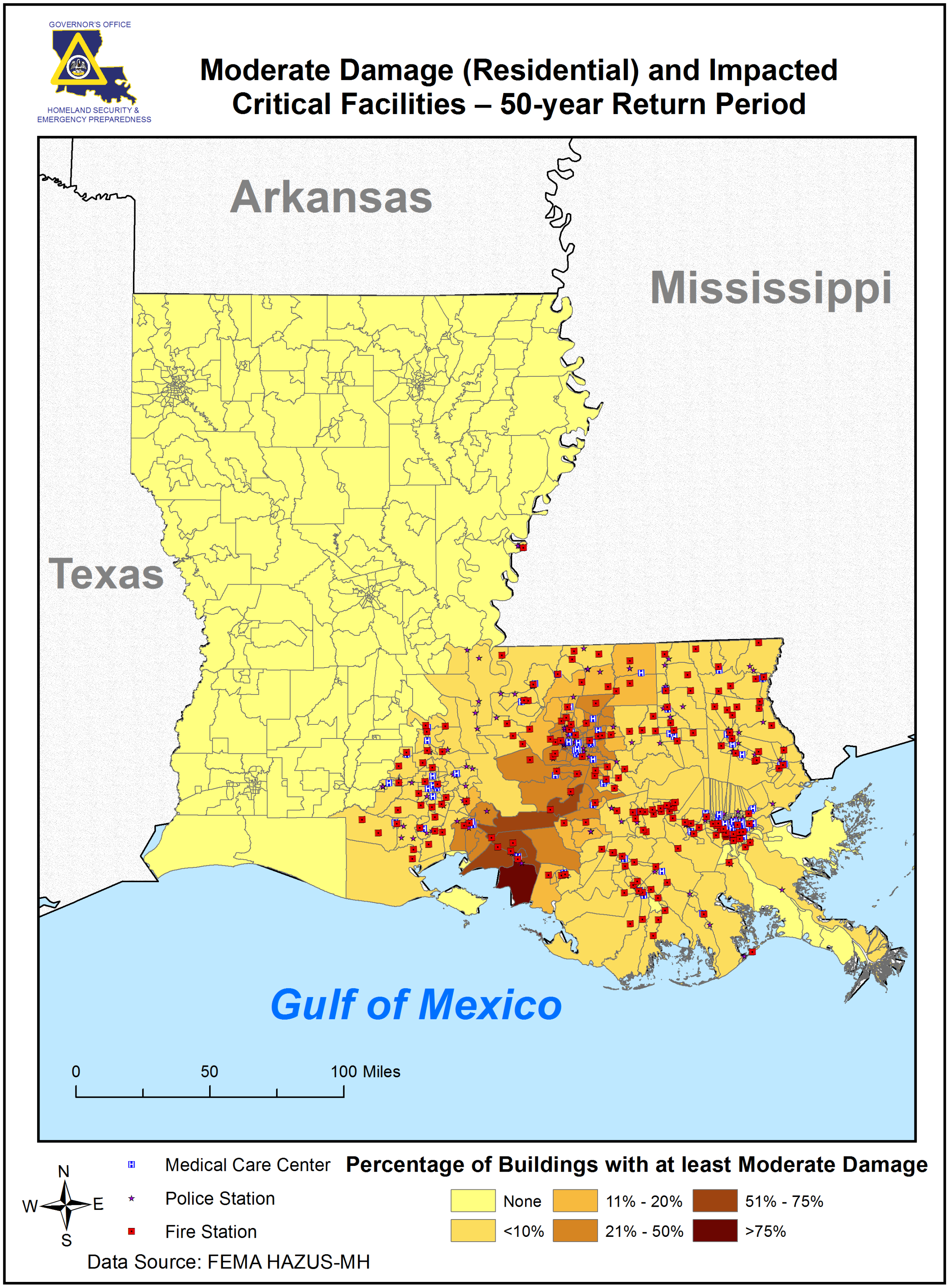
Map 2.85. Projected percentage of moderately damaged residential buildings and critical facilities (medical care center, police station, and fire station) after a 10-yr hurricane event.



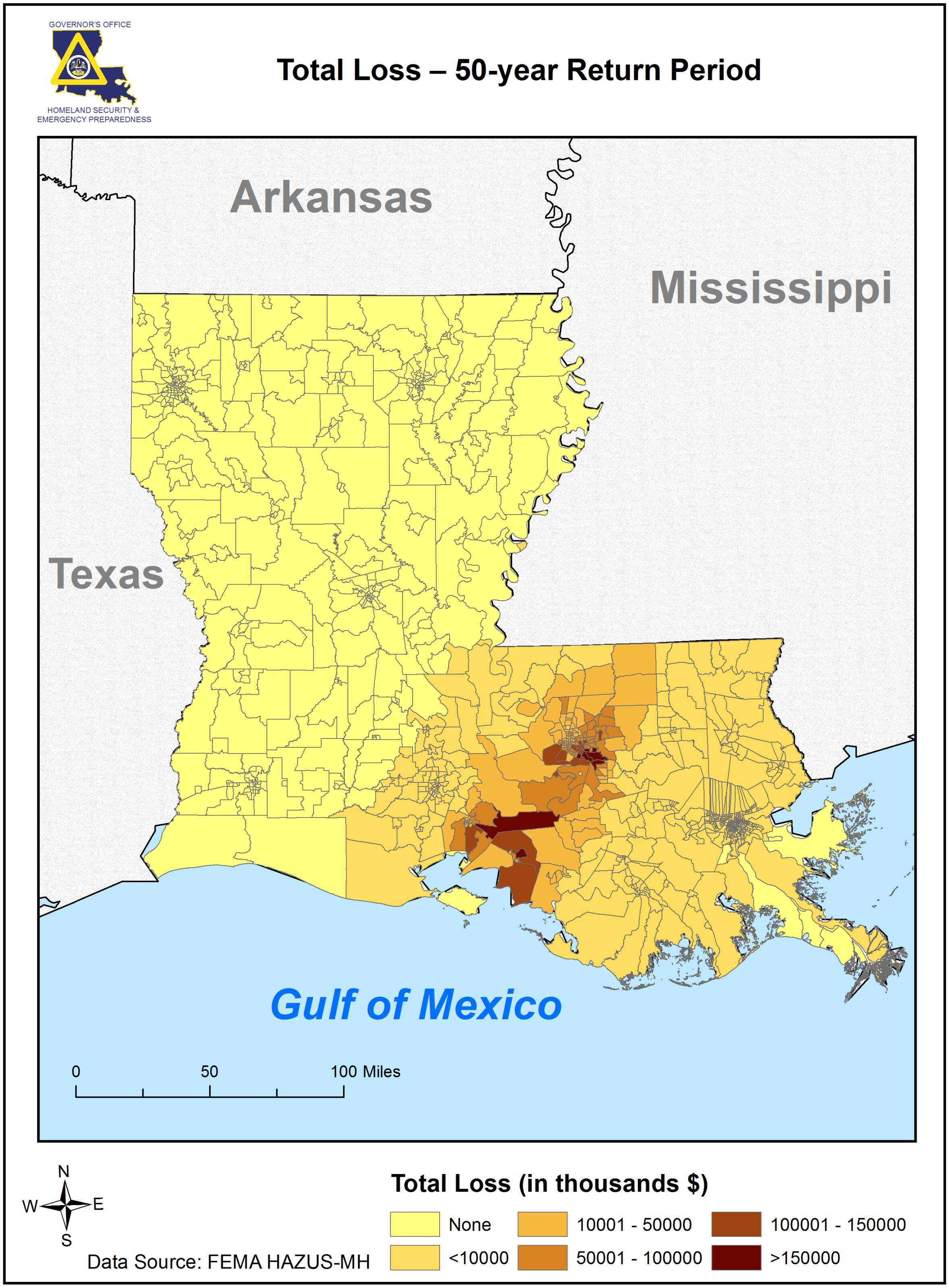
Map 2.86. Projected total economic losses (in thousands of dollars) to residential buildings after a 10-yr hurricane event.



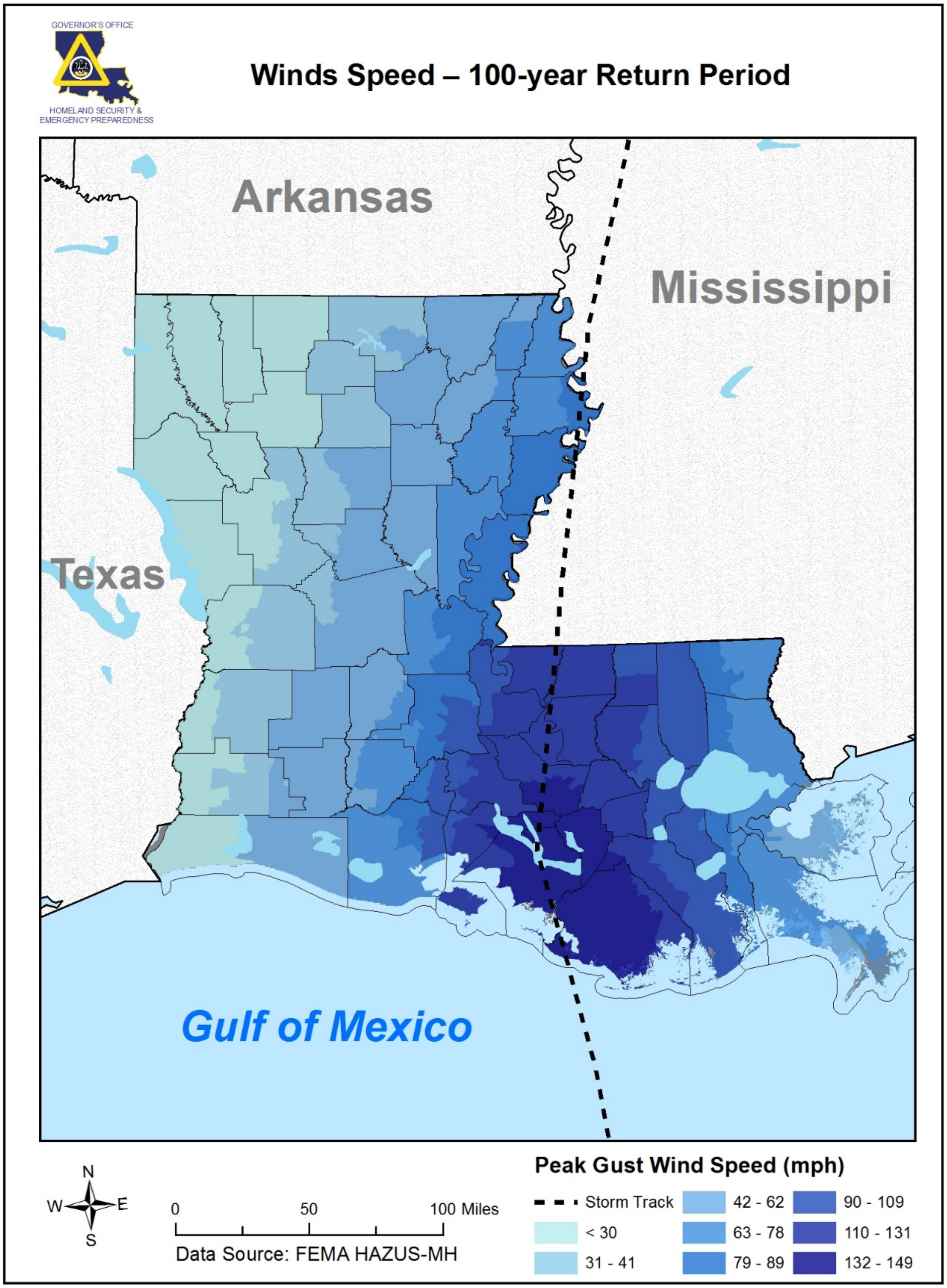
Map 2.87. Projected peak wind gusts during a 50-yr hurricane event, based on Hazus modeling.



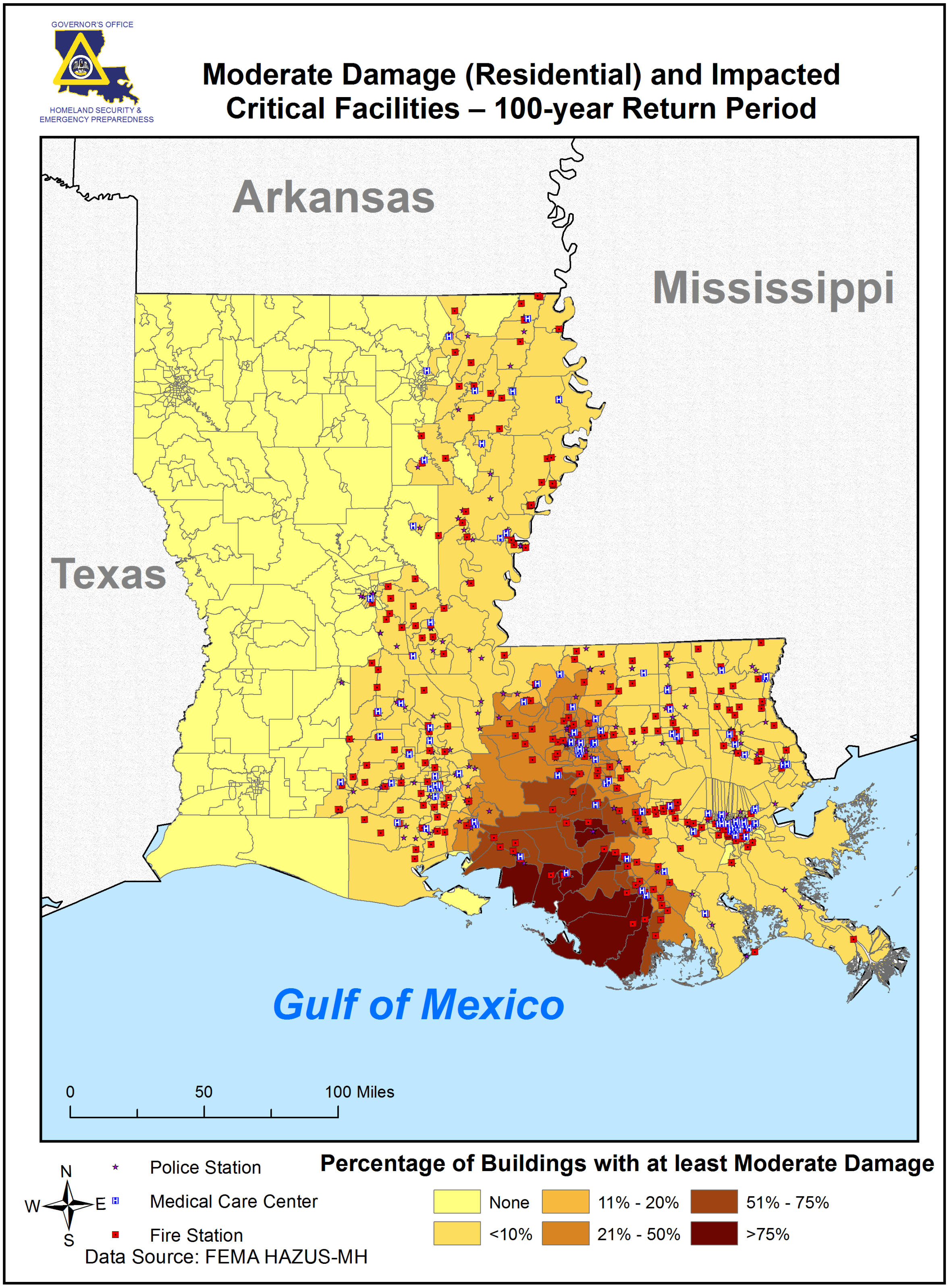
Map 2.88. Projected percentage of moderately damaged residential buildings and critical facilities (medical care center, police station, and fire station) after a 50-yr hurricane event.



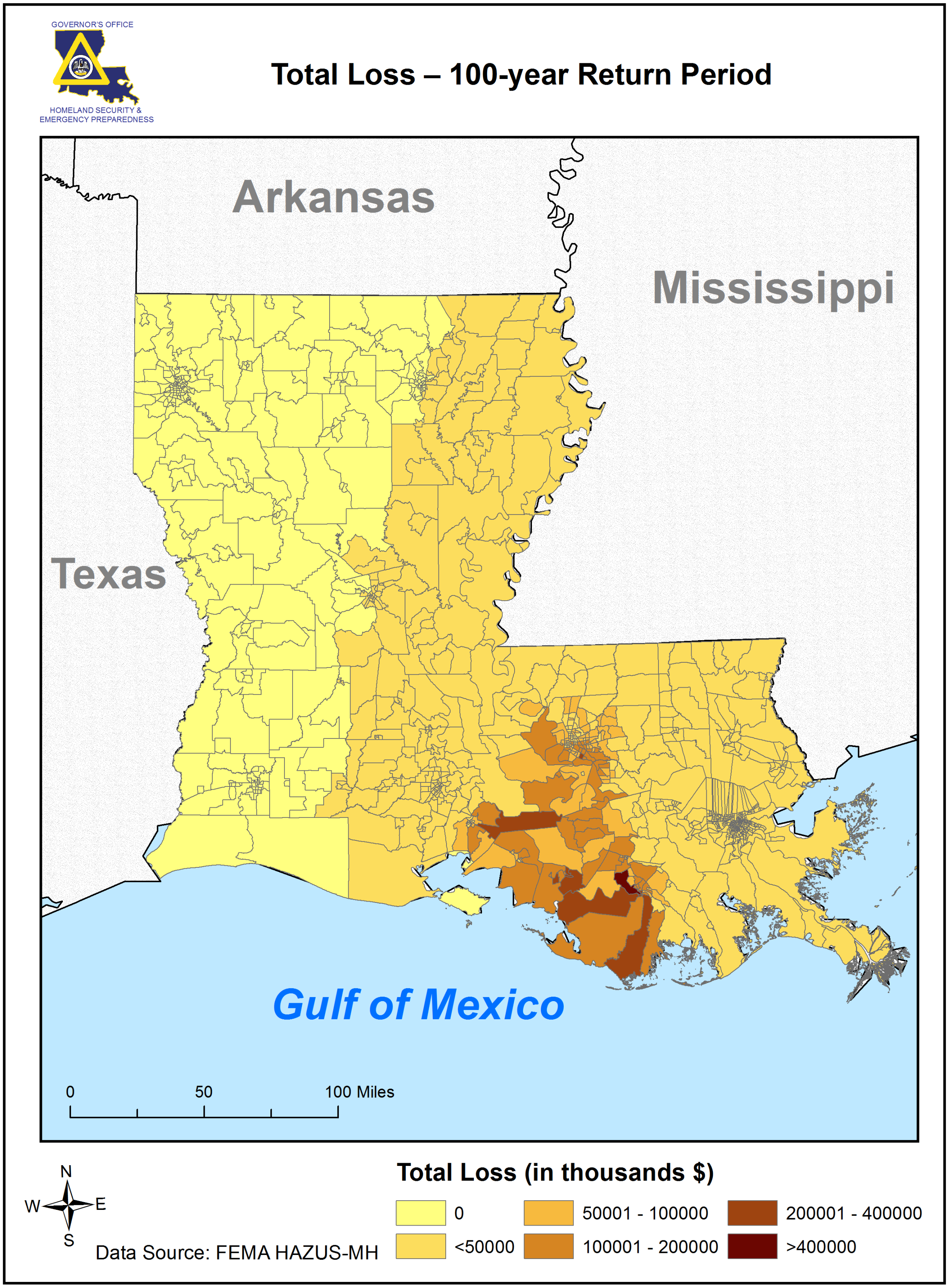
Map 2.89. Projected total economic losses (in thousands of dollars) to residential buildings after a 50-yr hurricane event.



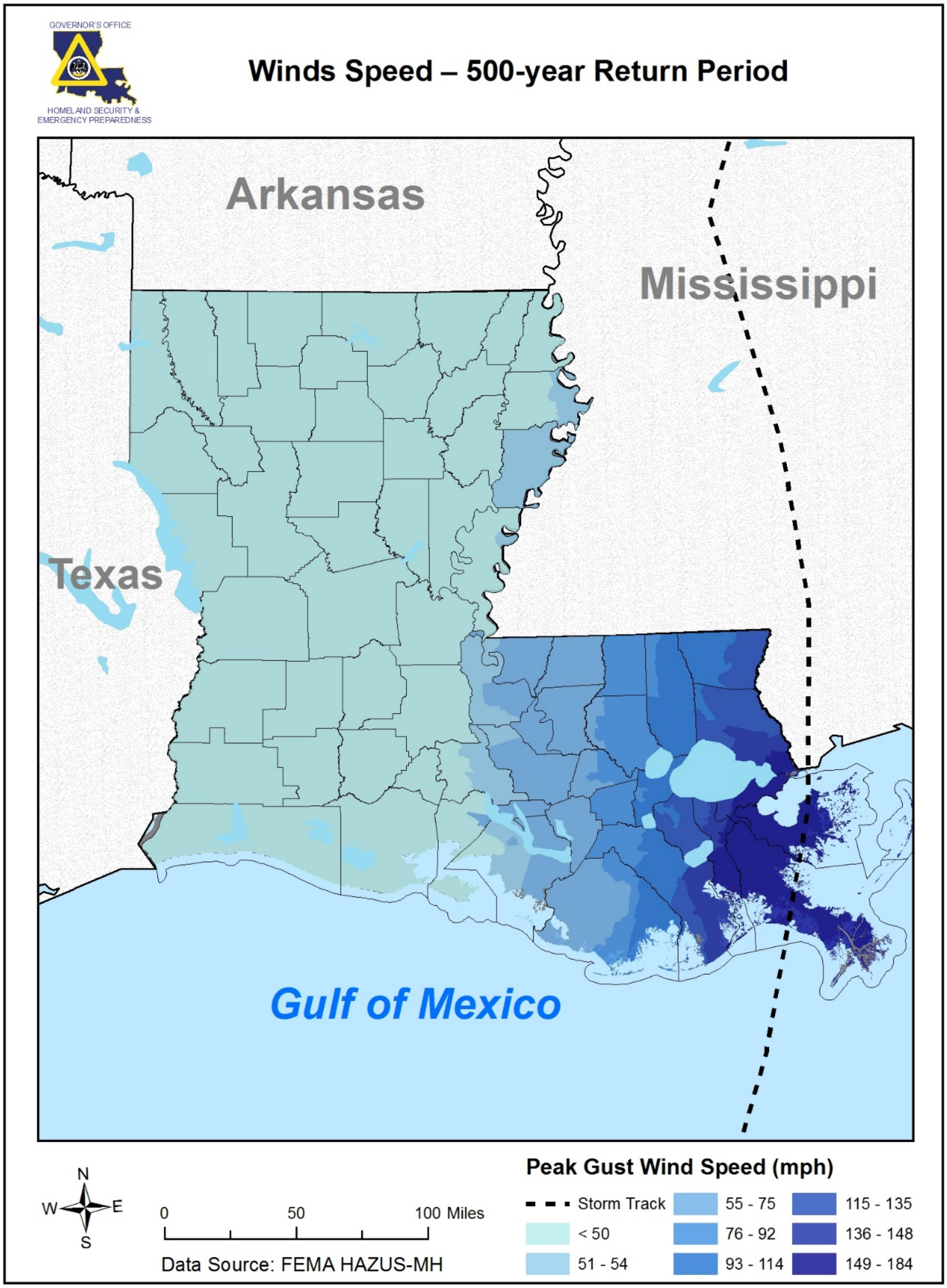
Map 2.90. Projected peak wind gusts during a 100-yr hurricane event, based on Hazus modeling.



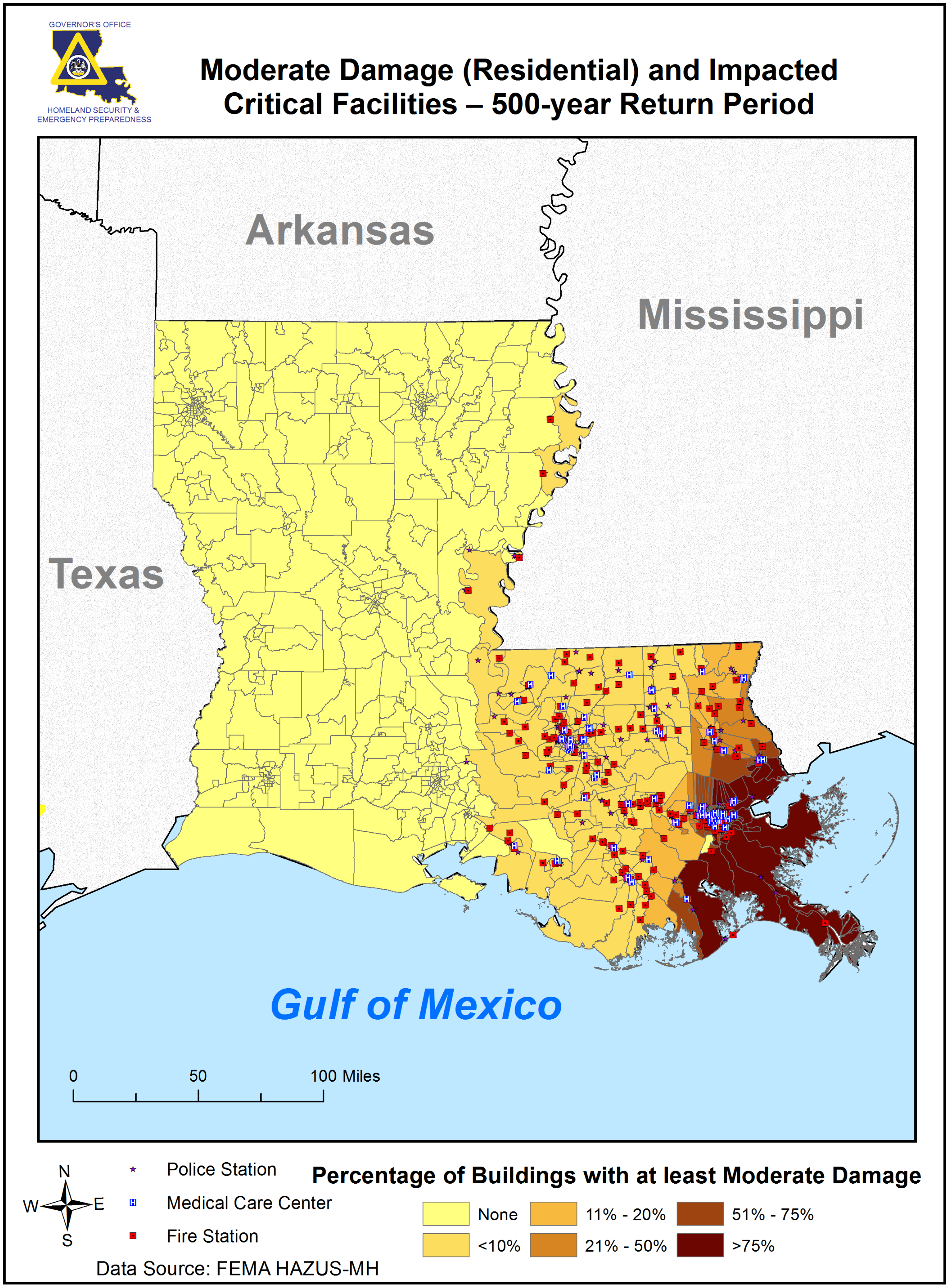
Map 2.91. Projected percentage of moderately damaged residential buildings and critical facilities (medical care center, police station, and fire station) after a 100-yr hurricane event.



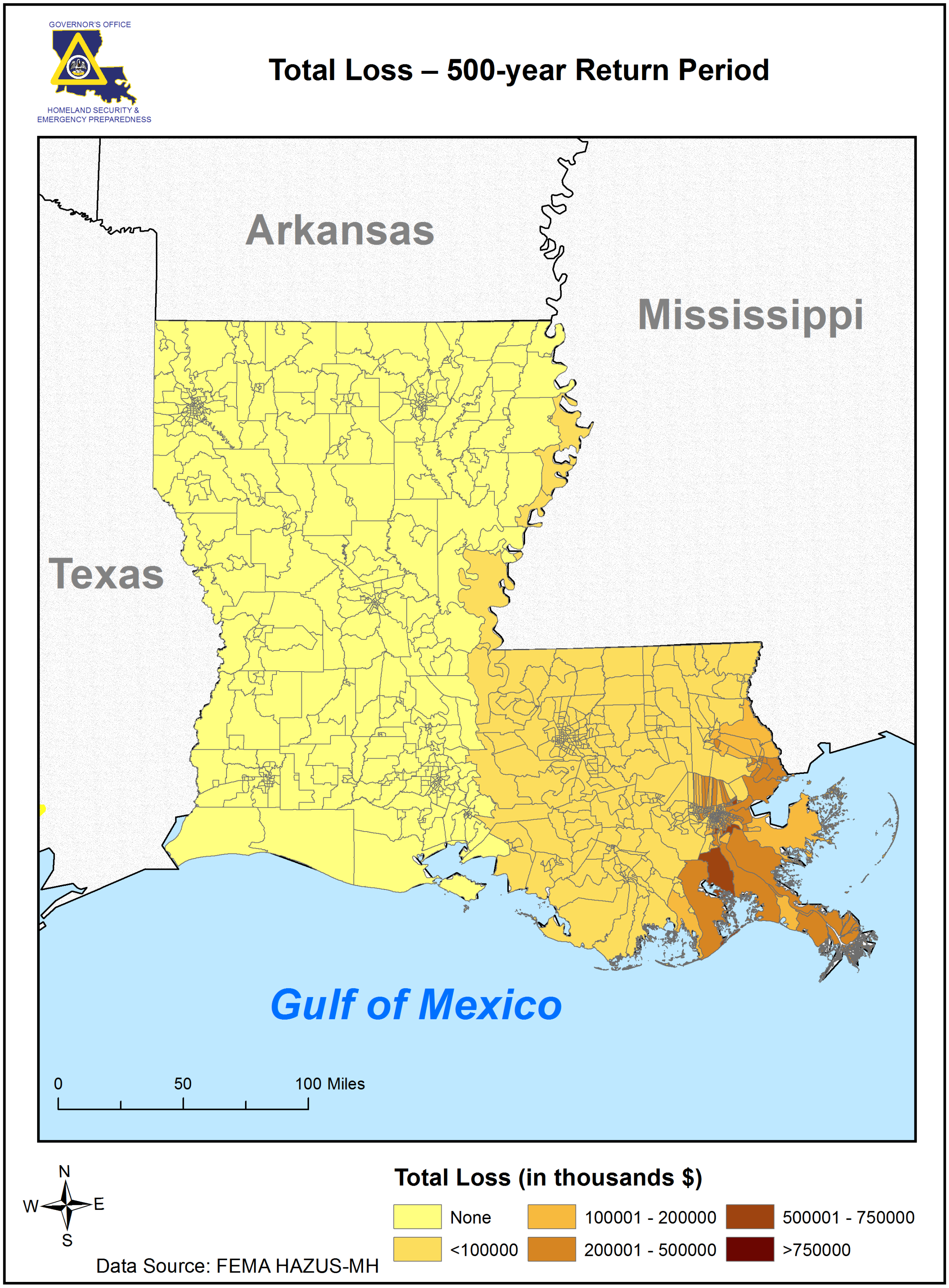
Map 2.92. Projected total economic losses (in thousands of dollars) to residential buildings after a 100-yr hurricane event.



Map 2.93. Projected peak wind gusts during a 500-yr hurricane event, based on Hazus modeling.



Map 2.94. Projected percentage of moderately damaged residential buildings and critical facilities (medical care center, police station, and fire station) after a 500-yr hurricane event.



Map 2.95. Projected total economic losses (in thousands of dollars) to residential buildings after a 500-yr hurricane event.

In terms of climate change, the impacts from tropical cyclones could increase in severity. Since the 1980s, the number of Category 4 and 5 hurricane events have increased considerably due to both natural variability and a changing climate. Studies suggest that in the future warming will cause fewer but *stronger* tropical storms, which will also carry more rainfall as the climate warms.[lxiii] Storm surges will likely be far worse given sea level rise, subsidence, the destruction of wetlands protection, and the greater precipitation totals during cyclone events. Maps 2.96, 2.97, 2.98, and 2.99 identify how tropical cyclones have affected the parishes of Louisiana between 1987 and 2012 in terms of total events, economic damage, injuries, and fatalities, respectively. As expected, the southeastern corner of the state is most directly affected by tropical cyclones, but every portion of Louisiana has been affected in the past. The entire coast is clearly always quite vulnerable to hurricane landfall. Lafayette, West Baton Rouge, Ascension, Livingston, Tangipahoa, and St. Tammany Parishes are at high risk (greater than 2.0 composite risk score) to tropical cyclones and have experienced significant population increases of more than 10% since 2000 with Ascension and Livingston Parishes experiencing greater than 20% increases in population (see Map 2.3). As a result, the vulnerability of these parishes to tropical cyclones has increased. Orleans, St. Bernard, and Plaquemines Parishes are at high risk to tropical cyclones, but have experienced significant population decreases of more than 10% since 2000 with Orleans and St. Bernard Parishes experiencing greater than 20% decreases in population (see Map 2.3). As a result, the vulnerability of these parishes to tropical cyclone has decreased.

Map 2.100 locates Louisiana's state assets previously damaged by tropical cyclones.

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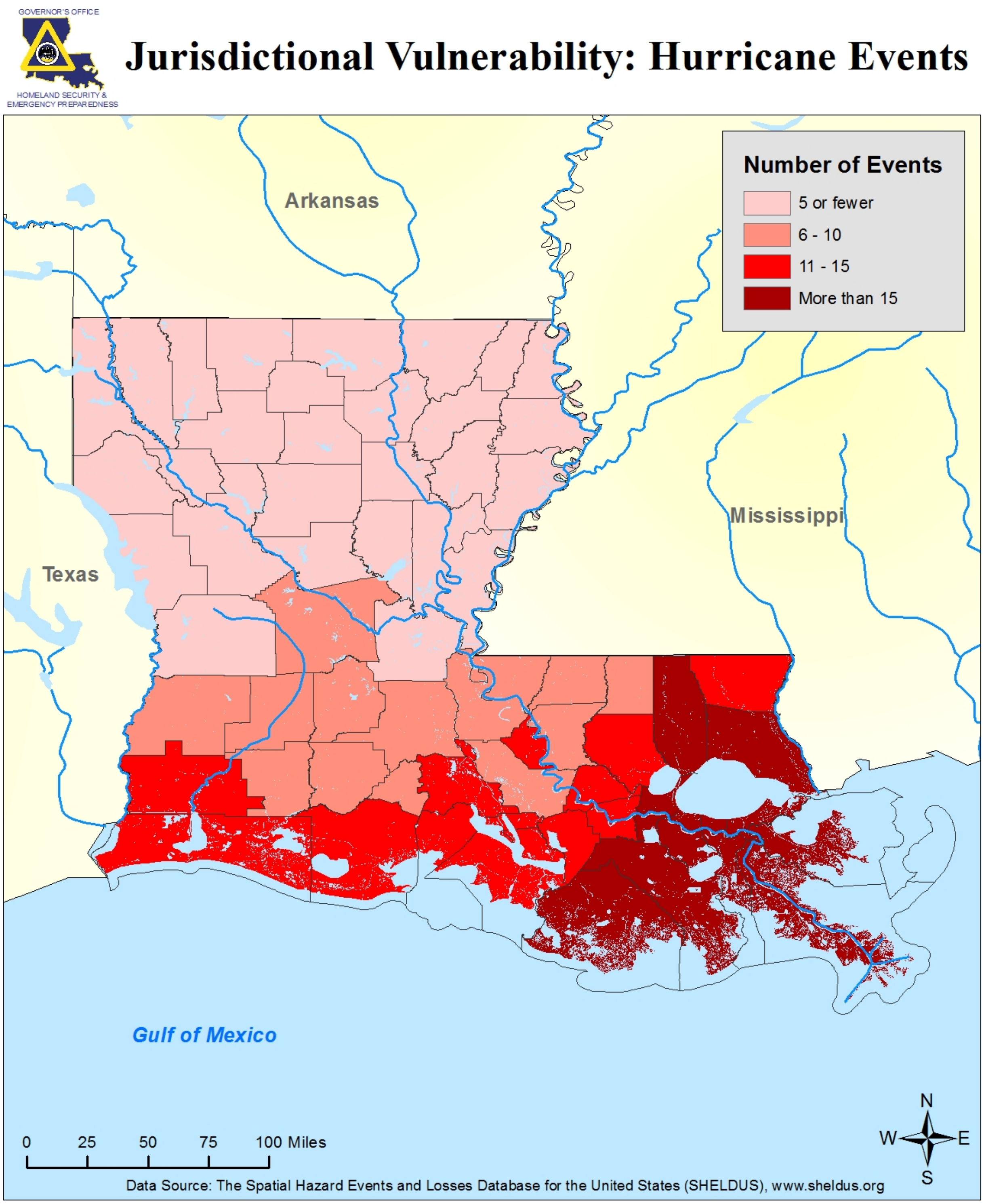
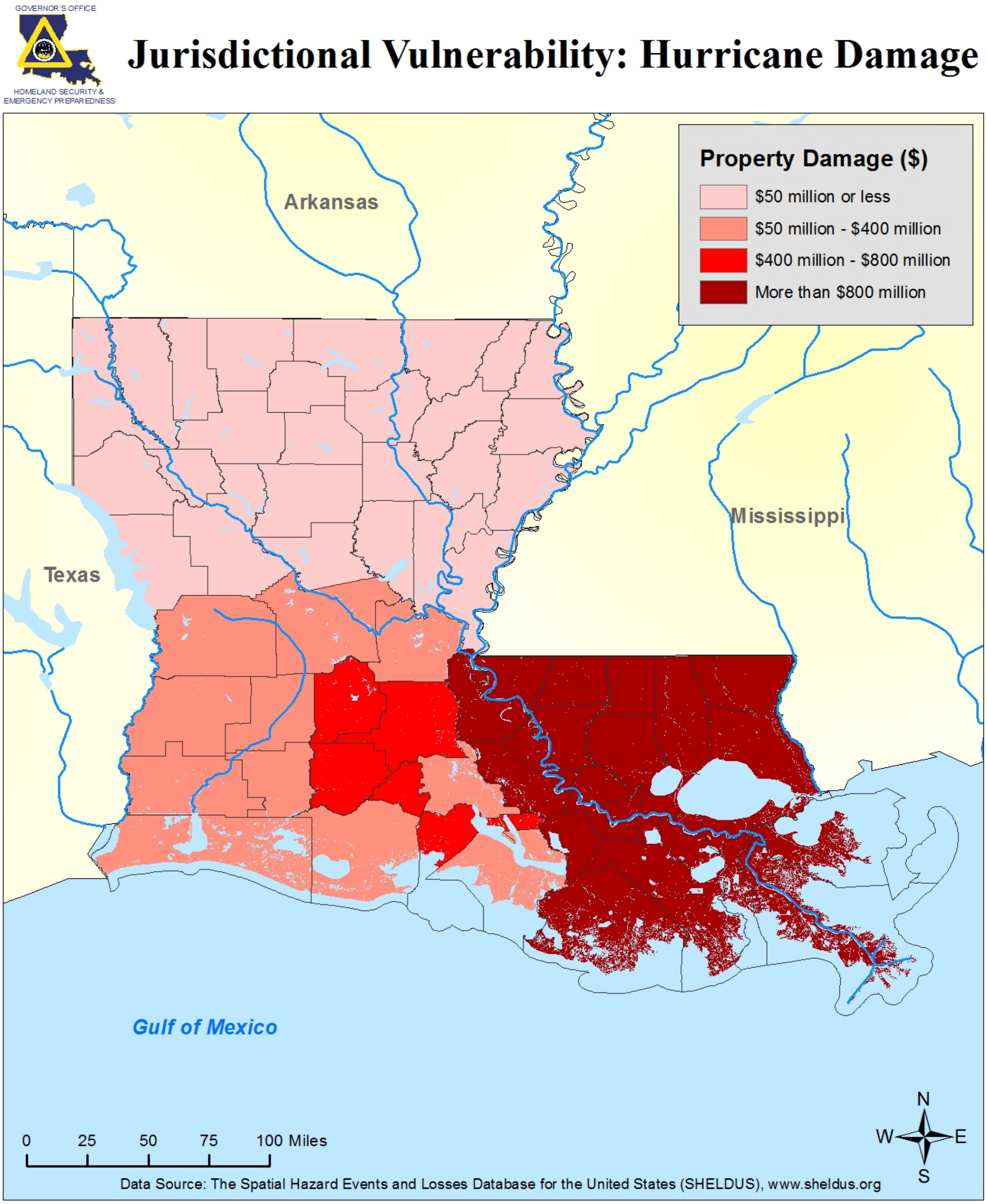
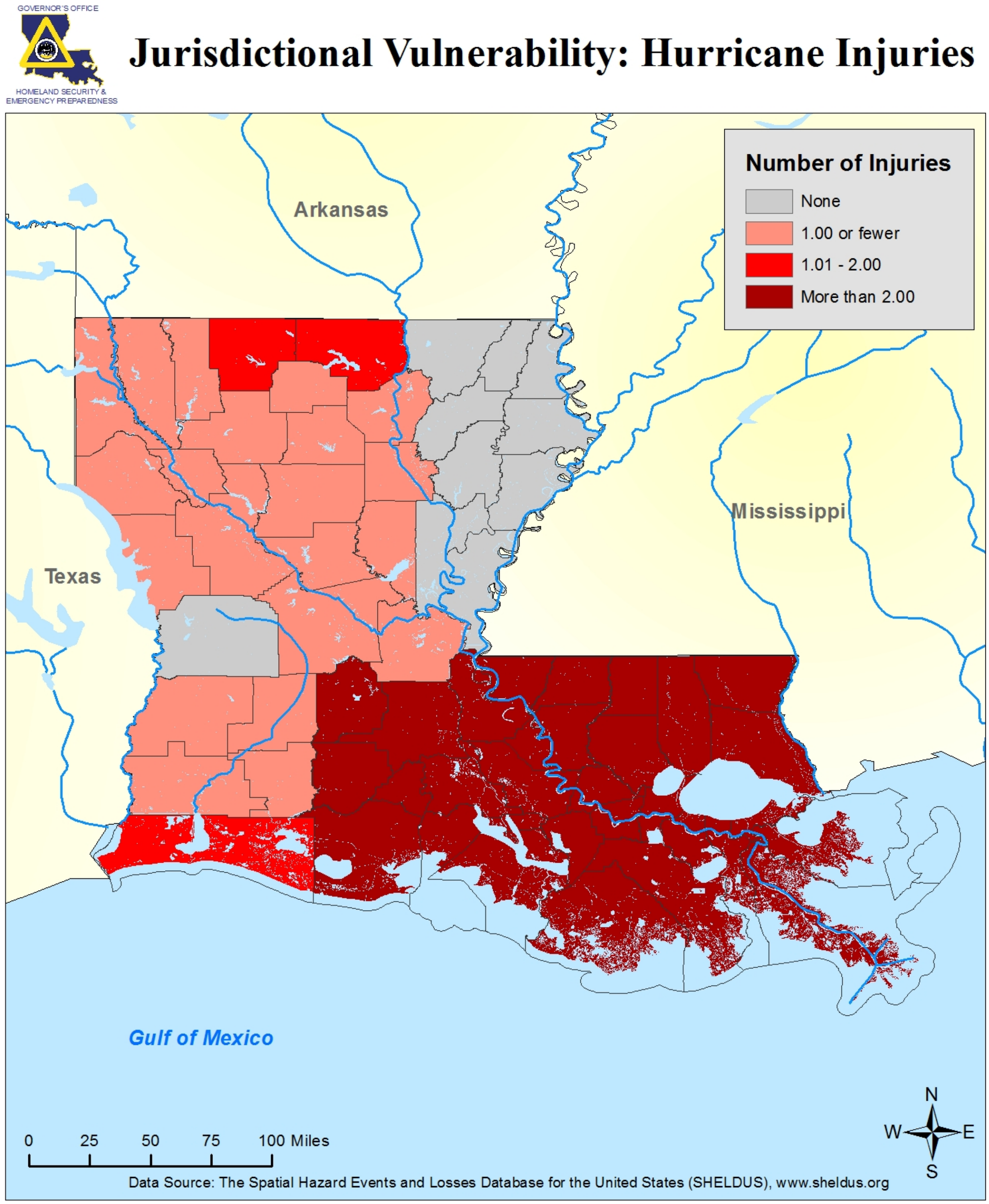


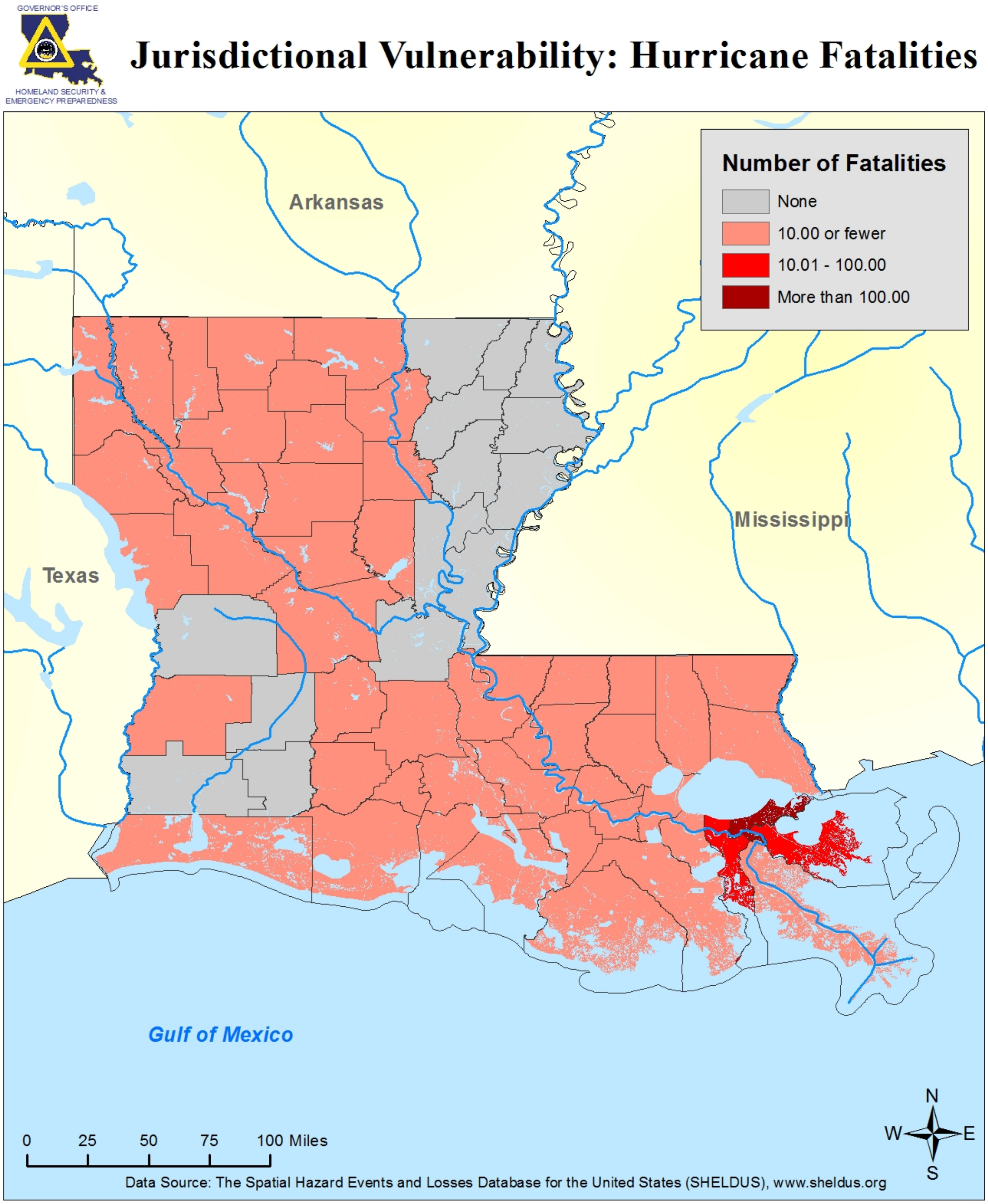
Map 2.96. Louisiana jurisdictional vulnerability for hurricane events based on data from 1987–2012.



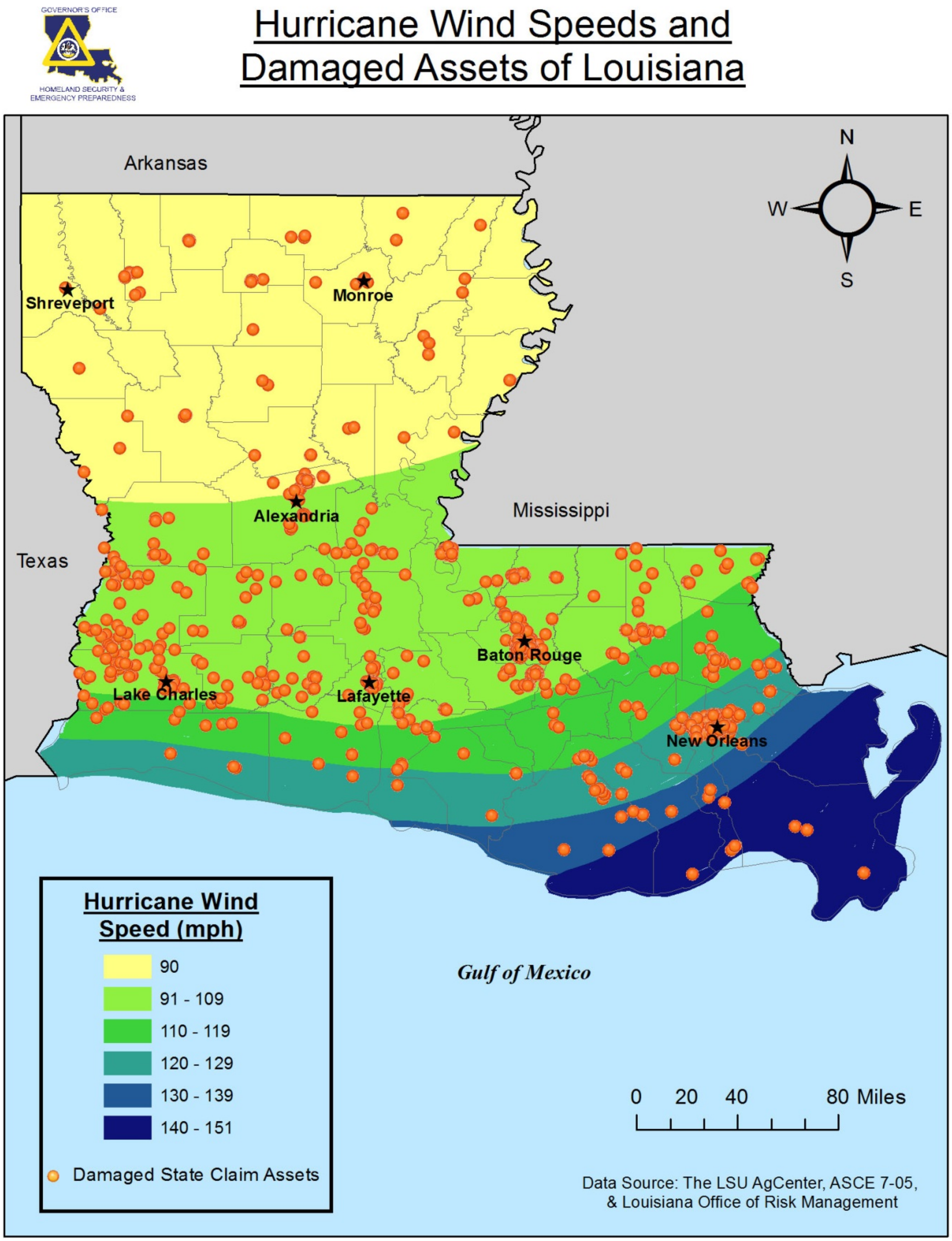
Map 2.97. Louisiana jurisdictional vulnerability for damage from hurricanes based on data from 1987–2012.



Map 2.98. Louisiana jurisdictional vulnerability for injuries from hurricanes based on data from 1987–2012.



Map 2.99. Louisiana jurisdictional vulnerability for fatalities from hurricanes based on data from 1987–2012.



Map 2.100. Louisiana state assets with paid repetitive claims for hurricane damage located within wind zones (map by ETSU student Hannah Miltier).

Table 2.34 lists the top 10 paid claims for hurricane-damaged state assets.

Table 2.34. Top 10 paid claims for hurricane-damaged state assets.

Top 10 Paid Claims for Hurricane-Damaged State Assets				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (Hurricane)
S04024	Archives - LA State Penitentiary	Angola	$14,013,954	2
S11609	University Center - University of New Orleans	New Orleans	$10,675,735	2
S11557	Kiefer Lakefront Arena - University of New Orleans	New Orleans	$7,854,885	2
S13367	Credit Union - McNeese State University	Lake Charles	$4,540,204	1
S12847	New Orleans Sports Arena	New Orleans	$3,883,214	2
S03743	Administration and Reception Center - LA State Penitentiary	Angola	$3,669,256	1
S03722	Administration Building - LA State Penitentiary	Angola	$2,913,006	1
S08891	School of Nursing Building - University of Louisiana-Monroe	Monroe	$2,786,856	1
S04074	TU/CCR Cellblock - LA State Penitentiary	Angola	$2,325,721	2
S02834	Main Building - Capital Area Tech College (Westside)	Plaquemine	$2,303,923	1

Map 2.101 shows the composite jurisdictional risk for hurricanes in Louisiana based on the preceding data. The southeastern parishes have the highest comparative risk for damage from hurricane events.

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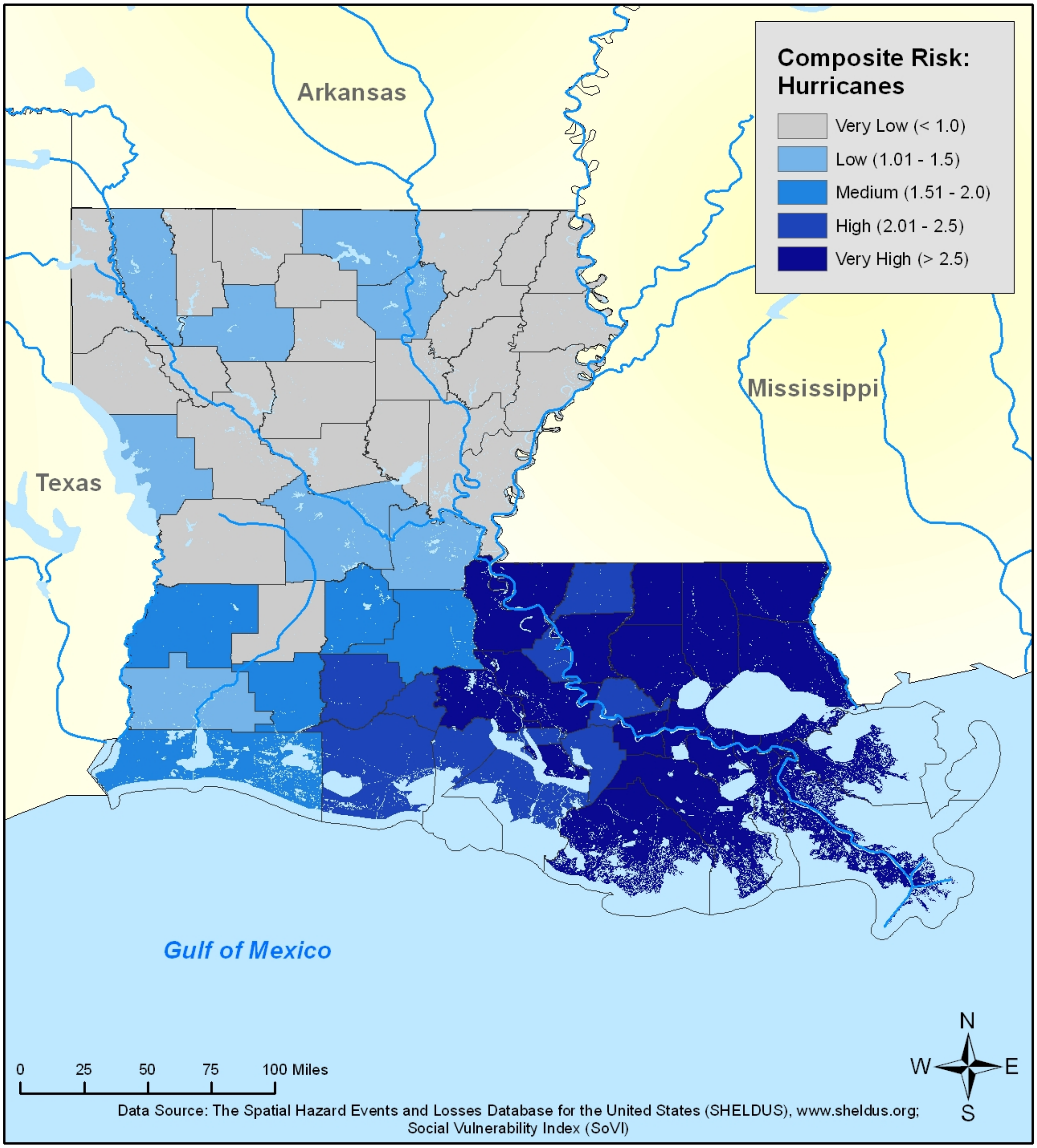
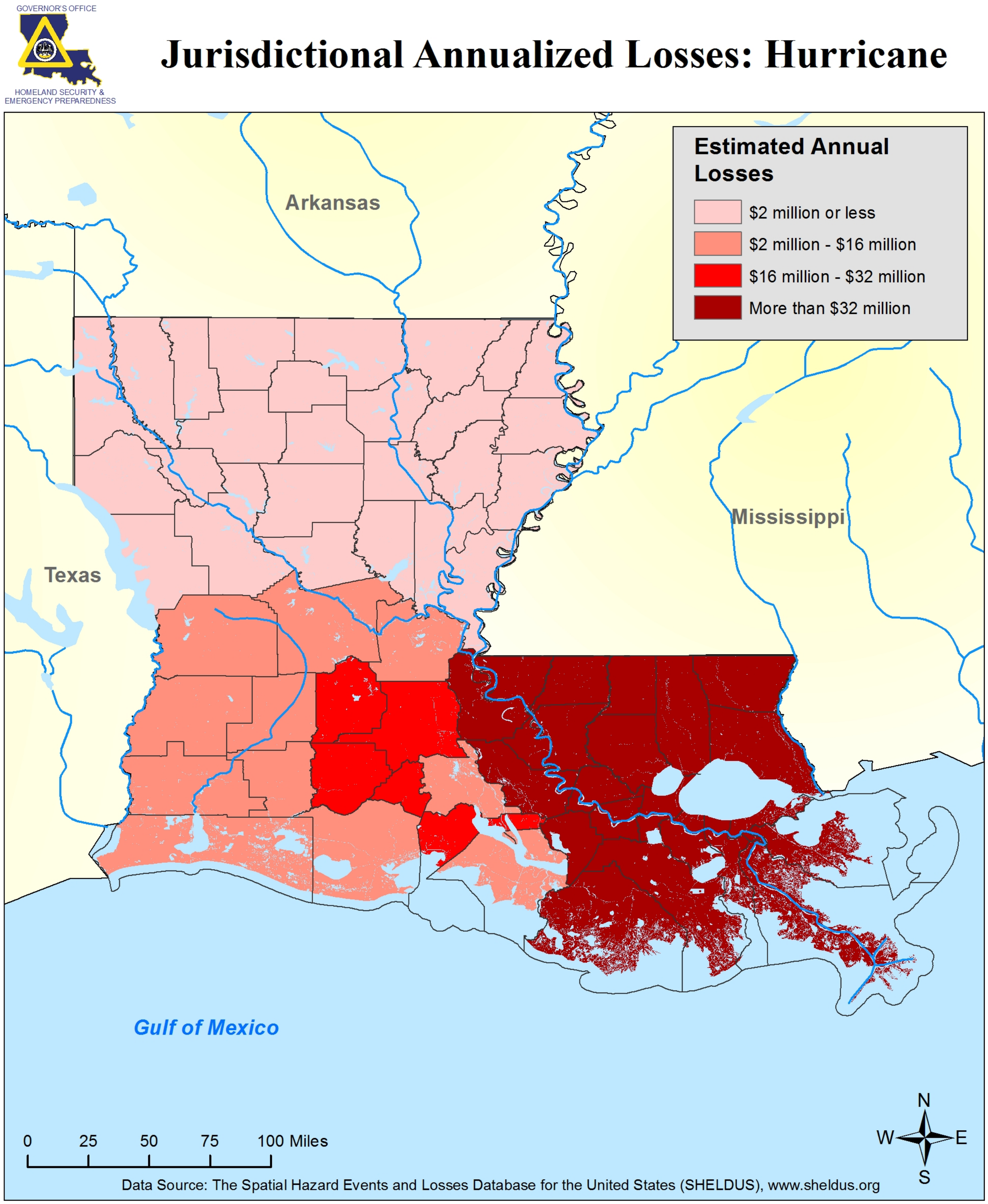
Jurisdictional Vulnerability: Hurricane Composite Risk



Map 2.101. Composite risk map for hurricanes, showing coastal parishes with the highest historical and highest potential risks (medium or greater). The southeastern parishes have the greatest risk (very high).

To determine potential loss estimates from hurricanes, the available historical loss data was annualized to determine future loss potential (see Map 2.102). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.



Map 2.102. Jurisdictional annualized loss due to hurricanes.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: Overall, most of Louisiana is vulnerable to tropical cyclones, but there are certain parishes that are more vulnerable than others. High wind and storm surge are major concerns in south Louisiana, while hurricane-induced flooding and the sheltering of evacuees appears to be a bigger issue in northern parishes. Similarly with tornadoes, poorly constructed or older homes and mobile home parks are at highest risk of sustaining the greatest damage during tropical cyclones.

Changes in jurisdictional population levels impact each parish across the state disparately. Changes in development are expected to impact loss estimates for tornadoes since most population growth and development is occurring in parishes within southern Louisiana that are impacted by both high wind and storm surge. In the parishes where tropical cyclone vulnerability has increased because of increases in population (Lafayette, West Baton Rouge, Ascension, Livingston, Tangipahoa, and St. Tammany), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In the parishes where tropical cyclone vulnerability has decreased because of decreases in population (Orleans, St. Bernard, and Plaquemines), concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure. Any new development represents an increase in the number of structures that are vulnerable to the effects of tropical cyclones.

POTENTIAL LOSSES OF STATE FACILITIES

The tropical cyclone hazard vulnerability assessment of state-owned buildings was based on the parish-level composite risk score, which incorporates the total number of tropical cyclone events, injuries, fatalities, and property damages as well as the social vulnerability of impacted parishes. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.35.

Table 2.35. Tropical Cyclone Vulnerability Criteria and Ranking Results.

TROPICAL CYCLONE VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Composite risk score greater than 2.0
Medium	Composite risk score between 1.5 and 2.0
Low	Composite risk score less than 1.5

The tropical cyclone loss-estimate ranges are derived from the 2011 state hazard mitigation plan and inflation-adjusted to 2013 dollars. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Hurricane Wind/Surge Hazard Vulnerability
- Average Building Type
- Hurricane Wind/Surge Damage Functions

Table 2.36. Tropical Cyclone Loss Estimate Ranges and Ranking Results.

Tropical Cyclone Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$534,400 to $160,320,000	4669
Medium	$10,689 to $534,400	260
Low	$0 to $10,688	3756

WILDFIRES

A wildfire is combustion in a natural setting, marked by flames or intense heat. Most frequently, wildfires are ignited by lightning or unintentionally by humans. Fires set purposefully (but lawfully) are referred to as controlled fires or burns.

There are three different types of wildfires. (1) **Ground fires** burn primarily in the thick layers of organic matter directly on the forest floor and even within the soil. Ground fires destroy root networks, peat, and compact litter. These fires spread extremely slowly and can smolder for months. (2) **Surface fires** burn litter and vegetative matter in the underbrush of a forest. (3) **Crown fires** spread rapidly by wind and move quickly by jumping along the tops of trees. There are two types of crown fires—(a) *passive (or dependent)* crown fires rely on heat transfer from surface fire, whereas (b) *active (or independent)* crown fires do not require any heat transfer from below. Active crown fires tend to occur with greater tree density and drier conditions. A firestorm is a mass, crown fire (also called a running crown fire, area fire, or conflagration). They are large, continuous, intense fires that lead to violent convection. They are characterized by destructively violent surface in-drafts near and beyond their perimeter.

Crown fires are the most damaging and most difficult to contain. The intensity of crown fires enables the fire to produce its own wind gusts. These so-called *fire whirls* can move embers ahead of the fire front and ignite new fires. Fire whirls are spinning vortex columns of ascending hot air and gases rising from the fire. Large fire whirls have the intensity of a small tornado.

WILDFIRE PROFILE

The conditions conducive to the occurrence of wildfires are not distributed equally across the United States. Wildfires have a much greater likelihood of occurring in the western part of the country. Although less frequent than in other areas, wildfires do occur in Louisiana. Wildfire danger can vary greatly from season to season; it is exacerbated by dry weather conditions. Factors that increase susceptibility to wildfires are the availability of fuel (e.g., litter and debris), topography (i.e., slope and elevation affect various factors like precipitation, fuel amount, and wind exposure), and specific meteorological conditions (e.g., low rainfall, high temperatures, low relative humidity, and winds). The potential for wildfire is often measured by the Keetch–Byram Drought Index (KBDI), which represents the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in the soil. The KBDI tries to measure the amount of precipitation needed to return soil to its full field capacity, with KBDI values ranging from 0 (moist soil) to 800 (severe drought).

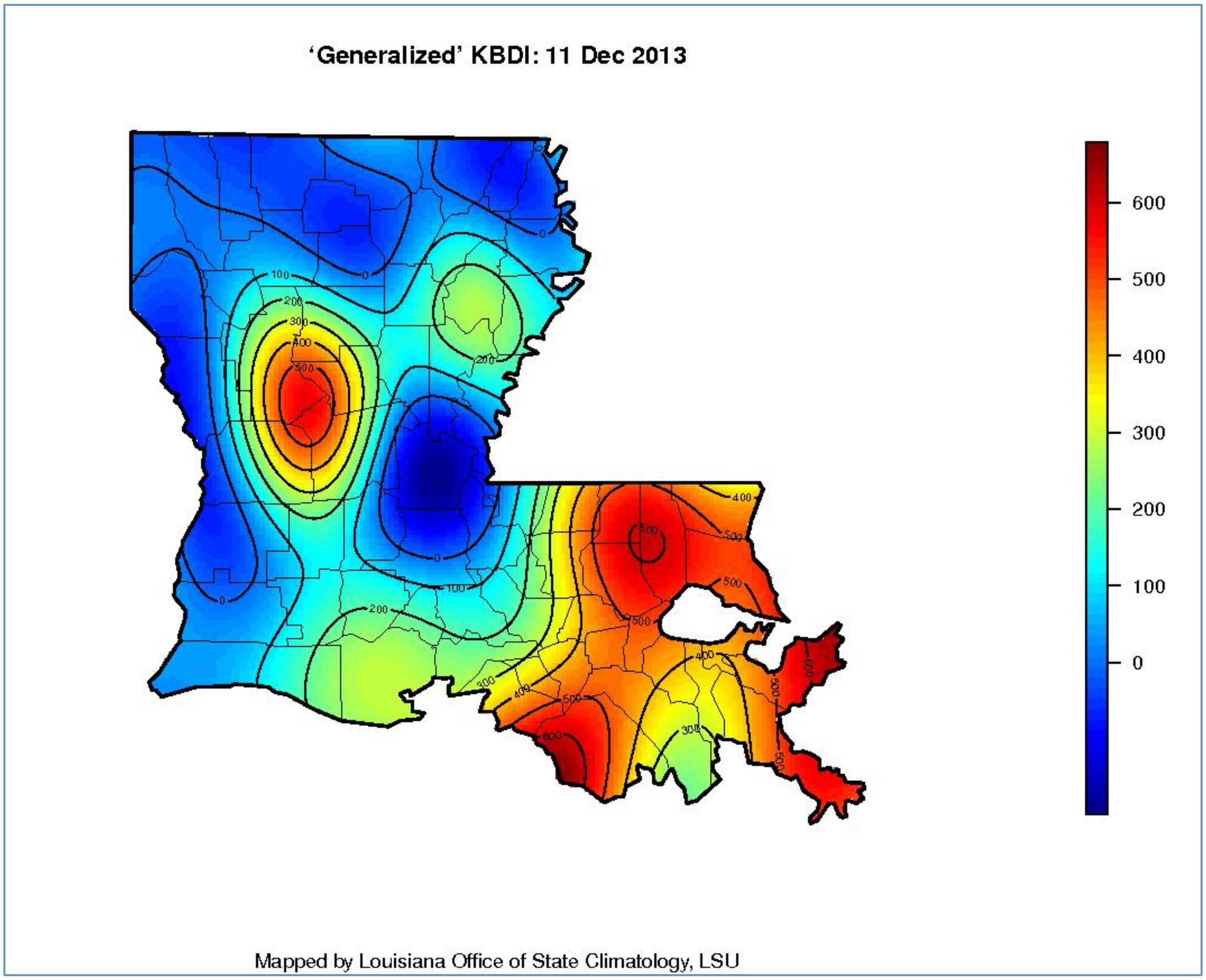
According to the State of Louisiana Forestry Division, most forest fires in Louisiana are caused by intentional acts (arson) or carelessness and negligence committed by people, exacerbated by human confrontation with nature. The wildland–urban interface (WUI) is the area in which development meets wildland vegetation, where both vegetation and the built environment provide fuel for fires. As development near wildland settings continues, more people and property are exposed to wildfire danger.

According to the State Forestry Division, Louisiana's forestlands cover 13.8 million acres, about 48% of the state's area. Private, non-industrial landowners own 62% of the state's forestland, forest products industries own 29%, and public entities own 9%. Forests provide the raw material for Louisiana's second largest manufacturing employer, the forest products industry, with over 900 firms in 45 parishes employing more than 25,000 people. An additional 8,000 people work in harvesting and transportation of these resources. Louisiana's forests provide many other benefits, including clean air and water, wildlife habitat, recreational opportunities, and scenic beauty.

There have been few wildfires in Louisiana. On 19 August 2003, lightning sparked five wildfires in Cameron Parish in the Sabine National Wildlife Refuge, burning 12,000 acres. No injuries or damages to structures, property, or crops were reported. In September 2010, a wildfire burned 258 acres of ten-year-old pine forest in Webster Parish, but no homes or structures were damaged. During the last half of October 2010, drought conditions led to the burning of 4,363 acres of timberland in Kisatchie National Forest, but once again, no structures were damaged or destroyed. In the same month, 250 acres burned in Winn Parish, destroying some outbuildings, resulting in $107,000 (2013 USD) in damage. Finally, in September 2011, high temperatures, low humidity, and extreme drought conditions in northern Louisiana led to a few wildfires. In Natchitoches (Natchitoches Parish), strong winds from Tropical Storm Lee in conjunction with the heat and drought conditions led to the burning of 5000 acres and 10 structures, which resulted in $519,000 (2013 USD) in damages. In Caddo Parish, 3300 acres of timberland and grassland, in addition to 2 homes, 3 mobile homes, 3 outbuildings, and several fishing camps along Caddo Lake burned, leaving $415,000 in damage.

The damage and damage possibilities in these occurrences vary according to specific conditions. For instance, grass fires do not have a direct damage figure associated with them, unless the fields were used as fodder, in which case the burning would have an indirect cost to the owner. With regard to forest fires, damage can vary from forest litter (like leaves) being consumed to "stand replacement" fires where an entire area is destroyed. A mature stand of southern yellow pine can be worth, on average, $2500 per acre. A "young" stand, for example a 13-year-old stand of pine, can be worth approximately $1000 per acre. These are direct costs. They do not include the costs of clearing and replanting an area, as well as waiting a decade for maturity to harvest potential.

Map 2.103 indicates the KBDI at the time this report went to publication. As Map 2.104 suggests, four areas are prevalent for fires in Louisiana. The highest densities are found where forestry and agriculture are present, along with national parks.



Map 2.103. KBDI at time of publication, indicating drought conditions that could precipitate wildfire.

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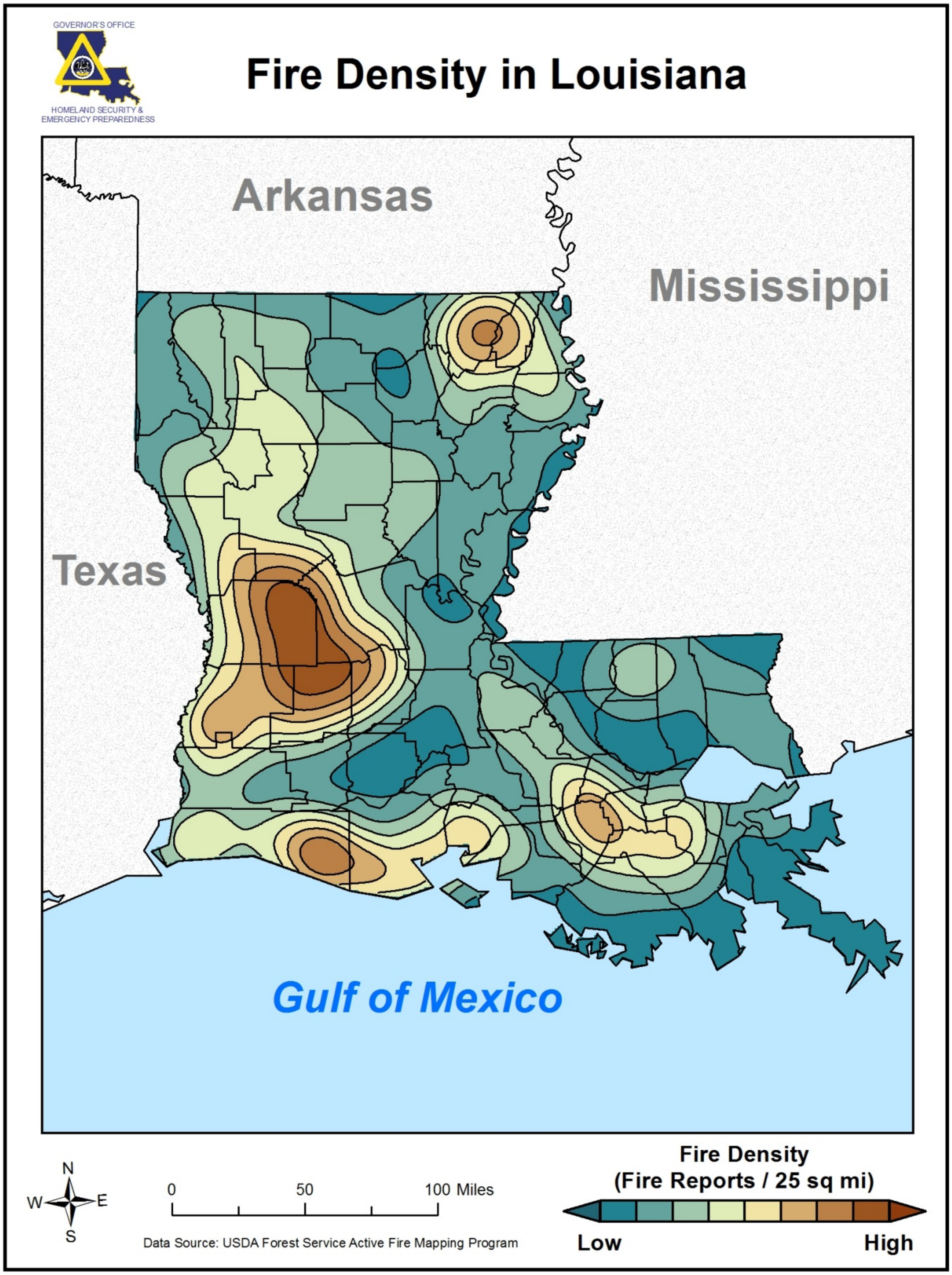

Map 2.104. Density of wildfires in Louisiana (source: USDA Forest Service Active Fire Mapping Program, 2001-2012).

WILDFIRE RISK ASSESSMENT

Based on historical records, and as indicated in Map 2.105, the probability of future occurrences of wildfire in Louisiana is **High**. However, impact on the built environment due to wildfire is minimal: there are few reports of actual monetary damage, and even fewer reports of human injuries. Still, wildfires can be an occasional hazard in Louisiana and will be included for Risk Assessment. Maps 2.106, 2.107, 2.108, and 2.109 represent historical data from the past 25 years and indicate the total wildfire events, as well as the damages, injuries, and fatalities attributed to wildfire. Since wildfire impacts are minimal, historical records are best at showing historical risk but limited in conveying vulnerability.

Areas of WUI signify locations where the built environment and a forested (or "wild") environment border each other. Importantly, the WUI identifies the locations of urban and suburban periphery areas, as well as migration trends. As the historical maps, WUI map, and wildfire density map suggest, Lincoln, Ascension, Livingston, Tangipahoa, and St. Tammany parishes are at high risk to wildfire and have also experienced significant population increases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to wildfire has increased. Cameron Parish is at high risk to wildfire based on its population density, but it has experienced a significant population decrease of more than 10% since 2000 (see Map 2.3). As a result, Cameron Parish's vulnerability to wildfire has decreased.

Map 2.110 shows classification change of WUI areas between 1990 and 2010, while Map 2.111 reveals the specific locations within each parish where the WUI has changed or remained the same since 1990. An additional map (Map 2.112) quantifies changes in the total area of WUI for each parish over a 20-year period (1990-2010). Parishes tended to increase in population when areas classified as interface increased, and vice versa. One parish, Ascension, experienced the opposite effect, however: a large population increase with a measurable decrease in interface areas. This could be the result of other development and land use changes. Ascension Parish contains some areas of prairieland (as opposed to forest), and it is possible that developers cleared large areas and unintentionally created a buffer between the interface areas and new developments. Regardless, over 25% of Ascension Parish is still classified as an interface area.

Map 2.113 locates state facilities and state parks within WUI areas—a much more specific criteria than simply examining their locations within a parish. There are 7 state parks (of 19 in the state) and 1,871 state facilities (of 8,685 in the state) within these areas. State-owned critical facilities located in these areas are of the following types: hospitals, shelters, and state police troop offices.

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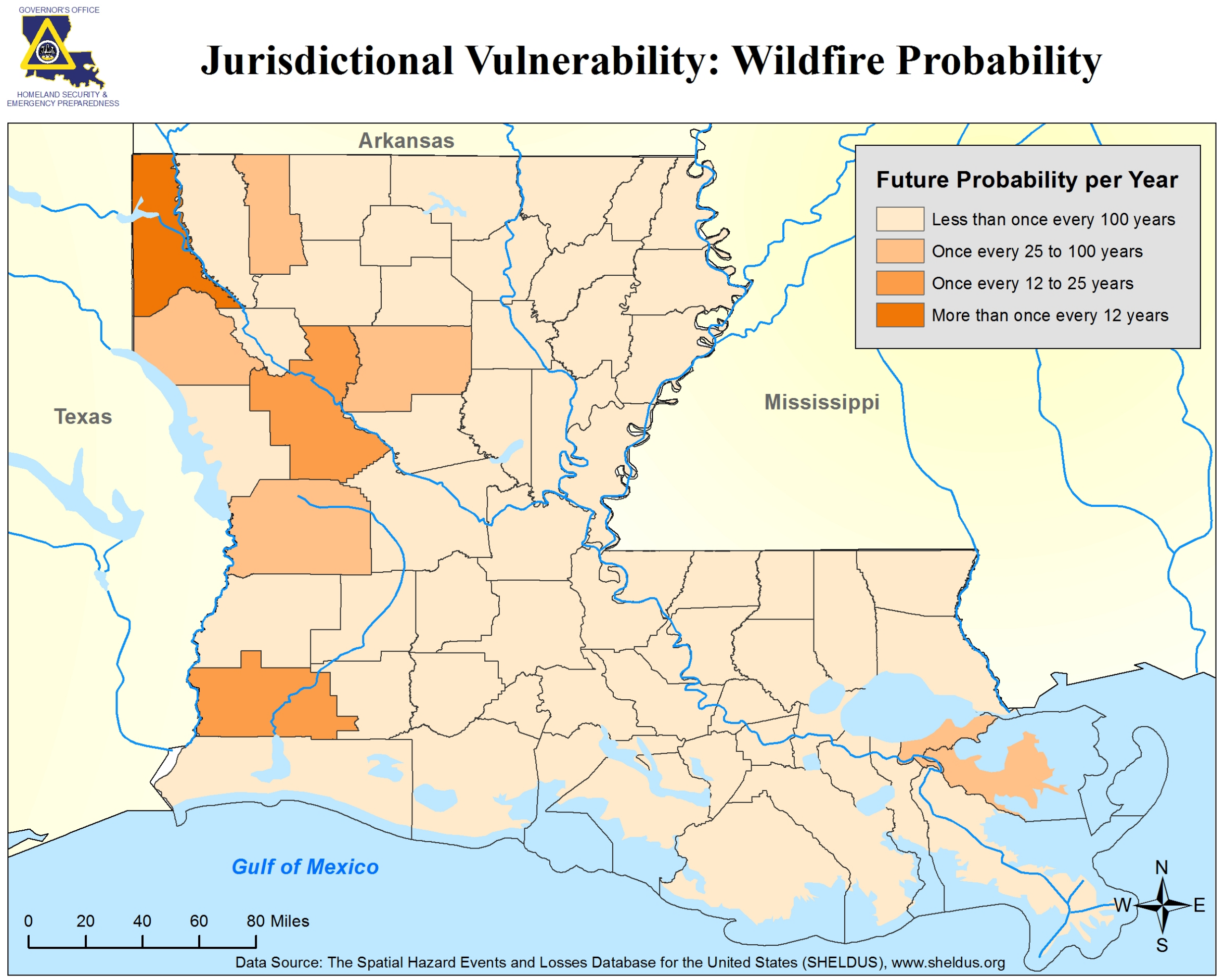

Map 2.105. Probability of wildfire events in Louisiana by parish based on data from 1987–2012.

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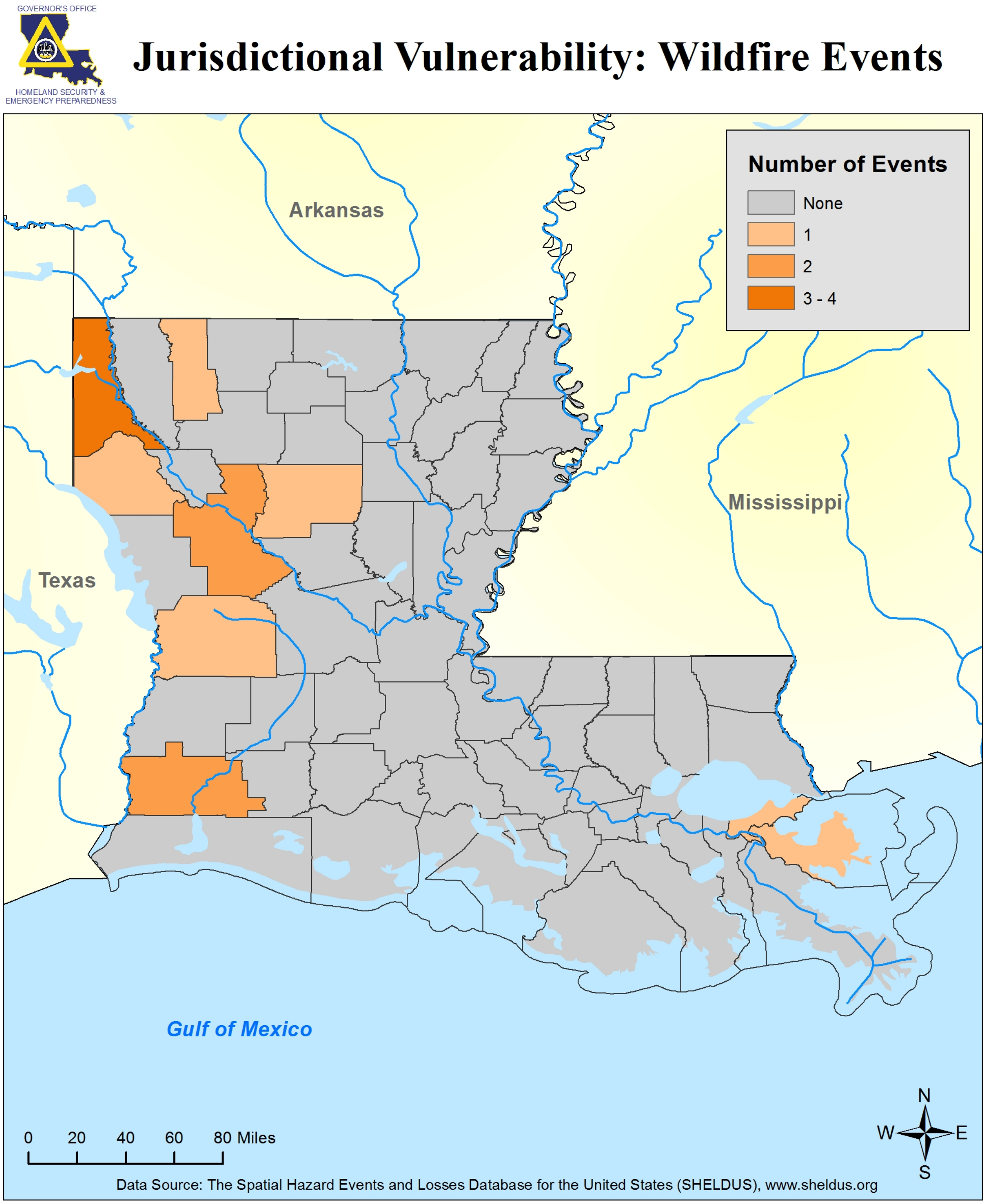
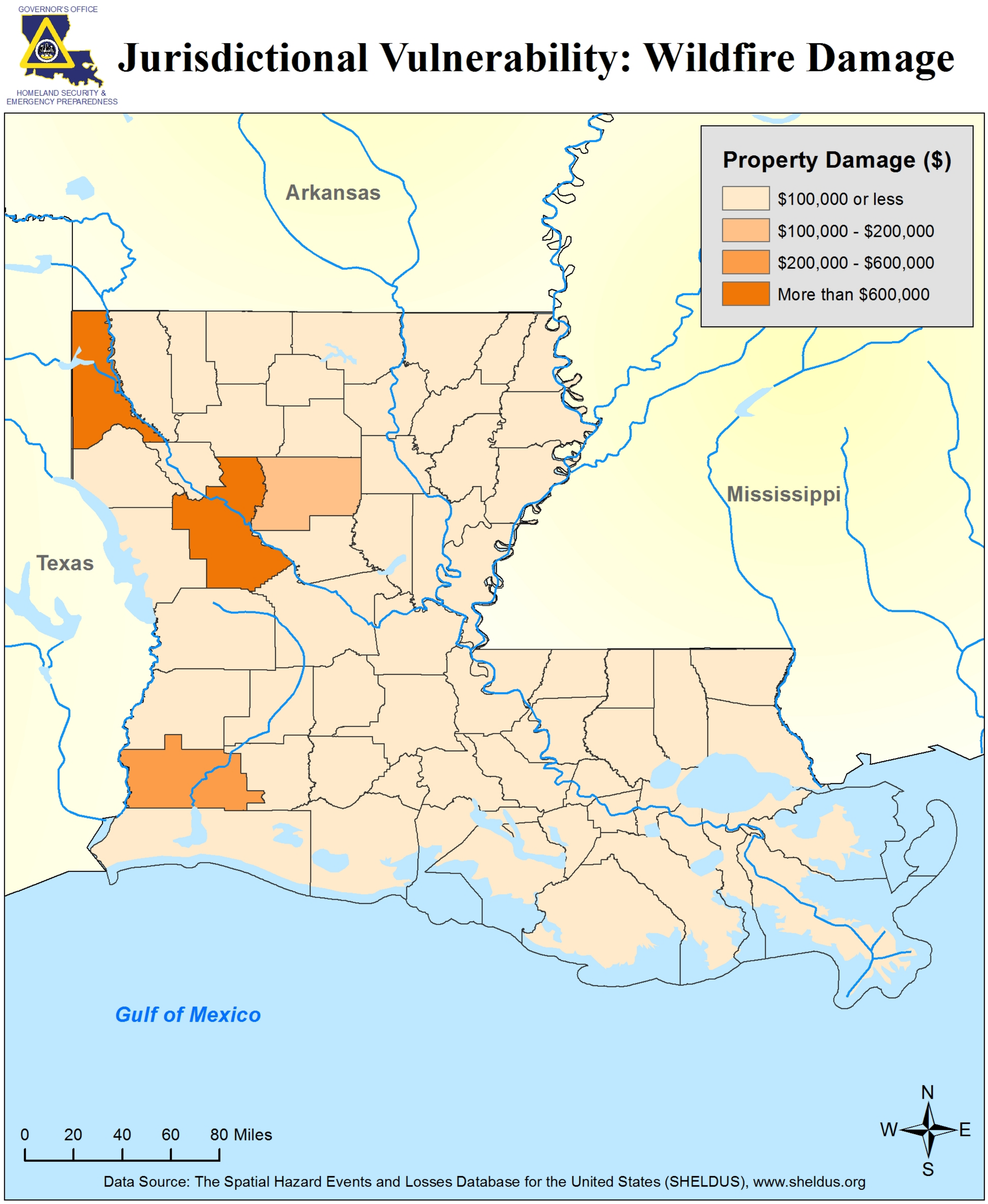


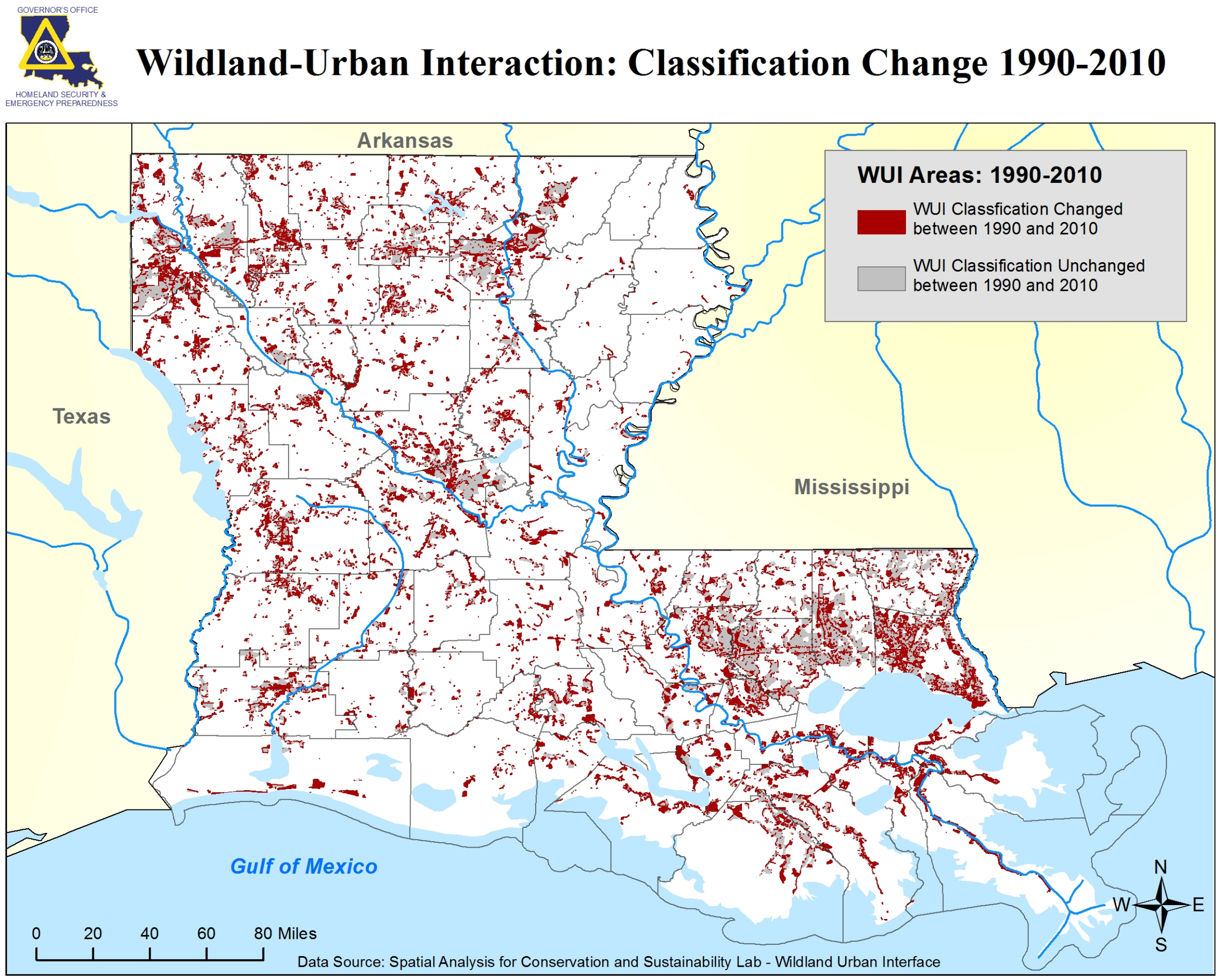
Map 2.106. Louisiana jurisdictional vulnerability for wildfire events based on data from 1987–2012.



Map 2.107. Louisiana jurisdictional vulnerability for damage from wildfire based on data from 1987–2012.

Map 2.108. Louisiana jurisdictional vulnerability for injuries from wildfire based on data from 1987–2012.

Map 2.109. Louisiana jurisdictional vulnerability for fatalities from wildfire based on data from 1987–2012.



Map 2.110. WUI areas are grouped by areas (1) that were classified as interface in 1990 and remained the same through 2010 and (2) whose interface classification has changed. The first areas are in gray, the second in red. The Florida parishes, as well as several northern parishes, show large areas of classification change.

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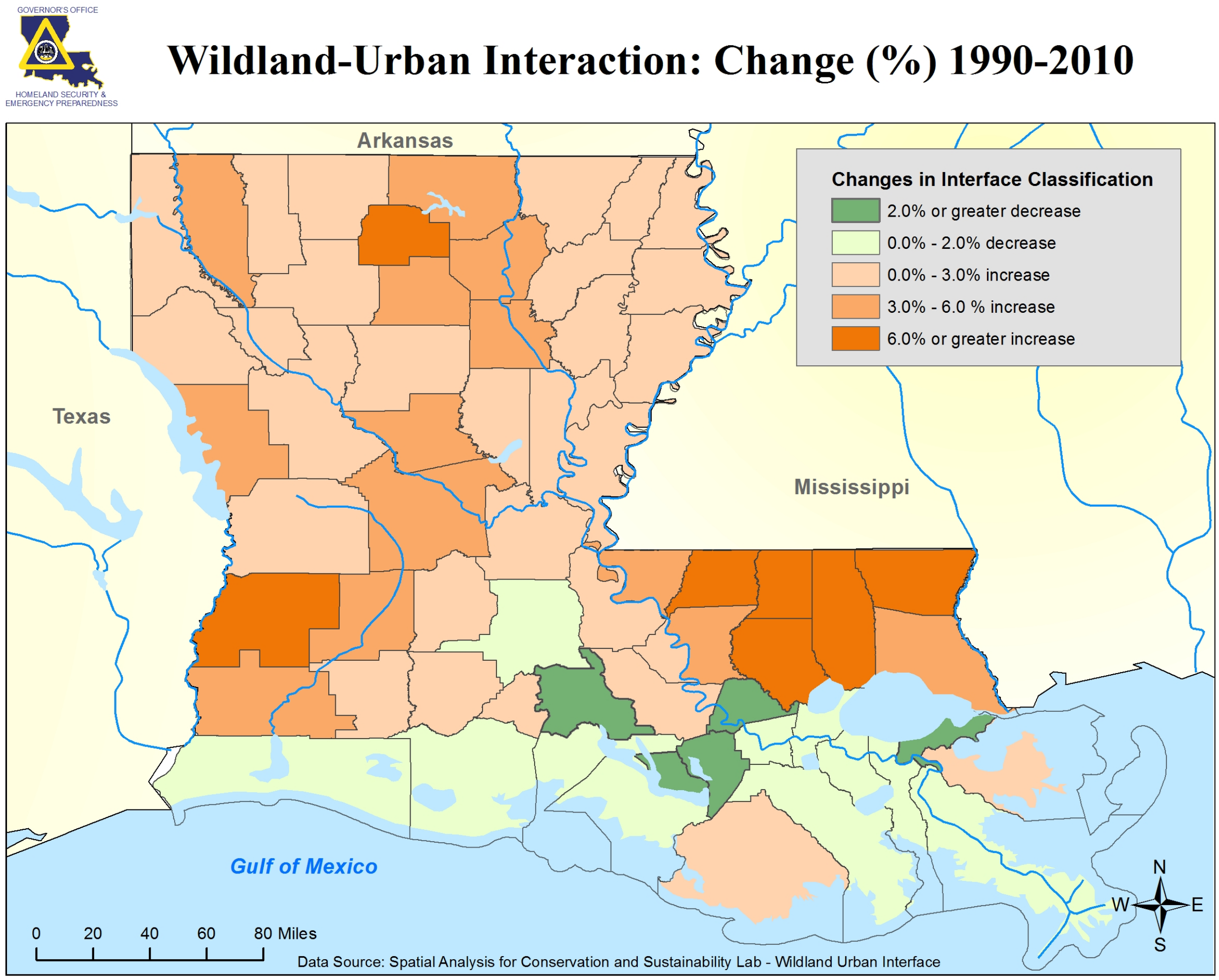

Map 2.111. Louisiana changes in jurisdictional vulnerability based on increases/decreases in WUI areas.

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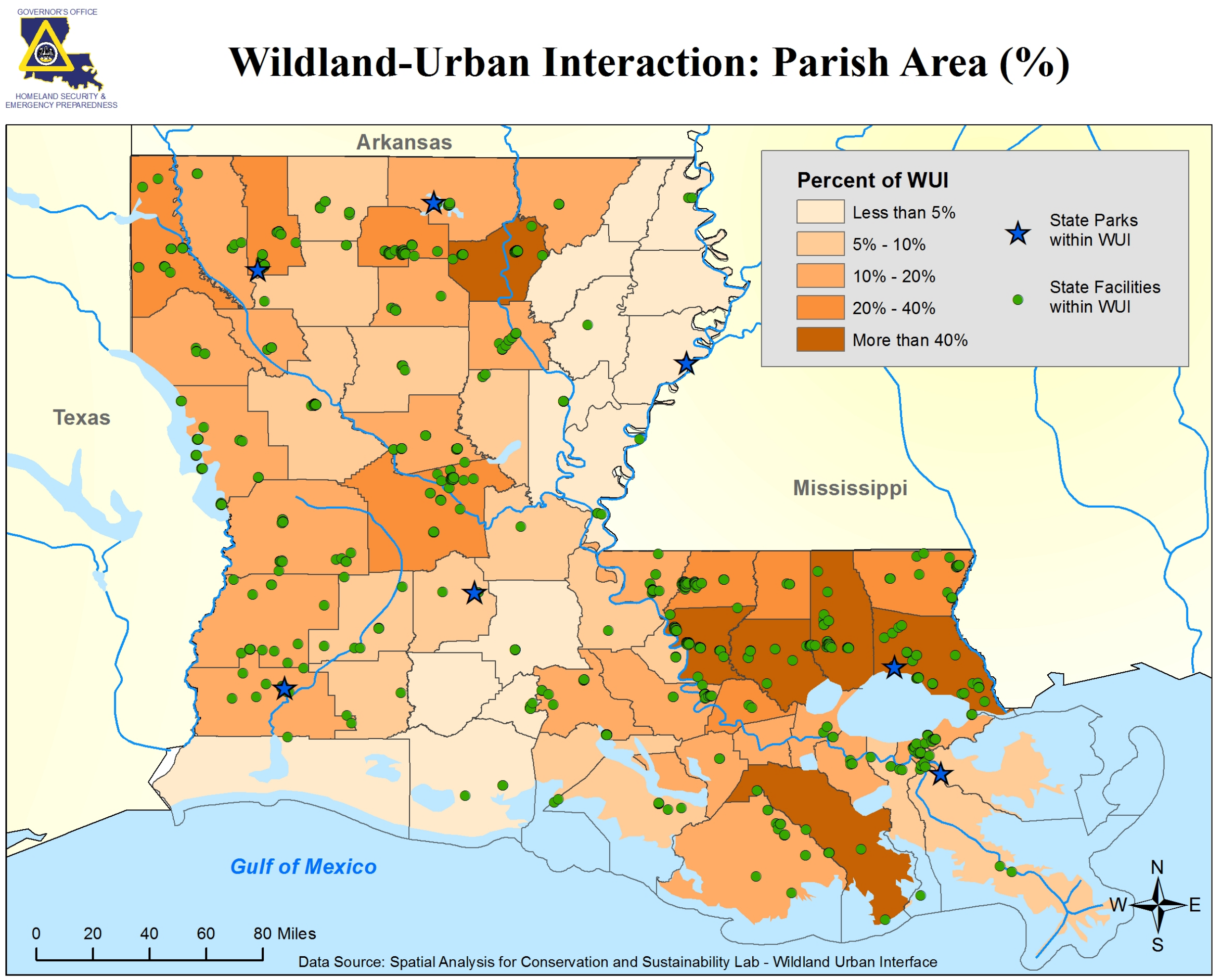

Map 2.112. Louisiana jurisdictional vulnerability based on the percentage of area in each parish that is considered to be a WUI area.

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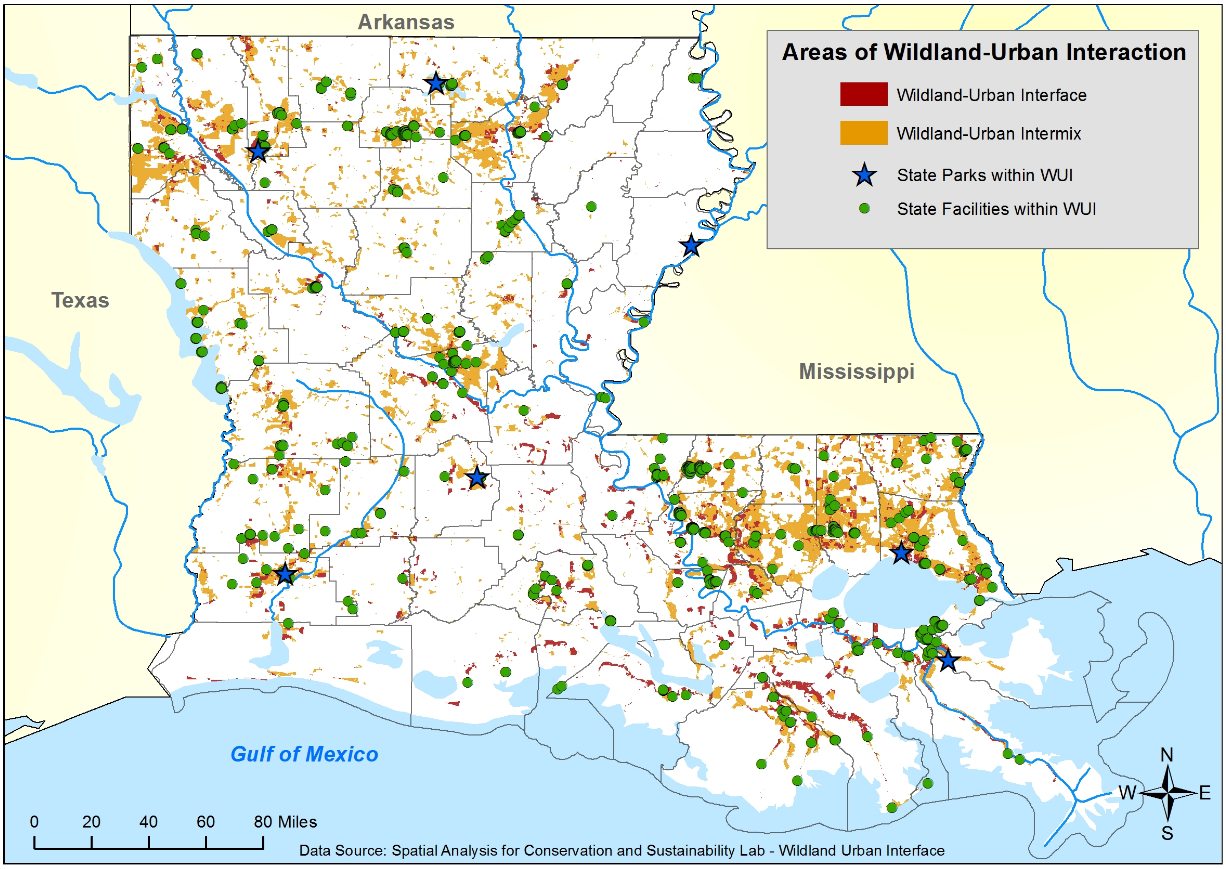
GOVERNOR'S OFFICE
HOMELAND SECURITY & EMERGENCY PREPAREDNESS

Wildland-Urban Interaction: State Vulnerability



Map 2.113. Louisiana state-owned property located within a WUI area.

Map 2.114 shows the composite jurisdictional risk for wildfire in Louisiana based on the historical data. Several northwestern Louisiana parishes have the greatest risk of wildfire hazards (medium to very high).

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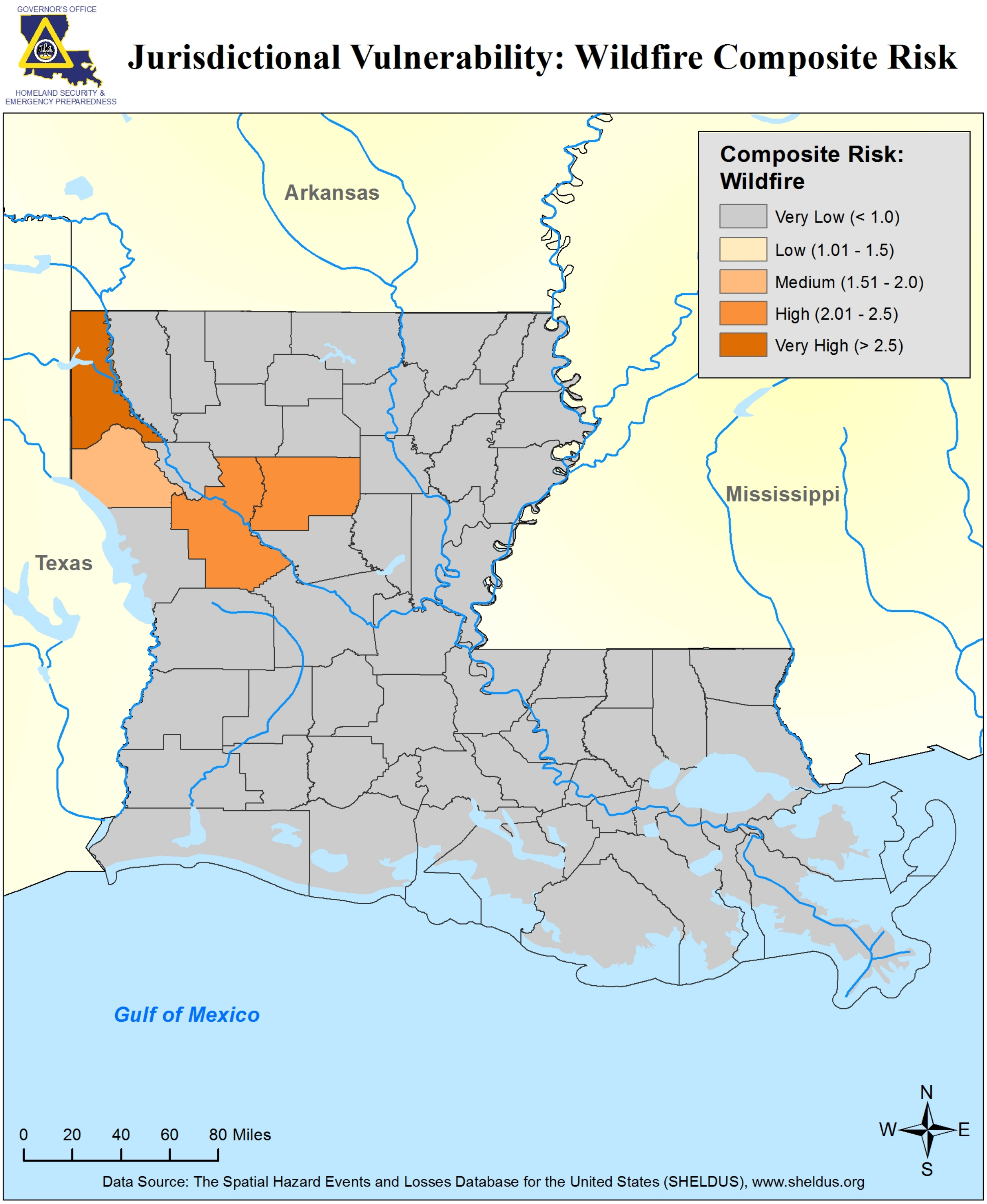

Map 2.114. Composite risk map for wildfire events showing parishes with the highest historical and highest potential risks, mostly in northwest Louisiana.

POTENTIAL ECONOMIC LOSS

Based on multiple sources (e.g., SHELDUS, NOAA, NCDC, USDA, Silvis), the following parishes are most likely to be affected by wildfires: Ascension, Assumption, Allen, Caddo, Cameron, De Soto, EBR, E. Feliciana, Lafourche, Lincoln, Livingston, Morehouse, Natchitoches, Ouachita, Rapides, St. Helena, St. Tammany, Tangipahoa, Vernon, Washington, Webster, W. Carroll, and Winn. Caddo, East Baton Rouge, and St. Tammany parishes are the three most populated parishes and have the highest infrastructure dollar exposures within Louisiana. These three parishes are considered to have the highest vulnerability to wildfires within the state.

Table 2.37 shows the overall exposure for high-risk parishes based on the Hazus-MH 2.1 inventory database and the 2010 population for each parish.

Table 2.37. Exposure data for the 18 highest wildfire risk parishes in Louisiana.

EXPOSURE DATA FOR PARISHES WITH HIGHEST WILDFIRE RISK		
Parish	Population (2010)	Total Exposure ($1,000)
Allen	25,764	$5,363,704
Ascension	107,215	$15,289,421
Assumption	23,421	$6,251,796
Caddo	254,969	$34,345,146
Cameron	6,839	$5,497,935
De Soto	26,656	$5,177,055
East Baton Rouge	440,171	$62,537,076
East Feliciana	20,267	$6,572,795
Lafourche	96,318	$14,695,652
Lincoln	46,735	$7,424,222
Livingston	128,026	$19,554,361
Morehouse	27,979	$6,391,012
Natchitoches	39,566	$8,404,586
Ouachita	153,720	$19,349,689
Rapides	131,613	$18,821,281
St. Helena	11,203	$5,465,428
St. Tammany	233,740	$31,411,675
Tangipahoa	121,097	$13,106,990
Vernon	52,334	$8,476,619
Washington	47,168	$6,658,683
Webster	41,207	$7,109,218
West Carroll	11,604	$2,412,695
Winn	15,313	$4,087,182
TOTALS	**2,062,925**	**$314,404,221**

This Plan Update also utilizes Hazus-MH 2.1 for the analysis of building exposure in each of the most vulnerable parishes by general occupancy type, which is detailed in Table 2.38.

Table 2.38. Building exposure for wildfire by general occupancy type.

Building Exposure of Most Vulnerable Parishes							
	Exposure Type ($1,000)						
Parish	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education
Allen	4,206,938	636,086	145,594	69,414	190,696	55,518	59,458
Ascension	11,107,747	2,419,973	1,186,650	51,686	309,422	111,001	102,942
Assumption	4,325,874	844,545	762,247	31,480	154,616	46,439	86,595
Caddo	24,028,899	6,808,440	1,781,362	103,056	1,140,772	226,850	255,767
Cameron	4,209,736	691,929	393,622	37,564	90,194	38,602	36,288
De Soto	4,099,351	547,708	210,562	28,702	199,404	45,114	46,214
East Baton Rouge	44,435,690	12,153,263	2,615,210	137,030	1,511,136	960,722	724,025
East Feliciana	4,986,588	868,098	308,317	34,200	201,656	116,666	57,270
Lafourche	11,267,397	2,122,336	708,103	55,486	245,694	98,260	198,376
Lincoln	5,441,177	1,083,517	388,514	45,284	275,472	45,226	145,032
Livingston	15,814,237	2,391,656	645,224	48,770	419,458	88,160	146,856
Morehouse	4,880,603	788,741	239,143	83,610	272,078	61,893	64,944
Natchitoches	6,407,131	1,087,075	253,406	48,482	392,736	80,155	135,601
Ouachita	12,968,015	4,382,733	938,805	80,576	616,220	181,698	181,642
Rapides	13,024,701	3,854,973	754,563	110,124	687,004	204,171	185,745
St. Helena	3,837,930	997,830	253,788	16,936	227,926	73,970	57,048
St. Tammany	23,583,443	5,750,413	927,918	111,050	565,620	246,405	226,826
Tangipahoa	9,581,467	2,226,918	520,534	67,496	435,132	101,324	174,119
Vernon	6,834,217	994,277	177,845	34,900	273,636	85,019	76,725
Washington	5,129,019	819,489	254,003	64,838	266,440	55,916	68,978
Webster	5,530,603	790,119	376,432	29,676	271,698	41,297	69,393
West Carroll	1,722,320	287,341	107,687	76,142	144,518	41,231	33,456
Winn	3,236,881	429,077	141,778	17,204	180,002	44,561	37,679
TOTALS	**230,659,964**	**52,976,537**	**14,091,307**	**1,383,706**	**9,071,530**	**3,050,198**	**3,170,979**

Based on the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to wildfire is listed in Table 2.39.

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Table 2.39. Regional vulnerability to wildfire.

REGIONAL VULNERABILITY TO SEVERE WILDFIRE	
Vulnerable Locations	Number of Records
Louisiana Parishes	23
Dams	524
Airports	54
Communication Towers/Facilities	254
Electricity Providers/Facilities	51
Emergency Response Centers	11
Fire Stations	417
Hospitals	104
Nuclear Plants	1
Police Stations	441
Elementary/Secondary Schools	1,317
Universities/Colleges	12

Wildfires prompt multiple hazards. The most damaging of these is the burning of property. Wildfires can spread quickly under ideal weather scenarios for combustion, including dry conditions combined with a strong wind. In strong winds, wildfires can spread rapidly from fields and forested areas into adjacent interface zones. In addition to the obvious danger from open flames, smoke from wildfires is a major health concern, particularly if few weather systems move through the area. Frontal boundaries can bring rain and winds to help push smoke out of an area and minimize smoke inhalation and the spread of wildfire, but a long period of time can pass between frontal boundaries.

To determine potential loss estimates from wildfire, the available historical loss data were annualized to determine future loss potential, as illustrated in Map 2.115. As the map demonstrates, Caddo, Natchitoches, Winn, and Calcasieu parishes are predicted to have the highest potential annualized losses.

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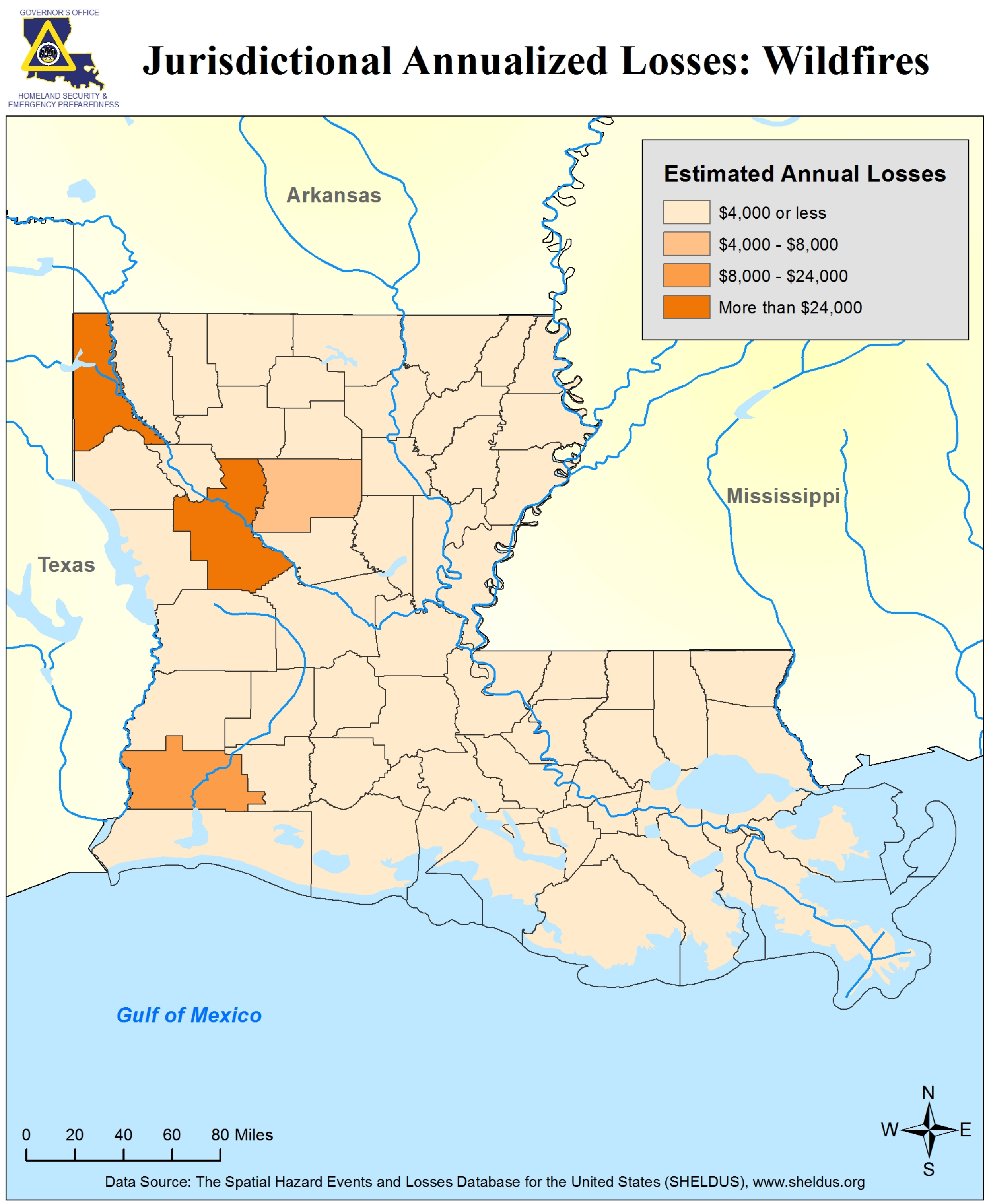

Map 2.115. Jurisdictional annualized loss due to wildfire.

All of Louisiana is potentially vulnerable to wildfire, but areas of rapid development in interface zones are especially so. Roads, bridges, utilities, and communications systems could be greatly impeded or even destroyed, resulting in high-level vulnerability for each impacted community. Transportation and emergency response could be inhibited, and utilities such as electricity, water, gas, sewer, and communications could be completely shut down. The elderly and young children are most vulnerable to smoke inhalation. State, local, and federal facilities located in the wildfire area would also be shut down and operations greatly hindered. State and local governments, churches, charities, and other support organizations could be stretched beyond their limits to furnish shelter and food to their citizens if an evacuation is required, although this has never happened in Louisiana. Other critical facilities, such as police, fire, and medical facilities, would be strained with an excess of calls and medical emergencies in the case of a very large wildfire. Without backup power, these institutions would be inoperable due to lost communication and mobility.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: All jurisdictions in Louisiana can suffer losses due to wildfires. Crop damage is the most common loss, but the built environment and human populations can experience loss as well.

Changes in jurisdictional population levels impact each parish across the state disparately. In the parishes where wildfire vulnerability has increased because of increases in population (Ascension, Livingston, Tangipahoa, and St. Tammany), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In Cameron Parish, where wildfire vulnerability has decreased because of decreases in population, concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The wildfire hazard vulnerability assessment of state-owned buildings was based on their location relative to the WUI, the percent of each parish covered by WUI zones, and the parish-level composite risk score, which incorporates the total number of wildfire events, injuries, fatalities, and property damages as well as the social vulnerability of impacted parishes. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.40.

Table 2.40. Wildfire Vulnerability Criteria and Ranking Results.

Wildfire Vulnerability Criteria and Ranking	
Ranking	Criteria
High	Located within the Wildland Urban Interface
Medium	Composite risk score between 1.5 and 2.0 & more than 10% WUI
Low	Composite risk score less than 1.5 and less than 10% WUI

The wildfire loss estimate ranges are derived from a ratio based on the expected annual losses in parishes with high, medium, and low vulnerability rankings. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Wildfire Hazard Vulnerability
- Previous Losses and Annual Loss Estimations
- Percentage of Parish Defined as Interface
- Location of Interface Zones

Table 2.41. Wildfire Loss Estimate Ranges and Ranking Results.

Wildfire Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$22,500 - $67,500	1871
Medium	$7,500 - $22,500	675
Low	$0 - $7,500	6139

Winter Weather

For Louisiana and other parts of the southeastern U.S., a severe winter storm occurs when humid air from the Gulf of Mexico meets a cold air mass from the north. As the temperature falls once the cold air mass crosses Louisiana, precipitation may fall in the form of snow or sleet. If the ground temperature is cold enough but air temperature is above freezing, rain can freeze instantly on contact with the surface, causing massive ice storms.

Winter storms are not only a direct threat to human health through conditions like frostbite and hypothermia, but they are also an indirect threat to human health due to vehicle accidents, loss of power and heat, and freezing of vital parts of the state's infrastructure. For instance, telecommunications and power can be disrupted for days. Moreover, unprotected pipes are especially vulnerable, causing disruption in water service and decreases in water pressure, which cause a cascading problem for emergency responders. Freezing rain can also cover roadways and electric utility poles, affecting travel and electric service. Depending on ice thickness, the size of the area covered, and the duration of the ice storm, the impact can be crippling: roadways become impassible, power is disrupted, communication is severed, and travel by vehicle or by foot becomes treacherous, causing injuries and fatalities. Homes and buildings are damaged by ice accumulation, either directly by the weight of the ice on the roofs or by trees and/or limbs falling on buildings.

Winter weather can also have a devastating effect on agriculture, particularly on crops (like citrus) that are dependent on warm weather. Long exposures to low temperatures can kill many kinds of crops, and ice storms can weight down branches and fruit. A number of techniques exist to temper the effects of cold weather on crops, such as covering crops with blankets or even a thin layer of water so a thin layer of ice protects the crop from even colder air. Farmers have long encountered cold weather events and have developed a number of successful mitigation strategies that they should continue putting into action.

While Louisiana is far less likely to have heavy snow and ice accumulation than most other states, winter weather is expected to occur at least once each winter. According to data from the National Climatic Data Center, Louisiana is in the lowest category of probable snow depth, with a 5% chance of <25 cm snow depth being equaled or exceeded in any given year. In Louisiana, damaging winter storms are generally associated with ice accumulations between 1 and 3 in.

Winter Weather Profile

An account of some of the major winter weather events in Louisiana can also indicate the surprising severity of these events in the state, as well as the geographic extent of the worst hazards. The winter weather events that affect the state are categorized as ice storms, freezes, and snow events. Each event can affect any part of the state.

Of the winter weather types listed above, ice storms are the most dangerous. In the past 20 years, Louisiana has suffered a few major ice storms. As might be expected, these ice storms have tended to affect the northern part of the state, in such parishes as Caddo, De Soto, Bossier, Red River, Webster, Claiborne, Bienville, Lincoln, Union, Ouachita, Morehouse, Richland, West Carroll, East Carroll, and Madison. But they can affect the whole state (see Map 2.116 for average maximum daily January temperatures in the state). In February 1989, an ice storm affected northwestern Louisiana, producing over 2 in. of ice and causing major power outages, in addition to the expected agricultural and forest damage.[lxiv] In February 1994, another ice storm affected northern Louisiana, which also turned out to be one of the worst disasters to affect the state. It began on February 9, appearing to be a normal cold air event, but an influx of humid Gulf air that confronted an Arctic anticyclone resulted in major ice accumulation across the southeastern United States. In Louisiana, more than 100,000 homes and businesses went without power for the duration of the four-day storm. Damage was estimated conservatively at $13.5 million in the state.[lxv] But the southern part of the state is not invulnerable to ice events. In January 1997, a storm caused extensive icing throughout southwestern Louisiana, in addition to southeastern Texas, resulting in a loss of power for several days in the area west of Lake Charles. Other areas of the state reached record ice accumulation, as well.[lxvi]

As ice storms can affect any part of the state, so can freezing temperatures. A freeze that affected Louisiana just before Christmas in 1989 demonstrates the widespread, severe, and often indirect effects of winter weather hazards, even in states bordering the Gulf. New Orleans observed freezing and below freezing temperatures for nearly three consecutive days, with 81 hours total below freezing. Temperatures in Baton Rouge plummeted to as low as 8°F. One of the worst aspects of the freeze were the breakage of water pipes, as illustrated by the 100+ fires recorded in New Orleans due to a loss of water pressure and improperly utilized heating sources. At least five deaths were attributed to the event in southern Louisiana.[lxvii] Crops in the area also suffered greatly.

Of all winter weather events to affect the whole state, snow events are the least common. Nevertheless, small snow events (called flurries and “dustings”) occur almost every year in the northern part of the state. And in recent years, even the southern part of the state has experienced a surprising frequency of larger snow events. In early December 2008, the southern part of the state experienced one of the earliest recorded snow accumulations, exceeding 5 in. in some places. The winter season of 2009–2010 caused two major snowfalls in the southern parishes, in December and then in February. The latter event seems to be the first acknowledged occurrence of snow in all 48 of the continental United States.[lxviii]

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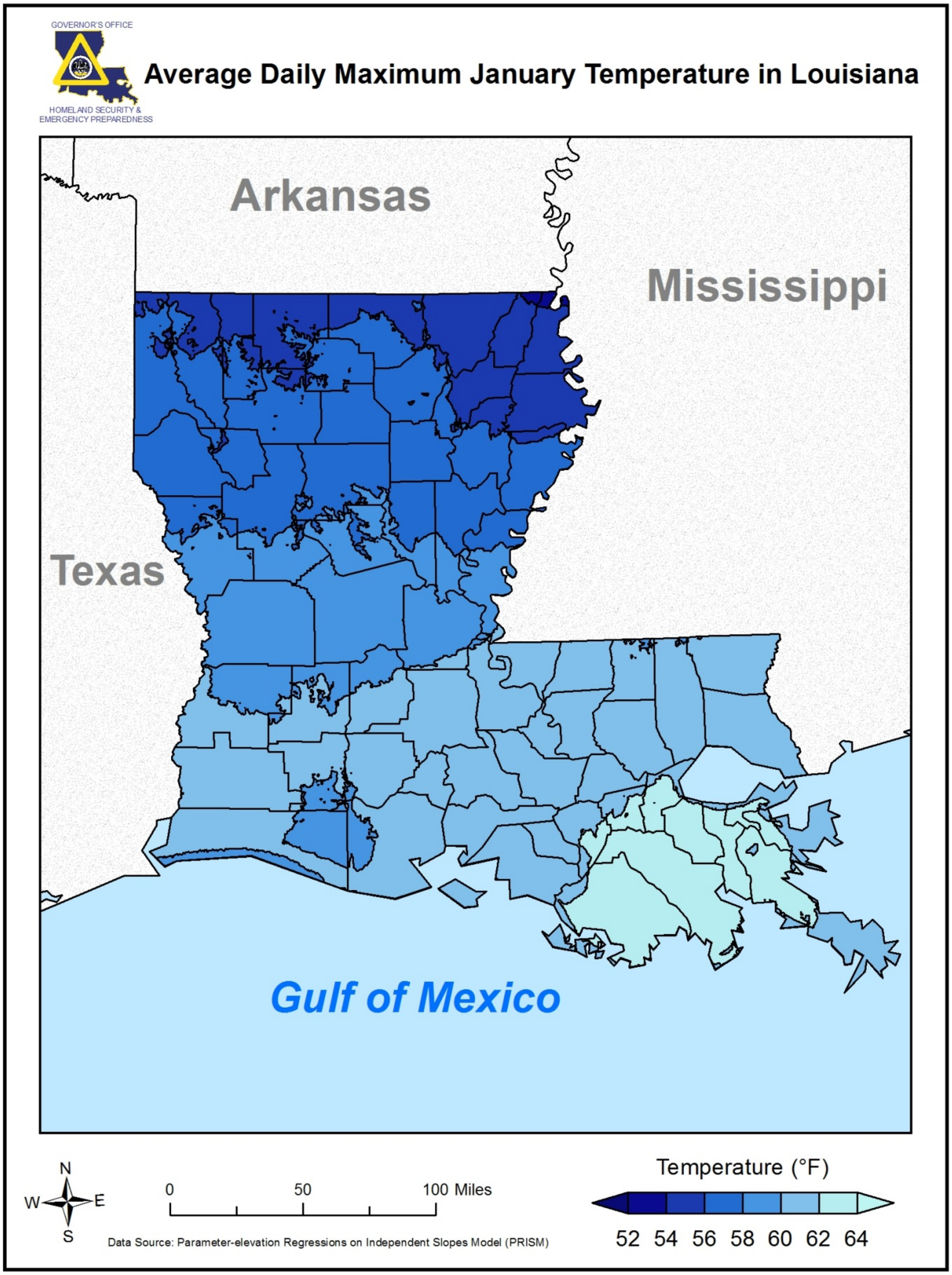

Map 2.116. Average maximum daily January temperatures by parish.

It may be tempting to dismiss the severity of winter events in Louisiana, but particularly for the most vulnerable citizens of the state—such as the elderly, poor, and homeless—these events can be deadly. Nevertheless, they can be mitigated effectively, given proper attention.

Winter Weather Risk Assessment

Based on historical records, and as indicated in Map 2.117, the probability of future occurrences of winter weather in Louisiana is **High**. Because extreme winter weather occurrences tend to be very disruptive to transportation and commerce, and due to a continued history of damaging ice storms in the state, ice storms are one of the hazards included for Risk Assessment. Maps 2.118, 2.119, 2.120, and 2.121 indicate the total winter weather events, as well as the damages, injuries, and fatalities attributed to winter weather. Bossier, Grant, and Lincoln Parishes are at high risk (greater than 2.0 composite risk score) to winter weather and have experienced significant population increases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to winter weather has increased. East Carroll, Madison, and Tensas Parishes are at high risk to winter weather, but have experienced significant population decreases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to winter weather has decreased.

Map 2.122 locates previously damaged state asset properties in relation to the density of winter weather events over the past 25 years. State-owned critical facilities located in areas affected by winter weather are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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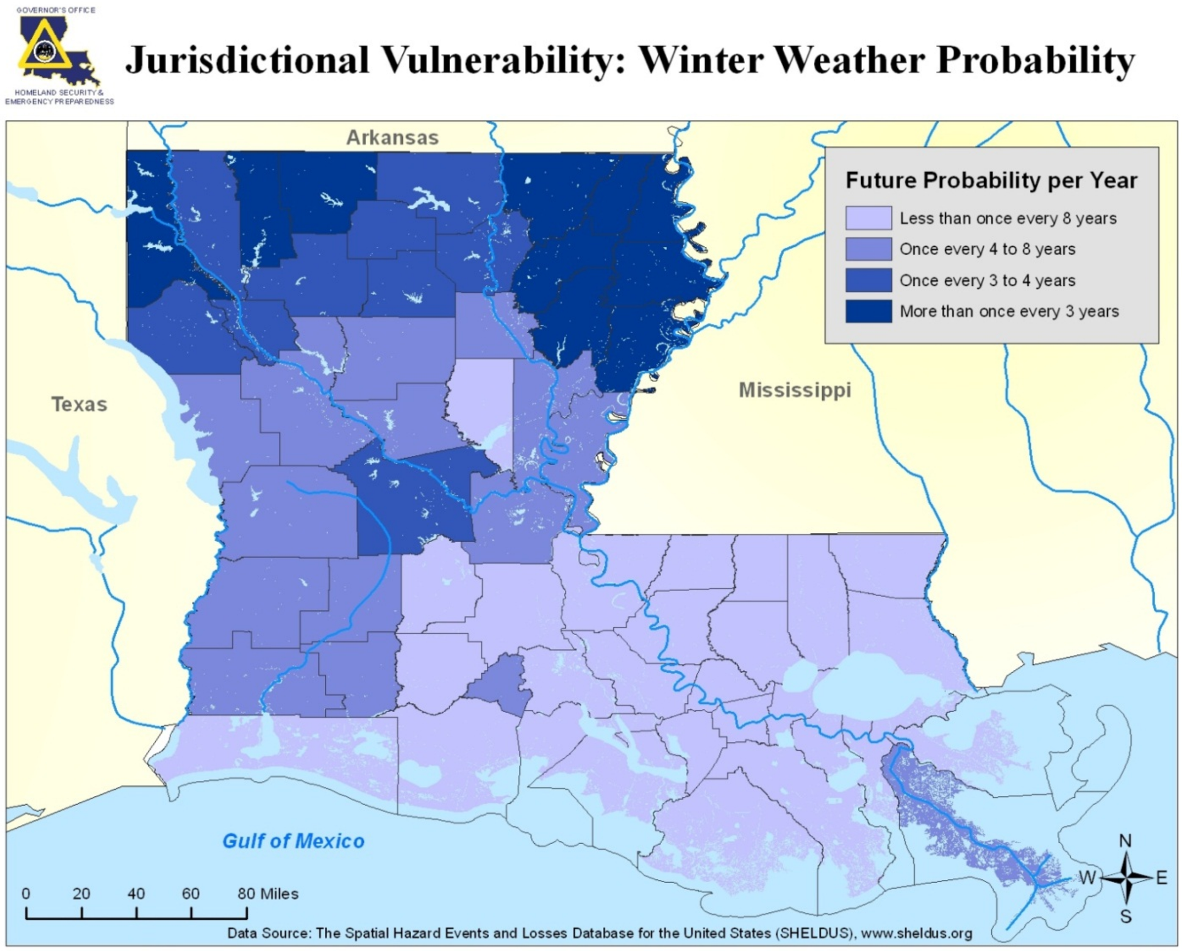

Map 2.117. Probability of future winter weather events in Louisiana by parish based on data from 1987–2012.

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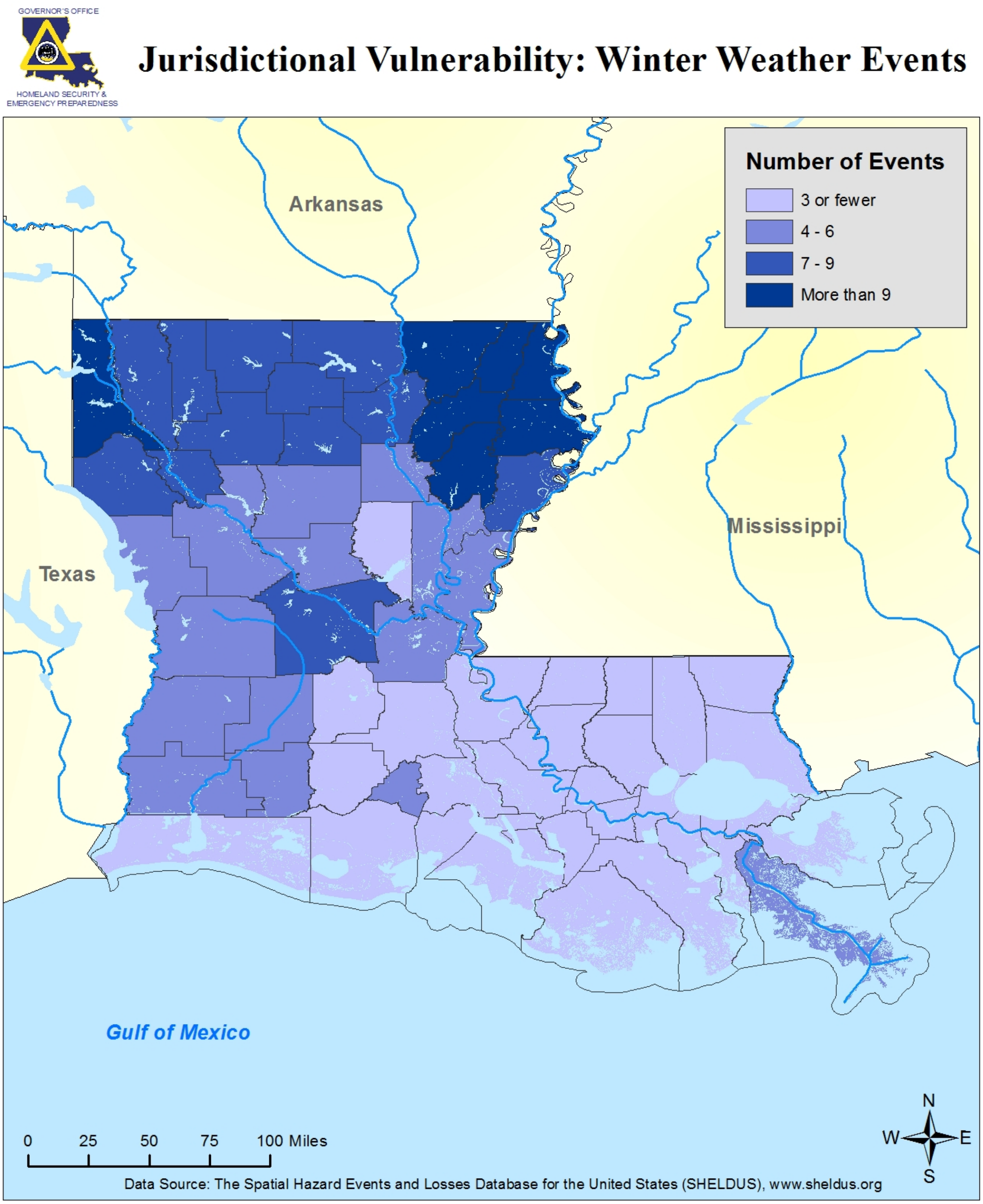
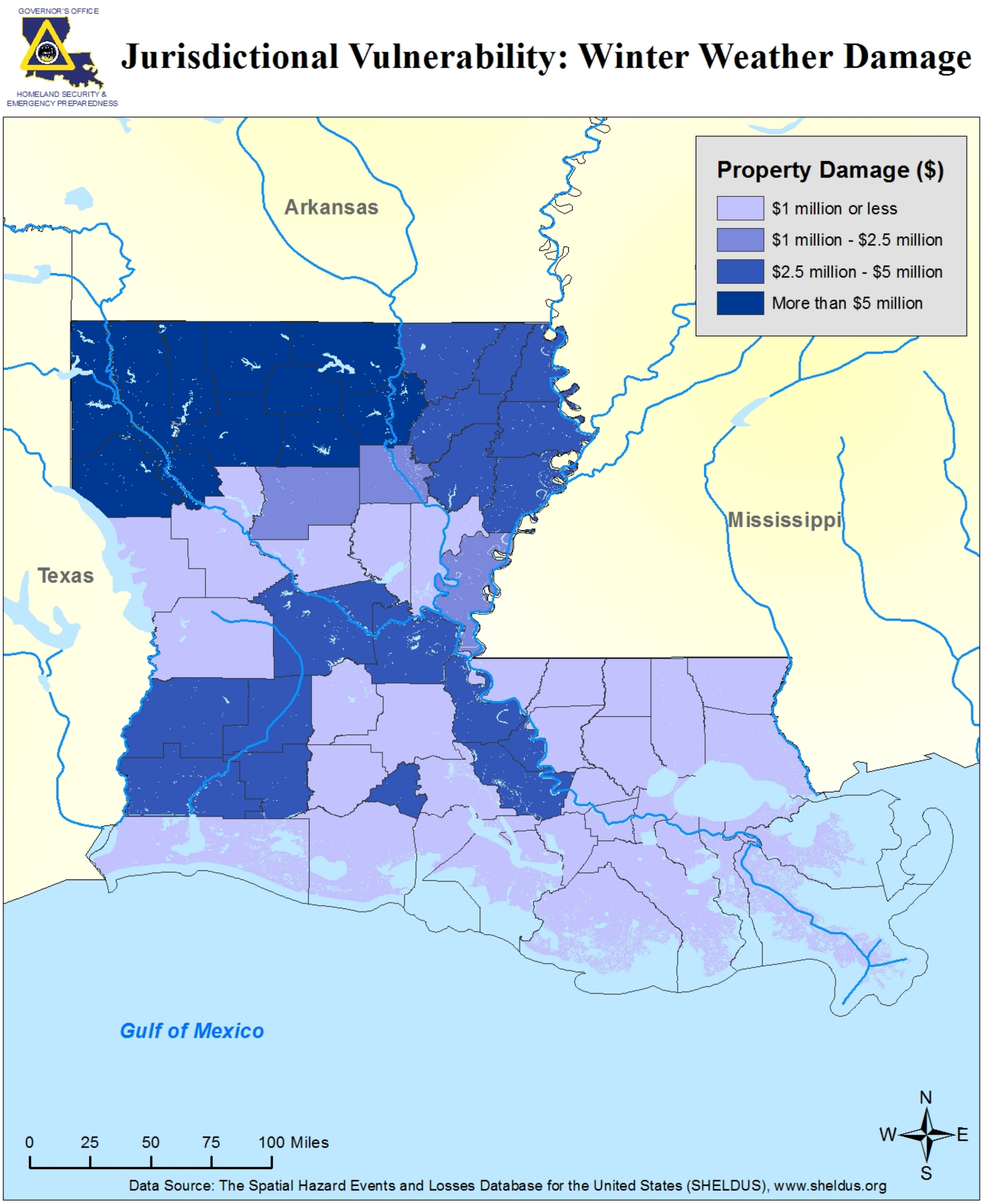
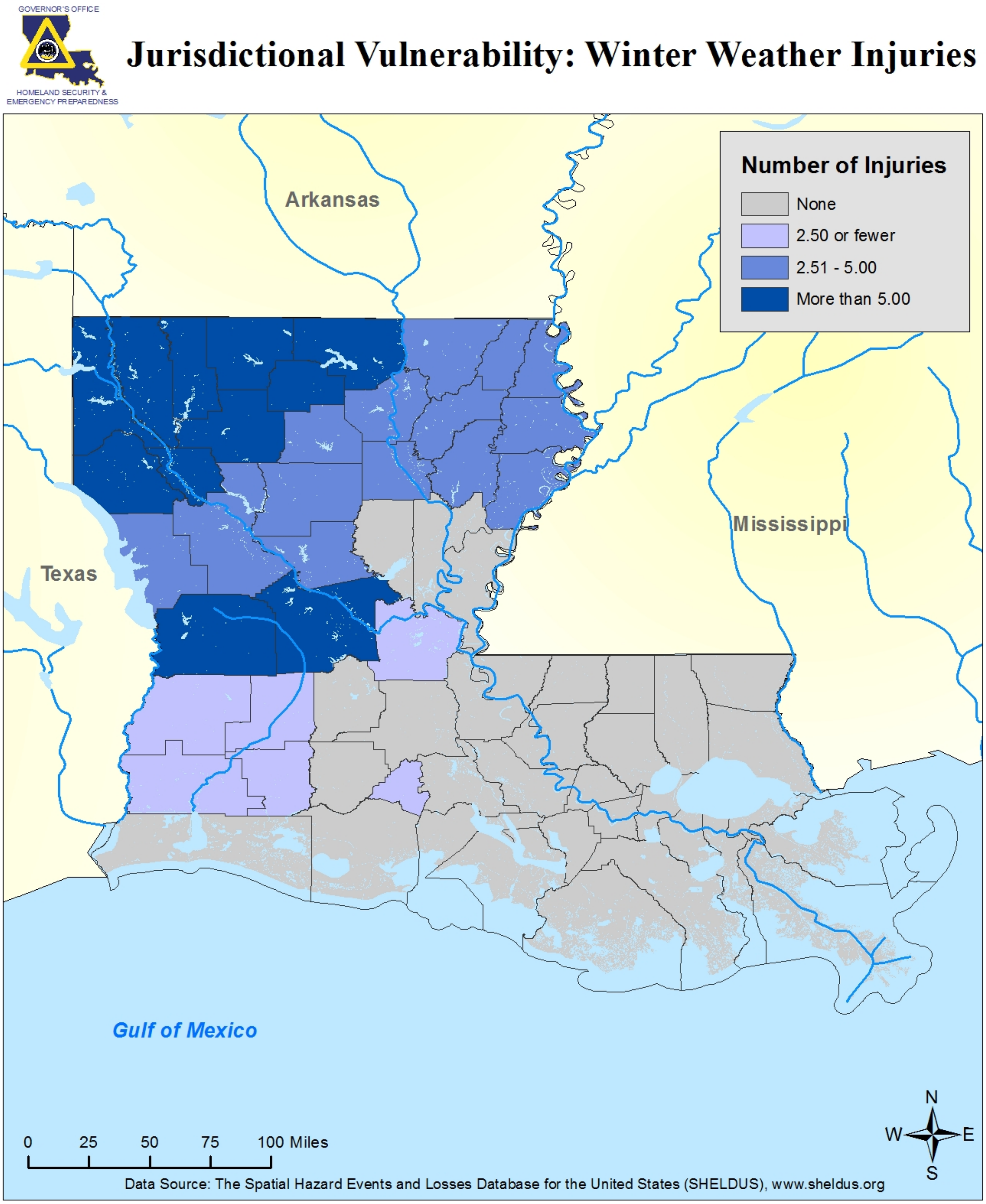


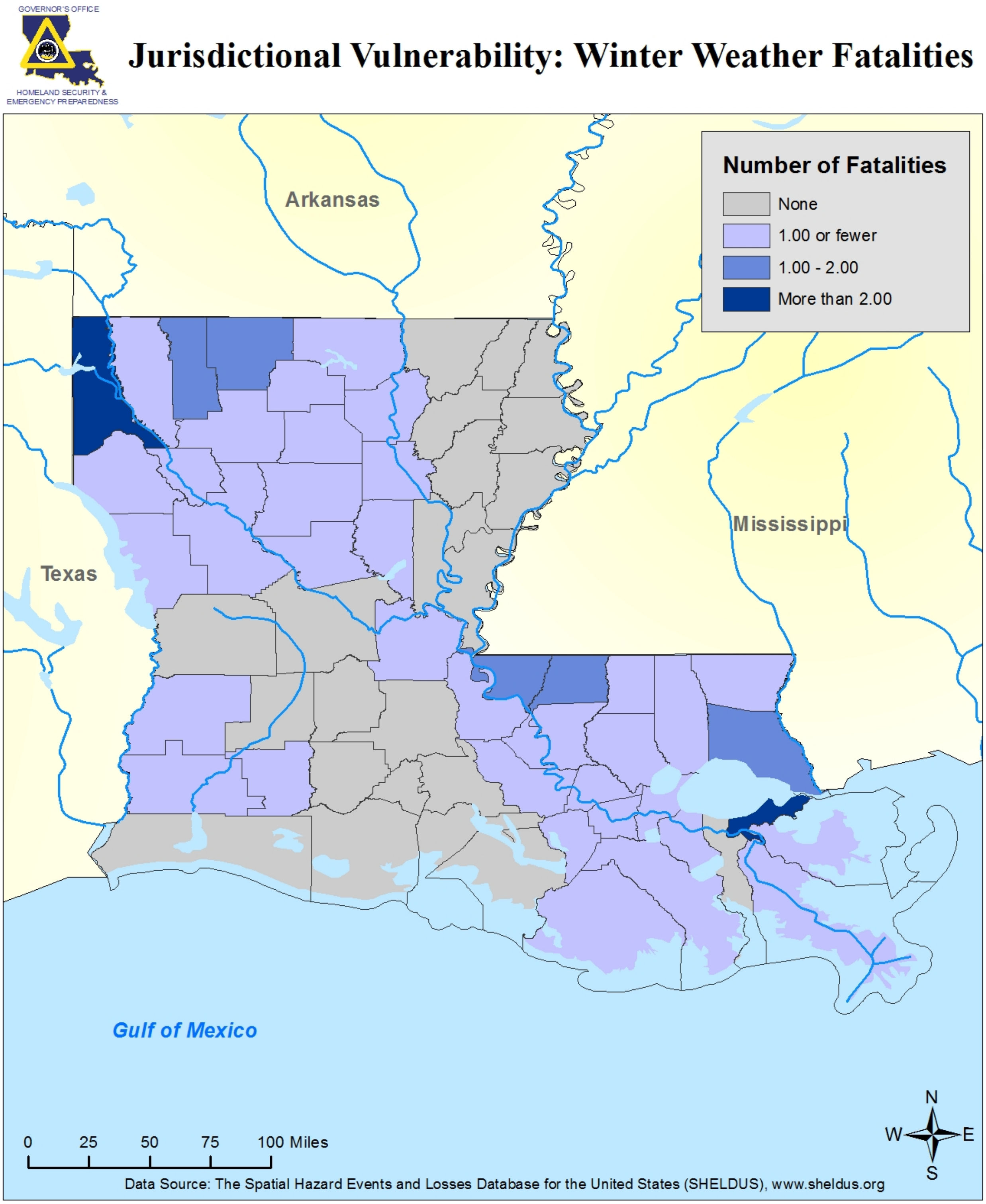
Map 2.118. Louisiana jurisdictional vulnerability for winter weather events based on data from 1987–2012.



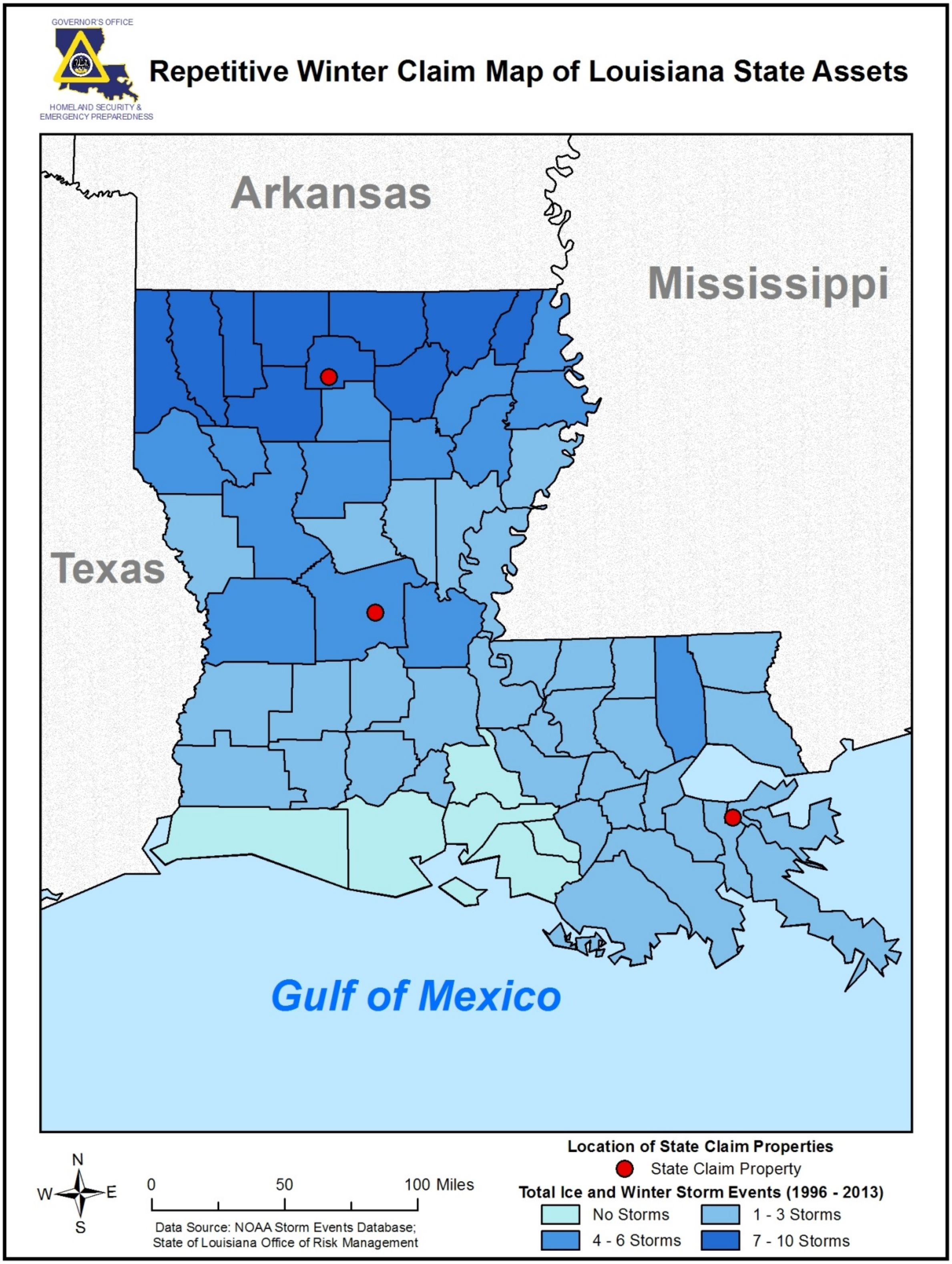
Map 2.119. Louisiana jurisdictional vulnerability for damage from winter weather based on data from 1987–2012.



Map 2.120. Louisiana jurisdictional vulnerability for injuries from winter weather based on data from 1987–2012.



Map 2.121. Louisiana jurisdictional vulnerability for fatalities from winter weather based on data from 1987–2012.



Map 2.122. Louisiana state assets with paid repetitive claims for winter weather damage.

Table 2.42 lists the top 10 winter-weather-damaged paid losses repetitive claims properties (source: Louisiana Office of Risk Management).

Table 2.42. Top paid claims for winter-weather-damaged state assets.

TOP PAID CLAIMS FOR WINTER-WEATHER-DAMAGED STATE ASSETS				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (All Hazards)
S00533	School of Nurses Building - Delgado Community College	New Orleans	$0	1
S10958	Medical Education Building - LSU Health Science Center	New Orleans	$1,860	1
S15630	State Evacuation Shelter	Alexandria	$5,750	1
S16064	Performing Arts Center - Grambling University	Dubach	$0	1

Map 2.123 shows the composite jurisdictional risk for winter weather in Louisiana based on the preceding data. The northern Louisiana parishes have the greatest risk of winter weather hazards (very high).

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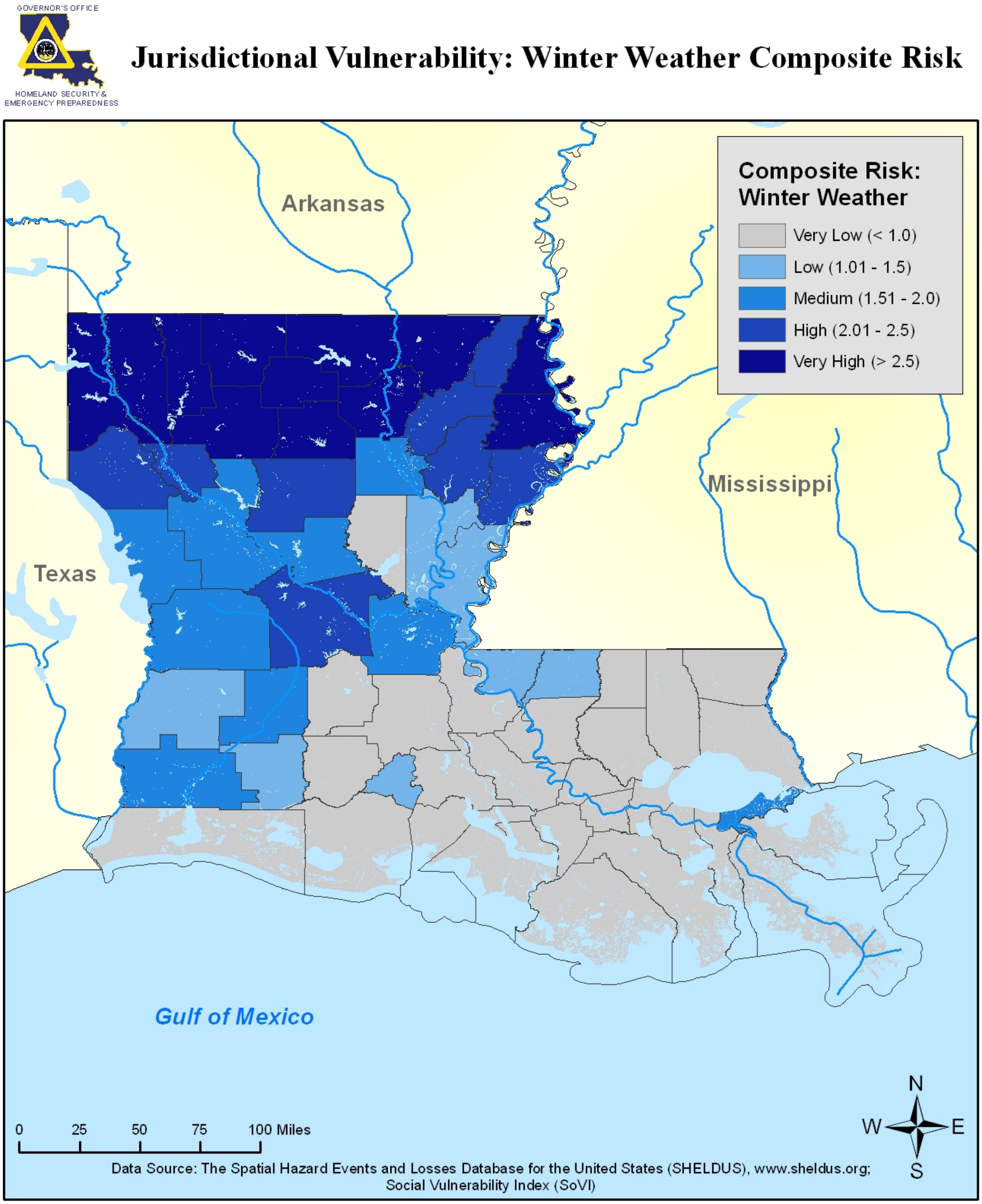

Map 2.123. Composite risk map for winter weather events showing parishes with the highest historical and highest potential risks scattered across Louisiana.

Severe winter weather events do not occur with the same frequency within all parts of Louisiana. The northern quarter of Louisiana has historically experienced the most severe winter events between 1987 and 2012. The central and, to an even greater extent, the southern parts of the state experienced the fewest severe winter events.

While snow has historically impacted Louisiana to varying degrees, the impacts resulting from ice storm events are often more severe in regards to human and economic losses.

- Deaths and injuries have occurred in the past from winter storm events. Deaths and injuries have resulted from various accidents including automobile collisions due to poor driving conditions or hypothermia resulting from insufficient heat.

- Emergency medical response can be severely hindered from the effects of a winter storm event. Roads and highways are most vulnerable to the effects of winter storms. Roads and, most often, bridges frequently become iced over resulting in accidents, injuries, deaths, and traffic congestion.

- Roads can be heavily damaged due to winter weather events. Potholes and cracks can be found on roadways after a winter weather event resulting in the need for repairs causing further economic losses to the local area.

- Electrical transmission lines are highly vulnerable to severe winter weather. Trees frequently are felled by heavy amounts of ice accumulating on branches. Trees falling on nearby power lines result in disruption of power service, resulting in additional costs for repairs and maintenance.

- Other impacts resulting from winter storms include damage to plumbing, sewers and waterlines, as well as minor roof damage and house fires caused by portable heaters.

- First responders are increasingly at risk as they respond to traffic incidents and calls for medical attention. They are vulnerable to the same transportation dangers as other citizens, but often have to proceed into the elements when ordinary citizens would not.

- During a winter storm and the days that follow, many people do not travel due to the road conditions. The absenteeism of workers impacts the overall continuity of the state government.

- Severe winter storms can result in localized environmental changes such as downed trees and flash flooding due to large amounts of ice and melting snow. Snow melt from upstream (US Midwest and Plains) could also be considered a winter storm event, but is accounted for in the flooding section of the hazard mitigation plan.

- Northern Louisiana contains large, rural farming communities and any winter weather events can have an adverse effect on crops ranging from a late winter/early spring storm that decimates crops as they are beginning to grow to heavy ice events that damage standing crops or impact animals.

POTENTIAL ECONOMIC LOSS

Based on multiple sources (e.g., SHELDUS, NOAA, NCDC), the following parishes are most likely to be affected by severe winter weather: Bienville, Bossier, Caddo, Claiborne, De Soto, East Carroll, Franklin, Jackson, Lincoln, Madison, Morehouse, Ouachita, Red River, Richland, Tensas, Union, Webster, and West Carroll. Bossier, Caddo, and Ouachita Parishes are the three most populated parishes and have the highest infrastructure dollar exposures within Louisiana. These three parishes are considered to have the highest vulnerability to severe winter weather within the state.

Table 2.43 shows the overall exposure for high-risk parishes based on the Hazus-MH 2.1 inventory database, and the percentage of residences composed of mobile home structures in each parish.

Table 2.43. Exposure data for the 18 highest winter storm risk parishes in Louisiana.

EXPOSURE DATA FOR PARISHES WITH HIGHEST WINTER WEATHER RISK			
Parish	Population (2010)	Total Exposure ($1,000)	Mobile Homes (%)
Bienville	14,353	$5,752,097	25.6
Bossier	116,979	$16,148,468	15.5
Caddo	254,969	$34,345,146	9.3
Claiborne	17,195	$4,272,885	24.3
De Soto	26,656	$5,177,055	30.0
East Carroll	7,759	$2,430,145	18.3
Franklin	20,767	$3,818,331	18.7
Jackson	16,274	$6,573,859	22.5
Lincoln	46,735	$7,424,222	17.6
Madison	12,093	$2,712,688	14.4
Morehouse	27,979	$6,391,012	16.9
Ouachita	153,720	$19,349,689	13.7
Red River	9,091	$4,618,478	19.9
Richland	20,725	$4,905,466	17.7
Tensas	5,252	$2,158,271	10.0
Union	22,721	$5,591,013	27.1
Webster	41,207	$7,109,218	20.5
West Carroll	11,604	$2,412,695	24.0
TOTALS	**826,079**	**$141,190,738**	**19.2 (Average)**

Based on the geographic extents determined in the hazard profile and the jurisdictional vulnerability assessments, the parishes in blue in Map 2.124 have the highest risk factor with respect to winter weather. The corridor outlined in red marks the extent of this high-risk area.

Map 2.124. High risk areas for severe winter weather in Louisiana.

This Plan Update also utilizes Hazus-MH 2.1 for the analysis of building exposure in each of the most vulnerable parishes by general occupancy type, which is detailed in Table 2.44.

Table 2.44. Building exposure for winter weather by general occupancy type.

Building Exposure of Most Vulnerable Parishes							
	Exposure Type ($1,000)						
Parish	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education
Bienville	4,510,931	570,939	282,913	36,384	264,558	37,245	49,127
Bossier	11,891,551	2,709,321	761,501	59,494	432,384	192,803	101,414
Caddo	24,028,899	6,808,440	1,781,362	103,056	1,140,772	226,850	255,767
Claiborne	3,222,505	469,511	284,397	28,354	170,516	43,930	53,672
De Soto	4,099,351	547,708	210,562	28,702	199,404	45,114	46,214
East Carroll	1,686,708	359,608	121,147	56,672	127,054	39,850	39,106
Franklin	2,797,175	530,282	139,622	72,966	183,488	48,884	45,914
Jackson	5,186,884	670,191	304,068	29,986	256,162	37,219	89,349
Lincoln	5,441,177	1,083,517	388,514	45,284	275,472	45,226	145,032
Madison	1,993,179	379,309	109,226	59,224	118,460	25,696	27,594
Morehouse	4,880,603	788,741	239,143	83,610	272,078	61,893	64,944
Ouachita	12,968,015	4,382,733	938,805	80,576	616,220	181,698	181,642
Red River	3,754,707	430,231	176,860	29,058	161,502	31,370	34,750
Richland	3,420,917	774,645	265,348	90,184	234,316	67,130	52,926
Tensas	1,490,623	421,817	63,506	52,738	70,438	30,406	28,743
Union	4,533,455	594,390	197,758	32,350	166,228	26,885	39,947
Webster	5,530,603	790,119	376,432	29,676	271,698	41,297	69,393
West Carroll	1,722,320	287,341	107,687	76,142	144,518	41,231	33,456
TOTALS	**103,159,603**	**22,598,843**	**6,748,851**	**994,456**	**5,105,268**	**1,224,727**	**1,358,990**

Based on the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to severe winter weather is listed in Table 2.45.

Winter storms can be accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, severe drifting, and dangerous wind chill. These types of conditions are very rare in Louisiana – even north Louisiana – but ice storms are more common. The climatic line between snow and rain often stalls over north Louisiana creating ideal conditions for ice accumulation. Strong winds with these intense storms and cold fronts can knock down trees, utility poles, and power lines. Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. Freezing temperatures can cause severe damage to crops and other critical vegetation. Pipes may freeze and burst in homes or businesses that are poorly insulated or without heat. Mobile homes are often most vulnerable because most pipes are left exposed in the crawlspace. Structure fires occur more frequently in the winter due to lack of proper safety precautions and present a greater danger because water supplies may freeze, and impede firefighting efforts. People die of hypothermia from prolonged exposure to the cold. Indigent and elderly people are most vulnerable to winter storms and account for the largest percentage of hypothermia victims largely due to improperly or unheated homes, but the leading cause of death during winter storms is from automobile or other transportation accidents.

Table 2.45. Regional vulnerability to severe winter weather.

Regional Vulnerability to Severe Winter Weather	
Vulnerable Locations	Number of Records
Louisiana Parishes	18
Dams	334
Airports	40
Communication Towers/Facilities	171
Electricity Providers/Facilities	35
Emergency Response Centers	5
Fire Stations	247
Hospitals	54
Nuclear Plants	0
Police Stations	237
Elementary/Secondary Schools	636
Universities/Colleges	8

Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. These are the most common consequences of severe winter weather in Louisiana. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

Heavy snow can immobilize an area and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow/ice removal, repairing damages, and loss of business can have large economic impacts on cities and towns.

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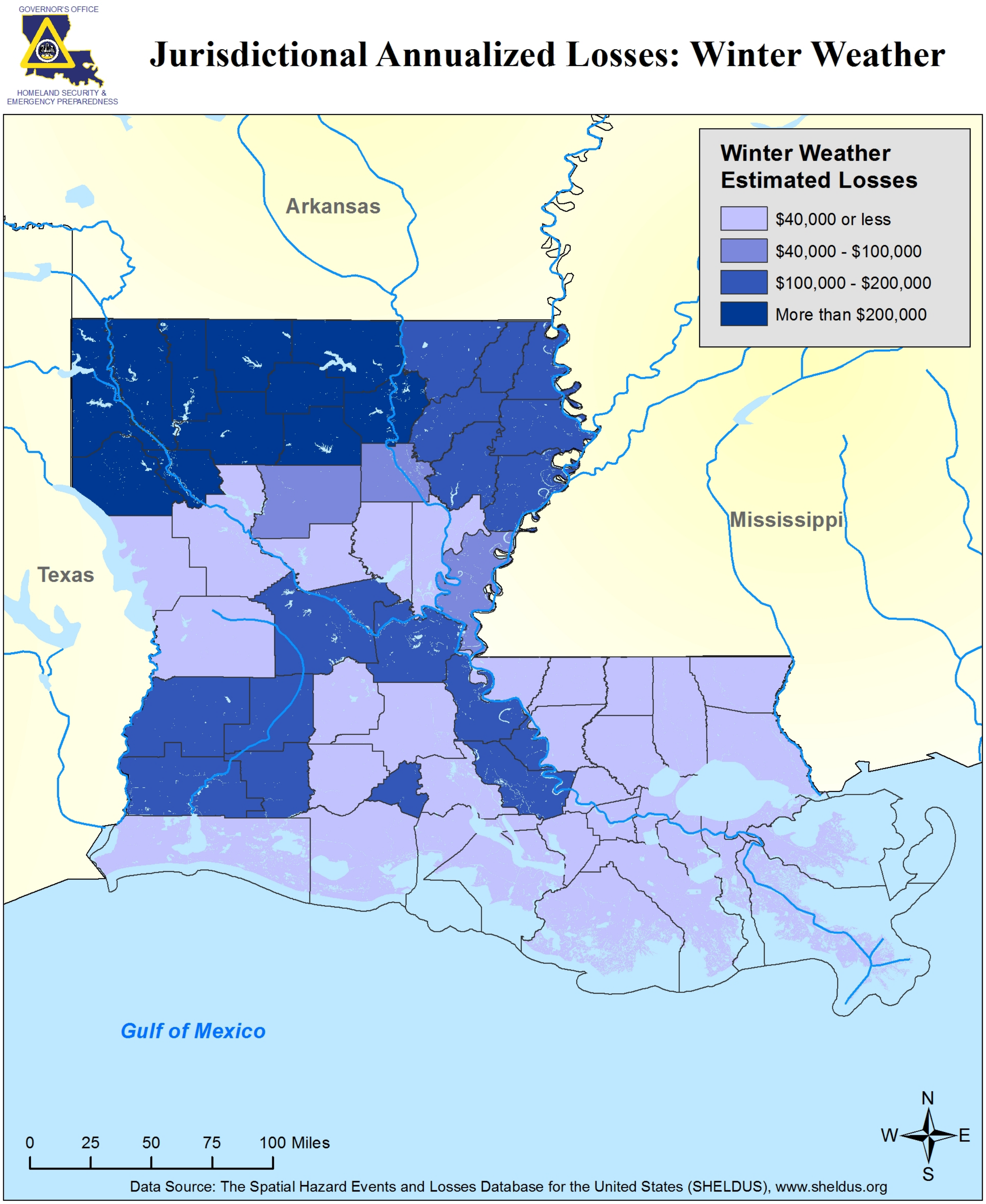
To determine potential loss estimates from winter weather, the available historical loss data was annualized to determine future loss potential (see Map 2.125). As shown, parishes with the largest populations are predicted to have the highest potential annualized losses.



Map 2.125. Jurisdictional annualized loss due to winter weather.

All of Louisiana can experience the impacts of winter storms, but north Louisiana is especially vulnerable. Winter storms are considered deceptive killers as they indirectly cause transportation accidents, and injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from wind chill, and asphyxiation. Roads, bridges, utilities, and communications systems could be greatly impeded or completely brought to a total stop resulting in a high level vulnerability in Shreveport, Monroe, and other north Louisiana communities. Transportation and emergency response could be inhibited and utilities such as electricity, water, gas, sewer, and communications could be completely shut down. Buildings could collapse from ice and/or snow accumulation. The elderly and young children are vulnerable to the cold temperatures and without power or other forms of heat could become sick or fall victim to the cold temperatures. State, local, and federal facilities located in the winter storm area would also be shut down and operations greatly hindered. Broken and falling tree limbs would endanger people, power lines, vehicles, and buildings they happen to fall on or strike. Severe winter storms often paralyze entire communities. State and local governments, churches, charities, and others can be stretched beyond their limits to furnish shelter, food and warmth to the citizens of the jurisdiction. Other critical facilities such as police, fire, and medical facilities are strained with an excess of calls and medical emergencies. Without backup power these institutions often become unable to operate due to lost communication and mobility.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: All jurisdictions in Louisiana can suffer losses due to winter weather. Nevertheless, the northern parishes of Louisiana are most vulnerable to the broadest spectrum of impacts from winter weather including heavy snowfall, damage to utilities from ice accumulation, damage to utilities from freezing weather, traffic accidents from ice/snow accumulation, crop damage from freezing temperatures and ice, and slippery sidewalks caused by ice accumulation. The central parishes of Louisiana are most vulnerable to ice-related impacts, while they are less vulnerable to snowfall accumulation. The southern parishes rarely experience winter weather, but they can still suffer losses due to it. Most impacts can be attributed to ice accumulation that could cause traffic accidents, slippery sidewalks, and minor damage to utilities.

Changes in jurisdictional population levels impact each parish across the state disparately. In the parishes where winter weather vulnerability has increased because of increases in population (Bossier, Grant, and Lincoln), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In the parishes where winter weather vulnerability has decreased because of decreases in population (East Carroll, Madison, and Tensas), concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The winter weather hazard vulnerability assessment of state-owned buildings was based on the parish-level composite risk score, which incorporates the total number of winter weather events, injuries, fatalities, and property damages as well as the social vulnerability of impacted parishes. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.46.

Table 2.46. Winter Weather Vulnerability Criteria and Ranking Results.

WINTER WEATHER VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Composite risk score greater than 2.0
Medium	Composite risk score between 1.5 and 2.0
Low	Composite risk score less than 1.5

The winter weather loss estimate ranges are derived from the 2011 state hazard mitigation plan and inflation-adjusted to 2013 dollars. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Winter Weather Hazard Vulnerability
- Average Building Type
- Winter Weather Damage Functions

Table 2.47. Winter Weather Loss Estimate Ranges and Ranking Results.

WINTER WEATHER LOSS ESTIMATE RANGES AND RANKING		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$1,604 to $10,153,600	2740
Medium	< $1,603	1690
Low	$0	4255

GEOLOGICAL/HUMAN-INFLUENCED HAZARDS

The geological/human-influenced hazards profiled in this section (coastal erosion, dam failure, earthquakes, levee failure, saltwater intrusion, sea level rise, sinkholes, and subsidence) are difficult to categorize because they tend to influence and be influenced by each other, and some can be related to the climatological hazards profiled above, to some degree. For instance, sea level rise contributes to saltwater intrusion, which contributes to the formation of salt domes, which—when mined extensively—can form sinkholes. Additionally, dam and levee failure, which might be prompted by earthquakes, can exacerbate or even cause flooding. Obviously, all of these are impacted by the effects of hazards like coastal storms. Nevertheless, a certain subset of these hazards can be considered in the framework of one major danger to the state of Louisiana: coastal hazards. Most especially, these coastal hazards contribute to a major ongoing problem for Louisiana: land loss. Land loss is the process by which coastal lands, particularly wetlands, erode or sink into open water as a result of violent storms, coastal erosion, sediment deprivation, saltwater intrusion, and rising sea levels. Thus, in this plan, coastal hazards are those hazards which directly influence the delicate ecosystem of Louisiana's Gulf coastline, here comprising coastal erosion, saltwater intrusion, sea level rise, and subsidence. Land loss can be mitigated through major coastal restoration and protection measures that are beyond the scope of most funding programs associated with DMA 2000 hazard mitigation planning, but which are being planned and implemented by other entities within the state and federal governments.

It should still be remembered, though, that these hazards are not isolated from the other geological/human-influenced hazards, as indicated above. Dam and levee failure, earthquakes, and sinkholes can all contribute to coastal hazards, but they are not constrained in threat to the coast like coastal erosion, saltwater intrusion, sea level rise, and subsidence.[lxix] First, this plan profiles the coastal hazards before moving on to dam failure, earthquakes, levee failure, and sinkholes. Since coastal erosion, saltwater intrusion, sea level rise, and subsidence are not addressed as stand-alone hazards, all of these hazards are subsumed under existing, expert plans for coastal protection and restoration—including the actions of Louisiana's Department of Natural Resources (DNR) Office of Coastal Management, NOAA's National Coastal Zone Management (CZM) Program, and the state's Coastal Protection and Restoration Authority (CPRA) Master Plan.

Coastal Land Loss

Coastal land loss is the loss of land (especially through beach, shoreline, or dune material) by natural and/or human influences. Coastal land loss occurs through various means, including coastal 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, as Figure 2.3 illustrates.

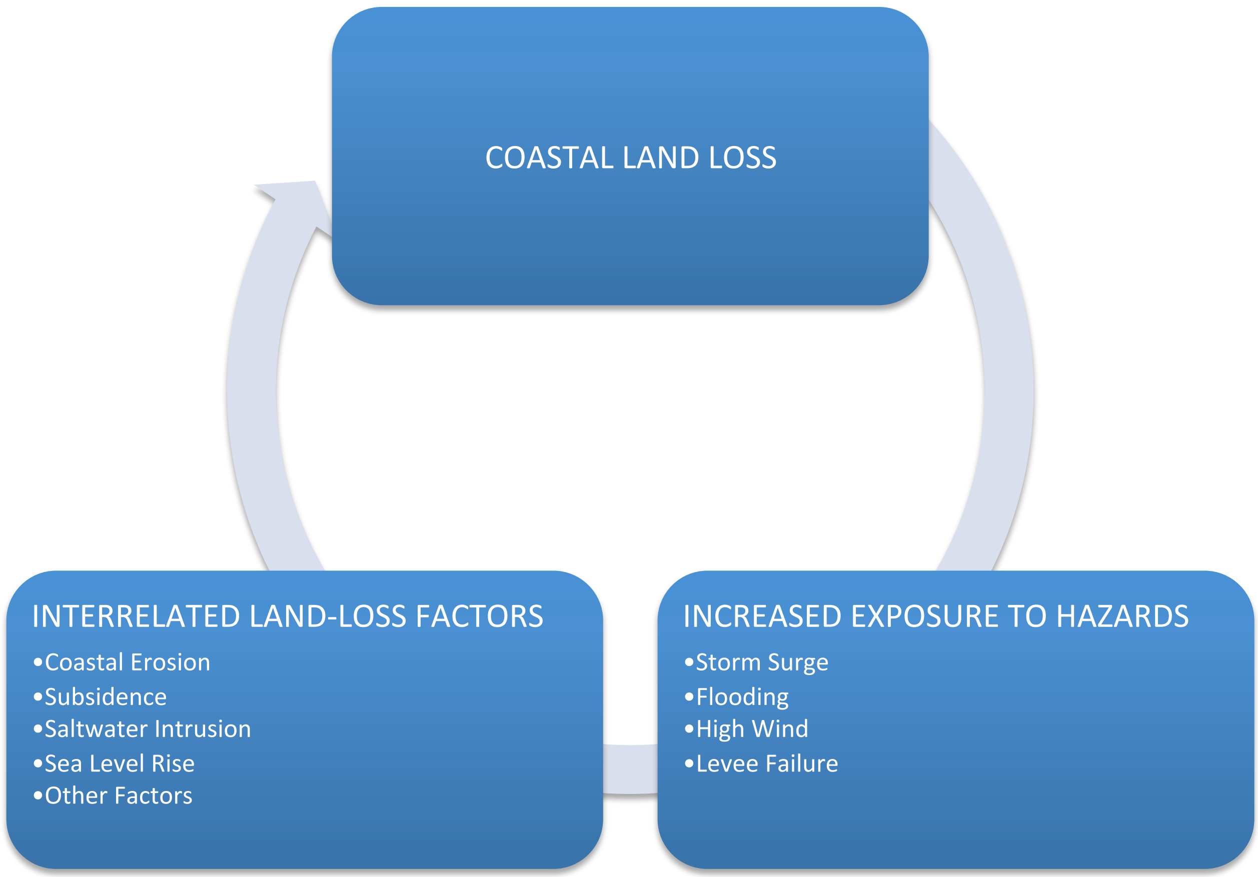
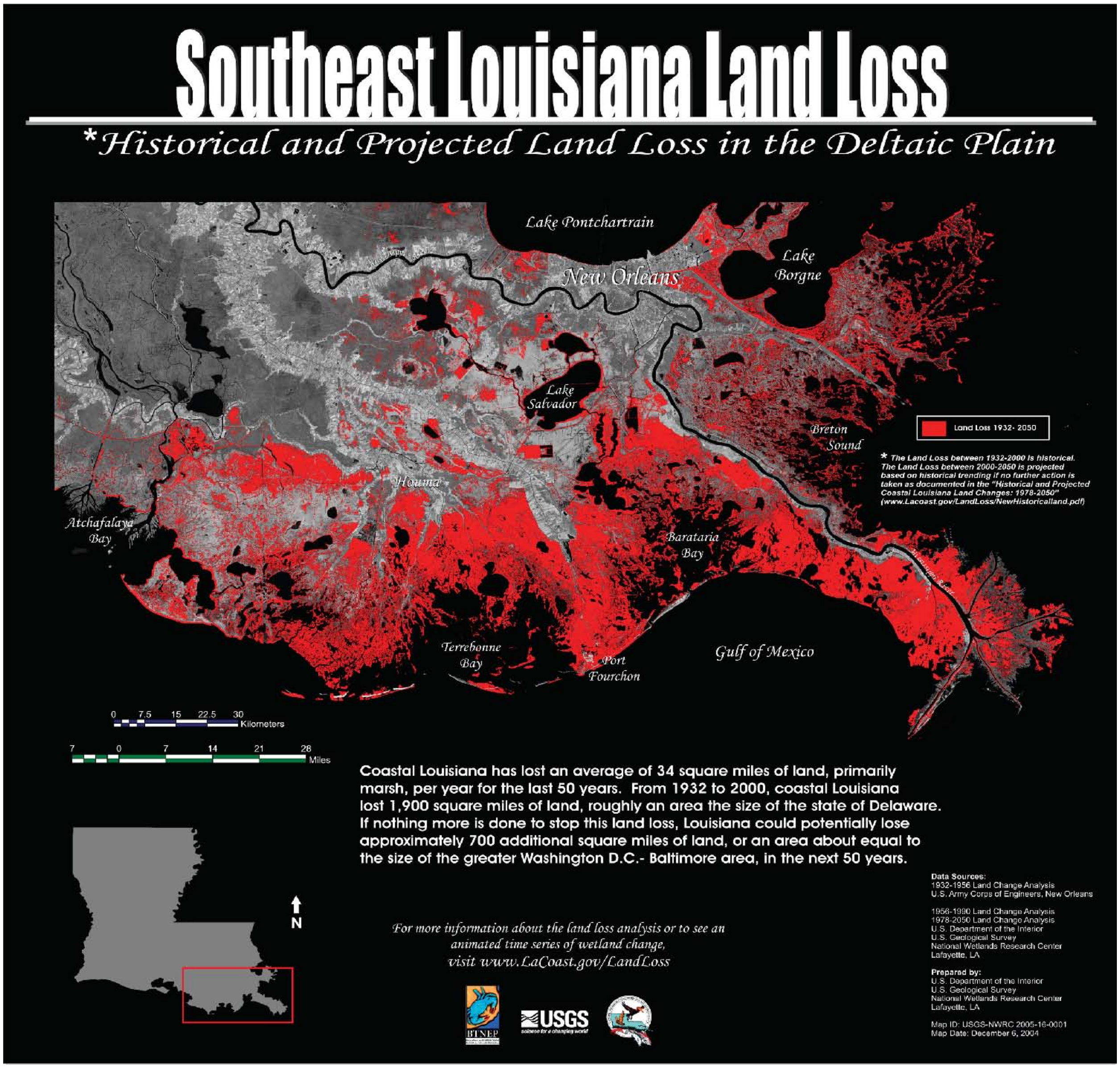


Figure 2.3. Interrelated factors contributing to coastal land loss, and their subsequent and cyclic effect on hazard vulnerability.

Regardless, most of southern Louisiana is vulnerable to coastal land loss because most of it is at—or only a few feet above—sea level. Map 2.126 illustrates historical coastal land loss since 1932 projected through 2050 for southeast Louisiana.



Map 2.126. Historical and projected land loss (map portions in red) along the southeastern Louisiana coast between 1932 and 2050 (source: USGS).

This loss and its causes are an environmental and economic concern not only for Louisiana, but also for the entire United States. Louisiana supplies an essential and unique natural waterway and wetland for fishery, shipping, water supply, seafood nursery, migratory waterfowl flyway, and recreational purposes, and therefore coastal erosion threatens the state's very livelihood.

Ironically, a delicate system of wetlands is all that protects these waterways from destruction inundation, even as those very waterways threaten the wetlands themselves. These wetlands are crucial to the mitigation of a variety of hazards that threaten Louisiana. As Figure 2.4

implies, artificial channels created for navigation purposes endanger the adjacent wetlands. Yet the wetlands surrounding them also help immensely to protect them, along with pipelines, ports, and property at the coast and farther inland. And again, ironically, many of the industries these wetlands protect also contribute to their destruction. Construction of dams and levees, the dredging of canals, and draining and filling in support of various coastal industries have altered the coastline by contributing to saltwater intrusion and the destruction of wetlands, which intensify Louisiana's coastal land loss.[lxx] Saltwater intrusion is the inland encroachment of saltwater into areas that previously contained freshwater, either above or below the land surface, and it is thus a very common problem in coastal areas. Despite the simplicity of the hazard, saltwater intrusion has numerous causes and consequences. In Louisiana specifically, it comes from coastal storms, wetland loss, canal construction, sea level rise, coastal erosion, and subsidence. As with all coastal hazards, most of these processes are interrelated. In canal construction, for instance, saltwater finds a straight and deep channel to freshwater areas (because it is more dense than freshwater), killing off freshwater plants and thus reducing wetlands. In terms of our nation's environment, the loss of wetlands to coastal land loss is catastrophic. The state contains about 40% of the nation's wetlands and accounts for 90% of coastal wetland loss in the continental United States.[lxxi]

Figure 2.4. "Navigation channel dissecting eroding marsh in coastal Louisiana" (source: Tim Carruthers, University of Maryland Center for Environmental Science).

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.

As Map 2.127 reveals, Hurricane Rita effectively pushed the coastline back a few mi. temporarily. Much of that land and other areas along the coast—217 mi^2 in total—were inundated permanently.[lxxii] Most noticeably, Katrina and Rita wiped out 85% of the above-surface land of the Chandeleur Islands. As Figure 2.5 shows, this major shield that protected Louisiana's coast just east of New Orleans was almost obliterated, leaving the city dangerously exposed. Figure 2.6 provides a microcosmic view of the storms' impact on the islands.

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Map 2.127. Coastal land loss due to Hurricane Rita. Source: http://www.nasa.gov/vision/earth/lookingatearth/h2005_rita.html.

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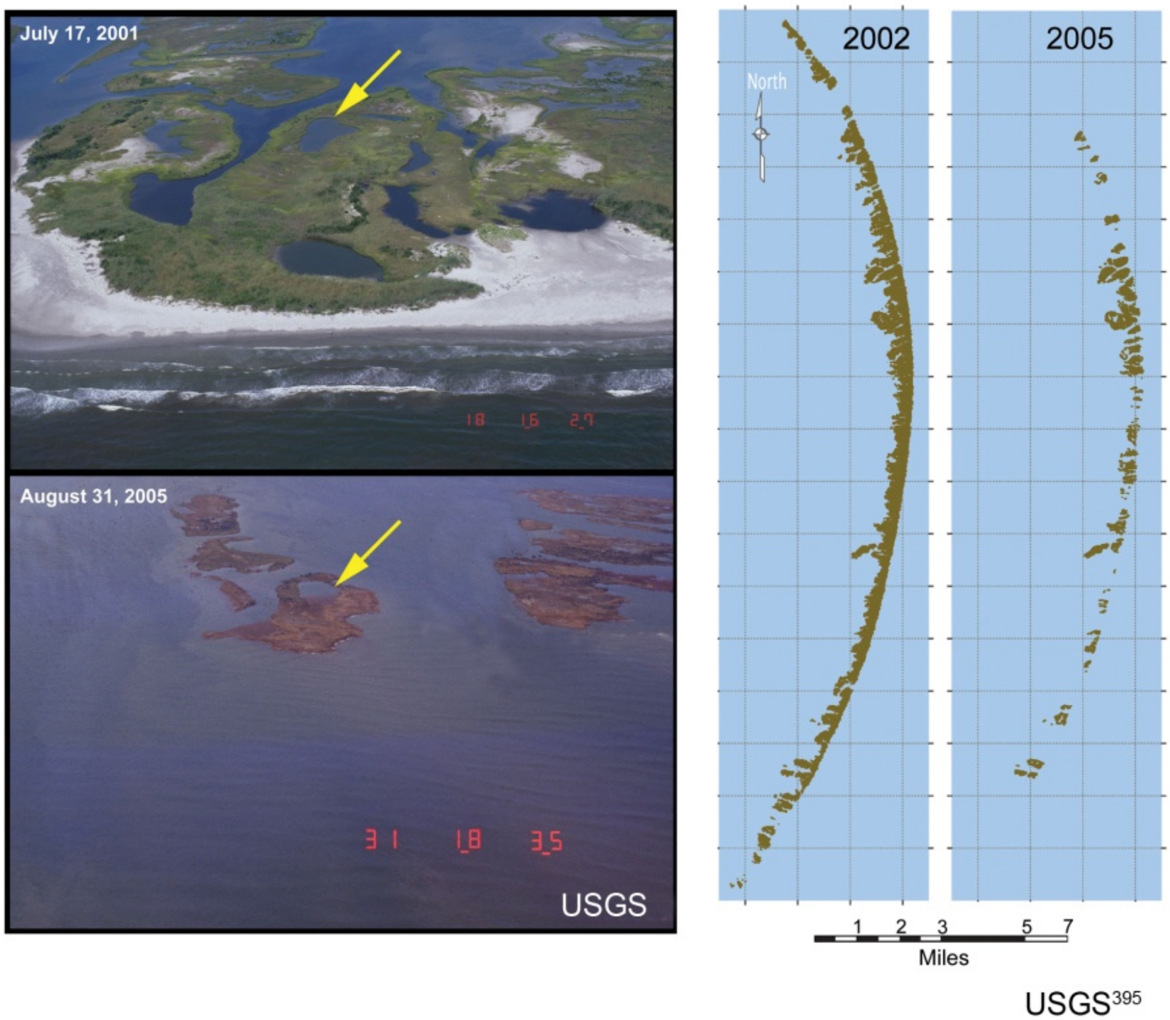

In 2005, 217 square miles of land and wetlands were lost to open water during hurricanes Rita and Katrina. The photos and maps show the Chandeleur Islands, east of New Orleans, before and after the 2005 hurricanes; 85 percent of the islands' above-water land mass was eliminated.

Figure 2.5. Loss to Chandeleur Islands after Hurricanes Rita and Katrina. Source: USGCRP (2009).

Figure 2.6. Pre- and post-Katrina photographs of part of the Chandeleur Islands. Source: USGS.

The disastrous legacy of these storms concentrated already ongoing efforts to combat coastal land loss and wetland loss. Nevertheless, consistent with the 2008 and 2011 updates to the State Hazard Mitigation Plan (and as indicated earlier), this 2014 Plan Update does not address coastal land loss as a stand-alone hazard, but rather considers it in terms of two of the most dominant factors: sea level rise and subsidence.

Sea level rise and subsidence impact Louisiana in a similar manner—again making it difficult to separate impacts. Together, rising sea level and subsidence—known together as **relative sea level rise**—can accelerate coastal erosion and wetland loss, exacerbate flooding, and increase the extent and frequency of storm impacts. According to NOAA, *global* sea level rise refers to the upward trend currently observed in the average global sea level. *Local* sea level rise is the level that the sea is rising 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. Observed local sea levels may vary widely from the average rate of global sea level rise, depending on local conditions such as subsidence or isostatic rebound; the latter does not affect Louisiana directly, as it refers to local rising motion in response to the release of compressive forces from the weight of glacial ice. Map 2.128 illustrates predictions of sea level rise in southern Louisiana by 2100.

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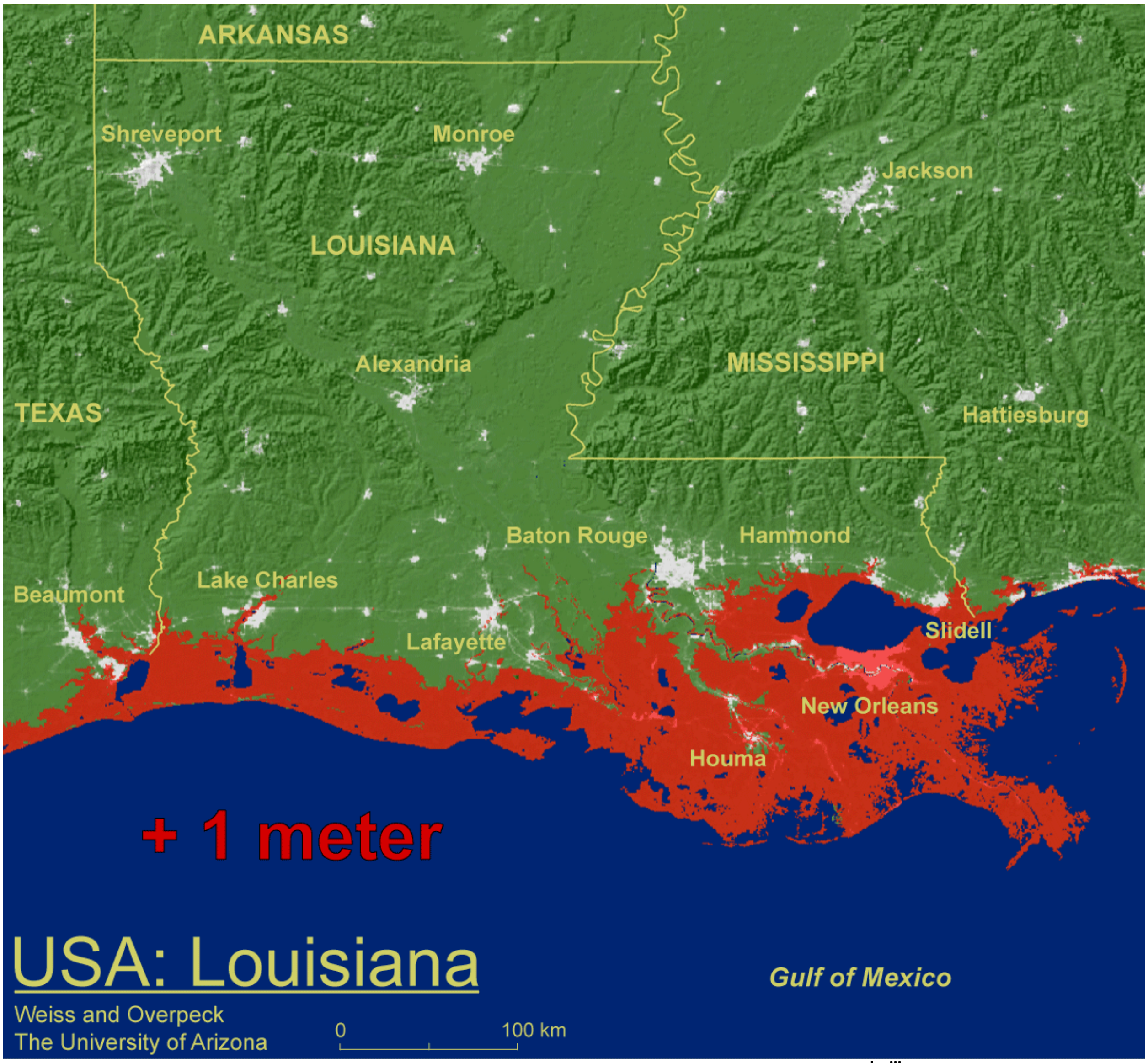

Map 2.128. Predictions of sea level rise by 2100 (source: Weiss and Overpeck).[lxxiii]

The current U.S. Environmental Protection Agency (EPA) estimate of global sea level rise is 10–12 in. per century, while future sea level rise could be within the range of 1–4 ft. by 2100.[lxxiv] 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. This hazard has been identified as one that is of such a scale and extent that it is addressed through the actions of multiple state agencies such as the Department of Transportation and Development, Department of Natural Resources, and CPRA, in addition to being addressed in this Plan Update.

Subsidence results from a number of factors including:

- Compaction/consolidation of shallow strata caused by the weight of delta deposits from the Mississippi River, 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)

This last element was only recently quantified, and research indicates that it may account for 50% or more of subsidence.[lxxv]

As a stand-alone hazard, subsidence has not been identified as a significant *acute* contributor to direct disaster damages in Louisiana. However, it is certainly one of the main drivers of land loss in Louisiana, and thus it dramatically increases flood risk—which is one of the most dangerous hazards the state faces.

For the most part, subsidence is a slow-acting process with effects that are not as evident as hazards associated with a discrete "event." Although subsidence effects in the New Orleans metropolitan area and in the coastal zone can be readily seen over the course of decades or even years, subsidence is a "creeping" hazard event with chronic impacts. 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 elsewhere in Louisiana, subsidence may make structures more vulnerable to flooding
- By destabilizing elevations in general, 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

Coastal Land Loss Risk Assessment

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 greatly 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.). Because coastal land loss is, and will continue to be, a major issue in Louisiana and has become very disruptive to transportation, commerce, and general livelihood over the past half century, coastal land loss is one of the hazards included for Risk Assessment. Coastal land loss is an ongoing process and data used for the risk assessment represent the aggregation of all previous occurrences, including discrete (hurricanes) and continuous (subsidence) processes. 2012 Hurricane Isaac is a recent example of a discrete event that caused some level of land loss in southeast Louisiana.

Areas of land loss and land gain between 1932 and 2010 are shown in Map 2.129, and rates of subsidence are shown in Map 2.130. Map 2.131 indicates the specific areas and associated parishes of coastal Louisiana where subsidence (and consequently land loss) is quantifiable and a major concern. Parishes at risk include Ascension, Assumption, Calcasieu, Cameron, Iberia, Jefferson, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, and Vermilion. Ascension, Livingston, St. Tammany, and Tangipahoa Parishes are at risk (within subsidence zone) to coastal land loss and have experienced significant population increases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to coastal land loss has increased. Cameron, Orleans, Plaquemines, and St. Bernard Parishes are at high risk to coastal land loss, but have experienced significant population decreases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to coastal land loss has decreased.

Assessing the state's vulnerability to coastal land loss is complicated and varies across space. Parishes that contain areas of subsidence are vulnerable to coastal land loss, but in some cases areas of subsidence do not cover an entire parish. Additionally, subsidence rates change across space. Coastal land loss vulnerability is directly related to the location of state facilities within subsidence zones, which are located in Map 2.131. Map 2.132 locates state facilities within these zones. Four state parks are located within subsidence zones out of a total of 19 and there are 1,425 state facilities within subsidence zones out of a total of 8,685. State-owned critical facilities located in areas affected by coastal land loss are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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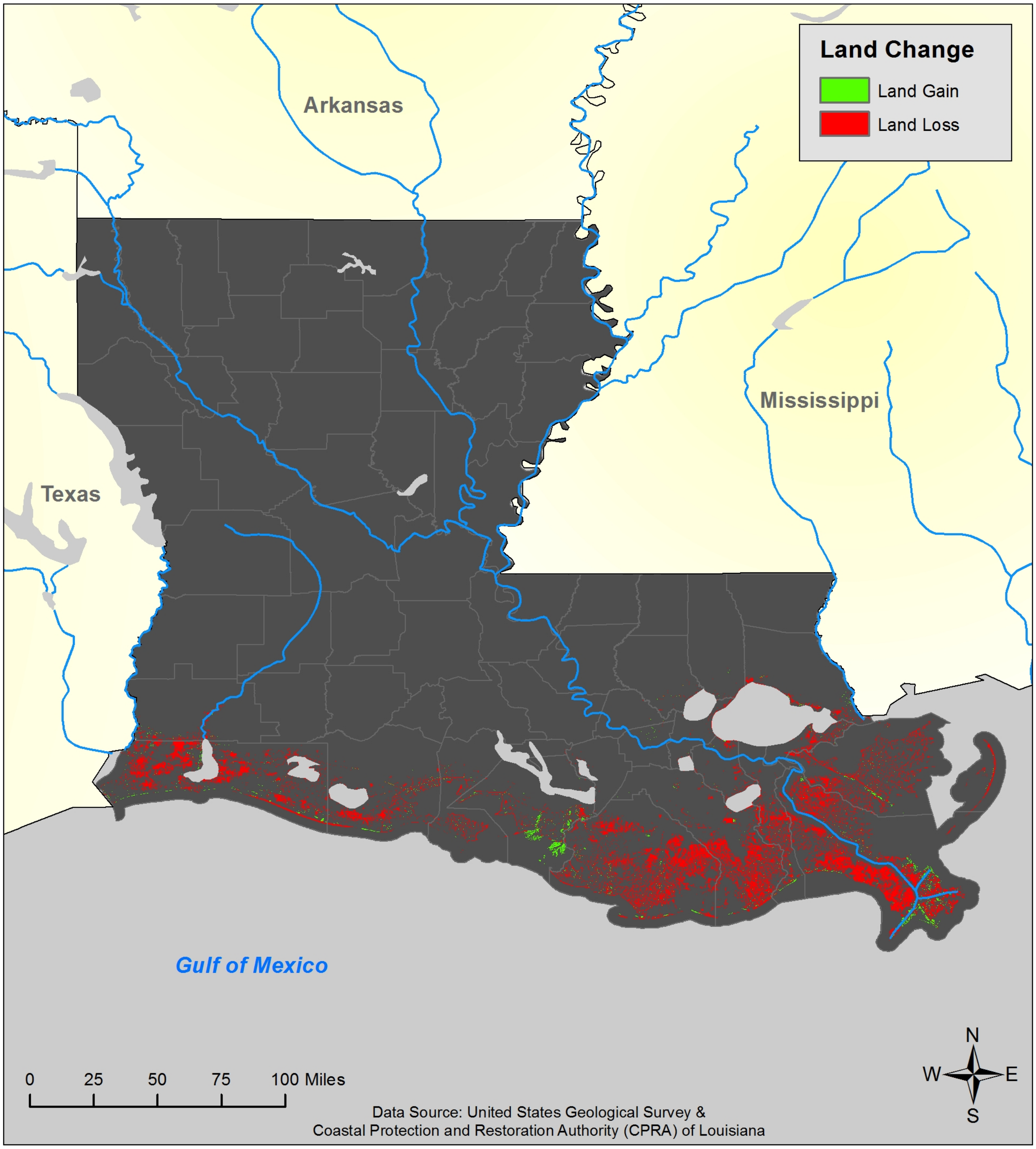
GOVERNOR'S OFFICE
HOMELAND SECURITY & EMERGENCY PREPAREDNESS

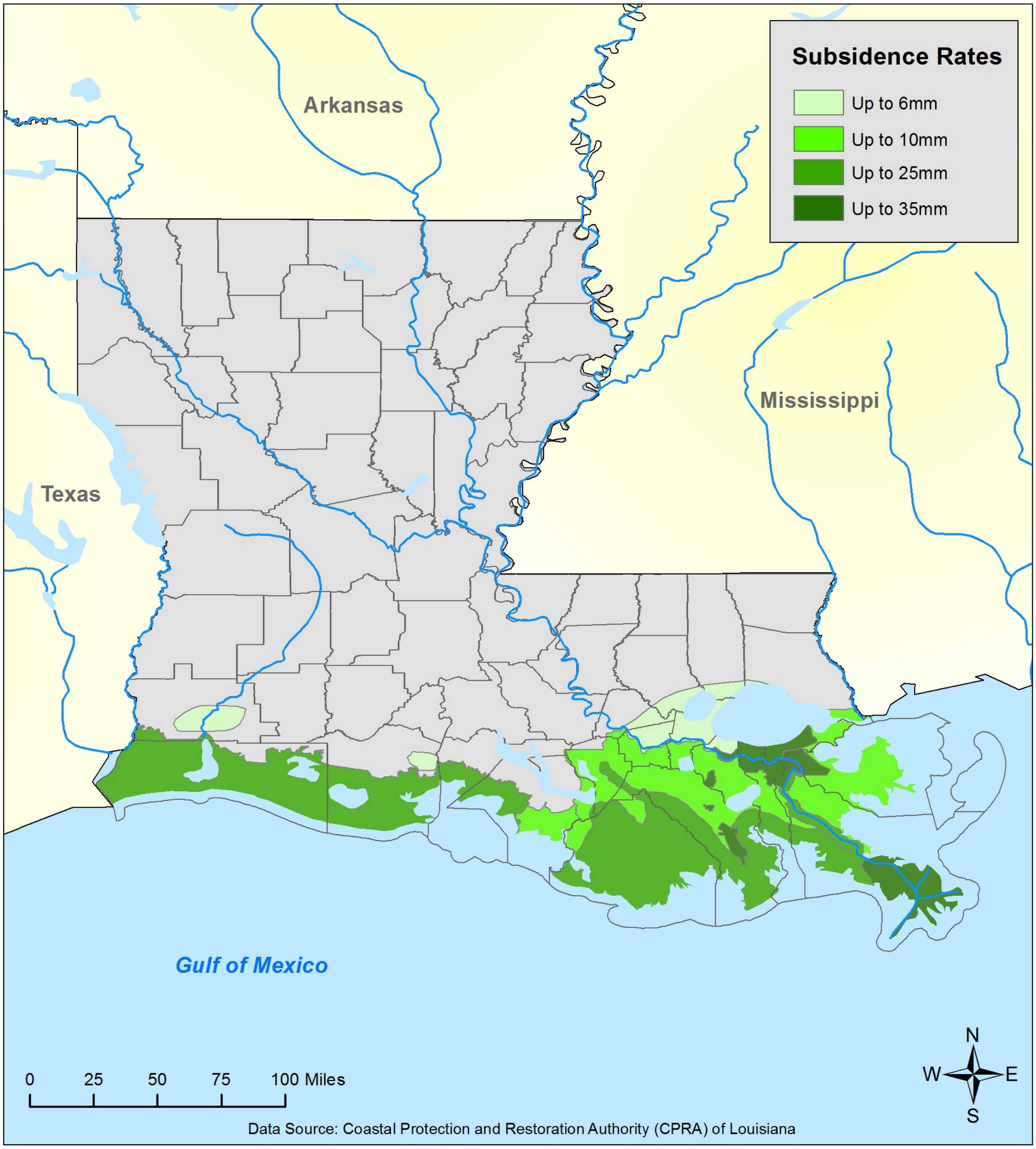
Land Loss/Gain: 1932-2010



Map 2.129. Historical areas of land loss and gain in coastal Louisiana between 1932 and 2010.

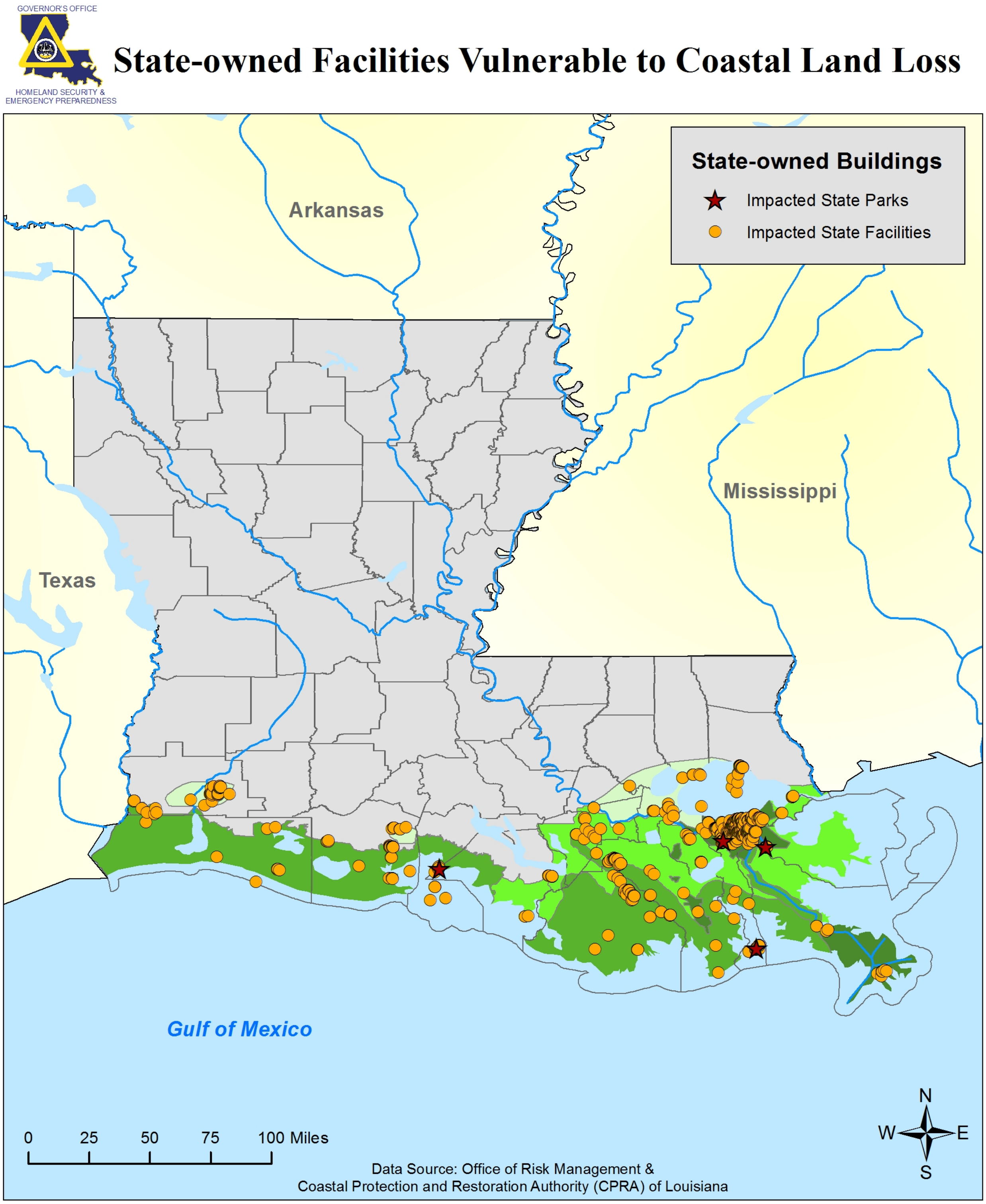
GOVERNOR'S OFFICE
HOMELAND SECURITY & EMERGENCY PREPAREDNESS

Annualized Rates of Subsidence



Map 2.130. Maximum annual subsidence rates based on subsidence zones in coastal Louisiana.

Map 2.131. Louisiana jurisdictional vulnerability for coastal land loss based on long-term subsidence rates.



Map 2.132. Louisiana state-owned property located within the major subsidence zones.

Map 2.133 shows the parishes within each vulnerability level based on the extent and rate of subsidence zones. The southern-most coastal Louisiana parishes have the greatest risk of ongoing coastal land loss (**High**) across most of each parish, while smaller spatial extents of Calcasieu, Ascension, Livingston, Tangipahoa, and St. Tammany Parishes are at risk of ongoing coastal land loss.

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Map 2.133. Vulnerability rating map for coastal land loss showing parishes with the highest risk in Louisiana.

POTENTIAL ECONOMIC LOSS

Since 1932, the average annual land loss in Louisiana is 35 mi^2, while the average annual land gain has been 3 mi^2 for a net change of -32 mi^2 per year. It is noted that erosion and land loss caused by hurricane storm surge account for a large percentage of total land loss and are the cause of many land loss peaks seen in Figure 2.7 below. The majority of land loss is currently occurring outside of populated areas in coastal marshes. While these marshes are extremely important, their loss does not directly affect the results of loss estimates to buildings using tools such as Hazus-MH, as building inventory is not located in these areas.

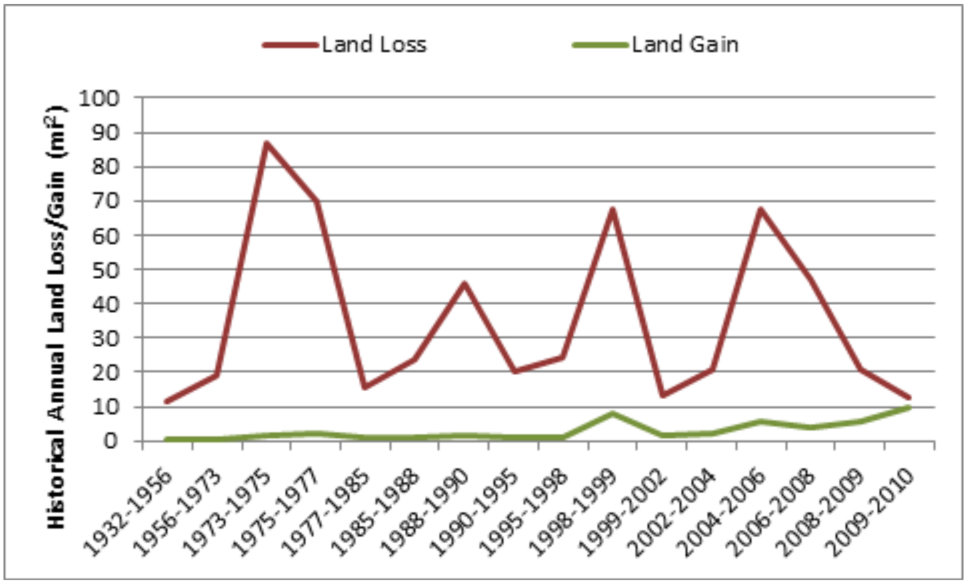

Figure 2.7. USGS historic land loss/land gain rates (annualized), 1932-2010.

Therefore, to conduct the economic loss assessment, two parameters were considered to estimate the projected increases in coastal flood losses from storm surge scenarios – global sea level rise and subsidence. A timeframe of 10 years was selected 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 entire coast of Louisiana. It should be noted that the MOM scenario is not designed to describe the storm surge that result from a particular event, but rather evaluates the impacts of multiple hurricane scenarios with varying forward speeds and storm track trajectories to truly create storm surge elevation surface that would occur given the simultaneous occurrence of all hurricane events for a given category. The economic loss assessment, therefore, is best used to describe the <u>increase</u> in expected coastal flood losses resulting from sea level rise and subsidence over 10 years, rather than to describe the estimated actual losses.

There are many global sea level rise scenarios from which to select; however, within a 10-year timeframe, methods that predict accelerating sea level rise rates do not deviate significantly from straight line methods. Therefore, a linear sea level rise projection for the sea level rise occurring in 10 years (SLR_{2024}) using a linear global sea level rise rate of 3.1 mm/year was selected (IPCC, 2007), which is also in accordance with the CPRA Coastal Master Plan. This resulted in an increase of 0.01 feet, which was applied to the NOAA MOM storm surge elevation results over the model output domain.

$$SLR_{2024} = 0.0031 \frac{mm}{year} x\ 10\ years$$
$$SLR_{2024} = 0.031\ meters = 0.10\ ft\ in\ 2024$$

To estimate the effects of subsidence, the elevation profile for southern Louisiana was separated into sections based on subsidence zones (see Map 2.131). The 20th percentile values for subsidence were used, in accordance with the CPRA Master Plan. The 20th percentile values for subsidence were then subtracted from the digital elevation model (DEM) for each zone and re-joined to create a final subsided ground elevation layer. To perform the economic loss assessment, depth grids were created for current conditions (SLOSH MOM Results—Current Land Elevation) and for projected 2024 conditions ([SLOSH MOM Results + 0.1 ft sea level rise]–[Current Land Elevation—Subsidence]). Hazus-MH was used to calculated economic loss for the current and future depth grids.

Table 2.48 shows the current and future exposure potential for high-risk parishes based on the Hazus-MH 2.1 inventory database. The entire parish was not considered as a whole, but rather each census block group was analyzed within the model. While parish-level estimates vary widely based on a number of factors, the overall projected increase in coastal flood losses from sea level rise and subsidence for a Saffir-Simpson Category 1 hurricane is 12%.

Table 2.48. Exposure data for the 20 at risk parishes for coastal land loss in Louisiana.

Exposure Data for Parishes with Highest Coastal Land Loss Risk				
Parish	Population (2010)	Current Conditions ($1,000)	Future (2024) ($1,000)	% Change (2024 vs. 2014)
Ascension	107,215	$147	$264	80%
Assumption	23,421	$36,483	$41,354	13%
Calcasieu	192,768	$21,241	$24,114	14%
Cameron	6,839	$150,211	$163,646	9%
Iberia	73,240	$94,780	$100,613	6%
Jefferson	432,552	$9,590,934	$10,599,915	11%
Lafourche	96,318	$301,398	$364,605	21%
Livingston	128,026	$1,907	$1,934	1%
Orleans	343,829	$7,489,485	$8,523,617	14%
Plaquemines	23,042	$469,040	$545,913	16%
St. Bernard	35,897	$98,224	$136,734	39%

Exposure Data for Parishes with Highest Coastal Land Loss Risk				
Parish	Population (2010)	Current Conditions ($1,000)	Future (2024) ($1,000)	% Change (2024 vs. 2014)
St. Charles	52,780	$183,449	$214,750	17%
St. James	22,102	$13	$110	746%
St. John the Baptist	45,924	$1,014	$1,446	43%
St. Martin	52,160	$25,843	$28,416	10%
St. Mary	54,650	$229,620	$252,844	10%
St. Tammany	233,740	$50,279	$51,185	2%
Tangipahoa	121,097	$0	$0	0%
Terrebonne	111,860	$583,804	$666,616	14%
Vermilion	57,999	$77,339	$84,512	9%
TOTALS	**2,215,459**	**$19,405,211**	**$21,802,588**	**12%**

Map 2.134 shows the projected changes over the next 10 years for each census block group with many areas expecting an increase in losses. It is also possible to see that some census block groups that are currently unaffected by a Category 1 hurricane will be impacted in 2024 based on subsidence and sea level rise projections (Map 2.135).

Of the parishes that have been and will continue to be impacted by coastal land loss, Jefferson and Orleans Parishes are the two most populated parishes and have the highest infrastructure dollar exposures within Louisiana. These parishes are considered to have the highest vulnerability to coastal land loss within the state.

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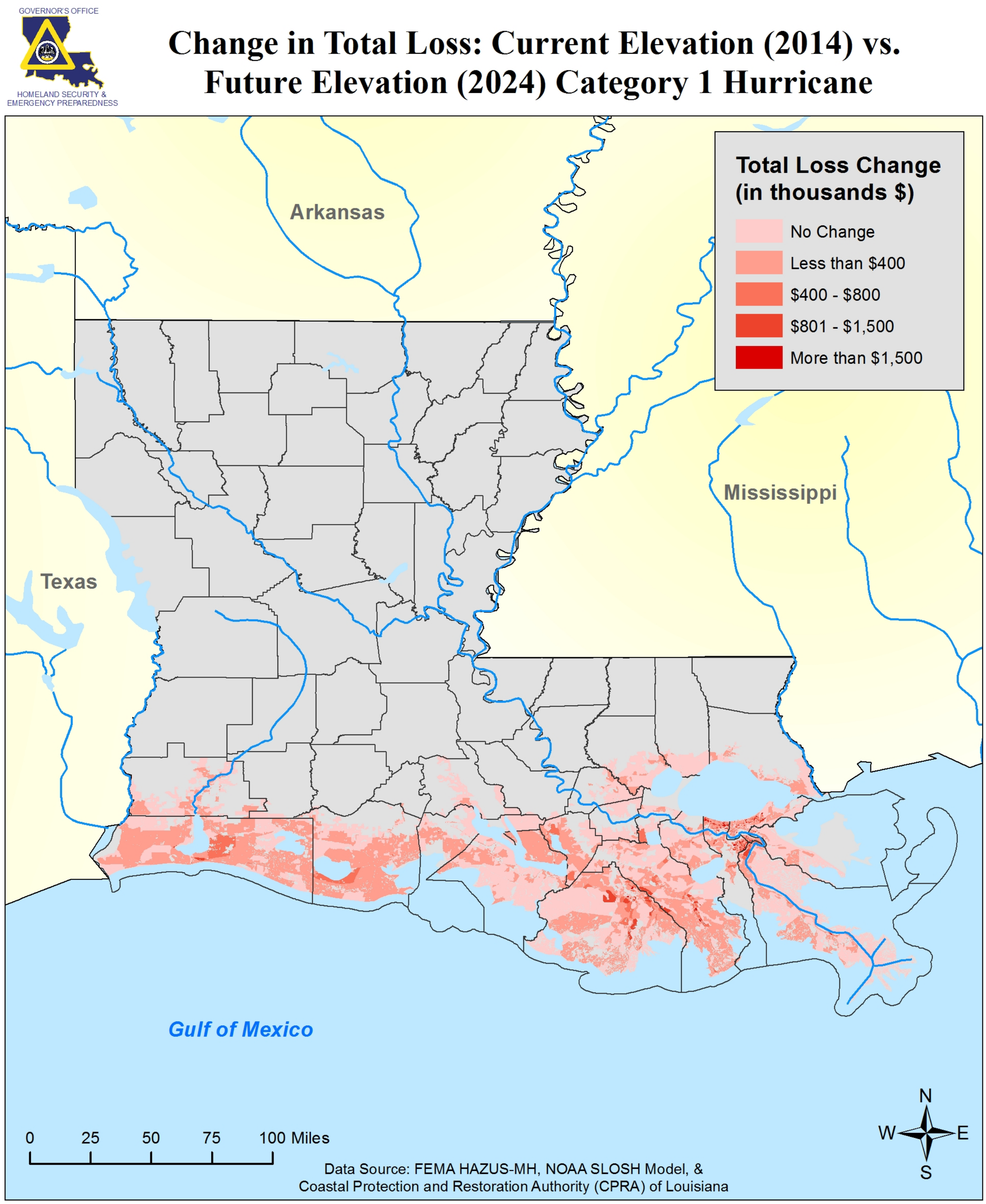

Map 2.134. Expected changes in loss estimates by census block group in 2024 based on the Hazus-MH flood model and NOAA SLOSH model.

Map 2.135. Census block groups that are currently not impacted by Category 1 hurricanes but expected to be impacted by the same category of hurricane in 2024 can be seen in red.

Based on the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to coastal land loss is listed in Table 2.49.

Table 2.49. Regional vulnerability to coastal land loss.

Regional Vulnerability to Coastal Land Loss	
Vulnerable Locations	Number of Records
Louisiana Parishes	20
Dams	119
Airports	47
Communication Towers/Facilities	208
Electricity Providers/Facilities	45
Emergency Response Centers	7
Fire Stations	308
Hospitals	96
Nuclear Plants	2
Police Stations	378
Elementary/Secondary Schools	1250
Universities/Colleges	7

To determine potential loss estimates for coastal land loss, increased exposure estimates over the next 10 years calculated using Hazus-MH were annualized (Map 2.136). As shown, parishes in southeast Louisiana and specifically the two parishes with the largest populations (Orleans and Jefferson) are predicted to have the highest potential annualized losses.

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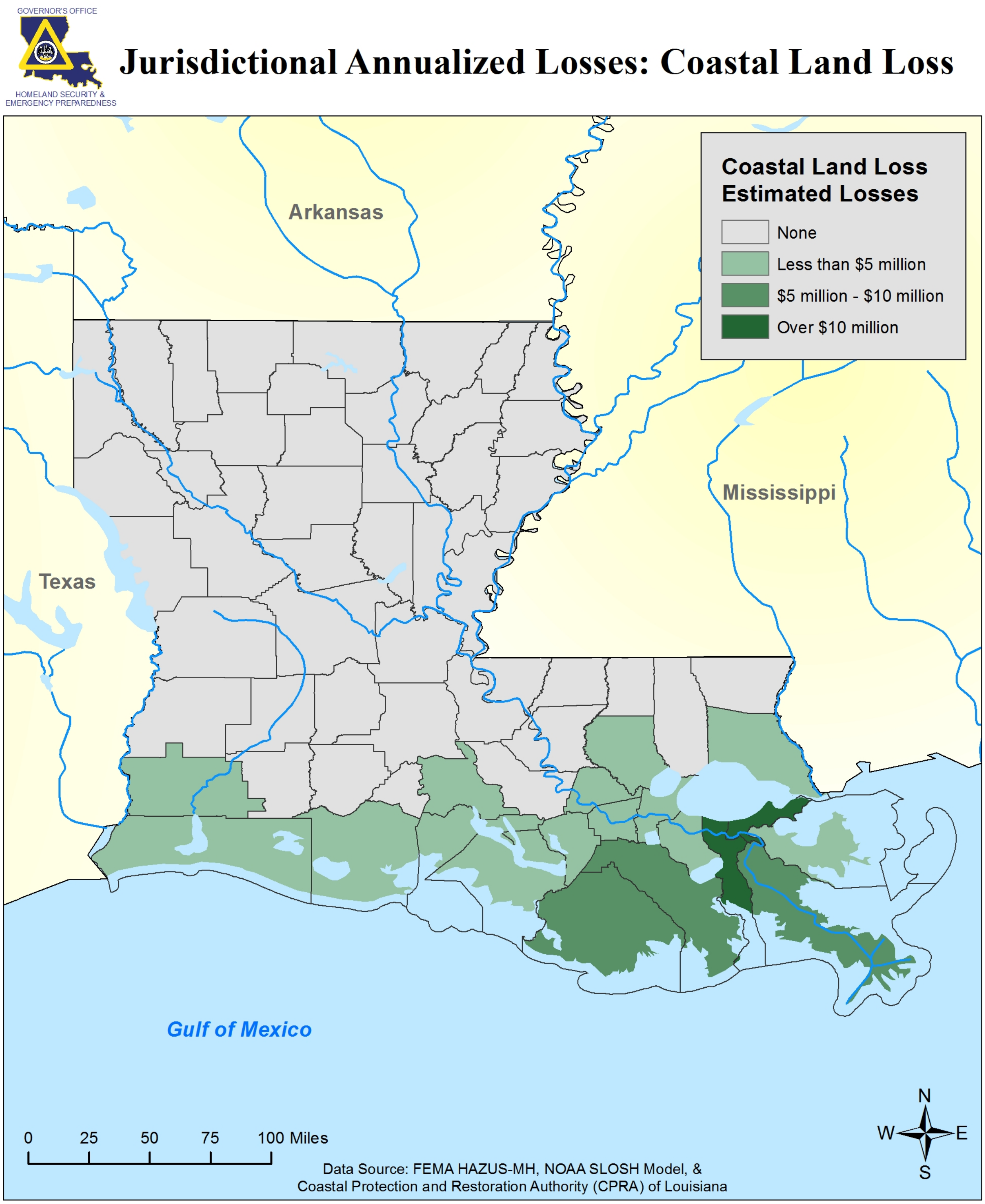

Map 2.136. Jurisdictional annualized loss due to coastal land loss.

All of coastal Louisiana can experience the impacts of coastal land loss, but certain areas are more vulnerable than others. Coastal land loss is relatively unpredictable, but subsidence rates have been quantified in specific areas (Map 2.131). Roads, bridges, utilities, and communications systems could be greatly impeded or become completely unusable, resulting in a high level of vulnerability in all High vulnerability parishes. Transportation and emergency response could be inhibited and utilities such as electricity, water, gas, sewer, and communications could be compromised over a long period of time. Buildings could collapse and, at a minimum, lose their structural integrity if they are within zones that have high rates of subsidence. Coastal land loss can impact all demographics and age groups. State, local, and federal facilities 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 and is already being discussed by communities that are at the highest risk for future coastal land loss. Some communities have lost most of their residents as their once dry land transitions to marsh and open water. Other critical facilities such as police, fire, and medical facilities could become unusable within a community impacted by coastal land loss.

Potential Losses by Jurisdiction

Overview & Analysis of Potential Losses: All jurisdictions in coastal Louisiana can suffer losses due to coastal land loss. Nevertheless, the southern-most and southeastern parishes of Louisiana are most vulnerable to the broadest spectrum of impacts from coastal land loss.

Changes in jurisdictional population levels impact each parish across the state disparately. In the parishes where coastal land loss vulnerability has increased because of increases in population (Ascension, Livingston, Tangipahoa, St. Tammany), concomitant changes in development have impacted loss estimates and will cause an increase in future losses (relative to what potential losses could be) due to increased levels of exposure. In the parishes where coastal land loss vulnerability has decreased because of decreases in population (Cameron, Orleans, Plaquemines, and St. Bernard), concomitant changes in development have impacted loss estimates and will cause a decrease in future losses (relative to what potential losses could be) due to decreased levels of exposure.

Potential Losses of State Facilities

The coastal land loss hazard vulnerability assessment of state-owned buildings was based on sea level rise, the occurrence and location of subsidence, the rate of subsidence in each zone, the extent of subsidence, and the annualized loss estimates. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.50.

Table 2.50. Coastal Land Loss Vulnerability Criteria and Ranking Results.

Coastal Land Loss Vulnerability Criteria and Ranking	
Ranking	Criteria
High	Subsidence: high rate, extent, & annualized loss
Medium	Subsidence: medium rate, extent, & annualized loss
Low	Subsidence: low rate, extent, & annualized loss

The coastal land loss economic loss estimate ranges are based on the expected future flooding losses in each parish resulting from a combination of subsidence and global sea level rise. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Subsidence Zones and Associated Rates
- Extent of Subsidence Relative to Parish Infrastructure

Table 2.51. Coastal Land Loss Economic Loss Estimate Ranges and Ranking Results.

Coastal Land Loss Economic Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$375,000 - $2 million	886
Medium	$187,500 - $375,000	203
Low	< $187,500	336
Very Low	$0	7,260

DAM FAILURE

Dams are water storage, control, or diversion barriers that impound water upstream in reservoirs. Dams are a vital part of our nation's infrastructure, providing drinking water, flood protection, renewable hydroelectric power, navigation, irrigation, and recreation. These critical daily benefits are also inextricably linked to the potential harmful consequences of a dam failure.

Dam failure is a collapse or breach in the structure. A dam failure can result in severe loss of life, economic disaster, and extensive environmental damage. While most dams have storage volumes small enough that failures have few repercussions, dams with large storage volumes can cause significant flooding downstream. Dam failures often have a rapid rate of onset, leaving little time for evacuation. The first signs of the failure may go unnoticed upon visual inspection of the dam structure. However, continual maintenance and inspection of dams often provide the opportunity to identify possible deficiencies in their early stages and can prevent a possible catastrophic failure event.[lxxvi]

The duration of the flooding event caused by the failure depends largely on the amount of water and downstream topography. Given smaller volumes of water and a topography suited for transporting the water rapidly downstream, the event may only last hours. Because of the lack of seasonality and other predictive factors, a predictive frequency or likelihood of dam failures cannot be determined. However, the National Dam Safety Program (NDSP) produces hazard rankings (high, significant, and low) and definitions of dam structures, based on potential impact.

Dam/reservoir failures can result from any one of or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross-section of the dam and abutments, or maintain gates, valves, and other operational components;
- Improper design, including the use of improper construction materials and construction practices;
- Negligent operation, including the failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion; and
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments that can weaken entire structures.

Louisiana has 147 USDA Natural Resources Conservation Service (NRCS)-assisted project dams built under the Small Watershed Protection Program and Flood Prevention Act authority. In Louisiana there are 548 dams managed by the Department of Transportation, Public Works & Water Resources Section as of March 2013. Map 2.137 shows dam locations per the Louisiana Department of Transportation and Development (LDOTD) inventory. The USACE National Inventory of Dams classifies dams as a “high hazard potential,” “significant hazard potential,” and “low hazard potential.” These categories are defined below.

- *High hazard potential* dams are dams where failure or improper operation will probably cause loss of human life.
- *Significant hazard potential* dams are those where failure or improper operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or other impacts. Dams classified as having “significant hazard potential” are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
- *Low hazard potential* dams are those where failure or improper operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner’s property.

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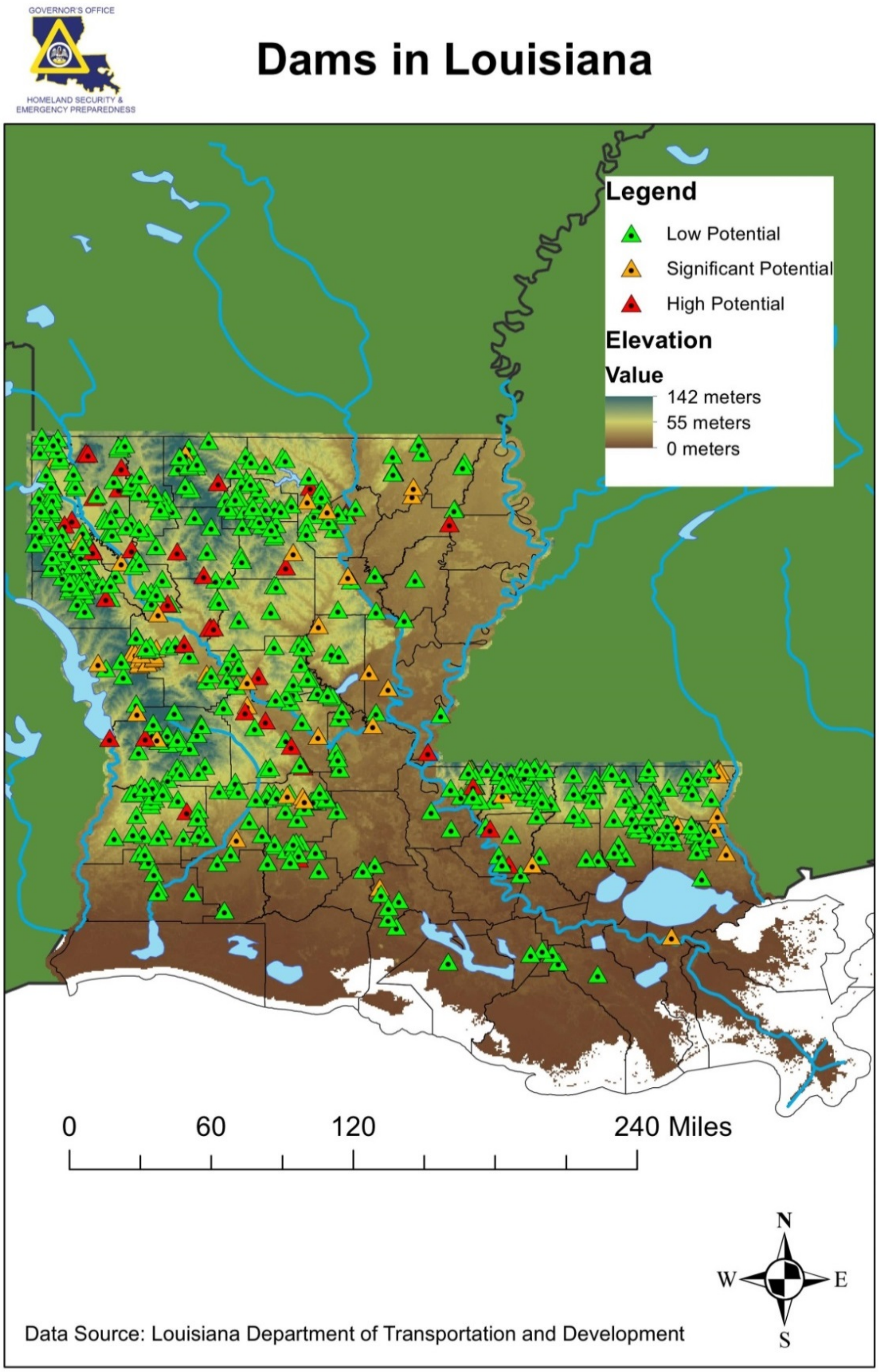

Map 2.137. Dam locations in Louisiana with respect to hazard potential (map by ETSU student Douglas Vance).

Most dams were built with a 50-yr life span. Louisiana has a number of dams that have reached their designed life span in the past few years, and more will reach their life span in the near future: 2013 (three dams), 2014 (two dams), and 2015 (one dam). Of the NRCS-assisted project dams in Louisiana, 7 dams are classified as having a high hazard potential, 26 as having a significant hazard potential, and 114 as having a low hazard potential. Twenty-eight of these dams will reach the end of their lifespan by 2017.[lxxvii] High-hazard potential dams are inspected by DOTD annually, and low-hazard potential dams are inspected every five years.

DAM FAILURE PROFILE

While there are no reports of significant dam failures in Louisiana, the National Performance of Dams Program, a database of dam incidents (events that affect the structural and functional integrity of dams, though not necessarily causing failure and not including ordinary maintenance and repair, vandalism, acts of war, recreational accidents, and sabotage) maintained by Stanford University, lists one incident from the autumn of 1985. Park managers at the Cotile Lake Dam/Reservoir in Rapides Parish reported seepage due to sand and gravel deposits that displaced concrete slabs. There was no dam failure or controlled breach reported in this incident.

In general, dam inspection by the LDOTD has very successfully mitigated against dam failure. For instance, upon inspection of their low hazard-potential earthen dams, owners have allowed controlled dewatering of their natural or manual impoundments in lieu of fixing the deficiencies noted during the periodic inspection. In the case of high water levels after Hurricane Isaac, high-water stress from the storm threatened the Percy Quin Dam (otherwise known as the Lake Tangipahoa Dam) near McComb, Mississippi, which led Tangipahoa Parish officials to order a mandatory evacuation of 60,000 people along the Tangipahoa River from Kentwood to Robert, Louisiana in case a dam failure caused flooding from the already swollen river.[lxxviii] Emergency crews were able to stabilize the dam, and evacuations ensured that had the dam failed, Tangipahoa residents would have been safe.[lxxix]

DAM FAILURE RISK ASSESSMENT

The future likelihood of dam failure is **Low**, but its impacts are devastating. Due to the high potential for significant personal injury and property damage for the state, this hazard will be carried forward for technical risk assessment. Map 2.138 shows the location density of dams by parish, while Map 2.139 provides an estimation of building loss due to dam failure. Map 2.140 indicates which populations are located near dams posing high or significant danger. Bossier, Grant, and St. Tammany Parishes contain multiple significant and/or high hazard dams and are at high risk to dam failure. These parishes have also experienced significant population increases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to dam failure has increased. Orleans Parish contains a significant hazard dam and is at high risk to dam failure, but it has experienced a significant population decrease of more than 20% since 2000 (see Map 2.3). As a result, the vulnerability of Orleans Parish to dam failure has decreased.

Map 2.141 reveals the top 10 repetitive paid claims (for any hazard) located near potentially dangerous dams. State-owned critical facilities located in areas affected by dam failure are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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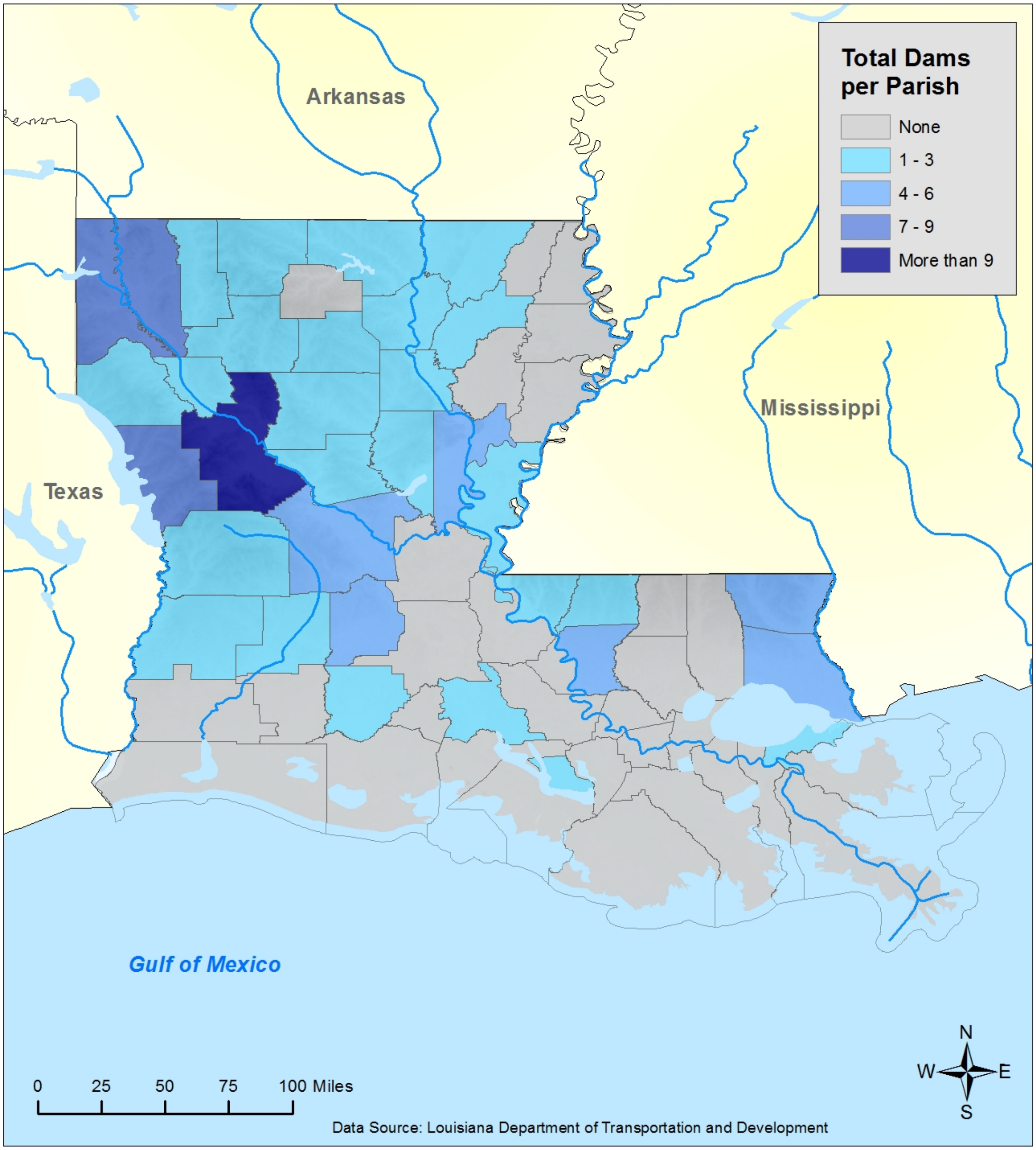
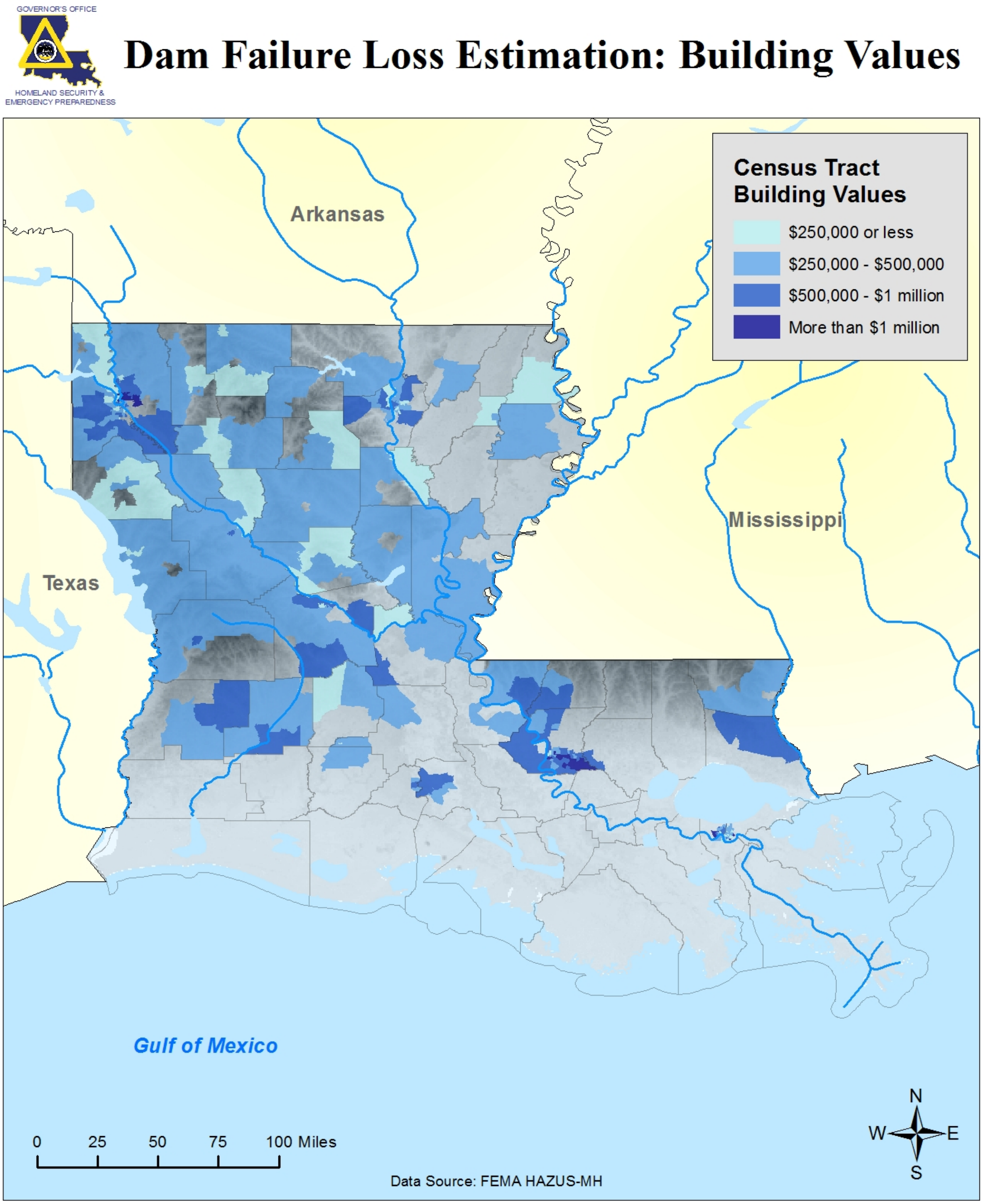
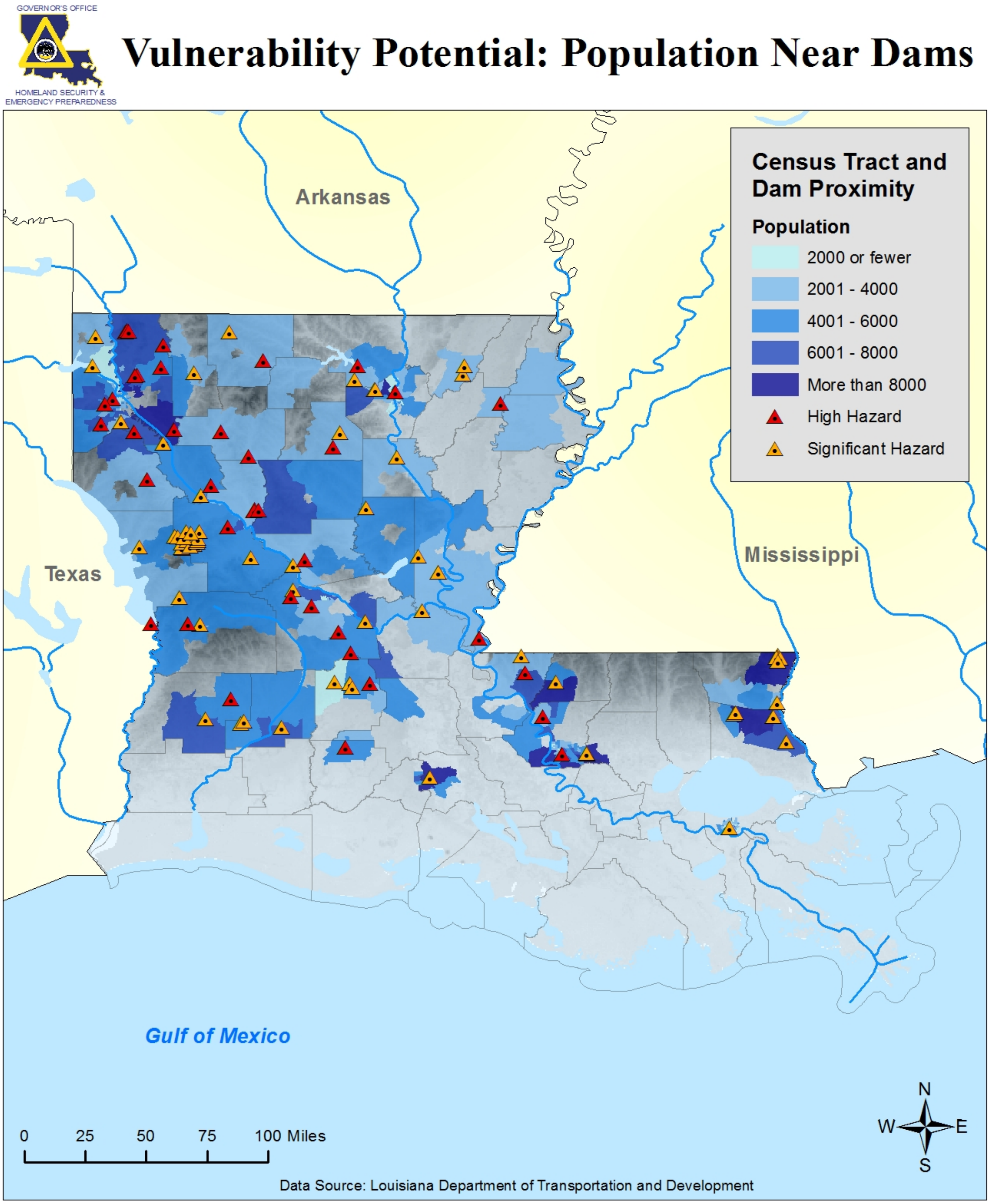
Jurisdictional Vulnerability: Dam Locations



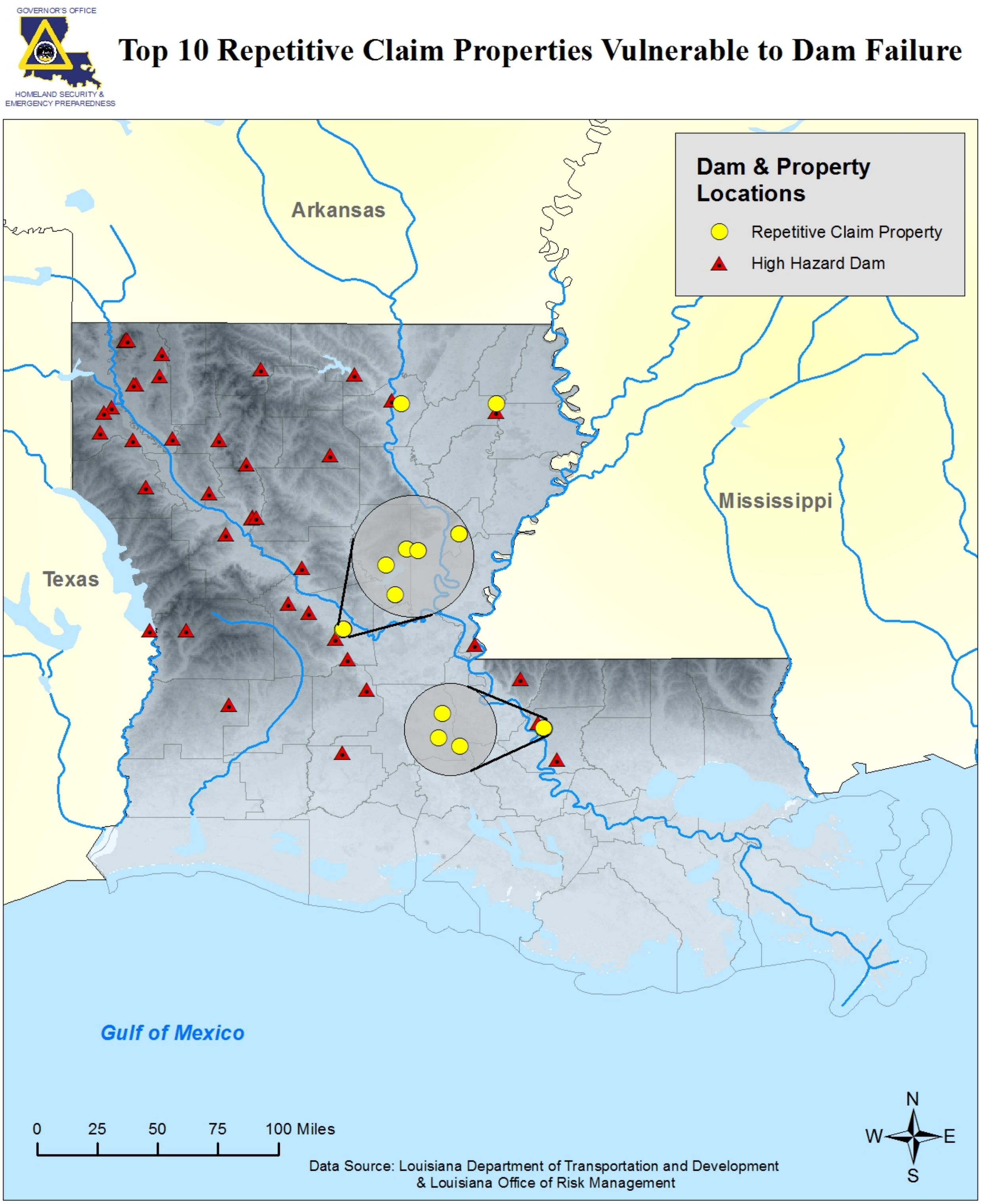
Map 2.138. Total number of dams in Louisiana by parish.



Map 2.139. Estimation of building damage in Louisiana by dam failure.



Map 2.140. Dam locations posing high or significant hazard to jurisdictional populations in Louisiana.



Map 2.141. Top 10 repetitive claim properties in relation to high hazard dams.

Based on the data presented in the preceding maps, Map 2.142 clarifies the jurisdictions most vulnerable to dam failure

Due to insufficient data, annualized losses for parishes are not available, but Map 2.139 illustrates the potential loss to specific census tracts that contain dams.

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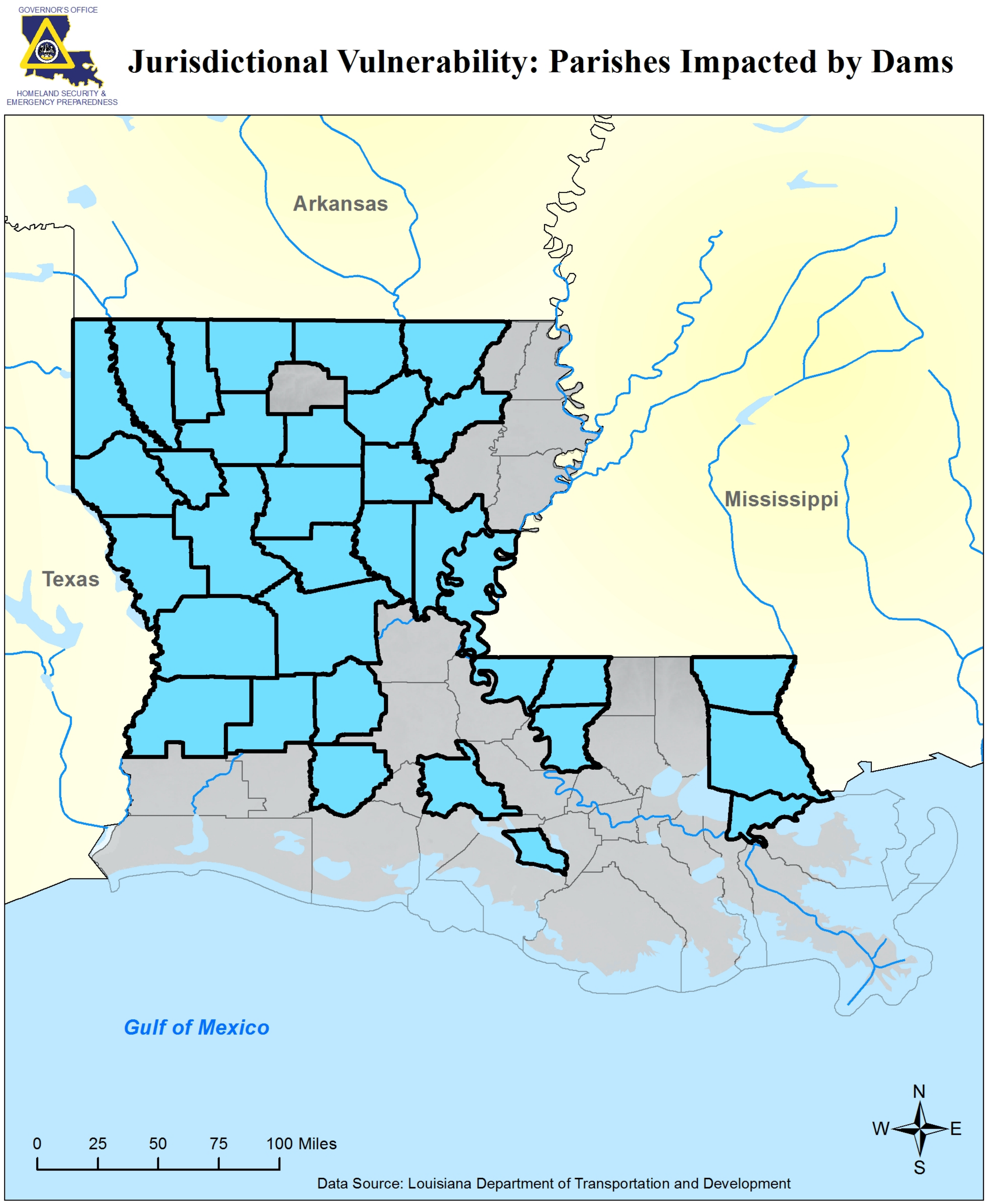

Map 2.142. Parishes impacted by dams.

Table 2.52 provides data on the risk posed to buildings and populations based on location to significant or high hazard dams, and Table 2.53 lists the top 10 paid claims (for any hazard) of state assets near high hazard dams.

Table 2.52. Statewide dam vulnerability based on proximity to dams of significant or high hazard (source: Hazus-MH).

LOUISIANA DAM VULNERABILITY			
Total Population	Population at Risk	Number of Buildings at Risk	Value of Buildings at Risk
4,533,372	1,413,219	602,083	$164,482,658

Table 2.53. Top 10 paid claims (of any hazard type) located within 5 miles of a high hazard dam (source: Louisiana Office of Risk Management).

TOP 10 PAID CLAIMS FOR STATE ASSETS NEAR HIGH-HAZARD DAMS				
Building ID	Building Name	Location	Net Paid	Total Number of Claims (All Hazards)
S02340	L. Jetson Correctional Center A	Baton Rouge	$789,817	2
S10461	LSU-Alexandria – General Operations A	Alexandria	$12,812	4
S12811	LSU-Alexandria – General Operations B	Alexandria	$3,600	2
L15257	LSU-Alexandria – The Oaks Apartments	Alexandria	$2,480	2
S10476	LSU-Dean Lee Agriculture Center Farm Supervisor Residence	Alexandria	$2,392	2
S08893	University of Louisiana-Monroe Baseball Field	Monroe	$2,021	2
S13309	L. Jetson Correctional Center B	Baton Rouge	$1,556	2
S10478	LSU-Dean Lee Agriculture Center Animal Science Residence	Alexandria	$1,322	2
S02337	L. Jetson Correctional Center C	Baton Rouge	$1,315	2
S13637	Poverty Point Reservoir	Delhi	$1,255	1

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: Areas at risk for dam failure are very specific in nature and are generally located within 3-5 miles downstream. Dams are located in many parts of the state, but parishes of central and northern Louisiana are most vulnerable. Two parishes (St. Tammany and Washington) in southeast Louisiana are also vulnerable to dam failure.

Changes in jurisdictional population levels impact each parish across the state disparately. Changes in development may greatly impact loss estimation associated with dam failure. Downstream building regulations do not need to be compliant with the NFIP as long as development is not below the BFE. This allows for development that could be in harm's way during a dam failure. In the parishes where dam failure vulnerability has increased because of increases in population (Bossier, Grant, and St. Tammany), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In Orleans Parish, where dam failure vulnerability has decreased because of a decrease in population, concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The dam failure hazard vulnerability assessment of state-owned facilities was based on the potential inundation from dam failure. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned critical facilities are shown in Table 2.54.

Table 2.54. Dam Failure Vulnerability Criteria and Ranking Results.

DAM FAILURE VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Structures within dam failure areas
Medium	Structures outside dam failure hazard radius, but within same census tract
Low	Not within radius/census tract or insufficient data available

The dam failure loss estimate of state-owned buildings in Louisiana involved an analysis of the following parameters.

- Dam Failure Hazard Vulnerability
- Average Inundation Depth
- Average Building Type
- Inundation Depth-Damage Functions

Table 2.55. Dam Failure Loss Estimate Ranges and Ranking Results.

DAM FAILURE LOSS ESTIMATE RANGES AND RANKING		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$1,000,001 to $70,000,000	153
Medium	< $1,000,000	6526
Low	$0	2006

Earthquake

An earthquake is a sudden motion or trembling of the Earth caused by an abrupt release of stored energy in the rocks beneath the Earth's surface. The energy released results in vibrations which are known as seismic waves. Ground motion from seismic waves is expressed as peak ground acceleration (PGA), the fastest measured change in speed for a particle at ground level that is moving because of an earthquake. PGA is commonly measured as a percentage of acceleration due to Earth's gravity (%g). This measurement is relied on to determine seismic load engineering design and construction requirements.

Earthquakes are typically described in terms of magnitude and intensity. Magnitude is the measure of the amplitude of the seismic wave and is often expressed by the Richter scale, and intensity is a measure of how strong the shock was felt at a particular location, indexed by the Modified Mercalli Intensity (MMI) scale. The Richter scale is a logarithmic measurement whereby an increase in the scale by one whole number represents a tenfold increase in measured ground motion of the earthquake (and an increase in energy released of more than 30 times). An increase by two whole numbers represents a 10^2 (or 100-fold) increase in ground motion, and thus more than 30^2 (or 900) times the energy released. Table 2.56 shows the rough correlation between the Richter scale, PGA, and the MMI. The relationship between these is approximate and depends upon such specifics as the depth of the focus (the location of the actual rock movement) and distance from the epicenter (the location on the Earth's surface above the earthquake focus) of the earthquake.

The system of subsidence faults in southern Louisiana developed due to accelerated land subsidence and rapid sediment deposition from the Mississippi River. The system stretches across the southern portion of the state from Beauregard Parish in the west to St. Tammany Parish in the east and it includes every parish south of this line. This system is thought to be responsible for many of the recorded earthquakes from 1843 to the present. All of the earthquakes that occurred over this period of time were of low magnitude, resulting mostly in limited property damage (such as broken windows, damaged chimneys, and cracked plaster). While faults throughout the northwestern parishes are thought to be inactive, the New Madrid seismic zone lies just to the north of Louisiana and originates in the region of New Madrid, Missouri. The magnitude of historic earthquakes originating in the New Madrid seismic zone is far greater than that generated by the subsidence fault system in coastal Louisiana. A significant seismic event from the New Madrid seismic zone is more likely to have a greater impact on Louisiana than a seismic event from the subsidence fault system.

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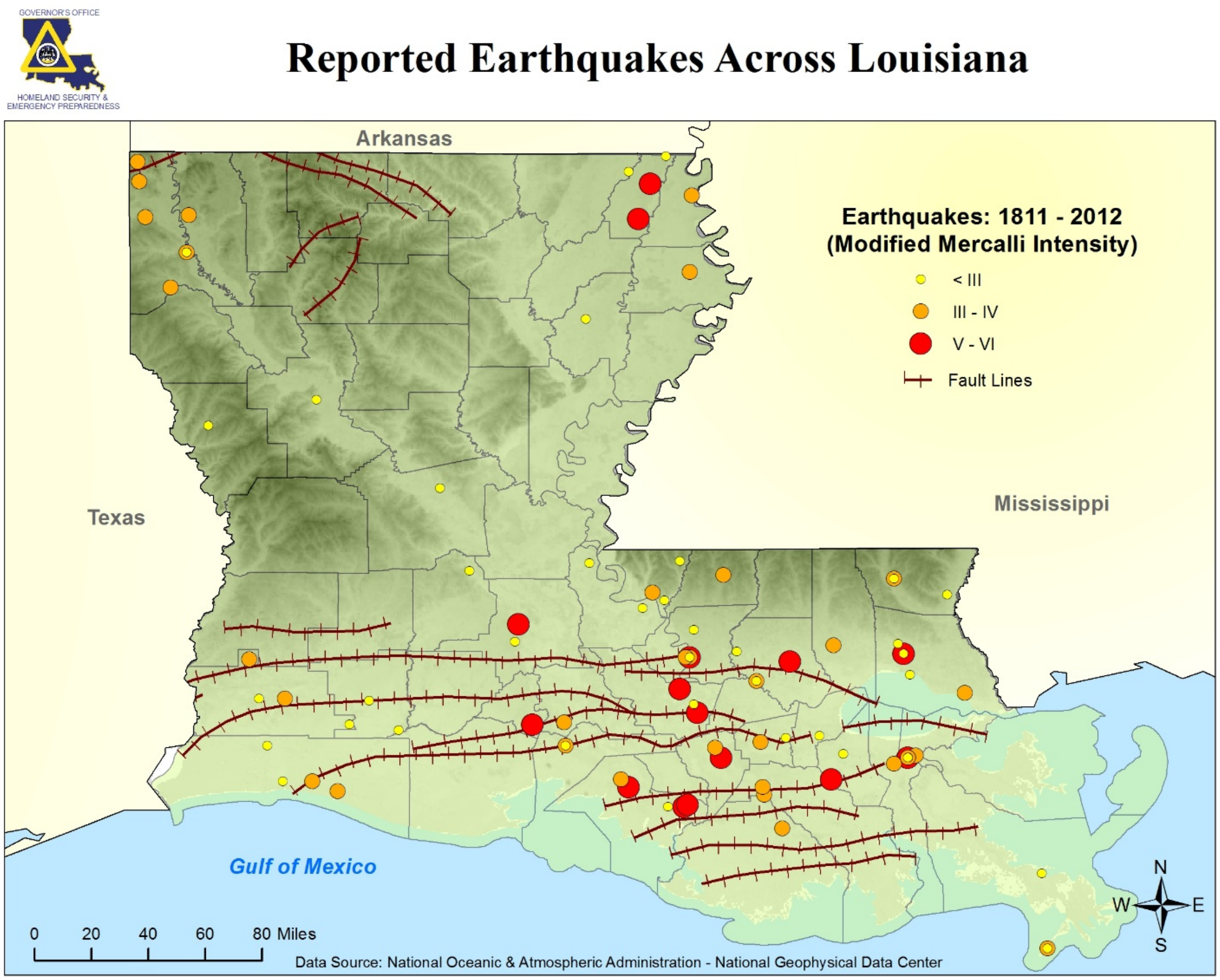
Table 2.56. Comparison of earthquake magnitudes for PGA, Richter, and MMI (source: USGS Earthquake Hazards Program).

Comparison of Earthquake Metrics			
PGA (%g)	Magnitude (Richter)	Intensity (MMI)	Description (MMI)
<0.17	1.0 - 3.0	I	**I**. Not felt except by a very few under especially favorable conditions.
0.17 - 1.4	3.0 - 3.9	II - III	**II**. Felt only by a few persons at rest, especially on upper floors of buildings. **III**. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
1.4 - 9.2	4.0 - 4.9	IV - V	**IV**. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motorcars rock noticeably. **V**. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
9.2 - 34	5.0 - 5.9	VI - VII	**VI**. Felt by all. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. **VII**. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
34 - 124	6.0 - 6.9	VII - IX	**VIII**. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. **IX**. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
>124	7.0 and higher	**VIII** or higher	**X**. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. **XI**. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. **XII**. Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Earthquake Profile

A number of earthquakes have occurred over the past two hundred years in the state, 47 of which were recorded by USGS (see Map 2.143 for geographic location of reported earthquakes in Louisiana). However, most were very minor. The two most significant historic earthquakes were the New Madrid earthquakes (1811–1812) and the 1930 earthquake in Donaldsonville in southern Louisiana, the latter of which measured 4.2 on the Richter scale.



Map 2.143. Reported earthquakes in Louisiana 1811 to 2012.

The New Madrid earthquakes were among the largest earthquake events ever to occur in the United States. Occurring near New Madrid, Missouri, from December 16, 1811 to February 7, 1812, a number of earthquakes originated in this region, with the three strongest earthquakes thought to have magnitudes between 8.4 and 8.7 on the Richter scale. The strongest tremors were felt from New Orleans to Quebec, and the course of the Mississippi River was permanently changed. Aftershocks were felt for more than five years after the initial series of earthquakes.

The largest recorded earthquake event originating in Louisiana occurred in Donaldsonville on October 19, 1930. The earthquake was felt over a 1,500-mi^2 area of southeastern Louisiana. The towns that suffered the most damage were Donaldsonville, Gonzales, Napoleonville, and White

Castle. There were reports of damaged brick chimneys, broken windows and overturned small objects. Other towns affected were Morgan City, Franklin, Elemans, Berwick, and Plaquemine, each reporting doors and windows rattling, houses creaking, and hanging objects swinging.

Based on historic events, the most severe earthquakes in the state are likely to occur to the very north (near the Arkansas–Mississippi border), originating from the New Madrid seismic zone, and to the south (near the coast) from the subsidence fault system. Nevertheless, the USGS has recorded only five minor earthquakes in Louisiana in the past 25 years (see Table 2.57 for information on those earthquakes). Historically, earthquakes have caused minimal damage.

Table 2.57. Information on five most recent earthquake events (source: USGS Earthquake Hazards Program).

Recent Recorded Earthquakes in Louisiana						
Event # (since 1843)	Date	Latitude	Longitude	Depth (miles) to Focus	Richter Magnitude	Nearest Parish
43	6/10/1994	33.01°	-92.67°	3.1	3.2	Union
44	3/3/2001	33.19°	-92.66°	3.1	3.0	Union
45	12/17/2001	33.2°	-92.7°	6.2	2.8	Union
46	12/20/2005	30.26°	-90.71°	3.1	3.0	Livingston
47	5/16/2007	33.3°	-92.59°	3.1	3.0	Union

Based on previous occurrences, the probability of future likelihood of earthquakes is **Low**. Based on the results of the hazard profiling for this plan update, earthquakes are not considered significant by the SHMPC in comparison to the other profiled hazards. Therefore, a technical risk assessment is not included.

Levee Failure

Levees and floodwalls are flood control barriers constructed of earth, concrete, or other materials. For the purposes of this plan, levees are distinguished from smaller flood barriers (such as berms) by their size and extent. Berms are barriers that only protect a small number of structures, or at times only a single structure. Levees and floodwalls are barriers that protect significant areas of residential, commercial, or industrial development; at a minimum, they protect a neighborhood or small community.

Levee failure involves the overtopping, breach, or collapse of the levee. Levee failure is especially destructive to nearby development during flood and hurricane events. The northern half of Louisiana is protected by levees on the Ouachita River, under the authority of the Vicksburg District of the United States Army Corp of Engineers (USACE). The Vicksburg District encompasses 68,000 mi^2 in the States of Arkansas, Mississippi and Louisiana. They manage seven drainage basins, including the Yazoo, Pearl, Big Black, Red, Ouachita, and Mississippi Rivers; 12 locks and dams on the Pearl, Red, and Ouachita rivers; 1,808 mi. of levees, including 468 along the Mississippi River; and multiple lakes with 1,709 mi. of shoreline. Map 2.144 illustrates the leveed areas in the Vicksburg and New Orleans Districts.

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

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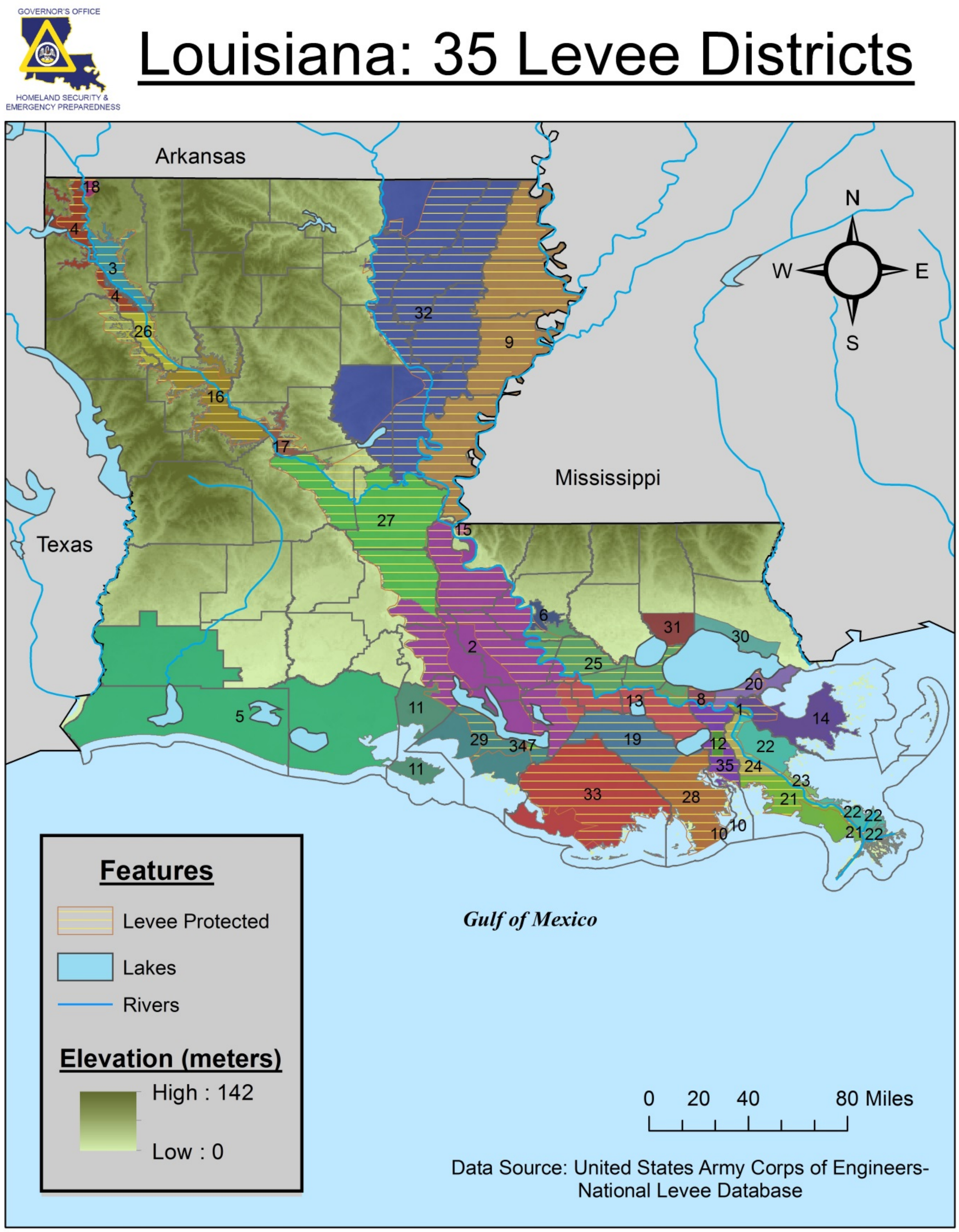
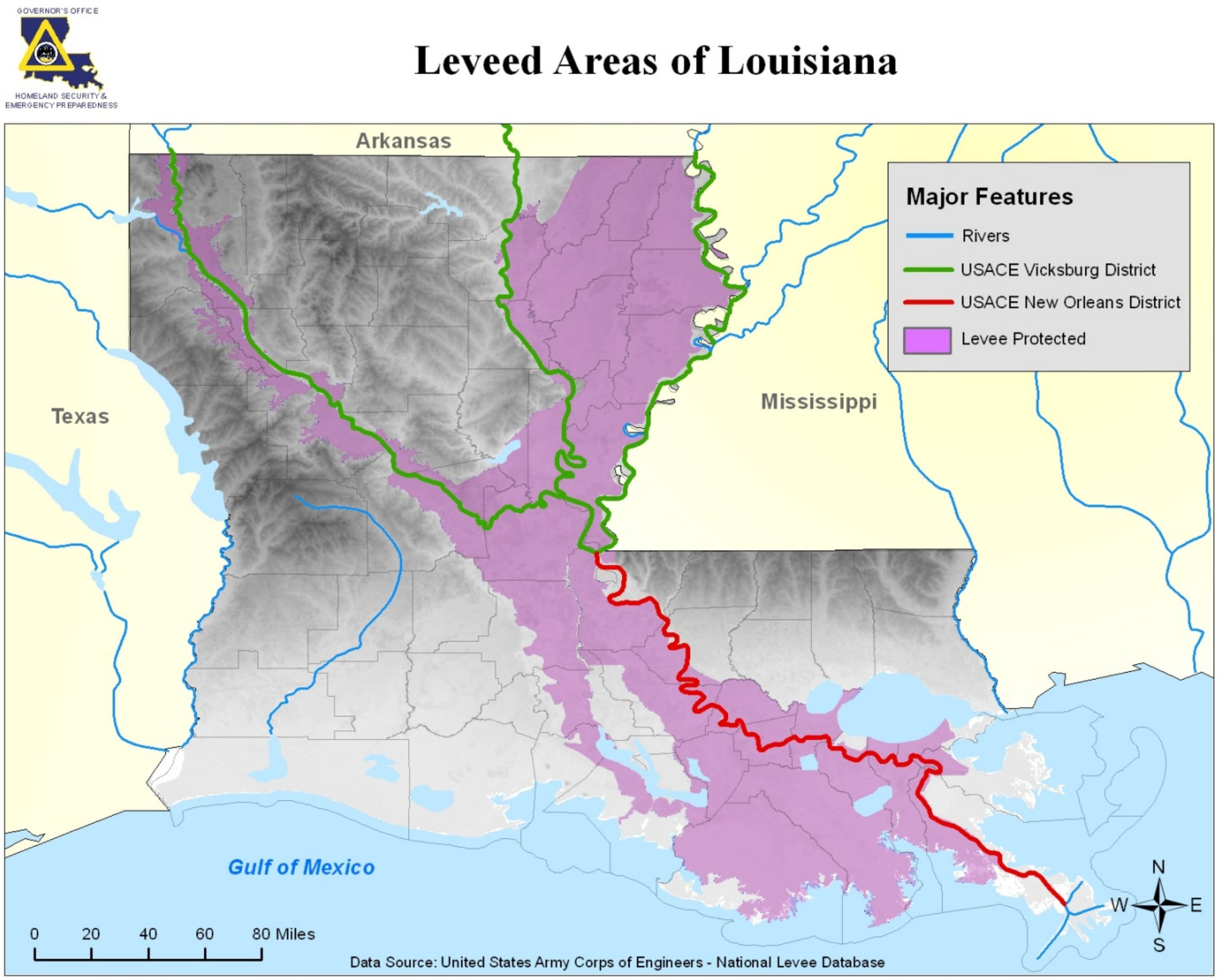


Map 2.144. Location of USACE levee districts of Louisiana (map by ETSU student Hannah Miltier).

Table 2.58 indexes the names of the numbered levee districts shown in Map 2.144, while Map 2.145 shows the levee-protected areas under the jurisdiction of the USACE Vicksburg and New Orleans Districts.

Table 2.58. Levee-protected areas under jurisdiction of USACE Vicksburg and New Orleans Districts.

Levee Districts in Louisiana	
1	Algiers Levee District
2	Atchafalaya Basin Levee District
3	Bossier Levee District
4	Caddo Levee District
5	Chenier Plain Coastal Restoration and Protection Authority
6	City of Baton Rouge
7	City of Morgan City
8	East Jefferson Levee District
9	Fifth Louisiana Levee District
10	Grand Isle Independent Levee District
11	Iberia Parish Levee, Hurricane Protection, and Conservation District
12	Lafitte Area Independent Levee District
13	Lafourche Basin Levee District
14	Lake Borgne Basin Levee District
15	Louisiana State Penitentiary
16	Natchitoches Levee and Drainage District
17	Nineteenth Louisiana Levee District
18	North Bossier Levee and Drainage District
19	North Lafourche Conservation, Levee, and Drainage District
20	Orleans Levee District
21	Plaquemines Parish (Buras Levee District)
22	Plaquemines Parish (Grand Prairie Levee District)
23	Plaquemines Parish (Orleans Levee District)
24	Plaquemines Parish (West Plaquemines Levee District)
25	Pontchartrain Levee District
26	Red River Levee and Drainage District
27	Red River, Atchafalaya, and Bayou Boeuf Levee District
28	South Lafourche Levee District
29	St. Mary Levee District
30	St. Tammany Levee District
31	Tangipahoa Levee District
32	Tensas Basin Levee District
33	Terrebonne Levee and Conservation District
34	Town of Berwick
35	West Jefferson Levee District



Map 2.145. Levee-protected areas under the jurisdiction of the USACE Vicksburg and New Orleans Districts.

Levee Failure Profile and Risk Assessment

Levees have been overtopped or breached during flood events and non-flood events. In 1985, a section of levee along the Mississippi River near Marrero failed due to scour in a non-flood-related event. The causes of this failure included scouring and erosion of sand from the toe of the river bank, which created an over-steepened slope and resultant instability of the upper bank. Severe scour at the toe resulted as the channel bottom deepened through the sandy substratum. Flow failure in the sands then led to loss of the upper bank. Thus, the location of the failure was controlled by the nature of the geologic deposits beneath the levee combined with progressive deepening of the river channel at that location.

Several sections along Lake Pontchartrain and along both navigation and drainage canals failed in New Orleans during Hurricane Katrina. The extent and depth of these levee failures resulting from Hurricane Katrina caused extreme flooding in New Orleans.

As storm surges breached the low-lying levees along navigation canals, including the Mississippi River Gulf Outlet (which connects the city directly to the Gulf), the first levee failures occurred in St. Bernard Parish. Another breach occurred along the 17th Street Canal, separating Orleans and Jefferson Parishes, while more failures occurred at the London Avenue Canal and the Internal Canal. Ultimately, these failures left 80% of the city under water.

In the end, though, it was simply pressure failures within the bodies of the levees that led to failure. The piling reinforcements that extended into the subsurface to provide more support often did not extend in deep enough. Indeed, the effects of subsidence will continue to contribute to that reinforcement vulnerability.

Besides the failure of the levee system in design and maintenance, likely the biggest contributor to the flooding of the city was the construction of the Mississippi River Gulf Outlet (MRGO). The 600-ft-wide canal channeled surge waters directly into the city from the Gulf, leading to about 20 percent higher-than-normal water levels. The MRGO also directed waters to populated regions 100–200% faster than the natural landscape would have allowed.

Areas of Bossier, Grant, West Baton Rouge, Ascension, Livingston, and Tangipahoa Parishes are protected by levees and are consequently at high risk (greater than 2.0 composite risk score) to levee failure. These parishes have also experienced significant population increases of more than 10% since 2000 with Ascension and Livingston Parishes experiencing greater than 20% increases in population (see Map 2.3). As a result, the vulnerability of these parishes to levee failure has increased. Areas of East Carroll, Madison, Tensas, Orleans, St. Bernard, and Plaquemines Parishes are protected by levees and are consequently at a high risk to levee failure. These parishes, however, have experienced significant population decreases of more than 10% since 2000 with Orleans and St. Bernard Parishes experiencing greater than 20% decreases in population (see Map 2.3). As a result, the vulnerability of these parishes to levee failure has decreased.

In any case, there have been no levee failures since Katrina. Although the likelihood of future occurrence for this hazard is **Low**, due to the high potential for significant personal injury and property damage for the state due to its occurrence, this hazard will be included in the Risk Assessments. Based on the data presented in Map 2.145, Map 2.146 clarifies the jurisdictions most vulnerable to levee failure.

Due to insufficient data, annualized losses for parishes are not available, but Map 2.147 (further below) illustrates the potential loss to specific census tracts that contain levees.

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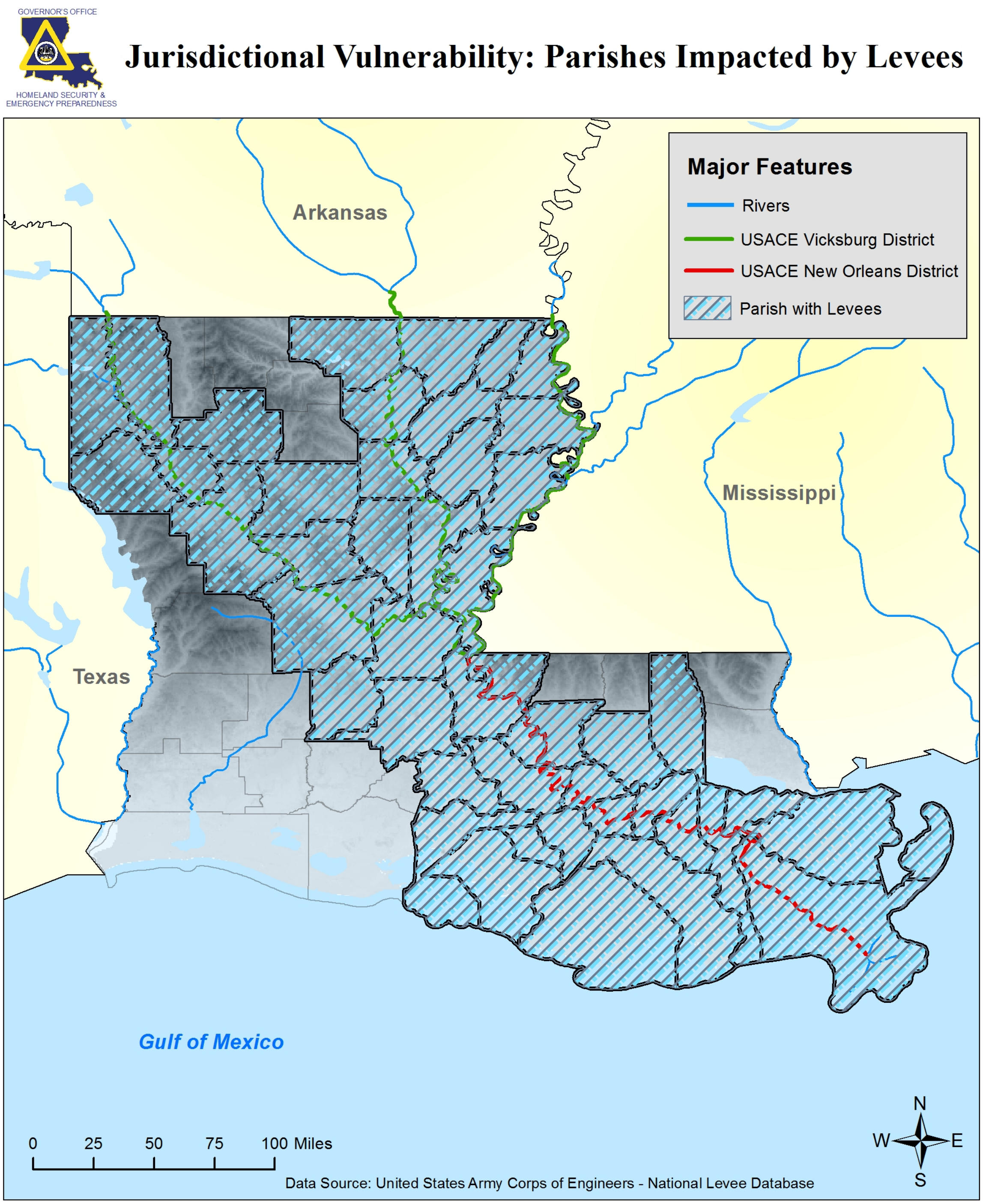

Map 2.146. Parishes impacted by levees, divided by levee-district lines.

POTENTIAL ECONOMIC LOSS

Table 2.59 provides data based on the recent census to indicate population and building vulnerability in leveed areas of Louisiana, while Maps 2.147 and 2.148 provide these data at the census tract levels. State-owned critical facilities located in areas affected by levee failure are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

Table 2.59. Population and building vulnerability in leveed areas based on census data.

Population and Building Vulnerability in Leveed Areas			
Total Population	Population at Risk	Number of Buildings at Risk	Value of Buildings at Risk
4,533,372	2,596,766	1,044,883	$289,419,758

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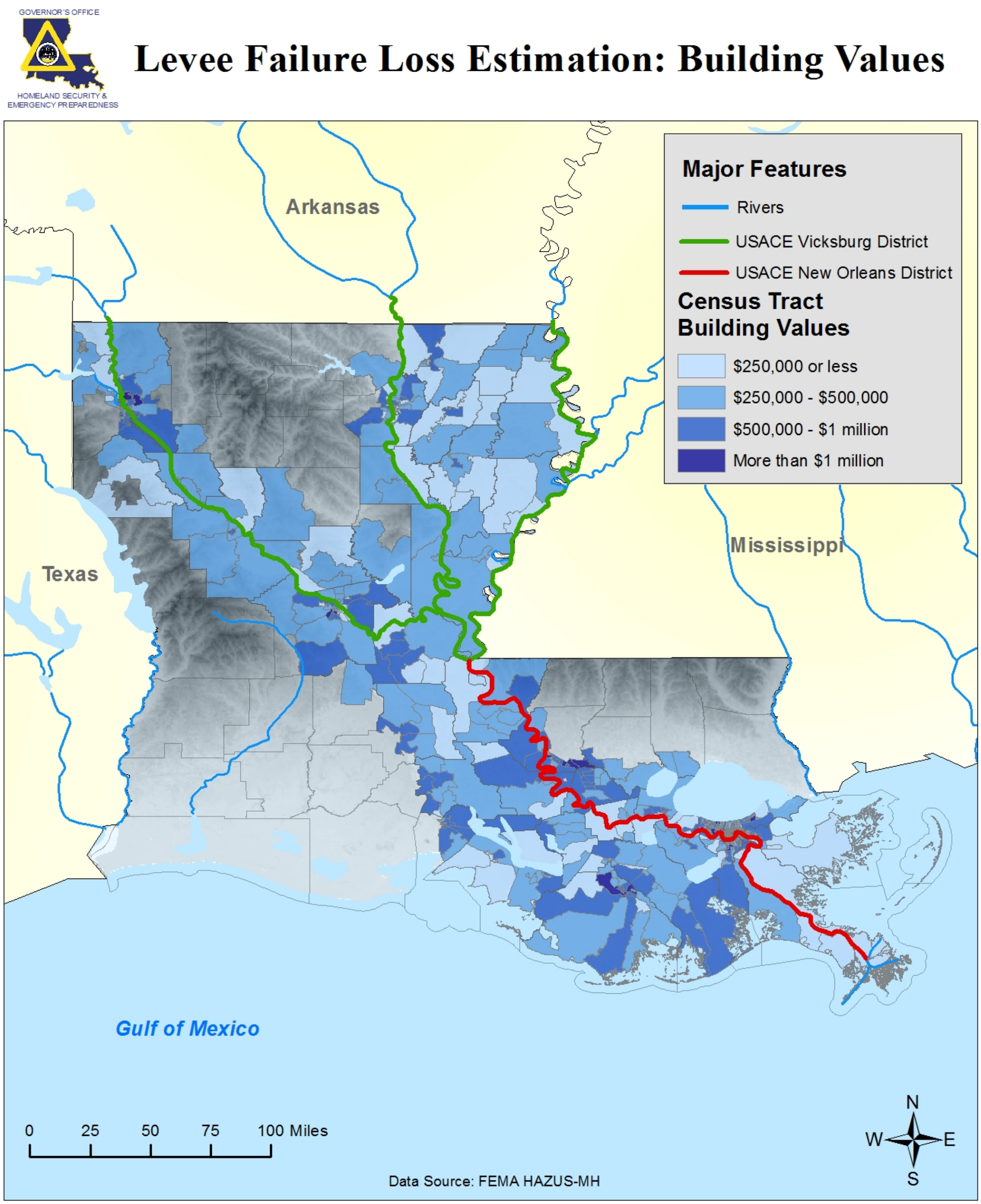
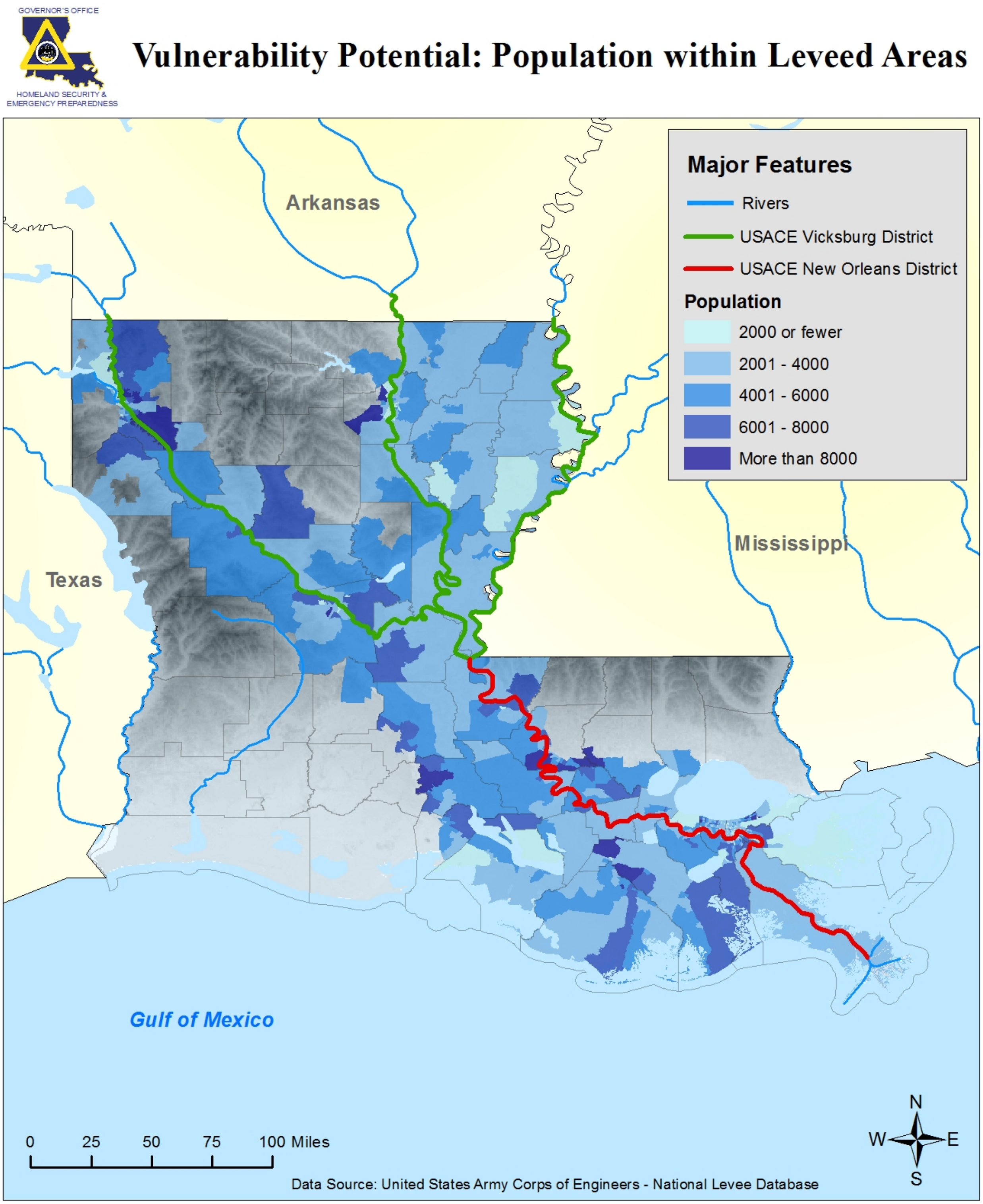


Map 2.147. Estimation of building losses due to levee failure.



Map 2.148. Vulnerable populations located within leveed areas.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: Half of the state's population is vulnerable to levee failure. Entire cities are either partially or fully-protected by a levee system – most notably the major cities along the Red River, Ouachita River, and Mississippi River including Shreveport, Bossier City, Alexandria, Pineville, Baton Rouge, Monroe, and New Orleans. Levee failure represents a potentially catastrophic loss for many parts of Louisiana and vast quantities of infrastructure are vulnerable.

Changes in jurisdictional population levels impact each parish across the state disparately. Changes in development may greatly impact loss estimation associated with levee failure. In the parishes where levee failure vulnerability has increased because of increases in population (Bossier, Grant, West Baton Rouge, Ascension, Livingston, and Tangipahoa), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. When a large amount of development occurs within a leveed area (as in Baton Rouge and New Orleans), these new developments are highly vulnerable to levee failure. Lack of regulations within leveed areas allows for development that could be in harm's way during a levee failure and is representative of the false sense of security that levees provide. In the parishes where levee failure vulnerability has decreased because of decreases in population (East Carroll, Madison, Tensas, Orleans, St. Bernard, and Plaquemines), concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The levee failure hazard vulnerability assessment of state-owned facilities was based on the potential inundation from levee failure. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned critical facilities are shown in Table 2.60.

Table 2.60. Levee Failure Vulnerability Criteria and Ranking Results.

LEVEE FAILURE VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Structures within levee protection zones
Medium	Structures outside of the levee protection zones, but within same census tract
Low	Not within zone/census tract or insufficient data available

The levee failure loss estimate of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Levee Failure Hazard Vulnerability
- Average Inundation Depth
- Average Building Type
- Inundation Depth-Damage Functions

Table 2.61. Levee Failure Loss Estimate Ranges and Ranking Results.

Levee Failure Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$100,001 to $215,000,000	2903
Medium	<$100,000	3626
Low	$0	2156

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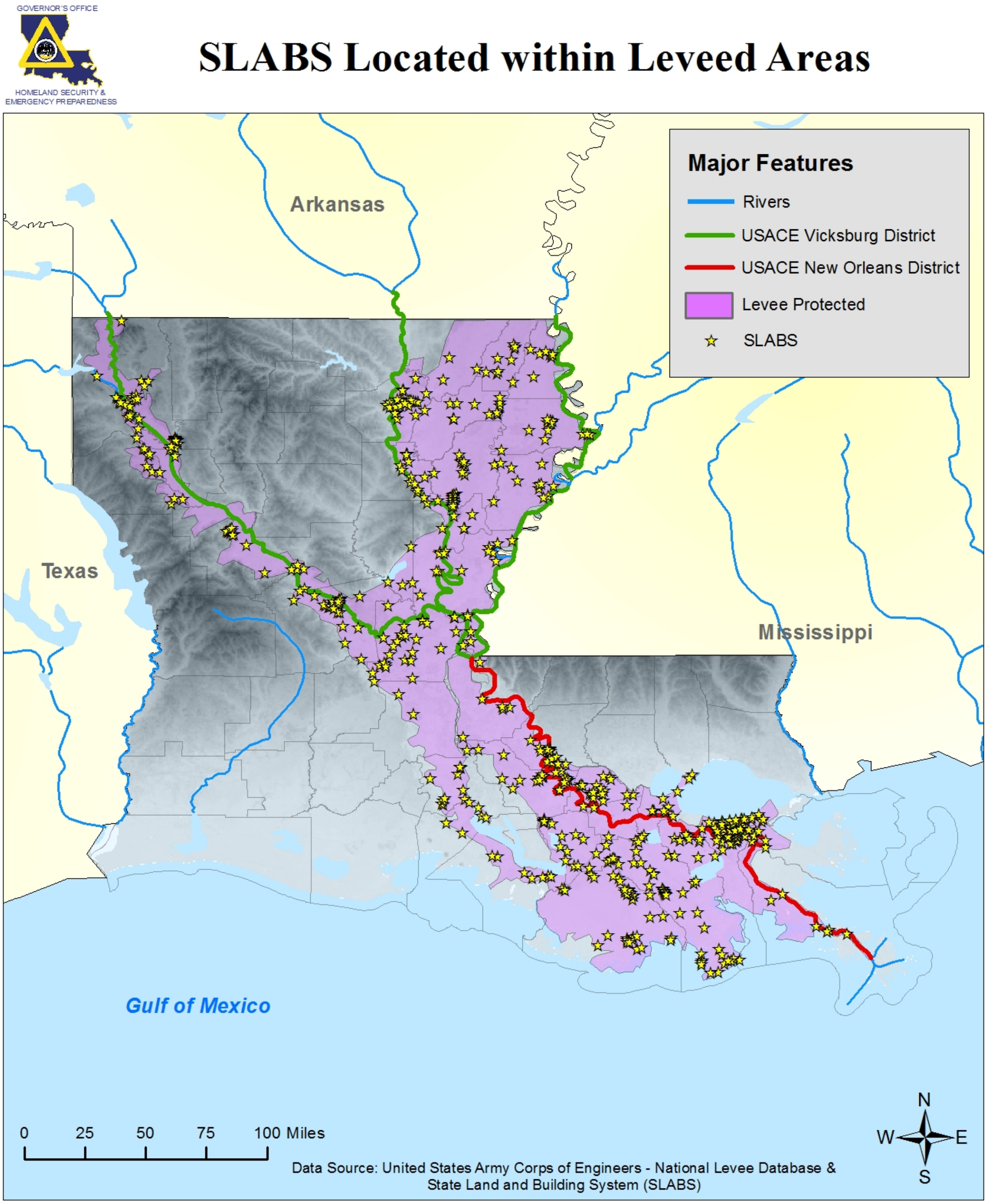

Map 2.149. State Land and Building Systems (SLABS) located within leveed areas.

Sinkholes

Sinkholes are areas of ground—varying in size from a few square feet to hundreds of acres, and reaching in depth from 1 to more than 100 ft.—with no natural external surface drainage. Sinkholes are usually found in *karst terrain*—that is, areas where limestone, carbonate rock, salt beds, and other water-soluble rocks lie below the Earth's surface. Karst terrain is marked by the presence of other uncommon geologic features such as springs, caves, and dry streambeds that lose water into the ground. Nevertheless, sinkholes are defined by any collapse of the earth's surface. 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).

General sinkhole formation is a very simple process. Whenever water is absorbed through soil and encounters water-soluble bedrock, and then begins to dissolve it, sinkholes start to form. The karst rock dissolves along cracks; as the fissures grow, soil and other particles fill the gaps, loosening the soil above the bedrock. Figure 2.8 illustrates the development of a cover-subsidence sinkhole. As the soil sinks from the surface, a depression forms, which draws in more water, funneling it down to the water-soluble rock. The increase of water and soil in the rock pushes open the cracks, again drawing more soil and water into it. This positive feedback loop continues, unless clay plugs into the cracks in the bedrock, at which time a pond may form. A sudden cover-collapse sinkhole occurs when the topsoil above dissolving bedrock does not sink, but forms a bridge over the soil that is sinking beneath it. As Figure 2.9 demonstrates, underground soil continues to fill the bedrock fissures, until finally the soil bridge collapses and fills the void beneath it.

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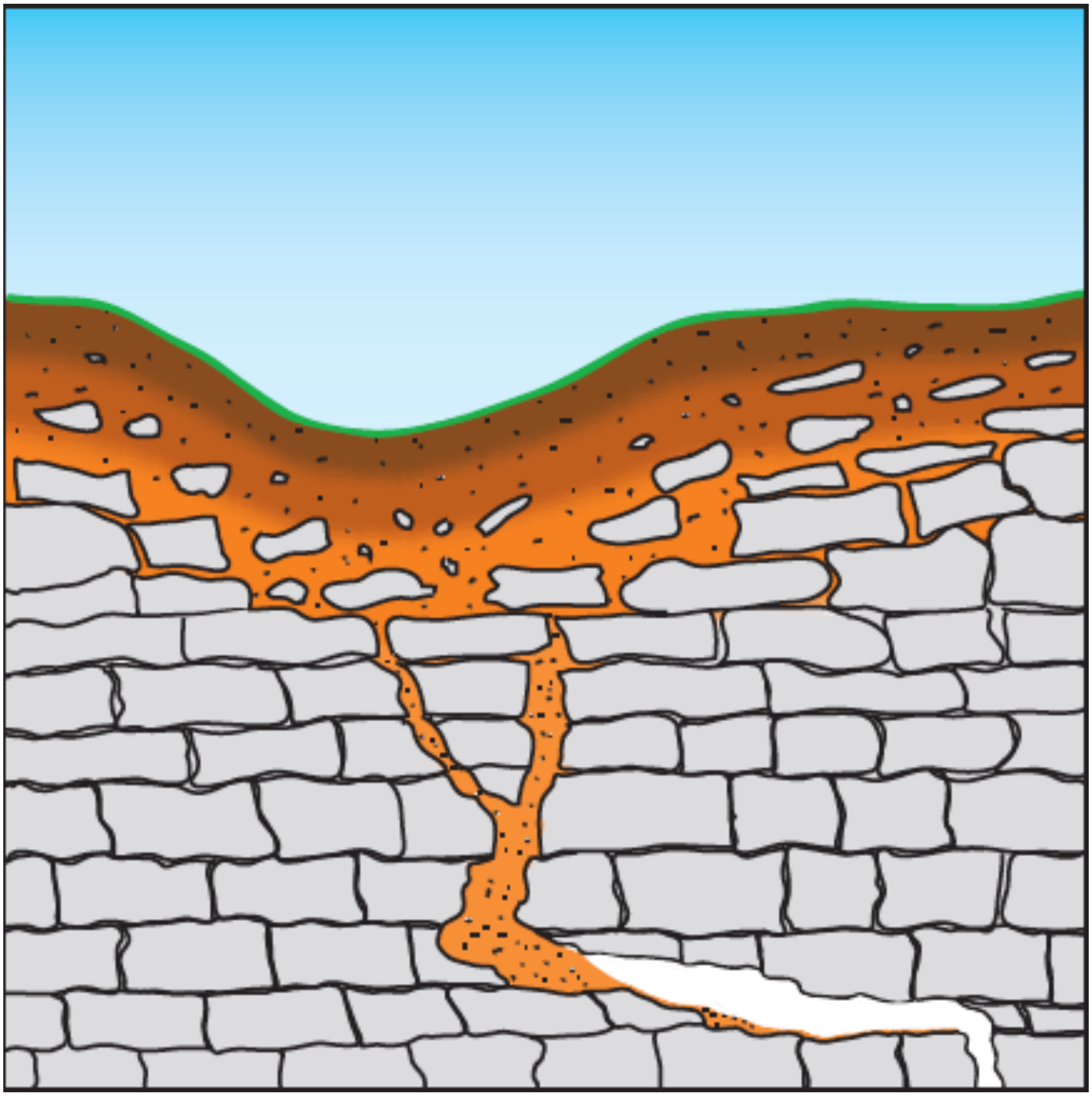

Figure 2.8. Cover-subsidence sinkhole formation from the breaking apart of karst bedrock by soil deposit (courtesy USGS Sinkholes Fact Sheet).

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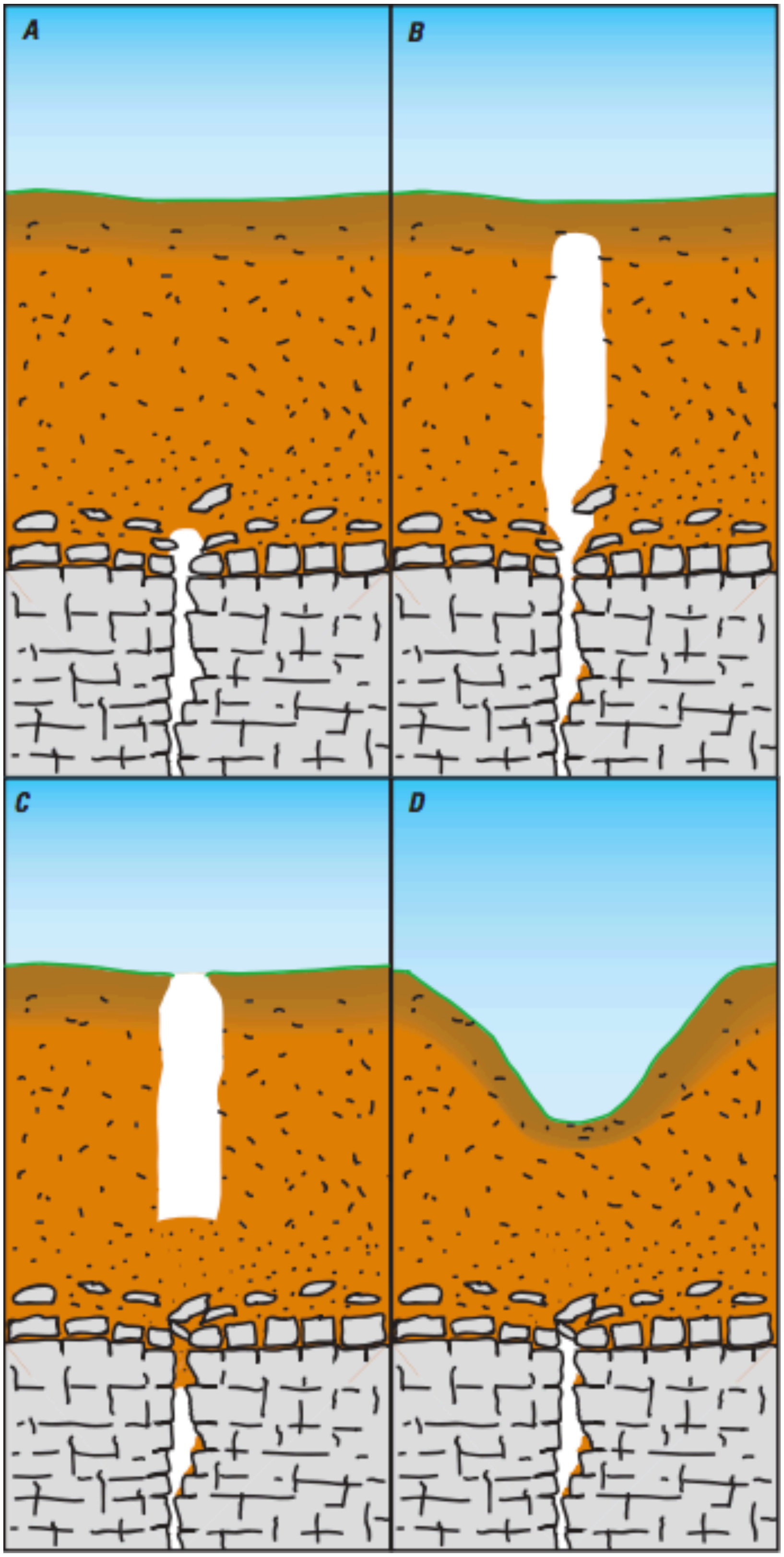

Figure 2.9. Formation of cover-collapse sinkhole after a soil bridge forms above dissolving bedrock (courtesy of USGS Sinkhole Fact Sheet).

Both kinds of sinkholes can occur naturally or through human influence. While sinkholes tend to form naturally in karst areas, sinkholes can form in other geological areas that have been altered by humans such as mining, sewers, hydraulic fracture drilling, groundwater pumping, irrigation, or storage ponds. In all of these cases, and others, the cause for the sinkhole is that support for surface soil has been weakened or substantially removed. In fact, Louisiana is not especially susceptible to karst-induced sinkholes since very little of Louisiana is located on either exposed or even buried karst terrain. Only a relatively small portion of Louisiana, cutting across some of its northern and central parishes (Madison, Franklin, Tensas, Caldwell, La Salle, and Grant Parishes) lie on buried karst ground.[lxxx] Sinkholes from such terrain have been negligible.

SINKHOLE PROFILE

In the United States, 20% of land is susceptible to sinkholes, although their types vary. Most of this area lies in Florida, Texas, Alabama, Missouri, Kentucky, Tennessee, and Pennsylvania. However, two of the most well-known sinkholes in North America are actually located in Louisiana, both of which were precipitated by the human-influenced collapse of salt dome caverns (Map 2.150).

The Lake Peigneur sinkhole (in Iberia Parish—Map 2.124) began to form on November 20, 1980 when an oil rig accidentally drilled into an underlying salt mine, leading to a rush of water from the lake into the mine. The 10-ft. lake quickly emptied through the drilled hole and into the salt mine. Due to a quick response, all of the miners evacuated the mine before it filled. The rush of water drained the lake and pulled water from the adjoining Delcambre Canal, reversing the natural flow of the water to Vermilion Bay and causing (temporarily) the largest waterfall in Louisiana. The whirlpool caused by the mine penetration swallowed eleven barges, several boats, a number of trees, an oil rig, and other debris. Several days later, nine of the barges resurfaced, after pressure equalized.[lxxxi] Luckily, no humans were injured, although many people were in serious danger of perishing. The landscape was permanently altered, changing the previously freshwater lake into a saltwater lake and increasing its depth.

At the time of publication, the Bayou Corne sinkhole is an ongoing disaster in Assumption Parish, about 40 mi. south of Baton Rouge (Map 2.124). Since the sinkhole event continues, certain details of the disaster are relatively few. Texas Brine, a salt-mining company, reported problems with its Oxy Geismar 3 cavern and well in early 2011, and closed it in June of that year. About a year later, on 30 May 2012, bubbles in Bayou Corne were reported, and throughout June and July residents and Texas Brine employees reported tremors. The continuing bubbling eruptions come from escaping methane and oil as the caverns and fissures fill. On August 3, Texas Brine employees reported a sighting of the sinkhole. By late September, drillers determined that the Oxy 3 cavern had collapsed. The sinkhole began as a 200 ft.-by-200 ft. hole, but has grown to include at least 24 acres.[lxxxii]

Some argue that the number of sinkholes reported has increased in recent years, although there is not enough data to know for certain since sinkholes are not systematically tracked. More information is needed to track trends in Louisiana. Florida's Office of Insurance Regulation has reported a dramatic increase in claims due to sinkholes in recent years, and Louisiana should attempt a similar tracking system for sinkhole claims. With increases in hydraulic fracture drilling—particularly near the Haynesville Shale in northwestern Louisiana—sinkhole incidents will almost certainly occur more often, although their location should be easily determined by such drilling.

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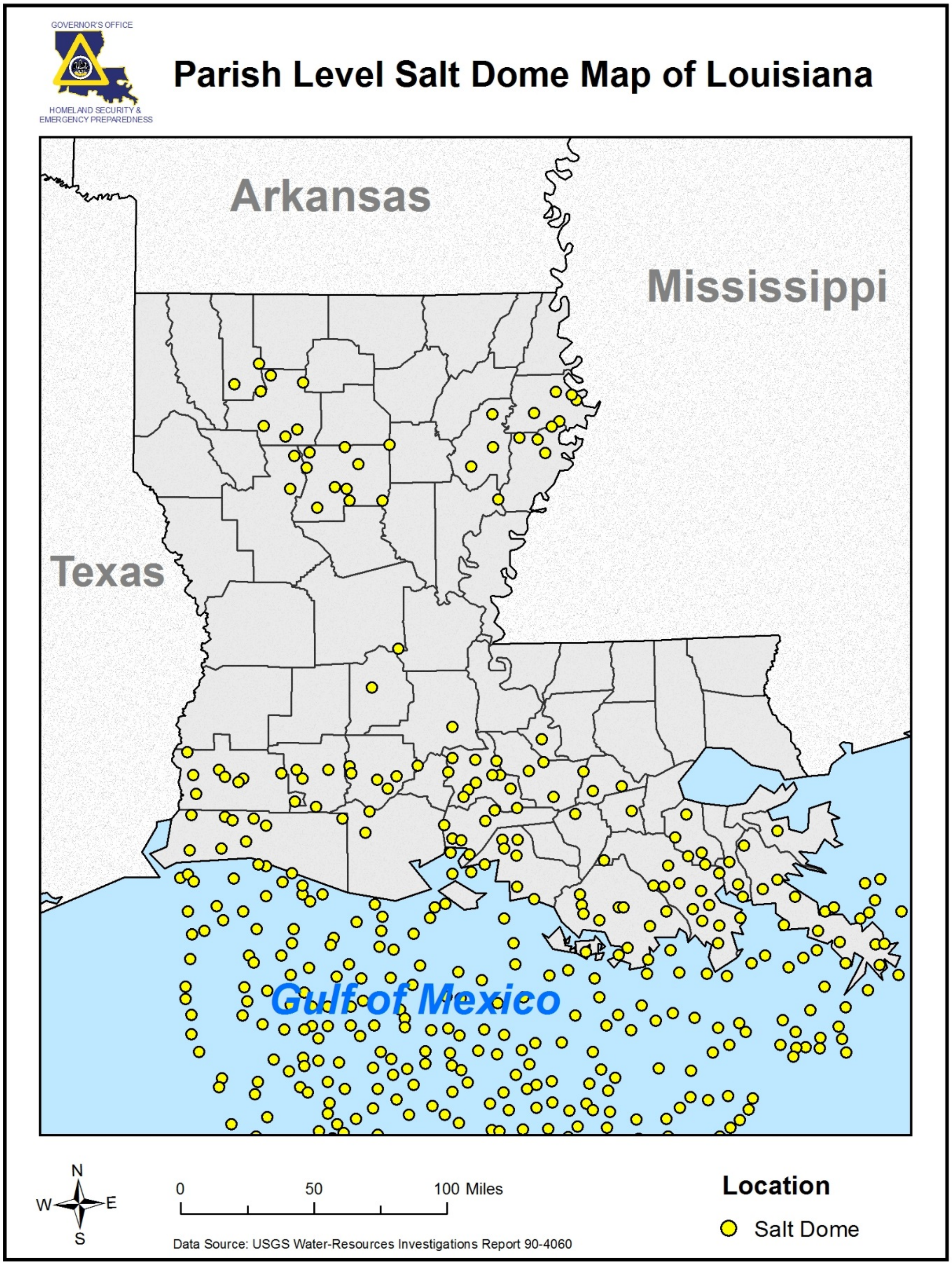
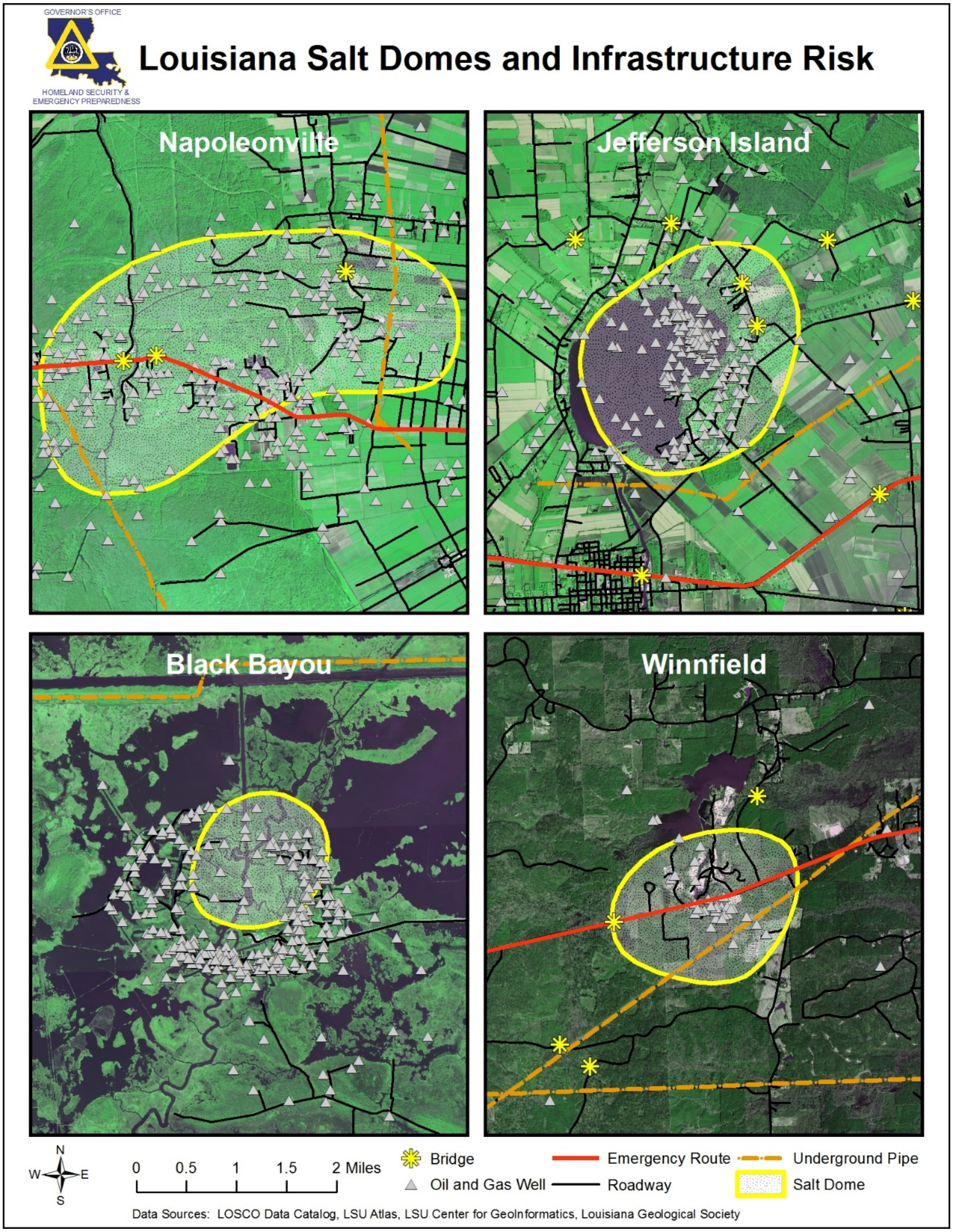


Map 2.150. Locations of salt domes across Louisiana.



Map 2.151. Notable salt domes in Louisiana with nearby infrastructure shown. The Bayou Corne sinkhole is located above a section of the Napoleonville salt dome and the Lake Peigneur sinkhole is located above a section of the Jefferson Island salt dome.

Sinkhole Risk Assessment

Based on historical records, the probability of future occurrences of sinkholes in Louisiana is **Medium**. Sinkholes of any kind, including those created by salt dome collapses, are usually infrequent in Louisiana, but their potential impact can be considerable. Sinkholes are disruptive to transportation and commerce, and can even force the indefinite evacuation of entire communities, as has been the case for Bayou Corne. For this reason, sinkholes are one of the hazards included for Risk Assessment. Since karst terrain is a very rare cause of sinkholes in Louisiana, Map 2.152 indicates the total number of salt domes in each parish. Ascension, Bossier, Lafayette, Lincoln, and West Baton Rouge parishes are at high risk (within 2 miles of a salt dome) to sinkholes, and have experienced significant population increases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to sinkholes has increased. Cameron, Madison, Plaquemines, St. Bernard, and Tensas parishes are at high risk to sinkholes, but have experienced significant population decreases of more than 10% since 2000 (see Map 2.3). As a result, the vulnerability of these parishes to sinkholes has decreased.

Assessing the state's vulnerability to sinkholes is complicated and requires a tiered approach. Parishes that contain salt domes are obviously vulnerable to future sinkholes, but salt domes bordering parish boundaries can also increase the vulnerability of an adjacent parish. Sinkhole vulnerability is directly related to distance from a salt dome. For this reason, vulnerability can be classified into two categories: (1) High: complete infrastructure loss could occur within 2 miles of a sinkhole; and (2) Medium: possible infrastructure loss and evacuation orders can extend up to 25 miles beyond the sinkhole.[lxxxiii] Map 2.153 locates state facilities in relation to 2- and 25-mile distances away from salt domes. There were 14 state parks (out of 19) within the 25-mile "Medium Vulnerability" buffer, and there were 6,060 state facilities (out of 8,685) within the 25-mile "Medium Vulnerability" buffer. There were no state parks within the two-mile "High Vulnerability" buffer, while there were 147 state facilities within the two-mile "High Vulnerability" buffer. State-owned critical facilities located in High and Medium vulnerability areas are of the following types: hospitals, shelters, Emergency Operation Centers, data processing centers, and state police troop offices.

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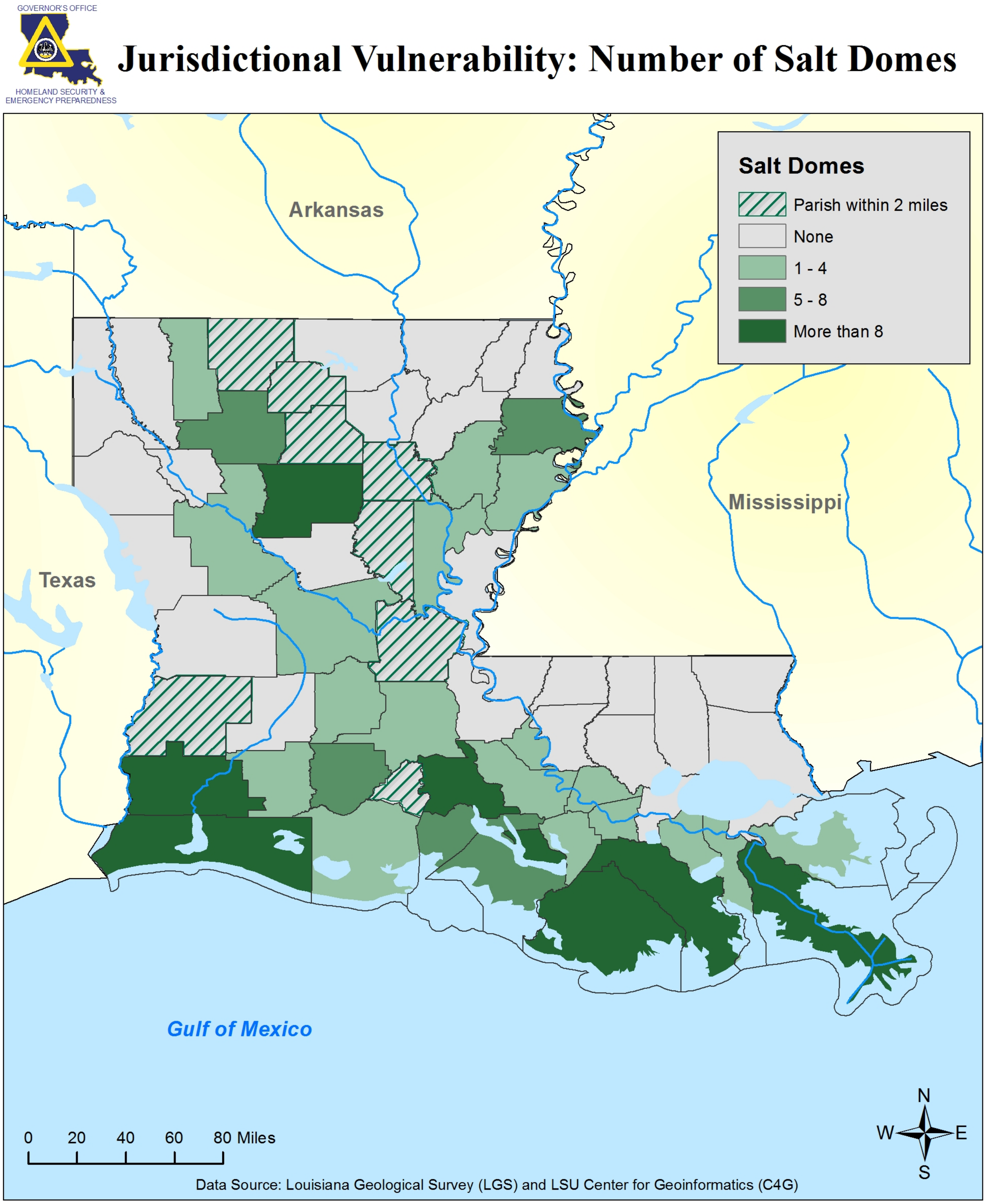
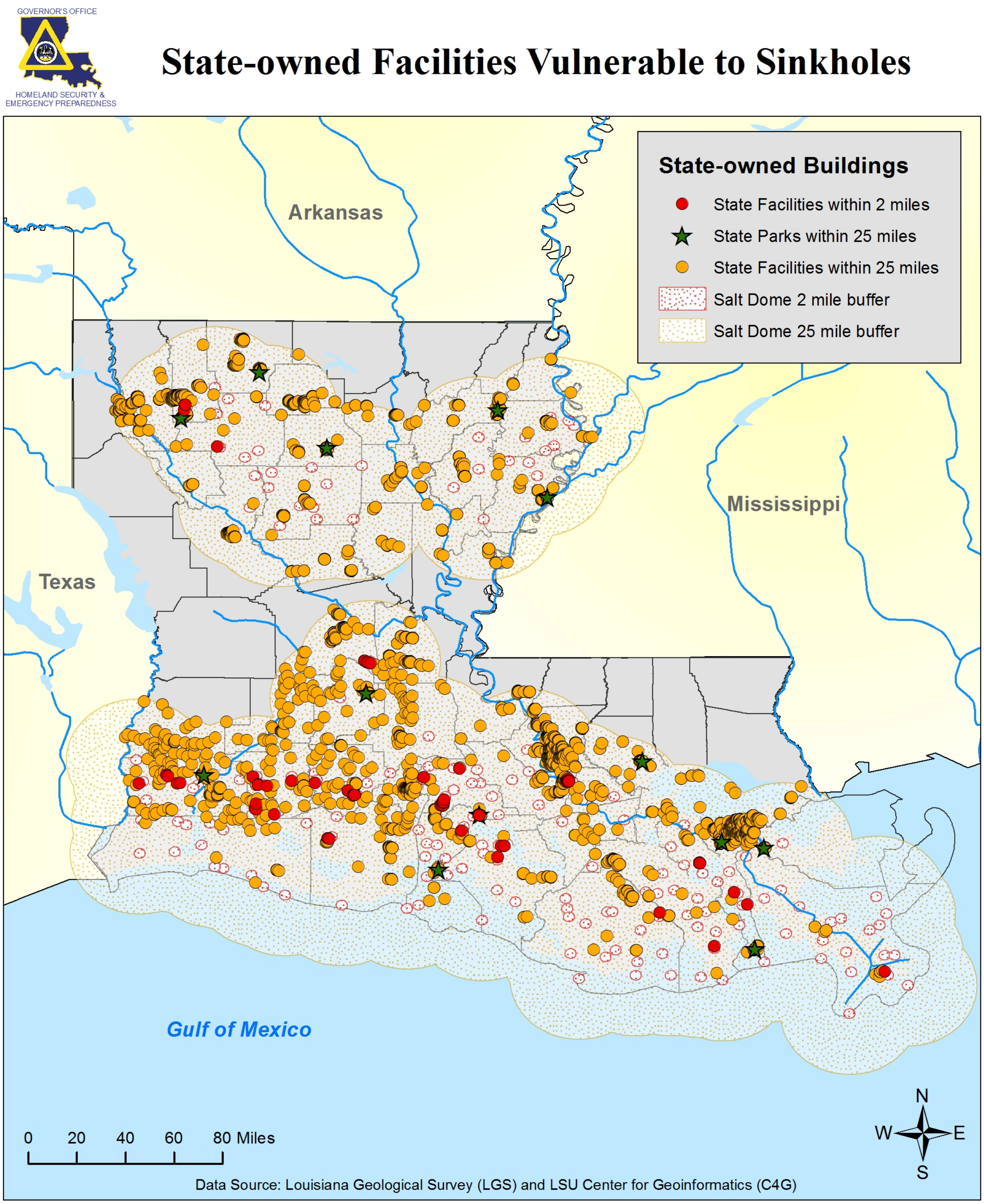


Map 2.152. Louisiana jurisdictional vulnerability for sinkholes based on the location of known salt domes.

State-owned Facilities Vulnerable to Sinkholes



Map 2.153. **Louisiana state-owned property located within either the two-mile High Vulnerability zone or the twenty-five-mile Medium Vulnerability zone.**

Map 2.154 shows which parishes fall within each vulnerability level based on proximity to the 2- and 25-mile buffer zones. The southern coastal Louisiana parishes and the parishes of northeast and north central Louisiana have the greatest risk of future sinkhole hazards (**High**).

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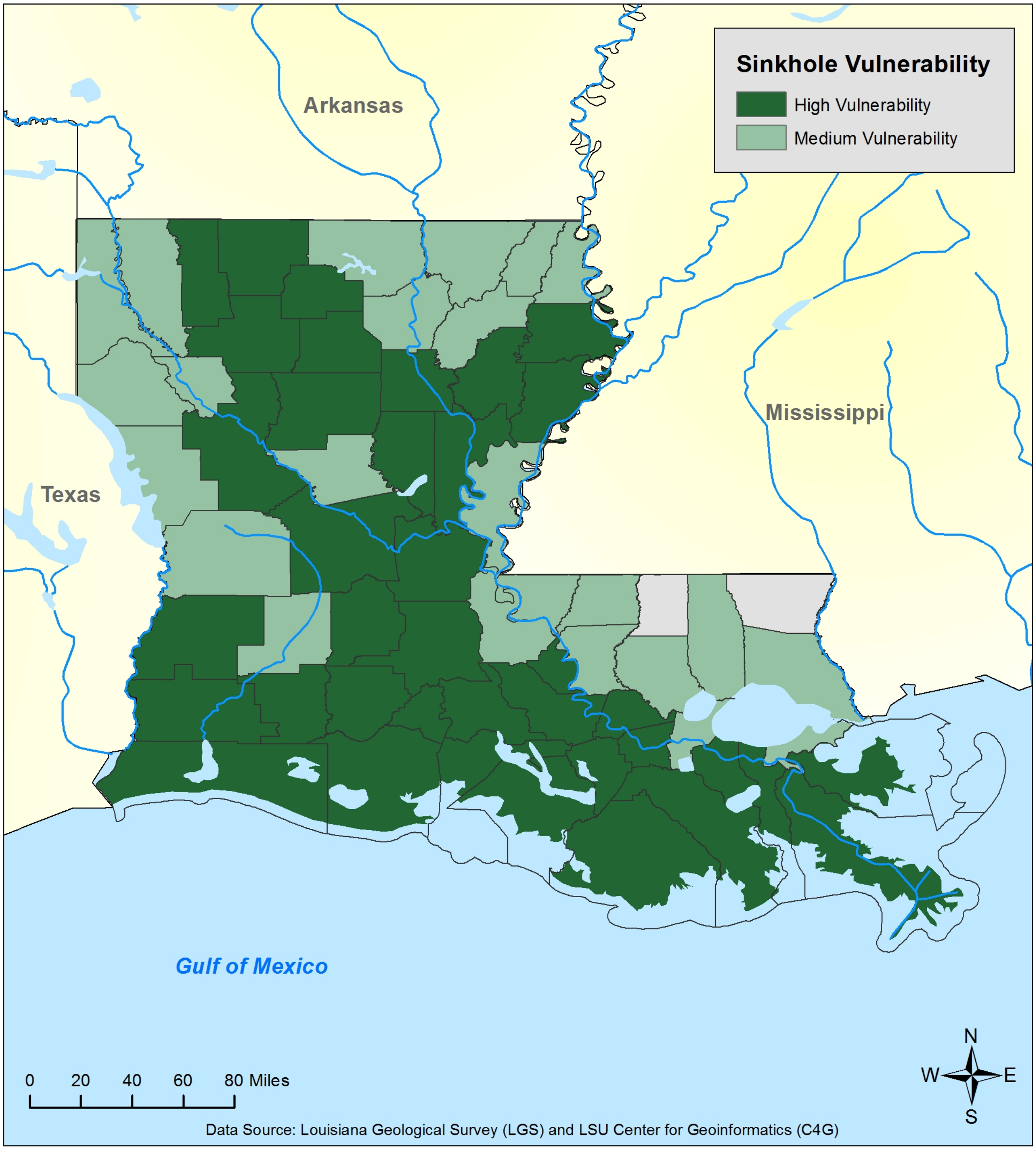
Jurisdictional Vulnerability: Sinkholes



Map 2.154. Vulnerability rating map for sinkholes showing parishes with the highest risk in Louisiana.

Potential Economic Loss

Based on their proximity to salt domes, the following parishes are most likely to be severely affected by sinkholes: Acadia, Ascension, Assumption, Bienville, Calcasieu, Cameron, Catahoula, Evangeline, Franklin, Iberia, Iberville, Jefferson, Jefferson Davis, Lafourche, Lincoln, Madison, Natchitoches, Plaquemines, Rapides, St. Bernard, St. Charles, St. James, St. Landry, St. Martin, St. Mary, Tensas, Terrebonne, Vermilion, Webster, West Baton Rouge, and Winn. While no salt domes exist within parish boundaries, salt domes within adjacent parishes are located within 2 miles of the border of the following parishes and could thus be severely affected by sinkholes: Claiborne, Lincoln, Jackson, Caldwell, La Salle, Avoyelles, Beauregard, and Lafayette. The following parishes are located more than 2 miles from a salt dome, but are within 25 miles and could be moderately affected by sinkholes: Allen, Bossier, Caddo, Concordia, De Soto, East Baton Rouge, East Carroll, East Feliciana, Grant, Livingston, Morehouse, Orleans, Ouachita, Pointe Coupee, Red River, Richland, Sabine, St. John the Baptist, St. Tammany, Tangipahoa, Union, Vernon, West Carroll, and West Feliciana. Of the high vulnerability parishes, Jefferson, Lafayette, and Calcasieu parishes are the three most populated parishes and have the highest infrastructure dollar exposures within Louisiana. These three parishes are considered to have the highest vulnerability to sinkholes within the state.

Table 2.62 shows the overall exposure for High-risk parishes based on the Hazus-MH 2.1 inventory database.

Table 2.62. Exposure data for the 38 highest sinkhole risk parishes in Louisiana.

Exposure Data for Parishes with Highest Sinkhole Risk		
Parish	Population (2010)	Total Exposure ($1,000)
Acadia	61,773	$10,551,833
Ascension	107,215	$15,289,421
Assumption	23,421	$6,251,796
Avoyelles	42,073	$7,711,021
Beauregard	35,654	$6,495,682
Bienville	14,353	$5,752,097
Calcasieu	192,768	$21,704,525
Caldwell	10,132	$3,123,824
Cameron	6,839	$5,497,935
Catahoula	10,407	$4,153,475
Claiborne	17,195	$4,272,885
Evangeline	33,984	$7,912,259
Franklin	20,767	$3,818,331
Iberia	73,240	$13,706,899
Iberville	33,387	$8,154,084
Jackson	16,274	$6,573,859

Exposure Data for Parishes with Highest Sinkhole Risk		
Parish	Population (2010)	Total Exposure ($1,000)
Jefferson	432,552	$68,890,600
Jefferson Davis	31,594	$8,082,036
Lafayette	221,578	$30,145,227
Lafourche	96,318	$14,695,652
La Salle	14,890	$4,480,265
Lincoln	46,735	$7,424,222
Madison	12,093	$2,712,688
Natchitoches	39,566	$8,404,586
Plaquemines	23,042	$9,583,932
Rapides	131,613	$18,821,281
St. Bernard	35,897	$9,052,282
St. Charles	52,780	$11,391,140
St. James	22,102	$7,071,972
St. Landry	83,384	$14,242,451
St. Martin	52,160	$16,854,779
St. Mary	54,650	$8,329,232
Tensas	5,252	$2,158,271
Terrebonne	111,860	$17,127,125
Vermilion	57,999	$10,828,531
Webster	41,207	$7,109,218
West Baton Rouge	23,788	$10,683,120
Winn	15,313	$4,087,182
TOTALS	**2,305,855**	**$423,145,718**

This Plan Update also utilizes Hazus-MH 2.1 for the analysis of building exposure in each of the most vulnerable (High) parishes by general occupancy type, which is detailed in Table 2.63.

Table 2.63. Building exposure for sinkholes by general occupancy type.

Building Exposure of Most Vulnerable Parishes							
	Exposure Type ($1,000)						
Parish	Residential	Commercial	Industrial	Agricultural	Religion	Government	Education
Acadia	7,979,614	1,419,342	563,874	148,772	237,546	56,573	146,112
Ascension	11,107,747	2,419,973	1,186,650	51,686	309,422	111,001	102,942
Assumption	4,325,874	844,545	762,247	31,480	154,616	46,439	86,595
Avoyelles	6,100,503	818,924	338,086	68,440	219,704	88,786	76,578
Beauregard	5,160,055	734,709	222,434	35,364	212,554	68,910	61,656
Bienville	4,510,931	570,939	282,913	36,384	264,558	37,245	49,127
Calcasieu	15,879,101	3,805,841	1,011,908	58,492	576,612	150,541	222,030
Caldwell	2,453,379	349,881	110,233	27,778	121,548	28,696	32,309
Cameron	4,209,736	691,929	393,622	37,564	90,194	38,602	36,288
Catahoula	3,057,422	629,752	138,779	63,292	153,556	57,673	53,001

Claiborne	3,222,505	469,511	284,397	28,354	170,516	43,930	53,672
Evangeline	5,944,281	1,182,228	269,190	95,536	237,802	85,080	98,142
Franklin	2,797,175	530,282	139,622	72,966	183,488	48,884	45,914
Iberia	9,678,096	2,192,541	1,254,014	65,726	233,766	118,320	164,436
Iberville	5,919,008	1,099,213	718,947	39,230	234,530	75,678	67,478
Jackson	5,186,884	670,191	304,068	29,986	256,162	37,219	89,349
Jefferson	50,104,392	13,418,248	3,024,142	114,922	1,204,366	437,819	586,711
Jefferson Davis	6,364,838	911,215	320,585	64,622	239,620	75,342	105,814
Lafayette	20,352,559	6,720,522	2,019,583	101,370	430,730	219,274	301,189
Lafourche	11,267,397	2,122,336	708,103	55,486	245,694	98,260	198,376
La Salle	3,559,732	449,362	206,503	20,330	148,028	51,762	44,548
Lincoln	5,441,177	1,083,517	388,514	45,284	275,472	45,226	145,032
Madison	1,993,179	379,309	109,226	59,224	118,460	25,696	27,594
Natchitoches	6,407,131	1,087,075	253,406	48,482	392,736	80,155	135,601
Plaquemines	7,797,736	1,087,148	385,252	20,648	170,950	52,157	70,041
Rapides	13,024,701	3,854,973	754,563	110,124	687,004	204,171	185,745
St. Bernard	7,159,720	1,160,684	438,162	13,074	149,344	51,617	79,681
St. Charles	8,318,110	1,948,898	717,882	25,498	204,072	96,946	79,734
St. James	5,072,548	966,014	685,835	33,634	182,106	66,993	64,842
St. Landry	11,074,652	1,981,588	525,532	84,532	312,906	112,478	150,763
St. Martin	11,788,213	2,844,362	1,539,197	69,592	319,552	138,656	155,207
St. Mary	5,740,011	1,301,020	810,172	30,540	250,480	108,412	88,597
Tensas	1,490,623	421,817	63,506	52,738	70,438	30,406	28,743
Terrebonne	11,485,574	3,445,304	1,463,699	62,230	379,368	122,228	168,722
Vermilion	8,196,283	1,596,191	631,852	69,528	161,172	57,631	115,874
Webster	5,530,603	790,119	376,432	29,676	271,698	41,297	69,393
West Baton Rouge	7,025,303	1,813,154	691,744	35,842	270,942	456,833	389,302
Winn	3,236,881	429,077	141,778	17,204	180,002	44,561	37,679
Totals	**309,963,674**	**68,241,734**	**24,236,652**	**2,055,630**	**10,321,714**	**3,711,497**	**4,614,817**

Based on the baseline Hazus-MH 2.1 inventory database, the Louisiana Digital Map GIS database (via LOSCO), and the U.S. Census Bureau, regional vulnerability to sinkholes is listed in Table 2.64.

Table 2.64. Regional vulnerability to sinkholes.

Regional Vulnerability to Sinkholes	
Vulnerable Locations	Number of Records
Louisiana Parishes	38
Dams	483
Airports	96
Communication Towers/Facilities	397
Electricity Providers/Facilities	77
Emergency Response Centers	24
Fire Stations	621

Regional Vulnerability to Sinkholes	
Vulnerable Locations	Number of Records
Hospitals	113
Nuclear Plants	1
Police Stations	714
Elementary/Secondary Schools	1,785
Universities/Colleges	10

Very little information was available to determine potential loss estimates from sinkholes, but based on the current cost of the Bayou Corne sinkhole (~$10 million), and the expectation that this cost will double, we can assume that a major sinkhole disaster can result in $20 million of damage. The Bayou Corne and Lake Peigneur sinkholes are the only sinkholes on record in Louisiana and occurred 32 years apart. If a sinkhole can at least be expected to occur once every 32 years, then the annual cost per sinkhole would average to $625,000. Thus, each salt dome was assigned this annualized amount to determine future loss potential by parish (Map 2.155). As shown, parishes with the most salt domes are predicted to have the highest potential annualized losses.

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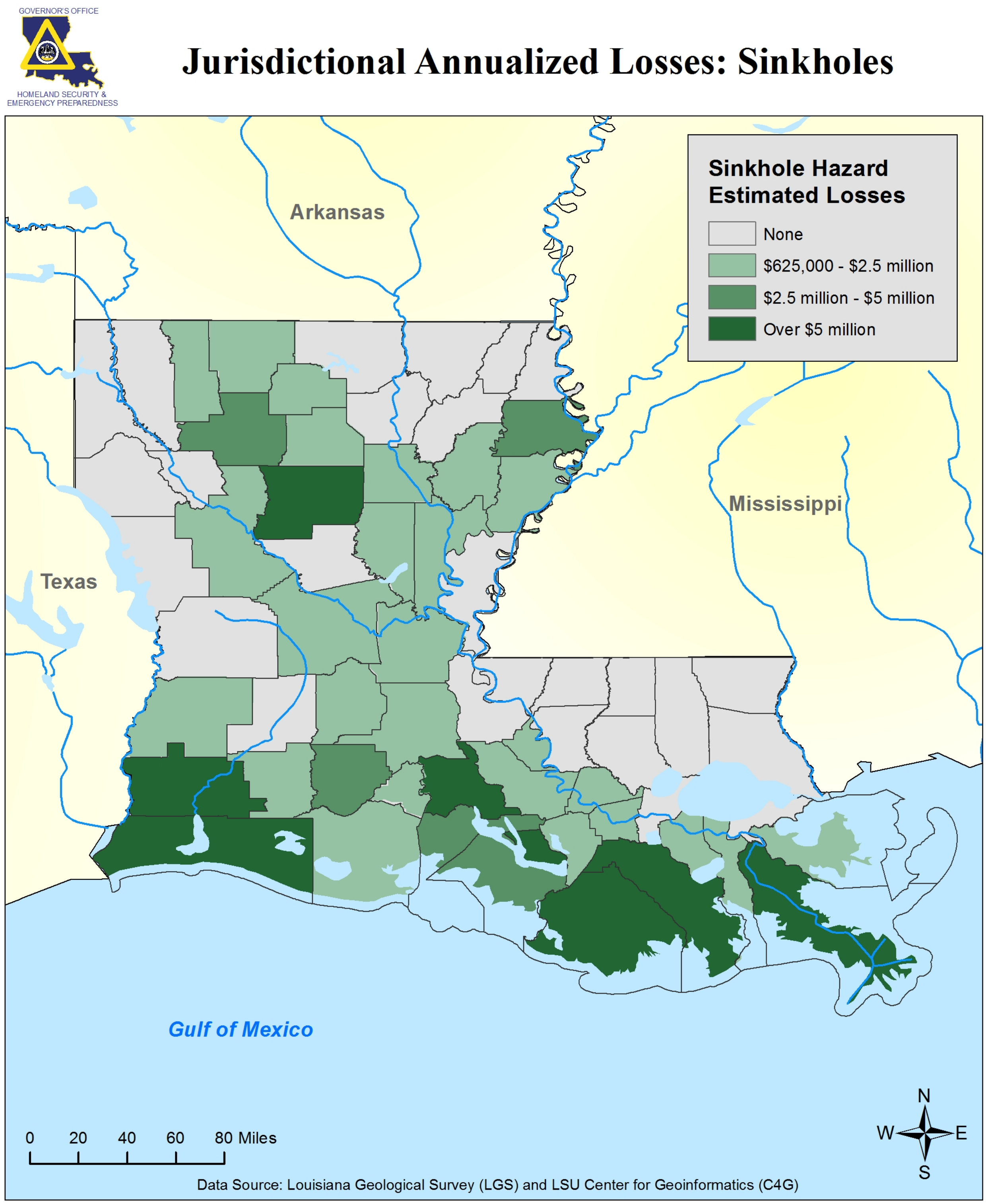

Map 2.155. Jurisdictional annualized loss due to sinkholes.

Almost every parish in Louisiana could be impacted in some way by a sinkhole, with the exception of the parishes of Washington and St. Helena. Sinkholes are extremely unpredictable and have historically been caused by human error in Louisiana. Roads, bridges, utilities, and communications systems could be greatly impeded or completely brought to a total stop resulting in a high level vulnerability in all High vulnerability parishes. Transportation and emergency response could be inhibited and utilities such as electricity, water, gas, sewer, and communications could be completely shut down. Buildings could collapse and, at a minimum, lose their structural integrity if they are within 2 miles of a sinkhole. A sinkhole can impact all demographics and age groups, as the evacuation of the Bayou Corne community demonstrates. State, local, and federal facilities located near a sinkhole would also be shut down, their operations greatly hindered. Long-term sheltering could be a concern if a sinkhole impacts a high-population area. Other critical facilities, such as police, fire, and medical facilities, could become unusable within a community impacted by a sinkhole.

POTENTIAL LOSSES BY JURISDICTION

Overview & Analysis of Potential Losses: Most jurisdictions in Louisiana can suffer direct and/or indirect losses due to sinkholes. The coastal, northeast, and north-central parishes are most vulnerable based on the locations of known salt domes and karst terrain.

Changes in jurisdictional population levels impact each parish across the state disparately. In the parishes where sinkhole vulnerability has increased because of increases in population (Ascension, Bossier, Lafayette, Lincoln, and West Baton Rouge), concomitant changes in development have impacted loss estimates and will cause an increase in future losses due to increased levels of exposure. In the parishes where sinkhole vulnerability has decreased because of decreases in population (Cameron, Madison, Plaquemines, St. Bernard, and Tensas), concomitant changes in development have impacted loss estimates and will cause a decrease in future losses due to decreased levels of exposure.

POTENTIAL LOSSES OF STATE FACILITIES

The sinkhole hazard vulnerability assessment of state-owned buildings was based on the two-mile “High Vulnerability” zone and the twenty-five-mile “Medium Vulnerability” zone around each salt dome. The criteria used to determine specific vulnerability rankings for each building and the results of applying this ranking to the state-owned buildings are shown in Table 2.65.

Table 2.65. Sinkhole Vulnerability Criteria and Ranking Results.

SINKHOLE VULNERABILITY CRITERIA AND RANKING	
Ranking	Criteria
High	Facility located within 2 miles of salt dome
Medium	Facility located within 25 miles of salt dome
Low	Facility not located within 25 miles of salt dome

The sinkhole loss estimate ranges are based on actual values of state facilities. A 100% loss is assumed for buildings ranked as High Vulnerability and a 1–10% loss is assumed for buildings ranked as Medium Vulnerability. The January 2014 state facilities database was used to obtain accurate building numbers for each loss estimate range. Loss estimates of state-owned buildings in Louisiana involved an analysis of the following parameters:

- Proximity to Salt Domes
- Distance-based Damage and Loss Estimate Ratios

Table 2.66. Sinkhole Loss Estimate Ranges and Ranking Results.

Sinkhole Loss Estimate Ranges and Ranking		
Ranking	Total Loss Estimate Ranges	Number of Buildings
High	$104,703,200	147
Medium	$109,869,334 - $1,098,693,337	6060
Low	$0	2478

Summary of Risk Assessments

On a statewide basis, per the results in this section, risk factors for some hazards are essentially equal throughout the State. For example, the risk due to lightning strikes or severe summer weather (i.e., high heat) is basically the same throughout the state. However, for the more significant hazards, potential effects tend to vary in different parts of the state. For instance, the coastal parishes have a higher percentage of weak tornadoes, while the northern parishes experience a higher percentage of stronger tornadoes (although weaker tornadoes are more prevalent throughout the state than stronger tornadoes).

The following discussion divides the State into four simplified regions for purposes of summarizing key sources of risk from natural hazards (see Map 2.156):

- Coastal parishes
- Inland southern parishes
- Central parishes
- Northwest parishes

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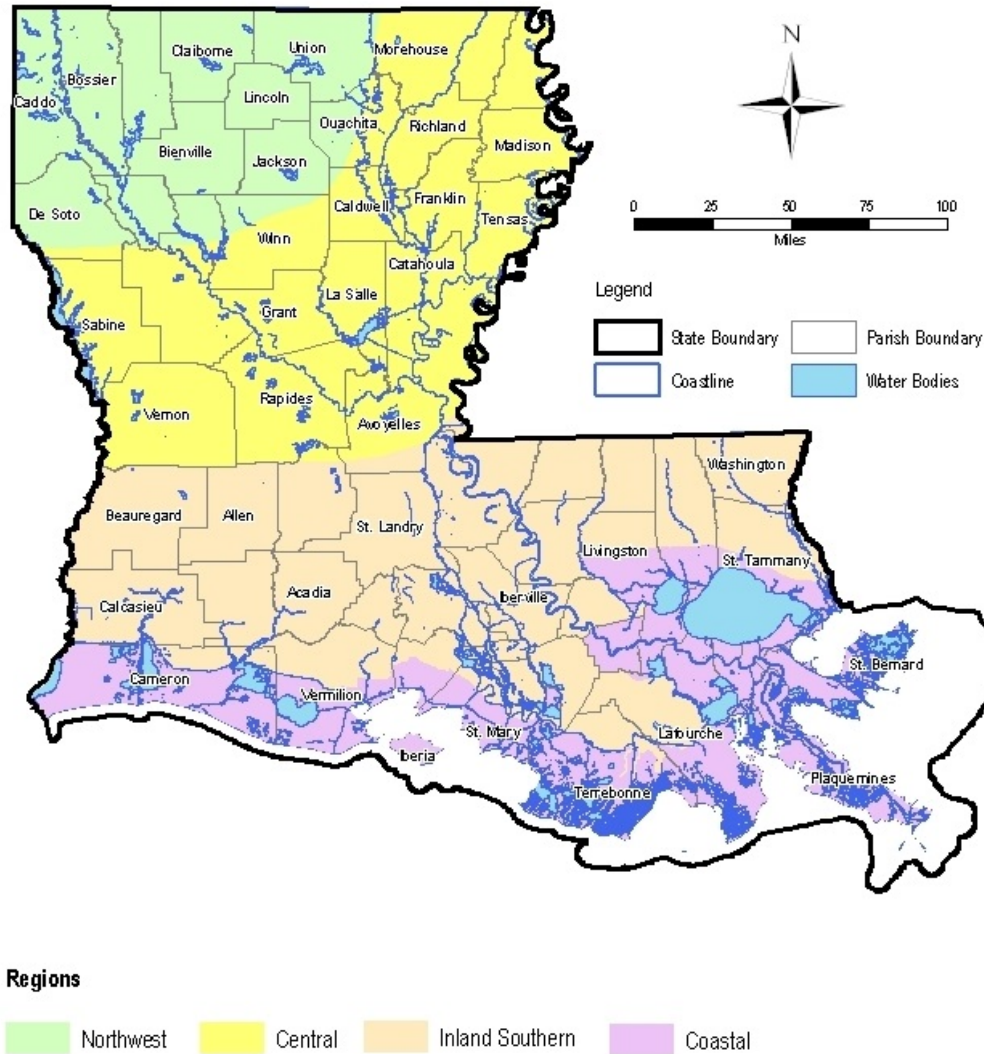

Map 2.156. General regions of Louisiana parishes.

Coastal Parishes

- High risk of loss of life, injury, and property damage due to inundation and wave action from storm surge caused by tropical storms and hurricanes. The largest concentrations of repetitive and severe repetitive loss properties in the State occur in the heavily populated areas in this region. Due to a variety of factors, including salt water intrusions, diversion of natural seasonal flooding, coastal erosion, subsidence and sea level rise, the extent and effectiveness of land and wetland buffers are decreasing. As a result, risk due to storm surge in existing urban areas is expected to increase.

- High risk of damage due to inundation directly from riverine and backwater flooding. The failure of levees, floodwalls, and forced drainage systems along the major rivers and drainage systems all pose a high risk in the southeast coastal parishes. Subsidence in much of this area—again, particularly in the southeast—is a significant contributing factor to an anticipated increase in exposure and risk to existing and future structures.

- High risk of direct wind damage and damage from wind-borne debris in existing pre-Uniform Construction Code (UCC) structures caused by tropical storms, hurricanes and tornadoes spawned by these major storm events.

- Low risk of drought, hailstorms, ice storms, earthquakes, and wildfires.

Inland Southern Parishes

- High risk of damage due to inundation directly from riverine and backwater flooding and failure of levees, floodwalls, and forced drainage systems along the major rivers and drainage systems. Future development is likely to occur in this region associated with existing urban areas and corridors between existing urban centers.

- Moderate-to-high risk of direct wind damage and low-to-moderate risk of damage from wind-borne debris in existing pre-UCC structures caused by tropical storms, hurricanes, and tornadoes. Risk caused by hurricane wind exposure or storm surge increases in direct relation to proximity to the coast.

    - Notable convergence of tornado tracks near Crowley and Rayne.

- Low risk of hailstorms and ice storms.

Central Parishes

- Moderate risk of damage due to inundation directly from riverine and backwater flooding. The failure of levees, floodwalls and forced drainage systems along the major rivers and drainage systems poses a particularly severe risk in parishes that about one of the two major river systems in the state: the Mississippi and the Red Rivers. Urban centers have concentrations of repetitive and severe repetitive loss properties. Rural parishes in this area have relatively low concentrations of repetitive and severe repetitive loss properties.

- Low risk of direct wind damage from tropical storms or hurricanes and in existing pre-UCC structures. Risk of damage from wind borne debris due to tropical storms and hurricanes is not considered as significant in these areas, compared to coastal and inland southern parishes. Moderate risk of tornado damage, with the exception of the far northeastern parishes, where the risk is high.

- Moderate-to-high risk of hailstorms, particularly in the northeastern parishes.

- Low-to-moderate risk of ice storms.

Northwest Parishes

- Much higher risk of hailstorms and ice storms than the rest of the state; tornadoes tend to have longer tracks and higher EF-scale status. In fact, given the tendency for longer-track tornadoes and the higher likelihood for stronger tornadoes in the northern parishes, the state should consider the recent tornado disasters in Moore, Tuscaloosa, and Joplin as possibilities, albeit extreme ones.

- Low-to-moderate risk of damage due to direct inundation from riverine and backwater flooding and failure of levees; floodwalls and forced drainage systems along the major rivers; and drainage systems. Similar to the central parishes, urban centers have concentrations of repetitive and severe repetitive loss properties. However, rural parishes in this region have the lowest concentrations of repetitive and severe repetitive loss properties in the State. Based on 19 of the high-hazard dam inundation areas, the parishes at highest risk due to dam failure are in the far northwestern corner of the state.

- Low risk of storm surge and direct wind damage from tropical storms. Moderate risk of direct wind damage from tornadoes in existing pre-UCC structures.

Map 2.157 indicates the total economic damage by parish that Louisiana’s state assets have claimed since 1987. Map 2.158 locates by parish those state assets that have claimed damage for a hazard, in order of total economic damage since 1987, ranging from under $1 million to over $100 million. As Maps 2.157 and 2.158 demonstrate, state assets suffering the greatest economic losses due to repetitive claims are concentrated in the parishes with the largest cities. Nevertheless, as Map 2.158 shows more clearly, state assets with repetitive claims under $10 million can be found evenly throughout the state, except in the least populated parishes.

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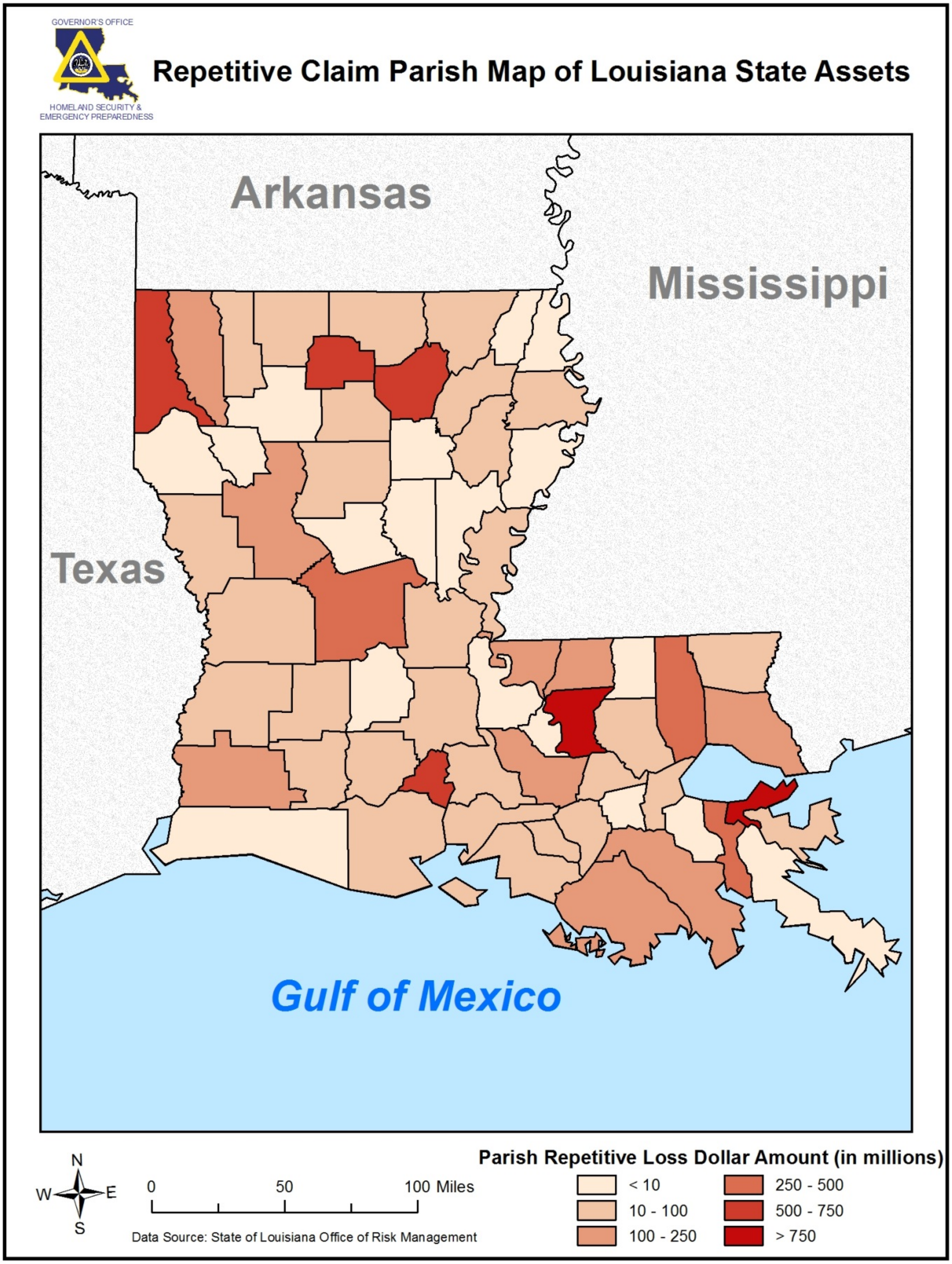
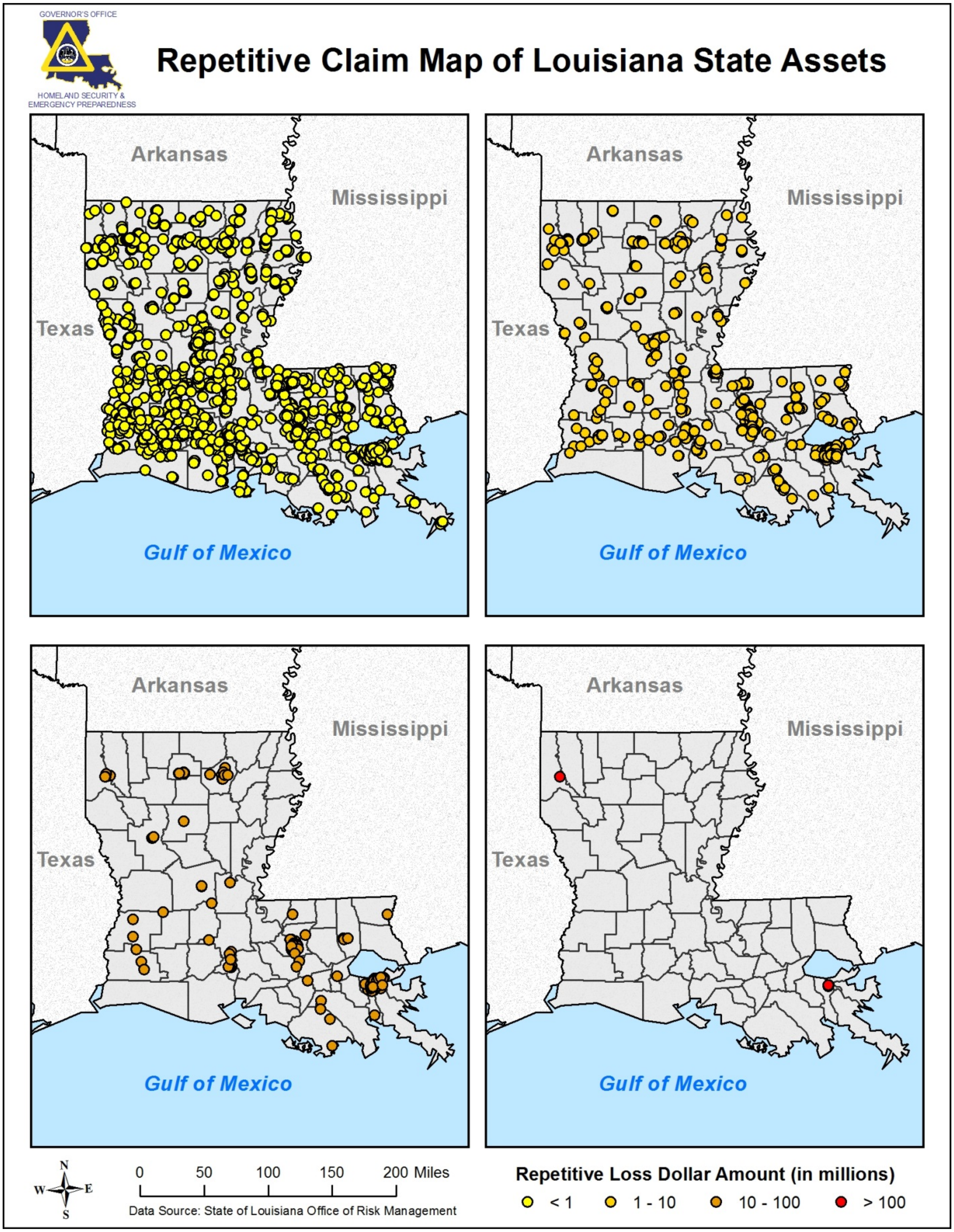


Map 2.157. Location of state assets with repetitive claims by parish.



Map 2.158. State assets with repetitive claims of less than $1 million, between $1 and $10 million, between $10 and $100 million, and over $100 million.

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3. State Historical Properties Risk Assessment

INTRODUCTION

Based on a programmatic agreement between the State Historical Preservation Office (SHPO), the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), and the Federal Emergency Management Agency (FEMA), the State Hazard Mitigation Planning Committee (SHMPC) selected a new goal for its mitigation strategy in this 2014 Plan Update. That goal, as stated in Section 5 of this Plan Update, is to integrate the vulnerability assessment of historic and cultural resources into hazard mitigation planning in order to improve their ability to withstand impacts of natural and human-influenced hazards while protecting character-defining architectural features. This Plan Update is only concerned with natural hazards.

THE SHPO CAPABILITY ASSESSMENT

Louisiana's Office of Cultural Development (OCD) is located within the Department of Culture, Recreation & Tourism (DCRT), which is overseen by the Lt. Governor of Louisiana. It is composed of three Divisions: Archaeology, Arts & Historic Preservation, and the Council for the Development of French in Louisiana (CODOFIL). The divisions of Archaeology and Historic Preservation both encompass the SHPO. The reasons for an alliance between the SHPO and the SHMPC can be defined well through a glance at the mission of the Historic Preservation division. That division is charged with preserving and restoring historic buildings "so they can enhance and enrich our environment and, thus, our lives." As the Historic Preservation division website argues, these buildings leave a legacy of "cultural, educational, recreational, aesthetic, social, and environmental benefits [that] must be preserved for present and future generations." Indeed, the destruction and threat of destruction of historical places in New Orleans following Hurricane Katrina highlighted the potential to lose historical markers that "play a special role in creating the distinctive character of each and every community." Moreover, historical places energize Louisiana's cultural economy. Protecting Louisiana's history is not just a way of protecting its identity but its livelihood, as well.[lxxxiv]

Hazard mitigation is also directly tied to Section 106 of the National Historic Preservation Act of 1966. This section, as amended, requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on such undertakings. The Section 106 Regulations (36 CFR 800) specify that the SHPO reflects the interests of the State and its citizens in the preservation of their cultural heritage. As such, the SHPO is a key participant in the Section 106 process. They advise and assist federal agencies in carrying out their 106 responsibilities, and they cooperate with such agencies, local governments, and organizations and individuals to ensure that the preservation of historic properties is taken into consideration at all levels of planning and development. The SHPO is federally mandated by the National Park Service to review and consult on Section 106 projects.

While the SHPO does not directly administer hazard mitigation programs, it provides first-hand confirmation to all agencies regarding listed or eligible resources, per guidance from the National Park Service's National Register Criteria for Evaluation. Understanding which resources are listed or eligible for listing in the National Register is a critical step in the Section 106 process. In addition to determinations of eligibility, the SHPO also provides guidance regarding appropriate treatment measures to safeguard below-ground and above-ground historic resources. Up to seven employees would be available to provide technical assistance in carrying out mitigation actions. Four employees work in the Division of Historic Preservation to address the built environment, and three employees work in the Division of Archaeology to address below-ground resources.

Geographic Information System Capabilities

Archaeological site files and the areas that have been surveyed are available online as are various databases summarizing data from those files. Archaeological site files are accessible to preapproved Cultural Resource investigators and federal and state agencies only. The Division of Historic Preservation is currently mapping the resources and making them available to the public. Currently, no one on staff is devoted to Geographic Information Systems (GIS), though two staff members are familiar with the program and can assist where needed. The expansion of GIS capabilities would allow the SHPO to expedite its Section 106 review. It would also provide municipalities with the necessary information to understand their historic resources when addressing Section 106 and National Environmental Policy Act (NEPA) requirements or other programs that may affect cultural resources in their areas.

Inter-Agency Coordination

Typically, many state agencies are involved in some capacity with a federal action. Due to federal involvement (through licensing, permitting, funding, and so on), the SHPO reviews projects for other state agencies and comments on impacts to cultural resources. The following agencies have had or have projects reviewed by OCD/SHPO:

- Coastal Protection and Restoration Authority
- Department of Agriculture and Forestry
- Department of Environmental Quality
- Department of Health and Hospitals
- Department of Natural Resources
- Department of Transportation and Development
- Department of Wildlife and Fisheries
- Governor's Office of Homeland Security and Emergency Preparedness
- Louisiana Housing Corporation
- Louisiana National Guard

- Louisiana Office of Coastal Restoration and Management
- Louisiana Office of State Parks
- Louisiana Division of Administration/Facility Planning & Control
- Office of Community Development

The Section 106 process was not designed to stop a project but to allow the SHPO and all interested parties an opportunity to consult with a federal agency or its agent on ways to avoid, minimize, or mitigate any adverse effects to historic properties. When consultation occurs early and all interested parties are included, discussions could result in the relocation of a federal undertaking that might threaten historical preservation. Other consultations include informed discussions on how to incorporate extant historic resources in the planning of the undertaking or how other projects (above and beyond the undertaking) may be developed and offered to the public in lieu of the adverse effect. For instance, had discussion taken place prior to the construction of the Mississippi River–Gulf Outlet (MRGO) Canal in the 1960s, which connected the Gulf of Mexico more directly to New Orleans, historical properties like Fort Proctor in St. Bernard Parish (which is profiled in this section) could have been preserved. At the present, the fort is surrounded and filled with water, inaccessible by land after MRGO was constructed. Future projects could avoid the disastrous consequences of such projects.

The SHPO is involved in the Section 106 review process along with federal agencies or their agent, usually following disasters. The Section 106 process requires that consultations take place to ensure that the federal agency or its agent has an understanding of what the consulting parties expect for the undertaking. In doing so, ways to reduce losses due to hazards may be identified.

The 106 review process begins once a state agency determines that its project will be funded in some way (1) under direct or indirect jurisdiction of a federal agency (including those carried out by or on behalf of a federal agency), or (2) requiring federal assistance, license, permit, or approval. The state agency must then determine if any above- or below-ground historic properties will be impacted by the project. They must work with the SHPO, federally recognized tribes, a Tribal Historic Preservation Officer (THPO), local governments, and public and private individuals to address any adverse effects. The state agency must also contact the Advisory Council to notify them and allow an opportunity to take part in the consultation process. When adverse effects are identified, consultation may result in a Memorandum of Agreement or a Programmatic Agreement document being finalized to outline minimization and/or mitigation measures to be completed within a determined period. The final document must be filed with the Advisory Council on Historic Preservation Office.

State agencies rely on federal funds to assist their constituent base, and pass on such funding (e.g., National Park Service funding or U.S. Department of the Interior funding) through awards to local governments, agencies, and organizations on an annual competitive basis to address safeguarding resources. Typical recipients include historical organizations, parish governments, economic development districts, planning commissions, museum houses, state agencies, municipal governments, educational institutions, and historic district commissions. Typical projects include public education proposals, survey projects (in which buildings over 50 years old in a geographical region are recorded and mapped), publications, projects to develop nominations to the National Register of Historic Places, and Historic American Buildings Survey projects (in which architecture students develop measured drawings of important and endangered buildings). All proposed projects must relate to the Goals and Objectives outlined in the recently approved Louisiana Comprehensive Plan (*Our Places, Our Heritage: A Plan for Historic Preservation and Archaeological Conservation in Louisiana*). These funds must be matched by non-federal monies on at least a 50/50 basis, though grantees may elect to overmatch. In addition, funds are distributed on a reimbursable basis—the recipient disburses monies and is subsequently reimbursed once the necessary billing documentation is received.

PROFILE OF SELECTED HISTORICAL PROPERTIES

For the following profiles, the SHMPC selected several properties to represent the range of historical sites in the state. The vast majority of such sites are engineered buildings, and so those sites comprise the bulk of the profiles (31), but this section also profiles archeological/monolithic sites (4), public squares (2), extant fortifications (3), and one museum ship. Funding limitations restricted this list to 41 historic sites evaluated for hazard vulnerability, resulting in an assessment of over 60 individual buildings.

The historical sites, divided by site type and in order of profiling in this section, are as follows:

- **Archaeological/Monolithic Sites**
  - LSU Campus Mounds
  - Marksville State Historic Site
  - Port Hudson State Historic Site
  - Poverty Point
- **Public Squares**
  - Congo Square
  - Jackson Square
- **Engineered Structures**
  - Blanchard Building
  - Brown Hall – Grambling State University
  - Cabildo
  - Ducournau Square
  - Foster Hall – Grambling State University
  - G.B. Cooley House
  - Gallier Hall
  - Jackson Barracks
  - Kaffie-Frederick Hardware Store
  - Madame John's Legacy
  - Natchitoches Parish Courthouse
  - Old Courthouse

  - Old Governor's Mansion
  - Old State Capitol
  - Old U.S. Mint
  - Old Ursuline Convent
  - Pontalba Buildings
  - The Presbytere
  - Prudhomme Building
  - Ruston POW Camps
  - Sabine Pass Lighthouse
  - St. Louis Cathedral
  - State Capitol
  - Southern Forest Heritage Museum & Research Center
  - **Plantations**
    - Destrehan Plantation
    - Melrose Plantation
    - Oak Alley Plantation
    - Oakley Plantation
    - Ormond Plantation
    - Poche Plantation
    - San Francisco Plantation
- **Extant Fortifications**
  - Ft. Jackson
  - Ft. Pike State Historic Site
  - Ft. Proctor
- **Museum Ship**
  - *USS Kidd*

CONCLUSIONS

In terms of the major hazards profiled in the preceding section, the selected SHPO properties profiled are in most danger of damage from flooding, hail, high winds, and tornadoes. In Maps 3.1, 3.2, 3.3, and 3.4, these properties are imposed on maps of Louisiana flood zones (3.1), hail density (3.2), high wind zones (3.3), and tornado density (3.4).

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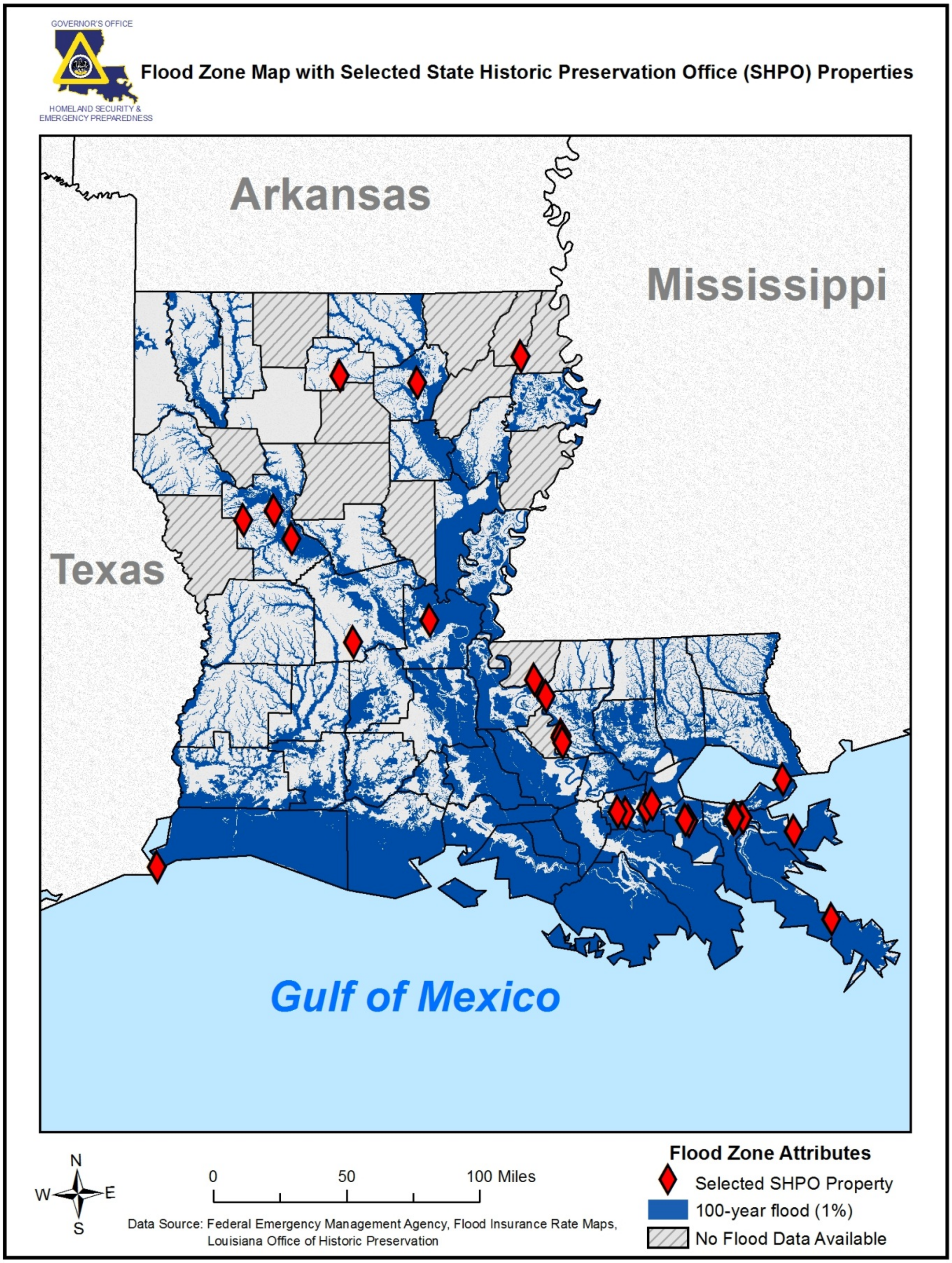
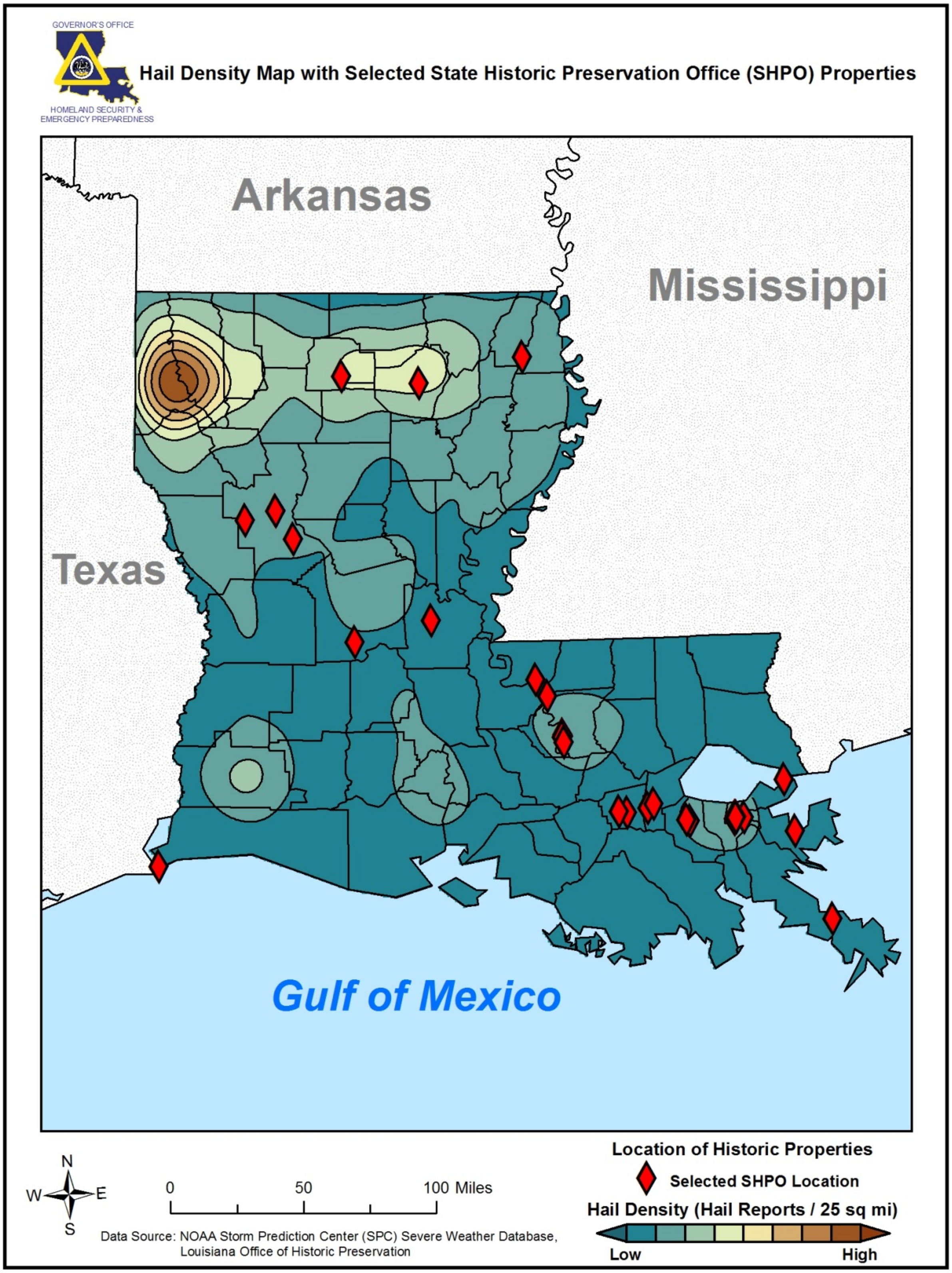
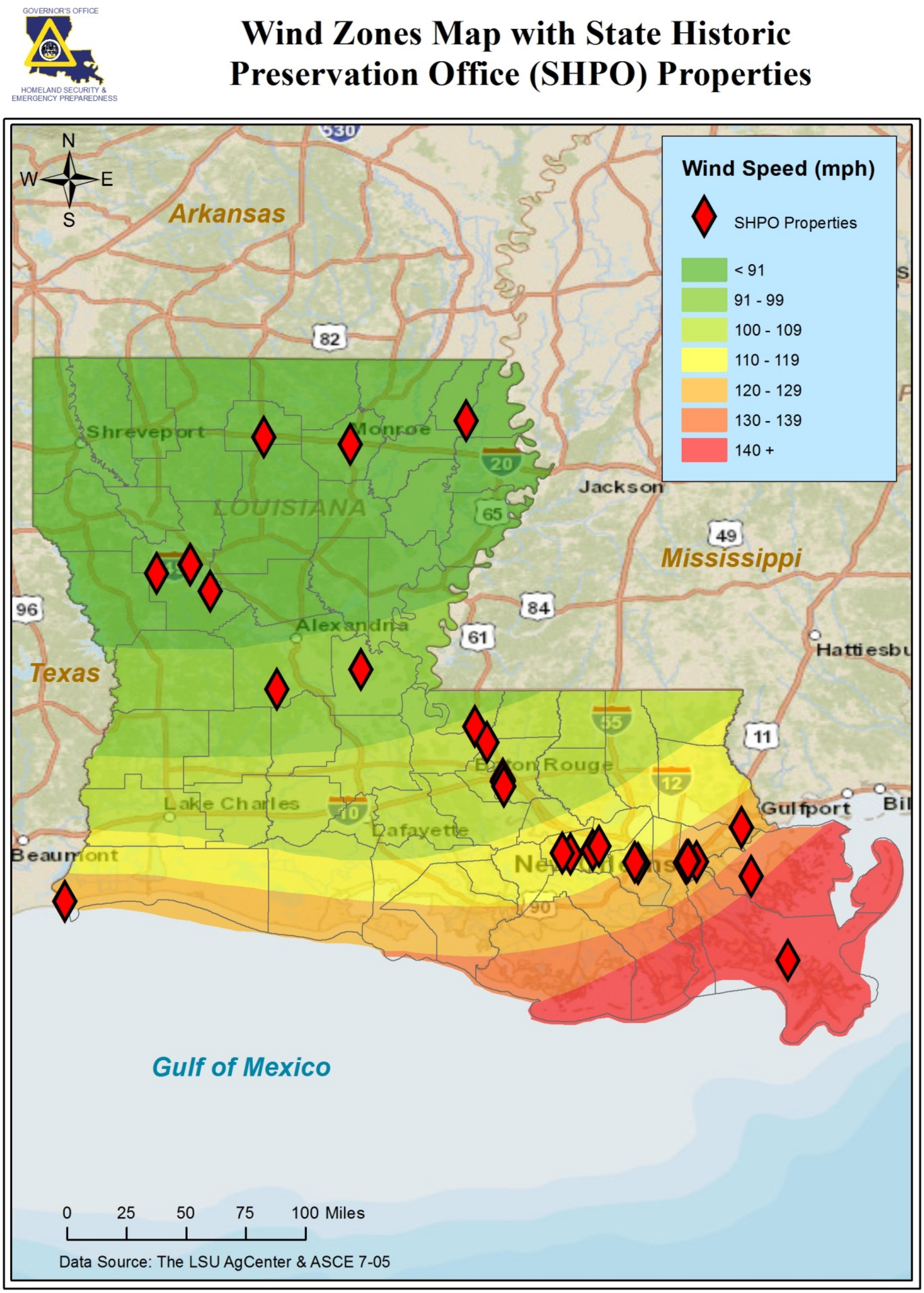


Map 3.1. The selected SHPO profiled properties in relation to 100-yr flood zones in Louisiana.

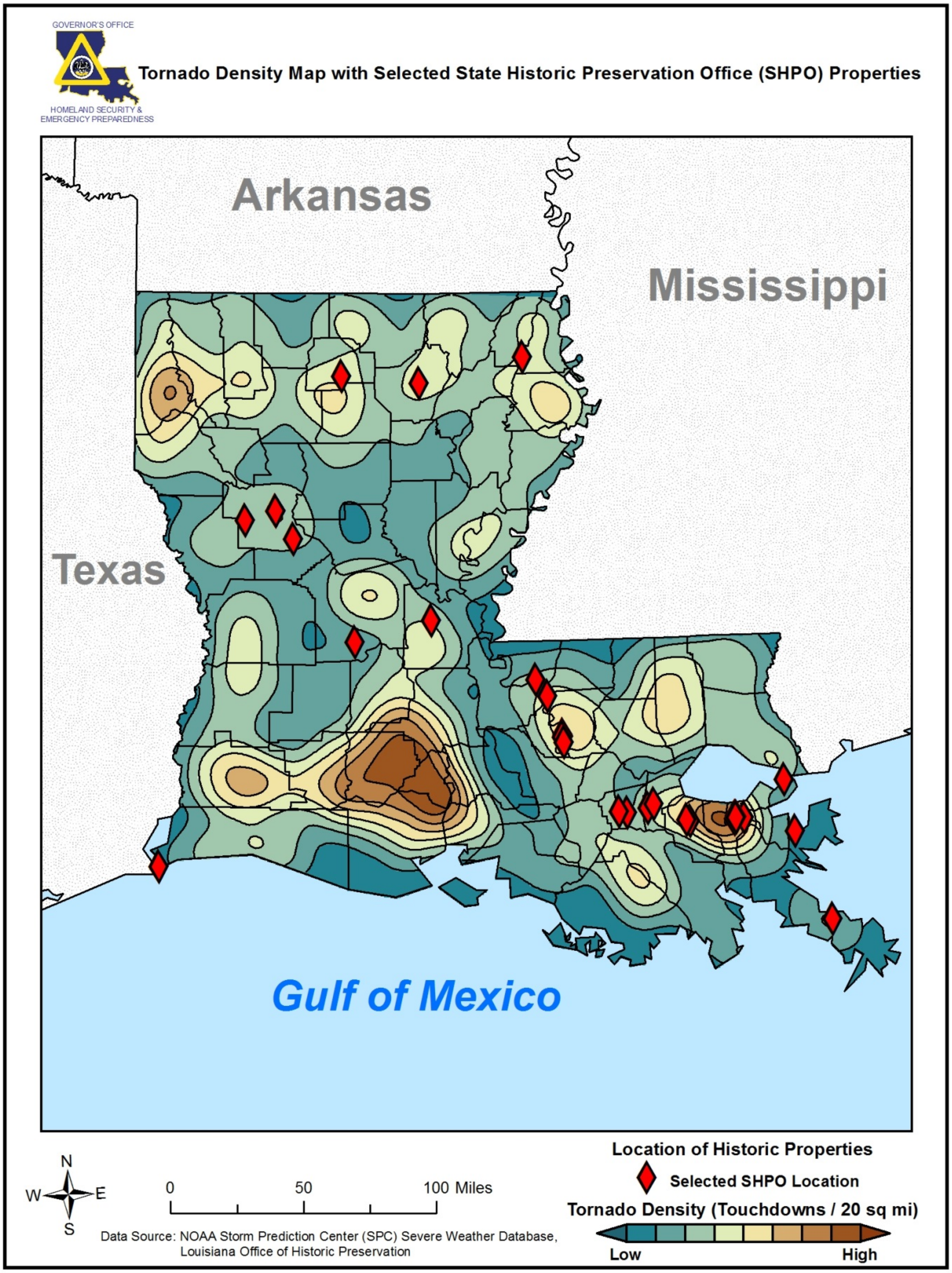


Map 3.2. The selected SHPO profiled properties in relation to hail density in Louisiana.

Wind Zones Map with State Historic Preservation Office (SHPO) Properties



Map 3.3. The selected SHPO profiled properties in relation to high-wind zones in Louisiana.



Map 3.4. The selected SHPO profiled properties in relation to tornado touchdown density in Louisiana.

The selected sites were found to have the following common vulnerabilities:

- **Window Protection for Non-Impact Resistant Windows:** Because non-impact resistant windows are susceptible to water infiltration once broken, window protection should be used in the case of high-wind events.

- **Condition of Non-Impact Resistant Windows:** Deterioration of the window, including the window frame and/or glazing, was observed at multiple locations. Windows with damaged frames or glazing are vulnerable to moisture intrusion, which can cause damage to the interior of the structure.

- **Deterioration of Exterior Building Envelope**: Deterioration of the exterior cladding, roof covering, doors, and windows was detected. Exterior building elements that are in poor condition can lead to moisture intrusion in the interior of the building. Holes in the building envelope can cause structural damage due to pressurization in the interior during high-wind events.

- **Moisture Damage:** Moisture damage was detected on building exteriors and/or interiors at multiple locations

- **Interior Moisture Damage:** Deterioration of plaster that has been applied over brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water from penetrating the wall, causing further moisture damage to the plaster, and to prevent brick failure and cracking.

- **Ponding Issues:** Ponding was detected on multiple flat roof structures. Roof drainage assemblies should be cleaned any of debris, such as foliage, that restricts rainfall runoff. Supplemental roof drainage may also warrant consideration.

- **Cracks and Movement in Structural Walls:** Large cracks were found in exterior masonry walls, suggesting that buildings have settled or experienced gradual differential movement.

- **Moisture Damage to the Exterior Building Envelope:** Moisture in exterior masonry walls can cause plaster damage and brick failure. Mortar joints of exterior masonry walls should be tuck-pointed as needed to prevent water from penetrating the wall.

- **Non-Structural Component Attachment:** Insufficient attachment of non-structural components was detected. Such components include gutters, awnings, and roof top equipment. Non-structural components that are not properly attached can become wind-borne debris sources in high-wind events.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

LSU Campus Mounds

Louisiana State University, Baton Rouge, LA 70803
East Baton Rouge Parish

Historical Profile: The LSU Campus Mounds are two Native American mounds from the Archaic Period, located on the campus of Louisiana State University in Baton Rouge. They are part of a larger, statewide system of mounds and are believed to have been used for ceremonial purposes, rather than burial mounds. The mounds are thought to be more than 6,000 years old, making them part of the oldest mound system in North America, Mesoamerica, or South America.

Primary Use: Historical site

Geographic Profile & Vulnerabilities

Geographic Profile: The LSU Indian Mounds are situated northwest of the LSU Quadangle and are less than a mile from the east bank of the Mississippi River.
Coordinates: 30°24'54"N, 91°10'56"W

Wind Zone: 91–99 mph

Flood Zone: X, levee protection

SFHA: No

Hail Density: Low-medium

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Historical earthworks, surrounded by pedestrian walking paths, roads, and parking lots	**Trees:** Large/mature trees (live oaks)
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** Large/mature trees	**Levee/Flood Protection:** Yes
Building(s) Present on Site: Campus buildings surrounding site		

Vulnerabilities & Mitigation Recommendations

Erosion of Historic Earthworks: The LSU Campus Mounds have experienced 6,000 years of natural erosion, but they are also being damaged by human activity, primarily during LSU football games. University officials have stated that "the mounds have suffered internal structural damage that would lead to their eventual collapse." In 2010, temporary fencing was used during football weekends to prevent access to the mounds. The fencing was quickly torn down by tailgaters, however. Permanent fencing may be considered to restrict human activity on the mounds.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Marksville State Historic Site

837 Martin Luther King Dr., Marksville, LA 71351
Avoyelles Parish

Historical Profile: Two thousand years ago, Marksville State Historic Site was home to the Marksville culture, a southeastern variant of the Hopewell Native American cultures centered in Ohio and Illinois. They practiced elaborate mortuary rituals, constructed conical burial mounds and other earthworks, and had complex trade networks. The seven mounds, one of which is a large burial mound, are surrounded by a horseshoe-shaped earthen embankment about 3,000 feet long.

Primary Use: Archaeological/historic site, museum

Contents: Museum exhibits, office equipment, documents

Year Built: 1952 (structure)	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
The 42-acre Marksville State Historic Site is located approximately 25 miles west of the Mississippi border. The site sits on a bluff overlooking the Old River, adjacent to the town of Marksville.

Wind Zone: 90 mph

Flood Zone: X | **SFHA**: No

Hail Density: Low

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Suburban, rural	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Fallen trees	**Levee/Flood Protection:** No

Vulnerabilities & Mitigation Recommendations



Deterioration of Exterior Building Envelope: ***(Structural Walls)*** Severe cracking and movement of the masonry walls is occurring in the southwestern corner of the museum building. The exterior wall coating is in need of new application. ***(Windows)*** The structure contains 22 windows with metal lintels that are in poor condition. Rusting and swelling of the metal lintels has caused drooping in the window opening and deterioration of the wood window units. ***(Roof)*** In slow rainstorm events, the flat roof leaks into the interior of the building.

Large/Mature Trees: Thirty large oaks were lost during Hurricane Gustav. Large water oaks, which have shallow root systems and are vulnerable to uprooting during high-wind events and slumping in waterlogged conditions, are near the museum structure and surround another structure on the property.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Port Hudson State Historic Site

U.S. 61, Jackson, LA 70748
East Feliciana Parish

Historical Profile:
The Confederacy chose the site to protect the Mississippi River against Union control. Soldiers began building earthwork fortifications in 1862. At this site, the longest siege in American history took place, lasting a total of 48 days. Approximately 7,500 Confederates resisted approximately 40,000 Union soldiers for almost two months during 1863. Among the troops to fight in this battle were the First and Third Louisiana Native Guards, comprised of free Blacks and former slaves.

Primary Use: Civil War battleground, tourism site

Contents: Site contains Civil War earthwork fortifications; Civil War artifacts are housed in the Visitor Center

Geographic Profile & Vulnerabilities

Geographic Profile:
889 acres of unpopulated land, 2.4 miles from the east bank of the Mississippi River
Coordinates: 30°41'36"N, 91°16'32"W

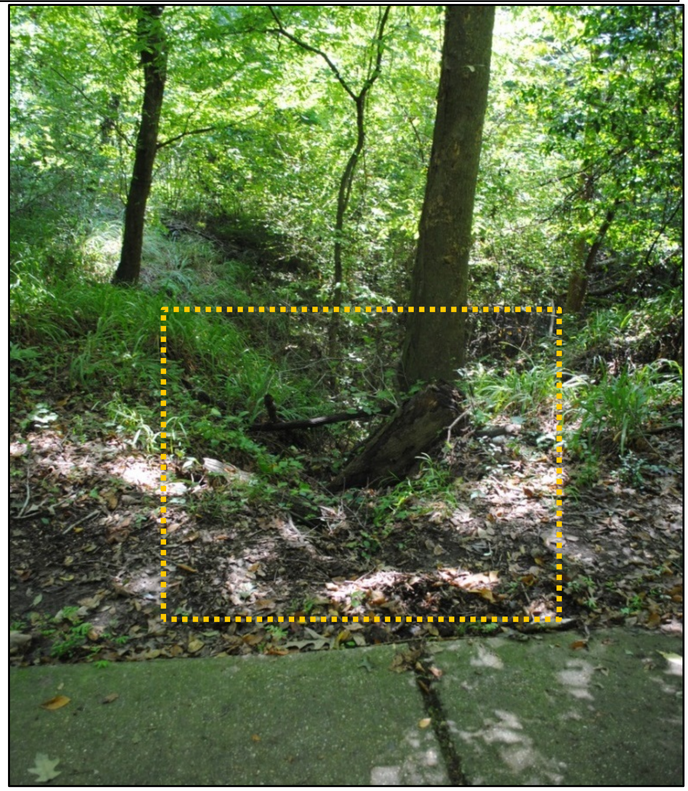
Wind Zone: 91–99 mph	
Flood Zone: X, A	**SFHA:** Yes
Hail Density: Low	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Open fields, hills, steep bluffs, tributary canals, and forests	**Trees:** Large/mature trees (water oak and other species), overhanging
Wind Exposure: Open, shielded by trees	**Wind-Borne Debris Source:** Large/mature trees	**Levee/Flood Protection:** No
Building(s) Present on Site: Yes; Visitor Center, which houses artifacts and historic relics of the Civil War period and site		

Vulnerabilities & Mitigation Recommendations

Runoff-Induced Erosion: Access trails throughout the park are eroding due to runoff and flooding events.



Property Located in SFHA:
Portions of the property fall in a Special Flood Hazard Area (SFHA) A zone. In previous floods, several bridges that connect access trails were washed away.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Poverty Point State Historic Site

6859 Hwy. 577, Pioneer LA 71266
West Carroll Parish

Historical Profile: The Poverty Point earthwork complex was constructed between 1700 and 1100 BC by a hunter-gatherer society. It consists of four earthen mounds, a series of six elliptical earthen ridges, and a large flat plaza, and required nearly 1 million cubic yards of earth-moving. In its time, the settlement was the largest in North America and was the center of a major exchange network.	**Primary Use:** Tourism site, archaeological research center **Contents:** Artifacts from the Poverty Point settlement still remain throughout the grounds, and a large collection of archaeological finds are housed in the Visitor Center and Research Center

Geographic Profile & Vulnerabilities

Geographic Profile:
Unpopulated, located along Bayou Macon (a marshy tributary) not far from the west bank of the Mississippi River.
Coordinates: 32°38'10"N, 91°24'12"W

Wind Zone: 90 mph	
Flood Zone: X, A	**SFHA:** No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** 35 acre site, containing a historical earthworks complex, open fields, forests, waterways	**Trees:** Large/mature trees (water oak and other species), overhanging
Wind Exposure: Open, shielded by trees	**Wind-Borne Debris Source:** Large/mature trees	**Levee/Flood Protection:** No

Building(s) Present on Site: Yes. Two buildings were assessed that house hundreds of thousands of priceless archaeological artifacts from the site, including copper artifacts that are moisture sensitive. The Visitor Center has no back-up generators. The Curation Facility has back-up power for the fire suppression system, but not for the climate control of the building. This facility is used to archive the archaeological collections, so it should have a way to monitor temperature and moisture and dehumidify the air.

Vulnerabilities & Mitigation Recommendations

Erosion of Earthworks: The Poverty Point earthworks have undergone over 3,000 years of erosion. They were even used as farmland in the nineteenth and twentieth centuries, significantly decreasing the height of the original mounds and elliptical ridges. Rain runoff, mature tree growth, and armadillo holes (which retain water and cause slumping) are common problems that the park must solve to reduce further erosion.

Runoff-Induced Erosion: Increased runoff into a tributary that joins Bayou Macon has caused landslides to a portion of Ridge 6 and the property housing the archaeological research center. According to the Poverty Point Park manager, increased runoff is likely due to neighboring farms that have altered the landscape.

Large/Mature Trees: Most of the Poverty Point site is heavily wooded with trees that are prone to high winds and oversaturation of the ground. The root balls of mature trees create large holes in the landscape that must be filled and repaired, and the trees must be removed off site. Staff should perform selective cutting or removal of trees on the earthworks or near facilities housing historic artifacts.

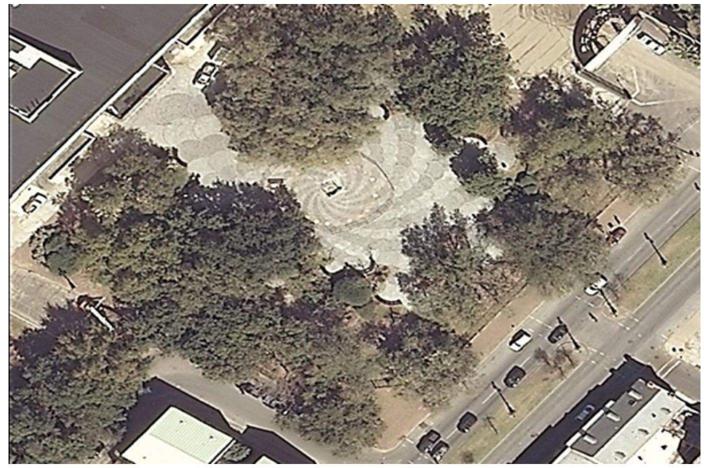

Deterioration of Exterior Openings: The exterior doors of the Visitor Center are in need of repair or replacement due to age and moisture damage.

Large/Mature Tree Vulnerability: Several mature water oaks are situated directly behind the Curation Facility. Many similar trees have fallen throughout the site during past high-wind events. The subject trees could pose a hazard to the structure and its contents.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Congo Square

700 North Rampart St., New Orleans, LA 70116
Orleans Parish



Historical Profile: Before the arrival of the French, the site of Congo Square was deemed sacred ground by the Houma Indians, who celebrated their annual corn harvest there. As early as the late 1740s, it became a mercantile center and gathering spot for slaves. In the early 1800s, Congo Square became famous for the Sunday afternoon gatherings of African slaves who performed native music and dancing that would influence jazz and rhythm and blues music. Congo Square was also the original site of the New Orleans Jazz Fest in 1970.

Primary Use: Open space/square used for music festivals, concerts, and other community gatherings

Geographic Profile & Vulnerabilities

Geographic Profile:
Congo Square is an open space within Louis Armstrong Park, located in the Tremé neighborhood of New Orleans, just north of the French Quarter.
Coordinates: 29°57’39”N, 90°4’6”W

Wind Zone: 110-119 mph

Flood Zone: X, levee protection

SFHA: No

Hail Density: Low-medium

Tornado Density: Medium-high

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature, medium
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Other buildings	**Levee/Flood Protection:** Yes
Building(s) Present on Site: Yes; New Orleans Municipal Auditorium		

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Jackson Square

700 Decatur St., New Orleans, LA 70116
Orleans Parish

Historical Profile: The center of early, French colonial New Orleans was originally called the Place d'Armes. After the Battle of New Orleans, in 1815, the Place d'Armes was renamed Jackson Square after the victorious United States general Andrew Jackson, whose statue is at the center of the park. Place d'Armes was the prime site for public executions and served as an arsenal in the Reconstruction era. A political uprising also took place on the site after the 1872 gubernatorial election when a several-thousand-man militia defeated the New Orleans militia, seizing control of the state's buildings and armory for a few days.

Primary Use: City common area, tourist attraction, site for artists, musicians, and street performers

Geographic Profile & Vulnerabilities

Geographic Profile:
Jackson Square is bounded by Decatur, St. Peter, St. Ann, and Chartres streets in the historic French Quarter. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 400 feet from the Mississippi River.
Coordinates: 29°57′26″N, 90°3′47″W

Wind Zone: 110-119 mph

Flood Zone: X, levee protection

SFHA: No

Hail Density: Low-medium

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Open square surrounded by trees	**Trees:** Large/mature trees (live oak)
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Large/mature trees	**Levee/Flood Protection:** Yes
Building(s) Present on Site: No		

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Blanchard Building

732-746 Front St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: Also known as the LaCoste Building, this building is one of two in Natchitoches that retains its original carriage drive from the street into the rear courtyard. In the early twentieth century, the second floor was a popular dance hall called the Comus Club. Damaged by fire, the building was renovated in the mid-twentieth century.

Primary Use: Shops (first floor), offices (second floor)

Contents: Shops (first floor): furniture, art, accessories, and kitchen products (approx. $200K value). Offices (second floor and attic): furniture, computer systems, and art (approx. $200K value); engineering and surveying documents, electronic data, intellectual property (approx. $200K value)

Year Built: 1853	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; engineering documents	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1994		

Geographic Profile & Vulnerabilities

Geographic Profile: The Blanchard Building is located along Front St., atop the western ridge of the Cane River in the Natchitoches Historic District.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data			
Construction Type: Masonry, timber	**Foundation Type:** Pier and beam		**Roof Type:** Gable
Stories: 2	**Basement:** Partial	**Attic:** Yes	**Roof Covering:** Metal
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown; roof sustained minor damage at various times
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 0.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

Roof Decking Deterioration: Deterioration of the wood-plank roof decking was detected throughout the span of the front porch. Some of this decking damage occurred at rafter connections, which could pose issues for that portion of the roof structure.

Interior Moisture Damage: Deterioration of the plaster application over brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster) and to prevent brick failure (such as cracking).

Non-Impact Resistant Windows: Non-impact resistant windows are susceptible to water infiltration once broken.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Brown Hall

Grambling State University Campus, Ruston LA 71245
Lincoln Parish

Historical Profile: Brown Hall was originally used as a first-year women's dormitory. Brown Hall was named after Hallie Q. Brown, a distinguished lecturer and elocutionist who traveled extensively. From 1939 to 1960, Grambling State University was the only institution of higher learning available to African-Americans in northern Louisiana.

Primary Use: Classrooms/administration

Contents: Office, school furniture and equipment

Year Built: 1956	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Unknown	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Brown Hall is located within the Grambling State University campus, approximately 33 miles from the Arkansas border and 78 miles from the Texas border.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Engineered site	**Trees:** Yes
Wind Exposure: Open, shielded on one side by a smaller building	**Wind-Borne Debris Source:** Building components (loose siding, other buildings)	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Unknown		**Roof Type:** Hip
Stories: 2	**Basement:** Unknown	**Attic:** Yes	**Roof Covering:** Shingle
Building Condition: Fair	**Window Condition:** Fair		**Roof Condition:** Fair
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 2 feet	**Mechanical Equipment Height (from ground):** Unknown	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Awning (no), Gutter (no)			

Vulnerabilities & Mitigation Recommendations


Deterioration of Exterior Building Envelope: Exterior wood siding (specifically used on the dormers, soffits, and fascia perimeter) is in need of replacement.

Insufficient Attachment of Non-Structural Building Features: Metal awning supports are deteriorated (one was missing on the north side of the building). Missing/broken gutters were also observed.

Condition of Non-Impact Resistant Windows: Deterioration of the window frames can lead to leaking between glazing, window frames, and exterior walls due to flashing, sealant, or gasket failure. Non-impact resistant windows are susceptible to water infiltration once broken.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

The Cabildo

701 Chartres St., New Orleans, LA 70116
Orleans Parish

Historical Profile: The Cabildo was rebuilt after the Great Fire of New Orleans (1788) to house the Spanish municipal government in New Orleans. The Cabildo was the site of the Louisiana Purchase transfer ceremonies in 1803. The New Orleans City Council continued to use the building until the mid-1850s.

Primary Use: Museum

Contents: Historic paintings, prints, photographs, textiles, three-dimensional objects, furniture, decorative arts, musical instruments, and other medias. The collection holds many irreplaceable artifacts that require a constant temperature in the range of 70 degrees and a constant humidity of 50%.

Year Built: 1722	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1988		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Cabildo is located along Jackson Square, next to St. Louis Cathedral in the historic French Quarter. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 800 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Building components (slate tiles, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood and masonry	**Foundation Type:** Pier and beam		**Roof Type:** Mansard
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1 foot	**Mechanical Equipment Height (from ground):** 1.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations

Moisture Damage to the Exterior Building Envelope: Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster) and to prevent brick failure (such as cracking)

Vulnerable Openings: During Hurricane Isaac, the gallery doors facing Jackson Square, as well as the dormer windows facing Pirate's Alley, blew open, causing interior damage from wind-driven rain. Exterior window and door protection should be used in the case of high-wind events, to prevent opening and breakage of the non-impact resistant glass units.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Ducournau Building

750 Front St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: The Ducournau Building is one of two commercial structures (the other being the neighboring Blanchard Building), which includes a carriage drive from the front to a rear courtyard—a feature primarily associated with French Quarter architecture in New Orleans.

Primary Use: Restaurant and bar (first floor), bed and breakfast (second & third floors)

Contents: Restaurant and Bar (first floor): restaurant/kitchen equipment, food inventory ($200K). Bed and breakfast (second & third floors): furniture, artwork, antiques (>$100K).

Year Built: 1935	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; Food in restaurant	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1999, 2006		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Ducournau Building is located along Front St., atop the west ridge of the Cane River in the Natchitoches Historic District.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Metal roof panels - roof sustained damage in 2011 (>$70K)	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Pier and beam		**Roof Type:** Gable, flat
Stories: 3	**Basement:** No	**Attic:** Partial	**Roof Covering:** Metal, single-ply membrane
Building Condition: Good	**Window Condition:** Good		**Roof Condition:** Unknown (gable), flat (fair). Roof damage sustained in 2011 (>$70K)
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 0.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

Ponding Issue: Ponding was detected on the carriage house in the rear of the property. Tree debris should be removed from the roof to prevent the restriction of rain runoff, and supplemental roof drainage should be considered for use.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Foster Hall

Grambling State University Campus, Ruston, LA 71245
Lincoln Parish

Historical Profile: Foster–Johnson Health Center was named after Madison Foster, a physician from Monroe, and Edward A. Johnson, who drove 200 miles roundtrip from Natchitoches to serve Grambling Campus and community residents. They were the first two college physicians at Grambling College. From 1939 to 1960, Grambling State University was the only institution of higher learning available to African-Americans in northern Louisiana.	**Primary Use:** Infirmary/Counseling Center **Contents:** Medical and office equipment, medical supplies, furniture, documents, and records

Year Built: 1943	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Foster Hall is located within the Grambling State University campus, approximately 33 miles from the Arkansas border and 78 miles from the Texas border.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Engineered site	**Trees:** Yes
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Building components (roof/soffit)	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

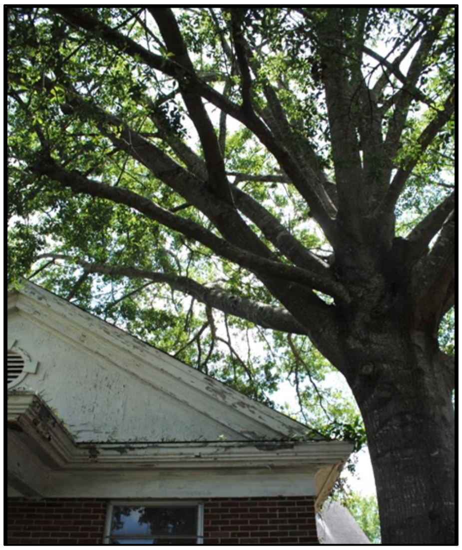
Construction Type: Wood and masonry	**Foundation Type:** Unknown		**Roof Type:** Gable
Stories: 1	**Basement:** Unknown	**Attic:** Yes	**Roof Covering:** Shingle
Building Condition: Fair	**Window Condition:** Fair-poor		**Roof Condition:** Fair-poor
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Gutters (no)			

Vulnerabilities & Mitigation Recommendations



Deterioration of Exterior Building Envelope: Severe deterioration of the wood soffits, siding, and trim were observed. The roof covering has warped and is missing shingles throughout, exposing the roof deck underlayment. The windows and doors were graded to be in fair condition but are in need of replacement. Each of these vulnerabilities can cause moisture damage in the interior and induce mold growth—in a facility used for health care.


Broken Non-Impact Resistant Windows: Broken windows at the rear of the building were detected. Non-impact resistant windows are susceptible to water infiltration once broken.




Overhanging Tree: Branches from an overhanging tree that are resting on a portion of the roof need to be trimmed. The subject tree is located in the rear of the property, approximately 1.5 feet away from the structure.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

G.B. Cooley House

1011 South Grand St., Monroe, LA 71201
Ouachita Parish

Historical Profile: Designed in 1908 by internationally renowned architect Walter Burley Griffin, the G.B. Cooley House was built for entrepreneur Gilbert Brian 'Captain' Cooley and his wife. The Cooley House is Griffin's last structure to be completed in the United States, and it is one of the last surviving examples of Prairie School residential architecture in the South.		**Primary Use:** Property of City of Monroe **Contents:** Original cork flooring, decorative woodwork and windows, and period table. Non-functioning, yet still in place: central vacuum system, central steam heating, an incinerator, a steam shower, and a sunken tub.	
Year Built: 1925	**Occupied:** No	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1976		

Geographic Profile & Vulnerabilities

Geographic Profile:
The G.B. Cooley house is bounded at the intersection of South Grand St. and Texas Ave. The Ouachita River is located directly west of the site.

Wind Zone: 90 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Engineered site	**Trees:** Large/mature (away from structure)
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** Slate tiles	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood, masonry	**Foundation Type:** Slab on grade		**Roof Type:** Gable, complex
Stories: 2	**Basement:** Partial	**Attic:** No	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

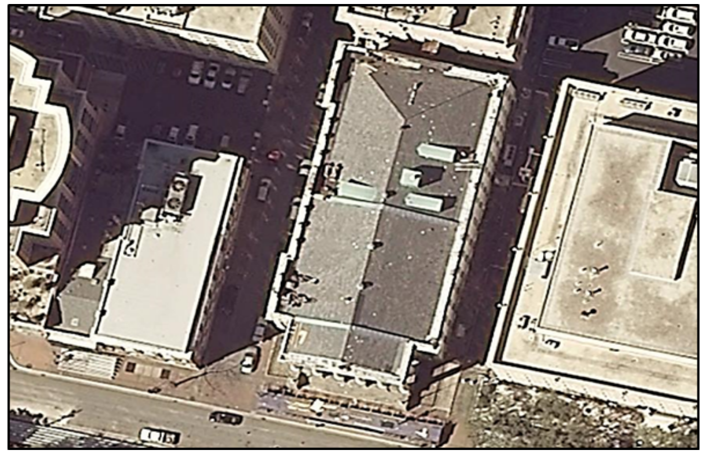

Deterioration of Exterior Building Envelope: Deterioration of the stucco cladding was detected at numerous locations around the soffit parameter, exposing the wood roof frame and sheathing to water damage.

Non-Impact Resistant Windows:
A cracked glass pane was observed on the southern side of the structure.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Gallier Hall

545 St. Charles Ave., New Orleans, LA 70130
Orleans Parish



Historical Profile: Gallier Hall served as City Hall for just over a century and has been the site of many important events in New Orleans' history, especially during Reconstruction and the Huey Long era. Several important figures in Louisiana history lay in state in Gallier Hall, including Jefferson Davis and General Beauregard.

Primary Use: Event hall/theatre

Contents: Paintings, draperies, lighting fixtures, furniture, office equipment

Year Built: 1845-1853	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** Unknown
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Gallier Hall is located in the New Orleans Central Business District and is approximately 3,000 feet from the west bank of the Mississippi River.

Wind Zone: 110-119 mph

Flood Zone: X, levee protection | **SFHA**: No

Hail Density: Low-medium

Tornado Density: Medium

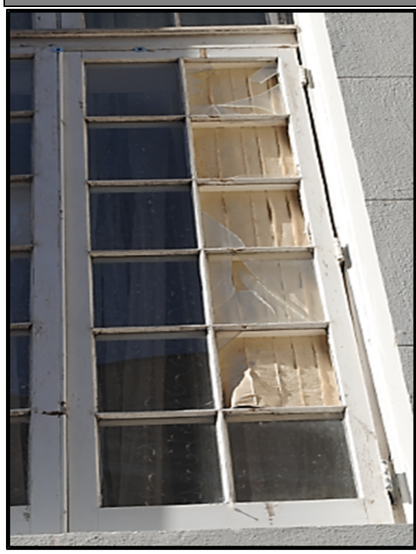
Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Masonry (stone)	**Foundation Type:** Unknown		**Roof Type:** Gable, hip, complex
Stories: 3	**Basement:** Yes	**Attic:** Yes	**Roof Covering:** Unknown
Building Condition: Good	**Window Condition:** Fair-poor		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1 foot	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations



Window Protection for Non-Impact Resistant Windows & Condition of Openings:
Several broken windows were found throughout the structure. Window protection should be used in the case of high-wind events because non-impact resistant windows are susceptible to water infiltration once broken.

Exterior doors to the basement portion of the structure were found to be in fair-poor condition, which could lead to wind-driven rain intrusion or opening during high-wind events.

Moisture Damage: Moisture damage was detected on numerous interior walls throughout the building.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Jackson Barracks Campus

6400 St. Claude Ave., New Orleans, LA 70117
Orleans Parish

Historical Profile: President Andrew Jackson signed a Congressional bill on July 19, 1832, that provided $87,000 for the building of a post to house U.S. troops. An additional $107,500 from the Federal Fortifications Act was appropriated by Congress, who realized after the War of 1812 that coastal cities were not adequately defended. The site for Jackson Barracks was purchased on December 16, 1833, from Pierre Cotteret due to its proximity to the city and the four forts (Forts Pike, Macomb, Jackson, Livingston, and St. Philip) guarding it against a seaborne invasion such as Jackson faced there in 1815. The Jackson Barracks campus suffered severe flood damage due to levee failure in Hurricane Katrina.

Primary Use: Military housing/administrative use/chapel

Contents: Furniture, residential contents, office items and equipment

Year Built: 1834	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Fort Jackson is located in the Lower 9th Ward of New Orleans. The southwest portion of the campus dead ends at the Mississippi River levee system.

Wind Zone: 110-119 mph

Flood Zone: X (500 yr. Flood Zone), AE

SFHA: Yes

Hail Density: Low-medium

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** Building components (slate tiles)	**Levee/Flood Protection:** Yes; located along MS River levee system

Structural Attributes & Vulnerability Data

Construction Type: Masonry, wood	**Foundation Type:** Pier and beam		**Roof Type:** Gable, hip, flat	
Stories: 1, 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate	
Building Condition: Good	**Window Condition:** Good		**Roof Condition:** Good	
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No	
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A	
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)				

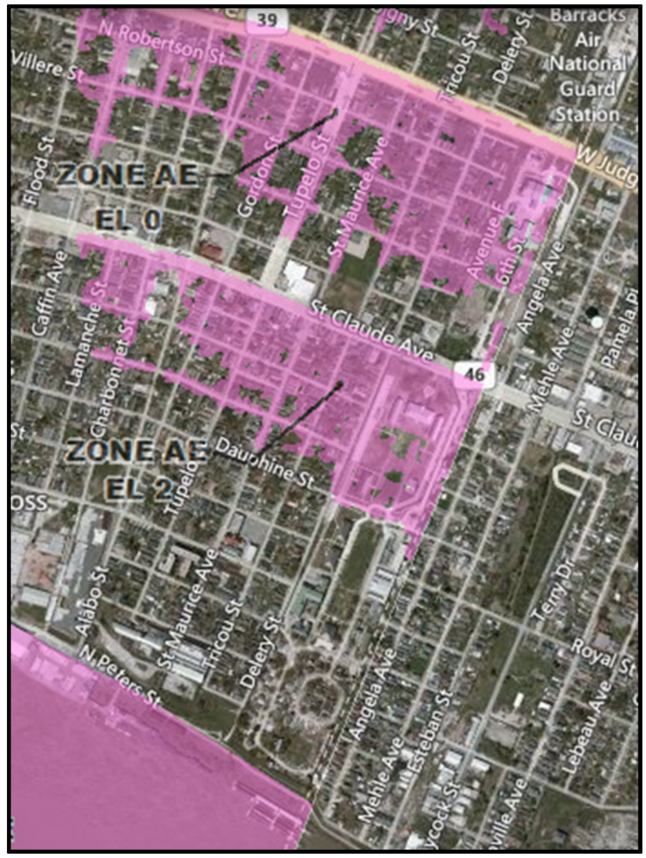
Vulnerabilities & Mitigation Recommendations



Exterior Building Envelope Damage: Missing/poorly attached siding and insufficiently attached ridge tiles were detected on the office/administration buildings. These items can become wind-borne debris sources during high-wind events, and failure of the building envelope material can lead to water infiltration into the interior portion of the structure.

Window Protection for Non-Impact Resistant Windows: Window protection should be used in the case of high-wind events because non-impact resistant windows are susceptible to water infiltration once broken.

Overhanging Trees: Large branches were found hanging over several of the residential structures and one had been struck by lightning. The subject trees should be selectively trimmed to avoid damage to the building in a high-wind event.



Campus within Special Flood Hazard Area (SFHA)/Flood History: Although the historic buildings that were assessed were not in the SFHA, portions of the Jackson Barracks campus do fall in the SFHA AE Zone. Moreover, the subject buildings sustained substantial flood damage during Hurricane Katrina, measuring up to 8 feet in some areas.

Grade-level air conditioning condensers and electrical were typical at each building, but generators were elevated.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Kaffie-Frederick Hardware Store

758 Front St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: Adolph and Harris Kaffie, Jewish–Prussian immigrants, opened for business in 1863. Their store has been in this building since 1892. The store is the oldest continuously operated hardware store in Louisiana.

Primary Use: Hardware store

Contents: Store inventory ($300K), furniture and fixtures ($128K)

Year Built: 1863	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1932		

Geographic Profile & Vulnerabilities

Geographic Profile:
Kaffie-Frederick Hardware Store is located along Front St., atop the west ridge of the Cane River in the Natchitoches Historic District.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry, wood	**Foundation Type:** Pier and beam, slab		**Roof Type:** Flat	
Stories: 2	**Basement:** No	**Attic:** No	**Roof Covering:** Unknown	
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good-fair; several places on roof need to be permanently fixed	
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No	
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No		**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes)				

Vulnerabilities & Mitigation Recommendations

Flooding Inside Structure: The storeroom in the back of the property has previously experienced flooding caused by drainage problems. Numerous buildings along Front St. have had flooding issues from the same source, and these episodes seem to be precipitated by periods of heavy rainfall. Drainage improvement projects should be explored to prevent further flooding events.

Fire Hazard: Since most of the building's interior is primarily built of wood, the current owner is concerned with fire vulnerabilities due to lightning strikes. Consideration of a lightning protection system is recommended to prevent possible loss.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Madame John’s Legacy

632 Dumaine St., New Orleans, LA 70116
Orleans Parish

Historical Profile: Madame John's Legacy is a product of the fire of 1788. It is a rare example of Creole French colonial design in the French Quarter. It is also of special interest because it escaped the Great Fire of 1795, which leveled much of New Orleans and changed the architectural look of the city.

Primary Use: Museum

Contents: Rotating museum exhibits (currently housing collection of Newcomb pottery), furniture

Year Built: 1789	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1948, 1972, 1996		

Geographic Profile & Vulnerabilities

Geographic Profile:
Madame John’s Legacy is located in the middle of the historic French Quarter. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 1,000 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

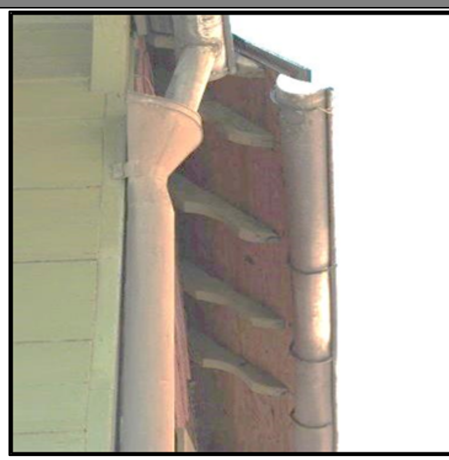
Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Building components (slate tiles)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data			
Construction Type: Wood and masonry	**Foundation Type:** Pier (brick)		**Roof Type:** Mansard
Stories: 2	**Basement:** Yes	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 8 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (partial)			

Vulnerabilities & Mitigation Recommendations

Exterior & Interior Building Envelope Damage: Plaster that was applied over the brick structural walls has caused serious and recurring moisture issues to the exterior and interior building envelope. The bricks, which naturally retain moisture, are not able to dry properly due to the plaster application.



Non-Structural Component Attachment: The gutter system on the side of the building needs additional support to prevent the gutter from tilting. Non-structural components not properly attached can become wind-borne debris sources in high-wind events.

Interior Moisture Damage: Slate tiles around the central chimney are causing moisture intrusion into the interior of the structure. Plaster that was applied over the brick structural walls has caused serious and recurring moisture issues to the interior of the structure. It is recommended that an ice and water shield be installed on the roof structure to prevent further damage and that the mortar of the chimney be tuck-pointed.

Wind-Borne Debris Source: Loose Slate tiles were detected on the roof of the neighboring building, to the rear of the property. Since loose tiles can become wind-borne debris sources in high-wind events, it is recommended that routine checks of roof tile attachment be made.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Natchitoches Parish Courthouse

226 Church St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: The Natchitoches Parish Courthouse was built during President Roosevelt's Works Progress Administration.

Primary Use: Courthouse, government offices

Contents: Books, furniture, photographs, artwork, government records, electronics, records (parish meetings & ordinances, court, property ownership, zoning, & tax records)

Year Built: 1940	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; records	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1959 (addition)		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Natchitoches Parish Courthouse is located in the center of the Natchitoches Historic District, one block west of the Cane River.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

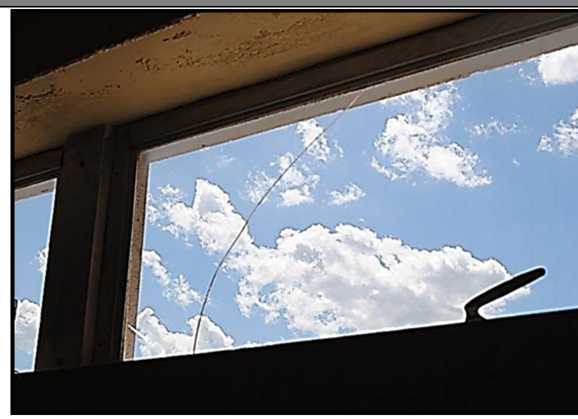
Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature (evergreen)
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Building components (rooftop communication equipment)	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Concrete, masonry	**Foundation Type:** Slab		**Roof Type:** Flat	
Stories: 4	**Basement:** Yes	**Attic:** Yes	**Roof Covering:** Asphalt section	
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good	
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No	
Lowest Floor Height (from ground): -8 feet	**Mechanical Equipment Height (from ground):** -7 feet	**Floodproofing:** No		**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Rooftop equipment (corroded attachments should be replaced in the near future).				

Vulnerabilities & Mitigation Recommendations

Ponding Issue: Roof membrane damage was detected on the roof of the rear building. Debris should be removed periodically from the roof drain to prevent the restriction of rain runoff, and supplemental roof drainage should be considered.



Non-Impact Resistant Windows: Broken glass panes were found on the first and fourth floor.

Moisture Damage to Exterior Building Envelope and Interior: The concrete overhang at the back of the rear building is causing moisture issues that are deteriorating exterior and interior building components. The tar covering of the concrete overhang is in poor condition. Other moisture problems were observed around the windows (pictured above in separate comment) of the same building.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Old Courthouse Museum

600 2nd St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: Constructed in 1896, the old courthouse serves as the library for the Natchitoches Genealogical and Historical Association	**Primary Use:** Museum
	Contents: Genealogical records, books, furniture, photographs, artwork, artifacts, electronics, and microfilm

Year Built: 1896	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; historic relics, books, documents	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1935, 1977		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Old Courthouse Museum is located in the center of the Natchitoches Historic District, one block west of the Cane River.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA:** No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Small
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Rooftop equipment from Natchitoches Parish Courthouse	**Levee/Flood Protection:** No

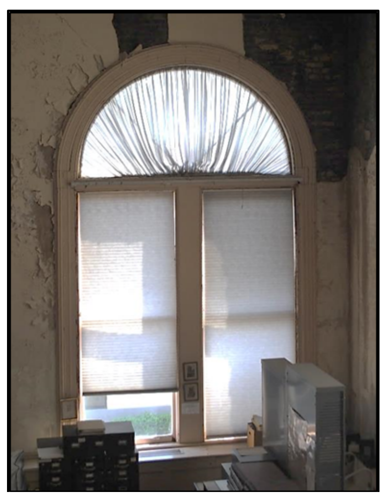
Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Pier and beam		**Roof Type:** Hip, complex
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Shingle
Building Condition: Fair	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1.5 feet	**Mechanical Equipment Height (from ground):** 2 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

Cracks in Structural Walls: Large cracks were observed on the north-facing interior, structural wall, which supports the two story loft and large hipped roof.

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion, causing moisture damage to the plaster, and to prevent brick failure, such as cracking.



Non-Impact Resistant Windows: The building envelope is comprised of numerous non-impact resistant windows, some measuring approximately 8 feet tall, that are in fair condition.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Old Governor's Mansion

502 North Blvd., Baton Rouge, LA 70802
East Baton Rouge Parish

Historical Profile: The Old Louisiana Governor's Mansion was used between 1930 and 1961 and was the home of Huey Long and family during the beginning of his governorship. The governor's mansion is modeled after the White House in Washington D.C., supposedly because Governor Long wanted to become familiar with Washington's White House.

Primary Use: Museum, event venue

Contents: Historic house museum collections (artifacts, furnishings, fine art, and collectables) related to the history of the landmark, office equipment ($800K)

Year Built: 1929	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; contents and building finishes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Multiple times		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Old Louisiana Governor's Mansion is located at 502 North Blvd. between Royal and St. Charles streets in downtown Baton Rouge and is five blocks east of the Mississippi River

Wind Zone: 91-99 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Small/Mature
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Unknown		**Roof Type:** Flat
Stories: 3	**Basement:** Yes	**Attic:** Yes	**Roof Covering:** Unknown
Building Condition: Good	**Window Condition:** Good		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): -9 feet	**Mechanical Equipment Height (from ground):** Unknown	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

Interior Moisture Damage & Possible Roof Ponding: Interior moisture damage was detected in the walls and ceilings of several rooms, causing serious and recurring moisture issues with the plaster.

Analysis of the roof from aerial imagery suggests that roof ponding exists over the ceiling portion that is damaged by moisture. The debris of an overhanging tree in this area may be clogging the roof drain, aggravating the moisture issue.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Old State Capital

100 North Blvd., Baton Rouge, LA 70801
East Baton Rouge Parish

Historical Profile: The Old State Capital was built to accommodate the move of the seat of government from New Orleans to Baton Rouge. Gutted by fire in the Civil War, the state house has been completely refurbished and is one of the most distinguished examples of Gothic Revival architecture in the United States.		**Primary Use:** Museum, event venue **Contents:** Furniture, draperies, office equipment, electronic equipment	
Year Built: 1850	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1990-1994		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Old State Capital building is located atop a bluff, approximately 600 feet from the Mississippi River.

Wind Zone: 91-99 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

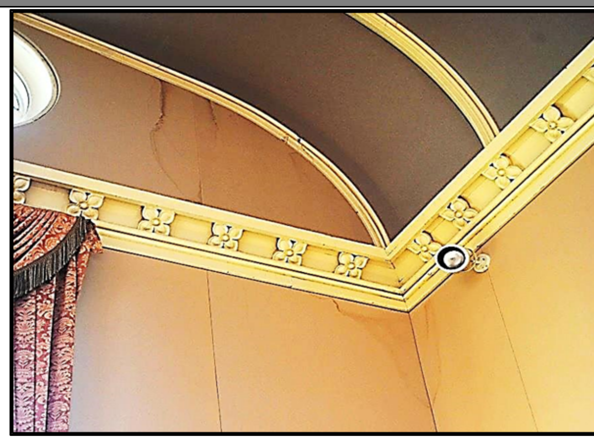
Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature, medium
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** Other buildings	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Slab on grade		**Roof Type:** Gable, flat
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Metal (copper)
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good-fair; several places on roof need to be permanently fixed
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 3 feet	**Mechanical Equipment Height (from ground):** 3.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Lightning protection (yes)			

Vulnerabilities & Mitigation Recommendations



Deterioration of Exterior Building Envelope: While the roof structure and covering is very well maintained, temporary fixes are in place on several locations throughout the roof system that could become problematic in the event of a major storm. The exact locations of the problem areas exist in the valleys of the gable roof structures, which have caused leaking in the interior. Such water damage includes interior walls (pictured above) and hardwood flooring.

Deterioration of Non-Impact Resistant Windows: Many of the windows were reported to have insufficient insulation and/or sealing, causing water intrusion of wind-driven rain. If left unattended during a major rain event, the windows can cause damage to wood floors, draperies, or furniture. Non-impact resistant windows are susceptible to water infiltration once broken.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Old U.S. Mint

400 Esplanade Ave., New Orleans, LA 70116
Orleans Parish

Historical Profile: The Old U.S. Mint holds the distinct title of being the only mint to produce both American and Confederate coinage. A product of Andrew Jackson's "Bank War" and westward expansion, the mint was built in 1835 and constructed on the site of Fort St. Charles. Minting began in 1838 and ended in 1909.

Primary Use: Museum

Contents: Wide variety of priceless collections exhibited and stored on-site

Year Built: 1835	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1854, 1970s		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Old U.S. Mint is located at the edge of the northeastern end of the French Quarter. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 450 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by buildings on three sides	**Wind-Borne Debris Source:** Building components (roof panels, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood, masonry	**Foundation Type:** Brick footing		**Roof Type:** Gable
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Metal (Copper)
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown; damage sustained in Hurricanes Katrina & Isaac
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Railing between columns (no)			

Vulnerabilities & Mitigation Recommendations

Window Protection for Non-Impact Resistant Windows: Non-impact resistant windows are susceptible to water infiltration once broken. It is recommended that window protection be used in the case of high-wind events.

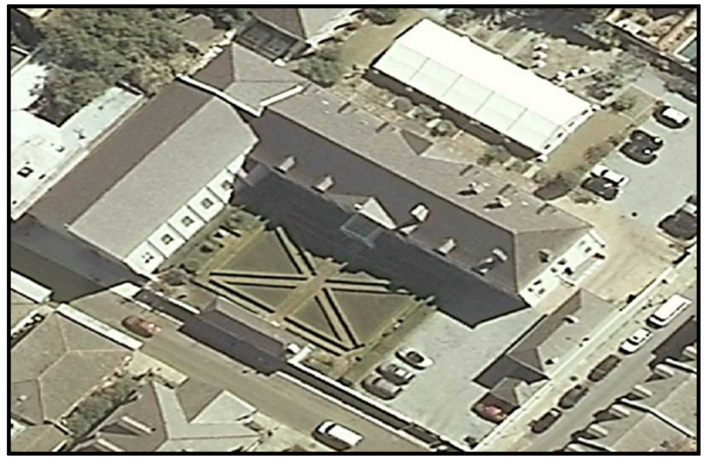
Deterioration of Exterior Building Components: Deterioration of wood trim was observed on the south end of the building.

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster) and to prevent brick failure (such as cracking).

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Old Ursuline Convent

1100 Chartres St., New Orleans, LA 70116
Orleans Parish



Historical Profile: The Old Ursuline Convent holds the title of being the oldest existing building in the Mississippi Valley. The structure has been a convent for the Ursuline nuns, a school, an archbishop's residence, and a meeting place for the Louisiana Legislature. Presently, it is part of the Catholic Cultural Heritage Center of the Archdiocese of New Orleans.	**Primary Use:** Museum **Contents:** Historic archives, religious relics and statues, antique furniture, original fixtures, hand painted murals, antique books, office equipment

Year Built: 1752-1753	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** Unknown
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Old Urseline Convent is located in the historic French Quarter and is approximately 850 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Small, medium
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** Building components (slate tiles, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood and masonry	**Foundation Type:** Pier and beam		**Roof Type:** Hip, gable, complex
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations

Non-Impact Resistant Windows: Non-impact resistant windows (single pane/annealed) are susceptible to water infiltration once broken. Leaking can occur between glazing, window frames, and exterior walls due to flashing, sealant, or gasket failure.

Condition of Non-Impact Resistant Glass Windows and Doors Frames: Deterioration of the most of window frames and second floor French doors was observed. Moisture intrusion, from wind-driven rain and humidity, will cause further deterioration to the opening systems. It could also cause water intrusion in the interior of the building. Window protection for non-impact resistant glass units should be used in the case of high-wind events because such windows are susceptible to water infiltration once broken.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Upper & Lower Pontalba Buildings

500 St. Ann St. & 500 St. Peter St., New Orleans, LA 70116
Orleans Parish

Historical Profile: The Pontalba Buildings are matching redbrick, one-block long, four-story buildings that form Two sides of Jackson Square in the French Quarter. The upper floors are apartments that are purportedly the oldest continuously rented apartments in the United States.

Primary Use: Retail and restaurants (ground floors), apartments (upper floors)

Contents: Furniture, artwork, decorative art, music instruments, period fixtures, restaurant equipment, retail goods, personal possessions of tenants

Year Built: 1840	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; food inventory, furnishings	**Emergency Generators:** No
Under Renovation: Yes; cosmetic	**Year Remodeled:** 1940, 1994		

Geographic Profile & Vulnerabilities

Geographic Profile:
The building fronting Rue St. Peter, upriver from Jackson Square, is the Upper Pontalba, and the building on the other side, fronting Rue St. Ann, the Lower Pontalba. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 400 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Large/mature (live oak)
Wind Exposure: Shielded by buildings and trees	**Wind-Borne Debris Source:** Building components (slate tiles, trees)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data			
Construction Type: Wood and masonry	**Foundation Type:** Pier and beam		**Roof Type:** Gable
Stories: 4	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown; roof damage sustained during Hurricane Isaac in 2012
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations

Non-Impact Resistant Windows: Non-impact resistant windows are susceptible to water infiltration once broken. It is recommended that window protection be used in a high-wind event.

Deterioration of Exterior Building Components: Deterioration of wood trim was observed on the South Upper Pontalba building.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

The Presbytere

751 Chartres St., New Orleans, LA 70116
Orleans Parish

Historical Profile: The Presbytere, originally called the Casa Curial (Ecclesiastical House), derives its name from the fact that it was built on the site of the residence, or presbytere, of the Capuchin monks. The building was used for commercial purposes until 1834 when it became a courthouse, until 1911.	**Primary Use:** Museum **Contents:** A wide variety of priceless collections are stored and exhibited in the building

Year Built: 1791	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1813, 1837, 1911, 1962		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Presbytere is located along Jackson Square, next to St. Louis Cathedral. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 800 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Shielded by buildings on three sides	**Wind-Borne Debris Source:** Building components (slate tiles, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood and masonry	**Foundation Type:** Pier and beam		**Roof Type:** Mansard
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown; roof damage sustained during Hurricane Isaac in 2012
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1 foot	**Mechanical Equipment Height (from ground):** 1.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes), conduit (no)			

Vulnerabilities & Mitigation Recommendations

Moisture Damage to the Exterior Building Envelope Damage: Deterioration to the front building façade was detected. The damage was reportedly caused during Hurricane Isaac in 2012. Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster) and to prevent brick failure (such as cracking).

Non-Structural Component Attachment: Unattached conduit was observed below the second-story ledge on St. Ann St. Non-structural components not properly attached can become wind-borne debris sources in high-wind events.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Prudhomme Building

Front St., Natchitoches, LA 71457
Natchitoches Parish

Historical Profile: Considered the oldest building on Front St., this structure has an original second-story facade. The cast iron, including a staircase in the rear, dates back to the 1850s. The building sustained fire damage in the 1970s and the top has remained vacant ever since.	**Primary Use:** Retail **Contents:** Home décor, gifts, jewelry, candles, furniture, displays, store equipment ($215K)

Year Built: 1827	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; candles, wall décor	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Prudhomme Building is located along Front St., atop the western ridge of the Cane River in the Natchitoches Historic District.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Small
Wind Exposure: Shielded by buildings	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data			
Construction Type: Masonry	**Foundation Type:** Pier and beam		**Roof Type:** Gable
Stories: 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Unknown
Building Condition: Fair-poor	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations




Cracks in Structural Walls: Large cracks were found at numerous locations on the south- and west-facing exterior masonry walls. At the bottom of the south-facing masonry wall, a half inch gap between the wall and the flooring material was observed, suggesting that the wall has moved outward over time. A large gap between the glass and frame of the storefront window display also suggests movement of the structure. The second floor interior was not assessed, since it has never been repaired after a 1970s fire. An exterior assessment of the second floor further confirmed that the south-facing exterior wall has moved outward, causing severe cracks in the structural wall.

Flooding Inside Structure: The storeroom attached to the back of the main structure has experienced flooding due to drainage problems in the back of the property. A 1.5-inch water line and mold damage was discovered. Numerous buildings along Front St. have had flooding issues from the same source, and these episodes seem to be precipitated by periods of heavy rainfall. Drainage improvement projects should be explored to prevent further flooding events.

Roof Leak and Evidence of Ponding: A frequent roof leak in the back portion of the building is most likely attributable to the ponding issue detected on the built-up roof system. The roof covering appears to be in fair-poor condition and should be replaced in the near future.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Ruston P.O.W. Camp Building

Grambling State University Campus Extension,
Ruston, LA 71270
Lincoln Parish

Historical Profile: In 1943, after being used as Branch "A" of the 5 The Women's Army Auxiliary Corps Training Center, Camp Ruston began operation as a WWII P.O.W. Camp for captured and impressed Nazi soldiers. The camp housed thousands of men from the Afrika Korps, Italy, Yugoslavia, Russia, Bosnia, Poland, Romania, and France. Most notably, Camp Ruston housed the entire crew from the captured U-505 U-boat, which carried an Enigma code machine; a new, acoustic torpedo; and over 1,000 lbs. of codebooks, charts, and maps. In February 3, 1946, the last prisoners were transferred out. On June 5, 1946, Camp Ruston officially closed and was formally transferred to the state in 1947.

Primary Use: N/A

Contents: Furniture

Year Built: 1942	**Occupied:** No	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
The site of the former Camp Ruston is located approximately two miles northwest of the Grambling State University campus, 33 miles from the Arkansas border and 80 miles from the Texas border.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Suburban/rural	**Site Conditions:** Open lot, surrounded by heavily wooded area	**Trees:** None
Wind Exposure: Open	**Wind-Borne Debris Source:** Building components and neighboring building in poor condition	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Wood	**Foundation Type:** Pier and beam/stem wall		**Roof Type:** Gable
Stories: 1	**Basement:** No	**Attic:** Yes	**Roof Covering:** Asphalt shingle
Building Condition: Poor	**Window Condition:** Poor		**Roof Condition:** Poor
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 3 feet (structure)	**Mechanical Equipment Height (from ground):** 4 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations




Building Condition: While there are two remaining P.O.W. Camp buildings on-site, one was severely damaged and partially crushed by a fallen tree and was not chosen for the assessment. The unharmed building, pictured above, is still intact with original fixtures, but it is in severe condition due to years of neglect. The damages are as follows: large hole in the roof covering; holes in the ceiling; no exterior door; broken windows; deterioration of wood siding; large sinkhole at southern end of the foundation; foundation damage; and water damage to interior walls and wood floors.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Sabine Pass Lighthouse

29°43′0″N, 93°51′0″W
Cameron Parish

Historical Profile: The Sabine Pass Lighthouse, one of only three built in the United States of similar design, went into operation in 1857. It remained lit for 95 years, with the exception of a brief period during the Civil War when it was temporarily shut down. The light was permanently extinguished by the Coast Guard in 1952 when modern technology made it obsolete. The wharfs, keeper's house, and wooden outbuilding have all been destroyed by marsh fire. Restoration plans have been proposed and the local preservation alliance is seeking funding for the repair of the structure.

Primary Use: Cultural Site

Contents: None

Year Built: 1857	**Occupied:** No	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** N/A		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Sabine Pass Lighthouse is located along the Sabine Pass ship channel, 2 miles north of the Gulf of Mexico in southwestern Louisiana. It is 0.7 miles from the Texas border.

Wind Zone: 110-119 mph	
Flood Zone: AE	**SFHA**: Yes
Hail Density: Low	
Tornado Density: Low	

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Engineered site, inlet surrounded by coastal marshland	**Trees:** Scrub vegetation
Wind Exposure: Open	**Wind-Borne Debris Source:** None	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry, shell crete	**Foundation Type:** Wood pile		**Roof Type:** Domed
Height: 85 feet	**Basement:** No	**Attic:** No	**Roof Covering:** None
Building Condition: Fair-poor	**Window Condition: N/A**		**Roof Condition:** Poor (structure)
Safe Room/Storm Shelter: N/A	**Impact Resistant Windows:** N/A		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 4 feet (structure)	**Mechanical Equipment Height (from ground):** N/A	**Floodproofing:** Wet floodproofing	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations



Cracks and Deterioration in Structural Walls: A large crack (estimated 20 feet in length) was found on the southern face of the structure. Motor deterioration has caused some masonry units to fall off the structure, especially on the buttresses and corners of the octagonal walls. Mortar joints should be tuck-pointed to prevent further brick failure and cracking.


Missing Roof Covering: The copper roof covering was stolen in the 1970s, leaving the interior portion of the structure exposed to the elements.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

St. Louis Cathedral

615 Pierre Antoine Alley, New Orleans, LA 70116
Orleans Parish

Historical Profile: St. Louis Cathedral is the seat of the Archdiocese of New Orleans and is the oldest continuously active Roman Catholic Cathedral in the United States. Originally built in 1727 and dedicated to King Louis IX of France, the original structure burned during the great fire of 1788, but it was rebuilt into its present structure. In 1987, Pope John Paul II visited the cathedral.

Primary Use: Church

Contents: Furniture, religious relics and artifacts, musical instruments

Year Built: 1850	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** Unknown
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
St. Louis Cathedral is located along Jackson Square in the historic French Quarter. The site was constructed atop a ridge created by the Mississippi River Basin and is approximately 800 feet from the Mississippi River.

Wind Zone: > 110-119 mph

Flood Zone: X, levee protection

SFHA: No

Hail Density: Low-medium

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Small
Wind Exposure: Shielded by buildings on three sides	**Wind-Borne Debris Source:** Building components (slate tiles, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data			
Construction Type: Masonry	**Foundation Type:** Unknown		**Roof Type:** Gable, complex, steeple
Number of Stories: 3	**Basement:** No	**Attic:** No	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1 foot (structure)	**Mechanical Equipment Height (from ground):** 1.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Gutters (yes), window protection (yes), exterior lighting (yes)			

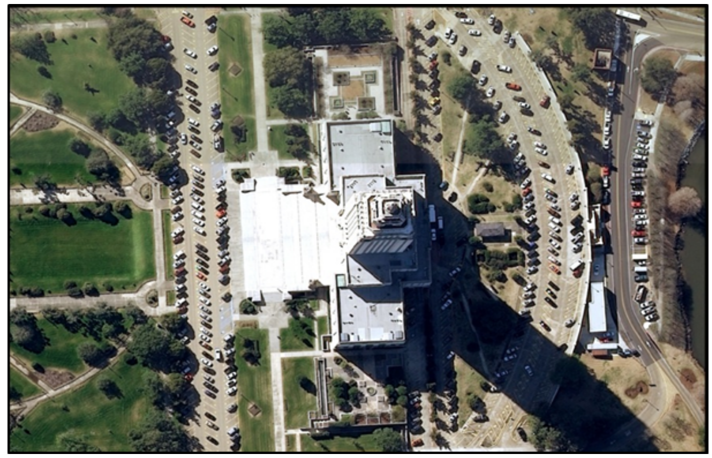
Vulnerabilities & Mitigation Recommendations

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster) and to prevent brick failure (such as cracking).

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Louisiana State Capitol

900 N 3rd St., Baton Rouge, LA 70802
East Baton Rouge Parish



Historical Profile: The 1932 construction of the current Louisiana State Capitol was influenced by then-former Governor Huey P. Long, and it has remained the seat of government for the U.S. state of Louisiana since then. It is the tallest building in Baton Rouge, the seventh tallest building in Louisiana, and the tallest capitol in the United States.

Primary Use: Houses the chambers for the Louisiana State Legislature, offices, including the Governor of Louisiana, tourist attraction

Contents: Furniture, office equipment, documents

Year Built: 1932	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** Unknown
Under Renovation: Yes	**Year Remodeled:** 2005-2014		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Louisiana State Capitol is located in downtown Baton Rouge on the east bank of the Mississippi River.

Wind Zone: 91-99 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Open, situated on large site and is tallest building downtown	**Wind-Borne Debris Source:** Building components (rooftop equipment)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Reinforced Masonry	**Foundation Type:** Slab and Piling		**Roof Type:** Flat
Number of Stories: 34	**Basement:** Yes	**Attic:** Yes	**Roof Covering:** Asphalt section
Building Condition: Good	**Window Condition:** Good		**Roof Condition:** Good, roof leaking due to blow off from vents
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0 feet (structure)	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Rooftop vents (partial)			

Vulnerabilities & Mitigation Recommendations



Insufficient Attachment of Fan Cowlings and Fan Base to Roof Curb: Attach exhaust fans and air intakes to the curb with corrosion resistant fasteners not exceeding 6 inches on center between the equipment, transition pieces, and the roof curb. Fan cowlings should be attached to the curb with steel cables. Two cables are recommended for areas with less than 120 mph wind speed and cowlings less than 4 feet in diameter, 1/8-inch-diameter stainless steel cables are recommended.


Interior Moisture Damage: Moisture damage to the interior plaster walls was detected on several floors of the structure. It is recommended that flashing around the ledges be repaired to prevent wind driven rain intrusion.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Southern Forest Heritage Museum & Research Center

77 Long Leaf Rd., Long Leaf, LA 71448
Rapides Parish

Historical Profile: The Long Leaf Saw Mill is the oldest complete sawmill facility in the South. This complex is unique in that it is a complete sawmill complex dating from the early twentieth century, and that it has the most complete collection of steam-powered logging and milling equipment known to exist. The Long Leaf Saw Mill contributed lumber for many projects and endeavors during World War II, especially Higgins Landing Craft.

Primary Use: Museum and research center

Contents: Antique lumber mill equipment, vehicles and motor equipment, shop tools, milled lumber, office equipment, museum artifacts, general store inventory and souvenirs

Year Built: 1900	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1988		

Geographic Profile & Vulnerabilities

Geographic Profile:
The Southern Forest Heritage Museum and Research Center is located 35 miles north of Eunice and is 100 miles off the Gulf Coast.

Wind Zone: 90 mph	
Flood Zone: X	**SFHA**: No
Hail Density: Low	
Tornado Density: Low-medium	

Site Attributes & Vulnerability Data

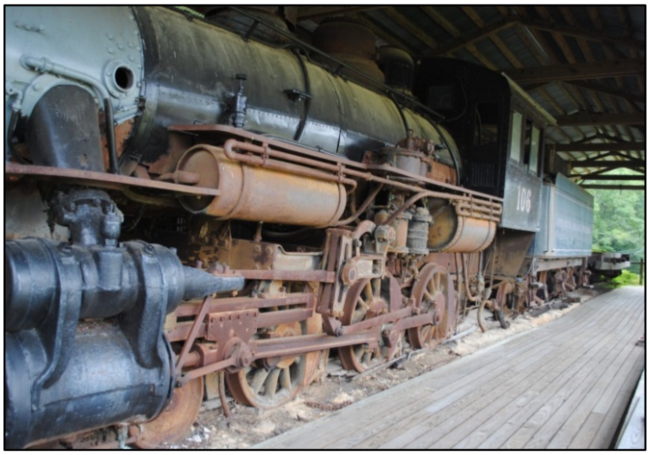
Location: Rural	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Building components (metal Panels, other buildings)	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Wood, metal	**Foundation Type:** Pier and beam		**Roof Type:** Gable, complex
Number of Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Asphalt shingle, metal
Building Condition: Fair	**Window Condition:** Fair		**Roof Condition:** Fair
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 1 foot	**Mechanical Equipment Height (from ground):** 2 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations

Erosion of Foundation: Storm water runoff from an uphill area is eroding and destabilizing the soil at the base of the machine shop, round house, and car knocker shed. As a result, the foundations are being undermined, threatening the stability of the structures.



Foundation Issue: The foundation the antique steam engine sits on appears to be sinking**.** The train car is situated atop a hill that may be sloughing off due to runoff.

Foundation Issue: The pier foundation of the museum must be leveled and is in need of permanent repair.

Non-Impact Resistant Windows: Several non-impact resistant windows were observed during the inspection. Non-impact resistant windows are susceptible to water infiltration once broken and can cause water infiltration into the interior of the building.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Destrehan Plantation

13034 River Rd., Destrehan, LA 70047
St. Charles Parish

Historical Profile: Destrehan Plantation is one of the few remaining examples of a colonial Louisiana house that has changed substantially and yet remained a functioning house for the past empires of indigo, sugar, and petrochemical production. The property was saved from neglect and vandalism by the River Road Historical Society.

Primary Use: Plantation Museum

Contents: Antique furniture ($450K), artwork ($100K), historic documents ($75K)

Year Built: 1787	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; historic documents.	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 1972		

Geographic Profile & Vulnerabilities

Geographic Profile:
Destrahan Plantation is located in rural, Southeast Louisiana. It is located directly across the road from the east bank of the Mississippi River Levee System and is approximately 800 feet from the Mississippi River.

Wind Zone: 110-119 mph

Flood Zone: X, levee protection | **SFHA**: No

Hail Density: Low-medium

Tornado Density: Medium

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Acreage, with multiple buildings and large trees	**Trees:** Large/mature (live oaks)
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Trees	**Levee/Flood Protection:** Yes

<table>
<tr><th colspan="5">Structural Attributes & Vulnerability Data</th></tr>
<tr><td>Construction Type: Wood and masonry</td><td colspan="2">Foundation Type: Pier and beam</td><td colspan="2">Roof Type: Mansard</td></tr>
<tr><td>Stories: 2</td><td>Basement: No</td><td>Attic: Yes</td><td colspan="2">Roof Covering: Wood Shingles</td></tr>
<tr><td>Building Condition: Good</td><td colspan="2">Window Condition: Fair</td><td colspan="2">Roof Condition: Good</td></tr>
<tr><td>Safe Room/Storm Shelter: No</td><td colspan="2">Impact Resistant Windows: No</td><td colspan="2">Roof Overhang >2 feet: Yes (porch connection)</td></tr>
<tr><td>Lowest Floor Height (from ground): 0 feet</td><td>Mechanical Equipment Height (from ground): 1 foot</td><td colspan="2">Floodproofing: No</td><td>Flood Vents: N/A</td></tr>
<tr><td colspan="5">Sufficient Attachment of Non-Structural Building Component: Shutters (yes)</td></tr>
</table>

Vulnerabilities & Mitigation Recommendations

Moisture Damage: Moisture damage was detected on the exterior and interior walls, as well as the ceilings.

Condition of Non-Impact Resistant Windows: Deterioration of the dormer window frames was observed. Window protection should be used in the case of high-wind events because non-impact resistant windows are susceptible to water infiltration once broken.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Melrose Plantation

3533 Hwy 119, Melrose, LA 71452
Natchitoches Parish

Historical Profile: Melrose Plantation is one of the largest plantations in the United States built by and for free Blacks. The land was granted to Louis Metoyer, the son of Marie Therese Coincoin, a former slave who became a wealthy businesswoman in the area. The Metoyers were free people of color for four generations before the American Civil War. Eight structures were built to create the Melrose complex and indigo, tobacco, cotton, and other crops were farmed on the property. In the late 1800s, the Henry family purchased the property and invited artists and writers to stay as long as they wished, so long as they were working on some creative project.

Primary Use: Plantation site/tourism

Contents: Period furniture, priceless wall murals by artist Clementine Hunter, antique books, and artifacts.

Year Built: 1796-1833	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Melrose Plantation is located along the east bank of the Cane River, appoximately 12 miles southeast of the city of Natchitoches.

Wind Zone: 90 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Low-medium	

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Building components (other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood, bousillage, masonry	**Foundation Type:** Brick slab, pier and beam		**Roof Type:** Hip
Stories: 1, 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Wood shingles
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Good
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)			

Vulnerabilities & Mitigation Recommendations





Structural Stability Concern: A two-story portion of the main house, located in the rear of the structure, shakes when persons walk in the upstairs portion. Upon inspection of the upstairs room (Candy Henry bedroom), a gap under the baseboard was observed and the floor drooped in that same area. Inspection of the ground floor room reflected the findings above, revealing a drooped ceiling above a window. Further inspection of the ground floor revealed that the interior masonry wall has suffered mortar deterioration. Exterior inspection of the wing showed deterioration of the foundation, directly under the window with the drooped ceiling above.



Protection of Wall Murals: The second floor of the Africa House includes painted wall murals by local folk artist Clementine Hunter. These murals are vulnerable to wind-driven rain, through the second story windows and roof. Water damage was detected on the ceilings and walls of the room housing the murals. Plantation caretakers feel that a plastic covering, or equivalent, that would either wrap around the second floor or cover the murals, during prolonged rain events, would provide sufficient protection.

Window Protection for Non-Impact Resistant Windows: Broken windows were detected in the rear room of the Main House and in the Admissions building. Non-Impact resistant windows are susceptible to water infiltration once broken and could cause moisture issues in the interior of the building.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Oak Alley Plantation

3645 Louisiana 18, Vacherie, LA 70090
St. James Parish

Historical Profile: Oak Alley operated as a sugar cane plantation until late 1860s, after the Civil War. The Heritage live oak trees that line the alley, leading to the front entrance of the plantation, were planted in the early 18th century, long before the present house was built. Restoration in 1925, by Mr. and Mrs. Andrew Stewart, was the first example of antebellum restoration along River Road.	**Primary Use:** Plantation Museum **Contents:** Period furniture, draperies, art, fixtures, documents

Year Built: 1837	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** Unknown
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Oak Alley Plantation is located in rural, Southeast Louisiana. It is located directly across the road from the south bank of the Mississippi River Levee System and is approximately 1,150 feet from the Mississippi River.

Wind Zone: 100-109 mph	
Flood Zone: X (500 yr. flood zone)	**SFHA**: No
Hail Density: Low	
Tornado Density: Low-medium	

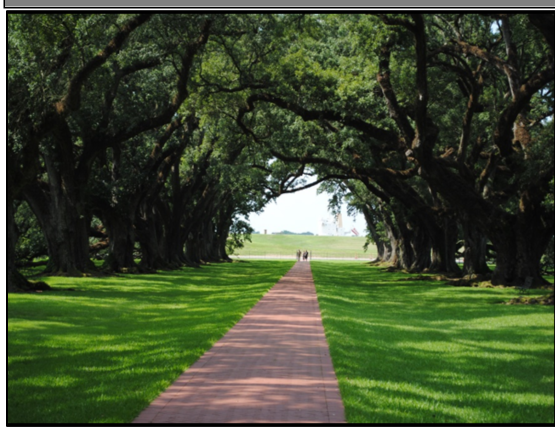
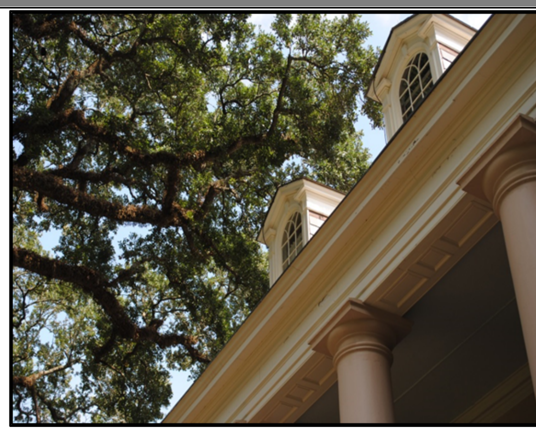
Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Acreage, with multiple buildings and large trees	**Trees:** Large/mature (live oaks)
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Building components (slate tiles), trees	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood and masonry	**Foundation Type:** Unknown		**Roof Type:** Hip, with widow's watch
Stories: 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes (porch connection)
Lowest Floor Height (from ground): 0 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes)			

Vulnerabilities & Mitigation Recommendations


Tree Protection: Oak Alley is famous for its Heritage live oak trees that reside on the property, especially those that line the alley walkway to the front entrance of the plantation. The lightning protection systems of individual trees were severely damaged during Hurricane Gustav, and seven unprotected trees are in need of lightning protection installation. Currently the subject trees are at risk of injury or death from a lightning strike.

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion, causing moisture damage to the plaster, and to prevent brick failure, such as cracking.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Oakley Plantation & Audubon State Historic Site

Louisiana 965, St. Francisville, LA 70775
West Feliciana Parish

Historical Profile: Oakley Plantation House was constructed for Ruffin Gray, a successful planter from Natchez, Mississippi. Gray died before the house was completed, and his widow, Lucy Alston, oversaw its completion. Ms. Alston remarried James Pirrie, and their daughter Lucy (born 1805) was the pupil of John James Audubon. Audubon's stay at Oakley lasted only four months, but he painted 32 of his famous bird pictures there.	**Primary Use:** Museum/tourism site **Contents:** Museum/gallery of original John James Audubon artwork, period furniture, draperies, and textiles, historic artifacts, photographs, and documents

Year Built: 1799-2	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; artwork and museum exhibits.	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Audubon State Historic Site is located approximately 4.5 miles from the east bank of the Mississippi River and northeast of the town of St. Francisville.

Wind Zone: 90 mph	
Flood Zone: C	**SFHA**: No
Hail Density: Low	
Tornado Density: Low-medium	

Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Engineered site	**Trees:** Large/mature
Wind Exposure: Shielded by trees	**Wind-Borne Debris Source:** Trees	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Wood and masonry	**Foundation Type:** Brick on grade, Pier and beam, slab-on-grade		**Roof Type:** Gable
Stories: 1, 2, 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Wood Shingles, metal
Building Condition: Good	**Window Condition:** Good		**Roof Condition:** Good
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes
Lowest Floor Height (from ground): 0 feet	**Mechanical Equipment Height (from ground):** 1 foot	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Lightning equipment (yes)			

Vulnerabilities & Mitigation Recommendations

Cracks and Movement in Structure: Large shear cracks and gaps were found on the rear facing exterior masonry wall and rear porch structure. Gaps between the main structure and each fireplace show that the chimney is separating from the house. Each of these issues is likely attributed to foundation issues.

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion (which causes moisture damage to the plaster), and to prevent brick failure (such as cracking).

Deterioration of Exterior Door: Exterior doors were found to be in fair-poor condition due to gaps in the wood joints, which make the interior prone to wind-driven rain intrusion.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Ormond Plantation

13786 River Rd., Destrehan, LA 70047
St. Charles Parish

Historical Profile: Ormond Plantation is the oldest French West Indies style Creole Plantation on the Mississippi, and shares the title of being the oldest restored plantation in the lower Mississippi River Valley. When used for crop production, it boasted a lucrative indigo and sugar operation.		**Primary Use:** Restaurant, special event facility, lodging **Contents:** Dining and lodging furniture, restaurant equipment, food inventory, artwork, fixtures	
Year Built: 1790	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; food inventory.	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Ormond Plantation is located directly across the road from the east bank of the Mississippi River Levee System and is approximately 550 feet from the Mississippi River.

Wind Zone: 110-119 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Acreage, with numerous buildings and mature trees	**Trees:** Large/mature (overhanging)
Wind Exposure: Shielded by trees on three sides	**Wind-Borne Debris Source:** Building components (broken slate tiles on small, rear building), overhanging trees	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data				
Construction Type: Masonry and wood	**Foundation Type:** Unknown		**Roof Type:** Hip, 3 connected systems	
Stories: 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate	
Building Condition: Good	**Window Condition:** Fair-good		**Roof Condition:** Good	
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No	
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** 0.5 feet	**Floodproofing:** No		**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes), gutters (yes)				

Vulnerabilities & Mitigation Recommendations

Opening Protection: The French doors, located on the second and first story, have a history of blowing open during high-wind events. It is recommended that wind-rated plantation shutters be installed for use.

Latch Mechanism Failure: Roof hatches have a history of blowing open, during high-wind events, subjecting the interior to rain infiltration.

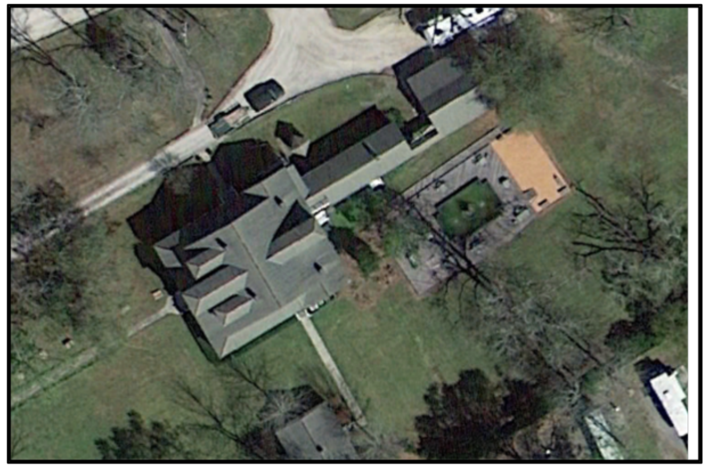
Window Protection for Non-Impact Resistant Windows: Window protection should be used during high-wind events, since non-Impact resistant windows are susceptible to water infiltration once broken. Locking mechanisms of shutters should be inspected regularly.

Moisture Damage: Moisture damage was detected on the interior wall.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Poche Plantation

6554 Louisiana 44, Convent, LA 70723
St. James Parish



Historical Profile: Poche Plantation is a post-Civil War structure that was built by Felix Poché, an accomplished attorney, Louisiana Supreme Court Justice, and co-founder of the American Bar Association. The plantation was built on a site that had already been a large sugar cane plantation, and its Victorian Renaissance Revival style architecture is unique, compared to surrounding plantations of the region.	**Primary Use:** Plantation Museum/bed & breakfast **Contents:** Period furniture, artwork, documents, fixtures

Year Built: 1867	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes	**Emergency Generators:** No
Under Renovation: Yes	**Year Remodeled:** 2013 (exterior)		

Geographic Profile & Vulnerabilities

Geographic Profile:
Poche Plantation located in rural, Southeast Louisiana, directly across the road from the east bank of the Mississippi River levee system and is approximately 550 feet from the Mississippi River.

Wind Zone: 100-109 mph	
Flood Zone: X (500 yr. flood zone)	**SFHA**: No
Hail Density: Low	
Tornado Density: Medium	

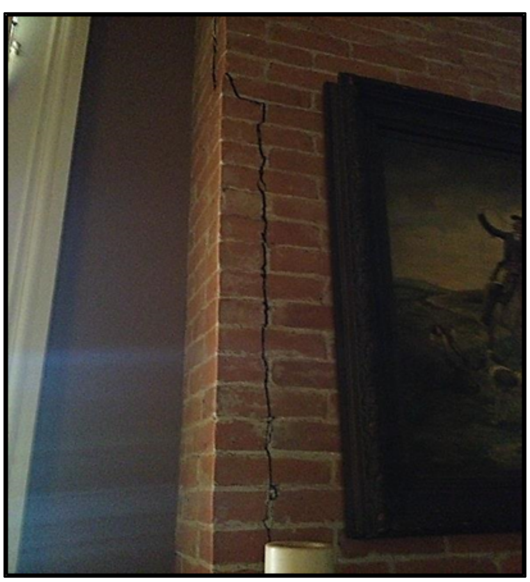
Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Acreage, with large trees and surrounding buildings	**Trees:** Large/mature
Wind Exposure: Shielded by trees and buildings on three sides	**Wind-Borne Debris Source:** Building components (slate tiles), trees	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data			
Construction Type: Wood and masonry	**Foundation Type:** Pier and beam		**Roof Type:** Gable, complex
Stories: 2	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Excellent
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** Yes (porch connection)
Lowest Floor Height (from ground): 2.5 feet	**Mechanical Equipment Height (from ground):** 0.5 feet	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Gutters (yes)			

Vulnerabilities & Mitigation Recommendations

Window Protection for Non-Impact Resistant Windows: Several broken window panes were found throughout the first floor and storm shutters have been removed from the structure. Window protection should be used during high-wind events, since non-Impact resistant windows are susceptible to water infiltration once broken.



Crack in Masonry Fireplace: A large crack was found on the front-facing fireplace.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

San Francisco Plantation

2646, Louisiana 44, Garyville, LA 70051
St. John the Baptist Parish

Historical Profile: San Francisco Plantation was built by sugar planter Edmond Bozonier Marmillion. The Steam Boat Gothic style structure has been noted for its unusual and opulent architecture and décor. Novelist Frances Parkinson Keyes even wrote about the plantation, entitled "Steamboat Gothic," a story about a family she imagined living there.	**Primary Use:** Plantation Museum **Contents:** Hand-painted ceilings, period furniture, artwork, draperies, textiles, photographs, and documents

Year Built: 1856	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; historic relics vulnerable to mold	**Emergency Generators:** No
Under Renovation: Preparing for structure leveling and interior work, scheduled for 2014	**Year Remodeled:** 1977		

Geographic Profile & Vulnerabilities

Geographic Profile:
San Francisco Plantation located in rural, Southeast Louisiana, less than 40 minutes from New Orleans. It is located directly across the road from the east bank of the Mississippi River levee system and is approximately 550 feet from the Mississippi River.

Wind Zone: 100-109 mph	
Flood Zone: X (500 yr. Flood Zone)	**SFHA**: No
Hail Density: Low	
Tornado Density: Medium	

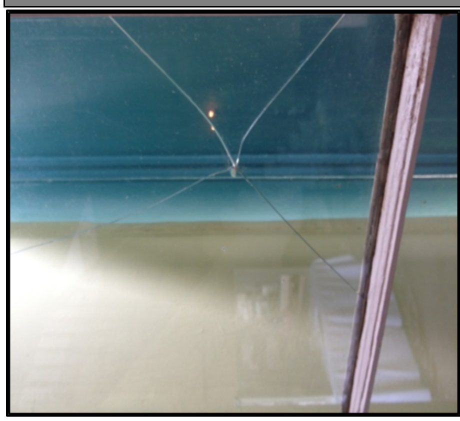
Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Acreage, with multiple buildings and large trees with multiple buildings and large trees, bordered by a large refinery.	**Trees:** Large/mature
Wind Exposure: Shielded on three sides by trees and buildings	**Wind-Borne Debris Source:** Building components (slate tiles, other buildings)	**Levee/Flood Protection:** Yes

Structural Attributes & Vulnerability Data

Construction Type: Wood, masonry	**Foundation Type:** Slab on grade		**Roof Type:** Hip, with dormers and widow's watch
Stories: 3	**Basement:** No	**Attic:** Yes	**Roof Covering:** Slate
Building Condition: Good	**Window Condition:** Fair		**Roof Condition:** Unknown
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0.5 feet	**Mechanical Equipment Height (from ground):** Unknown	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: Shutters (yes)			

Vulnerabilities & Mitigation Recommendations



Shutter Protection of Non-Impact Resistant Windows: Window protection should be used in the case of high-wind events because non-impact resistant windows are susceptible to water infiltration once broken. Locking mechanisms of shutters should be inspected regularly, and large plantation shutters should have multiple locks. Interior of structure sustained water damage during Hurricane Katrina, due to shutter failure.

Interior Moisture Damage: Deterioration of the plaster application over the brick structural walls was detected. Mortar joints should be tuck-pointed to prevent water intrusion, causing moisture damage to the plaster, and to prevent brick failure, such as cracking.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Fort Jackson

220 Herbert Harvey Dr., Buras, LA 70041
Plaquemines Parish

Historical Profile: Fort Jackson was the site of the American Civil War Battle of Forts Jackson and St. Philip from April 16 to April 28, 1862. The Confederate-controlled fort was besieged for 12 days by the fleet of U.S. Navy Flag Officer David Farragut. Fort Jackson fell on April 28 after the Union fleet bombarded it and then sailed past its guns. A mutiny against the officers and conditions then occurred and the fort fell to the Union. Union forces then went on to capture New Orleans. The fort was occupied off and on for various military purposes from its completion until after World War I, when it served as a training station.

Primary Use: Tourist site

Contents: None

Year Built: 1822	**Occupied:** No	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Fort Jackson is approximately 70 miles south of New Orleans on the west bank of the Mississippi, approximately 2.5 miles south of Triumph, Louisiana.

Wind Zone: 120-129 mph	
Flood Zone: AE	**SFHA**: Yes
Hail Density: Low	
Tornado Density: Low-medium	

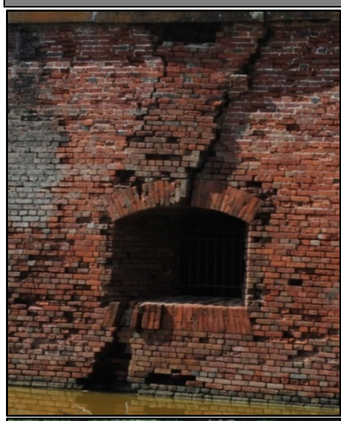
Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Engineered site	**Trees:** Medium – Large/mature
Wind Exposure: Open	**Wind-Borne Debris Source:** N/A	**Levee/Flood Protection:** Yes, earthen levee surrounding structure

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Cypress mats		**Roof Type:** N/A
Number of Stories: N/A	**Basement:** No	**Attic:** No	**Roof Covering:** N/A
Building Condition: Fair-poor	**Window Condition:** N/A		**Roof Condition:** N/A
Safe Room/Storm Shelter: N/A	**Impact Resistant Windows:** N/A		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0 feet (structure)	**Mechanical Equipment Height (from ground):** N/A	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations



Cracks and Movement in Structural Walls: Severe cracks of the outer, masonry structural walls were observed throughout the perimeter of the structure. Stepped shear cracks, specifically ones involving the widow openings, have resulted in the loss of masonry units.

Storm Surge/Flooding: Persons involved with the property have voiced concern about flood inundation in the event of future natural hazard events. The fort was damaged in Hurricanes Katrina and Isaac by storm surge and extended periods of flood inundation.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Fort Pike State Historic Site

27100 Chef Menteur Hwy., New Orleans, LA 70129
Orleans Parish

Historical Profile: Fort Pike was built to guard Rigolets Pass against British reinvasion of the United States. Together with existing and newly built forts, it helped create an extensive coastal defense system that stretched along the entire Atlantic and Gulf coasts, protecting strategic ports and rivers such as New Orleans and the Mississippi.

Primary Use: Tourist site

Contents: Small number of artifacts

Year Built: 1819	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Fort Pike is located directly off the Rigolets waterway and is above Lake Borgne and the Chandeleur Sound. It is approximately 23 miles east of downtown New Orleans.

Wind Zone: 110-119 mph	
Flood Zone: VE	**SFHA**: Yes
Hail Density: Low	
Tornado Density: Low-medium	

Site Attributes & Vulnerability Data

Location: Suburban	**Site Conditions:** Engineered site	**Trees:** None
Wind Exposure: Open	**Wind-Borne Debris Source:** N/A	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry	**Foundation Type:** Unknown		**Roof Type:** N/A
Number of Stories: 1	**Basement:** No	**Attic:** No	**Roof Covering:** N/A
Building Condition: Fair-good	**Window Condition:** N/A		**Roof Condition:** N/A
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No
Lowest Floor Height (from ground): 0 feet (structure)	**Mechanical Equipment Height (from ground):** N/A	**Floodproofing:** No	**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A			

Vulnerabilities & Mitigation Recommendations

Cracking and Movement of Structural Walls and Water Intrusion: Severe cracking of masonry walls was observed on the corners of the structure and at window openings. Standing water was present in the rooms facing the open waterway. Deterioration of the brick and mortar was severe in numerous areas. This structure sustained substantial damage from storm surge during Hurricanes Katrina and Isaac.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

Fort Proctor

29°52’2.3”N, 89°40’41.82”W
St. Bernard Parish

Historical Profile: Also known as Fort Beauregard due to P.T. Beauregard’s supervision during construction, Fort Proctor was intended to be part of the fortification systems that protected the Gulf Coast against foreign invasion. Due to delays caused by hurricane damage and then the start of the American Civil War, the fort was never garrisoned. By the end of the war, improvements in artillery had made the fort's design obsolete. The fort was accessible by road until the 1960s, when the construction of the Mississippi River-Gulf Outlet Canal cut off all land access to the site. It is now surrounded and inundated by water about 1.5 feet deep.	**Primary Use:** Ruined fort **Contents:** N/A

Year Built: 1856	**Occupied:** No	**Temperature/Moisture Sensitive Contents:** No	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** Unknown		

Geographic Profile & Vulnerabilities

Geographic Profile:
Fort Proctor is located on the shore of Lake Borgne, just north of the mouth of Bayou Ycsloskey, and can be seen in the distance from the settlement of Shell Beach, Louisiana.

Wind Zone: 110-119 mph	
Flood Zone: VE	
Hail Density: Low	
Tornado Density: Low	

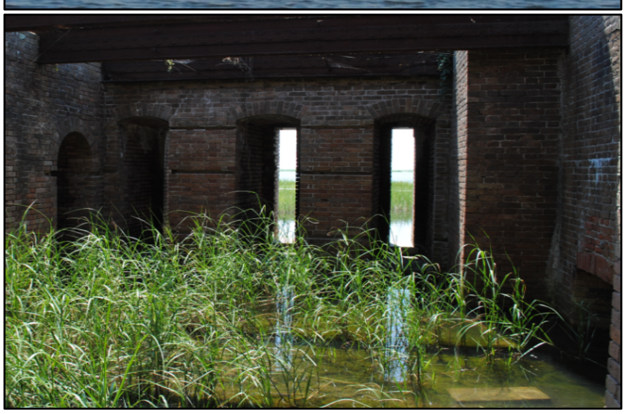
Site Attributes & Vulnerability Data

Location: Rural	**Site Conditions:** Waterway/marshland	**Trees:** None
Wind Exposure: Open	**Wind-Borne Debris Source:** N/A	**Levee/Flood Protection:** No

Structural Attributes & Vulnerability Data

Construction Type: Masonry, steel	**Foundation Type:** Unknown		**Roof Type:** N/A	
Number of Stories: 2	**Basement:** No	**Attic:** No	**Roof Covering:** N/A	
Building Condition: Poor	**Window Condition:** N/A		**Roof Condition:** N/A	
Safe Room/Storm Shelter: No	**Impact Resistant Windows:** No		**Roof Overhang >2 feet:** No	
Lowest Floor Height (from ground): 1.5 feet (structure)	**Mechanical Equipment Height (from ground):** N/A	**Floodproofing:** No		**Flood Vents:** N/A
Sufficient Attachment of Non-Structural Building Component: N/A				

Vulnerabilities & Mitigation Recommendations



Coastal Erosion, Subsidence, Wind, and Storm Surge Damage: Fort Proctor is in serious disrepair and is currently inundated by 1.5 feet of water. Many of the second story masonry walls have collapsed and have fallen to the ground floor, presumably from hurricane wind and storm surge damage. With increased sea level rise, active coastal erosion, and subsidence issues, increased inundation of the ground floor is expected.

VULNERABILITY ASSESSMENT REPORT OF HISTORIC LOUISIANA SITES

USS Kidd Veterans Memorial

305 South River Rd., Baton Rouge, LA 70802
East Baton Rouge Parish

Historical Profile: The ship is named after Rear Admiral Isaac C. Kidd, who was killed aboard his flagship, the *USS Arizona*, during the attack on Pearl Harbor. The *USS Kidd* is a representative of the Fletcher-class destroyers that formed the backbone of U.S. destroyer forces in World War II. *Kidd* received a total of 12 battle stars and saw heavy action in World War II, participating in nearly every important naval campaign in the Pacific. In 1951, it was deployed to Korean waters. Decommissioned in 1964, the ship was never modernized, making it the only destroyer to retain its World War II appearance.

Primary Use: Museum/memorial

Contents: Priceless furniture, historic documents, photos, and artifacts

Year Built: 1943 (Marine craft), 1986 (museum structure)	**Occupied:** Yes	**Temperature/Moisture Sensitive Contents:** Yes; historic documents, photos, and artifacts	**Emergency Generators:** No
Under Renovation: No	**Year Remodeled:** 2001, 2009 (structure)		

Geographic Profile & Vulnerabilities

Geographic Profile:
The *USS Kidd* is docked on the eastern side of the Mississippi River, just north of the Horace Wilkinson Bridge. The *USS Kidd* Museum Facility is located southeast of the marine craft, aside the Mississippi River levee system.

Wind Zone: 91–99 mph	
Flood Zone: X, levee protection	**SFHA**: No
Hail Density: Low-medium	
Tornado Density: Medium	

Site Attributes & Vulnerability Data

Location: Urban	**Site Conditions:** Engineered site	**Trees:** Medium
Wind Exposure: Shielded by buildings on two sides (structure), open (marine craft)	**Wind-Borne Debris Source:** Building components (roof aggregate, roof-top equipment), other buildings (structure)	**Levee/Flood Protection:** Yes (structure)

<table>
<tr><th colspan="5">Structural Attributes & Vulnerability Data</th></tr>
<tr><td>Construction Type: Steel (marine craft), wood (structure)</td><td colspan="2">Foundation Type: Slab-on-grade (structure)</td><td colspan="2">Roof Type: Flat (structure)</td></tr>
<tr><td>Number of Stories: 2 (structure)</td><td>Basement: No</td><td>Attic: No</td><td colspan="2">Roof Covering: Built-up, asphalt section (structure)</td></tr>
<tr><td>Building Condition: Good (structure), excellent (marine craft)</td><td colspan="2">Window Condition: Good (structure)</td><td colspan="2">Roof Condition: Fair (structure)</td></tr>
<tr><td>Safe Room/Storm Shelter: No</td><td colspan="2">Impact Resistant Windows: No (structure)</td><td colspan="2">Roof Overhang >2 feet: No</td></tr>
<tr><td>Lowest Floor Height (from ground): 0.5 feet (structure)</td><td>Mechanical Equipment Height (from ground): 1 foot</td><td colspan="2">Floodproofing: No</td><td>Flood Vents: N/A</td></tr>
<tr><td colspan="5">Sufficient Attachment of Non-Structural Building Component: Roof vents (no), lightweight aircraft (additional attachment recommended) (structure)</td></tr>
<tr><th colspan="5">Vulnerabilities & Mitigation Recommendations</th></tr>
</table>

Flood Hazard: An electrical junction box that provides power to the *USS Kidd*, located underneath the walkway used to access the ship, is subject to damage when flood events occur. In past inundation events, repair has cost several thousand dollars. It is recommended that the junction box be re-located to a higher elevation.

Insufficient Attachment of Fan Cowlings and Fan Base to Roof Curb: The exhaust fans were observed to have no mechanically screwed attachments to the roof curb. Exhaust fans and air intakes should be attached to the curb with corrosion resistant fasteners not exceeding 6 inches on center between the equipment, transition pieces, and the roof curb. Fan cowlings should be attached to the curb with steel cables. Two cables are recommended for areas with less than 120 mph wind speed and cowlings less than four feet in diameter, 1/8-inch-diameter stainless steel cables are recommended.

Flood By-Product: Riverine silt has buried the bottom portion of the propeller of the *USS Kidd*. While silt deposits are naturally occurring, the May 2011 flood event amplified the amount that currently exists over the propeller. Excavation of at least 3–4 feet of silt is needed to uncover the propeller and rear portion of the ship.

Window Protection for Non-Impact Resistant Windows: The exterior building envelope of the first and second floor is composed of floor to ceiling windows that are not impact resistant. Breakage of the subject windows has occurred within the last 5 years. It is recommended that window protection be used in the case of high-wind events.

Roof Condition: The built-up roof system and flashing were found to be in fair condition. Loose aggregate was found throughout the rooftop and can become wind-borne debris sources in a high-wind event. Flashing atop the penthouse needs to be repaired to prevent water intrusion.

4. Capability Assessment

This section summarizes the results of the State Hazard Mitigation Plan Committee and other state 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 state's infrastructure, as well as relevant changes in its laws since the last Plan Update, in order to suggest a mitigation strategy. Particularly, this section surveys expanded land use since the last update and gives an overview of coastal protection funding.

State Policies and Programs

In this first subsection, the Plan describes and analyzes state laws, regulations, and policies, in addition to programs, related to hazard mitigation and development in hazard-prone areas. Legislation regarding hazard mitigation is too abundant to enumerate here, but includes directives from the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) and the Coastal Protection and Restoration Authority (CPRA). Programs related to development in hazard-prone areas include the following:

- Regulation of state-owned property by Facility Planning and Control (FPC)
- the National Flood Insurance Program (NFIP) and Community Rating System (CRS)
- the Statewide Flood Control Program
- the Coastal Protection and Restoration Authority (CPRA)
- the Uniform Construction Code
- the Land Acquisition Program
- the Scenic Rivers Program
- the Louisiana Coastal Resources Program (LCRP) and Coastal Use Permit (CUP)
- the Coastal Forest Conservation Initiative (CIAP)
- the Floodplain Management Association (FMA)

Policies

Louisiana has 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 Louisiana to continually propose ways to improve it. Examples of existing documents include the following:

- Louisiana State Hazard Mitigation Plan

- Louisiana State Emergency Operations Plan
- Louisiana State Continuity of Operations Plan
- Integrated Ecosystem Restoration and Hurricane Protection: Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA)
- Louisiana State Public Assistance Administrative Plan
- Louisiana State Uniform Construction Code Council (LSUCCC)

The Louisiana Homeland Security and Emergency Assistance and Disaster Act (LHSEADA) is the main legislation affecting preparedness, response, recovery, and mitigation programs in the state. Among its many functions, the LHSEADA aims related to mitigation are as follows:

- To reduce vulnerability of people and communities of this state to damage, injury, and loss of life and property resulting from natural or man-made catastrophes, riots, or hostile military or paramilitary action
- To authorize and provide for cooperation in emergency or disaster prevention, mitigation, preparedness, response, and recovery
- To authorize and provide for management systems embodied by coordination of activities relating to emergency or disaster prevention, mitigation, preparedness, response, and recovery by agencies and officers of this state, and similar state-local, interstate, and foreign activities in which the state and its political subdivisions may participate

The statues within this part of the LHSEADA that reference or apply to Hazard Mitigation include, but are not limited to, various definitions; the power of the governor; GOHSEP and the powers of its director; and Parish Homeland Security and Emergency Preparedness Agency. As authorized under the above referenced statutes, GOHSEP's Hazard Mitigation Section in its Disaster Recovery Division is responsible for administering the Hazard Mitigation Grant Program and the Non-Disaster Hazard Mitigation Assistance Grants. The Hazard Mitigation Section is managed by the State Hazard Mitigation Officer and a Hazard Mitigation Section Chief, and it conducts outreach to communities, technical assistance to applicants, and grants management to the sub-grantees of those grants. Sub-grantees include state agencies, local governments, federally recognized Native American tribes, and private non-profit organizations.

The largest number of the mitigation policies, programs, and activities undertaken by Louisiana state agencies occur within GOHSEP. However, the Louisiana Department of Transportation and Development (DOTD), Department of Natural Resources (DNR), Department of Environmental Quality (DEQ), the CPRA, the Division of Administration (DOA) and its constituent offices, and the Louisiana Floodplain Management Association (FMA) all have policies, programs, and activities specific to mitigation or that actively support hazard mitigation. Additional agencies and entities have programs that further support hazard mitigation activities in the state.
Two specific examples of statewide policies for hazard mitigation are the Coastal Zone Boundary and the non-profit Center for Planning Excellence (CPEX) Coastal Land Use Toolkit.

Coastal Zone Boundaries attempt to preserve coastal communities and industries that rely on the ecosystem of the Gulf of Mexico. They require special permitting due to the proximity of delicate ecological processes. The permits are either approved or denied by the Office of Coastal Management Permits and Mitigation Division. Activities that will be required to apply for permits in the coastal zone are:

- Dredging
- Levee construction/maintenance
- Hurricane protection facilities
- Urban developments
- Energy development activities like exploration for oil/natural gas/geothermal/etc.
- Wastewater discharge
- Recreational developments, including marinas
- Drainage projects
- Anything to do with barrier islands

The Coastal Land Use Toolkit is a document made for public use by the non-profit CPEX, although it has not been officially adopted by any governmental entity yet. The Toolkit explains the national and local best management practices (BMPs) in coastal development for Louisiana on a range of scales. It also has recommendations based on geological land types. Strategies in the Toolkit include the following:

- Natural resource protection
- Wetland restoration
- Streetscape/parking lot design
- Maintaining networks of infrastructure
- Designing infrastructure in a resilient way while preserving local character

Specific zoning suggestions include the following:

- Elevation standards
- Impervious land cover limitations
- On-site design of elements to deal with stormwater management
- Erosion control standards

Some programs and policies, such as the ones just described, might use complementary tools to achieve a common end, but fail to coordinate with or support each other. Thus, coordination between state and local mitigation policies and programs is essential to hazard mitigation. This Plan will sketch a few of the numerous local policies and programs to suggest the range of policy types.

In East Baton Rouge Parish, local mitigation policies include a number of statements regarding flood-prone areas. For instance, the parish restricts off-site landfill in flood hazard areas and requires minimum slab elevations based on those areas. Regarding floodways, the parish stipulates that nothing shall encroach on them unless professionals deem that development would not alter the water flow, but permits uses such as the following:

- Agricultural land use
- Nonstructural industry
- Public & private recreational uses
- Extraction of natural resources
- Public infrastructure as long as it doesn’t encroach on the high water level area

The city of New Orleans is currently reviewing a comprehensive zoning ordinanace that will likely be adopted in 2014. The ordinance outlines and describes stormwater BMPs by function, suggesting that stormwater runoff should be detained, stored, infilitrated, and/or filtered using various, specific recommended BMPs. The ordinance also lays out planned development standards for environmentally sensitive development districts, restricting residential density to 6 units per acre. In non-residential areas, the ordinance gives a maximum floor area of 5,000 square feet per acre. It also gives design regulations requiring actions such as the following:

- Preserving scenic views
- 60% of site be for active or passive recreation
- Buildings developed in clusters
- Outlawing clear cuts of properties
- Protection of wildlife habitats
- Mitigation of negative impacts on wildlife after development

Other cities have their own zoning ordinances and flood area restrictions. For instance, the city of Mandeville has drainage overlay districts to require proposed buildings or structures to be located out of any area of periodic inundation to the greatest extent possible. If construction does proceed in such areas, vegetation disturbed must be restored fully before the project is complete. Parking anywhere should be kept out of inundation areas if possible, and natural drainageways cannot be culverted unless determined to be a public health problem.

Lake Charles has its own floodplain management regulations that restrict uses dangerous to health and safety in times of flood; control filling, grading, dredging, and other development which may increase flood damage; regulate flood barriers that will unnaturally divert flood waters or which may increase flood hazards to other lands; and compel structures in coastal high hazard areas have the bottom of the lowest part elevated to at least the base flood level and have breakaway walls (for certain types and locations).

In addition to the cities named above, other areas have progressive hazard mitigation policies, including Lafayette, which has a code similar to the EBR parish code, and Hammond, which has a new code under review before its adoption.

PROGRAMS

Many of the policies, programs, and activities undertaken by Louisiana agencies in mitigation occur within GOHSEP, whose programs (as well as the federal programs it administers) serve to actively reduce disaster-related losses in Louisiana. Additionally, state departments like DOTD, DNR, DEQ, the CPRA, the DOA, the LRA, and the FMA all have policies, programs, and activities specific to mitigation or that actively support hazard mitigation. Furthermore, other departments that have not all specifically been mentioned yet—such as the Department of Wildlife and Fisheries; the Department of Corrections; the Department of Health and Hospitals; the Department of Social Services; Department of Agriculture and Forestry; the Department of Insurance; Department of Public Safety; the Louisiana National Guard; and the LSU AgCenter—all have programs that provide support to hazard mitigation activities with regard to their own agency's purview in the state. The remainder of this subsection describes those programs.

Among these programs is the DOA's regulation of state-owned property through **Facility Planning Control (FPC)**. FPC is an effective mechanism for influencing the situation of state-owned facilities within hazard areas. The DOA regulation of state-owned property via capital outlay is effective because the funds are appropriated to FPC, and the design of the buildings is under that office's direction. For example, the FPC's location of new construction outside flood hazard areas and, as needed, in conjunction with new construction elevation above flood levels, represent an effective enhancement to the state's overall effort to mitigate risk through land development. As the building code authority for state-owned property, FPC also enforces the International Building Code for all state buildings, whether or not they are funded through capital outlay. As the central leasing authority for all state-owned property, FPC further enforces standards in the procurement of leases and has the authority to set the geographic limits for the bidding of leases (FPC does not make the lease payments). FPC has less control over decisions related to construction of state-owned facilities because such construction usually takes place on existing state-owned sites. Decisions for such facilities are largely driven by adjacency to existing facilities and similar functional concerns.

Another program related to hazard-prone areas is the **National Flood Insurance Program (NFIP) and Community Rating System (CRS)** facilitated in Louisiana by the DOTD. FEMA's NFIP is an extremely effective tool for encouraging local communities to regulate development in hazard areas. Every parish in Louisiana participates in the NFIP. Additionally, 39 Louisiana communities, accounting for approximately 80% of NFIP policies in the State of Louisiana, participate in the CRS. The CRS is an NFIP program that allows communities to lower the premiums charged to their citizens by going above minimum NFIP requirements via public education, additional freeboard requirements, and so on. According to the state program administrator, this translates into approximately $20 million in savings in policyholder premiums. NFIP participation also qualifies communities for grant funding through FEMA sources including FMA, SRL, and RFC (these funds are administered by GOHSEP). These sources have been used effectively to mitigate risk of flood by affecting land use and development within hazard areas. Table 4.1 shows the communities in Louisiana that participate in CRS.

Table 4.1. Louisiana Parish Participation in the NFIP CRS (source: DOTD, 2013).

CRS Participation in Louisiana			
Community	CRS Rating	Savings	Number of Policies
Ascension Parish	8	$394,815	9,330
Baker	8	$31,475	500
Bossier City	8	$188,144	3,063
Caddo Parish	8	$32,112	761
Calcasieu Parish	8	$284,412	6,936
Carencro	8	$8,105	368
Denham Springs	8	$166,133	1,686
DeRidder	9	$1,248	86
East Baton Rouge Parish	6	$3,180,703	26,414
French Settlement	9	$4,723	130
Gonzales	8	$56,077	993
Gretna	8	$251,185	3,631
Harahan	8	$82,866	2,606
Houma	7	$194,277	5,627
Jefferson Parish	6	$15,219,849	96,032
Kenner	7	$2,429,879	15,954
Lafayette	8	$222,386	6,760
Lafayette Parish	8	$228,515	7,900
Lake Charles	8	$185,275	5,590
Livingston Parish	9	$294,944	10,085
Lutcher	9	$125	171
Mandeville	7	$256,196	2,834
Morgan City	8	$118,707	2,037
New Orleans/Orleans Parish	8	$7,373,615	88,596
Ouachita Parish	9	$50,505	1,964
Rayne	9	$2,746	286
Ruston	9	$959	66
Scott	8	$64,753	887
Shreveport	7	$431,746	4,469
St. Charles Parish	8	$586,047	11,908
St. James Parish	7	$12,315	886
St. John Parish	8	$306,504	6,842
St. Tammany Parish	7	$1,886,145	35,413
Slidell	7	$976,259	7,875
Sorrento	9	$8,120	247
Tangipahoa Parish	9	$67,740	4,570
Terrebonne Parish	6	$1,201,325	13,690
Walker	9	$30,816	849

CRS Participation in Louisiana			
Community	CRS Rating	Savings	Number of Policies
West Baton Rouge Parish	8	$13,981	730
Westwego	8	$51,881	1,450
Zachary	7	$39,811	549
TOTALS		**$36,937,419**	**390,771**

The **Statewide Flood Control Program** is another program administered by the DOTD. Funded by Capital Outlay, the Statewide Flood Control Program works in cooperation with local governments, DOTD engineering and technical assistance to provide surveys, cost estimates, hydraulic designs, plans, right-of-way maps, specifications, advertising for bids, construction of levees, canals, dams locks, spillways, reservoirs, water wells and test holes, drainage systems, irrigation systems, navigation projects, flood control, and other types of public works projects. This DOTD program significantly enhances the state's ability to implement land use and/or land development activities in hazard areas through its integration of hazard (risk) mitigation data, techniques, and technologies into the design and construction of public works infrastructure. Such effective infrastructure design and development enables the state to consider and/or pursue other land-use or land development projects in hazard areas, and thereby greatly enhances the state's regulatory capability.

One of the most important new programs is the **Coastal Protection and Restoration Authority (CPRA)**, which was established in 2007 after hurricanes Katrina and Rita. It stands as the single state entity with authority to chart a comprehensive coastal protection and restoration strategy in order to create a more sustainable Louisiana. The Louisiana State Legislature charged the CPRA with responsibility for "hurricane protection and the protection, conservation, restoration, and enhancement of coastal wetlands and barrier shorelines or reefs" throughout southern Louisiana's coastal zone, which is comprised of the contiguous areas subject to storm or tidal surge. The CPRA's mandate is to develop, implement, and enforce a comprehensive, long-term coastal protection and restoration strategy through both *Louisiana's Comprehensive Master Plan for a Sustainable Coast*, a document with a 50-yr planning horizon (updated every 5 years), and the *Integrated Ecosystem Restoration and Hurricane Protection in Coastal Louisiana Annual Plan* (updated yearly).

The CPRA acts in direct response to both legislative and executive orders. According to the Louisiana Revised Statutes §214.1(C),

> The state must act to conserve, restore, create, and enhance wetlands and barrier shorelines or reefs in coastal Louisiana while encouraging use of coastal resources and recognizing that it is in the public interest of the people of Louisiana to establish a responsible balance between development and conservation. Management of renewable coastal resources must proceed in a manner that is consistent with and

complementary to the efforts to establish a proper balance between development and conservation.

Moreover, according to Governor Jindal's Executive Order BJ 2008-7: *Activity and Permit Consistency with Louisiana's Comprehensive Master Plan for a sustainable Coast*, "All state agencies shall administer their regulatory practices, programs, contracts, grants, and all other functions vested in them in a manner consistent with the Master Plan and public interest to the maximum extent possible." The CPRA is now established as the single state entity with authority to articulate a clear statement of priorities and to focus development and implementation efforts to achieve comprehensive coastal protection for Louisiana. It is working closely with other entities on coastal issues, including the state legislature; the Governor's Advisory Commission on Coastal Protection, Restoration, and Conservation; the Louisiana Recovery Authority (LRA); and the LRA's Louisiana Speaks regional planning process.

The Governor's executive assistant for coastal activities chairs the CPRA. Agencies in the CPRA include the following: the secretaries of the Department of Natural Resources (DNR); the Department of Transportation and Development (DOTD); the Department of Environmental Quality; the Department of Wildlife and Fisheries; the Department of Economic Development; the commissioners of the Department of Agriculture and Forestry; the Department of Insurance; and the Division of Administration; the director of the State Office of Homeland Security and Preparedness; and the chair of the Governor's Advisory Commission on Coastal Protection, Restoration, and Conservation. Additionally, CPRA membership includes two executive board members of the Police Jury Association and three levee district presidents from coastal Louisiana.

The mandate to the CPRA does not extend, however, to parish land use plans, as they are not within state purview. Given the emergency coastal erosion facing Louisiana, it is imperative that all government agencies act quickly and in accord with the CPRA's Master Plan. This order highlights the need for this Plan Update to drive and expedite state action across agencies; the same need applies to the state's partners at the local and federal levels, consistent with their mandates and missions.

Coordination between state and local authorities is vital in hazard mitigation. For instance, although the Louisiana **Uniform Construction Code (UCC)** may be enforced at the state level through the Office of State Fire Marshal (upon request for commercial construction), local education regarding the UCC is coordinated and supported by DPS through the Louisiana State Uniform Construction Code Council (LSUCCC). Since it went into effect in 2007, the UCC has had a significant impact on lowering risk by reducing exposure to wind- and flood-related hazards in hazard areas through the direct regulation of land use and development. Additionally, the UCC is adopted on the state level and all parishes are required to provide enforcement of the UCC. Recent reviews by the LSUCCC indicate that a small percentage of local officials are either not aware of UCC-enforcement, or inadequately equipped to provide proper enforcement. Continuing education of local officials is needed.

Many mitigation programs operate effectively and even without notice because they are integral to some agencies' objectives. The permanent protection of wildlife habitat through cash sale acquisitions, donations, or conservation easements in the **Land Acquisition Program** is a way to help accomplish the DWF's mission and to advance hazard mitigation goals. Since its inception, the program has acquired almost 610,000 acres of wildlife habitat through fee title acquisitions, donations, or land transfers. An additional 516,167 acres are under variable-length, lease agreements between DWF and private corporations, governmental agencies, and non-governmental organizations. The leased properties represent unprotected fish and wildlife habitat. The owned and leased properties collectively make up the 61 Wildlife Management Areas and Refuges managed by DWF. The WMAs and refuges provide a wide variety of habitats that help fulfill DWF's mission. The success of the land acquisition programs depends upon several factors. Funding is the primary limiting factor and therefore, it is extremely important to have a sufficient and sustained funding source. Land prices continue to escalate, particularly within the past few years as competing interests from land development, alternative fuels, and environmental projects such as carbon sequestration have emerged. Unfortunately, DWF's funding source has been static, thereby severely limiting its ability to acquire habitat from willing sellers.

Another program related to mitigation and mission is the **Scenic Rivers Program** at DWF, which is responsible for preserving, protecting, developing, reclaiming, and enhancing the wilderness qualities, scenic beauties, and ecological regimes of certain free-flowing Louisiana streams. DWF identifies projects requiring Scenic River Permits by (1) conducting routine surveillance of these streams; (2) responding to information provided by the public and local governing authorities; and (3) reviewing notices published by those seeking other state and federal permits for potential impacts to these streams. Channelization, clearing and snagging, channel realignment, reservoir construction, and commercial clear cutting of trees within 100 feet of the ordinary low water mark are prohibited on designated Scenic Rivers in Louisiana. By imposing restrictive permit conditions, modifying proposed activities in ways that minimize or eliminate impacts, and enforcing the provisions of the Scenic Rivers Act to insure compliance, DWF has been very effective in preserving vegetated stream buffers, protecting water quality, and preventing the encroachment of development and protecting the natural character and flood-mitigation capacity of these streams. There are currently approximately 80 streams, rivers and bayous in Louisiana's Natural and Scenic Rivers System, which includes approximately 3,000 linear stream miles.

Established in 1980, the DNR's **Louisiana Coastal Resources Program (LCRP)** requires permits for activities which have direct and significant impacts on coastal waters. Coastal Use Permit (CUP) applications are processed with respect to the consistency of the proposed use with the LCRP. Impacts to wetlands and coastal protective features, as well as hazard potentials, are elements which are evaluated during the CUP review process. The DNR developed a strategic plan pursuant to state law that requires the creation of performance measures. The LCRP's major performance measure is wetland mitigation. The goal is for the LCRP to obtain 100% mitigation for permitted wetland impacts. The performance measure is reported to the Legislature on a quarterly basis, is subject to auditing, and is available to the public. The LCRP mitigation performance measure has never been less than 100% and is usually greater than 100%.

The **Louisiana Coastal Wetland Conservation Plan** also provides documentation of the state's mitigation requirements through the CUP process. The documentation takes the form of a biannual report to Congress composed by the U.S. Fish and Wildlife Service, EPA, and USACE. Louisiana's Coastal Zone Inland boundary was modified in the 2012 Regular Session of the Louisiana Legislature with the passage of House Bill 656 (Act 588). Boundary changes are based on the recommendations of a scientific study conducted for and approved by the CPRA.

The goal of the Coastal Impact Assistance Program (CIAP) **Coastal Forest Conservation Initiative (CFCI)** is to conserve and protect in perpetuity coastal forest resources in Louisiana, which provide significant benefits to the citizens of Louisiana. The primary objective of the CFCI is to acquire land rights (fee title or conservation servitude) from willing landowners of properties that meet at least one of the following criteria: (1) provide direct storm damage reduction potential or protection of hurricane/storm protection features and measures (e.g., levees, cheniers, etc.); (2) are in areas of high ecological significance; or (3) have tracts that are in danger of conversion to non-forested uses. Different hydrologic classes and all native forest types across the coast are considered. The initiative also includes the potential for implementation of small-scale projects to restore and enhance forest sustainability, such as those that reduce excessive ponding or impoundment, help offset subsidence, and to reforest disturbed sites.

Another key tool in local mitigation of hazards is **floodplain management**. Floods, whether riverine, backwater, surge-related, or caused by levee failure, present the most costly and pervasive hazard in Louisiana. Floodplain management is the most comprehensive, relevant, and practical mitigation tool, with many funding options available through typical hazard mitigation sources.

One measure of the effectiveness of floodplain management is participation in FEMA's NFIP. Statewide, all parishes participate in NFIP. All affected jurisdictions adopted post-Katrina/Rita Advisory Base Flood Elevations (ABFEs), except St. John the Baptist Parish and the incorporated municipalities of Gueydan and Erath—however, Vermilion Parish, within which both of these municipalities are located, adopted ABFEs. As of July 26, 2013, 30 of the 64 parishes in Louisiana have Digital Flood Insurance Rate Maps (DFIRMs). Twelve parishes remain without them, while 22 are in some phase of a mapping update.

Table 4.2 summarizes relevant hazard-mitigation-related state policies, programs, and activities at the pre- and post-disaster phase, as well as those policies that relate directly to development regulation.

Table 4.2. Agencies and their pre-disaster and post-disaster actions, as well as their regulation of development.

STATE AGENCY HAZARD MITIGATION PROGRAMS AND ACTIVITIES			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
CPRA	Planning and implementation of structural and nonstructural protection programs and projects throughout coastal Louisiana • Quarterly and annual inspection of federal, state, and local levees and other flood protection projects in Louisiana coastal area • Local cost-share partner for levee construction and other structural protection measures • Provide technical assistance, training, and certification for levee inspectors and levee owners • Review of permits on riverine and hurricane protection activities • Development and prioritization of nonstructural projects in 2012 Coastal Master Plan • Support of land use planning through: the CPRA's Coastal Community Resiliency Program (CCR), publication of Best Practices Manual for Development in Coastal Louisiana and the Louisiana Coastal Land Use Toolkit Planning, engineering, design, construction, operation, maintenance, and monitoring of coastal restoration projects • State-funded coastal restoration projects (e.g., -sediment diversions, marsh creation, barrier island restoration, ridge restoration, hydrologic restoration, shoreline protection, bank stabilization, oyster barrier reefs, and others) • Obtains federal cost-share funding for and implements coastal restoration programs, feasibility studies, and projects. Public outreach and education • 4-H Youth Wetlands Education and Outreach Program	None	None

State Agency Hazard Mitigation Programs and Activities			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
GOHSEP	State Administration of Federal Grant Programs • PDM • Flood Mitigation Assistance Coordination of State and local mitigation planning Community Education and Outreach program (CEO) Training Programs	State Administration of Federal Grant Programs • HMGP • Individual Assistance (IA) • Public Assistance (PA) • (PA) / 406 HMGP	None
LDAF	Fire weather forecasting Soil and Water Conservation Animal Health Services (food security) Formosan Termite Initiative Louisiana Project Learning Tree (K-12 environmental education)	Production of reforestation seedlings	Enforcement of Timber Laws
DOC	Mass care and evacuation support for municipal and parish correctional facilities. Loss Prevention Unit (employee injury, property and records loss) State and local emergency management planning (ESF-6, housing, feeding, medical and mental healthcare)	General Support EOC Task Force DOC HQ Incident Management Center Continued mass care and evacuation support for municipal and parish correctional facilities Backup power generation Information/Business Continuity–(DOA) Living Disaster Recovery Program (LDRP)	None
Louisiana Economic Development	Pre-Disaster Economic Impact Analysis Development of community infrastructure through Louisiana Economic Development Corporation (LEDC)	Distribution of satellite imagery following a disaster Post-Disaster Economic Impact Analysis Small Business Administration (SBA) Small Business Assistance	LED jointly funded a project to write model zoning ordinances

State Agency Hazard Mitigation Programs and Activities			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
DEQ	Nuclear Power Plant Off-site Emergency Preparedness Program Radiological Emergency Planning and Response Remediation program OzoneAction! Drinking Water Well Protection Program Motor Vehicle Inspection and Enforcement Program	Underground Storage Tank and Remediation Division (USTRD)	Permitting Programs (Air, Water, Waste)
DHH	Fight the Bite Program (West Nile Virus) Bioterrorism Unit (training) Pandemic program	Regional Response Team Mobile Field Units Immunization Teams Evacuation Planning Requirement for Licensing Nursing Homes and Home Health Agencies Special Needs Shelters	None
LDI	Consumer 101 public education including oversight “watchdog” functions for protecting policy holders with private insurance companies and providing information on the NFIP. Also is proactive in storm mitigation education via press conferences, news releases and a mitigation brochure.	Office of Consumer Advocacy receives inquiries and complaints from consumers; prepares and disseminates information to inform and assist consumers; and may provide direct assistance and advocacy via one on one presentations and consultations. Office of Property and Casualty also receives complaints from consumers and seeks to resolve complaints in a timely manner with insurance companies.	None

State Agency Hazard Mitigation Programs and Activities			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
DNR	Digital Mapping (Geographic Information System (GIS)) Distributes information on causes of coastal and wetland erosion and methodologies to restore coastal and wetland areas Coastal Zone Management program and grants Coastal Wetlands Reserve Program Parish Coastal Wetlands Restoration program Prepare and plan for large scale evacuations and/or disruptions to the public fuel supply	Surveys coastal restoration projects for damages and seeks FEMA funding as appropriate for needed repairs Digital Mapping (GIS) Provides visibility on the public fuel supply for large scale evacuations and/or disruptions to the public fuel supply	Performs regulatory permit functions and mitigation activities related to the State's coastal zone; issues Coastal Use permits
DPS	Provides for the administration of the Louisiana State Uniform Construction Code Council (LSUCCC) Provides assistance to the LSUCCC and supports local education and training of the UCC	OSFM Urban Search and Rescue and Rapid Response teams assist local efforts Louisiana Traffic Safety Incident Management System (ICS)	OSFM reviews all new construction and renovation of existing structures statewide for compliance with life safety, fire protection, and accessibility regulations OSFM provides enforcement of the LSUCC where requested by parishes and municipalities or individuals
CRT	Hazard Mitigation is taken into consideration as part of planning, development projects and timber management Public education on disaster related topics are included in agency nature programs	Extended Recreation Sites operational hours for possible housing locations Sites used as staging areas	None

State Agency Hazard Mitigation Programs and Activities			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
DOTD	State management of NFIP Statewide Flood Control Program Ports Construction and Development Program Dam Safety Program Floodplain Management Program Educates and assists communities with CRS participation Educates and encourages working relationships between community NFIP staff and local HMGP POCs Plans and conducts educational workshops for local officials Produces and distributes a quarterly NFIP newsletter LA. Emergency Evacuation Plan, including highway contra-flow and evacuation of persons without access to transportation	Floodplain Management Staff contact each community within the declared disaster area to discuss the rules and regulations of the NFIP with a special emphasis on the community's post-disaster responsibilities Ports Construction and Development Program Post-disaster damage assessments	Permitting for all state roads and highways including road access and easements Permitting for all new construction and modifications to dams in Louisiana
WLF	Public information library and the Woodworth Education Center	Operates staging facilities for Search and Rescue (Enforcement Division) Utilizes building elevation and hardening in reconstruction effort	Land Acquisition for Wildlife Management Program Scenic Rivers Program

State Agency Hazard Mitigation Programs and Activities			
Agency	Pre-Disaster	Post-Disaster	Regulation of Development
DOA	Construction of state-owned structures via Facility Planning and Control (FPC) Integrating mitigation design features when feasible Enforcement of State and Federal regulations for design and construction of State buildings Maintenance of Facilities Management database	Disaster Recovery projects for state facilities (FPC) Designated applicant for public assistance to FEMA for all permanent repairs for Katrina and Rita (FPC) Administers Road Home housing assistance through the Office of Community Development Administers Road Home (HMGP) Elevation, Pilot Reconstruction, and Individual Mitigation Measures (OCD) Administers CDBG infrastructure grants through the Office of Community Development	FPC is the Building Code authority for all State owned buildings (with limited exceptions) FPC administers development activities of all non-DOTD State owned property through administration of the capital outlay bill FPC is the central leasing authority for all State agencies
LSU AgCenter	Hazard mitigation information for homeowners and professionals Flood Insurance Rate Maps interactive internet portal and floodplain management education Flood and surge risk appreciation programs Resilient Communities and Economies Initiative Website resources for specific flood and wind mitigation activities, mitigation legislation and development regulations Stewardship Programs for Louisiana's Coastal Landowners Louisiana House Project Master Farmer Program Youth program in hazard mitigation and planning Economic programs to help jurisdictions prepare fiscally for disaster expenses	Provides general information and website support regarding post-disaster recovery and related mitigation activities	Manages design, construction and restoration of research and extension facilities across the state

As this section has illustrated, Louisiana has a number of successful and promising hazard mitigation programs and activities through a wide variety of agencies and organizations. Louisiana now often implements programs that support natural hazard mitigation through ecosystem and coastal restoration, coastal zone monitoring and permitting, and other land-use regulation programs. Most programs overall directly mitigate risk from riverine, backwater, and surge flooding for their areas of concern, in addition to risk posed by high winds and other identified hazards.

In many cases, however, these programs' *full* potential for effective mitigation is unrealized. The cause of this most often cited is a shortage of funding, staff, or technical support. Programs or policies may also have loopholes, structural disincentives, or funding shortfalls.

Hazard Management Capabilities

This subsection scrutinizes the state's hazard management capabilities, including an overview of personnel and their technical capacities, as well as state and federal funding for mitigation actions.

Personnel Capability

In 2010, GOHSEP staffing increased from 273 to 350 in the Disaster Recovery Division with 100 staff (up from 89) working in Hazard Mitigation. Since then, GOHSEP has endeavored to streamline and otherwise improve internal processes, resulting in a smaller overall workforce. The number of employees in Hazard Mitigation decreased to 58. Likewise, the number of contractor personnel decreased from twenty-two in 2010 to six in 2013.

The ongoing decrease in contractor personnel reflects in part the growing technical abilities of GOHSEP personnel in both application development and grants management. It is also a reflection of a more tenured mitigation staff. Since the approval of the previous plan, GOHSEP has improved its hazard management capabilities due to the retention of trained staff who have increased their knowledge of running the division's programs. Moreover, since the Louisiana Recovery Office closed, GOHSEP staff have been working more directly with FEMA's Region VI. In the meantime, technical training remains a priority of the Section's management, but training topics also reflect the nuanced concerns of a more seasoned cohort. Nevertheless, salary levels at GOHSEP remain non-competitive with salaries in the private sector or at FEMA. As a result, GOHSEP has lost approximately five staff members in the past year to private firms working on Hurricane Sandy recovery, while an additional two employees have retired.

Much of the implementation capacity for programs coordinated at the state level lies at the local level. This is particularly true of floodplain management, Uniform Construction Code (UCC) enforcement, and Coastal Zone Management. GOHSEP's mitigation staffing capability extends to being tasked with coordinating state hazard mitigation planning and policy, in large part through the creation, maintenance, and implementation of this Plan Update.

GOHSEP is continuing to develop the capability to consistently maintain the level of accounting and documentation required to support labor-intensive HMGP administrative and management processes. The State of Louisiana has begun to build a web-based grant administration tool (Louisianahm.com) that allows both GOHSEP and its sub-applicants to create and administer Hazard Mitigation grants, from application development through closeout. The state has dedicated financial and human resources to build a system that will allow for electronic application submission, payment submission and processing, document retention, the submission of amendments, and requests for closeout. Documents of business requirements have been submitted to the state's contracted vendor for system build-out, and the system is expected to be ready for sub-applicants in 2014.

In addition, Hazard Mitigation has undergone a major reorganization reflecting the shift from application development to grants management and closeout. Figure 5.1 shows how staffing levels have changed over the past eight years and forecasts where staff might be needed in the future. As the chart suggests, Hazard Mitigation anticipates another significant shift in coming years as more staff members are dedicated to project closeout.

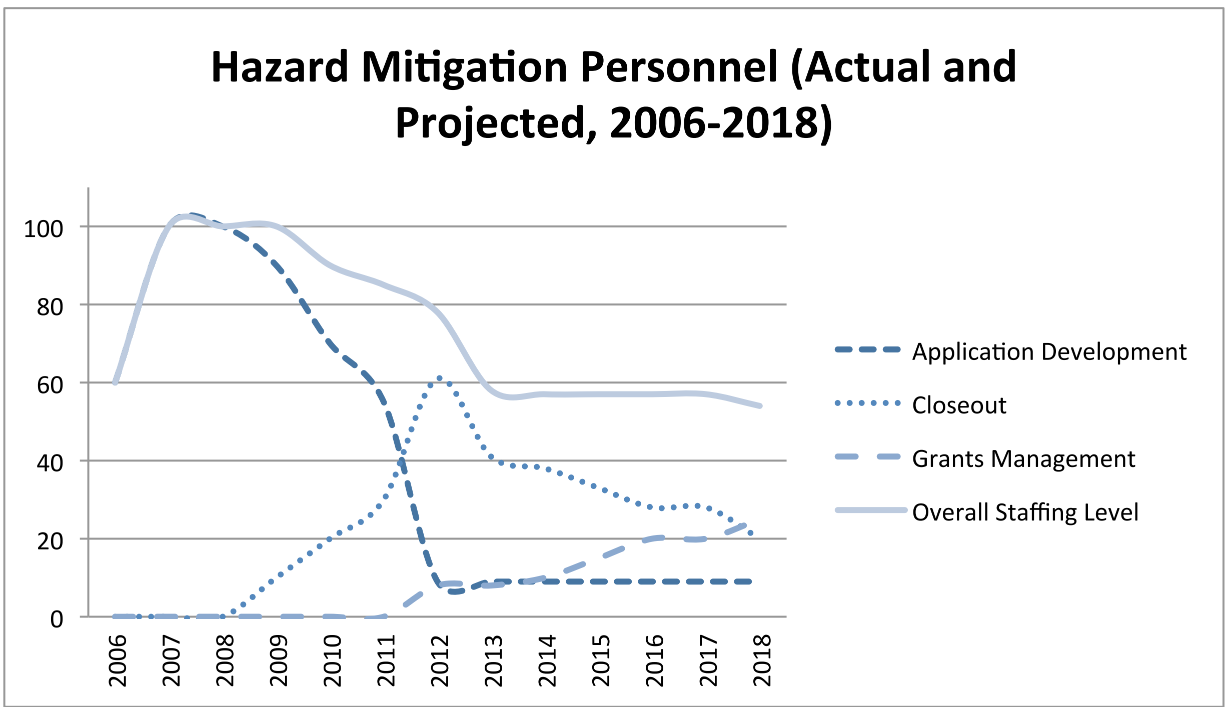


Figure 4.1. Hazard mitigation personnel, 2006-2013 (actual and projected, 2006 to 2018).

GOHSEP, DNR, and DOTD all have significant numbers of staff devoted specifically to hazard mitigation.

Technical Capability

Virtual Louisiana, the current common data portal, is a Google Earth Enterprise platform, a state-mandated information-sharing gateway for emergency management. It is an integrated system for GIS data-collection and management related to hazards in Louisiana. Several agencies and regional entities (as well as a number of localities and universities) maintain excellent GIS and other databases that are shared with GOHSEP and disseminated via Virtual Louisiana. At the state level, the CPRA, DOTD, DOA, DNR, DEQ, and others maintain valuable GIS data. The Louisiana Geographic Information Council (LAGIC) is also involved in coordination of data.

The CPRA makes its coastal protection and coastal restoration data available on the internet, which includes satellite imagery, aerial photography, U.S. Geological Survey quad maps, Louisiana coastal restoration project boundaries, project features, monitoring station locations, and elevation benchmarks. Soon to be added are GIS data and other information describing coastal protection projects and infrastructure, such as levees, floodwalls, and pump stations. Additionally, the CPRA will release results from the 2012 Master Plan modeling effort, including current-year and projected flood depths and flood damage dollars by census block. Such advances in information are a powerful resource for hazard mitigation.

Nevertheless, many state agencies report that their base geospatial data and paper maps are often extremely outdated, particularly following the hurricanes of 2005. Such lapses make accurate assessment of risk planning very difficult. GOHSEP has managed a $9.5 million dollar HMGP grant project that has greatly enhanced the statewide data sets that are available to all state agencies. They include the following: statewide high-resolution imagery, detailed critical infrastructure locations for all 64 parishes, updated state hydrology and flood maps, and upgraded tools and applications to provide mobile editing for future updates.

The management of GIS data regarding risk and hazard mitigation has greatly improved since the last plan update. This includes establishing the infrastructure and methods for ongoing GIS data transfers between state and local governments. Ongoing improvements will include a statewide geospatial portal, which will serve as a one-stop GIS data repository and will be managed and hosted by the LSU Stephenson Disaster Management Institute. This portal will link to the existing GOHSEP portal and provide data for non-emergency management related issues and professionals.

Some areas for improvement in regards to the technical capabilities and GIS data management for hazard mitigation include increased skill-specific professional development opportunities for existing hazard mitigation specialists and GIS staff; funding for GIS and hazard modeling software maintenance and licensing; a rigorous internship program to provide staffing support; and increased participation in EMAC events such as Super Sandy so best practices can be shared and implemented.

To provide a sound basis for ongoing and future hazard mitigation planning, and to integrate local and state planning, data must be improved in the following ways:

- a better system of GIS and other data creation
- consistency
- management
- distribution

The most viable option is likely one that involves partnerships between GOHSEP, Louisiana universities, and other state agencies, as well as local and regional entities.

Financial Capability

In order to discuss the current and potential funding sources for the implementation of mitigation activities in a timely way, this Plan Update will limit discussion to programs with direct relationships to hazard mitigation.

In this Update, the major new source of current and potential funding for hazard mitigation comes through penalties resulting from the Deepwater Horizon oil spill in 2010. Moreover, the state is actively exploring new sources of funding to ensure that the coastal program maintains its current momentum, including Clean Water Act (CWA) penalties resulting from the spill, future Gulf of Mexico Energy Security Act (GOMESA) funding, and credit initiatives that would generate revenue from the carbon sequestration and water quality benefits of constructed projects. The top five sources of all funding for the next projected three years (FY 2014–FY 2016) include the following:

- Natural Resource Damage Assessment (NRDA)—$537 million
- Surplus '07, '08, '09 Funds—$431.9 million
- Coastal Impact Assistance Program (CIAP)—$159.8 million
- Other Oil Spill Related Revenues—$146 million
- CPR Trust Fund Annual Revenue—$102.8 million

In terms of hazard mitigation, though, this subsection will first explore important continuing sources of funding through federal channels.

Federal Funding

Through FEMA, the federal government has several programs to support hazard mitigation. These programs are federally funded, but they are typically administered by GOHSEP and other state and local agencies. FEMA's **Pre-Disaster Mitigation (PDM)** program is designed to implement cost-effective hazard mitigation activities that complement a comprehensive mitigation program. These include planning, acquisition, retrofitting, flood control projects, generators, and other projects. All applicants must participate in the NFIP if they have been identified through the NFIP as having a Special Flood Hazard Area (SFHA). Only governments are eligible. PDM covers up to 75% of costs.

Authorized in the Stafford Act, the **Hazard Mitigation Grant Program (HMGP)** is administered by FEMA and provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Eligible projects include drainage systems, structure elevation, landscape alteration, floodwalls, road elevation, property acquisition, development of mitigation plans, development of land-use regulations, and more. Governments and selected non-profits are eligible. HMGP covers up to 75% of costs.

FEMA's **Public Assistance (PA)** also has a mitigation program. The PA Program provides supplemental federal disaster grant assistance for the repair, replacement, or restoration of disaster-damaged, publicly owned facilities and the facilities of certain private, non-profit organizations. Eligible projects include debris removal, emergency protective measures, repair to transportation infrastructure, repair to utility infrastructure, and more. PA covers up to 75% of costs. It is important to note that the cost share for PA can be adjusted on a disaster-by-disaster basis by an Act of Congress. For example, in the wake of hurricanes Katrina and Rita, the federal share of PA was increased to 90%, and then to 100%, waiving the state/local share entirely. The majority of Hurricane Katrina- and Rita-related funds came through PA and HMGP. The PA program contains a mitigation component wherein eligible damaged infrastructure can be mitigated if mitigation measures are deemed cost-effective and environmentally-sound. Table 4.3 compares PA hazard mitigation to HMGP.

Table 4.3. Source: FEMA, James Lee Witt Associates.

Comparison of Section 404 (HMGP) to Section 406 (PA) Hazard Mitigation Grants		
	Section 404 (HMGP)	Section 406 (PA)
Administration	State	FEMA
Funding source	Hazard Mitigation Grant Program (HMGP)	Public Assistance (PA) grant program
Application process	Application must go through HMGP review process	Application is part of PA review process
Funding uses	Usable on any facility	Limited to damaged facilities
	Usable for structural and non-structural measures	Limited to structural measures
	Usable for any mitigation purpose	Usable only for mitigation of a damaged facility or element

COMPARISON OF SECTION 404 (HMGP) TO SECTION 406 (PA) HAZARD MITIGATION GRANTS		
	Section 404 (HMGP)	Section 406 (PA)
	Usable anywhere in the State (some disaster declarations may limit the area where HMGP can occur)	Limited to declared disaster areas
Benefit Cost Analysis (BCA) criteria	Entire project must be cost-effective per FEMA BCA module	If <15% of the total project cost are mitigation measures under PA, a project may be given administrative approval by the FEMA project officer (certain projects may be funded at higher amounts as specified in Disaster Assistance Policy 9526.1)
Linkage to hazard mitigation benefits	Cost-effectiveness can be linked to any hazard mitigation benefit	Cost effectiveness (if mitigation is >15% of project cost) must be linked to mitigating the damages actually being repaired
Total award	Total award limited by a formula based on total eligible disaster-related Public Assistance (PA) and Individual Assistance (IA) grant programs	No limit to total award

The **Flood Mitigation Assistance (FMA)** program's goal is to reduce or eliminate claims under the NFIP. FMA provides funding to assist states and NFIP-participating communities in implementing plans, projects, and programs to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. This includes acquisition, elevation, flood mitigation, and more. FMA covers up to 75% of costs.

The **Biggert-Waters Flood Insurance Reform Act of 2012** eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs. Elements of these flood grant programs have been incorporated into FMA. The FMA program now allows for additional cost share flexibility:

- Up to 100-percent federal cost share for severe repetitive loss properties
- Up to 90-percent federal cost share for repetitive loss properties
- Up to 75-percent federal cost share for NFIP insured properties

Emergency Support Function #14, Long-Term Community Recovery (ESF #14 LTCR), provides a structure under the National Response Framework (NRF) to promote successful long-term recoveries for tribes, territories, states, and communities suffering extraordinary damages, where local capacity to implement a recovery process is limited. ESF #14 LTCR provides coordination and technical assistance to support federal, state, and local recovery processes.

As indicated above, a very large portion of funding from a variety of federal, state, and other funding sources support hazard mitigation in Louisiana through coastal programs. The following is an overview of key sources of federal funding and policies related to the implementation of coastal projects and programs.

The **Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA)** was authorized by Congress in 1990 to identify, prepare, and fund the construction of coastal wetlands restoration projects. CWPPRA is managed by a Task Force comprised of the State and five Federal agencies, including the EPA, the U.S. Fish and Wildlife Service (USFWS), the Natural Resources Conservation Service (NRCS), the National Marine Fisheries Service (NMFS), and the USACE. The CWPPRA Task Force evaluates projects proposed for inclusion in the CWPPRA program and prepares a ranked list of candidate projects annually based on cost-effectiveness, longevity, risk, supporting partnerships, public support, and support of CWPPRA goals.

The **Water Resources Development Act (WRDA)** refers to any of a set of public laws enacted by Congress to address various aspects of water resources including environmental, structural, navigational, flood protection, and hydrologic issues. The state is partnered with the USACE on multiple large-scale protection and restoration projects that have been authorized through past WRDA bills. Because WRDA projects are generally dependent upon Congressional appropriation for construction funding, federal fund procurement is the principal issue that could affect project implementation. Other issues affecting WRDA projects include cost-share agreement issues with federal partners, land rights issues, and permitting issues.

The **Coastal Impact Assistance Program (CIAP)** was authorized in 2005 as part of the Federal Energy Policy Act to help six coastal states mitigate the onshore effects of Outer Continental Shelf (OCS) oil and gas development. CIAP will provide approximately $495.6 million to Louisiana from the federal administrator (the USFWS). The state of Louisiana will receive 65% of these funds with the remaining 35% being distributed to the 19 coastal parishes. To date, approximately $486 million of Louisiana's CIAP funds have gone into implementation of 96 projects (97% of total Louisiana CIAP projects). Authorized uses of CIAP funds include projects and activities to conserve, protect or restore coastal areas, including wetlands; mitigation of damage to fish, wildlife or natural resources; planning assistance and the administrative costs of CIAP compliance; implementation of a federally approved marine, coastal or comprehensive conservation management plan; and onshore infrastructure projects and public service needs. Up to 23% of those funds can be spent on CIAP planning assistance and compliance and for onshore infrastructure projects and public service needs to mitigate OCS impacts.

The **Hurricane and Storm Damage Risk Reduction System (HSDRRS** was authorized by Public Law 109-234 (Emergency Supplemental Appropriations Act for Defense, the Global War on Terror, and Hurricane Recovery, 2006) and includes the West Bank and Vicinity project the Lake Pontchartrain and Vicinity project, the IHNC Lake Borgne Surge Barrier, and IHNC Seabrook

Complex (each of which is managed separately). Each of these projects is in turn comprised of multiple segments, which have separate design and construction schedules. HSDRRS also covers multiple restoration projects that are currently under development as mitigation for wetland impacts associated with construction of hurricane protection projects. As the non-federal sponsor along with the local Levee Authorities and Levee Districts, the State has contributed to the West Bank and Vicinity and Lake Pontchartrain and Vicinity projects through plans and specifications review, construction inspection assistance, project and program management, and payment of LERRDS costs.

State Funding

For many federal grants, the "non-federal" share can be borne by the state as "grantee"; the recipient community as "sub-grantee"; or in some cases, the property owner who benefits from the project. In Louisiana, the non-federal share is borne by the community or the property owner and not the state. In the following paragraphs, this Plan Update considers the various state agencies and programs that distribute direct federal funding for hazard mitigation, often through cost sharing.

For instance, the **Department of Transportation and Development (DOTD) Floodplain Management Program/NFIP** is the state coordinating program for the NFIP and promotes local government compliance with NFIP regulations to ensure the availability of low-cost flood insurance to minimize loss of life and property due to catastrophic flooding. This is accomplished through on-site assessments, distribution of a quarterly newsletter, conducting workshops, providing technical assistance on local government ordinance development, and participation in post-disaster flood hazard mitigation activities. The program is jointly funded by FEMA and DOTD on a 75:25 cost share.

The statewide **Flood Control Program** provides an average of $10 million annually to parish and municipal governments, levee boards, and drainage districts to support projects that (1) reduce existing flood damages, (2) do not encourage additional development in flood-prone areas, (3) do not increase upstream or downstream flooding, and (4) have a total construction cost of $100,000 or more. Eligible projects include channel enlargement, levees, pump stations, relocation of dwellings and business structures, reservoirs, and other flood damage reduction measures.

The mission of the DOA **Louisiana Community Development Block Grants** is to provide assistance to local governmental entities for developing viable communities. It is principally designed to assist persons of low- to moderate-income by providing decent housing, a suitable living environment, and expanded economic opportunities.

DOA **Capital outlays** are state budget General Fund expenditures for acquiring lands, buildings, equipment or other properties, or for their preservation or development or permanent improvement. Capital outlay planning and budgeting are directed toward the acquisition or renovation of fixed assets.

DOA's **Governor's Office of Rural Development (GORD)** has a mission to reach all of Louisiana's rural communities with resources to help them grow and benefit the lives of their citizens. The organization serves as the single point of contact for rural government service providers, state and federal agencies, and individuals interested in rural policies and programs of the State. As such, it is a crucial part in the dissemination of mitigation action.

The **Louisiana Department of Environmental Quality (DEQ) Municipal Facilities Revolving Loan Fund Program** provides below market rate loans to communities for construction or upgrade of wastewater treatment works and other water quality improvement projects. The DEQ also directs the **Drinking Water Revolving Loan Fund Program**, which provides assistance to public water systems to construct or upgrade drinking water systems to meet federal and state standards. DEQ and the Louisiana Office of Public Health, Department of Health and Hospitals (DHH) cooperate to implement this program in Louisiana.

State funding sources for coastal protection and restoration programs are relatively and appropriately large. For one, the Louisiana Legislature allocated $790 million in state budget surpluses for the years 2007, 2008, and 2009 for coastal protection and restoration activities. The state is utilizing these funds to expedite its coastal program by funding ongoing programs, developing initiatives, and implementing protection and restoration projects. The overwhelming majority of these funds have been allocated to project implementation. Louisiana has also begun implementation of projects without a federal partner using Trust Fund revenues. Broadly speaking, state-only projects generally involve one of the following categories:

- Expedited construction of components of Federal protection projects (e.g., Larose to Golden Meadow [TE-65], Morganza to the Gulf [TE-64]);
- Coordination on federal-only protection projects (e.g., CPRA's Storm-Proofing of Interior Pumping Stations [BA-74]);
- Feasibility studies for flood protection in areas not currently covered by the existing Federal protection network (e.g., South Central Hurricane Protection Plan [TV-54]);
- Protection and restoration projects not included in one of the other coastal programs that are to be implemented in conjunction with local parishes (e.g., Jean Lafitte Tidal Protection [BA-75-1], Morgan City/St. Mary Flood Protection [TV-55]); and
- Augmented design or construction of projects in other coastal programs (e.g., Medium Diversion with Dedicated Dredging at Myrtle Grove [BA-71], Caminada Headland Beach and Dune Restoration [BA-45]).

A total of $293.3 million in 2008 and 2009 was allocated to cover LERRDS cost for the Greater New Orleans Hurricane Protection System. Included within this total is $193.3 million from Act 20 of the 2009 Regular Legislative Session that was approved for Southeast Louisiana Hurricane

Protection projects. This includes credits and payments toward the State and levee district match requirements for the estimated $15 billion Greater New Orleans Hurricane Protection System work underway. The non-federal cost share of such work is estimated to be $1.8 billion plus applicable interest. Under the plan, $100 million of these funds advance planning, engineering, design and construction of hurricane protection and flood control projects in southeast Louisiana during the 2013-2014 fiscal year. These investments will match local and federal funds while improving the protection of our most vulnerable communities consistent with the Master Plan. These funds are projected to be expended in their entirety by the end of FY 2016.

The **Coastal Protection and Restoration (CPR) Trust Fund** was established in 1989 by the Louisiana Legislature to provide a dedicated source of funding for coastal restoration. Income for the fund is a dedication of a percentage of the state's mineral income and severance taxes from oil and gas production on state lands. The Trust Fund provides funding for the coastal program's ongoing operating expenses and for continuing state efforts in coastal restoration and protection. The CPRA is also charged with developing an annual plan for expenditures, managing, and administering the fund and implementing coastal restoration and hurricane protection activities.

The Gulf of Mexico Energy Security Act (GOMESA) provides four Gulf Coast states, including Louisiana, with 37.5% of federal revenue gained from new OCS drilling leases. Full funding from GOMESA will begin in 2017 and is expected to eventually contribute $100–200 million to Louisiana each year. No end date has been established for GOMESA funding.

The **CPRA/NRCS/Soil and Water Conservation Committee Vegetation Planting Program** will ensure that native marsh vegetation is planted and monitored throughout the coastal zone of Louisiana. The CPRA enters into annual cooperative agreements with the Louisiana Department of Agriculture and Forestry (DAF). It is through the DAF and the Soil and Water Conservation Committee, Soil and Water Conservation Districts (SWCD) that the planting tasks are selected, planned, evaluated, planted, and monitored. Each NRCS District Conservationist provides technical assistance to their respective SWCD throughout the planting task process.

Lastly, the **DNR Coastal Wetland Reserve Program** is meant to restore coastal wetlands on lands that have been converted to agriculture. Louisiana has pledged to make available over $200,000 each year to accomplish more of this vital coastal restoration work. The state is working with the Conservation Plan federal oversight agencies to obtain formal approval for shifting the funds for this program to focus on conservation of coastal forest through conservation easements purchased from willing landowners.

OIL SPILL FUNDING

As mentioned earlier, a coincidence at the time of this Plan Update is the large amount of funding coming in to Louisiana as a consequence of the Deepwater Horizon oil spill in 2010.

Much of this funding will implicitly fund hazard mitigation. The disaster was the worst oil spill in our nation's history, and as oil spill injuries are determined and penalties are assessed, multiple avenues for restoration are anticipated. Although the timing and amount of funds related to the Deepwater Horizon oil spill have not been fully determined, preliminary oil spill restoration planning is underway. With an understanding that the use of restoration funds will be guided by specific criteria, Louisiana is committed to maximizing its investment in oil spill recovery activities by implementing restoration projects that are consistent with the Coastal Master Plan to the extent possible. The following is an overview of anticipated sources of funding for oil spill restoration.

The **Natural Resource Damage Assessment (NRDA)** is the process used by natural resource trustees to develop, on behalf of the public, their claim for natural resource damages against the party or parties responsible for the spill. Through that claim, the trustees will seek compensation in the form of restoration for the harm done to natural resources and services. The assessment process is lengthy and complex. The NRDA will continue until the natural resource trustees have determined the full extent of damages, restoration plans are designed and implemented, and the environment and public are made whole for injuries to natural resource and services resulting from the Deepwater Horizon oil spill.

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating water quality standards for surface waters. The CWA makes it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit is obtained. Violations of the CWA can result in both civil and criminal prosecutions by the federal government. The U.S. Department of Justice (DOJ), on behalf of the Environmental Protection Agency (EPA), the United States Coast Guard (USCG), or another federal agency, may bring enforcement actions for civil or criminal penalties under the CWA.

The RESTORE Act dedicates 80% of all prospective CWA administrative and civil penalties related to the Deepwater Horizon spill to a Gulf Coast Restoration Trust Fund. The RESTORE Act also outlines a structure by which the funds can be utilized to restore and protect the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, coastal wetlands, and economy of the Gulf Coast region. The RESTORE Act sets forth the following framework for allocation of the Trust Fund:

- 35% to be divided equally between the five Gulf States for ecological and economic restoration efforts in the region;
- 30% through the Gulf Coast Ecosystem Restoration Council to implement a comprehensive plan for ecosystem and economic recovery of the Gulf Coast;
- 30% for states' plans based on impacts from the Deepwater Horizon oil spill;
- 2.5% to create the Gulf Coast Ecosystem Restoration Science, Observation, Monitoring and Technology Program within the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA); and

- 2.5% to the Centers of Excellence Research grants, which will each focus on science, technology, and monitoring related to Gulf restoration.

A civil action settlement may also include **Supplemental Environmental Projects (SEPs)**, which are tools used by the EPA and DOJ in settlements in environmental enforcement actions. The EPA describes SEPs as environmentally beneficial projects that a violator agrees to undertake when settling an enforcement action. The purpose of a SEP is to provide environmental or public health benefits beyond those required to remediate environmental damages.

Berm to Barrier Projects: The construction of the Barrier Berm projects introduced a significant amount of sediment into the state's barrier island systems. To maximize this opportunity and to improve resiliency of the material placed during construction of the berms, the state plans to convert existing barrier berms into barrier island restoration projects. The State plans to use approximately $105 million of Berm Enhancement Funding to construct the Riverine Sand Mining/Scofield Island Restoration (BA-40) project designed under CWPPRA. Any remaining funds will be applied to the Shell Island Restoration project (BA-110).

Lastly, a significant amount of funding is expected from the **BP Criminal Settlement**, which will resolve the criminal charges related to the Deepwater Horizon disaster. In total, BP agreed to pay $4 billion to resolve the criminal charges. A portion of the monies ($2.394 billion) was directed to the National Fish and Wildlife Foundation (NFWF) for natural resources restoration in the Gulf of Mexico. Approximately $1.2 billion of the funds directed to NFWF is dedicated to targeting Louisiana impacts by using the funds to "create or restore barrier islands off the coast of Louisiana and/or to implement river diversion projects on the Mississippi and/or Atchafalaya Rivers for the purpose of creating, preserving and restoring coastal habitat." The agreement states that NFWF must consider the Coastal Master Plan and the Mississippi River Hydrodynamic and Delta Management Study "to identify the highest priority projects, and to maximize the environmental benefits of such projects." If approved by the Court, the payments will be structured over a five-year period. The criminal fines do not impact the BP's liability for additional civil penalties from CWA violations.

Conclusion

Prior to the last Plan Update, to fully assess the State of Louisiana's capacity to support hazard mitigation, GOHSEP completed a history of the first twelve years of mitigation activities since the inception of the 1998 plan. All mitigation activities funded by the HMGP, FMA, and PDM programs were reviewed.

The process for identifying the history of mitigation projects in Louisiana involved a review of GOHSEP databases for each funding type from 1998 to 2010. Databases were gathered, then analyzed geographically and by funding type, type of mitigation action, structures affected (if applicable), and total project cost. A master database was compiled for all FMA, HMGP, and PDM projects from 1998 to 2010. While not all of the data was available in time for the last Plan

Update, the current Update presents additional data from that assessment. The information from the summary assessment is compiled in Table 4.4.

Table 4.4. Grants for hazard mitigation. Figures reflect approved projects (source: GOHSEP, 2013).

Summary of Grants for Hazard Mitigation (1998–2013)				
Grant Type	1998–2004	2005–2010	2011–2013	TOTAL
HMGP	$40,151,355	$1,939,881,509	$66,658,152	$2,046,691,016
FMA	$3,676,143	$47,822,715	$63,426,239	$114,925,097
PDM	$555,363	$1,273,860	$1,010,954	$2,840,177
TOTAL	$44,382,861	$1,988,978,084	$131,095,345	$2,164,456,290

Louisiana has also been enhancing its efforts to mitigate severe repetitive loss properties, both adding properties to the targeted SRL list, and by increasing efforts to mitigate them. Table 4.5 shows additions of properties to the severe repetitive loss list and Table 4.6 shows the types and number of SRL mitigation projects.

Table 4.5. Mitigation Projects for SRL properties. Funded by FMA grants, 2008–2011 (source: GOHSEP, 2013).

Severe Repetitive Loss Properties Approved for Mitigation Projects	
Year	Number of Properties
2008	137
2009	194
2010	54
2011	114
TOTAL	**499**

Since 2004, approximately 2 billion in federal mitigation grants have been approved for Louisiana mitigation projects. Hurricane's Katrina and Rita non-federal share was matched on the state's side by $500 million in "global match" funds. Global match refers to local and state match for HMGP funds that do not go directly to the project being funded. Instead, global match is provided by applying the value of other projects or investments made on HMGP-eligible activities (subsequent to the disaster declaration) using non-federal sources.

Table 4.6. Types of SRL property mitigation projects (source: GOHSEP, 2013).

Types of Severe Repetitive Loss Property Mitigation Projects	
Mitigation Measure	Number of Properties
Elevation–Coastal Properties	59
Elevation–Riverine Properties	374
Acquisition	59
Reconstruction	59
TOTAL: Completed SRL Projects	**499**

Global match is being provided by "overmatch" by homeowners who are elevating or reconstructing their homes in the Road Home (i.e., homeowners who are spending more than their grant on eligible expenses), plus $200 million in state funding being used for coastal restoration projects.

Recently, President Obama signed the Supplemental Appropriations Act of 2010, which states, "The Administrator of the Federal Emergency Management Agency shall consider satisfied for Hurricane Katrina the non-Federal match requirement for assistance provided by the Federal Emergency Management Agency pursuant to section 404(a) of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C. 5170c(a)." Disasters since Hurricanes Katrina and Rita non-federal share has been matched by the parishes or local governments.

In the following figures and table, this Plan Update presents data regarding the allocations of those funds. Figures 4.2 and 4.3 indicate the number of types of mitigation projects and their cost share by the federal government following Hurricane Katrina, while Figures 4.3 and 4.4 reveal the same information for Hurricane Rita.

Figures 4.6 and 4.7 illustrate the number of types of mitigation projects and their cost share by the federal government following Hurricane Gustav, while Figures 4.8 and 4.9 do the same for Hurricane Ike. For each figure, data in the legends are represented in the pie charts clockwise from darkest to lightest.

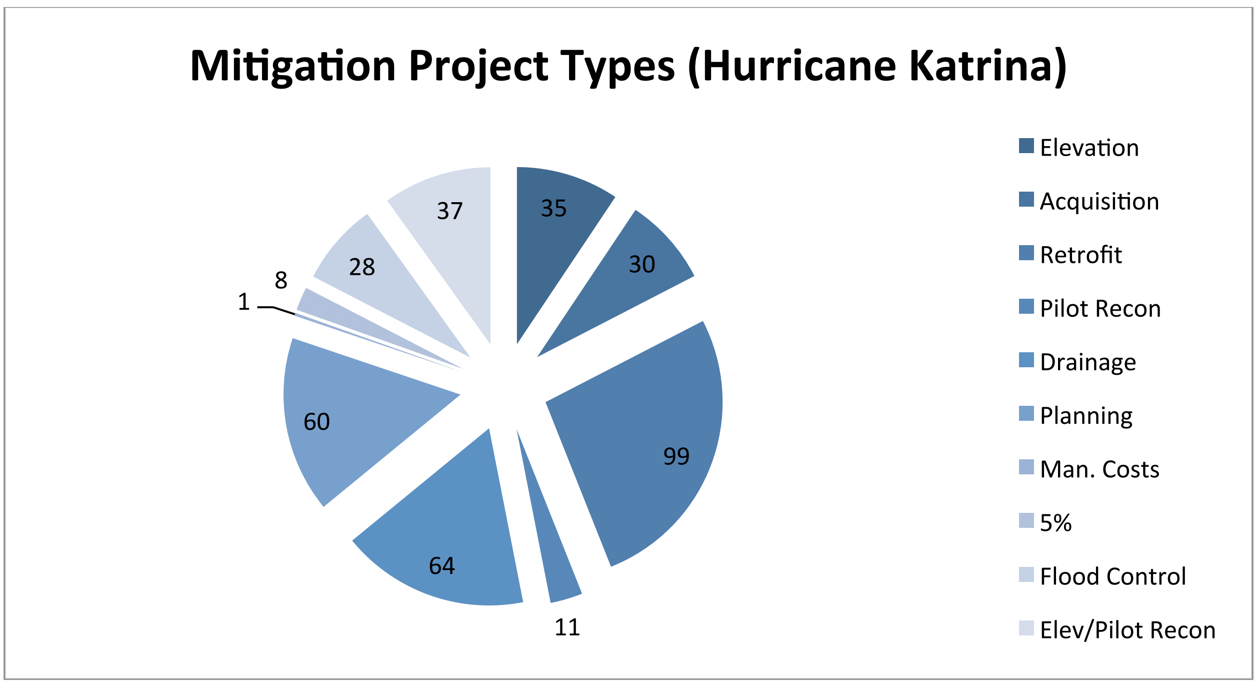


Figure 4.2. Quantity of mitigation project types.

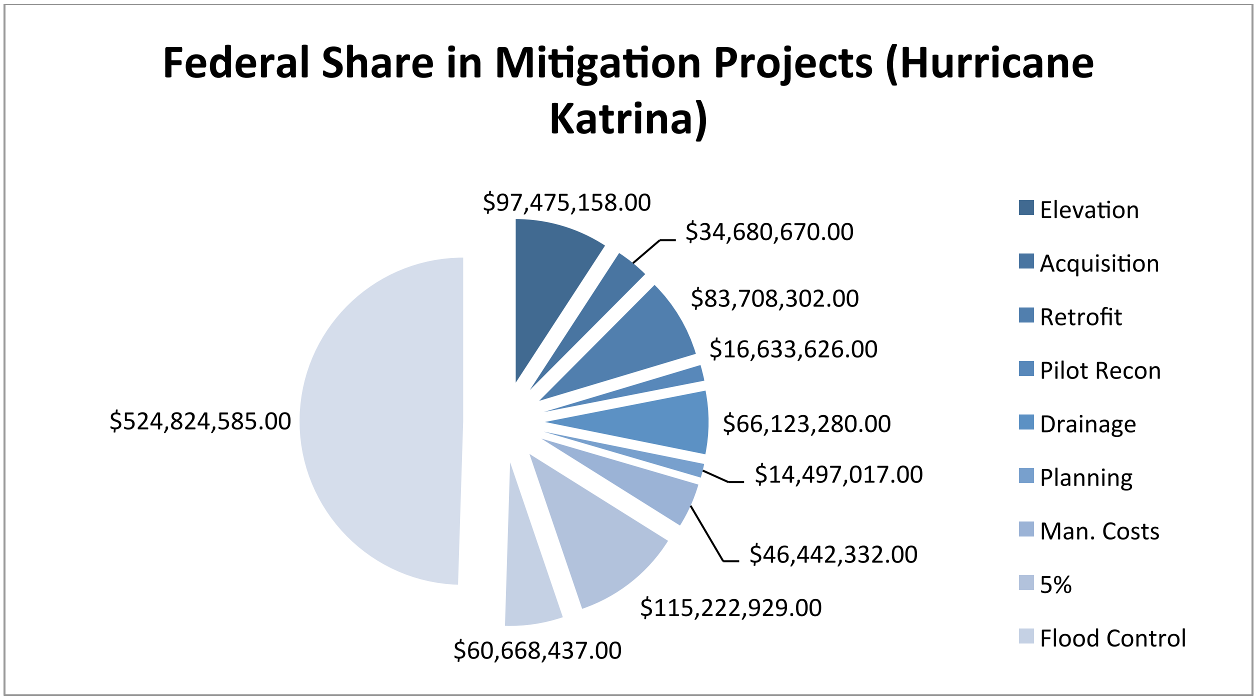


Figure 4.3. Federal share in mitigation project types.

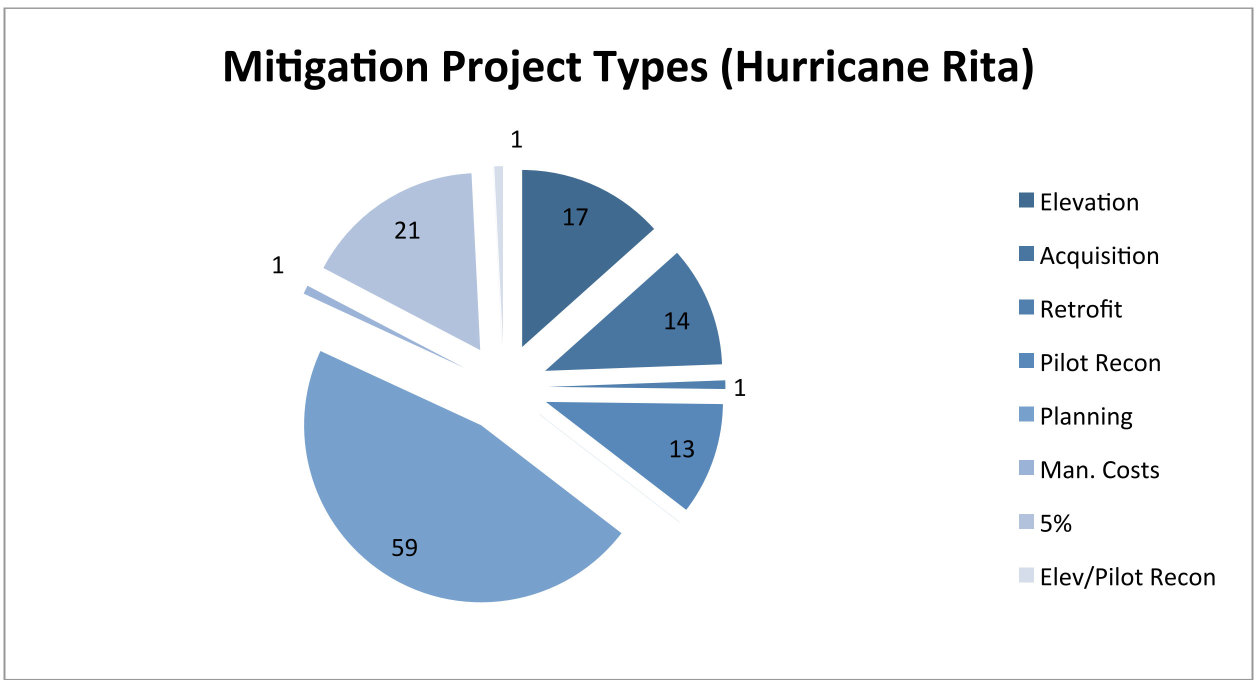


Figure 4.4. Quantity of mitigation project types for Hurricane Rita.

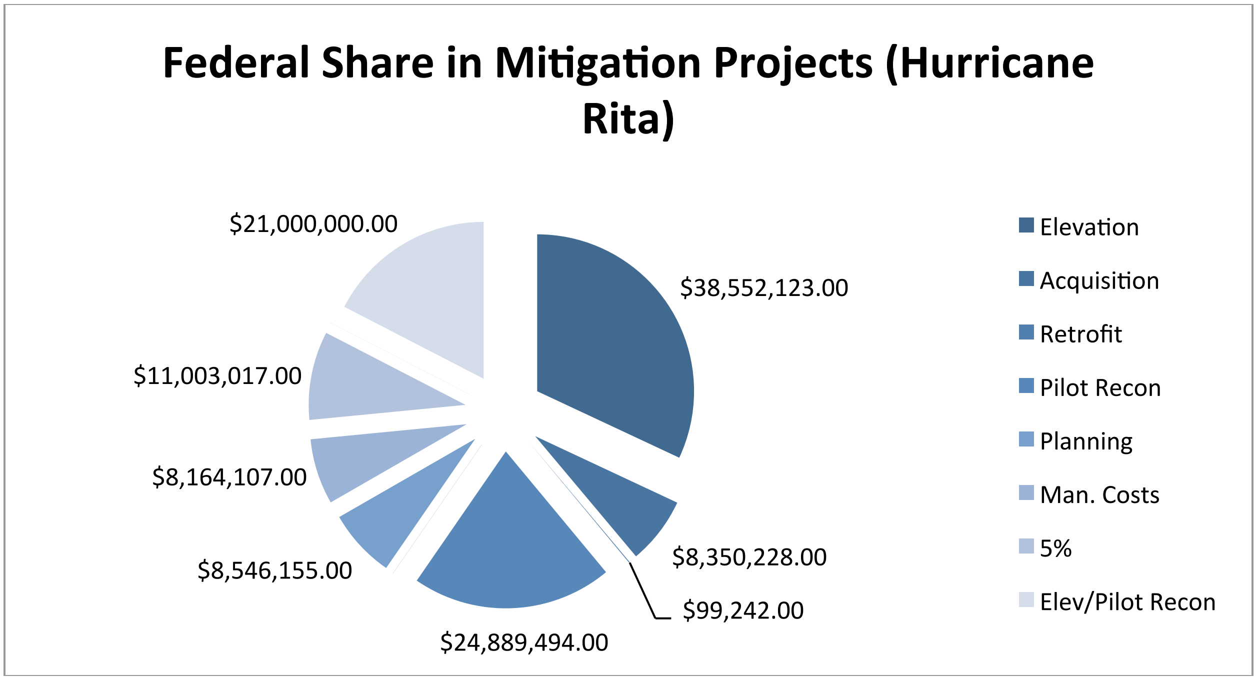


Figure 4.5. Federal share in mitigation projects for Hurricane Rita.

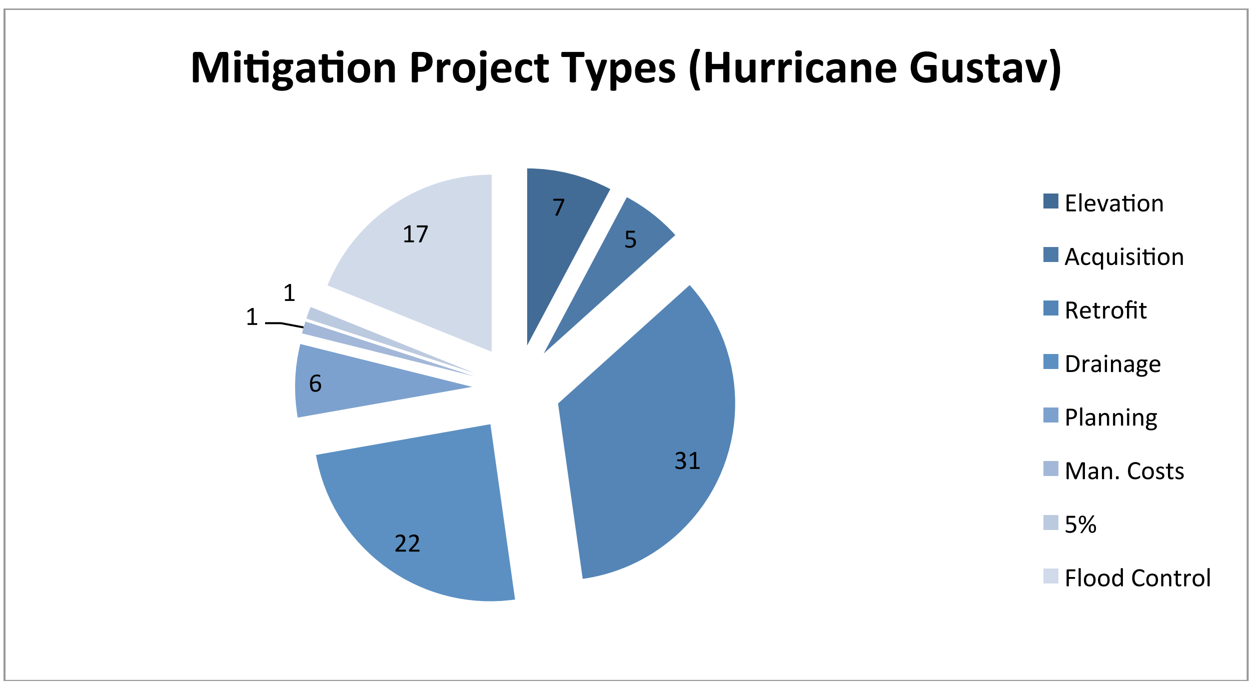


Figure 4.6. Quantity of mitigation project types for Hurricane Gustav.

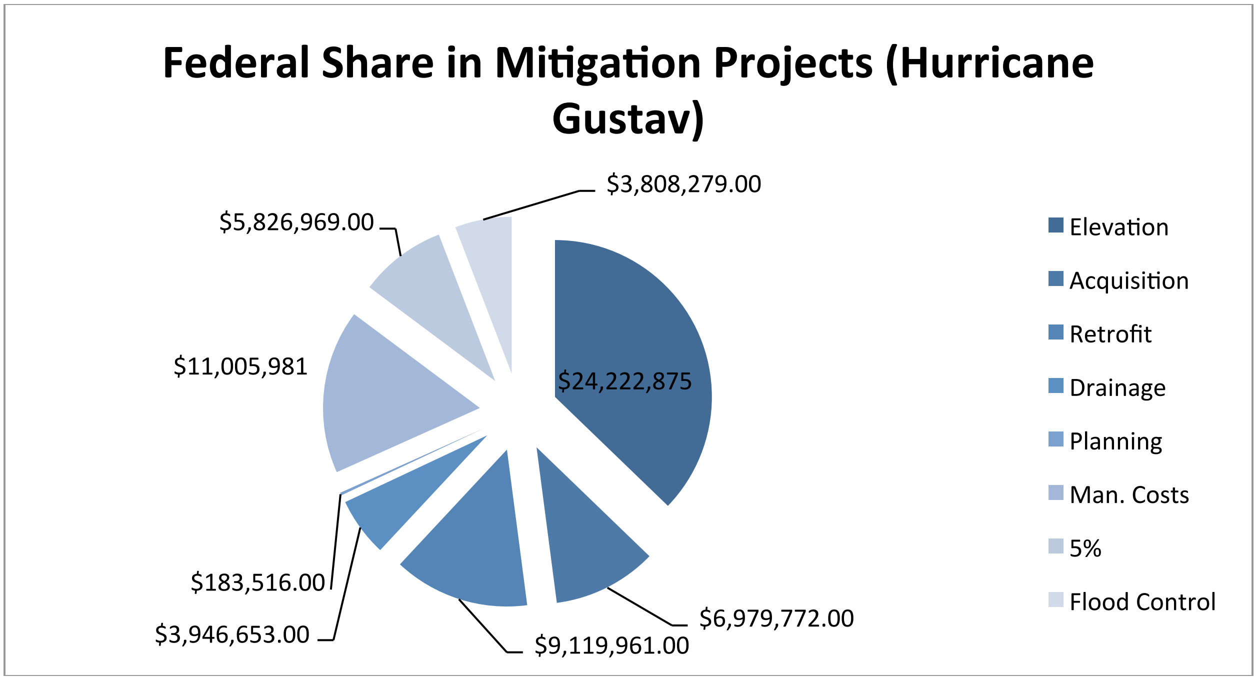


Figure 4.7. Federal share in mitigation projects for Hurricane Gustav.

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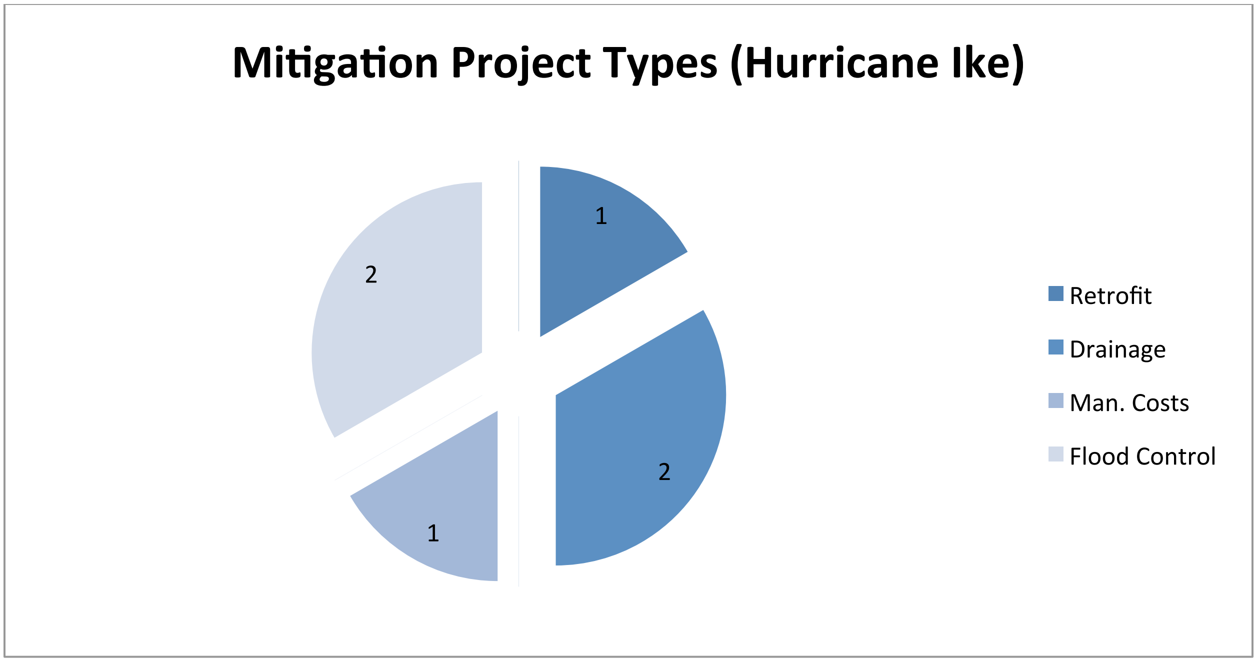


Figure 4.8. Quantity of mitigation project types for Hurricane Ike.

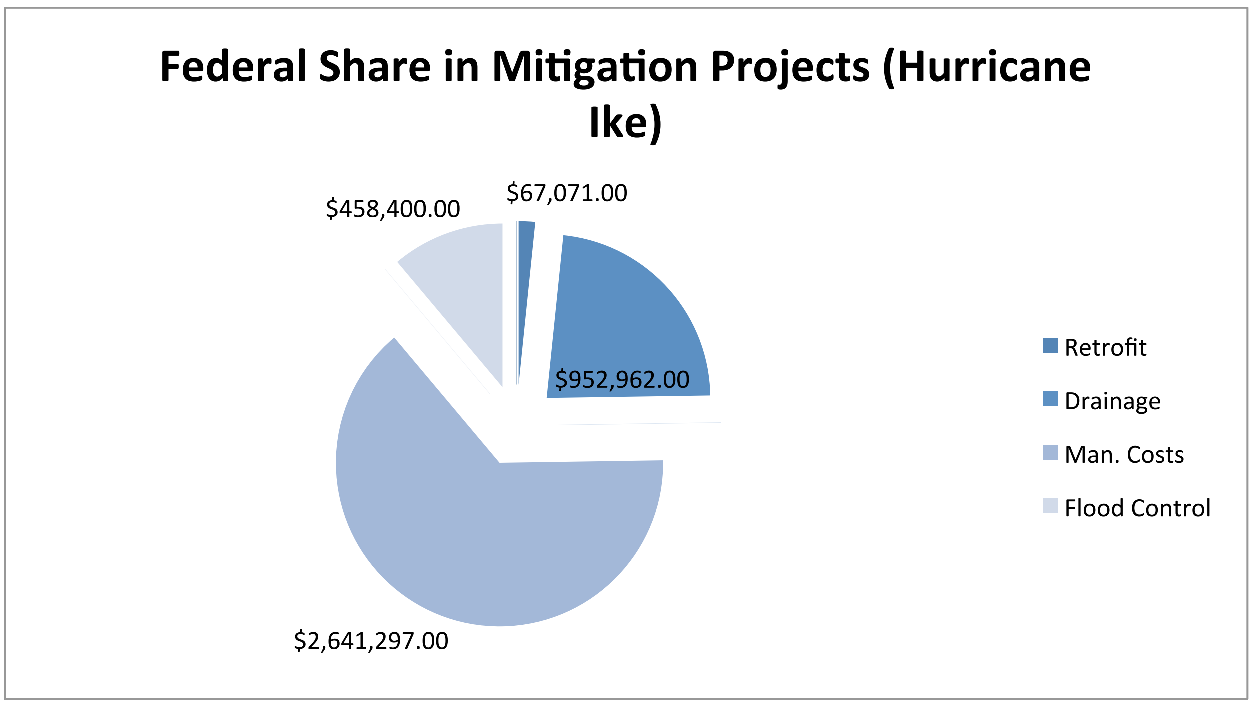


Figure 4.9. Federal share in mitigation projects for Hurricane Ike.

In 2012 the state re-allocated money from hurricanes Gustav and Ike into a statewide acquisition and elevation project. With that money, approximately 450 SRL and RL properties are to be mitigated.

Table 4.7 lists the allocations from FEMA to various parishes in Louisiana following damages from Hurricane Isaac.

Table 4.7. Parish allocations for $58 million in HMGP, awarded by FEMA for damage from Hurricane Isaac.

Hurricane Isaac Allocations by Parish	
Parish	Hurricane Isaac Allocation
Ascension	$578,737
Assumption	$292,291
East Baton Rouge	$637,195
Iberville	$292,291
Jefferson	$8,295,225
Lafourche	$666,424
Livingston	$2,998,908
Orleans	$3,910,856
Plaquemines	$12,118,394
St. Bernard	$1,455,610
St. Charles	$561,199
St. Helena	$257,216
St. James	$450,128
St. John	$11,603,961
St. Mary	$356,595
St. Tammany	$7,237,130
Tangipahoa	$3,396,424
Terrebonne	$1,514,068
Washington	$1,835,589
Total	**$58,458,241**

As these charts and tables demonstrate, mitigation efforts related to particular hazards are highly individualized. Flexibility in response and planning is essential. Indeed, although funding for relief from major disasters has been available and ample, those funds are not always directed effectively to the appropriate areas due to poor communication between state and local authorities. 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.

LOCAL CAPABILITY ASSESSMENT

Hazard mitigation plans and projects for each parish typically resides with a few exceptions with the parish Office of Emergency Preparedness (OEP) office, which is led by the parish OEP director. Exceptions to this guideline are parishes with larger populations or more frequent hazard-induced economic loss. Depending on size of the parish population the OEP office can have a staff of 1 (OEP director) to as many as 10. Most OEP offices, however, are typically staffed with a director and one or two support staff. The average OEP office in Louisiana is staffed with 4 employees. OEP directors often have significant experience in their positions; however, OEP offices are generally obligated beyond their capacity, especially during emergencies. As a result, hazard mitigation planning often is of lower priority.

In addition, for specific tasks such as development of hazard mitigation plans and plan updates and documenting hazard mitigation projects for funding applications, some parishes have dedicated staff that can adequately handle these tasks, but many parishes and municipalities rely heavily on consultant support. GOHSEP also observed that in some cases, consultants are not well-versed in relevant programmatic and technical aspects due to the specialized nature of the work and the sporadic instances when this expertise is required, i.e., it is difficult for communities and consultants alike to obtain and maintain expertise in an area that is not consistently and regularly required. The nature of HMGP funding tied to specific events results in the inability to budget properly into the future, thus these types of personnel uncertainties result.

GIS data is widely accessible, but the capability to analyze, process, create, and maintain such data is not feasible for most OEP offices. These capabilities only exist in large OEP offices with significant parish support. Parishes with GIS departments reported coordinating with or accessing off-site GIS indicated a variety of locations where this data was housed. In some cases (e.g., Jefferson Parish), the parish maintains GIS data. In others (e.g., South Central Planning Development Commission or Northwest Louisiana Council of Governments), a regional entity coordinates and houses data. Other parishes utilize local universities as the repository of important GIS data.

Parishes and communities in Louisiana vary widely in their capacity for planning and regulation relevant to hazard mitigation. Some communities have a full range of implementation tools, while others have none. Tools include:

- Local hazard mitigation plans (HMPs), see COORDINATION OF LOCAL PLANNING Section
- Land-use planning and regulations, see POLICIES Section
- Floodplain management, see POLICIES Section

Floodplain management is discussed in more detail earlier in this section (see POLICIES). However, community participation in the CRS is noteworthy when discussing local capabilities. Thiry-nine Louisiana communities, accounting for approximately 80% of NFIP policies in the

State of Louisiana, participate in the Community Rating System (CRS). Participation in the CRS strengthens local capabilities by lowering flood insurance premiums for jurisdictions that exceed NFIP minimum requirements. Table 4.8 shows the communities in Louisiana that participate in CRS.

Table 4.8. CRS Participation in Louisiana (source: Cindy O'Neal, National Flood Insurance Program State Coordinator, DOTD, 2007).

Community Rating System Participation by Parish	
Parish	CRS-Participating Jurisdiction
Acadia	Rayne
Ascension	Ascension Parish
	French Settlement
	Gonzales
	Sorrento
Beauregard	DeRidder
Bossier	Bossier City
Caddo	Caddo Parish
	Shreveport
Calcasieu	Calcasieu Parish
	Lake Charles
East Baton Rouge	Baker
	East Baton Rouge City/ Parish
	Zachary
Jefferson	Gretna
	Harahan
	Jefferson Parish
	Kenner
	Westwego
Lafayette	Carencro
Lincoln	Ruston
Livingston	Denham Springs
	Livingston Parish
	Walker
Orleans	New Orleans/Orleans Parish
Ouachita	Monroe

COMMUNITY RATING SYSTEM PARTICIPATION BY PARISH	
Parish	CRS-Participating Jurisdiction
	Ouachita Parish
St. Charles	St. Charles Parish
St. James	Lutcher
	St. James Parish
St. John the Baptist	St. John Parish
St. Mary	Morgan City
St. Tammany	Mandeville
	Slidell
	St. Tammany Parish
Tangipahoa	Tangipahoa Parish
Terrebonne	Houma
	Terrebonne Parish
West Baton Rouge	West Baton Rouge Parish

COORDINATION OF LOCAL PLANNING

At the writing of this Plan Update, all 64 of Louisiana's parishes have approved plans. The State of Louisiana prioritizes funding for them, and has thus provided funding and technical assistance to local jurisdictions, ensuring that all localities have them approved. Overall, the state has approved all 93 jurisdictional Hazard Mitigation Plans: 64 parish-level, 14 local community, 9 university, 5 special district plans, and 1 Native American tribe plan. Going forward, due to budget constraints, the state will only fund plans at the parish level, but will still provide technical assistance to all jurisdictional plans. Those jurisdictions will be encouraged to apply for PDM grants.

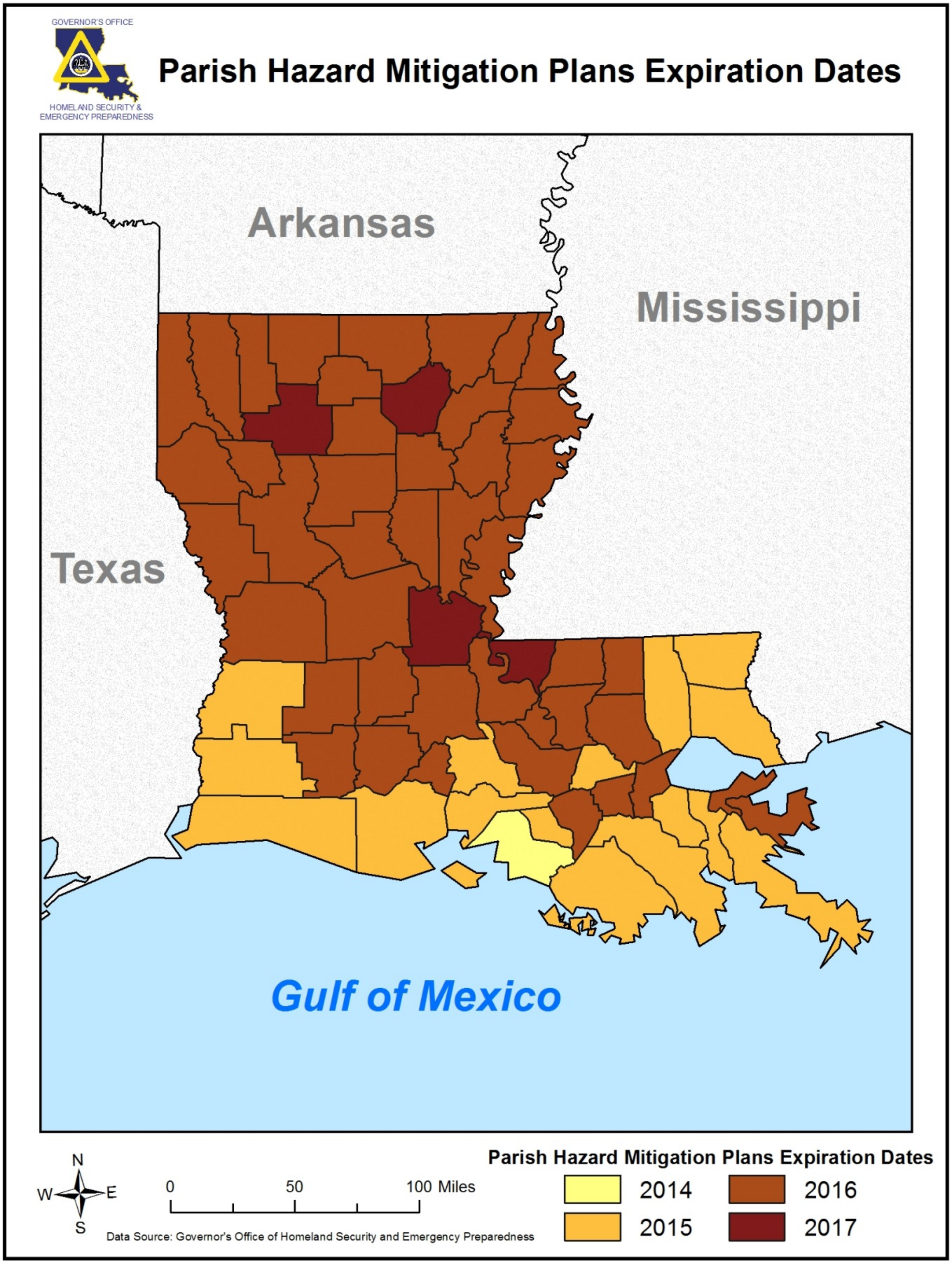
Since the last Plan Update, the State of Louisiana (through GOHSEP) also organized and hosted a Hazard Mitigation Plan Implementation Workshop following Hurricane Isaac in 2012. The workshop facilitated a meeting between GOHSEP planners and plan owners from parishes and jurisdictions affected by Isaac. The State sent a questionnaire to participants requiring them to consult their particular plans prior to meeting. Through four-hour workshops, federal and state planners worked one-on-one with local plan owners to discuss flood risk changes, the status of projects and plan implementation, and funding of projects.

Based on interactions with local plan owners, the State found that most jurisdictions were not managing their plans on a routine basis, despite varying levels of ongoing mitigation activities.

Moreover, in many cases, local jurisdictions did not know the point of contact for their plan. The workshop was determined to be an important step in relating mitigation planning with mitigation action, and it further highlighted the need for more coordination among the levels of government involved in hazard mitigation throughout the state.

Thus, in order to continue to provide funding and technical assistance for new plans and updates, GOHSEP has committed to support the updating of FEMA-approved, DMA 2000-compliant, jurisdictional plans. Between October 2014 and December 2017, the 64 parish plans are due for updating and approval. Of these, three parishes have already secured PDM funding for their next plan. To prepare for the 61 other updates, GOHSEP has allocated funding from the Hurricane Isaac FEMA Hazard Mitigation Grant Program to support a three-year planning effort that will produce updated plans in a framework that facilitates future updates and provides a degree of uniformity across jurisdictions. Thus, all plans will use similar but appropriate data sources and data processing steps. This coordination allows accurate comparisons between local plans and the state plan for the first time, which will foster more consistent mitigation planning within the state. For the next Plan Update, state mitigation planners will review the local plans for FEMA compliance and collate useful information for inclusion. Useful information will be stored in a computer file and reviewed again in January 2016 at the beginning of the next update process. The timeline for delivery of plan updates will be driven by the schedule on which the jurisdictional plans expire, as indicated by Map 4.1.

(Continued on Next Page)



Map 4.1. Parish Hazard Mitigation Plan expirations (2014–2017).

Local Plan Review Process

The step-by-step plan review process that GOHSEP employs is as follows:

Step 1:	The initial draft of a parish or municipal plan is sent to GOHSEP for review. GOHSEP staff develops and provides parish or municipal officials with comprehensive guidance for improving the format and content of the plan.
Step 2:	Parish or municipal officials revise the plan in accordance with GOHSEP guidance, and re-submit the plan for GOHSEP review. With satisfactory revisions, the plan is forwarded with GOHSEP comments to FEMA Region VI.
Step 3:	FEMA Region VI reviews the plan and forwards their comments to GOHSEP who then relays new comments back to the parish or municipality. GOHSEP continues to interface with parish or municipal officials to discuss and clarify all review comments on a point-by-point basis.
Step 4:	The parish or municipality addresses both GOHSEP and FEMA Region VI comments and revises the plan.
Step 5:	A revised draft is submitted to GOHSEP for review. GOHSEP staff evaluates revisions and forward to FEMA Region VI.
Step 6:	FEMA Region VI reviews the revised plan, and if all comments were satisfactorily addressed, a letter stating that the plan is "approvable pending adoption" is mailed to GOHSEP and the parish or municipality. In cases where comments have not been addressed satisfactorily, the parish or municipality again addresses the comments and repeats the process.
Step 7:	The plan is then formally adopted by all participating jurisdictions through a Resolution.
Step 8:	The plan is officially approved by the Regional Director of FEMA Region VI.

The timeframe for this review process is approximately six months, not including the time spent by parishes or municipalities to revise their plans in response to GOHSEP and FEMA comments and is based on the following assumptions:

- Step 1 requires approximately 45 days for State review
- Step 2 requires an additional 45 days for FEMA
- After resubmitting the plan for final review, the state and FEMA are each given a 45-day review period

Prioritizing Parish and Municipal Assistance

IFR subsection 201.4(c)(4)(iii) states that the State Hazard Mitigation Plan must include "[c]riteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with:

- Highest risk

- Repetitive loss properties
- Most intense development pressures

Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.

The sub-sections below discuss these four criteria. Following these subsections is additional discussion of how the state intends to prioritize applications for funding future planning efforts. In all cases applicants must demonstrate that their risk is sufficient to merit grant funds, particularly when compared to the project cost, but there is often considerable uncertainty in risk determinations. For this and other reasons, the state considers a variety of factors in addition to risk and benefit-cost analysis in determining its priorities for mitigation grants.
In addition, as identified above, GOHSEP has established a policy of prioritizing funding for hazard mitigation planning efforts at the parish level in the future. This policy includes making sure that the interests of municipalities are protected and acknowledged as part of the process.

Jurisdictions with Highest Risk

One of the primary purposes of this Plan Update is to identify the areas in Louisiana with the highest risk from natural and manmade hazards. As described in Section Five, the parishes in Louisiana have different levels of exposure and risk. Although the state does not have a formal system established to evaluate and prioritize potential mitigation projects on the basis of risk, this Plan Update is partly intended to introduce such criteria to the process. In general, the state will direct mitigation grant funds to the areas with the highest risk. However, in many cases, more localized risk assessments (possibly produced in the parish and municipal mitigation planning process), as well as risk assessments and benefit-cost analyses done in support of applications, may indicate areas with high risk outside the highest-risk parishes identified in this Plan Update.
The most worthwhile mitigation projects are a product of both the risk in a particular place and the effectiveness of a project. Although risk is clearly a good initial indicator of mitigation potential, the state will also carefully consider the effectiveness and cost of mitigation projects in determining funding priorities.

Jurisdictions with Repetitive Loss Properties

There is currently no formal requirement that grants made through either the HMGP or Pre-Disaster Mitigation Competitive Grant Program (PDM-C) emphasize repetitive loss properties. However, in response to the Federal emphasis on reducing the burden that repetitive losses place on the National Flood Insurance Program (NFIP), the State presently considers the repetitive loss status of properties in determining the grants it will support (i.e., forward to

FEMA for consideration and funding), and will continue to do so as additional grant funds are available.

The FMA program mandates that grant funds are directed to NFIP repetitive loss properties, and the state will continue to comply with this requirement as it has since its inception. The Flood Insurance Reform Act of 2004, which was signed into law by the President on June 30, 2004, requires the NFIP to provide a disincentive to property owners to live in repetitively flooded areas. Rather than continue to rebuild, the program would provide repeatedly flooded homeowners assistance in either elevating or moving their homes away from floodwaters. Those who refuse mitigation assistance would pay premiums that will progressively approach the full actuarial costs for choosing to live in a risky area.
(This strategy to mitigate repetitive loss properties and especially severe repetitive loss properties contributes to meeting Louisiana's requirements for increased federal match on SRL and FMA grants under FEMA's Flood Mitigation Grants and Hazard Mitigation Planning Interim Rule, § 201.4(c)(3)(v).)

Jurisdictions with Most Intense Development Pressure

At the time this Plan Update was developed Louisiana had no formal process for evaluating potential mitigation grants relative to future development. As it develops a more rigorous review and recommendation process, the state will include development pressure as a potential review criterion. It is assumed that parish and municipal plans will provide some indication of the implications of future development per DMA 2000 requirements for local plans. The degree to which this information is included in the parish and municipal plans will determine the ability of GOHSEP and the SHMPC to make decisions based on these criteria. Although development pressure is clearly a potential factor in any risk determination, development that is undertaken in accordance with adequate building codes, land planning and floodplain management principles should in many cases be less risky than development that pre-dates these codes and principles. However, the state is aware that increased development does cause related increases in population, infrastructure, etc., and may in some cases have adverse impacts on existing areas. These factors will be carefully considered in additional reviews.

Maximizing Benefits According to Benefit-Cost Review of Local Projects

Regulations for FEMA's HMA grant program state that proposed mitigation projects must be cost effective. Under some pre-established conditions, certain projects may be exempt from this regulation, but in most cases a benefit-cost analysis is undertaken for projects either prior to being submitted to GOHSEP and FEMA for funding consideration, or during the grant evaluation process.

The PDM-C program, which was instituted in 2003/04, further emphasizes the role of cost-effectiveness by making the benefit-cost ratio the single most important criterion in project rating and evaluation. For the HMGP and FMA programs, the regulations require only that proposed mitigation projects are cost-effective, *not* that they are the *most* cost-effective projects that the state or FEMA is considering. However, the state generally believes that projects with high benefit cost ratios should get preference, all other aspects being equal.
In most cases, grant applications are either accompanied by a benefit-cost analysis, or GOHSEP or FEMA performs one in accordance with FEMA and the Louisiana Office of Management and Budgets regulations. Projects that do not achieve the required 1.0 benefit-cost ratio, and are not exempted from benefit-cost analysis, are rejected from funding consideration. This is the case for all FEMA HMA grants.

Prioritization of Parishes to Receive HMGP Funding

The State Hazard Mitigation Officer shall submit recommendations to the Governor or his/her Designee for the use of available HMGP funds. These recommendations will include:

- Priority for use of funds, if any
- Allocation of funds to parishes based on their prorated share of damages as determined by the final damage assessment figures
- Allocations of available funds to State and Regional Agencies
- Use of all available initiative funds
- Other priority related issues as a result of the disaster

Funds will only be made available to those eligible applicants that have or is covered by a FEMA approved state or local mitigation plan. The parishes will submit eligible project applications to GOHSEP in prioritized order up to the amount of their allocation. Parishes are encouraged to submit more projects than their allocation in case several projects are deemed not eligible.

5. MITIGATION STRATEGY

The State of Louisiana's Hazard Mitigation Strategy has a common guiding principle as expressed through its mission statement. Louisiana's Hazard Mitigation Strategy is the demonstration of the state's commitment to reduce risks from hazards, and serves as a guide for State decision makers as they commit resources to reducing the effects of hazards.

To help implement this strategy and adhere to this mission statement, the preceding section of the Plan Update was focused on identifying and quantifying the risks faced by the residents and property owners in the State of Louisiana from natural and manmade hazards. By articulating goals and objectives based on 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, the state 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 State 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.

GOALS

The current goals of the state's hazard mitigation teams represent long-term commitments by the State of Louisiana. After assessing these goals, the State Hazard Mitigation Planning Committee (SHMPC) has decided that the current five goals are valid. Four of those goals are from the 2011 Plan Update, while a fifth goal was added as an amendment in May 2013 as part of a programmatic agreement between the State Historic Preservation Office (SHPO), the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), and the Federal Emergency Management Agency (FEMA). The actions this Plan Update names are only suggestions and cannot be enforced by the Plan.

The goals are as follows:

Goal 1: **The State of Louisiana will improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact.**

Goal 2: **The State of Louisiana will improve data collection, use and sharing to reduce the impacts of hazards.**

Goal 3: **The State of Louisiana will improve capabilities and coordination at the municipal, parish, regional and state level to plan and implement hazard mitigation projects.**

Goal 4: **The State of Louisiana will continue to pursue opportunities to reduce impacts to the State's manmade and natural environment through mitigation of repetitive and severe repetitive loss properties and other appropriate construction projects and related activities.**

Goal 5: **The State of Louisiana will improve on the protection of its Historic Structures/Buildings, Traditional Cultural Properties and Archaeological Sites from natural and man-made hazards.**

The Mitigation Action Plan focuses on actions to be taken by GOHSEP and the SHMC. It is important to note that many of the mitigation actions identified below are activities (education, training, facilitating, etc.) as opposed to "brick and mortar" projects, most of which are the purview of local sub-grantees. As such, demonstrating cost effectiveness of identified state actions can be difficult. Costs can be quantified, but specific benefits are more ephemeral. Additionally, while Goal #4 is clearly focused on supporting the development and implementation of cost effective projects, the Plan does not identify projects to implement in specific locations or situations. However, all of the activities in this Mitigation Action Plan will be focused on helping municipalities, parishes and State agencies 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.

ACTIONS

In order to determine the actions for this Plan Update, the SHMPC convened a stakeholder meeting on November 7, 2013 and asked attendees to fill out evaluations of each action from the previous Plan Update after it was presented and discussed. Evaluations were based on whether actions were (1) technically feasible, (2) cost effective, and (3) environmentally sound. Evaluation proved somewhat difficult since many of the actions comprised indirect activities, while the committee asked for a balance of direct (measurable) and indirection actions. After evaluating each action, participants were then asked to prioritize the actions based on four criteria:

Is it based on risk assessment?
Is there a link to parish plans?
Does it contribute to mitigations goals?

Is it measurable?

After this process, three new measurable actions were added to the pre-existing ten, along with three new indirect actions. None of the previous actions were fully completed. Each action is listed below with its summary description; its status; an update on it; the organization(s) responsible for it; a timeframe for its completion; and its evaluation and priority ranking at the meeting.

Action 1.1 Statewide Education and Outreach

Summary Description: Support start-up and implementation of the Community Education Outreach (CEO) program and institutionalize practices for after the completion of CEO.
Status: Ongoing
Update: The mission of the GOHSEP Community Education and Outreach Program is to inform citizens, business owners, visitors, and government officials about the risk they face, what can be done to reduce those risks and how investing in certain mitigation measures can be cost - effective.

CEO Partnerships include the following:

- LSU Stephenson Disaster Management Institute (SDMI)
    - The purpose of this interagency agreement is for GOHSEP to provide funding to SDMI in order to implement mitigation and preparedness outreach and education projects through a center run by SDMI intended for small business owners and non-profit organizations throughout the State. The goal of this project is to assist in meeting the Statewide Hazard Mitigation goals, as stated in the State Hazard Mitigation Plan, by promoting regional and community sustainability and resilience through better prepared businesses; promoting public-private partnership for same.

- Building Officials Association of Louisiana (BOAL)
    - The purpose of this cooperative endeavor agreement is to partner with BOAL to assist GOHSEP in disseminating important information on hazard and risk reduction opportunities and techniques in a format that both the construction professional and the typical citizen can understand. Providing educational and outreach opportunities on hazard mitigation to the construction industry is a key goal of the Statewide Community Education and Outreach project.

- The University of New Orleans (UNO-CHART)
    - The goals of this interagency agreement include:
        - Create a culture of mitigation
        - Promote community-based mitigation
        - Promote personal responsibility

    - Promote regional partnerships
    - Build mitigation capacity at every level of society.

- Louisiana State University Agricultural Center (LSU AgCenter)
    - Through the LSU Agricultural Center, GOHSEP will expand and enhance its hazard mitigation education program to increase understanding of hazards and adoption of practices that will reduce damage in future events and to be more hazard resistant. The program, while primarily for adult audiences, will educate and engage youth in hazard mitigation through 4-H Youth and Family Development program, and will use technology, modeling, graphics, animation and social media tools to increase interest in mitigation principles and projects.

- University of Louisiana at Lafayette, National Incident Management Systems and Advanced Technologies (NIMSAT)
    - The purpose of this interagency agreement is to provide, through the CEO Program, much needed natural hazard and risk information and disaster analytics accessible to all interested parties, allowing a better understanding of the risks faced from various hazards and, more importantly, how to reduce identified risks. One of the key elements of the CEO Program is the collection and dissemination of hazard and risk data in a format that the everyday citizen can understand and use to make informed decisions about the amount or degree of risk they are willing to accept. The information contained in the disaster informatics repository will aid in the creating of disaster declarations and aid elected officials in making critical public safety decisions about hazards and response to such.

- Louisiana State Historic Preservation Office
    - The purpose of this agreement is to minimize risk and prepare for future disasters as well as provide critical Environmental and Historic Preservation information, pursuant to Section 106 of the National Historic Preservation Act, to the citizens and leaders of Louisiana, implemented through the CEO program and in coordination with the State Historic Preservation Officer (SHIPO).

CEO activities over the past 3 years include the following:

- Disaster Resilient University Statewide Conference
    - UNO-CHART hosted the Disaster Resistant University Workshop 2011– Building Partnerships in Mitigation, February 16-18, 2011, on its main campus. The Workshop was attended by more than 100 participants representing 25 universities/colleges from around the country and Canada. A second Workshop, held March 20-22, 2013, included over 130 attendees representing 36 universities and colleges from around the country, plus Canada, Japan, and South Africa. Presentation topics included but were not limited to mitigation

program assessment, campus violence, risk communication, mitigation planning, risk assessment, floodproofing, and instructional continuity.

- Community Executives Program in Risk Management
    - Since 2011, the CHART team facilitated Executive Symposia in Resilience and Risk Management intended to enhance the capacity of Louisiana community and business leaders to make strategic decisions related to risk management based on sound, scientific principles of resilience. Additional meetings will be held in 2014.

Responsible Organization: GOHSEP/State Hazard Mitigation Officer (SHMO)
Timeframe: Long Term
Evaluation Score: 22
Priority Ranking: 10

Action 1.2 Education and Outreach for State Agencies

Summary Description: Develop and implement an "internal" state agency mitigation education and outreach program (parallel to the public education and outreach program (Action 1.1)

Status: Not Started
Update: Not Applicable
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 21.06
Priority Ranking: 16

Action 1.3 Analyze Past Education and Outreach Efforts

Summary Description: Analyze past outreach efforts and update them as needed based on anticipated local mitigation strategies.
Status: New
Update: Not Applicable
Responsible Organization: GOHSEP
Timeframe: Short Term
Evaluation Score: 22.25
Priority Ranking: 5

Action 2.1 Statewide Data-Related Efforts

Summary Description: Define and implement appropriate institutional arrangements for collection, use and sharing data for parishes and municipalities.

Status: Ongoing
Update: In May 2013, GOHSEP and NIMSAT (National Incident Management Systems and Advanced Technologies) entered into phase 2 of the development of Louisiana All-Hazard Information Portal (LAHIP) a web-based portal to provide easy access to hazard and risk-related data, and to improve the system for collection and management of historical data. LAHIP is intended to assist in development and maintenance of the State Hazard Mitigation Plan, but also to support parishes and local communities with their respective hazard mitigation, continuity of operations, and other planning efforts.
Responsible Organization: GOHSEP / NIMSAT
Timeframe: Intermediate
Evaluation Score: 23.13
Priority Ranking: 9

Action 2.2 Data-Related Efforts for State Agencies

Summary Description: Develop and implement hazard data management program for State agencies-this may be addressed by CEO through a grant to maintain a portal for ORM and agencies to upload building inventory data.
Status: Not Started
Update: Not Applicable
Responsible Organization: GOHSEP
Timeframe: Intermediate
Evaluation Score: 22.19
Priority Ranking: 7

Action 3.1 Technical Support for Parish and Municipal Hazard Mitigation Planning

Summary Description: Provide technical support to municipalities, parishes or groups of parishes for on-going and continuing municipal hazard mitigation planning efforts.
Status: Ongoing
Update: BCA training is provided at least once a year to local jurisdictions. Planning workshops were provided to affected plan holders after Hurricane Isaac.
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 24.44
Priority Ranking: 3

Action 3.2 Technical Support for State Agencies Hazard Mitigation Planning

Summary Description: Increased hazard mitigation planning and implementation capability for State agencies to include Board of Regents and technical assistance to DRU's.

Status: Ongoing
Update: 8 university plans approved where approved during the past 3 years.
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 21.06
Priority Ranking: 13

Action 3.3 Plan Integration

Summary Description: Conduct follow-up activities to engage members of the SHMPC in a review of planning and implementation activities under their jurisdictions and responsibility.
Status: Ongoing
Update: The operations section and hazard mitigation section of GOHSEP has worked together to develop the current THIRA and HIRA plans.
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 24.44
Priority Ranking: 6

Action 3.4 Complete Web-Based Grant Administration Tool

Summary Description: The State of Louisiana has started building a web-based grant administration tool, LouisianaHM.com, which will allow both GOHSEP and its sub-applicants to create and administer Hazard Mitigation grants, from application development through closeout.
Status: Ongoing
Update: Expected roll out is early 2014
Responsible Organization: GOHSEP
Timeframe: Short Term
Evaluation Score: 25.75
Priority Ranking: 4

Action 4.1 Identifying Cost Effective Projects with Parishes and Municipalities

Summary Description: Work with municipalities, parishes and State agencies to identify, fund and implement cost effective projects to mitigate repetitive and severe repetitive loss properties and other appropriate risks, and to prioritize them according to cost effectiveness
Status: On Going
Update: Hurricane Isaac funding allocated over 58 million to hazard mitigation in 2013. Project applications were submitted in August 2013. Eighty-eight million in Hurricane Gustav funding

was reallocated to a statewide elevation project that will provide funding for approximately 250 SRL and RL properties.
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 23.56
Priority Ranking: 1

Action 4.2 Identifying Cost Effective Projects with State Agencies

Summary Description: Support efforts by State agencies to identify and pursue hazard mitigation projects for at-risk state-owned assets and critical infrastructure, and prioritize them according to cost-effectiveness.
Status: On Going
Update:

Table 5.1. State agency projects approved since 2010.

State Agency Projects Approved since 2010		
State Agency	Project Type	Cost
DOTD	Hurricane Screen Installation	$ 489,442
DOTD	Wind Retrofit	$ 86,685
Wildlife and Fisheries	Manchac Bank Stabilization	$ 221,608
GOHSEP	Statewide Retrofit/Community Saferoom	$ 4,100, 00

Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 22.25
Priority Ranking: 8

Action 4.3 Legislative and Regulatory Enhancements

Summary Description: Support and pursue legislative agendas at municipal, parish, state and federal levels.
Status: Not Started
Update: Not Applicable
Responsible Organization: GOHSEP
Timeframe: Long Term
Evaluation Score: 21.06

Priority Ranking: 15

__Action 4.4 Enhance current State Hazard Mitigation Strategy__

Summary Description: Enhance the current State Hazard Mitigation Strategy, specifically strengthening the linkage to mitigation action implementation.
Status: New
Update: Not Applicable
Responsible Organization: GOHSEP
Timeframe: Short Term
Evaluation Score: 25.19
Priority Ranking: 2

__Action 5.1 Integrate historic preservation into hazard mitigation planning__

Summary Description: Integrate historic and cultural resources protection into hazard mitigation planning to improve the ability of resources to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.
Status: New
Update: Not Applicable
Responsible Organization: GOHSEP / SHPO
Timeframe: Long Term
Evaluation Score: 22.75
Priority Ranking: 12

__Action 5.2 Education/Outreach for Historic Perseveration Best Management Practices__

Summary Description: Encourage and support opportunities for statewide stakeholders to facilitate the assessment and dissemination of appropriate mitigation techniques and Historic Preservation Best Management Practices and suitable design options for retrofitting historic properties to improve their ability to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.
Status: New
Update: Not Applicable
Responsible Organization: SHPO / SHMO
Timeframe: Long Term
Evaluation Score: 23.50
Priority Ranking: 11

Action 5.3 Education/Outreach for Polices of Historic Preservation

Summary Description: Promote increased awareness and greater understanding of the concepts of the National Historic Preservation Act (NHPA), Section 106 and critical information regarding Louisiana Archaeology to the citizens and leaders of Louisiana.
Status: New
Update: Not Applicable
Responsible Organization: GOHSEP / SHPO
Timeframe: Long Term
Evaluation Score: 23.25
Priority Ranking: 14

These newly evaluated actions align GOHSEP's priorities with its major focus, where 90% of its funding goes: projects. Furthermore, this realignment demonstrates the importance of planning and the need for a comprehensive balanced strategy since many actions that were previously ranked high lost their place drastically. Table 5.2 compares the actions between their present priority ranking and their prior ranking.

Table 5.2. GOHSEP mitigation actions by priority.

GOHSEP Mitigation Actions by Priority			
Action	Description	Priority Ranking (2014 Update)	Prior Ranking (2011 Update)
1.1	Statewide Education and Outreach	10	1
1.2	Education and Outreach for State Agencies	16	2
1.3	Analyze Past Education and Outreach Activities	5	N/A (new action)
2.1	Statewide Data-Related Effort	9	5
2.2	Data-Related Efforts for State Agencies	7	7
3.1	Technical Support for Parish and Municipal Hazard Mitigation Planning	3	10
3.2	Technical Support for State Agencies Hazard Mitigation Planning	13	8
3.3	Plan Integration	6	6
3.4	Complete Web-Based Grant Application Tool	4	N/A (new action)
4.1	Identify Cost Effect Projects with Parishes and Municipalities	1	4
4.2	Identify Cost Effective Projects with State Agencies	8	3
4.3	Legislative and Regulatory Enhancements	15	9
4.4	Enhance current State Hazard Mitigation Strategy	2	N/A (new action)

GOHSEP Mitigation Actions by Priority			
Action	Description	Priority Ranking (2014 Update)	Prior Ranking (2011 Update)
5.1	Integrate historic preservation into hazard mitigation planning	12	N/A (new action)
5.2	Education/ Outreach for Historic Perseveration Best Management Practices	11	N/A (new action)
5.3	Education/Outreach for Polices of Historic Preservation	14	N/A (new action)

Mitigation Monitoring and Review

Each mitigation project or activity has an established period of performance that GOHSEP and FEMA monitor throughout the development and execution of the activity. As described in the *State of Louisiana Administrative Guidelines and Procedures*, GOHSEP uses the following system for monitoring mitigation projects and project closeouts. No changes have been made to this system in this Plan Update.

Monitoring Mitigation Projects

Mitigation projects are generally monitored as follows:

- GOHSEP regularly meets with representatives from FEMA Region VI to coordinate project monitoring activities
- Every calendar quarter, GOHSEP sends correspondence to all sub-grantees with open projects (i.e., ones that have been funded but are not completed), requesting a project progress update
- Each of the sub-grantees responds to the GOHSEP request by preparing a standard report that details progress on individual mitigation projects and indicates a percent complete estimate
- GOHSEP compiles the sub-grantee progress reports and produces a consolidated quarterly report that is sent to FEMA Region VI for review. The consolidated quarterly report identifies changes from previous reports, areas of concern, and strategies to address problems

Monitoring Project Closeouts

Mitigation project closeouts generally occur in the following sequence, as established in the *State of Louisiana Administrative Guidelines and Procedures* and in accordance with FEMA requirements for State Administrative Plans and Hazard Mitigation Grant Program (HMGP) guidelines that are set out in the HMGP Desk Reference.

- Sub-grantee indicates in a quarterly project progress report that a mitigation project is 100% complete
- GOHSEP reconciles the FEMA SmartLink account for the project (by disaster)
- GOHSEP initiates a comprehensive internal financial audit of the project
- GOHSEP works with sub-grantees to resolve any issues discovered in the audit
- GOHSEP sends FEMA Region VI a closeout letter that identifies the final eligible cost of the project, de-obligations that are required, and any monies that will be recovered from the sub-grantee

In order to review progress on achieving goals, GOHSEP ensures that both the annual and three-year Plan evaluations include a detailed examination and analysis of the goals and the various actions that are intended to achieve them. This section of the Plan Update describes five major hazard mitigation goals and describes sixteen strategies and actions that the state is undertaking (or considering undertaking) to address the identified goals. In updated versions of the plan, GOHSEP will indicate the status of the various actions and a general indication of progress.

GOHSEP focuses on progress to mitigate repetitive loss properties and especially severe repetitive loss properties as a priority, contributing to meeting Louisiana's requirements for increased federal match on Severe Repetitive Loss (SRL) and Flood Mitigation Assistance (FMA) grants.

In order to review progress on activities and projects included in the Mitigation Action Plan, and as part of the yearly and three-year evaluations and updates to this plan, GOHSEP will initiate a review of all activities and projects noted in the Mitigation Action Plan. The review takes place in five stages:

1. In cooperation with the SHMPC, GOHSEP's Hazard Mitigation Planning Section will undertake a preliminary review and analysis of progress on the actions.

2. GOHSEP's Hazard Mitigation Planning Section will prepare a draft report that describes progress, remaining tasks, and projected time to complete the tasks.

3. The draft report will be presented to the SHMPC during the meeting(s) related to the yearly (and three-year) updates.

4. After SHMPC review, comment, and approval, results of the progress review will be included as a new or updated column in the tabulation of mitigation goals and actions.

5. If requested by FEMA, GOHSEP will prepare a summary report describing the results of the review.

6. MITIGATION IN ACTION

A crucial component of successful mitigation is its self-analysis. Before any new mitigation takes place, the success or failure of mitigation actions implemented before a disastrous event should be evaluated. As the very first figure (Figure 6.1 here) in this Plan Update indicates, this self-analysis should take place during the recovery and mitigation phases of emergency management when the community can take stock of how well it prepared for an event and to what degree it needed to respond.

Figure 6.1. The four phases of emergency management.

No state mitigation actions were completed since the last Update. But in this section, this Plan Update profiles just a few representative examples of the many local mitigation projects that have been started or have finished in recent years in Louisiana. The following text provides descriptions and explanations of hazard mitigation projects in various communities in Louisiana, as written by those communities. First, this section provides a lengthy, 40-page summary produced by GOHSEP concerning its Community Education Outreach (CEO), which was a high-priority action in the last Plan Update. Next, the City of Slidell has provided profiles and identification of hazards it faces, as well as its mitigation efforts against these hazards. Third, this section summarizes various mitigation projects from a few parishes, and last, the mitigation efforts of the Town of Jean Lafitte are presented.

LOUISIANA MITIGATION PROJECTS

COMMUNITY EDUCATION OUTREACH

A summary of the CEO initiative is republished in full over the course of the following pages.

(Continued on Next Page)

1 STRATEGIC PLAN

4 STRATEGIC PARTNERSHIPS

8 MAJOR PROJECTS + PROGRAMS

30 POWERPOINT® PRESENTATIONS
(24 Regional Meetings + 4 Versions of Strategic Plan + 4 BOAL + 2 LMA Convention)

61 JOB AIDS
(Preparedness + Response + Recovery + Hazard Mitigation + Procurement + Debris)

17 WORKSHOPS
(1 Statewide + 11 Regional Meetings + 3 BOAL + 2 SDMI)

6,344 CONTACTS

19 PIECES OF LITERATURE
(4 ToolKits [Funding Hazard Mitigation + Procurement + Recovery/Preparedness + Code Officials])

TOUCHED 3 MILLION+ LOUISIANA CITIZENS
(Reach of NP and TV and Radio PSAs + movie advertising + brochure and guide sponsor ads for Plaquemines Parish Emergency Guide + LUS Hurricane Handbook + web ads + MORE!)

175% INCREASE IN HAZARD MITIGATION GRANT ACTIVITY

250% INCREASE IN HAZARD MITIGATION FEDERAL DOLLARS

$1.1 MILLION INVESTMENT

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Table of Contents

1. INTRODUCTION

2. PARTNERSHIPS
   - National Incident Management Systems and Advanced Technologies (NIMSAT) Institute 13
   - University of New Orleans Center for Hazards Assessment, Response and Technology (UNO-CHART) 15
   - Building Officials of Louisiana (BOAL) 21
   - Stephenson Disaster Management Institute (SDMI) 25

3. K-12 OUTREACH PROJECTS
   - Mitigation Game Development 31
     - K-12
     - Professional Development

4. STAKEHOLDER OUTREACH PROGRAMS
   - 2010 Regional Meetings 37
   - Procurement Seminar 43
   - 2012 Regional Meetings 47
   - Educate to Mitigate LAB/LPA Media Campaign 51
   - On the Web 53
     - eNewsletters
     - Website Redesign

5. KEY HAZARD MITIGATION PRINT RESOURCES
   - 10 Things to Know About Funding Hazard Mitigation 59
   - Funding Hazard Mitigation Workbook 61
   - Funding Hazard Mitigation Non-Disaster and Disaster Resource Reference Binder 63
   - ”How To” PowerPoint® Presentations 65

6. BRAND DEVELOPMENT
   - Branding 69

7. APPENDIX
   - Procurement Seminar
   - Awards

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1 INTRODUCTION

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INTRODUCTION

On June 1, 2009, the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) began a Statewide Hazard Mitigation Community Education and Outreach (CEO) project, a best practices initiative designed to educate the homeowners, businesses, construction and design professionals, lenders, agents, insurers, academia, governmental entities, media and other mitigation stakeholders on pre- and post-disaster hazard mitigation opportunities and actions.

The project, funded by a FEMA grant, offers Louisiana a unique opportunity to break some long-held practices of repairing damages caused by disasters to their before-disaster states as opposed to making the decisions and choices needed to make their communities more disaster resilient, resulting in a lessened need for future disaster recovery support.

The initiative was a multi-faceted approach to consistently share and strengthen the need for improved hazard risk identification and the implementation of subsequent mitigation with the public throughout Louisiana's current disaster recovery process and prior to future disasters and resulted in many first-of its-kind materials and tools and best practice strategies.

The goals of the CEO initiative were designed to follow the goals set forth in the FEMA grant requiring the funds be used to educate state and local governments, businesses and individuals about hazard mitigation. Parallel to those goals are those that are part of the *State Hazard Mitigation Plan* (SHMP). Four goals in particular served as guidelines for the CEO project:

- **SHMP Goal #1** – Improve education and outreach efforts regarding potential impacts of hazards and identification of specific measures that can be taken to reduce their impact.
- **SHMP Goal #2** – Improve data collection, use and sharing of information to reduce impacts of hazards.
- **SHMP Goal #3** – Improve capabilities and coordination at the municipal, regional and state levels to plan and implement hazard mitigation projects.
- **SHMP Goal #4** – Pursue opportunities to reduce impacts to the state's man-made and natural environment through mitigation of repetitive and severe repetitive loss properties and other appropriate construction projects and related activities.

Based on the goals outlined in the FEMA grant and those identified in the SHMP, GOHSEP identified a Scope of Services for communications and outreach support. The scope included a multimedia approach to outreach and community awareness-building; training initiatives to public and private professionals, government officials and the general public; school curricula; conferences, demonstration projects, workshops, seminars and more. The expected outcomes to be achieved were:

- Create a culture of mitigation within the Louisiana community.
- Promote personal responsibility for decisions that can protect families and personal, commercial and government-owned properties and facilities.
- Promote community-based mitigation activities.
- Promote regional partnerships that can positively impact awareness and community buy-in to best

practices in mitigation.

- Build capacity at the local level to identify, promote, support and implement mitigation initiatives and help communities understand the value added to community sustainability that mitigation efforts deliver.

2 PARTNERSHIPS

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NATIONAL INCIDENT MANAGEMENT SYSTEMS AND ADVANCED TECHNOLOGIES (NIMSAT)

GOHSEP collaborated with the National Incident Management Systems and Advanced Technologies (NIMSAT) Institute, GOHSEP sub grantee, to plan the project which, would ultimately lead to the design of the Louisiana All Hazards Information Portal (LaHIP); a web-based hazard information data collection, storage and retrieval tool. LaHIP provides useful hazard and risk-related information to local and state emergency managers. The information housed on the site assists users with hazard mitigation planning and projects as well as with vulnerability and risk assessments. A plan has been developed for training users. The LaHIP web portal directly supports SHMP Goal #2 (information collection and sharing). The project is being implemented in two phases. Phase I involved the development and design of a portal that is password protected and for use by the emergency management community. Phase II involves a public access side where homeowners and businesses can have access to materials. The design has been reviewed by GOHSEP and work is proceeding on Phase II. Once complete, the site will offer multiple mitigation planning and project implementation benefits such as:

- Helping to develop benefit cost analyses (BCA) for mitigation project applications.
- Affording local access and control of steady-state data collected about parishes and impacts in the event of disaster.
- Allowing for easy collection, storage and retrieval of data on smaller events and includes the ability to generate event-specific reports.
- A repository of local hazard mitigation and operations plans and updates.

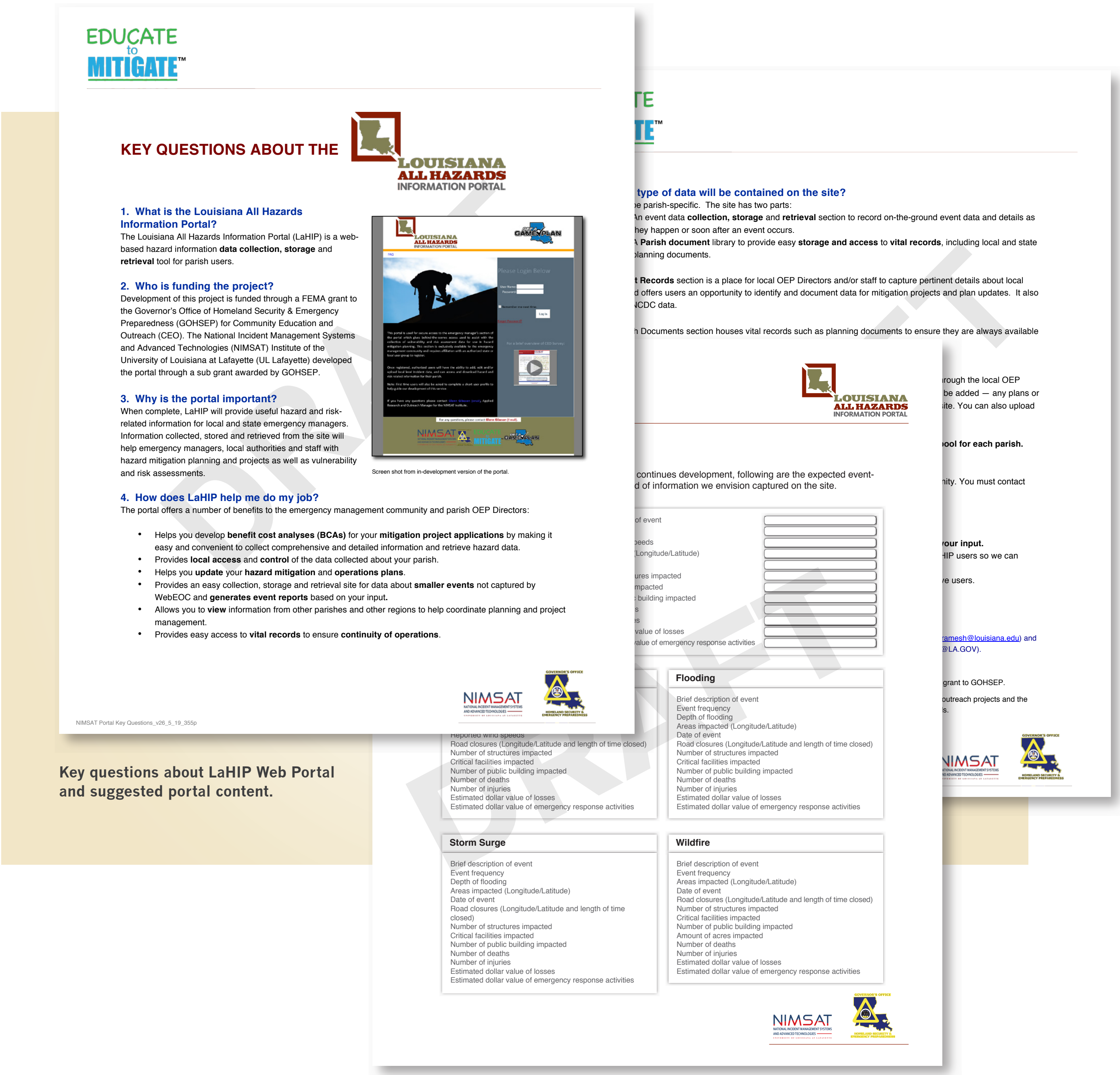
NIMSAT
NATIONAL INCIDENT MANAGEMENT SYSTEMS AND ADVANCED TECHNOLOGIES
UNIVERSITY OF LOUISIANA AT LAFAYETTE

LOUISIANA ALL HAZARDS INFORMATION PORTAL

NIMSAT LaHIP web portal and email blast.

- Enabling users to view information from other parishes and regions to help coordinate regional planning and project management and identifying and sharing best practices mitigation.
- Providing easy access to vital records to ensure continuity of operations.

The work with NIMSAT supports SHMP Goal #2 (data collection and sharing) and #3 (improve capabilities and coordination at all levels).



EDUCATE to MITIGATE™

KEY QUESTIONS ABOUT THE LOUISIANA ALL HAZARDS INFORMATION PORTAL

1. What is the Louisiana All Hazards Information Portal?
The Louisiana All Hazards Information Portal (LaHIP) is a web-based hazard information **data collection, storage** and **retrieval** tool for parish users.

2. Who is funding the project?
Development of this project is funded through a FEMA grant to the Governor's Office of Homeland Security & Emergency Preparedness (GOHSEP) for Community Education and Outreach (CEO). The National Incident Management Systems and Advanced Technologies (NIMSAT) Institute of the University of Louisiana at Lafayette (UL Lafayette) developed the portal through a sub grant awarded by GOHSEP.

3. Why is the portal important?
When complete, LaHIP will provide useful hazard and risk-related information for local and state emergency managers. Information collected, stored and retrieved from the site will help emergency managers, local authorities and staff with hazard mitigation planning and projects as well as vulnerability and risk assessments.

Screen shot from in-development version of the portal.

4. How does LaHIP help me do my job?
The portal offers a number of benefits to the emergency management community and parish OEP Directors:

- Helps you develop **benefit cost analyses (BCAs)** for your **mitigation project applications** by making it easy and convenient to collect comprehensive and detailed information and retrieve hazard data.
- Provides **local access** and **control** of the data collected about your parish.
- Helps you **update** your **hazard mitigation** and **operations plans**.
- Provides an easy collection, storage and retrieval site for data about **smaller events** not captured by WebEOC and **generates event reports** based on your input.
- Allows you to **view** information from other parishes and other regions to help coordinate planning and project management.
- Provides easy access to **vital records** to ensure **continuity of operations**.

NIMSAT Portal Key Questions_v26_5_19_355p

Key questions about LaHIP Web Portal and suggested portal content.

UNIVERSITY OF NEW ORLEANS CENTER FOR HAZARDS ASSESSMENT, RESPONSE AND TECHNOLOGY (UNO-CHART)

GOHSEP worked with their sub grantee the University of New Orleans Center for Hazards Assessment, Response and Technology (UNO-CHART) to provide support to its sub grant. GOHSEP to support UNO-CHART's five initiatives:

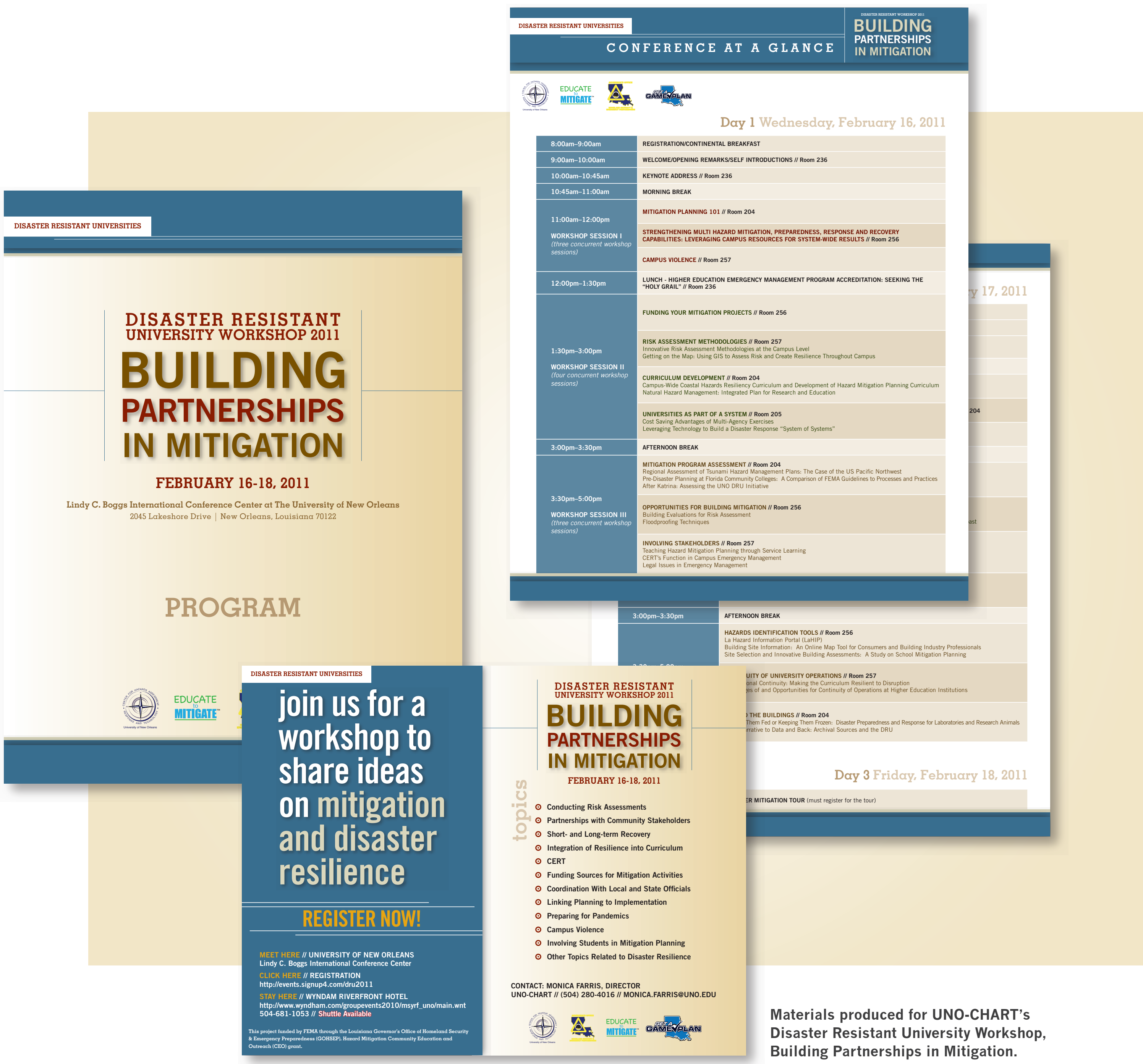
UNO-CHART EXECUTIVE PROGRAM

- Identification of local and regional best practices in continuity contingency planning and mitigation for community organizations.
- Development of campus-wide coastal hazards resiliency curriculum and hazard mitigation resiliency curriculum.
- In partnership with other programs, development of an education program focused on disaster and literacy.
- Plan and implement a Disaster Resilient University statewide conference.
- Outreach and education to executive level officials and civic leaders to develop strong leadership and competence in hazards management.

The initiatives of UNO-CHART create best practices for hazard mitigation in the academic environment. Each initiative works toward fulfilling the goal of raising awareness

UNO-CHART workshops.

Materials produced for UNO-CHART's Executive Program in Resilience and Risk Management Symposiums held in Lafayette, Baton Rouge and New Orleans.



Materials produced for UNO-CHART's Disaster Resistant University Workshop, Building Partnerships in Mitigation.


DISASTER RESISTANT UNIVERSITIES

DETAILED AGENDA

Day 1 Wednesday, February 16, 2011

8:00-9:00am Registration/Continental Breakfast

9:00-10:00am **Welcome/Opening Remarks/Self Introductions // Room 236**
Introduction by Monica Farris, Director, UNO-CHART
Joe M. King, Provost, The University of New Orleans
Casey Levy, State Hazard Mitigation Officer, GOHSEP

10:00-10:45am **Keynote Address // Room 236**
Introduction by Mark Cooper, Director, GOHSEP
Anthony (Tony) Russell, Regional Administrator, FEMA Region VI

10:45-11:00am Morning Break

11:00-12:00pm **WORKSHOP SESSION I** *(three concurrent workshop sessions)*

Mitigation Planning 101 // Room 204
Patty Sanchez, GOHSEP

Strengthening Multi Hazard Mitigation, Preparedness, Response and Recovery Capabilities: Leveraging Campus Resources for System-Wide Results // Room 256
Toby Osburn, McNeese State University
Joseph "Joey" V. Pons, IV, University of Louisiana-Lafayette

Campus Violence // Room 257
Pam Jenkins, UNO-CHART

12:00-1:30pm Lunch

Higher Education Emergency Management Program Accreditation: Seeking the "Holy Grail" // Room 236
Steve Charvat, Director of Emergency Management, University of Washington and Secretary, IAEM-USA Council

1:30-3:00pm **WORKSHOP SESSION II** *(four concurrent workshop sessions)*

Funding Your Mitigation Projects // Room 256
Casey Levy, GOHSEP

Risk Assessment Methodologies // Room 257
Innovative Risk Assessment Methodologies at the Campus Level
Alessandra Jerolleman, Natural Hazard Mitigation Association (NHMA)

Getting on the Map: Using GIS to Assess Risk and Create Resilience Throughout Campus
Andre Le Duc, University of Oregon

conference schedule


DISASTER RESISTANT UNIVERSITY WORKSHOP 2011
BUILDING PARTNERSHIPS IN MITIGATION

Curriculum Development // Room 204
Campus-wide Coastal Hazards Resiliency Curriculum and Development of Hazard Mitigation Planning Curriculum
John Kiefer, UNO-CHART
Kristina Peterson, UNO-CHART
Earthea Nance, UNO-CHART
Shirley Laska, UNO-CHART

Natural Hazard Management: Integrated Plan for Research and Education
Islam El-Adaway, Mississippi State University

Universities as Part of a System // Room 205
Cost Saving Advantages of Multi-Agency Exercises
William Moorhead, All Clear Emergency Management Group
Ginny Schwartzer, All Clear Emergency Management Group

Leveraging Technology to Build a Disaster Response "System of Systems"
Sara Estes Cohen, G&H International Services, Inc.
Robert Greenberg, G&H International Services, Inc.

3:00-3:30pm Afternoon Break

3:30-5:00pm **WORKSHOP SESSION III** *(three concurrent workshop sessions)*

Mitigation Program Assessment // Room 204
Regional Assessment of Tsunami Hazard Management Plans: The Case of the US Pacific Northwest
Edmund Merem, Jackson State University
Yaw Twumasi, Alcorn State University
Joan Wesley, Jackson State University
Benetta Robinson, Jackson State University

Pre-Disaster Planning at Florida Community Colleges: A Comparison of FEMA Guidelines to Processes and Practices
Timothy J. De Palma, Florida Atlantic University

After Katrina: Assessing the UNO DRU Initiative
Amanda Green, The University of New Orleans

Opportunities for Building Mitigation // Room 256
Building Evaluations for Risk Assessment
Stuart Adams, Louisiana State University
Carol Friedland, Louisiana State University
Mark Levitan, Louisiana State University

Floodproofing Techniques
Pat Skinner, LSU AgCenter

Involving Stakeholders // Room 257
Teaching Hazard Mitigation Planning through Service Learning
Melanie Gall, Louisiana State University

CERT's Function in Campus Emergency Management
Calvin Brown, University of Texas-Dallas

Legal Issues in Emergency Management
William Moorehead, All Clear Emergency Management Group

conference schedule

and identifying best practices for hazard mitigation. The individual initiatives are important because they lay a framework to make hazard mitigation part of the university culture and education. GOHSEP's work in support of UNO-CHART included:

- Materials for the education workshops and meetings hosted by UNO-CHART. Three types of meetings were held: one for training that targeted nonprofits, small businesses and church congregations, an executive symposium for elected officials and business executives and a third, targeted to university faculty and leadership.
- Communications support for a series of four Community Continuity Regional Meetings targeted to nonprofits, small businesses and church congregations. These training workshops were held in Jennings, Ruston, Alexandria and Kenner. GOHSEP provided graphic support to produce a PowerPoint® presentation *"Building Disaster Resilient Communities"*, provided creative for blast email series for all meetings, CD labels, welcome posters, on-site staffing support and photography, workshop attendee summary report and creative for all branded workshop materials.

- Meeting support materials for their 2011 *Executive Leadership Program: Community Executive Symposiums on Resilience and Risk Management*. The meeting held in New Orleans targeted business and government leaders in southeast Louisiana. The Baton Rouge meeting was geared specifically toward business and government leaders throughout Louisiana.

- Materials support for the 2011 *Disaster Resistant University Workshops* held on UNO's campus over a three-day period. University leaders and appropriate faculty members from colleges across the state were invited for discussions on topics like disaster preparedness, grant funding, mitigation curriculum development and continuity of operations. GOHSEP produced a PowerPoint template and provided creative concept and design of meeting materials like presenter bios, evaluation forms, workshop program development and signage. On-site meeting support and photography were also provided.

The work with UNO-CHART directly supports SHMP goals #1 (improve education and outreach) and #3 (improve capabilities and coordination at all levels).

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BUILDING OFFICIALS ASSOCIATION OF LOUISIANA (BOAL)

An important partnership created under the CEO project is with the Building Officials Association of Louisiana (BOAL). The 750-member organization includes building officials at the local level, including 250 code officials. GOHSEP recognized that officials who enforce state and local building codes are on the front lines of dealing with those planning, designing and/or building new construction and offered an opportunity to work with them to affect change. Code officials' offices are an opportunity to promote mitigation messages with public audiences as individuals come in for permits.

- GOHSEP created toolkits with hazard mitigation messaging for distribution through BOAL membership. A series of four counter cards and posters branded with the theme *Got To. Want To! Should Do.* were presented in a toolbox package. This educational suite was produced to increase awareness of mitigation measures to lessen damages from future hazards and they are code-related. Materials in the suite are Roofing Mitigation, Windows and Shutters, and Elevation Techniques posters and counter cards to be distributed by BOAL to code and building officials' offices across the state.

- Also included in the toolbox is a tri-fold brochure called *Mitigate Your Home & Business!* that teaches homeowners, business owners and contractors how to mitigate Louisiana disasters, simple ways to mitigate homes and businesses, as well as deal with codes when rebuilding or building new construction.

BOAL
BUILDING OFFICIALS ASSOCIATION of LOUISIANA

Mitigation brochure created for BOAL.

This brochure is also branded with the theme *Got To. Want To! Should Do*. A second wave of BOAL materials was produced and targeted to individual homeowners and businesses. As part of this project, GOHSEP produced an additional poster and counter card on Connectors and Brackets to be included in the suite, an introduction office poster for every BOAL office, a *How to Use Toolkit* PowerPoint for BOAL officials, and presented toolbox packaging recommendations and secured pricing for packaging.

Mitigation poster series created for BOAL.

Mitigation counter card series created for BOAL.

- The GOHSEP CEO program was presented to BOAL members at its 2011 Annual Conference in Baton Rouge. The meeting served as hazard mitigation training for code officials. At the meeting GOHSEP introduced a branding logo and theme: *Mitigation Matters! Helping You Build. Safer. Stronger. Smarter.* GOHSEP produced folders for the participants at the conference that included GOHSEP mitigation materials like the *Funding Hazard Mitigation Workbook*, agenda, four handouts from the National Disaster Recovery Framework (NDRF) document and presenter biographies. In addition, GOHSEP produced a PowerPoint template for presenters, a materials toolbox, event signage and a slide show to be shown at the conference of all commercials from the "Storms Come Up Fast" series. GOHSEP provided event day photography and staffing support.

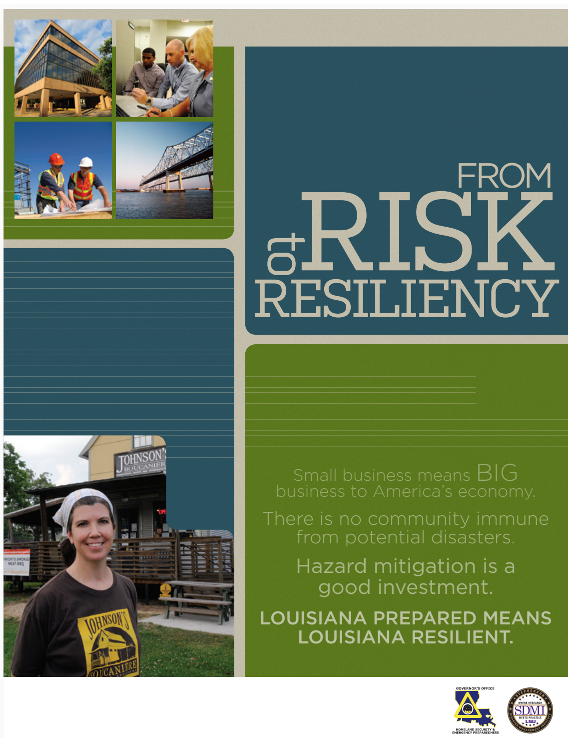
The work with BOAL directly supports SHMP goals #1 (improve education and outreach) and #3 (improve capabilities and coordination at all levels).

STEPHENSON DISASTER MANAGEMENT INSTITUTE (SDMI)

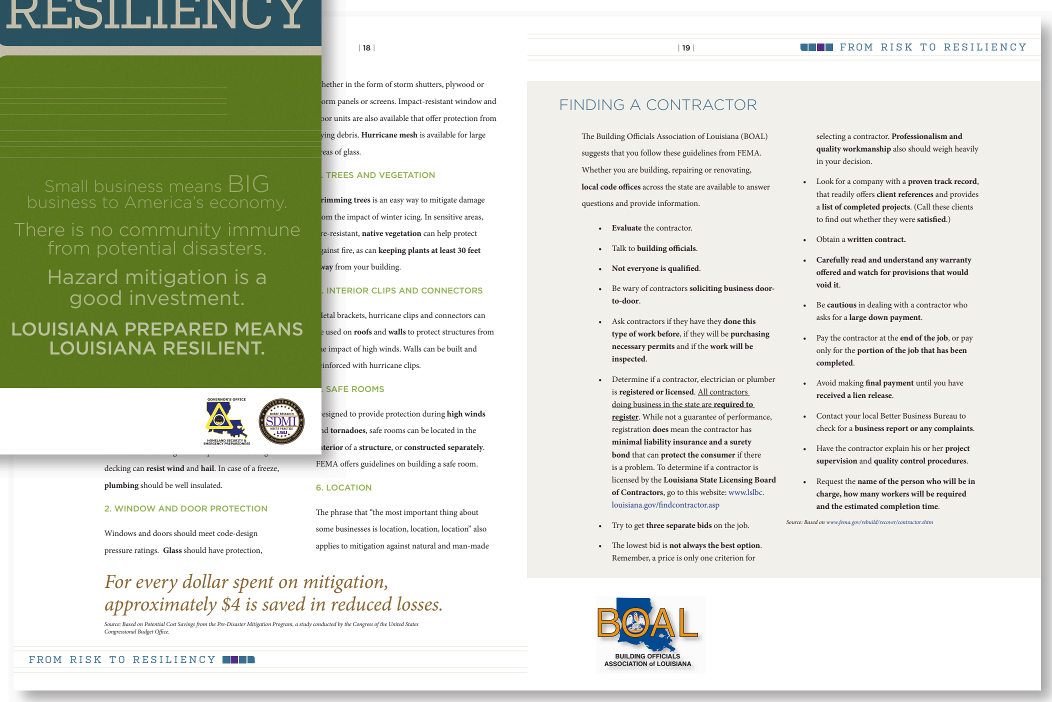
Stephenson Disaster Management Institute (SDMI) launched the Center for Business Preparedness on Louisiana State University's (LSU) campus. The Center for Business Preparedness was created by SDMI to bridge the gap between academic research and business continuity. The Center is dedicated to creating a cultural shift in the value of preparedness by creating a central point of collaboration for research, knowledge sharing and outreach to address challenges to small businesses while working to enhance and evolve private sector resilience. GOHSEP supports their partnership with SDMI to hold workshops that address business continuity mitigation and preparedness issues.

GOHSEP CEO Team developed workshop materials that include logos for Ready to Resume and From Risk to Resiliency workshops, a PowerPoint presentation, a GOHSEP hazard mitigation brochure to prepare business continuity in the event of a disaster, photography for brochure, focus group and testing the content of e-blast invitations, participant certificates as well as banner and other meeting signage.

The first meeting with SDMI on small business workshop planning was held at the SDMI office on the LSU campus March 2, 2012. The meeting was requested by SDMI in order to introduce members of their organization who will be working on the 25 small business workshops across Louisiana beginning in 2012 as part of a GOHSEP CEO sub grant. Each of the SDMI



From Risk to Resiliency **brochure developed for SDMI.**



Banners, agenda and PowerPoint templates produced for SDMI's Ready to Resume workshops.

participants, as well as those from GOHSEP, provided the group with background information regarding roles and expectations. A general discussion of the type of support that SDMI could expect in carrying out the workshop deliverables was a central part of the meeting, with that focus on materials design and development and outreach counseling and assistance.

A second meeting with SDMI on small business workshop planning was held at the SDMI office on the LSU campus on April 12, 2012. This meeting expanded the discussion of GOHSEP support to SDMI to include assistance with the web portal portion of the sub grant deliverables and ways GOHSEP CEO can provide design support. Plans for four upcoming focus group sessions were discussed and SDMI indicated that the results of those input workshops would help them in planning the direction of their statewide meetings. Discussions at the meeting included suggestions for appropriate meeting venues, ideas with regard to CEO materials support of the SDMI sub grant and an agreement to have GOHSEP staff lead the specific workshop sessions on hazard mitigation during the 25 statewide events.

A third meeting with SDMI's Associate Director & Special Projects on the portal and support materials for small business workshops was held at the GOHSEP JFO on April 25, 2012. At this meeting, GOHSEP CEO Team members provided the SDMI representative with an outline of a brochure that will be a support piece for the GOHSEP presentations during the SDMI small business workshops. SDMI representatives were to review the brochure and provide input into its development. Specific materials will also be designed for SDMI event promotion during the current CEO project, and assistance with an SDMI workshop brochure(s) will be a part of the CEO II project when it is in place. That timetable allows SDMI to benefit from focus group input. Also discussed was the plan for the SDMI portal, called for among their sub grant deliverables. The SDMI representative indicated that approximately 125 documents are being loaded into a master holding site that will be used to inform the state-specific site that is to be developed. SDMI requested that GOHSEP let them know as to whether the Louisiana site would be freestanding or a part of an existing website. The GOHSEP representative indicated that the decision would be brought to office leadership but that the site would likely be a link out of the existing getagameplan.org website.

The first of a series of Focus Group Workshops was held at the Baton Rouge Bar Association office in Baton Rouge on May 11, 2012. SDMI led the event with a series of questions designed to gather input from attorneys who are either a part of a small business or who represent small business clients.

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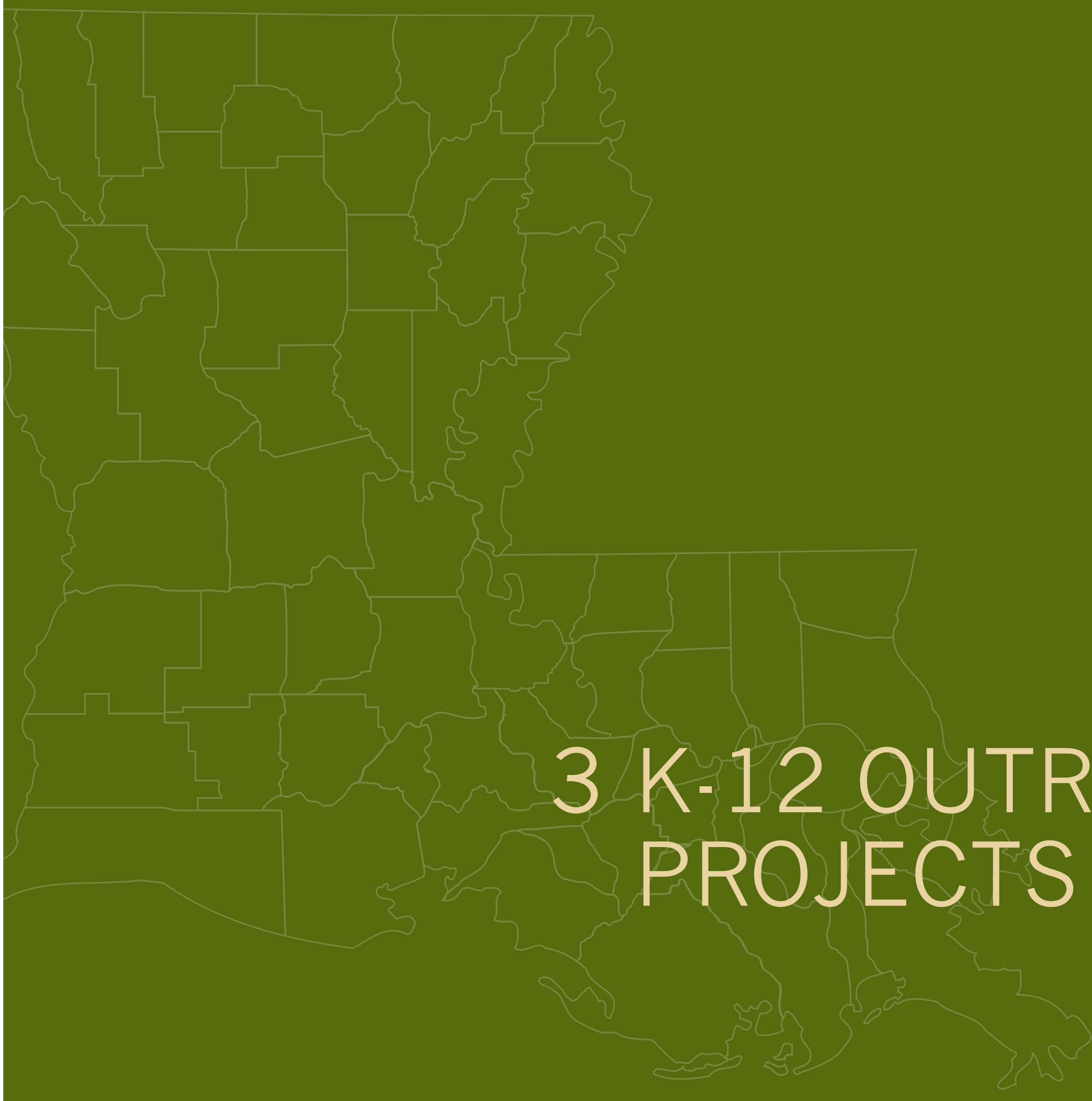

3 K-12 OUTREACH PROJECTS

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MITIGATION GAME DEVELOPMENT

***Mitigation Nation* and *It's Your Turn!* game boards and game pieces used to teach elementary, middle and high school students mitigation techniques.**

CEO Team leadership developed three versions of a hazard mitigation game in order to raise another generation in the culture of mitigation. This best practices measure was created to teach students, from an early age, what they, their families and their communities can do to reduce the effects of future disasters. Each game has been designed for a different grade grouping and tested with student focus groups. GOHSEP has reached out to the Louisiana Department of Education (DOE) to develop a distribution strategy to place games in schools.

The first game, called *It's Your Turn!*, is designed for grades K-5. There are also two versions of *Mitigation Nation*: one is a box set for grades 6-8, and the other is a spiral bound book version for grades 9-12. Each of these games educate students on the 11 hazards Louisiana is most likely to face as well as ways to mitigate against damage from each. An expansion pack has been developed for GOHSEP professional development training purposes.

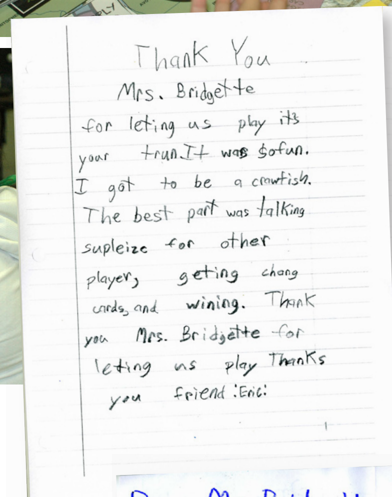
Mitigation Nation and *It's Your Turn!* fulfill the objectives in ways that are inclusive, fun and educational. The games also provide links to additional information on hazards and mitigation techniques so teachers can further expand lesson plans.

The games:

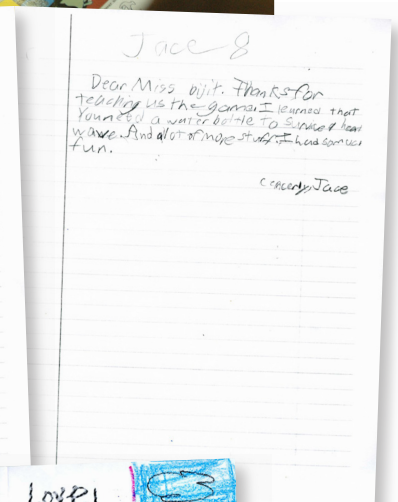
- Enlighten students as to what kinds of damaging events are possible.
- Teach students what mitigation is and how it is different from preparedness.
- Inform students about actions they can take to mitigate against each kind of hazard.
- Provide students with a sense of responsibility as well as proactive measures and initiative.

After the games were initially tested by GOHSEP Hazard Mitigation (HM) State Applicant Liaisons (SALs), a fourth professional version of the game has been drafted for staff

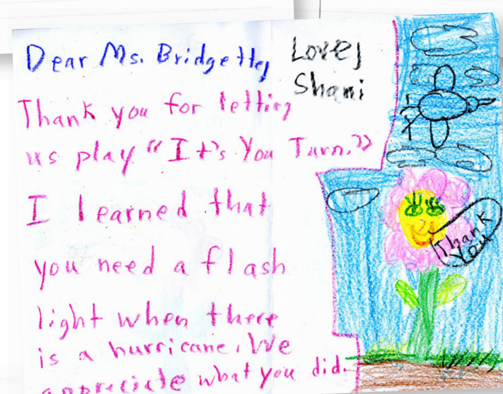
Photos of students playing *Mitigation Nation* and *It's Your Turn!* games.



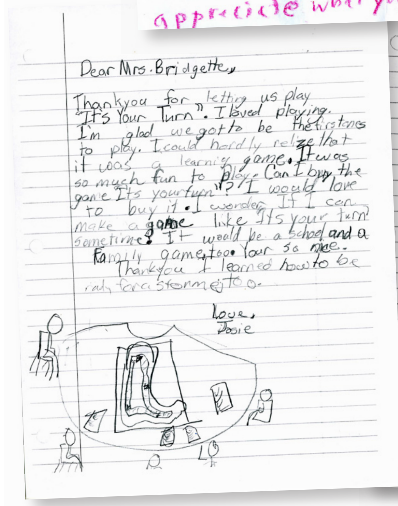
Thank You
Mrs. Bridgette
for leting us play its
your trun It was sofun.
I got to be a crawfish.
The best part was talking
supleize for other
player, geting chang
cards, and wining. Thank
you Mrs. Bridgette for
leting us play Thanks
you friend :Eric:



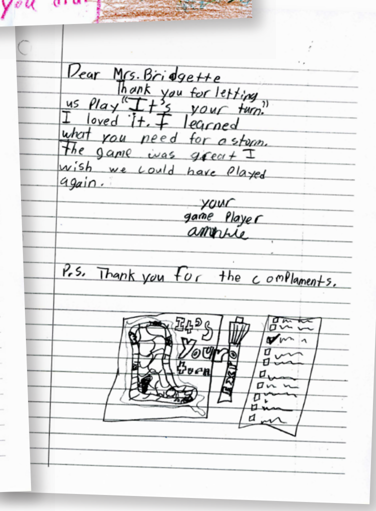
Jace 8
Dear Miss bijit. Thanks for teaching us the game. I learned that You need a water bottle to survive a heat wave. And allot of more stuff. I had som uch fun.
Cencerly, Jace



Dear Ms. Bridgette,
Thank you for letting us play "It's You Turn."
I learned that you need a flash light when there is a hurricane. We appreciate what you did.
Love, Shani



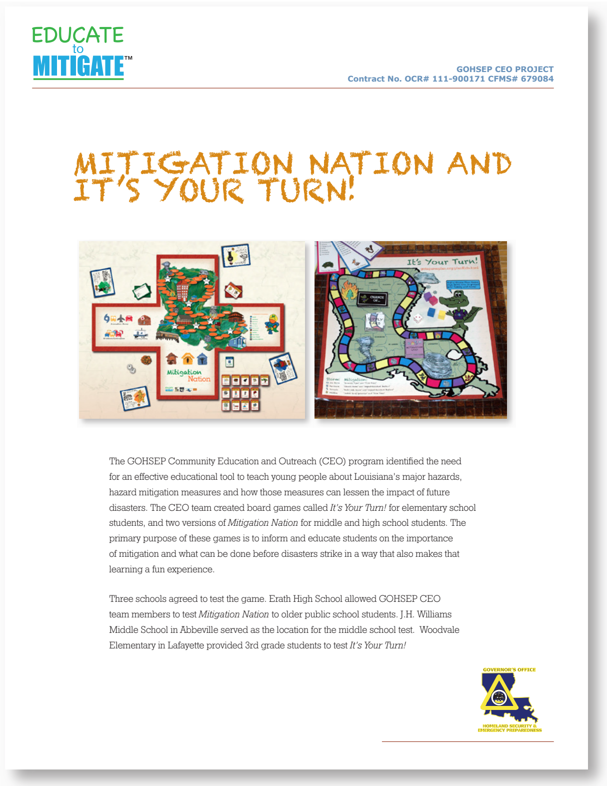
Dear Mrs. Bridgette,
Thankyou for letting us play "It's Your Turn". I loved playing. I'm glad we got to be the firstones to play. I could hardly relize that it was a learnig game. It was so much fun to play. Can I buy the game "It's your turn"? I would love to buy it. I wonder If I can make a game like It's your turn sometime? It would be a school and a Family game, too. Your so nice.
Thankyou I learned how to be rady for a storm too.
Love,
Josie



Dear Mrs. Bridgette
Thank you for letting us Play "It's your turn."
I loved it. I learned what you need for a storm. The game was great. I wish we could have Played again.
your game Player
P.S. Thank you for the complaments.

training purposes. The GOHSEP testing team agreed that the game, with adjustments to the questions and game play, is a nice enhancement to a hazard mitigation teaching tools. They also suggest the game be used as an exercise at the end of training sessions they conduct.

School game testing was held at Erath High School, J.H. Williams Middle School and Woodvale Elementary School. GOHSEP facilitated game testing, provided photography and composed post-game reports. After testing information was compiled, a report was provided to DOE with pictures, feedback from students, teacher contact information and other findings.


EDUCATE to MITIGATE™

GOHSEP CEO PROJECT
Contract No. OCR# 111-900171 CFMS# 679084

MITIGATION NATION AND IT'S YOUR TURN!

The GOHSEP Community Education and Outreach (CEO) program identified the need for an effective educational tool to teach young people about Louisiana's major hazards, hazard mitigation measures and how those measures can lessen the impact of future disasters. The CEO team created board games called *It's Your Turn!* for elementary school students, and two versions of *Mitigation Nation* for middle and high school students. The primary purpose of these games is to inform and educate students on the importance of mitigation and what can be done before disasters strike in a way that also makes that learning a fun experience.

Three schools agreed to test the game. Erath High School allowed GOHSEP CEO team members to test *Mitigation Nation* to older public school students. J.H. Williams Middle School in Abbeville served as the location for the middle school test. Woodvale Elementary in Lafayette provided 3rd grade students to test *It's Your Turn!*

GOVERNOR'S OFFICE
HOMELAND SECURITY & EMERGENCY PREPAREDNESS

Work on this project directly supports SHMP Goals #1 (education and outreach) and #3 (capabilities and coordination at the municipal, regional and state levels).

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4 STAKEHOLDER OUTREACH PROGRAMS

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2010 REGIONAL MEETINGS

Historically, many local Louisiana parishes have underutilized available resources to help them with mitigation initiatives and projects. This is likely because they either do not know those resources exist, are unaware of how to access them, do not believe they have the capabilities to access them, or, if a local match is required, believe they cannot afford to meet that match. GOHSEP devised a strategic initiative to address those barriers.

The centerpiece of the CEO-driven effort was the planning and implementation of GOHSEP-conducted Regional Meetings targeted to the professional staffs of local government authorities and other prospective eligible applicants. Originally, the meetings were to be held in conjunction with the launch and tour of the Louisiana Mitigation House, but the strategy shifted to focus on holding Regional Meetings based on educating targeted audience on mitigation funding and grant processes. Initially planned as a series of nine meetings, it was decided for logistical and geographic reasons to combine some regions into a single meeting at a central location. In all, five meetings were held across Louisiana.

Meetings were developed as a series of workshops:

Workshop #1:	*HMA 101 + the Importance of Planning*
Workshop #2:	*Hazard Mitigation Grant Application Process*
Workshop #3:	*Project Management, Procurement and Documentation*
Special Presentation:	*Creative Ways to Meet the Local Match*

Photos from GOHSEP's Funding Hazard Mitigation Regional Workshops.

Email blast used to promote registration for the regional workshops.

GOHSEP coordinated the workshops in three ways – workshop planning and materials development, attendee outreach and workshop execution.

In the planning phase, GOHSEP assisted with developing a strategy that included deciding what GOHSEP regions would be combined for workshops; selecting dates and identifying, scouting and securing meeting locations and developing and managing online registration protocols.

GOHSEP identified what staff members would participate as presenters at each workshop. GOHSEP also helped identify and secure keynote and special workshop speakers. As the planning progressed, the team provided presentation training and professional development for all GOHSEP staff that participated in the initial workshops for Regions 2+9 and Regions 4+5 and individually for other meetings as necessary.

GOHSEP developed, conceptualized and updated 13 separate PowerPoint presentations that would be used at the meetings and another for the initial keynote speaker's use. Work included copywriting and graphic design. The presentations, worksheets, samples, maps and presenter bios were placed in a meeting binder that attendees would take home, along with electronic versions of presentations on portable flash drives. Takeaways included pens, mugs, binders and workbooks.

CEO Team leadership developed an extensive outreach plan that would include building lists, by region, of potential invitees, identifying and filling gaps in the targeted groups. These lists included elected officials, local government staff, planning consultants, water management officials, grant

Posters and signage created for the Regional Meetings.

writers, engineers, hospital CEOs, school officials and other stakeholders. GOHSEP identified and collected contact information for each individual so meeting notices could be delivered by email, fax or direct mail as part of the outreach marketing strategy. By the end of the last Regional Meeting, the list had 5,169 contacts.

GOHSEP designed a registration management and confirmation strategy for each meeting, as well as copywriting and graphic design for the getagameplan.org website registration page where attendees could sign up. Online use would be used to gather registrations made by phone or fax.

Once the lists were completed, a series of blast email notifications were conceived and developed. A series of five emails (and faxable flyers) were designed and produced for each meeting – messaging included *Save the Date!, Register Now!, Space is Limited!, It's Not Too Late!* and *See You Tomorrow!* were sent out on a schedule at the appropriate time right up until registration closed. A week before each workshop, a personal letter from then-Director Cooper was sent to each contact in that region.

Through a partnership with the Louisiana Municipal Association (LMA), LMA members also received the same blast emails and Director Cooper letter.

The outreach campaign included emails and/or calls to all potential attendees on the developed lists. This continued for each of the five meetings. Those interested in registration could fax their information, reply by email or call a toll-free number to register. Once they were registered, they received a fax or email confirmation. As registrations were made, an updated list of registrants and a matrix comparison of attendees by region was developed and sent to GOHSEP daily so they could track and compare registrations daily.

Before and during each workshop GOHSEP provided logistical support. Video capture of each meeting was prearranged as well as photography for each workshop. GOHSEP assisted with registration check-in and sign-in sheets.

GOHSEP collected, reviewed and analyzed comment card feedback. It was determined that across all categories throughout the state, the workshop was a significant success. Every category was rated positively. Considering the high degree of receptivity by participants to the GOHSEP message, the importance of hazard mitigation, resources available to implement local hazard mitigation projects and how to access those resources are now better understood throughout the state, a key goal of the Regional Meetings initiative was met.

In all, 497 individuals participated in five full-day regional training workshops held across the state, ranging from just under 60 participants to over 120, eclipsing previous training efforts.

Following the Regional Workshops was an immediate increase in grant applications. In the months following June 27, 2010 (the day of the first meeting), GOHSEP received what has now totaled 28 grant applications with requests for $57,274,641 — a 304 percent increase over the previous year.

Work on the Regional Workshops directly supports SHMP Goals #1(education and outreach efforts) and #3 (improve capabilities and coordination at the municipal, regional and state levels).

Materials from the *Funding Hazard Mitigation Non-Disaster and Disaster Resource Binder* given to attendees.

HAZARD MITIGATION GRANT WORKSHOPS PARTICIPANT EVALUATIONS FROM SURVEY CARDS

Comments received through comment cards collected at all five (5) Funding Hazard Mitigation Regional Workshops across the state were decidedly positive. Presentations, take-home materials, and overall workshop experience all rated high.

Across all categories, and from every GOHSEP region, the workshops were a success based on evaluations of those who attended. Every category rated by participants received high marks. Out of 262 comment cards received, no part of the meeting received more than seven (7) negative marks. The standout, in terms of ratings, was the take-home binders, which didn't receive a single negative comment.

The following summary is from Comment Cards received from participants.

RATINGS OF WORKSHOP AND MATERIALS

Overall Rating

Negative 1

Neutral 12

Positive 159

105 of 172 respondents chose 9 or 10, and 66 of those gave a 10 rating.

Workbook Rating

Negative 2

Neutral 16

Positive 209

156 of 227 respondents chose 9 or 10, and 124 of those gave a 10 rating.

Binder Rating

Negative 0

Neutral 7

Positive 191

157 of 198 respondents chose 9 or 10, and 131 of those gave a 10 rating.

RATINGS OF PRESENTATIONS

Workshop #1

Negative 1

Neutral 21

Positive 229

145 of 251 respondents chose 9 or 10, and 100 of those gave a 10 rating.

Workshop #2

Negative 7

Neutral 19

Positive 211

130 of 237 respondents chose 9 or 10, and 83 of those gave a 10 rating.

Workshop #3

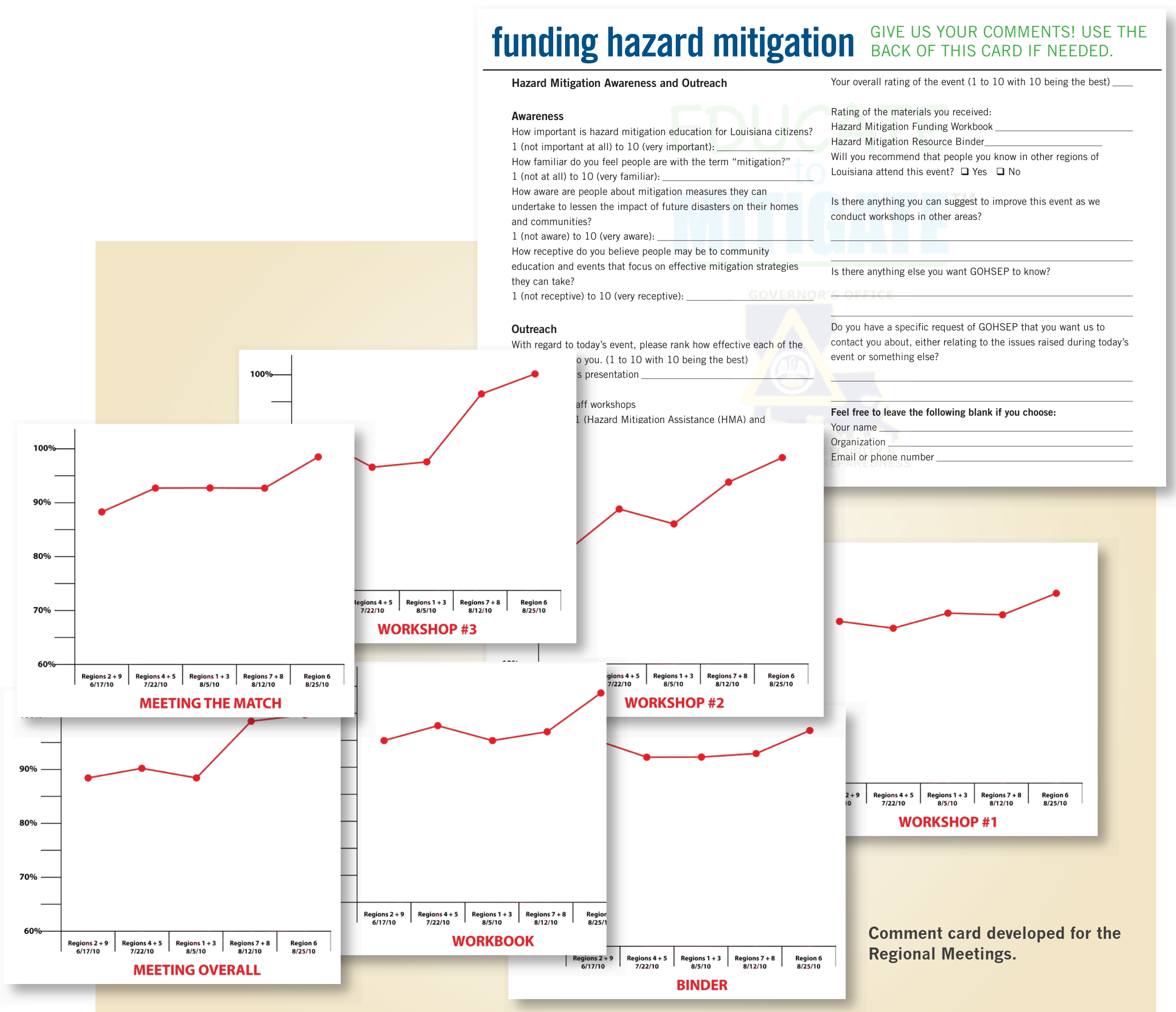
Negative 4

Neutral 17

Positive 174

109 of 195 respondents chose 9 or 10, and 77 of those gave a 10 rating.

Considering the high degree of receptivity by participants to the GOHSEP message, the importance of hazard mitigation, resources available to implement local hazard mitigation projects and how to access those resources are now better understood throughout the state, a key goal of the GOHSEP CEO program and the Regional Meetings initiative. One of the overriding themes among those surveyed was the need, in the view of participants, for GOHSEP to offer this workshop content again, along with other educational opportunities.



Comment card developed for the Regional Meetings.

PROCUREMENT GUIDE AND SEMINAR

Procurement and Debris Guides developed for getting it right!
The Practice of Procurement legal seminar.

Following a Presidentially declared emergency or disaster, the Disaster Recovery Division works to ensure applicants receive and retain all FEMA funding to which they are entitled.

Under a separate project funded through a CEO grant, GOHSEP developed hazard mitigation grant support through an easy-to-use *Procurement Guide* and a legal seminar to address issues likely to put FEMA funding received at risk of de-obligation. The *Guide* is necessary for those who purchase goods or services using FEMA funds, as well as anyone providing legal advice, to practice proper procurement. The consequences of

failing to procure correctly can include having funds de-obligated, not being eligible to receive future funding and other penalties.

The *Procurement Guide* is a publication that would help eligible applicants identify and apply 44 CFR 13.36 when using FEMA funds for disaster and non-disaster materials, supplies, publics works projects and services. The Guide is intended for use by local governing authorities, eligible private nonprofits and tribal governing authorities that receive funding through FEMA PA, HMA programs and some Homeland Security grants where 44 CFR 13.36 applies.

As part of the effort to secure and protect federal funding, they conduct an annual emergency management law seminar to addresses legal issues that affect funding for the grant applicants of Hurricanes Katrina, Rita, Gustav and Ike. The identification and notification of the statewide target audiences for the seminar – anyone who procures with federal funding – had proven to be elusive.

The workshop seminar event, branded *getting it right! The Practice of Procurement* was held October 5, 2011. A database of 5,000 target audience email addresses was developed. The goal was to secure between 80 and 100 attendees and that goal was surpassed with a list of 300 attendees and a waiting list of more than 60. To give additional value to the event, GOHSEP project leadership secured continuing education credits for legal seminar participants.

Materials developed for getting it right! The Practice of Procurement legal seminar.

The GOHSEP Team developed a branding logo for the seminar, created PowerPoint presentations, table exercises, comment cards, event signage, takeaway and promotional outreach materials, in addition to providing logistics and staffing support for the event. Event topics included the practice of procurement when using FEMA funding, cost analysis, administrative fees, change orders and insurance, ethics for the emergency management lawyer, professionalism and Q&A with subject matter experts (SMEs). Each participant was provided a takeaway of materials such as the *Procurement Guide* produced by GOHSEP, the *Debris Guide* produced by GOHSEP, 44 Code of Federal Regulations, FEMA Public Assistance Policy Digest (FEMA 321), FEMA Public Assistance Applicant Handbook (FEMA P-323) and copies of all PowerPoint presentations.

After the seminar, the results of the event participant evaluations were collected, reviewed, analyzed and bound.

When asked if the presentations added to their overall understanding of procurement rules, those who filled out survey cards provided the following evaluations:

- Four (4) participants indicated a low amount of understanding was gained.
- Six (6) participants indicated a moderate amount of understanding was gained.
- One hundred eighteen (118) participants said a great amount of understanding was gained.

When asked if they would recommend this seminar to others:

- One hundred and fifteen (115) out of 116 respondents said yes, they would recommend this seminar.

Participants also gave overwhelmingly positive responses when asked about individual presentations, handouts, the workshop food and location.


Food & Beverage

Please rate the following using a scale of 1 to 10 with 1 least favorable and 10 most favorable.

1. Please rate the quality of food and refreshments today.
   1 2 3 4 5 6 7 8 9 10
2. Please rate the service for food and beverage today.
   1 2 3 4 5 6 7 8 9 10

Overall

1. Why did you decide to participate in today's seminar?
3. Why or why not?

Thank you for your participation today!

Optional

Name:

Organization:

Email and/or Phone number:

❑ Track 2: Subject Matter Expert. Subject:

❑ Other:

getting it right! The Practice of Procurement

Awareness

Please rate the following using a scale of 1 to 10 with 1 least important and 10 most important.

1. How important is the procurement process to your work?
   1 2 3 4 5 6 7 8 9 10
2. How familiar are you with the procurement process?
   1 2 3 4 5 6 7 8 9 10
3. How familiar are the people you work with, with the procurement process?
   1 2 3 4 5 6 7 8 9 10

Please respond yes or no to the following questions.

4. Do you know what the 44 CFR is?
   _____Yes _____No
5. Do you know what the 44 CFR 13.36 is?
   _____Yes _____No
6. Do you use either in your work?
   _____Yes _____No

Content

With regard to today's event, please rank how effective each of the following was to you. Please rate the following using a scale of 1 to 10 with 1 least important and 10 most important.

1. Did today's presentations add to your overall understanding of procurement rules?
   1 2 3 4 5 6 7 8 9 10
2. Procurement Presentation.
   1 2 3 4 5 6 7 8 9 10
3. Cost Analysis Presentation.
   1 2 3 4 5 6 7 8 9 10
4. Other Subjects: Administrative Fees, Insurance and Change Orders.
   1 2 3 4 5 6 7 8 9 10
5. Track 1: Attorneys: Ethics.
   1 2 3 4 5 6 7 8 9 10 N/A
6. Track 1: Attorneys: Professionalism.
   1 2 3 4 5 6 7 8 9 10 N/A
7. Track 2: Q&A with Subject Matter Experts (SMEs).
   1 2 3 4 5 6 7 8 9 10 N/A

Takeaways

Please rate the following using a scale of 1 to 10 with 1 least favor and 10 most important.

1. CD.
   1 2 3 4 5 6 7 8 9 10
2. Procurement Guide: Getting and KEEPING your FEMA grant dollars!
   1 2 3 4 5 6 7 8 9 10
3. Cost Analysis hand out.
   1 2 3 4 5 6 7 8 9 10
4. Funding Hazard Mitigation Workbook
   1 2 3 4 5 6 7 8 9 10
5. Debris Guide
   1 2 3 4 5 6 7 8 9 10

Comment card developed for getting it right! The Practice of Procurement legal seminar.

2012 REGIONAL MEETINGS

GOHSEP was tasked with planning, outreach and execution of a series of six workshops that were held in July 2012.

These workshops were similar in size and scope to the 2010 Regional Workshops. In the planning phase, GOHSEP assisted with selecting dates and identifying, scouting and securing locations; identifying and securing premiums for attendees; and assisting GOHSEP with printed materials, sound equipment and catering along with technical assistance in developing workshop content, PowerPoint presentations, creation and presentation training for key staff.

Work included identification and development of appropriate printed materials and takeaways to support workshop content; signs for parking, restrooms and directions; Welcome poster, Planning Arrow poster; and session signage for pre-disaster planning of hazard mitigation strategies and funding sources, obtaining FEMA assistance, documentation, procurement, cost analysis and more.

GOHSEP developed an outreach plan that closely mirrors the one for the successful 2010 Regional Workshops through emails, phone calls and faxes to reach targeted audiences. The current 6344-member GOHSEP list was updated and additions were made. Those targeted include applicants, local elected officials, senior staff and department heads of local governing authorities, state agencies leadership, procurement officials, risk managers, LMA members, intergovernmental agencies, water and levee districts boards, school boards and superintendents, port authority boards, airport boards and directors, nongovernmental organizations and hospital CEOs.

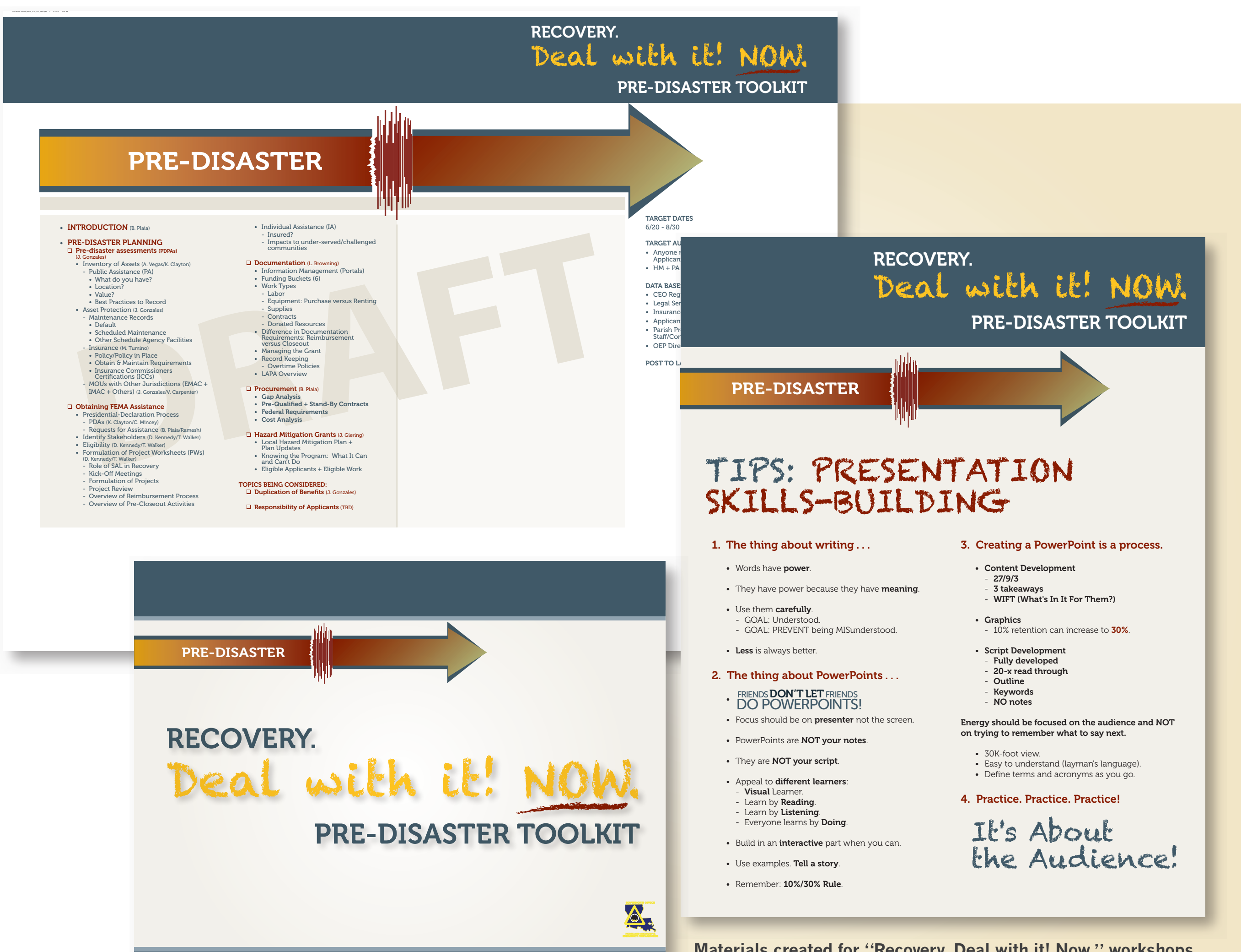
A series of initial blast emails was developed to drive registration using the same themes as Regional Workshops – *Save the Date!, Register Now!, Space is Limited!, It's Not Too Late!* and *See You Tomorrow!*

Session signs for "Recovery. Deal with it! Now." workshops.

GOHSEP collected, reviewed and analyzed comment card feedback. It was determined that across all categories throughout the state, the workshop was a significant success. Every category was rated positively.

Over 600 individuals attended the meetings, and 503 provided ratings for the events. Overall, the meetings received 98 percent positive scores.

Work on this project directly supports SHMP Goals #1 (education and outreach) and #3 (improve capabilities and coordination at the municipal, regional and state levels).



Materials created for "Recovery. Deal with it! Now." workshops included posters, handouts and PowerPoint presentations.

Materials created for "Recovery. Deal with it! Now." workshops included posters, handouts and PowerPoint presentations.

RECOVERY. DEAL WITH IT! NOW. WORKSHOPS PARTICIPANT EVALUATIONS FROM SURVEY CARDS

GOHSEP conducted six recovery workshops over a 14-day period between July 18 and July 31, 2012. From the over 600 individuals who attended, 523 participants provided overall ratings for the events.

Across all categories, and from every GOHSEP region, the workshops were a success based on evaluations of those who attended.

The following summary is from Comment Cards received from participants.

RATINGS OF WORKSHOP AND MATERIALS

Overall Rating

Negative 0

Neutral 11

Positive 513

412 of 513 respondents chose 9 or 10, and 241 of those gave a 10 rating.

RATINGS OF PRESENTATIONS

Negative 0.3%

Neutral 3.9%

Positive 95.7%

TAKEAWAYS

Negative 0.4%

Neutral 3.6%

Positive 95.9%

Comment cards created for "Recovery. Deal with it! Now." workshop.

EDUCATE TO MITIGATE LAB/LPA MEDIA CAMPAIGN

Task 2 called for the design and production of newspaper, radio and television public service announcement advertising regarding hazard mitigation to run in statewide placements GOHSEP had previously arranged through the Louisiana Association of Broadcasters (LAB) and the Louisiana Press Association (LPA). The value of the exposure of these efforts totaled six million dollars.

To complete this task, GOHSEP scripted, produced and/or developed the following public service ads under the *Educate to Mitigate* brand:

- Designed storyboards, produced and delivered 10 each :15 and :30 television ads featuring hazard mitigation for flooding/elevation, all hazards mitigation, ice storms, tornado/safe rooms, insurance, high winds/storm shutters, high winds/braced roof, tornado/manufactured homes, flooding/build on high ground and flooding/raise electrical. These ads were also shown in movie theaters, during which an estimated 11.6 million people were in attendance.
- Scripted, produced and delivered 10 each :15 and :30 radio ads featuring hazard mitigation for flooding/elevation, all hazards mitigation, ice storms, tornado/safe rooms, insurance, high winds/storm shutters, high winds/braced roof, tornado/manufactured homes, flooding/build on high ground and flooding/raise electrical.
- Designed and delivered 52 newspaper ads in four sizes (3.25"x2", 3.25"x4", 3.25"x5", 3.25"x6") with messaging highlighting *Mitigation Savings, Never Too Late to Mitigate, Trimming Trees, So You Have a*

Educate to Mitigate newspaper and web ad series.

Home to Return to, An Education on Elevation, Rise Up. Elevate, Air Conditioners Don't Float and *Build to Last*. A second series with winter hazard messages, but similar themes, was also produced.

- Developed, placed and delivered hazard mitigation ads in two annual hurricane emergency guides – *Lafayette Utilities System Hurricane Handbook* (2010, 2011) which distributed 35,000 copies each year and *Plaquemines Parish Emergency Guide* (2010), which distributed 15,000 copies, as well as ads on evacuation guides, kids books and other hurricane preparedness publications.
- Designed and delivered 24 web banner ads in two sizes (300x250 pixels and 728x90 pixels).

Work on this project directly supports SHMP Goals #1 (outreach and education) and #3 (improved capabilities and coordination at all levels).

Educate to Mitigate TV PSAs.

LAFAYETTE UTILITIES SYSTEM HURRICANE HANDBOOK

disaster mitigation education

A vital aspect of recovery from any disaster is mitigation; that is, making changes in the community, buildings and the land to ensure that large-scale devastation will be minimized. Communities and individuals must learn from past catastrophes and plan for better ways to withstand the destruction wrought by an event of great magnitude.

The hurricane season of 2005 taught us many lessons about the planning process in Louisiana. The main lesson we learned is that we did not have plans in place to effectively shield our communities and property from damage or destruction in the face of the worst natural disasters in U.S. history, Hurricanes Katrina and Rita. Out of the devastation these storms caused, we realize we have to make changes to strengthen our communities against future disaster – we can accomplish this through mitigation planning.

WHAT DO WE MEAN BY MITIGATION?

The Federal Emergency Management Agency (FEMA) defines mitigation as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. In this context, mitigation means preparation and modifications both on the community and individual level to lessen the catastrophic effects of a future natural disaster on our area. Some projects utilizing mitigation plans involve drainage enhancement, acquisition and relocation of at-risk structures, improvements of structures and nonstructures, damaged and undamaged buildings, communications and land. Stricter building codes, revised floodplain regulations and alternative uses for land within flood zones all contribute to future disaster mitigation. It is important for members of the community to embrace these important modifications.

If you are planning new construction or renovations to an existing building, keep these mitigation tips in mind.

HOW DO WE AS COMMUNITY MEMBERS FIND OUT MORE ABOUT DISASTER MITIGATION?

Many good sources of information are available. The Internet is a handy resource, and most of the agencies and organizations listed on individual Web sites have toll-free numbers. See Page 4 of this handbook for listings.

DOES THE STATE HAVE AGENCIES OR PROGRAMS TO HELP?

A good place to start looking for more information is the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) Web site www.getagameplan.org, (Mitigation Plan button) which provides information about hazard mitigation.

WHAT ABOUT MY LOCAL GOVERNMENT? WHERE DO I GO TO FIND OUT ABOUT NEW BUILDING CODES AND GET BUILDING PERMITS?

Many parish and local building departments are re-evaluating and changing building codes and requirements to make them more stringent in order to prevent future flood and other damage to structures. Inquire at Lafayette Consolidated Government or your municipality to find out what new codes may be in effect. In the city of Lafayette and unincorporated areas call Planning, Zoning and Codes at 291-8013, in Broussard call City Hall at 837-6681, in Carencro call the Code Department at 896-2971, in Duson call City Hall at 873-6754, in Scott call City Hall at 233-1130 and in Youngsville call City Hall at 856-4181.

It is Never Too Late to Mitigate.
LEARN ABOUT MITIGATION.
To learn more about how you can protect your family and property, visit **getagameplan.org** and click on Mitigation Plan.
RISE
STORM SAFE LOUISIANA
REINFORCE INSURE SHUTTER ELEVATE
EDUCATE to MITIGATE
Governor's Office of Homeland Security & Emergency Preparedness

ARE THERE OTHER NATIONAL AGENCIES OR ASSOCIATIONS WHO CAN HELP?

The National Association of Home Builders (NAHB) is an excellent source of information concerning rebuilding and recovery. The Web site (www.nahb.org) features many pamphlets, Web site links and other vital information. Titles on the Web site include: "Home Builders' Guide to Coastal Construction," "Choosing a Home Builder," "Small Business Disaster Planning and Preparedness" and "Hurricane Rebuilding."

The Disaster Contractors Network (DCN) is an organization which includes members of construction-related associations, state and federal emergency management organizations and regulatory agencies. Its purpose is to provide opportunities for information sharing and resource matching among government, construction experts, and home and business owners. The DCN Web site (www.dcnonline.org) facilitates this information sharing.

If you are a home or business owner with property covered by flood insurance in a community participating in the National Flood Insurance Program (NFIP), and you are required to meet certain building requirements to reduce future flood damage before repairing or rebuilding your property, you may be eligible for additional coverage through Increased Cost of Compliance. The NFIP Web site (www.floodsmart.gov) provides additional information.

WHAT ARE SOME HOME AND BUSINESS OWNERS DOING TO REDUCE RISKS FROM FUTURE DISASTERS?

Home and building owners can take many steps to ensure their property may be strengthened against the effects of natural disasters. The following tips can help you to make changes or additions to your property or buildings that can reduce your risk of severe damage in future disasters.

TO REDUCE YOUR RISK FROM WINDS
The hazard of most concern in Lafayette Parish is wind damage from hurricanes or tornadoes. Home and business owners can improve several areas to help minimize wind damage including roof, doors, windows, garage door, walls and the exterior of your property.

Roof Hazard Mitigation Projects
- Inspect the roof's bracing. Install additional bracing if necessary.
- Install truss bracing for gabled roofs.
- Brace gable end of roof framing.
- Install hurricane straps in your home or business to better secure the roof to wall and foundation.
- A layer of peel-and-stick roof protection under shingles can lessen water intrusion if roof shingles are lost. These rubber or asphalt sheets cost $700 to $1,000 more than standard roofing felt for a 2,400-square-foot house.

Exterior Doors and Windows
- Make sure all doors and openings are completely covered and braced.
- Reinforce double entry doors. Make sure your doors have at least three hinges and a dead bolt lock with a minimum one-inch bolt throw. Check connections on surface bolts. Be sure the bolt extends into the door header and through the threshold into the subfloor.
- Reinforce or replace garage doors.
- Install storm shutters on your windows and patio doors.
- To secure panels in high wind-prone areas with basic wind speeds of 110 mph or greater, ring-shank nails are less likely to pull free. Costs are comparable, and with a slightly smaller diameter, they offer the added benefits of less frequent reloading of nail guns.
- Permanent or removable shutters reduce force on the building and can lessen water and/or wind-related damage to the interior by protecting windows. Storm-resistant shutters for a standard single-story home with 312 square feet of windows cost about $700.

Educate to Mitigate PSA ad used in the 2012 Lafayette Utilities System Hurricane Handbook.

eNEWSLETTERS

To keep the lines of communications open to mitigation stakeholders, GOHSEP planned a distribution system and developed a series of blast eNewsletters that are sent to a 6,344-member list of interested stakeholders in mitigation issues and information. The eNewsletters give the recipient information on topics such as non-disaster mitigation grant programs, upcoming events, GOHSEP staff announcements and the grant cycle. They are sent as needed and a total of four have gone out to date.

Work on this project directly supports SHMP Goals #1 (education and outreach) and #3 (improve capabilities and coordination at the municipal, regional and state levels).

hazard mitigation
what YOU need to know NOW!

FY12 NON-DISASTER GRANT CYCLE OPENS

$$$ AVAILABLE

Fiscal Year 2012 grant cycle has opened for FEMA's four non-disaster grant programs: Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), Severe Repetitive Loss (SRL) and Pre-Disaster Mitigation (PDM).

Cycle will close on December 2, 2011.

FY12 NON-Disaster Grant Cycle Open NOW!
Deadline to GOHSEP: 9-2-2011
Cycle Closes: 12-2-2011
ICC funds NOW available

Deadline to have applications submitted to GOHSEP is September 2, 2011. Please contact Kimberly Rodrigue at kimberly.rodrigue@la.gov if assistance is needed for project development and application submission.

$$$ AVAILABLE
FUTURE FUNDING FOR PLAN UPDATES

If your Hazard Mitigation Plan is due for an update on or before 2015 and in need of funding, NOW is the time to seek funding through the Pre-Disaster Mitigation (PDM) grant program. As a reminder all PDM grant applications must be submitted online by using the FEMA *eGrants system.*

The PDM program provides funds on an annual basis for hazard mitigation planning. Grant awards are 75% federal and 25% non-federal cost share. Cash and in-kind contributions are accepted as part of the non-federal matching share.

Eligible applicants are:
- State agencies
- Local governments
- Native American tribes

ICC FUNDS AVAILABLE

ICC funds are NOW available for Severe Repetitive Loss (SRL) structures in an approved SRL grant, regardless of whether recent flood damage has occurred. These funds will be used for the required non-federal match, not to exceed $30,000.

NON-DISASTER GRANTS: CHANGES!!! FOR FY12

BENEFIT COST ANALYSIS
- For the 2012 grant cycle, applicants must use BCA 4.5.5 module for all grant programs. If assistance or training is needed, please e-mail Michelle Gonzales, michelle.gonzales@la.gov.
- In some cases, FEMA has pre-calculated the BCA for SRL properties into a list called the *Greatest Savings to the Fund (GSTF)*. A list of GSTF properties in your community can be obtained by e-mailing michelle.gonzales@la.gov

MITIGATION RECONSTRUCTION
Mitigation Reconstruction is eligible as a project type only for SRL grants. In addition, it is no longer necessary that a home be unfeasible to elevate for Mitigation Reconstruction to be considered. A homeowner/community statement of why Mitigation Reconstruction is chosen over Elevation is now sufficient.

FROM GOHSEP

Your GOHSEP Teams At Work

Welcome to the first edition of the Hazard Mitigation: *What YOU Need to Know NOW!* eNewsletter. From time to time your GOHSEP Hazard Mitigation Team will be sharing important information that we think you need to know. We will use this eNewsletter as one of several tools to help ensure you have up-to-date information so you can maximize your hazard mitigation strategies and access to important resources. This edition of the newsletter includes:
- An announcement of key grant application dates.
- Notification of important program changes.
- A recap of the big 5 Hazard Mitigation Assistance (HMA) programs.
- A reminder of tools that can be accessed through the getagameplan.org website.
- And MORE!

State Hazard Mitigation Officer (SMHO)

If you have information that you would like to share through the eNewsletter, let us know. If there are specific kinds of information you find most helpful, let us know that too. And if you need help with anything mitigation-related, call or e-mail. Contact info is noted below.

For more information on this eNewsletter, or to suggest content, please contact Erin Tramontozzi at erin.tramontozzi@la.gov.

USEFUL INFORMATION: WHAT IS PROCUREMENT? WHAT DO I NEED TO KNOW?

Procurement is the process of obtaining goods and services. Care must be taken when purchasing goods and materials and contracting for services for projects approved under the Hazard Mitigation Assistance (HMA) programs. Contracts must be of reasonable cost; generally competitively bid; comply with federal, state and local procurement standards; and applicants must document the process.

Applicants should generally follow their own procurement procedures as long as they meet or exceed the federal standards as stipulated in the 44 Code of Federal Regulations (CFR), Section 13.36. FEMA will ONLY reimburse fair and reasonable costs for any contract an applicant enters into.

The methods of procurement are:
- Small purchases
- Sealed bids
- Competitive proposals
- Non-competitive proposals

The table below provides a quick reference guide to different methods of procurement.

COST ANALYSIS
When proposals are only received from one source, or when it can be documented that competition is inadequate, a detailed cost analysis is required. The cost analysis is documentation from the applicant that demonstrates costs are reasonable based on a comparative analysis of cost from vendors for similar goods and services. Costs are considered reasonable if it can be demonstrated that they are fair and equitable based on what a reasonable person would pay or charge for the services under the circumstances at the time.

AUDITS
Remember ALL projects are subject to audits. To assure that you keep the funds awarded to you, it is important that you properly follow standard procurement procedures. It is equally important that you DOCUMENT, DOCUMENT, DOCUMENT the process used to procure goods and services.

Failure to properly follow and document procurement process can lead to your having to return funds provided under federal grants.

For additional information on procurement, please contact your procurement office or GOHSEP Applicant Liaison. You can also download a *Procurement Guide: Getting and KEEPING your FEMA grant dollars!* from the GOHSEP website, www.gohsep.la.gov. Click on Legal. Navigate to *Procurement Guide* under Legal Library.

PROCUREMENT GUIDE: Getting and KEEPING your FEMA grant dollars!

Procurement REQUIREMENTS by category of purchase + size of contract

CATEGORY OF PURCHASE	FEDERAL REGULATIONS: [44 CFR 13.36]	SIZE OF CONTRACT	STATE REQUIREMENTS [TITLE 38]	LOCAL
Materials + supplies	Quotes required.	Less than $1K and $1K - $9,999	No bid requirement. LLA recommends 3 written quotes.	Check with local authorities for local procurement rules.
Materials + supplies	Quotes required.	$10K - $30K	3 telephone or FAX quotes.	
Materials + supplies	Quotes required.	$30K +	Bid required.	
Materials + supplies	Quotes required.	Less than $100K	Bid required.	
Materials + supplies	Bid required.	$100K +	Bid required.	
Public works	Quotes required.	Less than $100K	No bid requirement. LLA recommends RFP process and/or 3 solicited bids.	
Public works	Bid required.	$100K +	No bid requirement. LLA recommends RFP process and/or 3 solicited bids.	
Public works	Bid required.	Less than $150K	No bid requirement. LLA recommends RFP process and/or 3 solicited bids.	
Public works	Bid required.	$150K +	Bid required.	
Services (Except for A/E)	Quotes required.	Less than $100K	No bid requirement. LLA recommends RFP process and/or 3 solicited bids.	
Services (Except for A/E)	Bid required (RFP).	$100K +	No bid requirement. LLA recommends RFP process and/or 3 solicited bids.	
A/E services	RFQ	ANY	No requirement.	
GSA	•Authorized under the *Disaster Recovery Purchasing Program or* cooperative purchasing program. •Must be competitive bid with 3 GSA vendors.	ANY	•Authorized with the permission of the GOHSEP Director. •Must use Louisiana vendor. •Must be competitive bid with three GSA vendors.	
State Cooperative Purchase (SCP)	Authorized under 44 CFR 13.36 (b) (5)	ANY	•Authorized under La RS 38:2212.1 (F) (Louisiana bid law). •Limited to public entities as defined by 38:2211. •ONLY Office of State Purchasing (OSP) SCP contracts. •Can be used for materials + supplies + equipment.	

The most restrictive rules apply; those are circled above. Local rules may vary.

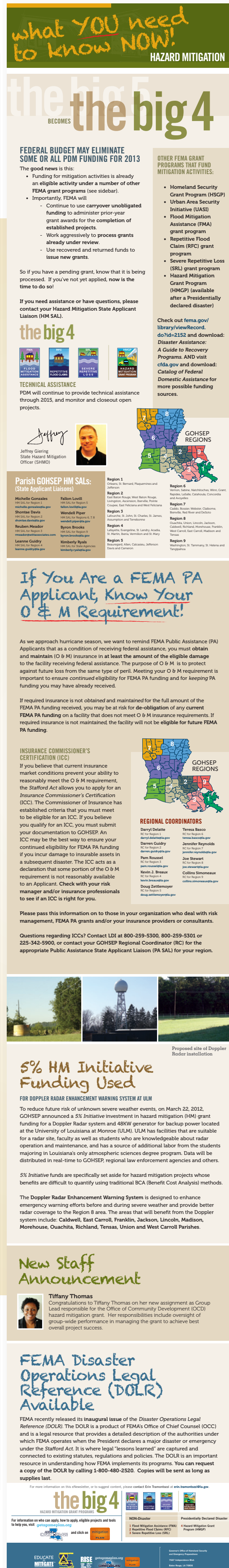
the big 5

For information on who can apply, how to apply, eligible projects and tools to help you, visit getagameplan.org and click on mitigation PLAN

NON-Disaster
1 Pre-Disaster Mitigation (PDM)
2 Flood Mitigation Assistance (FMA)
3 Repetitive Flood Claims (RFC)
4 Severe Repetitive Loss (SRL)

Disaster
5 Hazard Mitigation Grant Program (HMGP)

Governor's Office of Homeland Security & Emergency Preparedness
7667 Independence Blvd.
Baton Rouge, LA 70806
225-925-7500



Series of Hazard Mitigation eNewsletters.

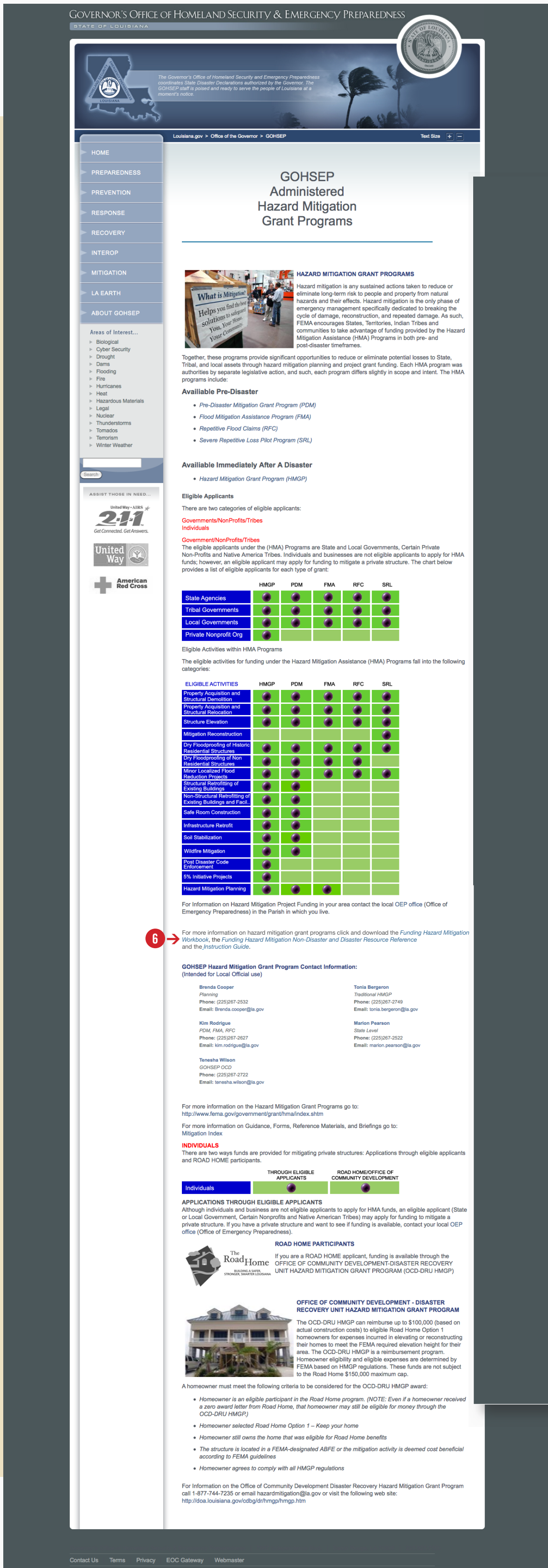
GETAGAMEPLAN.ORG WEBSITE

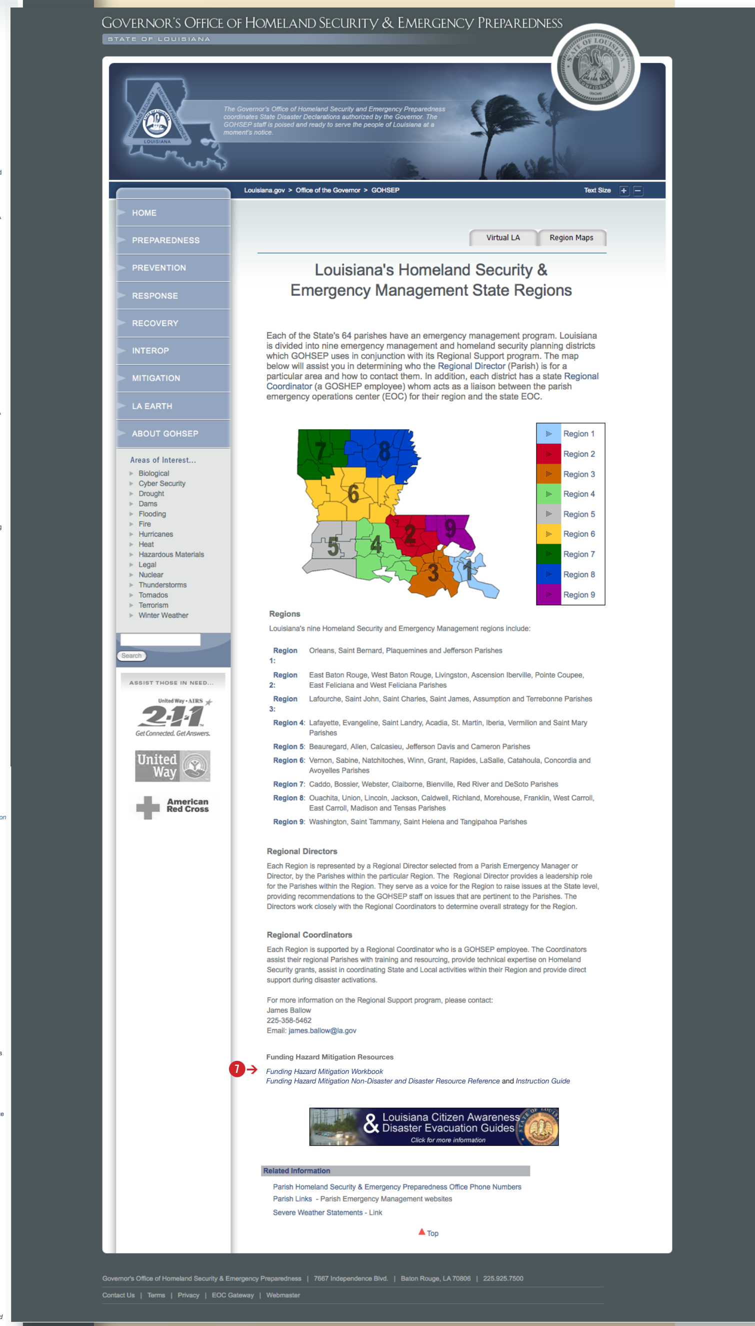
The CEO program assisted in enhancing GOHSEP's Get a Game Plan! website in order to further the effectiveness of its mitigation messaging portal.

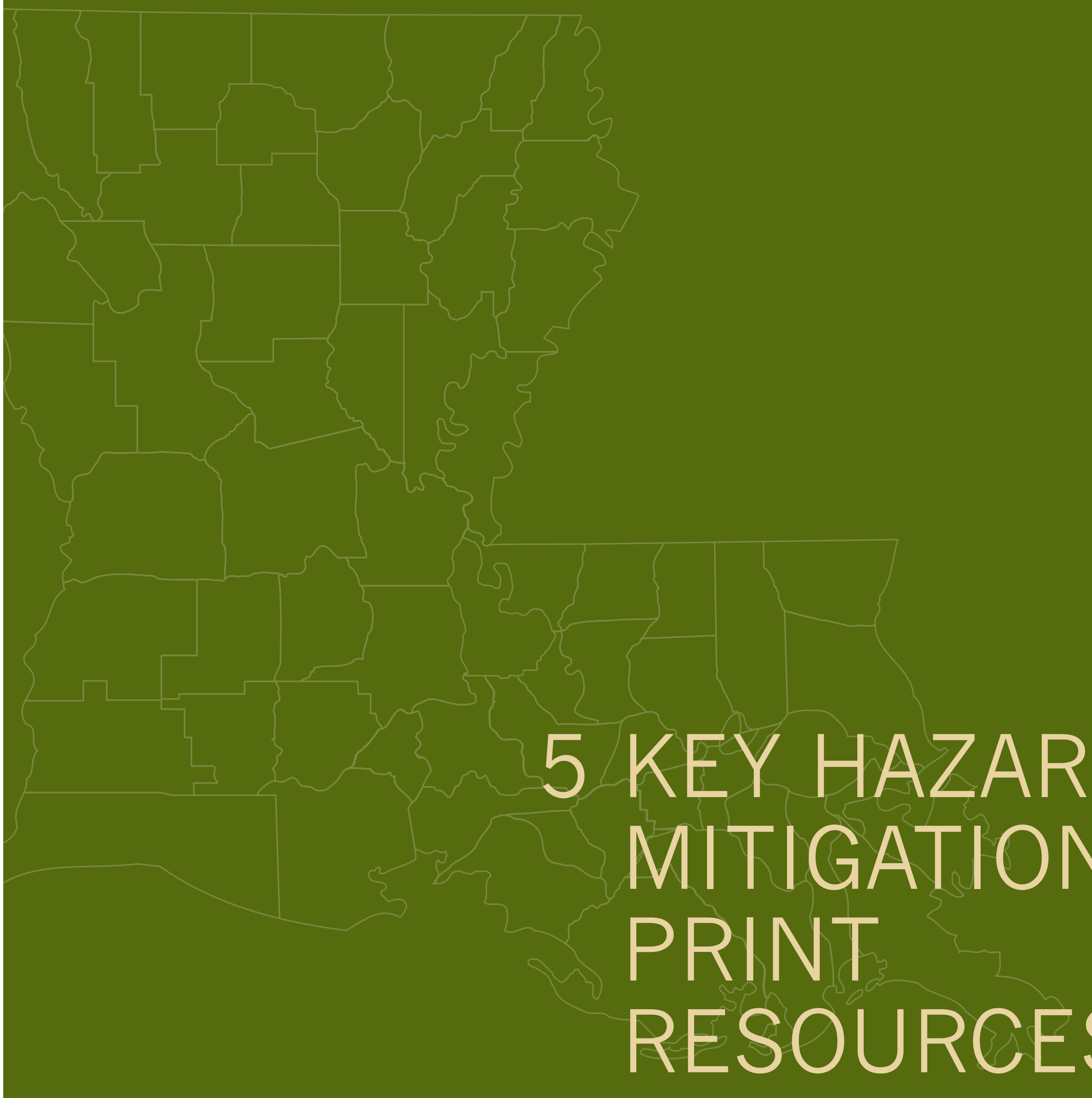
Efforts included the posting of web-based materials to support GOHSEP Regional Meetings and sub grantees, while also providing recommendations for additional content. Examples of additions include grant lists and drop down boxes for more information on hazards such as flood, hailstorm, hurricane, tornado, ice storm, storm surge, subsidence, wildfire, dam failure, levee failure and hazardous materials. GOHSEP also proposed changes to areas such as navigation, the Mitigation Plan section of getagameplan.org, the addition of media sections for the viewing of hazard mitigation-related media and advertisements as well as an icon with lists of public and other outreach meetings and additional content on GOHSEP.la.gov Mitigation tabs. GOHSEP designed an online registration page where meeting participants could register on the getagameplan.org website for any of the five Funding Hazard Mitigation Workshops. Registration was simplified to filling out the information fields and submitting the form.

Work on this project directly supports SHMP Goals #1 (improve education and outreach efforts regarding potential impacts of hazards and identification of specific measures that can be taken to reduce their impact) and #3 (improve capabilities and coordination at the municipal, regional and state levels to plan and implement hazard mitigation projects).

Proposed enhancements to the getagameplan.org website.


Governor's Office of Homeland Security & Emergency Preparedness
State of Louisiana
GOHSEP
Administered
Hazard Mitigation
Grant Programs
HAZARD MITIGATION GRANT PROGRAMS
Available Pre-Disaster
Available Immediately After A Disaster
Eligible Applicants
GOHSEP Hazard Mitigation Grant Program Contact Information:
6


Governor's Office of Homeland Security & Emergency Preparedness
State of Louisiana
Louisiana's Homeland Security &
Emergency Management State Regions
Regions
Regional Directors
Regional Coordinators
Funding Hazard Mitigation Resources
7
Louisiana Citizen Awareness & Disaster Evacuation Guides



5 KEY HAZARD MITIGATION PRINT RESOURCES

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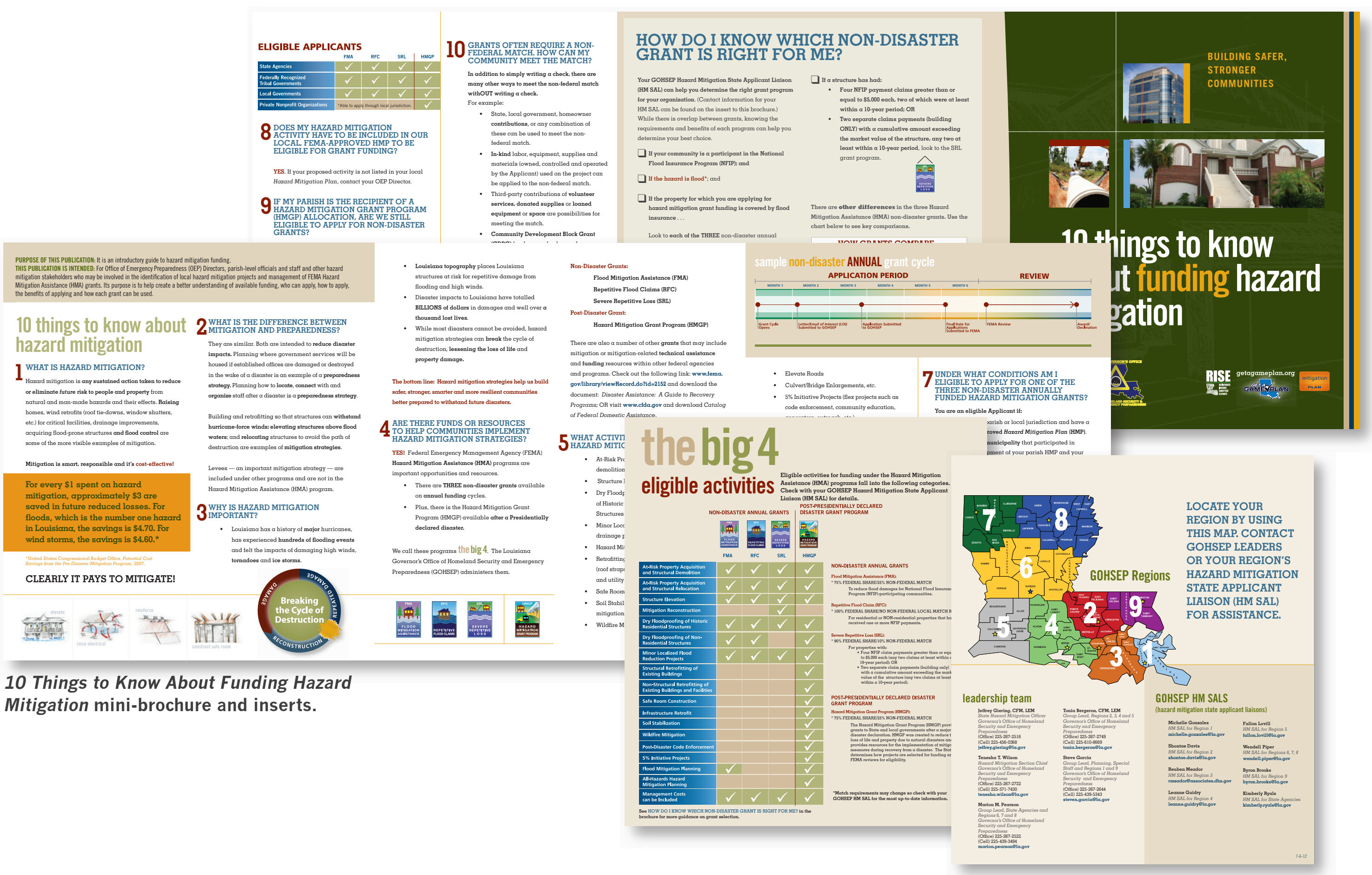
10 THINGS TO KNOW ABOUT FUNDING HAZARD MITIGATION MINI-BROCHURE

Designed as a companion piece to the *Funding Hazard Mitigation Workbook*, the *10 Things to Know About Funding Hazard Mitigation* mini-brochure is an introductory guide to hazard mitigation for OEP directors, parish-level officials and staff and other hazard mitigation stakeholders who may be involved with identifying local hazard mitigation projects and managing FEMA Hazard Mitigation Assistance (HMA) grants.

It helps create a better understanding of what funding is available, who can apply, how to apply, the benefits of applying and how grants can be used. It contains information on hazard mitigation funding basics in an FAQ format, outlines GOHSEP regions, and provides information on available disaster grants, the application period, meeting local funding matches, how the getagameplan.org website can be an asset and GOHSEP contact information.

Work on this project directly supports SHMP Goals #1, (outreach and education) and #3 (improved capabilities and coordination at all levels).



10 Things to Know About Funding Hazard Mitigation mini-brochure and inserts.

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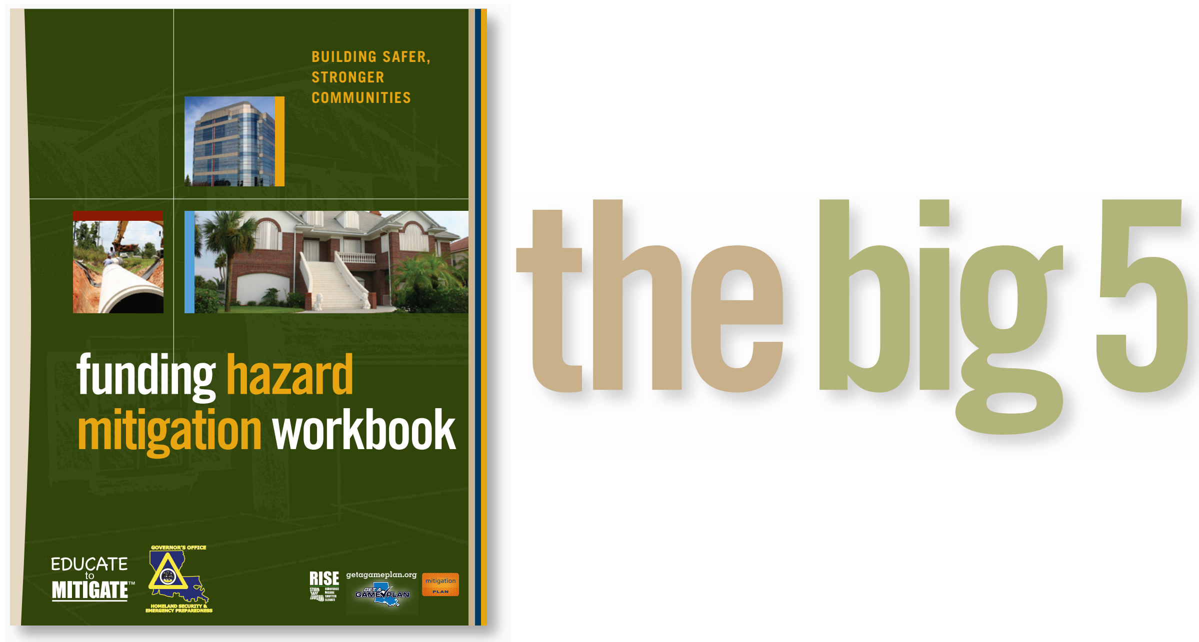
THE BIG 5: FUNDING HAZARD MITIGATION WORKBOOK



GOHSEP created innovative materials for use by government officials, businesses and individuals that raise awareness of mitigation funding sources, provided valuable help when applying for those resources, and helped community leaders identify mitigation opportunities to implement.

The Big 5: *Funding Hazard Mitigation Workbook* is a first-of-its-kind, best practices education tool and job aid for grant seekers at the state and local levels. It serves as a companion piece, along with the *10 Things to Know About Funding Hazard Mitigation* mini-brochure and *Funding Hazard Mitigation Non-Disaster and Disaster Resource Reference Binder*.

The *Workbook* was introduced to prospective grant applicants to increase awareness, interest and access to important hazard mitigation funding resources for Louisiana parishes and communities. Although initially created for use at the Regional Workshops, the *Workbook* serves as support material to other outreach efforts and events.

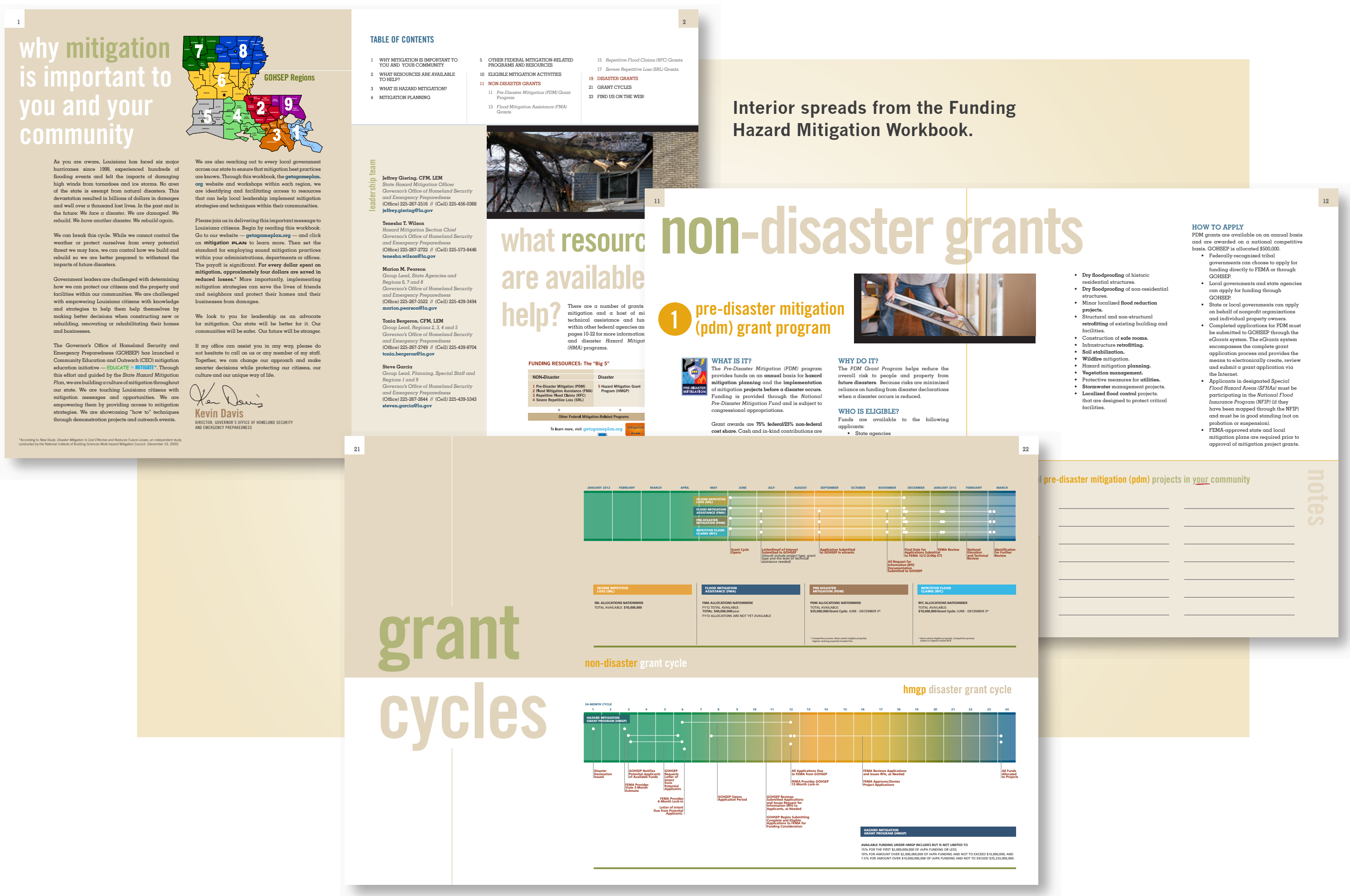
More specifically, the *Workbook* provides basic information on the then-five major sources of hazard mitigation funding (as of 2013, Pre-Disaster Mitigation (PDM) grants will no longer be funded) as well as a host of other federal mitigation-related funding resources. It also contains overviews of:

- The importance of mitigation planning in the funding process.
- Who is eligible to apply for mitigation-specific grants.
- What projects are eligible for funding.
- An explanation of the grant cycles.
- An overview of the application and grant management processes.

Research staff organized the information into three categories: non-disaster grants, grants available immediately post-disaster and grants available within other federal agencies. The first two categories are part of the Hazard Mitigation Assistance (HMA) program. GOHSEP branded those as THE BIG FIVE (four non-disaster and one available upon a Presidentially declared disaster). Other mitigation-related federal resources are catalogued in a separate section of the *Workbook*.

The *Workbook* was vetted through GOHSEP subject matter experts and FEMA staff to ensure accuracy and to facilitate the reconciliation of conflicting information from multiple sources.

Work on this project directly supports SHMP Goals #1 (outreach and education) and #3 (improved capabilities and coordination at all levels).



Interior spreads from the Funding Hazard Mitigation Workbook.

FUNDING HAZARD MITIGATION NON-DISASTER AND DISASTER RESOURCE REFERENCE BINDER

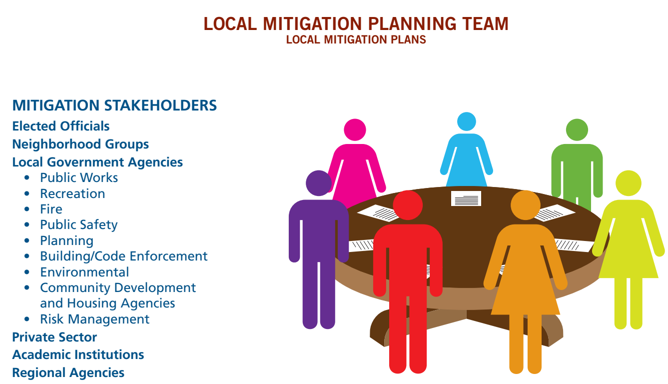
***Funding Hazard Mitigation Non-Disaster and Disaster Resource Binder* and CD.**

GOHSEP created an all-inclusive takeaway for Regional Workshops. The *Resource Reference* binder is another first-of-its-kind publication. It was developed to be adaptable with information specific to the region where workshop participants work. The intended audiences include Office of Emergency Preparedness (OEP) Directors, professional local government staff, policy makers and prospective applicants for mitigation funding grants.

The *Resource Reference* binder articulates how hazard risks are identified across the state, key grant application and management processes and how to plan and implement hazard mitigation projects. It contains information about:

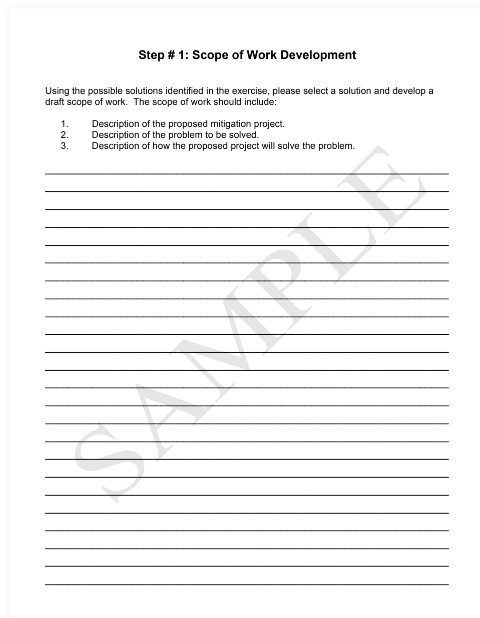
- Available grants and other mitigation-related funding and technical assistance resources.
- How to apply for hazard mitigation grants.
- How to meet the match when a local match is required.
- Project and applicant eligibility requirements.
- The necessity of mitigation planning and Benefit Cost Analysis requirements in completing a grant application.
- Grant management processes including procurement and documentation requirements.

To facilitate use beyond the workshops, the *Resource Reference* binder also includes each of the PowerPoint presentations used in the GOHSEP CEO workshops, hands-on exercises, sample scopes of work (SOWs), regional and statewide risk



maps, GOHSEP contact information and instructions for using the *Resource Reference* binder. Electronic versions of presentations and other materials were loaded onto portable drives that Regional Workshop attendees would also receive. GOHSEP provided collation assistance of binders for the initial workshops and developed a master binder that housed materials from all five meetings.

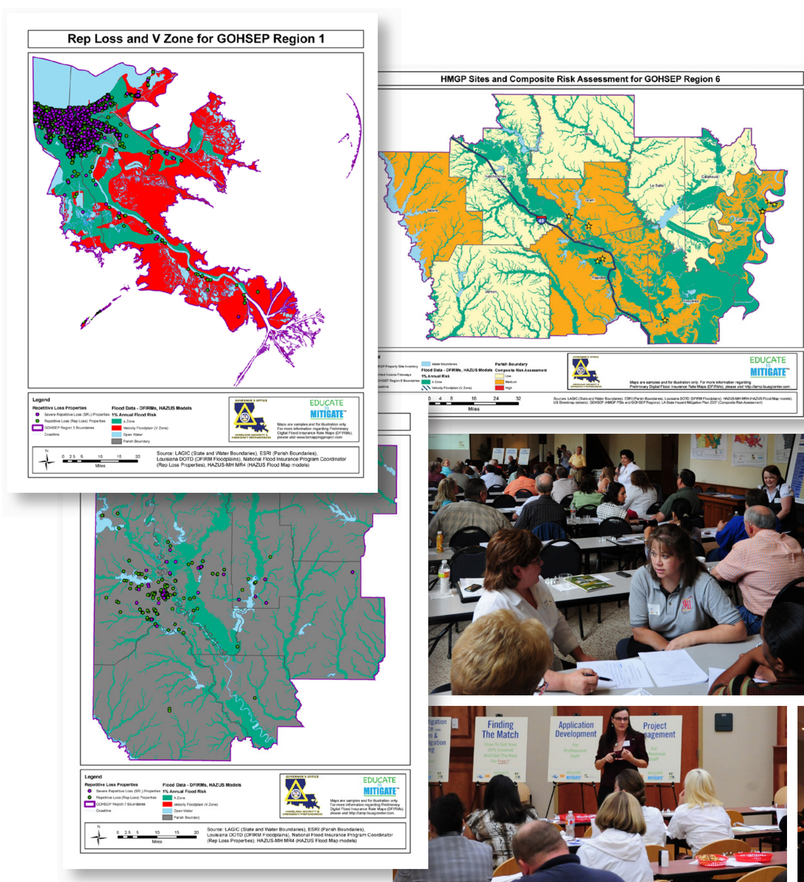
Work on this project directly supports SHMP Goals #1 (outreach and education) and #3 (improved capabilities and coordination at all levels).


Step # 1: Scope of Work Development

Using the possible solutions identified in the exercise, please select a solution and develop a draft scope of work. The scope of work should include:

1. Description of the proposed mitigation project.
2. Description of the problem to be solved.
3. Description of how the proposed project will solve the problem.

SAMPLE



"HOW TO" POWERPOINT PRESENTATIONS

2010 Regional Meetings

- Louisiana Hazard Mitigation Assistance (HMA) Program
- HMA Program Overview
- Hazard Mitigation Planning
- The Big 5 Non-Disaster
    1 Pre-Disaster Mitigation (PDM)
    2 Flood Mitigation Assistance (FMA)
    3 Repetitive Flood Claims (RFC)
    4 Severe Repetitive Loss (SRL)
- Disaster
    5 Hazard Mitigation Grant Program (HMGP)
- Disaster Grant Program Overview
- HMGP
- The other HMGP
- Federal Mitigation Funding
    Opportunities Across the Federal Government
- Benefit Cost Analysis (BCA) Overview
- Application Types/Types of Projects Overview
- Application Exercises
- Grant Management 101
    - What Happens After Your Grant is Approved?
- Project Implementation
- Project Closeout
- Meeting the Match

Strategic Plan

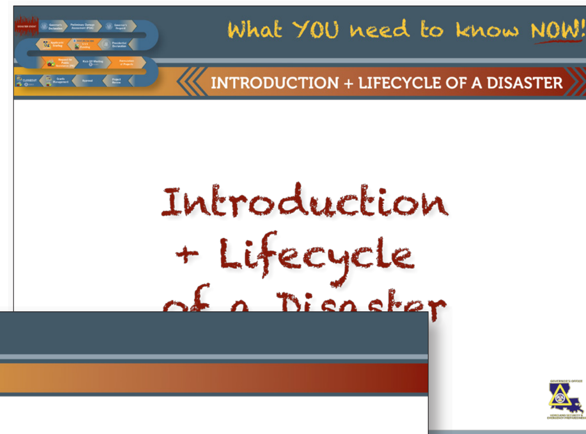
- Louisiana Hazard Mitigation Community Education and Outreach (CEO) Initiative

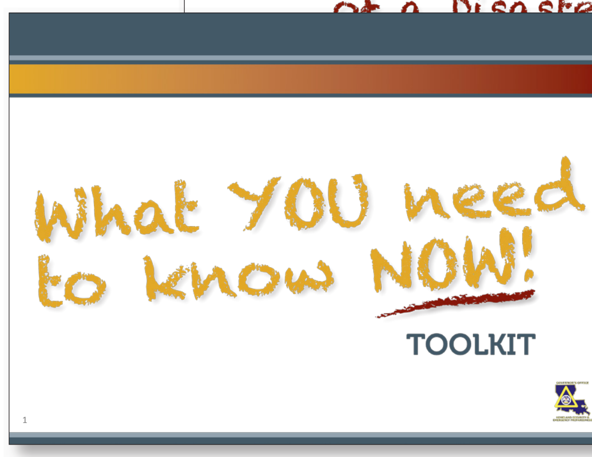
BOAL 2011 Conference

- DEVELOPING RELATIONS: A Dialogue Between OCD, GOHSEP & BOAL Members Building Department Challenges & Opportunities
- FEDERAL GRANT FUNDING: getting it right! Procurement, Legal & Management Issues
- BUILDING DEPARTMENTS & MITIGATION INITIATIVES: Innovative Ways to Communicate With Our Customers
- BUILDING DEPARTMENTS & MITIGATION INITIATIVES: Funding Sources

2012 Regional Meetings

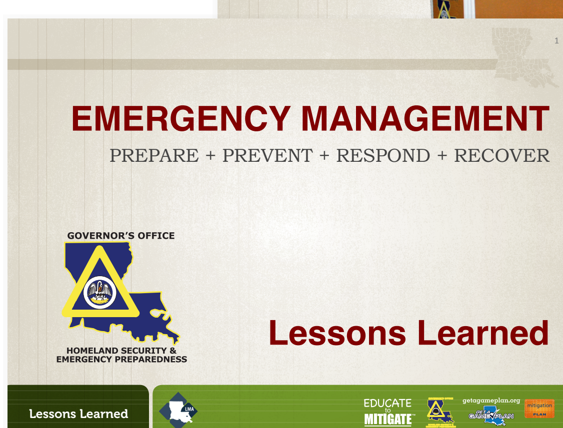
- Introduction + Lifecycle of a Disaster
- Debris
- Procurement + Cost Analysis
- Insurance Requirements
- Other Important Things You Need To Know
- Presidential Declaration Process
  - Presidential Declaration Request
  - Presidential Declaration Request: Economic Impact Statement
  - Preliminary Damage Assessment
- FEMA Individual Assistance
- Hazard Mitigation Assistance (HMA) Grants





Louisiana Municipal Association (LMA) 2012 Convention

- Emergency Management: Lessons Learned
- Hazard Mitigation Assistance



6 BRAND DEVELOPMENT

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BRANDING

GOHSEP has created an umbrella of branded logos and looks for materials developed across the broad scope of work under the CEO program. In each case, the branding readily identifies the project. All these projects fit under the main branding of *Educate to Mitigate*. A logo was developed and appears on almost everything produced by GOHSEP. One of the first items produced under the CEO project were coffee mugs with the *Educate to Mitigate* logo emblazoned on the side. These were given as premiums to Regional Workshop attendees. A CEO FAQ and carry card with the *Educate to Mitigate* logo were also developed and dispensed at various workshops and other events.

Branded looks were created for the getagameplan.org, mitigation button that incorporates the iconic getagameplan.org identity and logo already developed prior to initiation of the CEO program. The same kind of branded look applies to every project listed in this report. Logos were created for *RISE*, *The Big 5, Louisiana Mitigation Makeover* and *Louisiana Mitigation House*.

Branding also was a part of the support GOHSEP provided to the sub grantees. Logos were developed for UNO-CHART and the DRU, NIMSAT's *LaHIP* web portal, BOAL's *Mitigation Matters*, and SDMI's *Ready to Resume* and *From Risk to Resiliency*.

The branding work directly supports SHMP goals #1 (improve education and outreach) and #3 (Improve capabilities and coordination at all levels).

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7 APPENDIX

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PROCUREMENT GUIDE AND SEMINAR

Procurement and Debris Guides developed for getting it right!
The Practice of Procurement legal seminar.

Following a Presidentially declared emergency or disaster, the Disaster Recovery Division works to ensure applicants receive and retain all FEMA funding to which they are entitled.

Under a separate project funded through a CEO grant, GOHSEP developed hazard mitigation grant support through an easy-to-use *Procurement Guide* and a legal seminar to address issues likely to put FEMA funding received at risk of de-obligation. The *Guide* is necessary for those who purchase goods or services using FEMA funds, as well as anyone providing legal advice, to practice proper procurement. The consequences of failing to procure correctly can include having funds de-obligated, not being eligible to receive future funding and other penalties.

The *Procurement Guide* is a publication that would help eligible applicants identify and apply 44 CFR 13.36 when using FEMA funds for disaster and non-disaster materials, supplies, publics works projects and services. The Guide is intended for use by local governing authorities, eligible private nonprofits and tribal governing authorities that receive funding through FEMA PA, HMA programs and some Homeland Security grants where 44 CFR 13.36 applies.

As part of the effort to secure and protect federal funding, they conduct an annual emergency management law seminar to addresses legal issues that affect funding for the grant applicants of Hurricanes Katrina, Rita, Gustav and Ike.

The identification and notification of the statewide target audiences for the seminar – anyone who procures with federal funding – had proven to be elusive.

The workshop seminar event, branded *getting it right! The Practice of Procurement* was held October 5, 2011. A database of 5,000 target audience email addresses was developed. The goal was to secure between 80 and 100 attendees and that goal was surpassed with a list of 300 attendees and a waiting list of more than 60. To give additional value to the event, GOHSEP project leadership secured continuing education credits for legal seminar participants.

Materials developed for getting it right! The Practice of Procurement legal seminar.

GOHSEP developed a branding logo for the seminar, created PowerPoint presentations, table exercises, comment cards, event signage, takeaway and promotional outreach materials, in addition to providing logistics and staffing support for the event. Event topics included the practice of procurement when using FEMA funding, cost analysis, administrative fees, change orders and insurance, ethics for the emergency management lawyer, professionalism and Q&A with subject matter experts. Each participant was provided a takeaway of materials such as the *Procurement Guide* produced by GOHSEP, the *Debris Guide* produced by GOHSEP, 44 Code of Federal Regulations, FEMA Public Assistance Policy Digest (FEMA 321), FEMA Public Assistance Applicant Handbook (FEMA P-323) and copies of all PowerPoint presentations.

After the seminar, the results of the event participant evaluations were collected, reviewed, analyzed and bound.

When asked if the presentations added to their overall understanding of procurement rules, those who filled out survey cards provided the following evaluations:

- Four (4) participants indicated a low amount of understanding was gained.
- Six (6) participants indicated a moderate amount of understanding was gained.
- One hundred eighteen (118) participants said a great amount of understanding was gained.

When asked if they would recommend this seminar to others.

- One hundred and fifteen (115) out of one hundred and sixteen (116) respondents said yes, they would recommend this seminar.

Participants also gave overwhelmingly positive responses when asked about individual presentations, handouts, the workshop food and location.

Food & Beverage

Please rate the following using a scale of 1 to 10 with 1 least favorable and 10 most favorable.

1. Please rate the quality of food and refreshments today.
   1 2 3 4 5 6 7 8 9 10
2. Please rate the service for food and beverage today.
   1 2 3 4 5 6 7 8 9 10

Overall

1. Why did you decide to participate in today's seminar?

3. Why or why not?

Thank you for your participation today!

Optional

Name:______
Organization:______
Email and/or Phone number:______

❑ Track 2: Subject Matter Expert. Subject:______

❑ Other:______

getting it right! The Practice of Procurement

Awareness

Please rate the following using a scale of 1 to 10 with 1 least important and 10 most important.

1. How important is the procurement process to your work?
   1 2 3 4 5 6 7 8 9 10
2. How familiar are you with the procurement process?
   1 2 3 4 5 6 7 8 9 10
3. How familiar are the people you work with, with the procurement process?
   1 2 3 4 5 6 7 8 9 10

Please respond yes or no to the following questions.

4. Do you know what the 44 CFR is?
   _____Yes _____No
5. Do you know what the 44 CFR 13.36 is?
   _____Yes _____No
6. Do you use either in your work?
   _____Yes _____No

Content

With regard to today's event, please rank how effective each of the following was to you. Please rate the following using a scale of 1 to 10 with 1 least important and 10 most important.

1. Did today's presentations add to your overall understanding of procurement rules?
   1 2 3 4 5 6 7 8 9 10
2. Procurement Presentation.
   1 2 3 4 5 6 7 8 9 10
3. Cost Analysis Presentation.
   1 2 3 4 5 6 7 8 9 10
4. Other Subjects: Administrative Fees, Insurance and Change Orders.
   1 2 3 4 5 6 7 8 9 10
5. Track 1: Attorneys: Ethics.
   1 2 3 4 5 6 7 8 9 10 N/A
6. Track 1: Attorneys: Professionalism.
   1 2 3 4 5 6 7 8 9 10 N/A
7. Track 2: Q&A with Subject Matter Experts (SMEs).
   1 2 3 4 5 6 7 8 9 10 N/A

Takeaways

Please rate the following using a scale of 1 to 10 with 1 least favor and 10 most important.

1. CD.
   1 2 3 4 5 6 7 8 9 10
2. Procurement Guide: Getting and KEEPING your FEMA grant dollars!
   1 2 3 4 5 6 7 8 9 10
3. Cost Analysis hand out.
   1 2 3 4 5 6 7 8 9 10
4. Funding Hazard Mitigation Workbook
   1 2 3 4 5 6 7 8 9 10
5. Debris Guide
   1 2 3 4 5 6 7 8 9 10

Comment card developed for getting it right! The Practice of Procurement legal seminar.

HAZARD MITIGATION GRANT WORKSHOPS PARTICIPANT EVALUATIONS FROM SURVEY CARDS

Comments received through comment cards collected at all five (5) Funding Hazard Mitigation Regional Workshops across the state were decidedly positive. Presentations, take-home materials, and overall workshop experience all rated high.

Across all categories, and from every GOHSEP region, the workshops were a success based on evaluations of those who attended. Every category rated by participants received high marks. Out of 262 comment cards received, no part of the meeting received more than seven (7) negative marks. The standout, in terms of ratings, was the take-home binders, which didn't receive a single negative comment.

The following summary is from Comment Cards received from participants.

RATINGS OF WORKSHOP AND MATERIALS

Overall Rating

Negative 1

Neutral 12

Positive 159

105 of 172 respondents chose 9 or 10, and 66 of those gave a 10 rating.

Workbook Rating

Negative 2

Neutral 16

Positive 209

156 of 227 respondents chose 9 or 10, and 124 of those gave a 10 rating.

Binder Rating

Negative 0

Neutral 7

Positive 191

157 of 198 respondents chose 9 or 10, and 131 of those gave a 10 rating.

RATINGS OF PRESENTATIONS

Workshop #1

Negative 1

Neutral 21

Positive 229

145 of 251 respondents chose 9 or 10, and 100 of those gave a 10 rating.

Workshop #2

Negative 7

Neutral 19

Positive 211

130 of 237 respondents chose 9 or 10, and 83 of those gave a 10 rating.

Workshop #3

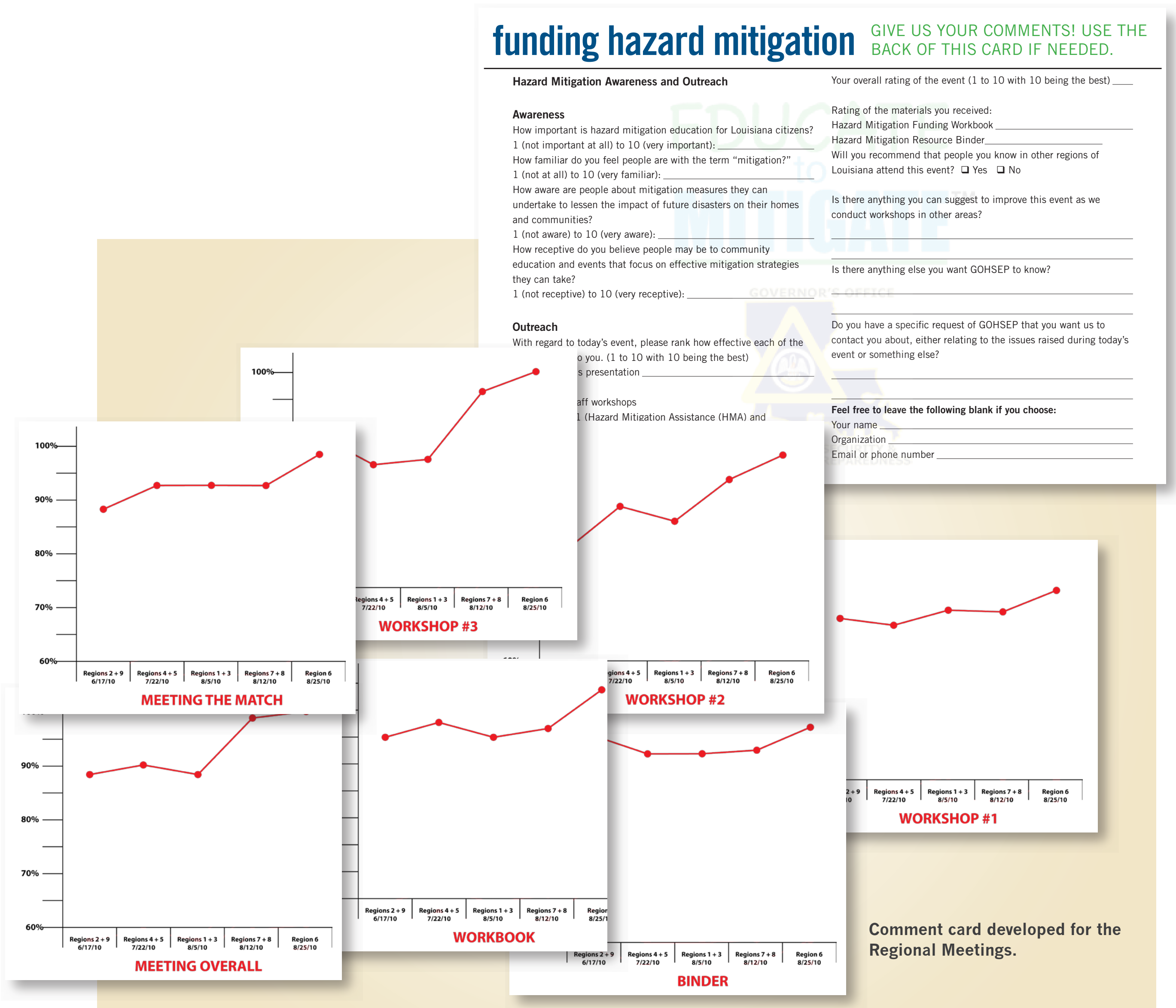
Negative 4

Neutral 17

Positive 174

109 of 195 respondents chose 9 or 10, and 77 of those gave a 10 rating.

Considering the high degree of receptivity by participants to the GOHSEP message, the importance of hazard mitigation, resources available to implement local hazard mitigation projects and how to access those resources are now better understood throughout the state, a key goal of the GOHSEP CEO program and the Regional Meetings initiative. One of the overriding themes among those surveyed was the need, in the view of participants, for GOHSEP to offer this workshop content again, along with other educational opportunities.



Comment card developed for the Regional Meetings.

GOHSEP 2010–2012 AWARDS BY PROJECT

REGIONAL MEETINGS – TASK 1, TASK 2, TASK 3

Funding Hazard Mitigation Workbook

- 2010 Silver Davey Award
- 2010 Gold MarCom Award
- 2010 Bronze Service Industry Advertising Award
- 2011 Bronze Summit International Award
- 2011 Award of Excellence Southern Public Relations Federation

Funding Hazard Mitigation Binder

- 2010 Gold Service Industry Advertising Award
- 2011 Silver Communicator Award
- 2011 Certificate of Merit Southern Public Relations Federation

LPB/LPA AD SERIES – TASK 2

Educate to Mitigate Newspaper

- 2010 Gold Service Industry Advertising Award

Educate to Mitigate TV PSA

- 2010 Silver Service Industry Advertising Award
- 2011 Silver Communicator Award

MITIGATION PLAN WEBSITE – TASK 2, TASK 3

Mitigation Plan Website

- 2010 Bronze Service Industry Advertising Awards (SIAA)

NIMSAT – TASK 1, TASK 2

LaHIP Logo

- 2011 Award of Excellence Southern Public Relations Federation

UNO-CHART – TASK 1, TASK 2

UNO-CHART Logo

- 2011 Certificate of Merit Southern Public Relations Federation

HAZARD MITIGATION CEO PROGRAM – TASK 1

Hazard Mitigation CEO Program

- 2011 Certificate of Merit Southern Public Relations Federation

LOUISIANA MITIGATION HOUSE – TASK 1, TASK 4

Louisiana Mitigation House Letterhead/Logo

- 2010 Merit Service Industry Advertising Award

GETTING IT RIGHT! THE PRACTICE OF PROCUREMENT LEGAL SEMINAR

- 2011 Gold MarCom Award
- 2012 Bronze Summit International Award
- 2012 Platinum Hermes Creative Award
- 2012 Silver Communicator Award

City of Slidell

The City of Slidell is located on the northeast shore of Lake Pontchartrain between the Pearl River Basin (on the east) and the Bayou Liberty–Bonfouca waterways (on the west). Bayou Bonfouca winds through the western half of the city, passing by the city's historic Olde Towne district and several waterfront residential neighborhoods, as indicated in Figure 6.2. The city is sliced by a number of smaller bayous and canals that drain storm and flood waters from the city into Bayou Bonfouca and onward into Lake Pontchartrain. The city's topography is low and flat, which makes it (1) susceptible to flooding and storm surge, (2) slow to recover from heavy rain or flood events, and (3) vulnerable to successive rapidly recurring storm events.

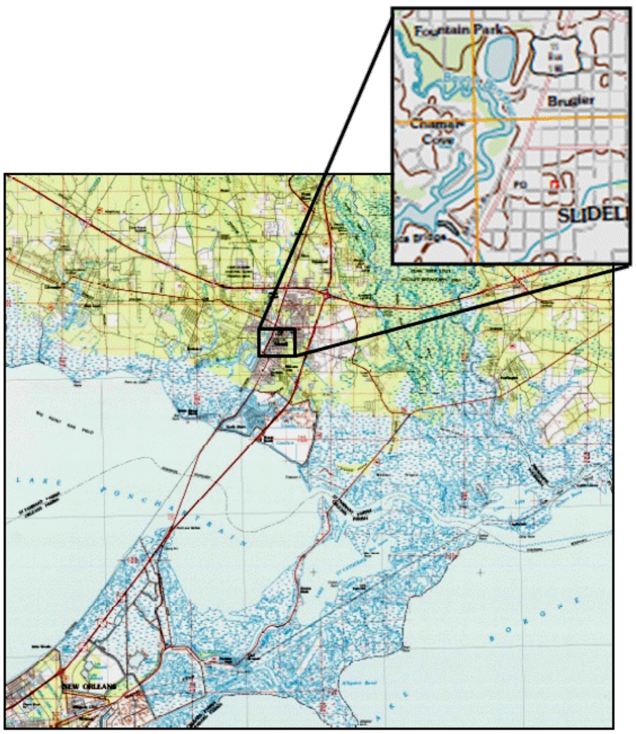


Figure 6.2. City of Slidell.

As a result of the city's low, flat, coastal topography, the majority of the city lies within a Special Flood Hazard Area (SFHA), which includes most of the city's critical infrastructure. A unique characteristic of the city's low flat topography is the lack of a defined floodway, resulting in a stark transition from the A Zone to the X Zone.[lxxxv]

The City of Slidell was founded circa 1882 where Bayou Bonfouca comes closest to a rail line running from New Orleans to the Gulf Coast. Today the population of Slidell is approximately 27,000, and it consists of about 10,000 households whose residents earn a median household income of $49,000. Figure 6.3 provides a cross section of the population by age groups.

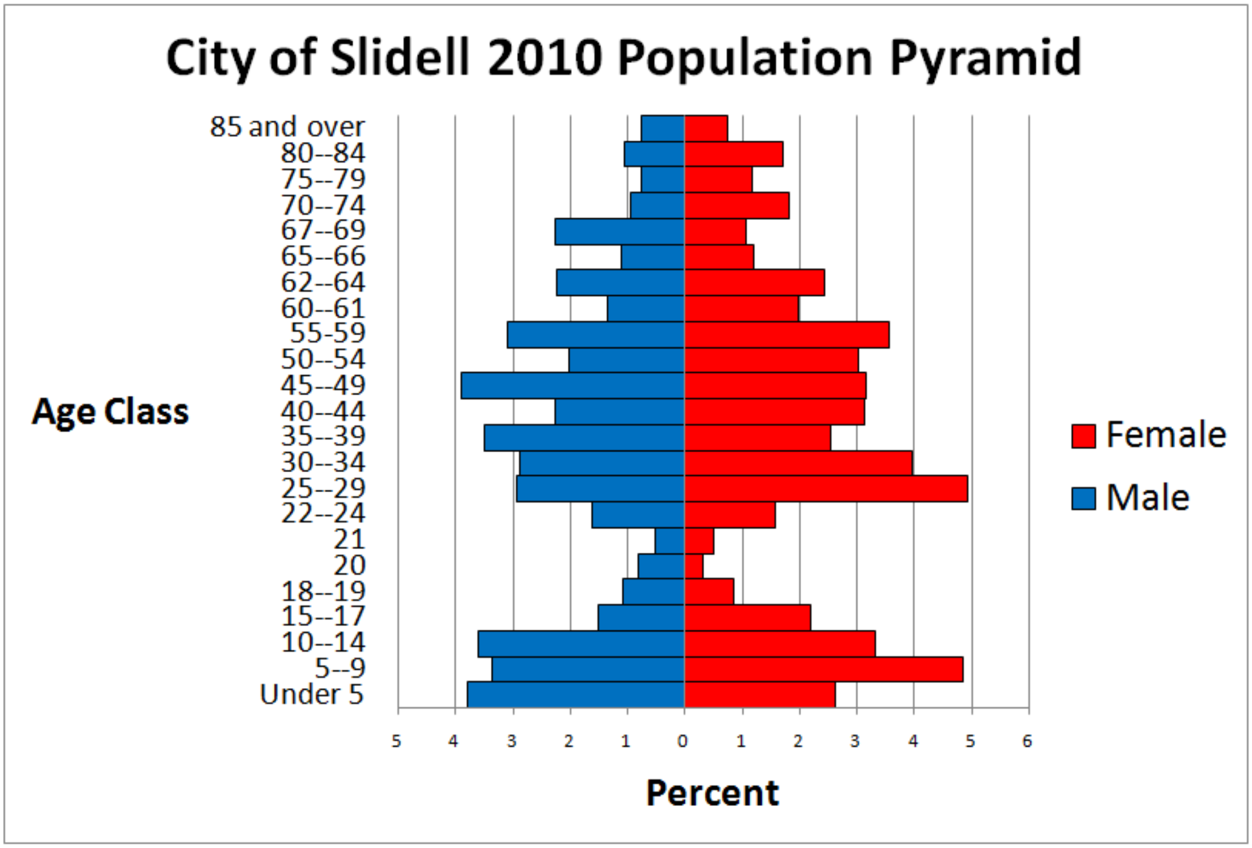


Figure 6.3. City of Slidell Population Pyramid.

The principal natural hazard facing the City of Slidell is flooding, as suggested by Figure 6.4. Major flood events have struck Slidell about every five years from 1995 to the present. In 1995, storm water flooded low-lying parts for the city. During 2001 and 2002 a series of tropical storms and hurricanes overwhelmed the city's drainage capacity, causing portions of the city to flood. In 1995 Hurricane Katrina's storm surge overwhelmed the city's defenses and flooded the majority of the city. During Hurricane Isaac in 2012 backflooding from Lake Pontchartrain combined with persistent heavy rains overwhelmed the city's pumping capacity, causing the city's Olde Towne and surrounding neighborhoods to flood.

(Continued on Next Page)

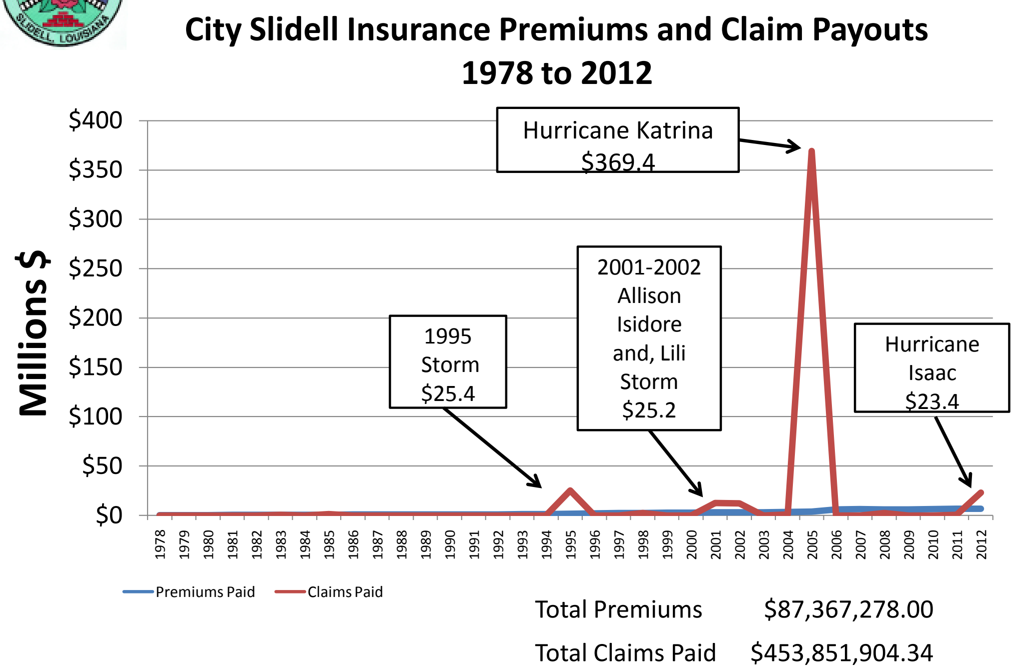


Figure 6.4. City of Slidell Flood Claims and Payments: 1978 to 2012.

The city is vulnerable to three types of flooding—storm surge, backflooding, and localized drainage problems. The principal threat is from tropical storm or tropical cyclone storm surge. Storm surge generated by these events can push large quantities of water into the northeast shore of Lake Pontchartrain that - since the City of Slidell lacks an integrated, enclosed barrier system - quickly overwhelms localized protection efforts. Some recent efforts to construct flood protection barriers and tie them together with temporary barriers have provided a measure of increased protection. However, these efforts are meant to be temporary and limited to specific events and require extraordinary human intervention to make them effective. Plans for more comprehensive and enduring protection remain in the conceptual phase.

More insidious but just as devastating is backflooding from Lake Pontchartrain. Tropical storms and cyclones can force large quantities of water from the Gulf of Mexico, across the Lake Borgne–Lake Catherine land bridge, and into the western end of Lake Pontchartrain. As the storm passes, this large quantity of water plus storm water flowing into the lake from numerous rivers and bayous tries to flow out to the Gulf through the Rigolets and Chef Menteur passes. Lacking the force that propelled these waters into the lake, the outflowing water piles up at these two checkpoints. Water then begins to flow back into the rivers and bayous and combines with upstream storm waters to overtop protective barriers or overwhelm the city’s pump capacity. During Hurricane Isaac pressure from backflooding combined with large amounts of storm water that fell on the city overwhelmed the city's pumps and flooded Olde Towne and some of the surrounding neighborhoods.

The third common cause of flooding is localized drainage issues, both inside and outside the city's SFHA. Localized drainage issues can cause flooding even during relatively brief thunderstorms. Impaired or obstructed drainage reduces the drainage systems capacity, causing neighborhoods to flood. While brief and localized, these events can occur anytime throughout the year, making them a costly and traumatic ordeal for those affected.

The areas affected by the three types of flooding can easily be identified by examining the city's repetitive flood loss locations displayed in Figure 6.5. The Palm Lake area has repeatedly been inundated by tropical storm and cyclone storm surges, which are often exacerbated by high tide events. The Driftwood Circle and north 9th Street area, which are only partially in the SFHA, are prone to flooding after heavy thunderstorms. Some of the flooding is the result of an overtaxed drainage system. Smaller pockets of repetitive loss properties are spread throughout the city.

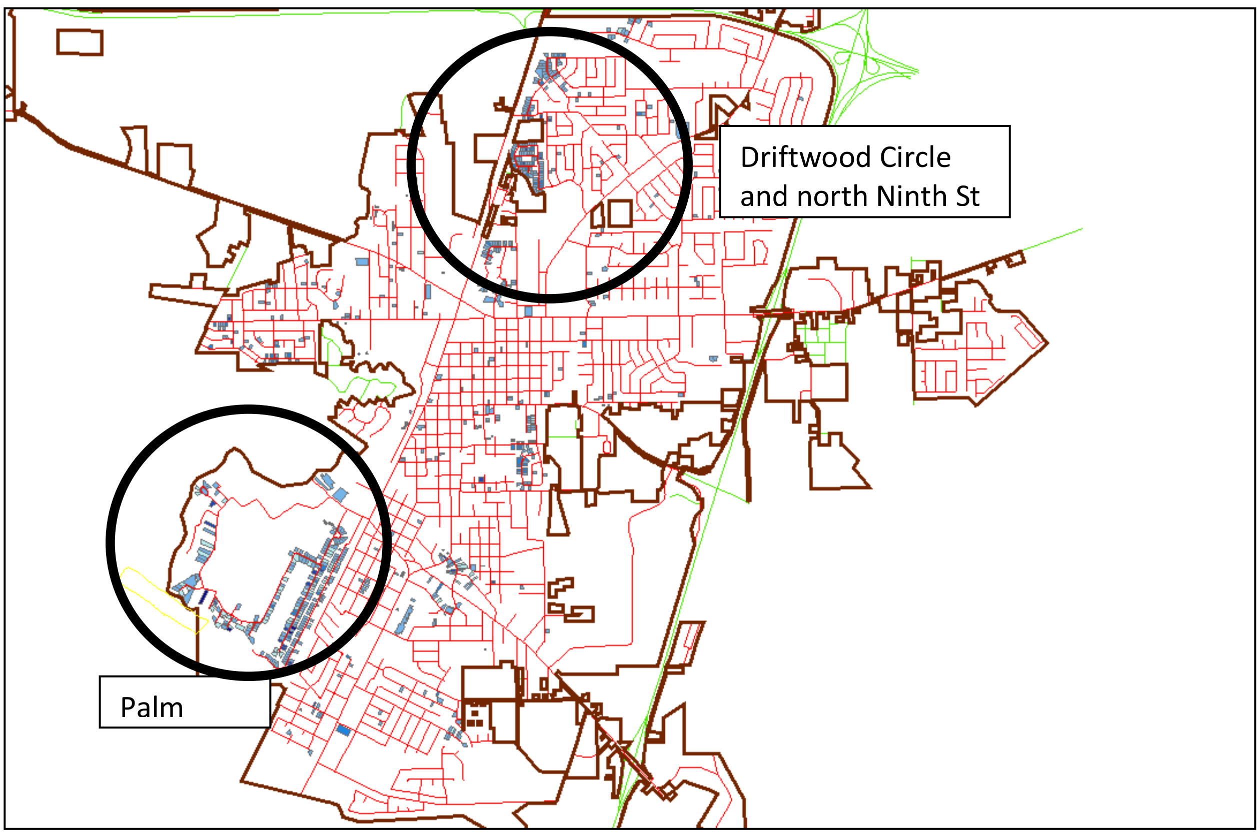


Figure 6.5. City of Slidell Repetitive Loss Areas.

Because the majority of the city is located in the SFHA, as Figure 6.6 illustrates, a policy of restricting development in or moving structures out of the SFHA is tantamount to abandoning the city. In fact, the city's goals are to infill and redevelop not abandon distressed areas located in the SFHA. To realize this goal the city focuses its efforts on mitigating the risks from hazardous weather conditions. Efforts range from elevating homes and businesses to improving drainage, drafting a new Unified Development Code (UDC), landscaping, and litter abatement programs.

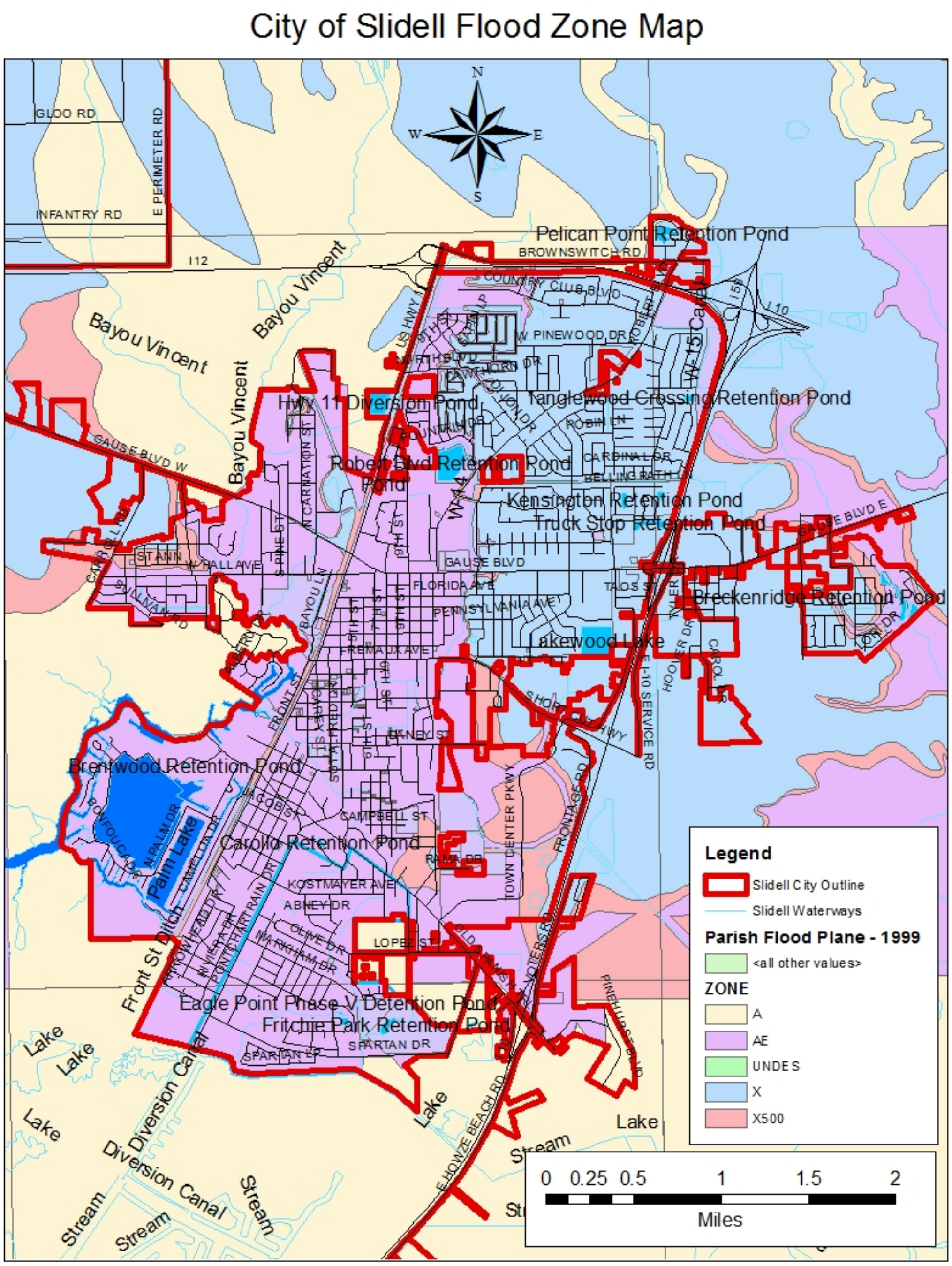


Figure 6.6. City of Slidell Special Flood Hazard Area.

Elevating existing homes above Base Flood Elevation (BFE) is a priority for the City of Slidell. Even before Hurricane Katrina, the city actively supported efforts by its residents and business owners to elevate. The preponderance of home elevations is in the Palm Lake area. Another cluster of home elevations has been ongoing in the north 9th Street area. A number of homes have also recently been raised in Olde Towne and its adjoining neighborhoods. Recently, the city chose to increase its home elevation efforts by participating in additional federal hazard mitigation grant program that will award at-risk homeowners grants to elevate. Grants will be awarded based on cost-benefit analysis, with the most at-risk homes getting priority. Over 150 residents submitted their applications and are awaiting notification.

While effective, elevating homes is not easy. Each elevation takes a long time, requires detailed coordination to implement, and is costly. The city is subsequently also pursuing policies and programs that protect larger groupings of homes and businesses. These efforts included passing and enforcing zoning, subdivision, flood protection, and storm water management ordinances. These ordinances allow the city to control where and what type of development occurs in the flood zone; provide guidance on how structures should be designed and located to reduce obstructions or deepen the flood zone; research how storm waters are channelized, retained, and slowly released; and understand how landscaping and litter abatement can reduce the risk of flooding. One key requirement is for all new or substantially improved sites to retain 10% more storm water post construction. Another key requirement is for vehicles to be parked on hard surfaces, so as to reduce the amount of silt runoff that reaches the sewer and drainage system.

The city has undertaken a number of capital improvement projects intended to reduce the threat of flooding. During 2012 and 2013, the city constructed improved barriers around its main outfall pumping station. Levees and embankments were heightened and strengthened to enable them to resist the dual pressure of backflooding from Lake Pontchartrain and the need to pump out large quantities of water accumulating as a result of persistent heavy downpours. The city also installed improved rakes and bar screens at its pumping stations to remove litter and debris from the water so that the outfall systems would not become clogged. The 2013 budget also included projects to clean and improve a number of the city's drainage lines to include ones that have caused problems in the past. These projects included Markham–Peachtree Drainage Line, Eastwood Line, and the W-15 Lateral Canal.

Landscaping and litter abatement are key elements of the city's mitigation efforts. One way the city is meeting its goal for all new or substantially improved developments to retain 10% more stormwater is through increased landscaping. Landscaping requirements include perimeter, parking lot, and pedestrian plantings. The retention and protection of mature trees is encouraged, since they are an existing way to absorb, hold, and slowly release floodwaters. To augment existing trees the city requires trees to be planted no more than 25 feet apart and that each tree have a corresponding number of shrubs. The increased landscaping not only improves the look of the city, it also expands the amount of green space and has attendant benefits to storm water management.

The city has an active beautification program overseen by Keep Slidell Beautiful, a non-profit city-supported organization dedicated to improving the city's appearance through planting and litter abatement programs. The side benefit for mitigation is better storm water management. Keep Slidell Beautiful plans and supports a twice-a-year citywide litter cleanup event as well as numerous neighborhood and school litter and beautification projects. Since the beginning of the program the city, has seen a 75% reduction in the litter it collects. This means less litter to clog the city's sewers and drains.

A challenge is the city's numerous ordinances and programs, which were adopted and implemented at different times and to meet differing needs. This reactionary method has led to a number of redundancies and gaps in coverage. To correct this oversight, the city is in the final stage of drafting and adopting a Unified Development Code (UDC). The UDC will supersede existing ordinances and put in place one integrated document that increases requirements, encourages good habits and discourages bad decisions, and makes it easier for design professionals, developers, and city employees to reduce the city's risk from natural hazards and to improve quality of life.

The City of Slidell's location, topography, and history make it susceptible to flooding. Moving structures out of and denying development in the SFHA is not an option if the City of Slidell is to survive and thrive. There is no near- or mid-term state or federal program that will protect the city. So the city has taken a more holistic and long-term approach to flood hazard mitigation. The city supports elevating homes and businesses above the BFE. The City invests a large portion of its budget in capital projects intended to reduce the threat from flooding by building permanent flood barriers, constructing temporary barriers when storms approach, cleaning and re-shaping drainage canals to improve flow, adding detention ponds to capture and control the release of storm waters, and landscaping and beautification to improve storm water management and quality of life. The combination of consistent and persistent mitigation efforts is reducing the city's residents' risk from flooding and new ordinances are making it easier for homeowners and businesses to rebuild in distressed flood susceptible areas safely.

Parish Mitigation Projects

Beauregard Parish

Project: Retrofit of courthouse, jail complex, and War Memorial Civic Center-window film protection and roof retrofitting project

Total Project Cost: $746,028

The Beauregard Parish Jail and Sheriff's Office was built in 1983. The complex is a single story prefabricated building and other metal construction with 26,795 ft^2 and is in good structural condition. The replacement value of the building estimated to be $2,944,997. Windows and doors along the building perimeter are not impact-resistant glass. During Hurricane Rita, the jail complex sustained substantial wind and rain damage to the exterior and interior and portions of the metal roof and ridge end caps. The Sheriff's Office received severe damage to the interior area, after which walls and ceilings had to be replaced.

This project will address necessary upgrades for the facilities to work effectively. The project will consist of (1) installing impact-resistant hurricane screens for the windows and doors, and (2) retrofitting the roof with a spray-on foam approximately 3 in. thick. This will address wallowed out holes and roof penetrations, which allow moisture from wind-driven rains. Accessible exterior walls will receive an 8 in.-thick vinyl-faced basseted system installed between the wall grits for additional protection.

The Beauregard Courthouse is a three-story masonry brick building that was constructed in 1914, and is in good structural condition. The building is 33,600 ft^2, and the replacement value of the building is approximately $10,920,000. Windows along the building perimeter are not impact-resistant glass. The existing exterior doors are not stormproof doors.

During Hurricane Rita, these critical facilities sustained substantial wind damage. Windows of the courthouse were broken, causing debris to enter, breaking light fixtures, and destroying equipment. Rainwater entered the building and damaged certain courthouse documents from the open windows and through leaks from the roof. This caused additional damage to the courthouse including damaging ceiling tiles in the main courtroom area.

The impact screens and doors have met strict standards along with codes and specifications. They provide continuous protection from wind-borne debris. It is much harder for the wind to get behind the windows and pull them off, which can occur with shutters and plywood. This project has addressed the necessary upgrades for a safe Governmental Building.

Caldwell Parish Residential Acquisition

Project: Caldwell Parish Residential Acquisition

Total Project Cost: $1,814,321

The residents of Caldwell Parish have been experiencing flooding and severe land scouring due to severe rain and tidal intrusions of the Ouachita River on the land by barge movement. This places the residents in imminent risk of losing their homes, damaging their homes, and jeopardizing health.

The proposed project consisted of the acquisition of 26 structures and the elevation of one structure, within the 100-yr. floodplain of Caldwell Parish. The acquired properties have been demolished and the land has been returned to open space. This project will prevent the homes along the Ouachita River from falling into the river, the potential injury or loss of life of these homeowners, and any future damages to the structures and to the NFIP.


Department of Health and Hospitals

Project: Generator Project

Total Project Cost: $32,000,000

The purpose of this project was to improve electrical power-generating capabilities prior to and immediately following a disaster and equip facilities with emergency power capability to power HVAC, operating suites, and other critical functions currently unavailable with existing generator capabilities. The highest priority for funds allocated in this grant is to assist statewide licensed hospitals and nursing homes, the state-operated Louisiana Megashelter in Alexandria, and the six Louisiana Strategic National Stockpile (SNS) receiving locations. Staging and storage sites for medicine and medical supplies help minimize the costly and dangerous processes of transporting, relocating, and evacuating frail and infirm patients. The sites also preserve temperature-sensitive medicines, medical supplies, medical equipment, and vaccines obtained during a disaster.

This project is consistent with the State of Louisiana's Hazard Mitigation Strategy and its guiding principles as expressed through its mission statement. Louisiana's Hazard Mitigation Strategy demonstrates the state's commitment to reduce risks from hazards, and serves as a guide for the state's decision makers as they commit resources to reducing the effects of hazards.

East Baton Rouge Parish Woman's Hospital Generators

Project: Woman's Hospital Four 2,000KVA Generators
Total Project Cost: $5,000,000

The Woman's Hospital Generator Project is part of a Statewide Generator Project that is providing generators for several critical facilities, including some that have already been approved for Department of Transportation and Development and Department of Health and Hospitals, with others still currently under FEMA review.

GOHSEP and local government throughout Louisiana recognize the importance of maintaining the key life and safety functions provided by critical facilities as key elements needed to assist in recovery efforts. Additionally, the protection of critical facilities is an integral part of the National Strategy for Homeland Security. The National Strategy identifies thirteen sectors that are essential to an effective response and recovery operation.

These sectors include but are not limited to the distribution of food, water, public health, emergency services, governmental services, information and telecommunications, energy, transportation, and banking and finance. The effective delivery of each of these services is dependent on the ability of communities to maintain key critical facilities before, during, and after major hazardous events. Each community is different, but the baseline of basic infrastructure must be maintained for the community to respond and recover from a disaster. The baseline should start with a community's ability to maintain and/or provide emergency power to pre-identified essential critical facilities before, during, and after a major event.

The scope for this work is to provide materials, labor, and equipment to permanently install four 2,000 KVA generators for the new Woman's Hospital facilities (the hospital is approximately 497,000 ft^2, the central plant approximately 24,000 ft^2, and the support services building approximately 69,000 ft^2). The work included multiple automatic transfer switches, circuit breakers, and related switchgear, along with the necessary wiring to distribute electricity and two 25,000 gallon fuel tanks. Also included will be a two-year warranty period associated with the equipment.

This emergency generator system is on the second floor of the central plant building. The main underground disturbances associated with this emergency generator system are the 70-ft. long piles supporting the foundation of the building and the nine to ten deep, concrete-encased, underground duct banks through which electrical service is routed from the generators to the hospital and support services buildings.

The function of this emergency generator system is to provide emergency standby power for all systems in the hospital and associated support services building when the facilities lose access to commercially provided electricity.

This generator program is intended to provide generators and related equipment to critical facilities and key state owned facilities throughout the State of Louisiana that are portable and or permanent. Hurricanes Katrina, Rita, Gustav, and Ike caused unprecedented power outages in most regions throughout Louisiana. Since electricity was limited or non-existent in most areas, the recovery efforts were slowed down tremendously. Furthermore, hospitals and nursing homes were evacuated because of the lack of electricity. Critical facilities can be defined as those facilities that are vital to the health, safety, and welfare of the population and that are especially important following a hazardous event. These facilities include, but are not limited to, the following: police stations, fire stations, hospitals and related medical facilities, water and waste water treatment facilities, and hazardous materials processing sites.

St. Tammany Parish Elevation

Project: House elevation

Total Project Cost: $928,510

William Lowery and his wife, Pomeroy, were among the first to apply for FEMA Funds after the surge from Hurricane Katrina brought the bayou up into their home. Their house is a "Creole Cottage," a low house that could not be put up on exposed piers and remain historic. The area was a work site where Francois Cousin made bricks for the oldest home in St. Tammany Parish (now called the Lowry House), which was built by the French entrepreneur in 1789. The house is listed on the National Register of Historic Places.

The home was inundated with 5.5 ft. of water and needed to be elevated with new pilings, foundation work, plumbing, and wiring. Hurricanes Ike and Gustav brought floodwaters under the home, along with more electrical damage. Restoration of the Francois Cousin home has involved the State Historic Preservation Office (SHPO), the National Park Service, archaeologists, architects, and contractors. During the elevation, more than 1,000 historic artifacts excavated during the elevation have been sent from the site to the State Historic Preservation Project.

TANGIPAHOA PARISH GOVERNMENT BUILDING REPAIR

Project: Wind Retrofit

Total Project Cost: $204,555

The Governmental Building serves as a critical facility for Sheriff, Assessor, Registrar of Voters, and other parish offices. During emergency situations, this building is used as a post-disaster recovery center. Based on the limited site investigation, the building is in good structural condition, including its roof, walls, and doors. The windows are not impact-resistant glass, and the existing exterior doors are not wind-rated/stormproof doors, thus providing a hazard risk to this critical facility.

Window protection and hardening of exterior doors was completed with final inspection on April 4, 2013.

Screens

Screens/Shutters

TOWN OF JEAN LAFITTE

The Town of Jean Lafitte is located in the southern part of Jefferson Parish near Barataria Bay. Because of its proximity to the Gulf of Mexico and New Orleans there are challenges but also many opportunities for Jean Lafitte.

The current levee system in Jean Lafitte provides insufficient water protection against flooding in the case of weather events even as relatively minor as Tropical Storm Lee. While the Town is working hard to secure federal and state funds to bolster the levee, those funds are not guaranteed.

Insurance costs in Jean Lafitte are very high. In many cases homeowners spend more for insurance than home mortgages. While high insurance premiums may be partially mitigated by lower housing prices, they, along with the limited levee protection, are significant deterrents to attracting businesses to the area.

Jean Lafitte's proximity to New Orleans plays an important role in marketing the Town as both a nearby tourist destination and as an attractive small town community away from the hustle and bustle of a large city. For New Orleans' residents, Jean Lafitte represents an excellent opportunity to take a day trip south and explore the bayou. For tourists visiting New Orleans, a trip to Jean Lafitte offers an opportunity to experience the fishing and bayou culture of southern Louisiana not found elsewhere. And for Jean Lafitte residents, New Orleans provides a larger economic and employment base they can take advantage of while living in Jean Lafitte.

Several events and key attractions draw tourists to Jean Lafitte on a regular basis. Bayou and fishing tours are staples of the tourism industry while events such as the annual "Blessing of the Fleet" and the Jean Lafitte Seafood Festival are also popular. Attractions are both a source of local economic revenue and a source of local pride and identity. Community residents expressed a desire to show their Town to visitors to help teach "the essence of Louisiana" found in Jean Lafitte.

To address these challenges and opportunities to assist Jean Lafitte in becoming more resilient in the future, Louisiana's independent non-profit Center for Planning Excellence (CPEX) partnered with the Office of Community Development Disaster Recovery Unit and the Town of Jean Lafitte to create a Comprehensive Community Resiliency Plan for Town of Jean Lafitte—Jean Lafitte Tomorrow. The public plan development process received input from more than 20 percent of Jean Lafitte's residents and was guided by a professional planning team (Figure 6.7).

Figure 6.7. Public meeting in Jean Lafitte to solicit ideas and desires from the residents of Jean Lafitte for the development of the Jean Lafitte Tomorrow Plan.

The planning team consisted of experts in transportation, architecture, engineering, water management, and town planning who visualized and formulated the ideas and visions of Jean Lafitte's residents. In this process, experts looked holistically at soil conditions, drainage, existing land use, FEMA flood maps, proposed levees, and historic architecture to determine the best future development and redevelopment of Jean Lafitte. Through this process, two Priority Development Areas (PDAs) emerged.

The team inventoried existing land uses, including residential, commercial, and civic/park land uses (see Figures 6.8–10). The team also examined which sections in Jean Lafitte and surrounding areas are undeveloped (see Figure 6.11) and the FEMA flood map profile for the area (see Figure 6.12). Additionally, the team investigated how soils and drainage have made up the area geologically (see Figures 6.13–15). Using these datasets and maps, the team informed the location of the PDAs (see Figure 6.16).

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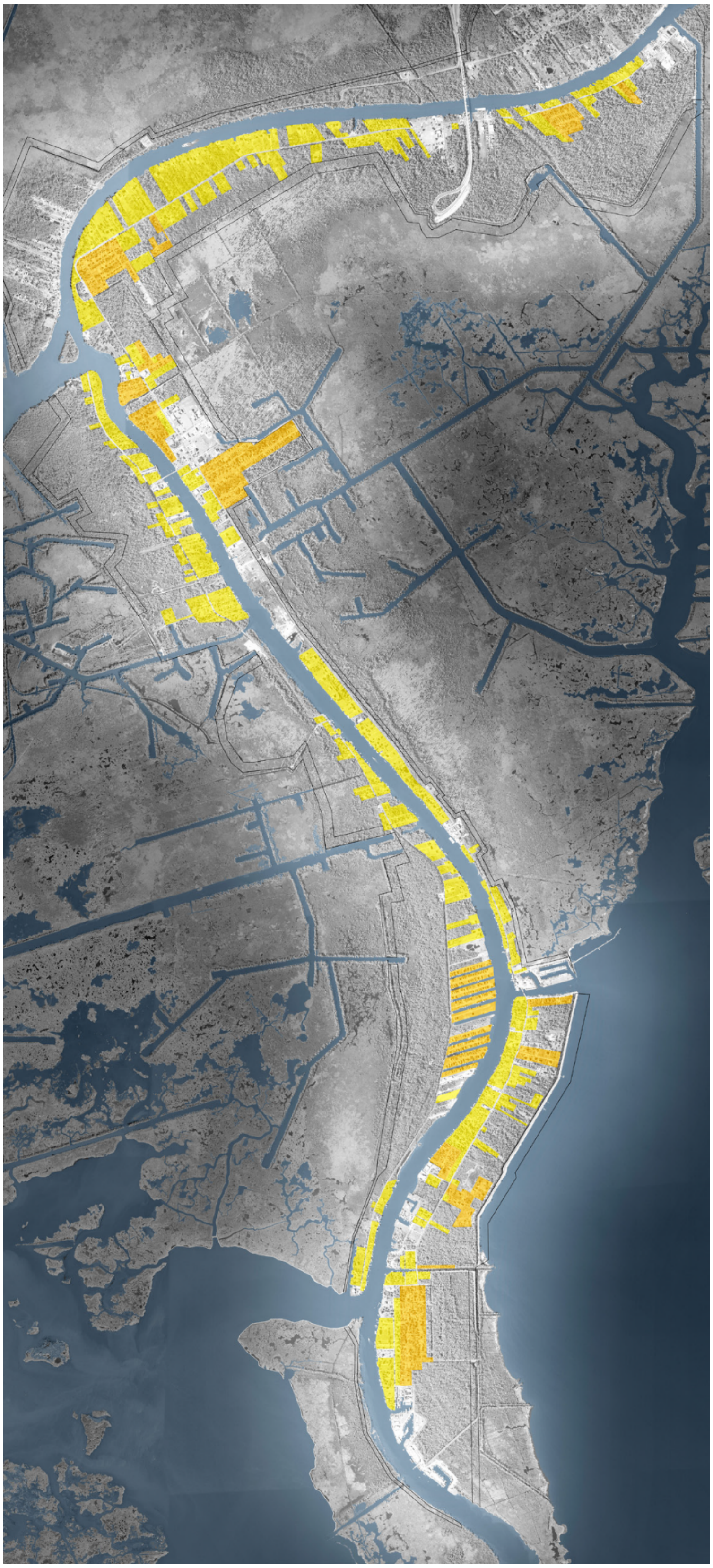

Figure 6.8. Existing residential land use map for the Jean Lafitte area.

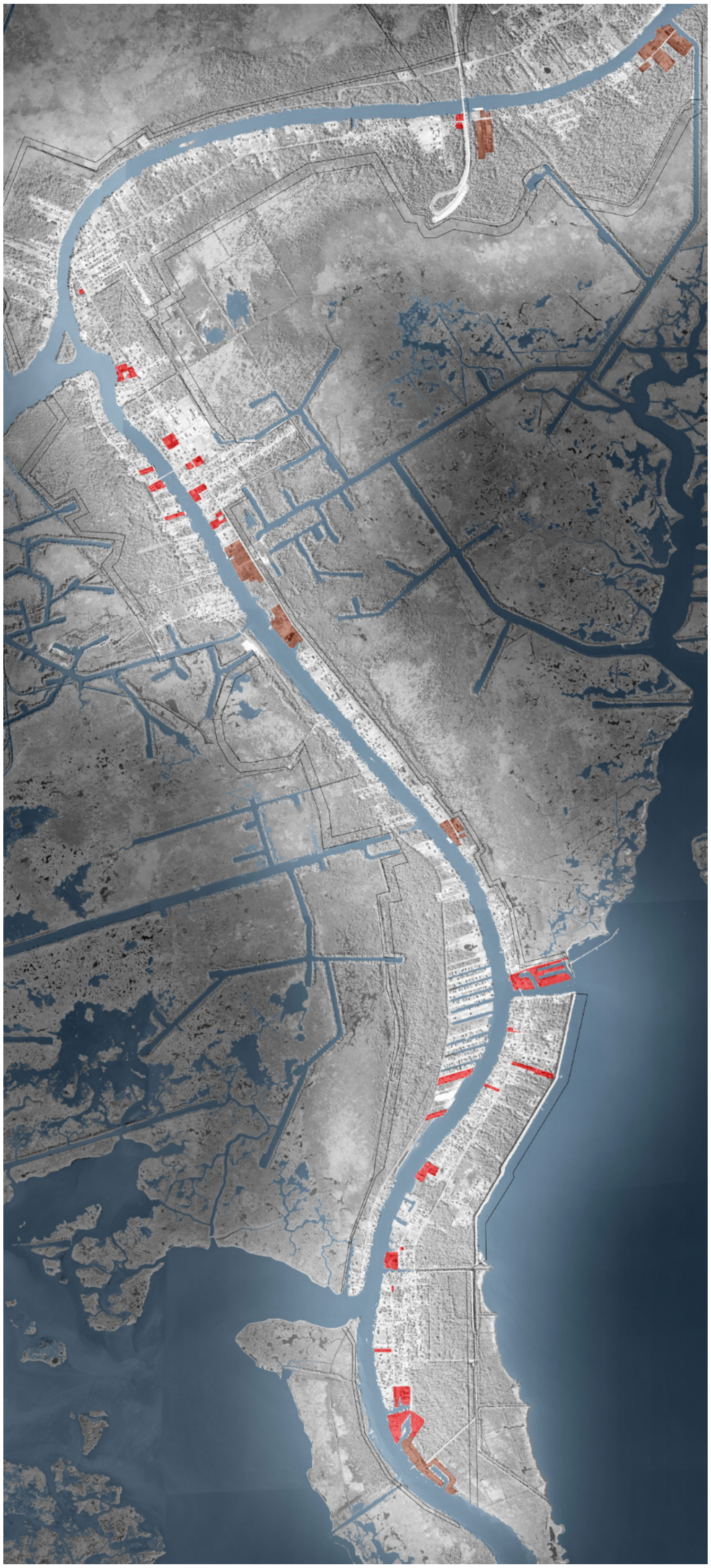

Figure 6.9. Existing commercial and industrial land use for the Jean Lafitte area.

Figure 6.10. Existing civic and park land uses for the Jean Lafitte area.

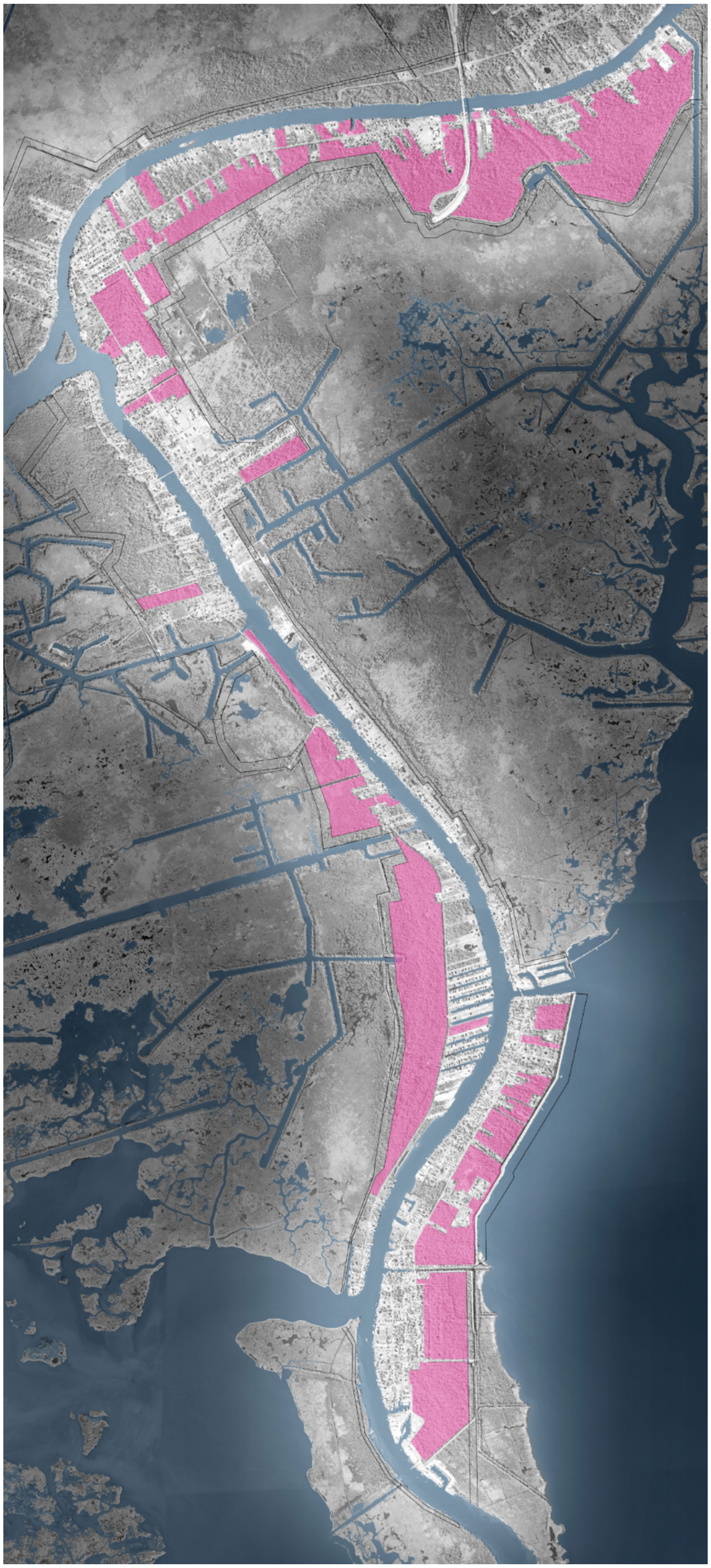

Figure 6.5. Existing undeveloped land for the Jean Lafitte area.

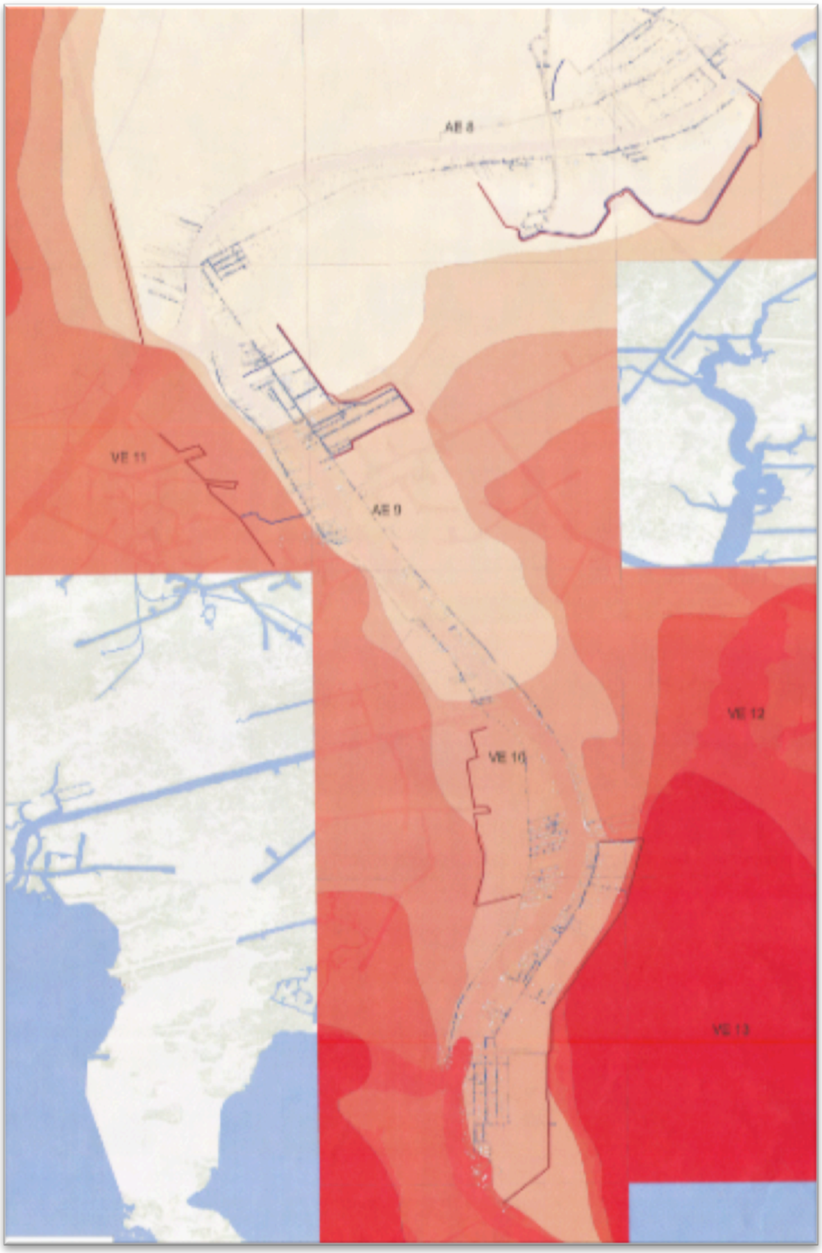

Figure 6.6. FEMA flood map for the Jean Lafitte area.

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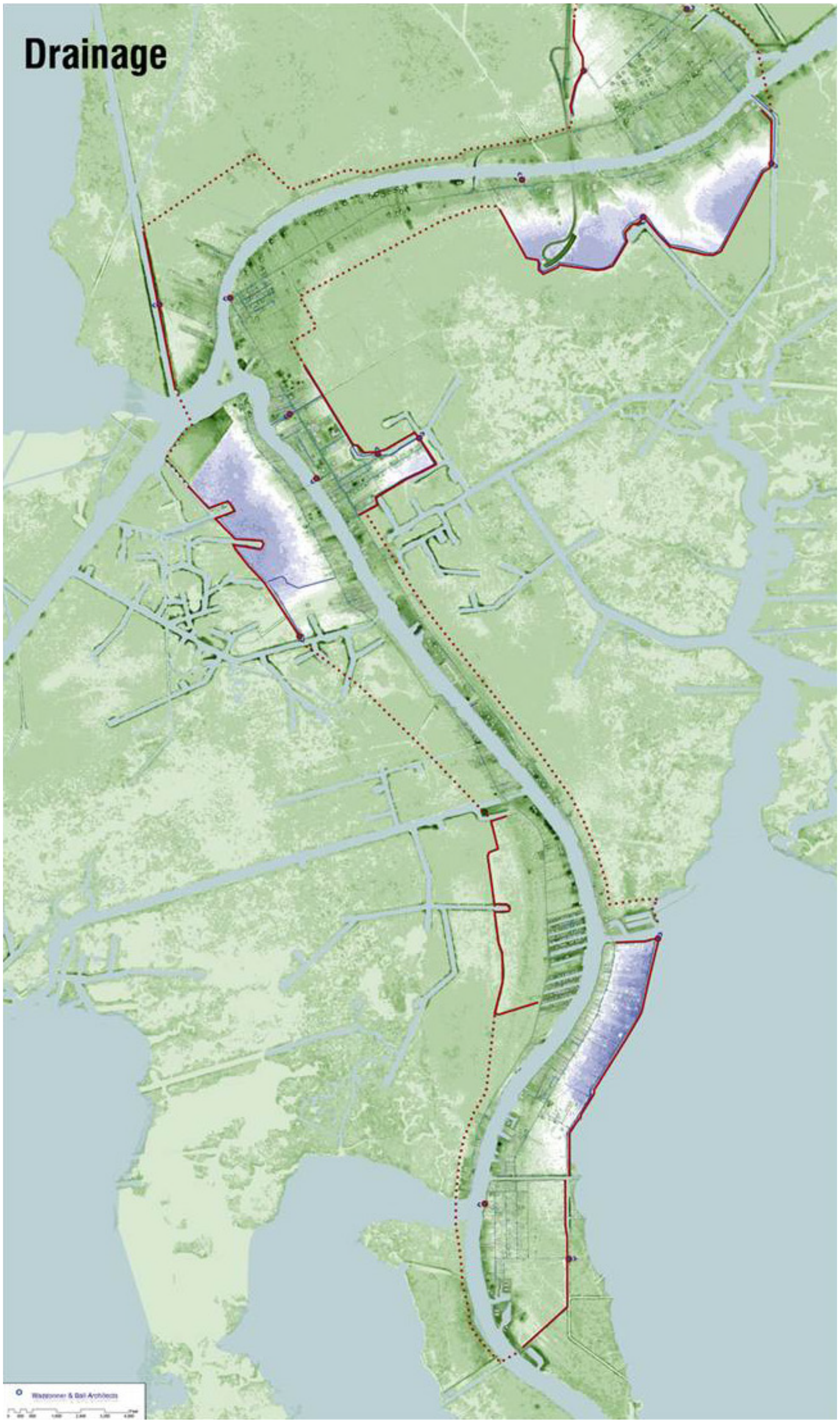

Figure 6.13. Drainage profile for the Jean Lafitte area.

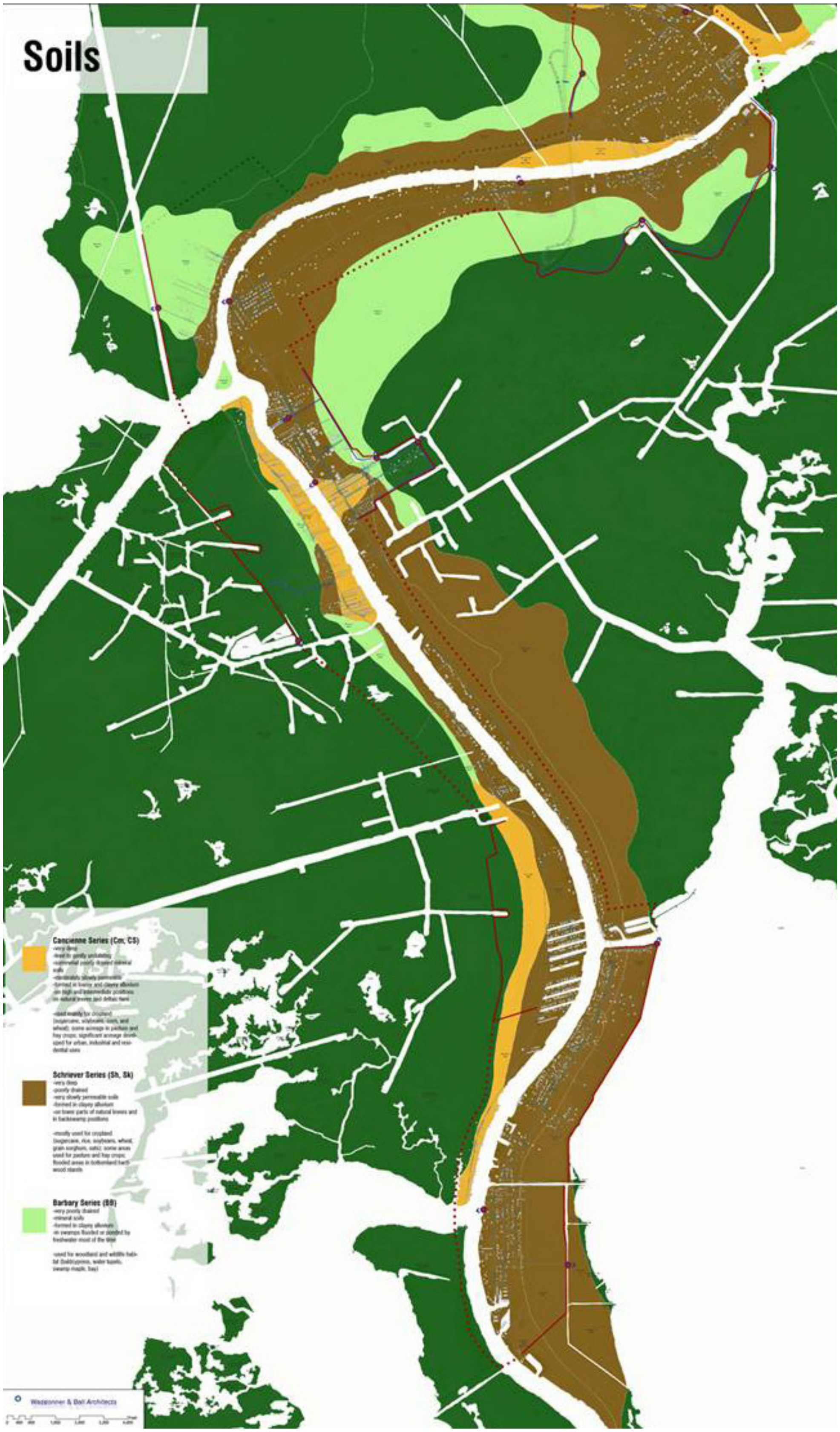

Figure 6.14. Soils profile for the Jean Lafitte area.

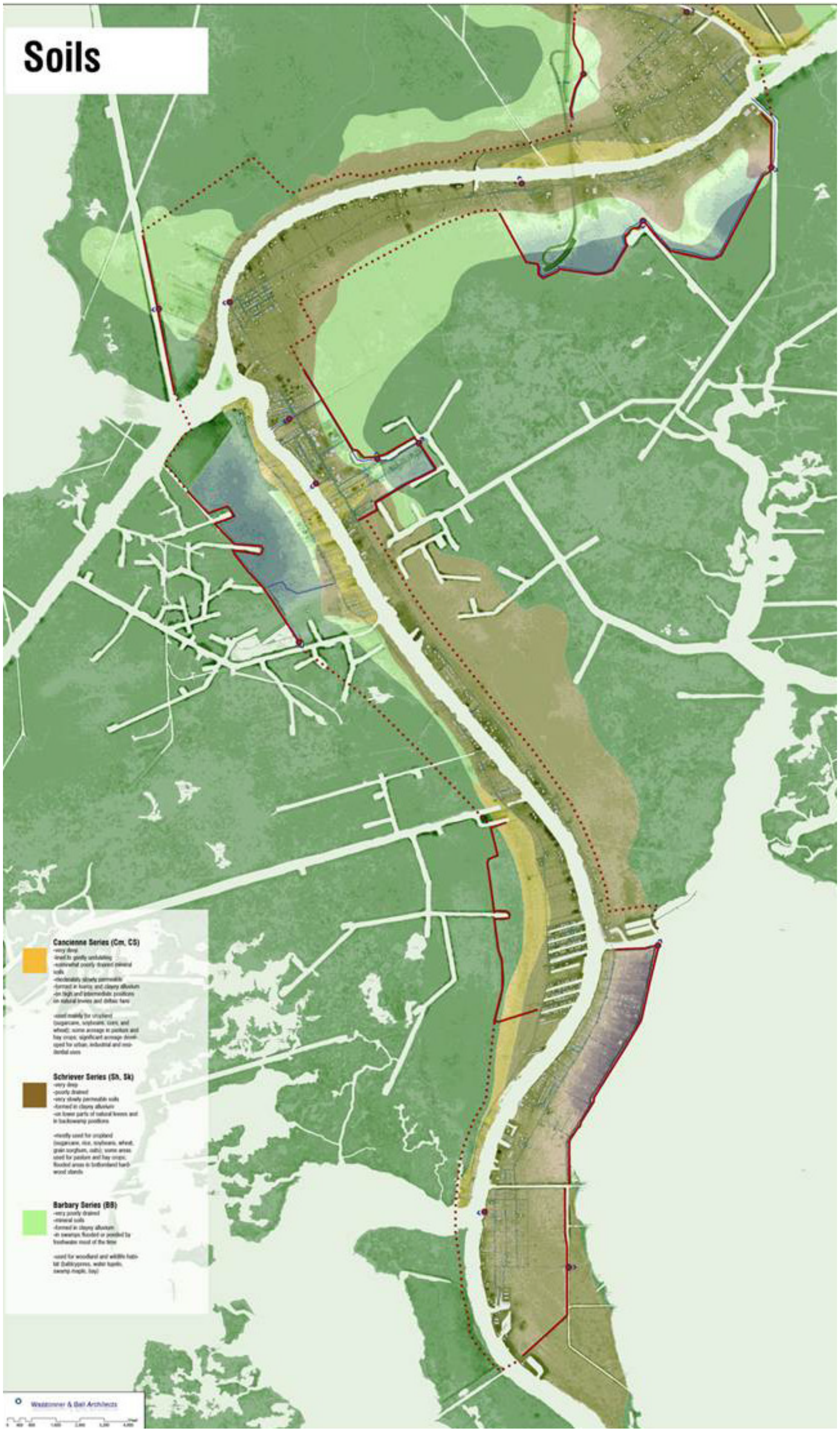

Figure 6.15. Overlay of soils and drainage profiles for the Jean Lafitte area.

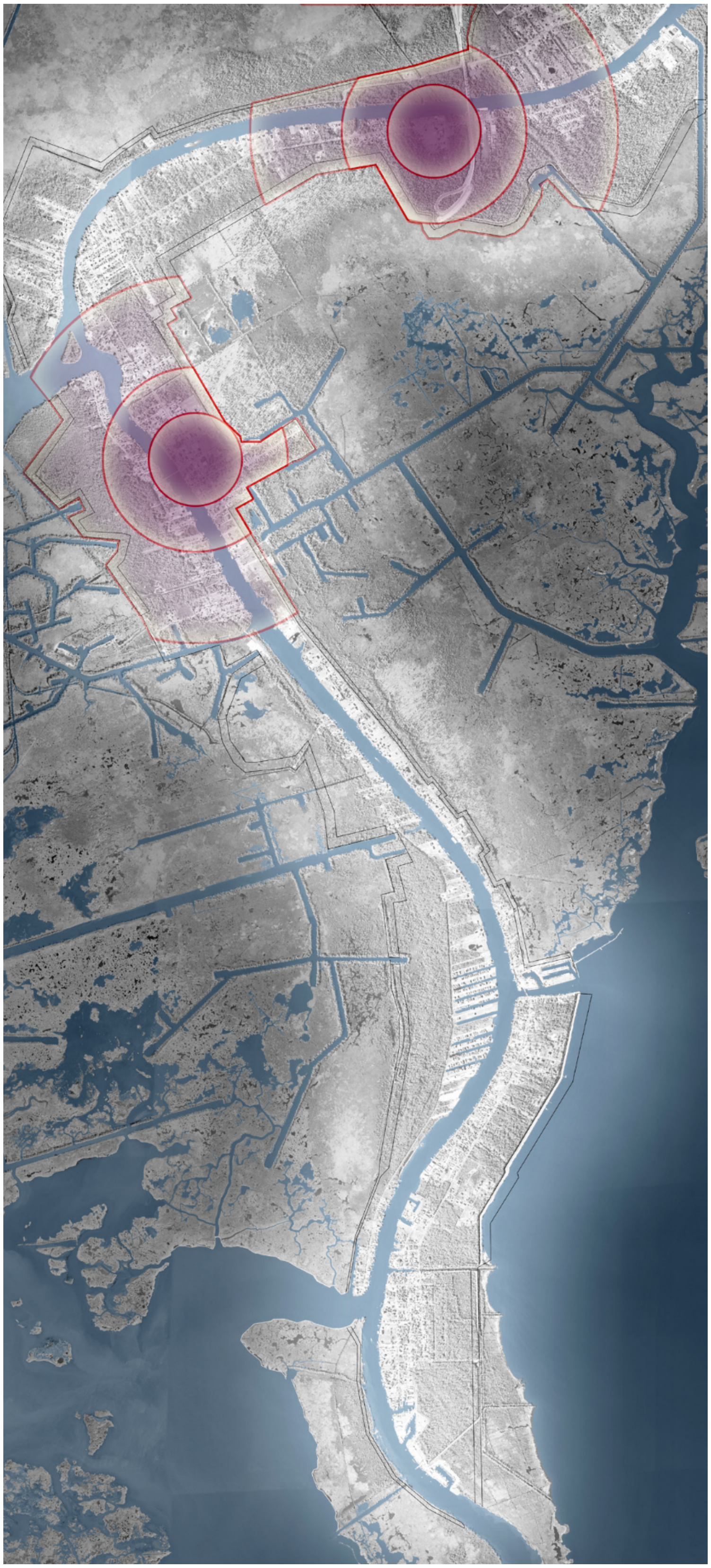

Figure 6.76. PDAs for the Jean Lafitte area.

During the public meetings, it became evident that, for many residents, construction of a ring levee is essential for the Jean Lafitte community to survive. Since a ring levee is also laid out in the State's Master Plan for a sustainable coast 2012, the team further investigated possible solutions for wiser water management. In response, the team looked to the drainage terrace approach to store water and combat subsidence (Figure 6.17). The Jean Lafitte community together with the team also determined a possible site for the needed reservoir (Figure 6.18). Implementing this approach to water management coupled with the Priority Development Areas will allow Town of Jean Lafitte to become more resilient and sustainable in the future.

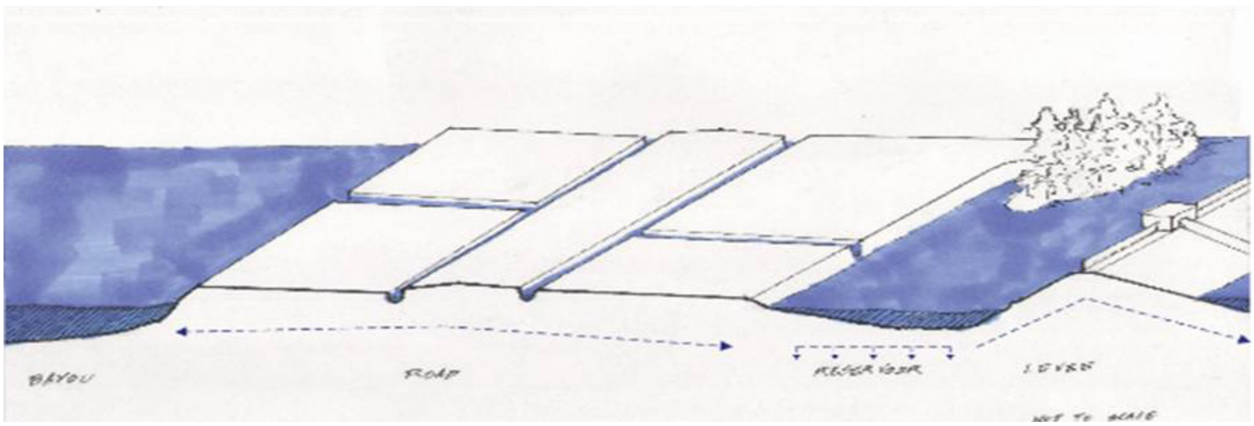

Figure 6.87. The Drain Terrace System has a large water catchment area, known as the reservoir, within the levee to store water and prevent the speed of subsidence. Water still uses gravity to drain away from higher land to both the bayou and the reservoir. However, the reservoir is able to hold more water, therefore allowing the pumps to be used less often. In typical conditions, the pumps would not be necessary because water would be stored within the reservoir or the bayou until it is able to percolate back into the ground. In order to utilize this type of system in Jean Lafitte, some areas of wetland would need to be captured within the levee system, cutting it off from the rest of the surrounding wetlands.

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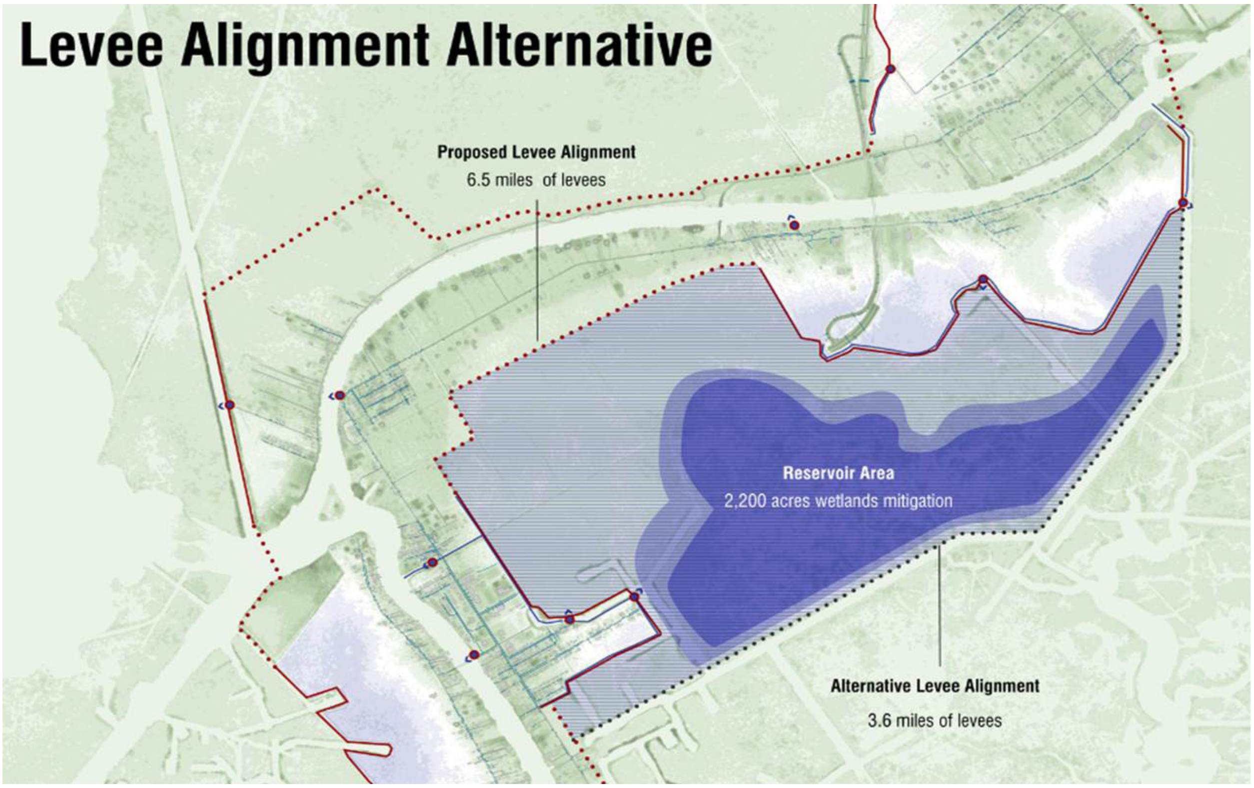

Figure 6.98. Alternative levee alignments would store water in place. Though they currently come into conflict with the Clean Water Act and require the payment of substantial mitigation fees, these ideas should continue to be discussed until federal policy changes to allow them.

A. Planning Process

Purpose

The Code of Federal Regulations (CFR) requires every state to have a State Mitigation Plan that is approved by the Federal Emergency Management Agency (FEMA) if it is to receive non-emergency Stafford Act assistance and FEMA mitigation grants.[lxxxvi] The section of the code pertaining to State Mitigation Plans lists seven required components for each plan: a description of the planning process; risk assessments; mitigation strategies; a description of coordination of local mitigation planning; a method and system for plan maintenance; verification of plan adoption; and assurances of state compliance with the plan. This Appendix details the planning process to demonstrate Louisiana's observance of §201.4's suggestions that the planning should include "coordination with other State agencies, appropriate Federal agencies, interested groups, and…[integration] with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives."

The Disaster Mitigation Act of 2000 provided a strong incentive for the development of a Standard State Hazard Mitigation Plan. Thus the State of Louisiana, through the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), began the process of developing the first State Hazard Mitigation Plan in 2003. The planning process began in May 2004 and the plan was adopted by the Governor and approved by FEMA on April 26, 2005.

Planning

To comply with Emergency Management Accreditation Program (EMAP) requirements, an interim update of the plan was prepared by GOHSEP in 2007. This update included improving integration between this plan and the state Emergency Operations Plan (EOP) and Continuity of Operations Plan (COOP). The Update was presented to and approved by the State Hazard Mitigation Team (SHMT) in 2007. This Update consisted of updating all sections of the 2005 Plan using the best available data and methodologies, culminating with FEMA approval in April 2008. These changes were integrated into the 2011 update, as well, and have been brought forward.

Currently, plan updates and FEMA re-approvals are required every three years. Thus, the process to update the plan a second time was formally initiated in December 2009. The scope of work initiated by all participants consisted of updating each section of the 2008 Plan using the best available data and methodologies, culminating with FEMA approval on April 7, 2011. The process for updating the plan this third time began in early 2013.

It is GOHSEP's duty to ensure that preparations of this state will be adequate to deal with emergencies or disasters and so the Strategic Plan was updated July 1, 2013. GOHSEP strives to continue to improve Louisiana's (1) preparation for, (2) response to, and (3) recovery from the next emergency. To become better prepared, Louisiana needs protected communities that are prepared to respond to emergencies and disasters. To do this, the state must have emergency response capabilities which focus on the protection of life, property, and the environment. Further, it is vital for the state to have the capabilities to execute and sustain safe and timely recovery from emergencies and disasters. All of GOHSEP's existing programs support these goals and are essential to the State's efforts, to protect its citizens, and to create a resilient infrastructure.

The Plan Maintenance Section of the State Plan states that the Plan will be done by the State Hazard Planning Committee (SHMPC), and this plan is supported by GOHSEP despite the fact that no mandate exists for it (since the 2004 Executive Order by Governor Blanco that gave the mandate has been dissolved). As directed by the Governor or Governor's Authorized Representative, the SHMPC should:

- Direct the development of the plan
- Act as a voice for the state
- Convene stakeholders (including state, local, and non-profit agencies) for meetings in large attendance since their feedback is necessary to facilitate an effective planning process
- Comment on drafts (through www.freecamp.com, which is similar to a sharepoint website that includes all drafts and communication done through the plan update process).
- Publish all presentation and meeting notes on the freecamp website.

The SHMPC met on six separate occasions while developing the 2014 Plan Update. Table A1 provides a summary regarding the six meetings that contributed to the current update of the plan.

SHMPC 2014 Update Meetings by Date			
Meeting Number	Date / Place	Subject	Participants
1	March 13, 2013	SHMPC Meeting #1—Kick off meeting	GOHSEP, SHMPC & Consultants
2	May 03, 2013	SHMPC Meeting #2—Hazard Profiles	GOHSEP, SHMPC & Consultants
3	April 07, 2013	SHMPC Meeting #3—Review of Profiles and Ranking	GOHSEP, SHMPC, Key Stakeholders & Consultants
4	October 10, 2013	SHMPC Meeting #4—Risk Assessment	GOHSEP, SHMPC & Consultants
5	November 7, 2003	SHMPC Meeting #5—Mitigation Strategy (Goals and Actions)	GOHSEP, SHMPC, Key Stakeholders & Consultants
6	December 20, 2013	SHMPC Meeting #6—Draft Review	GOHSEP, SHMPC, Key Stakeholders & Consultants

These workshops and meetings were facilitated by GOHSEP and its consultants. Prior to these meetings, the SHMPC and key stakeholders received packets of information that were subsequently presented and discussed at the meetings. The products were also distributed for access to those who could not attend the meetings. GOHSEP also posted information on the "Get a Game Plan" website for review and comment through a collaborative interface. Each section of the plan was discussed at Plan Update meetings, where comments and questions were encouraged from all attendees. After the presentations, the SHMPC reviewed modified proposed elements of the Plan Update for possible inclusion. A full draft of the Plan Update was circulated to SHMPC state agencies and key stakeholders for final review and comment. Prior to submitting the Plan Update to the Governor, the SHMPC took a formal vote to approve and recommend the Plan Update for adoption.

A number of individuals and agencies played key roles in preparing the entire Plan Update including:

- Governor's Authorized Representative State Hazard Mitigation Planning Committee (SHMPC)
- State Hazard Mitigation Stakeholders Group
- Federal Emergency Management Agency, Region VI
- Consultants from Louisiana State University

The Governor's Authorized Representative was responsible for authorizing the SHMPC to develop the State of Louisiana Hazard Mitigation Plan; reviewing the recommendations of GOHSEP and the SHMPC to adopt the plan on behalf of the state; requesting revisions to the plan's contents if deemed necessary; and formally adopting the plan.

GOHSEP was the lead state agency for developing the Plan Update, with specific responsibility for project management resting with the State Hazard Mitigation Officer. Although the SHMPC was responsible to the Governor's Authorized Representative for the actual development and production of the Plan Update, GOHSEP performed an important coordination function throughout its development. GOHSEP directly supervised the consultants' activities and facilitated the involvement of the SHMPC members. GOHSEP also provided important oversight and quality control to ensure that the plan and the associated process met federal requirements. At the end of the process, GOHSEP provided a formal recommendation for the Governor's Authorized Representative to adopt the Plan Update.

At GOHSEP, the SHMT was responsible for developing, reviewing, and approving the 2005 Plan; the 2007 Interim Plan Update; the 2008 Plan Update; and the 2011 Plan Update. The present 2014 Plan Update was developed by the SHMPC according to principles it decided at its first meeting on March 13, 2013. The SHMT and the SHMPC decided the plan would not be developed by an outside contractor, but rather by GOHSEP itself. In addition, the SHMT decided to streamline information from the 2011 to make the Plan Update a workable and living document.

At present, the SHMPC is composed of the following state agencies and key stakeholders:

- GOHSEP
- Department of Transportation and Development (DOTD)
- Department of Wildlife and Fisheries (DWF)
- Department of Environmental Quality (DEQ)
- Governor's Office of Coastal Activities (OCA)
- Department of Natural Resources (DNR)
- Department of Agriculture and Forestry (DAF)
- Division of Administration, Office of Risk Management (DOA-ORM)
- Division of Administration, Office of Community Development, Disaster Recovery Unit (DOA-OCD-DRU)
- One Office of Emergency Preparedness Director representing GOHSEP Regions 1,2,3,4 and 9
- One Office of Emergency Preparedness Director representing GOHSEP Regions 6,7 and 8

This team's duties and functions include (but are not limited to) identifying the state's vulnerability to hazards; reviewing existing mitigation plans and prioritizing recommendations; developing or updating Hazard Mitigation Plans; developing a comprehensive strategy for the development and implementation of a State Mitigation Program; reviewing, assigning priority, and recommending mitigation actions for implementation; and seeking funding for implementation of mitigation measures. Additionally, an agreement between FEMA, GOHSEP, and the Department of Culture and Restoration was signed on December 12, 2007 to help owners of historic homes protect their properties from the risk of future disasters while retaining character-defining architectural features. Therefore, GOHSEP planned for this update to include information on cultural resources and historic preservation topics. Risk assessments have been completed on several Historic Properties and integrated into this Plan.

The primary audience for the Plan Update was taken into consideration at all stages. Their input was also solicited at various stages of the process. The term "stakeholders" includes the following:

- GOHSEP Regional Coordinators
- Parish Offices of Homeland Security and Emergency Preparedness
- Parish and local Floodplain Administrators
- Parish and local Coastal Zone Administrators
- Parish and local Building Officials
- State agencies with at-risk facilities

The term "local" as used in this plan includes parishes, municipalities, and tribal governments. Although federally recognized tribes have specific rights under DMA 2000 to be recognized as the equivalent of a state for planning purposes, all of the federally recognized tribes in

Louisiana participating in hazard mitigation planning have done so participating as jurisdictions under a parish-level, multi-jurisdictional hazard mitigation plan.

FEMA, through its Region VI office in Denton, Texas, is the responsible party for reviewing the plan for compliance with DMA 2000 and the CFR. Representatives of FEMA Region VI also helped facilitate completion of this plan through on-going review of the plan as it was developed and updated.

The consultants for the 2014 Hazard Mitigation Plan Update were a group from Louisiana State University, comprising Dr. Carol Friedland, Dr. Robert Rohli, Dr. Andrew Joyner, Dr. Kristopher Mecholsky, Shandy Ogea, Joshua Gilliland, Dr. Lynne Carter, and Seyed A. Madani. The consultants assisted in a variety of ways, including the following:

- Assembling information for inclusion in the plan
- Editing previous editions of the plan
- Writing new material as needed
- Providing technical support in profiling the hazards and in performing the risk assessments
- Developing written materials for meetings
- Making presentations at THE SHMPC meetings and workshops
- Providing support for outreach to interested parties and coordination efforts among federal and state agencies

COORDINATION AMONG AGENCIES

The CFR requires that states describe how federal and state agencies were involved in the planning process. It also requires that states describe how interested groups and individuals were involved in the planning process.

For the purposes of this Plan Update, a distinction is made between stakeholders and interested parties. “Stakeholders” are primarily organizations and agencies that will potentially play a direct role and/or receive a direct benefit in implementing the recommendations in the Mitigation Action Plan. Interested parties include anyone else who could potentially benefit either directly or indirectly from the Plan Update recommendations. This primarily refers to residents, property owners, and business owners in the State of Louisiana.

This subsection describes the following:

- the involvement of other Federal and state agencies and stakeholders
- the process by which GOHSEP and the SHMPC coordinated various agencies, stakeholders, and interested parties during the plan update’s development

FEMA and the state agencies that are members of the SHMPC had regular involvement in developing the Plan Update. GOHSEP and the SHMPC also sought participation from additional federal and state agencies and stakeholders while developing the Plan Update. As part of this process, the participation of universities, private citizens, businesses, and non-profit and non-governmental organizations was solicited.

In addition, contacts were made with federal and state agencies to inform them of the Plan Update and to for ask for assistance in providing the most current data. These agencies included the following:

Federal Agencies

- US Department of Defense, U.S. Army Corps of Engineers
- US Environmental Protection Agency
- US Department of the Interior U.S. Geological Survey
- US Department of Commerce National Oceanic and Atmospheric Administration
- US Department of Agriculture Natural Resources Conservation Service
- US Department of Agriculture Census
- US Department of Commerce, U.S. Census Bureau
- US Department of Education
- US Department of Homeland Security, U.S. Coast Guard, National Response Center

State Agencies

- Division of Administration (DOA)
- Department of Culture, Recreation and Tourism
- Department of Economic Development (LED)
- Department of Insurance (DOI)
- Department of Justice
- Department of Labor
- Department of Public Safety and Corrections (DPS)
  - Office of State Police
  - Office of Youth Development
- Department of Revenue
- Department of Social Services
- Department of State
- Department of the Treasury
- Department of Veterans Affairs
- Louisiana State University System
- Louisiana Technical College System
- University of Louisiana System
- Louisiana State University Health Sciences Center
- Southern University System

Correspondence to the agencies also indicated the desire of GOHSEP and the SHMPC to establish long-term partnerships as part of implementing the plan's recommendations.

In addition to contacts made with stakeholders, correspondence similar to that sent to the federal and state agencies was sent to all 64 parish emergency management agency directors, as well as parish and community floodplain administrators. Various stakeholders were contacted to assist with the plan update. Selected groups were asked to provide subject matter expertise and they were asked to review and provide comments on relevant sections of the plan.

PROGRAM INTEGRATION

The CFR requires that states describe how their mitigation planning process is integrated with other ongoing state planning efforts, as well as FEMA mitigation programs and initiatives. Thus, this subsection describes State Mitigation Programs and Initiatives and FEMA Mitigation Programs and Initiatives.

A measure of integration and coordination is achieved through the participation of representatives of state agencies on the SHMPC who administer three programs: floodplain management under the National Flood Insurance Program (NFIP), coastal protection and restoration under the provisions Act 8 of the First Extraordinary Session of 2005, and the State Uniform Construction Code. Furthermore, in order to achieve EMAP compliance, a number of refinements and changes were submitted to and approved by the State Hazard Mitigation Team for the Plan Update in late 2007. These changes have been brought forward through the 2011 Plan Update and the current 2014 Plan Update, and will be integrated into subsequent plan updates.

The Department of Transportation and Development (DOTD) administers the NFIP within the State of Louisiana. The state NFIP Coordinator (the DOTD representative on the SHMPC) and staff provide technical assistance visits to local municipalities to advance hazard mitigation planning concepts and advise communities how to best meet certain Community Rating System requirements. They work directly with local floodplain management officials and planners to emphasize the links among land use, comprehensive planning, and hazard mitigation planning.

In response to the hurricanes of 2005, under Act 8 of the First Extraordinary Session of the 2005 State Legislature, the State Legislature established the Coastal Protection and Restoration Authority (CPRA) as the single state entity with authority to articulate a clear statement of priorities and to focus development and implementation efforts to achieve comprehensive coastal protection for Louisiana. Moreover, the CPRA is meant to "provide aggressive state leadership, direction, and consonance in the development and implementation of policies, plans, and programs to achieve comprehensive integrated coastal protection," which includes encouraging multiple uses of coastal areas “achieve a proper balance between development and conservation, restoration, creation, and nourishment of renewable coastal resources.”[lxxxvii]

The CPRA was formed through the integration of two state agencies—the Department of Natural Resources (DNR), which directed coastal restoration activities, and the Department of Transportation and Development (DOTD), which coordinated coastal flood control measures. It is comprised of the CPRA Board and the implementation agency located within the Governor’s Office. The CPRA Board is made up of members from the following departments, agencies, and liaisons:

- Department of Natural Resources (DNR)
- Department of Wildlife and Fisheries (DWF)
- Department of Environmental Quality (DEQ)
- DOTD
- LED
- DOA
- Department of Agriculture and Forestry (LDAF)
- DOI
- Governor’s Office for Coastal Activities (GOCA)
- Governor's Advisory Commission on Coastal Protection, Restoration, and Conservation
- GOHSEP
- Seven representatives of levee districts in the state’s coastal zone
- Selected state congressional members and other parish leaders

Along with a subsequent constitutional amendment, Act 8 also dedicated existing and future state monies to the Coastal Protection and Restoration Fund within the state treasury in order to provide a dedicated, recurring source of revenue for hurricane protection and coastal restoration. The fund is comprised of annual mineral revenues derived from the production of exploration for minerals; other additional funding sources may be included as well. The act also mandated the development of a comprehensive Master Plan every five years, in addition to an annual plan, both of which establish clear priorities for activities and expenditures for the promotion of hurricane protection, storm damage reduction, flood control, conservation, and restoration of the coastal area. The CPRA’s mandate is to develop, implement, and enforce their plan, which recognizes the important role of coastal restoration, structural protection, and nonstructural protection in an integrated hurricane and flood protection strategy.

Louisiana adopted the Louisiana State Uniform Construction Code (LSUCC) in 2005, and it was effective immediately for eleven of the parishes most severely affected by hurricanes that year. The code was adopted statewide in 2007, as recommended in the 2005 Plan Update. Although administered and enforced at the local level, the LSUCC is given program support by the state Department of Public Safety through the Louisiana State Uniform Construction Code Council (LSUCCC). The Plan Update incorporates the LSUCC as a key part of the State of Louisiana Hazard Mitigation Strategy.

There are also several initiatives that have fostered further coordination and integration of the SHMPC, such as the State of Louisiana's Emergency Operations Plan (EOP), which was developed to address the roles and responsibilities of state and non-governmental (NGO) partners in responding to all threats and hazards but especially those outlined in the State Hazard Mitigation Plan. Planners have ensured that coordination efforts between the two plans range from seeking consistency in the way hazards are identified to identifying opportunities to integrate mitigation practices in response and recovery operations. Additional ongoing efforts by the SHMPC to create a comprehensive updated plan include utilizing materials from EOP Attachment 2 (Hazard Identification and Risk Assessment) to update and coordinate the Risk Assessments in the State of Louisiana Hazard Mitigation Plan.

Another program is the GOHSEP Continuity of Operations Plan (COOP), which was updated in 2012 when GOHSEP also developed a Pandemic Flu Annex for it. The COOP was incorporated into the overall State of Louisiana Hazard Mitigation Strategy to specifically acknowledge that key provisions of that plan were part of the total approach to reducing risk and the impacts of hazards. In particular, GOHSEP considered providing for redundancy of critical systems, equipment, flow of information, operations, and materials consistent with the overall goals and objectives of the plan.

GOHSEP also provides leadership for state and local mitigation planning efforts, and administers and oversees FEMA-related hazard mitigation grant programs (HMGPs) for the state that are related to hazard mitigation, emergency management, and disaster relief. Based on this role, GOHSEP has the opportunity to integrate mitigation planning and project information with the FEMA grant application process for the following:

- HMGP
- Pre-Disaster Mitigation Competitive Grant Program
- Flood Mitigation Assistance (FMA) Program
- Public Assistance Grant Program

The objective of HMGP is to accomplish long-term hazard mitigation measures that reduce the loss of life and property from future disasters. Hazard mitigation activities funded may not necessarily relate to the damages caused by the disasters, though. Grants under HMGP are available statewide.

DOCUMENTATION

The following pages contain documentation (in their original format) of the attendees, agendas, minutes, and sign-in sheets (as well as any related, accompanying documents) for the six meetings of the SHMPC held during the development of the Plan Update.

MEETING #1

Meeting Notes
State Hazard Mitigation Plan Update Meeting

Meeting Name
State Hazard Mitigation Plan Update Meeting #1

Date and Time
March 13, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Wayne Ryland	Dept. of Corrections
Rebecca M. Broussard	Vermillion OHSEP
Joe Delaune	OSFM
John Callahan	GOHSEP
Preston Bates	GOHSEP
Bonnie Anderson	City of Carencro
Melissa Becker	RAPC
Jerry Monier	GOHSEP
Richard Hollowell	DHH
Scott Van Keuren	GOHSEP
Melanie Saucier	CPRA
John Rahaim	SBPO/OHSEP
Nikki Blazies	LMA
Jim Ferguson	City of Baton Rouge DPW
Keith Horn	LDEQ
Stephen Tassin	DOTD
Angie White	OCD-DRU – HMGP
Jeffrey Giering	GOHSEP
Dodi Langlois	ORM
Nicole Hobson-Morris	LA SHPO
Jason Lachney	GOHSEP
Karim Belhadjali	CPRA

Cindy O'Neal	DOTD
Manuel Martinez	FP&C
Jubal Marceaux	LDWF
Pamela Davidson Ehlers	US DoC EDA
Courtney Maciasz	CRPC
Jennifer Gerbasi	TPCG
Rusti Liner	GOHSEP
Kathleen Smith	GOHSEP
Brenda Cooper	GOHSEP – Planning
Nicolette English	GOHSEP – Planning

The State Hazard Mitigation Plan Update Meeting is being conducted to introduce the planning timeline and tasks that have been assigned to the GOHSEP Planning team to the Planning Committee. Brenda Cooper will present the plan update and the overview of the Planning Process. Nicolette English will present on how this update will be different then the last update. Also, Scott Van Keuren with GOHSEP will present on THIRA. Brenda will conclude with the next steps of the planning process.

Meeting Notes

Welcome (Jeffrey Giering)

Introductions (Brenda Cooper)

Plan Maintenance Section will be done by the planning committee and will be supported by GOHSEP. There was an Executive Order by Gov. Blanco that has been dissolved. It is asked who decides what projects are funded and who the funding is distributed to? Jeffrey stated that a committee would get together and rank projects and it was usually just a few people in a room. These ranked projects would get approved by the governor. They established the LRA and the authority to figure out where the funds were distributed was transferred to the recovery authority. When the recovery authority no longer existed GOHSEP proposed an executive order reestablishing GOHSEP as the authority, but this has not been signed yet. Now the focus is the responsibility of this group (Planning Committee). Administration has the final say about where the funding is distributed. Based on certain criteria the governor's office makes decisions on the distribution of the funds. There needs to be an explanation in the plan explaining to FEMA what the process is currently

The Planning Committee includes everyone who was invited and attends the meetings. Everyone will have similar responsibilities when updating the plan.

The plan update due in 2014 will be completed by GOHSEP and not by a contractor in previous years.

State Hazard Mitigation Plan Update Presentation (Brenda Cooper and Nicolette English)

- What is a Hazard Mitigation Plan?
    - The State Hazard Mitigation Plan is a demonstration of the State's commitment to reduce risk from natural hazards and serves as a guide for State Decision Makers as they commit resources to reducing the effects of natural hazards.
- Regulatory Requirement
    - Per 44 CFR 201.4 (a) (1)- For all disasters declared on or after November 1, 2004, all states, local governments and tribes must have a FEMA approved plan in order to become eligible for all types of FEMA funding:
        - Hazard Mitigation Grant Program
        - Pre-Disaster Mitigation Grant Program
        - Flood Mitigation Assistance Program
        - Severe Repetitive Loss Program
        - Repetitive Flood Claims Program
        - Public Assistance (beyond Parts A & B) - Parts A&B do not require a plan, but everything past that will require a plan.
- Status of Current Plan
    - Some have heard that FEMA is going to 5 years on the State plans, similar to the Parish plans. It is currently proposed in congress and has a 60 day comment period. This will not apply to the current plan update. Everyone is encouraged to please review the current plan.
    - The current plan was approved April 6, 2011 and expires April 5, 2014.
    - The current plan is located on the Get a Game Plan website: www.getagameplan.org/planMitigate.htm
- Role of the Planning Committee
    - Directs the development of the plan
    - Voice for the State
    - Attendance is valued and necessary to facilitate an effective planning process.
    - Stakeholders – a large list of stakeholders, which include state, local and non-profit agencies.
    - Comment on drafts through www.freecamp.com – this is similar to a sharepoint website which will include all drafts and communication that will be done through the plan update process. The presentation and meeting notes will also be included on this website.
- Planning Cycle
    - 1. Organize Resources → 2. Assess Risks → 3. Develop a Mitigation Plan → 4. Implement Plan and Monitor Progress.
    - The next meeting in April will include an assessment of risks.

- State Plan Overview – These are the items that will be updated in the plan.
    - Planning Process
    - State-Wide Risk Assessment
    - Risk Assessment for State-Owned Assets
    - Capability Assessment
    - Mitigation Goals, Objectives and Action Plan
    - Plan Maintenance
    - Coordination with Parish and Local Hazard Mitigation Plans
    - The Plan will include each of these requirements.
- Planning Process
    - During this process the group will take a comprehensive approach. Included will be how the plan was developed, who was involved and the agencies that participated.
- Statewide Risk Assessment
    - Identify Hazards
        - Hurricanes, Flooding, Tornadoes, etc.
    - Profile Hazard Events
        - January 2013 Flooding, Hurricane Isaac, Spring Flooding 2012, etc.
    - Inventory Assets
        - Recognize vulnerable structures and infrastructure highways, state buildings, bridges, etc.
- Capability Assessment
    - Administrative Assessment of the State's ability to manage Hazard Mitigation Programs and Funding
    - Identify strengths and weaknesses.
    - Identify resources in place to support new or expand mitigation initiatives.
- Mitigation Action Plan
    - Goals, Objectives and Actions are reviewed and revised to reflect progress in mitigation efforts and changes in priorities.
    - There is an overall blueprint and long term strategy. The goals will be reviewed and a fifth goal will be included with the state historical society.
- Plan Maintenance Process
    - Once the plan is approved, plan maintenance begins:
        - Incorporate new hazard and risk information
        - Determine effectiveness of existing plans and implementation
        - Prepare future periodic SHMP updates.
    - All new data will be added as an amendment and sent to FEMA immediately instead of waiting till the three year update period.

- Coordination with Parish/Local HMP's
  - Purpose of coordination:
    - Build the State Plan from the ground up by importing data from the local plans.
    - Continue to improve identification and implementation of feasible, cost effective, environmentally sound hazard mitigation projects at the parish/local level.

Nicolette English presents:

- How is this Update different?
  - Our current state plan is 1600-1700 pages long. There is a lot of additional information that either has nothing to do with the state or is required. There is also a lot of factual information pertaining to the state. The plan will be cut down to the important information. A lot of unimportant information and information that is not required will be removed.
  - A contractor will not be hired so everyone's input is needed. The process on allocating different contribution will also be different.
  - The committee is not required to do what the contractor did before, but there is a blueprint of what the contractor did.
  - Capability assessments are required but not the surveys after the capability assessment. We will be going by what FEMA requires.
  - We want to make the plan a workable document and living document.
  - Participation by the Planning Committee is encourages along with solutions.
  - HIRA vs. THIRA - HIRA and THIRA are similar but different. Man-made hazards and how you respond to it. THIRA looks at how to reduce the impact. FEMA is looking to combine these documents. They don't want 2 different risk assessments being completed so the HIRA and THIRA will be combined and parts will be included in the plan. Response and preparedness will be included.

Threat and Hazard Identification and Risk Assessment Presentation (Scott Van Keuren)

- Threat Description Statements
  - Tropical Storm with Cascading Events
  - Flooding
  - Severe Storms with Cascading Events
  - Influenza Pandemic
  - Biological Attack
  - Adversarial
  - Wildland Fire
  - Cyber

- Jerri Monier: PPEA required a series of national frameworks for preparedness. GOHSEP was tasked to complete a couple of frameworks. Prevention framework – terrorist related, preparedness – training exercise, national disaster recovery framework – recovery employees are using that process in Plaquemines and St. John Parish after Hurricane Isaac. National Threat Assessment – THIRA process and National preparedness report – state preparedness report that is given to FMEA every calendar year.
- THIRA is a tool that includes 31 core capabilities you should be able to perform. This tool allows you to identify threats and hazards and what resources you have to meet those threats.
- The preparedness section created different scenarios of threats.
- Fusion center sent out a survey to each parish to identify state hazards.
- You want to see the impact on your core capabilities so you can create a better response plan.
- Scenarios were created with low probability, but high risk.

State Hazard Mitigation Plan Update Presentation continued (Nicolette English)

- Draft Schedule (handout given)
    - The draft will be turned in to FEMA in pieces until the Final Draft is submitted November 29, 2013.
    - Hazard Profile is first and then the actions. There is a sequence to how to do this.
    - April 24th and June 5th are the tentative meeting dates. At the April meeting the committee will rank the hazards and what to do with them. Hazard Profiles were based off of actual data. We have access to all the data sources. It will all be based off of data, but there might be new sources of data.
    - The update will also provide the opportunity to be consistent through all the plans.
    - The update is going to focus on the last three years.
- Preview of next meeting: List of Hazards (handout given)
    - List of Hazards: FEMA gives you first column.
    - All hazards that FEMA lists are mentioned briefly in the plan either to say they are not important or the information doesn't exist to mitigate it. Appendix D in the plan includes the hazards if you don't want to read the whole plan.

<u>Misc Items</u>

- Brenda will be getting in touch with each person.
- If you think someone should be included who isn't present please let us know so we can add them to the list.
- If you have an opportunity to look at the guide and you see something that doesn't make sense please let us know. We want to make it more of a user friendly document. If you think of something that needs to be added please let us know.

Action Items

Task	Responsible	Task Detail	Due Date	Completed Yes/No
Meeting Notes and Presentation will be posted to Freecamp	Kathleen Smith	Information will be uploaded to the common website so all participants will have access.	1 week	No
FEMA Plan Guideline will be posted to Freecamp	Nicolette English	Information will be uploaded to the common website so all participants will have access.	1 week	No
Invitations to join Freecamp	Brenda Cooper	Invitations to join the planning website will be sent out so everyone has access to the notes and updates.	1-2 weeks	No

Follow up Meeting

Date and Time: April 24, 2013
Location: GOHSEP Joint Field Office

These notes were prepared by Kathleen Smith on **March 13, 2013**. If there are items that are considered incorrect or omitted, these should be identified as soon as possible so appropriate revisions can be made and notes redistributed.

(Continued on Next Page)

List of Hazards	Hazards Profiled in Current Plan	Hazards W/ Risk Assessment in Current Plan	Proposed Hazards to be Profiled in Update	Proposed Hazards W/ Risk Assessment in Update
Avalanche	Coastal Erosion	Storm Surge	Climatological Hazards	
Coastal Erosion	Drought	High Wind-Hurricane / Tropical Storm	Drought*	
Coastal Storm	Earthquake	Flood	Extreme Heat	
Dam Failure	Flood	High Wind-Tornado	Flooding * (Riverine, Flash Flooding, Ponding, Backup Water, Urban)	
Drought	Hailstorm	Levee Failure	Hurricane/Tropical Storm * (Storm Surge)	
Earthquake	High Wind - Hurricane	Subsidence	Thunderstorm (Hail, High Wind, Lightning)	
Expansive Soils	High Wind-Tornado	Hazardous Materials Incident	Tornadoes	
Extreme Heat	Severe Winter Weather- Ice Storm	Ice Storm	Wildfire	
Flood	Lightning	Hailstorm	Winter Weather * (Extreme Cold, Ice Storm, Snow)	
Hailstorm	Severe Sumer and Winter Weather / Extreme Heat and Cold	Wildfire	**Geological/Human Influenced**	
Hurricane	Storm Surge	Dam Failure	Coastal Erosion *	
Land Subsidence	Subsidence		Dam Failure	
Severe Winter Storm/ Extreme Cold/ Ice Storms	Wildfire		Earthquake	
Tornado	Dam Failure		Levee Failure	
Tsunami	Levee Failure		Saltwater Intrusion *	
Volcano	Hazardous Material Incident		Sea Level Rise *	
Wildfire			Sinkhole	
Levee Failure			Subsidence*	
Lightning				
Storm Surge				
Salt Water Intrusion				
Hazard Materials Incident			*Hazards will include Climate Change as an Amplifier	

Task	March 2013	April 2013	May 2013	June 2013	July 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	March 2013	April 2014
Current Plan Expires on 04/05/14														April 5th
Meeting # 1 Kick Off	Mar 13th													
Section 1 Introduction														
Section 2 Plan Adoption														
Section 3 Planning Process														
Meeting # 2 Hazard Profiles Identifcation and Ranking		May 2nd												
Meeting # 3 Review Hazard Profiles and Ranking				June 5th										
Section 4 Hazard Identification and Profiles														
Submit Sections 1,2,4 to Fema				June 19th										
Meeting # 4 Risk Assessment						Aug 7th								
Section 5 Statewide Risk Assessment														
Section 6 Risk Assessment for State-Owned Assets														
Meeting # 5 Risk Assessment for State Owned Assets							Sept 11 th							
Submit Sections 5, 6, & 7 to Fema							Sept 25							
Section 7 Capability Assessment														
Section 8 Mitigation Action Plan														
Meeting # 6 Goals & Actions								Oct 2nd						
Submit Sections 8, 9 & 10									Nov 29th					
Section 9 Coordination of Local Mitigation Planning														
Section 10 Plan Maintenance Process														
Appendix A - EMAP														
Appendix B - Planning Process														
Appendix C - Hazard Id & Profiles														
Appendix D- Statewide Risk Assessment														
Appendix E- Statewide Risk Assessment for State Assets														
Appendix F- Plan Evaluation and Progress														
Appendix G- SHIPO														
Plan at FEMA for Approval														
Plan Approved														

MEETING #2

Louisiana State Hazard Mitigation Plan Update 2014

Meeting #2: Hazard Profiles May 3, 2013 9 am to 11 am

Meeting Name
State Hazard Mitigation Plan Update Meeting #2

Date and Time
May 3, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Brenda Cooper	GOHSEP
Nicolette English	GOHSEP
John Rahaim	St. Bernard OHSEP
Stephen Tassin	DOTD
Bonnie Anderson	City of Carencro
Lara Robertson	OCD-DRU
Rebecca Broussard	Vermilion OHSEP
Joe Delaune	La. Office of State Fire Marshall
Gary Ramsey	State Parks
Richard Hollowell	DHH
Ronald Moore	DOC
Estelle Jefcoat	GOHSEP/Hazard Mitigation
Jim Ferguson	City of Baton Rouge/LFMA
Melanie Saucier	CPRA
Jerry Monier	GOHSEP
Jubal Marceaux	LDWF
Casey Tingle	GOHSEP
Manuel Martinez	Facility, Planning and Control
Melissa Harris	ORM
Nikki Blazies	LMA
Steve Garcia	GOHSEP
Larry Sides	Sides & Associates
Nicole Hobson-Morris	SHPO
Sandra Gunner	OCD-DRU

Thomas Thiebaud	Washington Parish OHSEP
Linda Pace	DNR

9:00 Greeting : Casey Tingle
9:10 Introductions: Brenda

9:15 Explanation of Hazard Profiles:

- Nici: Introduction of Dr. Joyner – LSU helping, Mapping Contest
- Andrew: Overview of why hazards are listed in the order and grouping

10:00 SHELDUS: Dr. Gall

10:30 What's Next: Nicolette

- Committee's Input on Introduction needed
- Risk Assessment by LSU

10:40 Closing Remarks: Brenda
- Accept invitation on FREEDCAMP.COM
- Next meeting set for June 26th

Greeting by Casey Tingle, newly appointed Assistant Deputy Director, Grants and Administration

Mr. Tingle expressed his appreciation in being a part of this meeting and is encouraged by the experts involved to assist in this endeavor. He said he is looking forward to working with this important aspect of the Hazard Mitigation Grant Process.

Introduction by Brenda Cooper

Brenda thanked everyone for coming to the second meeting of the Louisiana State Hazard Mitigation Plan Update 2014. She is encouraged by the outcome and is looking forward to a truly successful plan for 2014.

Explanation of Hazard Profiles

Nicolette English reviewed hazard profiles; those in the current plan and those that will be included in the plan update (attached). The current plan ranked the hazards but this is not required by FEMA. The hazards in this plan will not be ranked, to ensure that all of the state is equally represented. The hazards will be divided into two categories: climatological and manmade/human influenced.

Hazards Profiled in Current Plan	Hazards to be Profiled in Update
Coastal Erosion	**Climatological Hazards**
Drought	Drought*
Earthquake	Extreme Heat
Flood	Flooding * (Riverine, Flash Flooding, Ponding, Backup Water, Urban)
Hailstorm	Hurricane/Tropical Storm * (Storm Surge)
High Wind -Hurricane	Thunderstorm (Hail, High Wind, Lightning)
High Wind- Tornado	Tornadoes
Severe Winter Weather- Ice Storm	Wildfire
Lightning	Winter Weather * (Extreme Cold, Ice Storm, Snow)
Severe Sumer and Winter Weather / Extreme Heat and Cold	**Geological/Human Influenced**
Storm Surge	Coastal Erosion *
Subsidence	Dam Failure
Wildfire	Earthquake
Dam Failure	Levee Failure
Levee Failure	Saltwater Intrusion *
Hazardous Material Incident	Sea Level Rise *
	Sinkhole
	Subsidence*
	*Hazards will include Climate Change as an Amplifier

Nicolette English introduced Dr. Andrew Joyner from LSU. Dr. Joyner was heavily involved with the LSU Hazard Mitigation Plan and is volunteering his time to help with the hazard profile section of the update. Dr. Joyner is with the Disaster Science & Management Program at Louisiana State University.

Dr. Andrew Joyner with the Disaster Science & Management Program at Louisiana State University, gave a presentation on Profiled Hazards in Update (attached)

Dr. Joyner gave a brief description of each of the hazards listed on the handout that have or could have an impact on Louisiana. One or two of these hazards may not impact our state as much as other states in the nation. Dr. Joyner elaborated on each profiled hazard with his PowerPoint presentation (attached). He emphasized that hazards such as drought, flooding, hurricane/tropical storm, winter weather, coastal erosion, saltwater intrusion, sea level rise and subsidence will be affected by climate change (amplifier).

Our next presenter was Dr. Melanie Gall who is a hazards geographer and certified floodplain manager (CFM) with expertise in the qualification of social vulnerability, hazard mitigation planning, geospatial analysis, and impact assessments. Dr. Gall's presentation covered Disaster Loss Databases; comparing storm data between SHELDUS and NCDC (attached)

Dr. Gall compared the information provided by SHELDUS to the information provided by NCDC in her presentation. Please refer to her presentation (attached) for details.

Brenda Cooper advised the parish representatives that the information provided by Dr. Gall would be beneficial in the update of their Hazard Mitigation Plans.

Brenda Cooper conveyed to the committee members to sign-up on to Freedcamp.com.; which will be the Sharepoint Site for the Update of the La. State Hazard Mitigation Plan. Drafts for review, Meeting Minutes, comments and responses will be administered through this site. The next meeting is tentatively scheduled for June 26, 2013.

MEETING #3

Stakeholder Meeting
August 7, 2013

Meeting Name
State Hazard Mitigation Plan Update Meeting #3

Date and Time
August 7, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Kristopher Mecholsky	LSU
John Rahaim	St. Bernard OHSEP
Lynne Carter	SCIPP/LSU
Darren Guidry	GOHSEP
Tonia Bergeron	GOHSEP
Gary Ramsey	State Parks
Andrew Joyner	LSU
Nicolette English	GOHSEP
Brenda Cooper	GOHSEP
Sandra Dugas	GOHSEP
Richard Hollowell	DHH
Kelton Noce	GOHSEP
Estelle Jefcoat	GOHSEP
Jeffrey Giering	GOHSEP
Melanie Saucier	CPRA
Keith Horn	LDEQ
Carrie Robinette	Rapides Parish
Melissa Becker	Rapides Parish
Kimberly Barnett	GOHSEP
Jubal Marceaux	LDWF – LED
Steve Garcia	GOHSEP
Sandra Gunner	OCD – DRU
Rebecca Broussard	Vermilion OHSEP/Region 4
Cindy O’Neal	DOTD

Sandra Turley	Town of Iowa
Pat Forbes	OCD

10:00 Introductions
10:05 Update
10:15 Presentation: Profile Section Results, Dr. Mecholsky
10:45 Presentation: Climate Change, Dr. Carter
11:15 Risk Assessment: Dr. Joyner
11:45 Questions

Time Line for Plan Update 2014

	March 2013	April 2013	Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	April 2014
Meeting Timeline								
Meeting # 1 Kick Off	**03/13**							
Meeting # 2 Hazard Profiles Identifcation		**05/03**						
Meeting # 3 Results of Hazard Profiles			**08/07**					
Submit Hazard Profiles to FEMA			**08/14**					
Meeting # 4 Results of VI (Present Goals)					**10/2**			
Submit Vulnerablity and Impact to FEMA					**10/9**			
Meeting # 5 Goals & Actions					**10/30**			
Submit Goals & Actions to FEMA						**11/6**		
Meeting # 6 Draft Review							**12/4**	
Submit Complete Draft to FEMA							**12/23**	
Plan Approved								
Current Plan Expires on 04/05/14								**04/05**

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MEETING #4

Meeting Name
State Hazard Mitigation Plan Update Meeting #4

Date and Time
October 10, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Brenda Cooper	GOHSEP
Nicolette English	GOHSEP
Jeffrey Giering	GOHSEP
Shandy Heil	LSU
Carol Friedland	LSU
Steve Garcia	GOHSEP
Reggie Dardar	GOHSEP
A.J. Walker	GOHSEP
Ronald Moore	DOC
Sandra Dugas	GOHSEP
Leanne Guidry	GOHSEP
Kelton Noce	GOHSEP
Byron Brooks	GOHSEP
Gary Ramsey	State Parks
Collins Simoneaux	GOHSEP
Darren Guidry	GOHSEP
Rebecca Broussard	Vermilion OHSEP
Jubal Marceaux	LDW-LED
Eddie Skena	LDWF-LED
Sara Krupa	LDNR
George Chike	DOTD
Melissa Harris	ORM
Manuel Martinez	Facility, Planning & Control
Nicole Hobson-Morris	SHPO
Kristopher Mecholsky	Robert Rohli
Jennifer Gerbasi	TPCG
Sandra Gunner	OCD-DRU
Lynne Carter	SCIPP/LSU
Andrea Galinski	CPRA

Keith Horn	LDEQ
Cindy O'Neal	DOTD
Richard Hollowell	DHH

Stakeholder Meeting Agenda
October 10, 2013 1-3 pm

1:00 pm Introductions - Jeffery
1:05 pm Presentation: State Risk Assessment, Joshua Gilliland, PhD Candidate, Department of Geography and Anthropology, Louisiana State University
1:30 pm Presentation: Flood and Hurricane Modeling, Carol Friedland, PH.D., P.E., Assistant Professor, Department of Construction Management, Louisiana State University
2:00 pm Break
2:10 pm Presentation: SHPO Risk Assessment, Shandy Ogea Heil, Extension Paraprofessional, LSU AgCenter
2:50 pm Next Steps
FEMA very pleased with Profile Section
Outstanding Risk Assessment, Modeling is more detailed than most plans
Time Line off Slide
Pass Out Goals & Actions
Nov 7th meeting
Presentation on Groundwater Balance / Storm water Management
Capability Assessment Results
Ranking & Prioritize Actions
Map Judging
Time for Nov 7th Meeting

(Continued on Next Page)

Stakeholder Meeting 4 (Handout): Results of the State Risk Assessment
October 10, 2013

1:00 Introductions
1:05 Presentation: State Risk Assessment, Joshua Gilliland, PhD Candidate, Department of Geography and Anthropology, Louisiana State University
1:30 Presentation: Flood and Hurricane Modeling, Carol Friedland, PH.D., P.E., Assistant Professor, Department of Construction Management, Louisiana State University
2:00 Break
2:10 Presentation: SHPO Risk Assessment, Shandy Ogea Heil, Extension Paraprofessional, LSU AgCenter
2:50 Next Steps

Tentative Time Line for Plan Update 2014

October 25th	Suggestions for Mitigation Actions due, submit on Freedcamp
October 29th	Risk Assessment sent to Committee for review
October 31st	Comments on Risk Assessment due, submit on Freedcamp
November 1st	Submit Risk Assessment to FEMA for preliminary review
November 7th	Meeting 5, Mitigation Strategy and Capability Assessment
November 27th	Submit Mitigation Strategy and Capability Assessment to FEMA for preliminary review
December TBD	Meeting 6, Draft Review
December 23	Submit Draft to FEMA for official review

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Current Goals and Actions 2011 Plan

Goal 1: **The State of Louisiana will improve education and outreach efforts regarding potential impacts of hazards and the identification of specific measures that can be taken to reduce their impact.**

Action 1.1 Support start-up and implementation of the Community Education Outreach (CEO) program and institutionalize practices for after the completion of CEO.

Action 1.2 Develop and implement an "internal" state agency mitigation education and outreach program (parallel to the public education and outreach program (Action 1.1)

Goal 2: **The State of Louisiana will improve data collection, use and sharing to reduce the impacts of hazards.**

Action 2.1 Define and implement appropriate institutional arrangements for collection, use and sharing data for parishes and municipalities.

Action 2.2 Support implementation of a coordinated approach to data collection, use and sharing for State agencies to validate and disseminate results of the Risk Assessment for State-Owned Buildings, Critical Facilities and Infrastructure.

Goal 3: **The State of Louisiana will improve capabilities and coordination at the municipal, parish, regional and state level to plan and implement hazard mitigation projects.**

Action 3.1 Provide technical support to municipalities, parishes or groups of parishes for on-going and continuing municipal hazard mitigation planning efforts.

Action 3.2 Provide technical support to state agencies for on-going and continuing mitigation planning

Action 3.3 Conduct follow-up activities to engage members of the SHMPC in a review of planning and implementation activities under their jurisdictions and responsibility.

Goal 4: **The State of Louisiana will continue to pursue opportunities to reduce impacts to the State's manmade and natural environment through mitigation of repetitive and severe repetitive loss properties and other appropriate construction projects and related activities.**

Action 4.1 Work with municipalities, parishes and State agencies to identify, fund and implement cost effective projects to mitigate repetitive and severe repetitive loss properties and other appropriate risks, and to prioritize them according to cost effectiveness.

Action 4.2 Support efforts by State agencies to identify and pursue hazard mitigation projects for at-risk state-owned assets and critical infrastructure, and prioritize them according to cost-effectiveness.

Action 4.3 Support and pursue legislative agendas at all levels of government.

New Goal and Actions* for 2014 Plan Update

Goal 5: The State of Louisiana will improve on the protection of its Historic Structures/Buildings, Traditional Cultural Properties and Archaeological Sites from natural and man-made hazards.

Action 5.1 Integrate historic and cultural resources protection into hazard mitigation planning to improve the ability of resources to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.

Action 5.2 Encourage and support opportunities for statewide stakeholders to facilitate the assessment and dissemination of appropriate mitigation techniques and Historic Preservation Best Management Practices and suitable design options for retrofitting historic properties to improve their ability to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.

Action 5.3 Promote increased awareness and greater understanding of the concepts of the National Historic Preservation Act (NHPA), Section 106 and critical information regarding Louisiana Archaeology to the citizens and leaders of Louisiana.

***These were added as an amendment to the 2011 plan in 2013**

Proposed Actions for 2014 Update

Action 1.3 Analyze past outreach efforts and update them as needed based on anticipated local mitigation strategies.

Action 4.4 Enhance the current State Hazard Mitigation Strategy, specifically strengthening the linkage to mitigation action implementation.

- Comments on the proposed actions or suggestion for new actions can be submitted to the State Hazard Mitigation Project on Freedcamp.com until October 17th, 2013.

Freedcamp Instructions:

Login to Freedcamp.com
Click on Choose Project
Select HM State Plan Update 2014
Select Files to view meeting documents
Or
Select Discussions to leave comments

Meeting #5

Meeting Name
State Hazard Mitigation Plan Update Meeting #5

Date and Time
November 7, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Brenda Cooper	GOHSEP
Nicolette English	GOHSEP
Bob Rohli	LSU
Shandy O. Heil	LSU
Lynn Carter	LSU
Kris Mecholsky	LSU
Pat Skinner	LSU
George Chike	DOTD
Cindy O'Neal	DOTD
Sara Krupa	LDNR
Charles Reulet	LDNR
Sandra Dugas	GOHSEP
Gary Ramsey	State Park
Richard H. Hollowell	DHH
Rebecca Broussard	Vermilion OHSEP
Keith Horn	LDEQ
Manuel Martinez	FP&C
Collins Simoneaux	GOHSEP
Pam Roussel	GOHSEP
Darren Guidry	GOHSEP
John Rahaim	St. Bernard Parish OHSEP
Sandra Turley	Town of Iowa

Stakeholder Meeting Agenda
November 7, 2013 9am to 12 pm

9:00 am Introductions - Jeffery
9:05 am Presentation: Dana Brown

9:45 am	Capability Assessment Update
10:15 am	Break / Map Judging
10:30 am	Current Goals and Actions
11:55 am	Next Steps

Stakeholder Meeting 5: Mitigation Strategy (Handout)

November 7, 2013

9:00 am **Introductions - Jeffery**

9:05 am **Presentation: Ground Water Balance / Storm Water Management Dana Brown, Dana Brown & Associates**

9:45 am **Capability Assessment Update**

10:15 am **Break / Map Judging**

10:30 am **Current Goals and Actions**

11:55 am **Next Steps**

Tentative Time Line for Plan Update 2014

November 7th	Meeting 5, Mitigation Strategy and Capability Assessment
November 27th	Submit Mitigation Strategy and Capability Assessment to FEMA for preliminary review
December 20th	Meeting 6, Draft Review, Draft sent to Committee for review
January 3rd	Committee Comments Due
January 6th	Submit Draft to FEMA for official review

Notes:

	Action	The action is based on the risk assessment	There is a link to parish plans	Contributes to the mitigation goals of the state	Measurable	Total
1.1	Support start-up and implementation of the Community Education Outreach (CEO) program and institutionalize practices for after the completion of CEO.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
1.2	Develop and implement an "internal" state agency mitigation education and outreach program (parallel to the public education and outreach program (Action 1.1)	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
1.3	Analyze past outreach efforts and update them as needed based on anticipated local mitigation strategies	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
2.1	Define and implement appropriate institutional arrangements for collection, use and sharing data for parishes and municipalities.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
2.2	Support implementation of a coordinated approach to data collection, use and sharing for State agencies to validate and disseminate results of the Risk Assessment for State-Owned Buildings, Critical Facilities and Infrastructure.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
3.1	Provide technical support to municipalities, parishes or groups of parishes for on-going and continuing municipal hazard mitigation planning efforts.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
3.2	Provide technical support to state agencies for on-going and continuing mitigation planning	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
3.3	Conduct follow-up activities to engage members of the SHMPC in a review of planning and implementation activities under their jurisdictions and responsibility.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
4.1	Work with municipalities, parishes and State agencies to identify, fund and implement cost effective projects to mitigate repetitive and severe repetitive loss properties and other appropriate risks, and to prioritize them according to cost effectiveness.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	

	Action	The action is based on the risk assessment	There is a link to parish plans	Contributes to the mitigation goals of the state	Measurable	Total
4.2	Support efforts by State agencies to identify and pursue hazard mitigation projects for at-risk state-owned assets and critical infrastructure, and prioritize them according to cost-effectiveness.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
4.3	Support and pursue legislative agendas at all levels of government.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
4.4	Enhance the current State Hazard Mitigation Strategy, specifically strengthening the linkage to mitigation action implementation.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
5.1	Integrate historic and cultural resources protection into hazard mitigation planning to improve the ability of resources to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
5.2	Encourage and support opportunities for statewide stakeholders to facilitate the assessment and dissemination of appropriate mitigation techniques (Historic Preservation Best Management Practices) and suitable design options for retrofitting historic properties to improve their ability to withstand impacts of natural and man-made hazards while retaining character-defining architectural features.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	
5.3	Promote increased awareness and greater understanding of the concepts of the National Historic Preservation Act (NHPA), Section 106 and critical information regarding Louisiana Archaeology to the citizens and leaders of Louisiana.	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	

MEETING #6

Stakeholder Meeting # 6 Agenda
Draft Plan Review
December 20, 2013 9am to 11 am

Meeting Name
State Hazard Mitigation Plan Update Meeting #6

Date and Time
December 20, 2013

Location
GOHSEP JFO

Attendees:

Name	Agency
Brenda Cooper	GOHSEP
Nicolette English	GOHSEP
Jeffrey Giering	GOHSEP
John Rahaim	St. Bernard OHSEP
Jennettee Dubinin	CPEX
Steve Garcia	GOHSEP
Charles Reulet	LDNR
Ronald Morre	DOC
Gary Ramsey	State Parks
Andrea Galinski	CPRA
Keith Horn	LDEQ
Manuel Martinez	Facility, Planning & Control
Mark Riley	GOHSEP

9:00 am Welcome by Jeffrey Geiring, State Hazard Mitigation Officer
Jeffrey expressed appreciation for everyone's participation in the planning progress.

9:05 am Presentation: Flood Modeling Results, Dr. Andrew Joyner
Results of the state flood modeling were presented along with practical applications for the results.

9:30 am Draft Review: Nicolette English, GOHSEP Planner

Results of the profile rankings given, overview of the changes made in the update, 550 page draft presented to committee.

9:50 am Break

10:00 am Presentation: Town of Jean Lafitte, Jeanette Dubinin
Case study on the Town of Jean Lafitte and its approach to resiliency and hazard mitigation.

10:40 am Presentation: Mitigation Success Stories, Dr. Andrew Joyner

10:55 am Next Steps: Nicolette English, GOHSEP Planner
The plan will be available for review on Dec 23rd and will be sent to FEMA on Feb 3rd. The state will apply for PDM funding in the summer of 2014 for the 2017 update. The 2017 update will begin in January 2016. This update, heavy focus was put on the risk assessment. The 2017 will be heavily focused on the mitigation strategy which was identified as weak by the committee in this update cycle.

B. PLAN MAINTENANCE

PURPOSE

The section of the Code of Federal Regulations (CFR) pertaining to State Mitigation Plans lists seven required components for each plan: a description of the planning process; risk assessments; mitigation strategies; a description of coordination of local mitigation planning; a method and system for plan maintenance; verification of plan adoption; and assurances of state compliance with the plan. This Appendix details the method and system for plan maintenance, following the CFR's guidelines that the Plan Update must include (1) "an established method and schedule for monitoring, evaluating, and updating the plan," (2) "a system for monitoring implementation of mitigation measures and project closeouts," and (3) "a system for reviewing progress on achieving goals as well as activities and projects identified in the Mitigation Strategy."

MONITORING, EVALUATING AND UPDATING THE PLAN

By law, the Plan must be updated every three years prior to re-submittal to the Federal Emergency Management Agency (FEMA) for re-approval. The first part of this subsection describes the whole update process, including the responsible parties, methods to be used, evaluation criteria to be applied, and, scheduling for monitoring and evaluating the plan. These descriptions are followed by an explanation of how and when the plan will be periodically updated. The Plan must be updated every three years prior to re-submittal to the Federal Emergency Management Agency (FEMA) for re-approval. The first part of this subsection describes the whole update process, including sections on the following:

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

These descriptions are followed by an explanation of how and when the plan will be periodically updated.

RESPONSIBLE PARTIES

The Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP) is the state agency directly responsible for maintaining the plan. Within that agency, the State Hazard Mitigation Officer (SHMO) is the individual responsible for assuring that plan monitoring and evaluating are done in accordance with the procedures outlined in this section. The State Hazard Mitigation Planning Committee (SHMPC) is responsible for developing periodic updates to the plan.

Methods for Monitoring and Evaluating the Plan

On a quarterly basis (and as warranted by circumstances such as a major disaster declaration), GOHSEP will monitor the plan in order to assess the degree to which assumptions and underlying information contained in the plan may have changed. For example, GOHSEP will look for the following:

- Changes in the information available to perform vulnerability assessments and loss estimates. For example: as parish and municipal risk assessments and plans are integrated into this Plan Update, GOHSEP will be soliciting feedback from parish and municipal emergency management directors about any changes in their real or perceived risks.
- Changes in laws, policies and regulations. Changes in state agencies and/or their procedures, including GOHSEP and the administration of grant programs

The results of these monitoring efforts will be made available to the SHMPC as they are produced.

Using the compiled results of ongoing monitoring efforts, the plan will be evaluated annually, generally starting in the month of January (unless circumstances indicate otherwise). GOHSEP will initiate the evaluations by contacting state agencies identified as responsible parties in the Mitigation Action Plan, as well as other agencies and organizations that have been involved in developing the plan.

GOHSEP and the SHMPC have the authority to determine if other organizations should also be involved in the process. The SHMPC will be encouraged to include other agencies/organizations which have specific technical knowledge and/or data pertaining to risks.
The initial contacts will be made no later than December of each year for the first two years and in September in the third year (in anticipation of the required Plan Update for FEMA re-approval). The initial contact will advise the appropriate agencies/organizations that the plan will be re-evaluated in the coming months, and request their participation in the process. GOHSEP also has the authority to evaluate and update the plan at times other than those identified in this section under the following general conditions: (1) After a major disaster declaration; (2) At the request of the Governor; or (3) When significant new information regarding risks or vulnerabilities is identified.

Plan Evaluation Criteria

The evaluations will consider several basic factors which are similar to those addressed in the monitoring process, and any additional review indicated by GOHSEP or the SHMPC. The factors that will be taken into consideration during these periodic evaluations of the plan include the following:

1. Changes in vulnerability assessments and loss estimations. The evaluation will include an examination of the analyses conducted for hazards identified in the plan and determine if there have been changes in the level of risk to the state and its citizens to the extent that the plan (in particular the strategies and prioritized actions the state is considering) should be modified.
2. Changes in laws, policies, or regulations. The evaluation will include an assessment of the impact of changes in relevant laws, policies, and regulations pertaining to elements of the plan.
3. Changes in state agencies or their procedures (in particular GOHSEP, which is responsible for maintaining the plan) that will affect how mitigation programs or funds are administered
4. Significant changes in funding sources or capabilities
5. Progress on mitigation actions (including project closeouts) or new mitigation actions that the state is considering

Updating the Plan

Updates will follow the original planning process outlined in Appendix A. The update process will entail a detailed and structured re-examination of all aspects of the original plan, followed by recommended updates. The update process will be undertaken by GOHSEP and assisted and monitored by the SHMPC. The recommendations will be presented to the SHMPC for consideration and approval. It is expected that the Governor will issue a letter of adoption for each update of the plan.

At a minimum, the plan will be updated and re-submitted to FEMA for re-approval every three years, as required by DMA 2000. The three-year update for FEMA re-approval requires that all the original steps outlined in Appendix A be revisited to make sure the plan assumptions and results remain valid as a basis for further decision-making and priority-setting.

The plan will also be subject to interim updates as significant changes or new information is identified in the periodic evaluations described above. The degree to which the entire process is repeated will depend on the circumstances that precipitate the update.

GOHSEP will initiate, coordinate and lead all plan updates in conjunction with the SHMPC. The next two paragraphs describe the procedures for interim and three-year updates, respectively.

The nature of Plan Updates will be determined by the evaluation process described above. In general, GOHSEP will notify the SHMPC that the agency is initiating an interim Plan Update, and describe the circumstances that created the need for the update (per the list in the Plan Evaluation Criteria section above). GOHSEP will determine if the SHMPC should be consulted regarding potential changes. If it is determined that the SHMPC should be involved, the nature of the involvement will be at the discretion of GOHSEP.

When interim updates are completed absent the involvement of the SHMPC, GOHSEP will advise all SHMPC members via email that the plan has been updated, and describe the nature of the update. In addition, GOHSEP will provide FEMA Region VI with a copy (although there is no requirement to have the plan re-approved by FEMA for interim updates).

As required by the DMA 2000, the plan will be updated every three years and re-submitted to FEMA for re-approval. In those years, the evaluation process will be more rigorous, and will examine all aspects of the plan in detail. It is anticipated that several meetings of the SHMPC will be required and that the Governor Authorized Representative will formally re-approve the plan prior to its submission to FEMA.

Based on the three-year renewal requirements for Plan Updates, GOHSEP anticipates that the submission date for the required update will be approximately January 2017. Prior to that time, GOHSEP will contact SHMPC members and other appropriate agencies/organizations to confirm a schedule for the Plan Update.

The following basic schedule will be undertaken for monitoring, evaluating and updating the plan:

- At a minimum, monitoring activities by GOHSEP should be done on a quarterly basis
- Notices regarding annual evaluations should be sent by GOHSEP to the SHMPC in December of the first two years of the plan and in September of the third year
- The timetable for evaluations and updates for the first two years is expected to last up to four months (January–April), and up to six months for the update in the third year for re-submittal to FEMA (November–April).

2011 Plan Method and Schedule Evaluation

For the current Update, the previously approved plan's method and schedule were evaluated to determine if the elements and processes involved in the required 2011 update. Based on this analysis, the method and schedule were deemed to be acceptable, and nothing was changed for this update. The process was very successful, as the majority of the plan was significantly revised.

C. MAPPING METHODOLOGY

This section explains the methodology and results for the mapping in this Plan Update.

STATE INFORMATION

Before discussing the methodology for the particular hazards, this section will explain the baseline data used for information on Louisiana as a state. Of overarching importance to data analysis is current knowledge of the people and land of the state, including its population, state property, and land cover information.

POPULATION

For population, U.S. Census data were used to calculate the percentage of population change for each parish from 2000 to 2010. In addition, 2010 Census data were used to display the current population size for each parish as well for the state of Louisiana.

STATE PROPERTY

The Louisiana State Land and Building System (SLABS) inventory is maintained by the Division of Administration pursuant to LA R. S. 39:11 and 13. The inventory maintains data relative to the fixed immovable property in which the State of Louisiana has a surface interest (SLABS is not a mineral interest inventory). The Louisiana State Land Office is responsible for maintaining this centralized inventory as currently and comprehensively as possible and practical.

The files are separated into three main categories: Facility/Site Summary data identified by the facility's SITE CODE Number; Individual Building data identified by the building's State I.D. Number; and Individual Conveyance data identified by the document's Site Code Number and Document Number. The individual building and conveyance data are linked to the facility/site data for that particular facility by the facility's Site Code Number. The electronic data files contain more detailed information for these three categories. As a result, these state properties were overlaid onto the 100-yr flood map to show which SLABS properties are vulnerable to possible flood risks associated in the state of Louisiana.

In terms of building damage of state-owned properties, this Plan Update focuses on properties that have been paid for repetitive claims. The State of Louisiana Office of Risk Management administers a cost-effective comprehensive risk management program for all agencies, boards, and commissions of the State of Louisiana and for any other entity for which the state has an equity interest, in order to preserve and protect the assets of the State of Louisiana. The office annually updates the replacement cost of state assets if a natural disaster (e.g., flood event) were to affect the property of interest. Each state asset found was then analyzed by its replacement cost and mapped onto the state of Louisiana. The repetitive loss amounts were divided into four categories: (1) < $1 million, (2) $1 million–10 million, (3) $10 million–100 million, and (4) > $100 million. Additionally, a cumulative sum by parish was calculated to determine the total repetitive loss amount based on a spatial scale.

For the Louisiana State Historic Preservation Office (SHPO) risk assessment (RA), this Plan Update selected 44 properties to be further investigated and analyzed for potential issues. However, the main focus of the SHPO RA portion of the study analyzes the possible natural hazards risk associated with each of the chosen properties. These 44 properties were superimposed over 100-yr flood risk areas, as well as tornado and hail density maps to understand possible risks associated with each property.

LAND COVER

The Plan Update uses two national datasets to determine change in land cover. The National Land Cover Dataset 1992 (NLCD1992) is a 21-class land cover classification scheme that has been applied consistently across the lower 48 United States at a spatial resolution of 30 meters. The National Land Cover Database and 2001 and 2006 (NLCD 2001 and 2006) is a 16-class land cover classification scheme that has been applied consistently across the conterminous United States at a spatial resolution of 30 meters.

NLCD92 is based primarily on the unsupervised classification of Landsat Thematic Mapper (TM) circa 1990s satellite data. Other ancillary data sources used to generate these data included topography, census, and agricultural statistics, soil characteristics, and other types of land cover and wetland maps. NLCD1992 is the only NLCD dataset that can be downloaded by state and by user defined area from the MRLC Consortium Viewer.

NLCD2006 is based primarily on the unsupervised classification of Landsat Enhanced Thematic Mapper+ (ETM+) circa 2001 and 2006 satellite data. NLCD2006 also quantifies land cover change between 2001 and 2006. The NLCD2006 land cover change product was generated by comparing spectral characteristics of Landsat imagery between 2001 and 2006, on an individual path/row basis, using protocols to identify and label change based on the trajectory from NLCD2001 products. It represents the first time that this type of 30-meter resolution land cover change product is known to have been produced for the conterminous United States. A formal accuracy assessment of the NLCD2006 land cover change product occurred in 2011 It is expected to be released in early 2014.

A noticeable change is evident in the land cover type in the eastern and western parts of the state (especially in Livingston, Washington, St. Helena, Allen, and Beauregard Parishes) between 1992 and 2001. These parishes experienced a land classification change of more than 10% during a 5-yr period (2001–2006). In general, forested areas have been converted to agriculture, and urban classifications (or “cut-overs”) have been reforested.

The Spatial Analysis for Conservation and Sustainability Lab at the University of Wisconsin produced wildland–urban interface (WUI) datasets based on land cover data across the United States. WUI data illustrate where the WUI was located in 1990, 2000, and 2010, which enables analysts to detect interface change (although this particular technique was not needed here). There are two main types of WUI: intermix and interface. Intermix WUI are areas where housing and vegetation are co-located, while interface WUI are areas with housing located adjacent to contiguous wildland vegetation. Other areas of the WUI surface include areas with varying levels of housing density (no housing, low density, medium/high density, low density with vegetation). The WUI for 2010 was mapped and the interface/intermix areas were the focal point. These are areas that could be more susceptible to wildfire.

CLIMATOLOGICAL HAZARDS

The data and approach for climatological hazards will be described in the risk assessment's order of hazards:

- Climatological Hazards
    - Droughts
    - Extreme Heat
    - Flooding
    - Thunderstorms (Hail, High Wind, and Lightning)
    - Tornadoes
    - Tropical Cyclones
    - Wildfires
    - Winter Weather

DROUGHTS

Drought information and maps were obtained from governmental sources such as the National Drought Mitigation Center.

EXTREME HEAT

The dataset for temperature contains spatially gridded average monthly and annual maximum temperature for the climatological period 1981–2010. Interpolation of the point measurements to a spatial grid was accomplished using PRISM (Parameter-elevation Regressions on Independent Slopes Model), developed and applied by Chris Daly of the PRISM Climate Group at Oregon State University. There are many methods of interpolating climate from monitoring stations to grid points. Some provide estimates of acceptable accuracy in flat terrain, but few have been able to adequately explain the extreme, complex variations in climate that occur in mountainous regions. Significant progress in this area has been achieved through the development of PRISM. PRISM is an analytical model that uses point data and an underlying grid such as a digital elevation model (DEM) or a 30-yr climatological average (e.g. 1981–2010 average) to generate gridded estimates of monthly and annual precipitation and temperature (as well as other climatic parameters). PRISM is well-suited to regions with mountainous terrain because it incorporates a conceptual framework that addresses the spatial scale and pattern of orographic processes. Grids were modeled on a monthly basis. Annual grids of temperature are produced by averaging the monthly grids. For the readability of this Plan Update, temperatures were converted from Celsius to Fahrenheit (i.e., raster calculator) in the following way:

- Divide the raster by 100 (raster was originally multiplied by 100 to allow for decimals to become whole integers - e.g., 20.04 became 2004)
- Multiply by 1.8
- Add 32

In terms of July temperatures, a latitudinal increase is described in the average maximum daily temperature for the state of Louisiana. The lowest (highest) average temperature was recorded along the coastline (northern and central) portion of the state at 86.8 º F (93.6º F). Heat advisory information given by the National Weather Service (NWS) was also used.

FLOODING

The data are available from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) and LOSCO Data Catalog, which consist of 1999 and 2012 flood zones. As a result, flood zones used in this project are focused on 100-yr flood zones.

The National Flood Hazard Layer (NFHL) data incorporates all Digital Flood Insurance Rate Map (DFIRM) databases published by FEMA, and any Letters Of Map Revision (LOMRs) that have been issued against those databases since their publication date. The DFIRM Database is the digital, geospatial version of the flood hazard information shown on the published paper Flood Insurance Rate Maps (FIRMs). The primary risk classifications used are the 1%-annual-chance flood event, the 0.2%-annual-chance flood event, and areas of minimal flood risk. The NFHL data are derived from Flood Insurance Studies (FISs), previously published FIRMs, flood hazard analyses performed in support of the FISs and FIRMs, and new mapping data where available.

The FISs and FIRMs are published by the Federal Emergency Management Agency (FEMA). The specifications for the horizontal control of DFIRM data are consistent with those required for mapping at a scale of 1:12,000. The NFHL data contain layers in the Standard DFIRM datasets except for S_Label_Pt and S_Label_Ld. The NFHL is available as state or U.S. territory data sets. Each state or territory data set consists of all DFIRMs and corresponding LOMRs available on the publication date of the data set. As a result, FIRM parcels classified as 100-yr flood (1%) were selected and further analyzed based on 2010 Census data and parish coverage.

An intersection was applied to consolidate attributes between the 100-yr flood zones in each parish. The area of each new polygon was calculated and then a summary was computed based on each individual parish. Next, a "spatial join" operation is used to determine the amount or area of each parish is affected or within the 100-yr flood zone.

A similar approached was used to determine the percentage of parish population located in a 100-yr flood zone except using 2010 U.S. Census data. An intersection was applied to consolidate attributes between the 100-yr flood zones and 2010 Census block data. Next, the area of each new polygon was calculated and then a "spatial join" operation was used to calculate the number of people or population found in each 100-yr flood zone and census block. Finally, a summarized count is made by each parish to determine the percent of parish population are located within the 100-yr flood zone.

Louisiana is prone to flooding. Most of the parishes that border a body of water are exposed to 100-yr floods. However, 13 parishes do not have current flood zone maps based on the data collected for this project.

THUNDERSTORMS

Similar to temperature, precipitation for Louisiana was obtained from the PRISM database at Oregon State University. The entire United States gridded precipitation normals (averages) for 1981–2010 were downloaded, and then only Louisiana was extracted. A graduated color scheme was used to illustrate gradations of high to low (relatively) precipitation across the state.

HAIL

These data are also available from NOAA's Storm Prediction Center (SPC) Severe Weather Database. The dataset consists of point attribute data from 1955-2012. All reports were selected to include only those natural hazards that occurred in Louisiana. Kernel density analysis, with a 25-mi. radius applied to each dataset, is used to approximate the density of hail reports based on diameter: (1) All sizes, (2) < 1 in., (3) 1-2 in., and (4) ≥ 2 in.

The highest density of hail reports is found in the northern part of the state, in particular with the largest number of reports occurring around Shreveport. An urban bias is still noted in the results but it is not as extreme when compared to tornado touchdowns and tracks. Strong maxima exist in northern Louisiana for all size intervals.

High Wind

Thunderstorm wind events were obtained from the NOAA SPC and covered the time period between 1955 and 2011. The original file showed exact locations (coordinates) of high wind events. Data were aggregated to the parish level and then normalized by area. The resulting chloropleth map revealed the number of high wind events per 10 mi^2 in each parish.

Lightning

Lightning density imagery was downloaded from the Global Hydrology Resource Center (a division of NASA. It was then georeferenced, rectified, and re-color coded for the state of Louisiana. No additional analyses were performed since the lightning densities were pre-defined to show the density of lightning flashes per mi^2 per year.

Tornadoes

The data are available from the SPC Severe Weather Database. The dataset consists of point and track data attributes from 1950–2012. All points and tracks were selected to include only those natural hazards that occurred in Louisiana. Kernel density analysis—with a 20-mi. radius applied to each dataset—is used to approximate the density of tornado touchdowns and tracks across the state.

The highest densities of touchdowns in the data are prominent in urban areas (i.e., Lafayette, New Orleans, and Shreveport) with highest occurrences developing in Lafayette. It is typical to see a bias toward metropolitan areas because of a higher population density and proximity to NWS Doppler radar locations. The highest densities of tornado tracks are also found in urban areas, although a distinct center is found in the northern part of the state. This may indicate that tornadoes in the northern parishes remain on the ground longer when compared to those in the southern part of the state.

Tropical Cyclones

Precipitation

The precipitation data—which are quality-controlled, multi-sensor (radar and rain gauge) precipitation estimates obtained from NWS River Forecast Centers (RFCs)—are available from Advanced Hydrologic Prediction Service (AHPS). The original data are in XMRG format and projected in the Hydrologic Rainfall Analysis Project (HRAP) grid coordinate system with a polar stereographic projection true at 60°N / 105°W. Software reads each participating RFCs XMRG file and retrieves the 24-hour precipitation estimate for each HRAP grid cell. Information on precipitation data for particular storms follows:

- Hurricane Katrina (2005)
    - Dates of data used (8/29/05–9/1/05)
    - Heaviest precipitation amounts are found in the southeastern part of the state, ranging from a few in. to more than 10 in.
- Hurricane Rita (2005)
    - Dates of data used (9/20/05–9/25/05)
    - The state was affected by the hurricane but the heaviest rainfall occurred along the landfall through the southwestern part of the state, where more than 10 in. fell.
- Hurricane Gustav (2008)
    - Dates of data used (9/1/08–9/5/08)
    - The central and northeastern part of the state received the heaviest rainfall, ranging from 10–20+ in.
- Hurricane Ike (2008)
    - Dates of data used (9/13/08–9/14/08)
    - The western part experienced a small amount of precipitation from Ike, ranging from 1 in. to several isolated areas receiving 7+ in.
- Tropical Storm Lee (2011)
    - Dates of data used (9/1/11–9/6/11)
    - Heaviest precipitation amounts were found in southeastern and east-central Louisiana, where totals exceeded 10 in.
- Hurricane Isaac (2012)
    - Dates of data used (8/29/12–9/3/12)
    - The highest amounts are observed along the stalled front of Isaac in southeastern Louisiana, with values ranging from 10–15 in.

Wind zone data were originally obtained from the LSU AgCenter, which mapped the wind zones based on building codes released in the ASCE 7-05 report. These building codes are primarily used to inform construction standards as they relate to hurricane-prone areas. The data were only available in web format so a process of digitization in 1 mph increments was implemented to map wind zones across Louisiana. The resulting layer was delineated based on 10 mph intervals with areas lower than 90 mph not further delineated. This is the threshold where buildings are not expected to withstand a strong hurricane and this area covered most of the northern half of Louisiana. Southeast Louisiana has historically been impacted by stronger hurricanes.

Wind observations used for the study were collected from three and six hourly surface wind data (0.05 º x 0.05º) from NOAA's Hurricane Research Division (HRD). This dataset is assembled from a variety of weather observations ranging from *in-situ*, marine, aviation, and reconnaissance aircraft data to remote sensing platforms. All wind data used by the HRD are quality controlled and processed to meet the wind height standard of 10 meters set by the World Meteorological Organization. Wind speeds are classified by the Saffir-

Simpson scale; spatial queries, intersections, and merges were used to consolidate and dissolve the observations into one shapefile for each tropical cyclone of interest to the project. Information on wind data for particular storms follows:

- Hurricane Katrina (2005)
  - Hurricane force winds were experienced by the eastern portion of the state with tropical storm winds extending outward to East and West Baton Rouge Parishes.
- Hurricane Rita (2005)
  - Hurricane and tropical storm strength winds are observed along the southern and southwestern parts of Louisiana.
- Hurricane Gustav (2008)
  - Hurricane force winds were experienced along the southern tip of Louisiana but a sizable portion of the state experienced tropical storm winds from Gustav.
- Hurricane Ike (2008)
  - Tropical storm force winds were recorded along the southern shorelines of Louisiana as the storm made landfall along the Texas coastline.
- Tropical Storm Lee (2011)
  - The southern part of Louisiana observed tropical storm strength winds prior to the tropical cyclone being classified as subtropical cyclone upon landfall.
- Hurricane Isaac (2012)
  - The southeastern part of Louisiana experienced tropical storm force winds before the system dissipated upon landfall after stalling out along the coast for two days.

The North Atlantic Hurricane Dataset (HURDAT) dataset was used to determine the tracks and intensities of North Atlantic that impacted Louisiana for the study period of 1851–2012. Each track contained in the database is comprised of six-hourly observations (0000, 0600, 1200, and 1800 UTC), longitude, latitude, maximum sustained wind, categorical strength based on Saffir-Simpson Hurricane Scale (SSHS), central surface pressure, and date as classified by the National Hurricane Center (NHC). The figures are broken down into intervals of 50 and 15 years for the project, as follows:

- 1851–1899: Thirty-two tropical cyclones made landfall across Louisiana.
- 1900–1949: Thirty-five tropical cyclones tracked across Louisiana.
- 1950–1964: Eleven tropical cyclones made landfall.
- 1965–1979: Eight tropical cyclones tracked across Louisiana—a quiet period; Hurricane Betsy.
- 1980–1994: Nine tropical cyclones tracked across Louisiana—a quiet period.
- 1995–2012: Seventeen tropical cyclones tracked across Louisiana, with several classified as major hurricanes (Saffir-Simpson category 3-5).

WILDFIRES

The data are available from the USDA Forest Service Active Fire Mapping Program. The dataset consists of point attribute data from 2001–2012. All reports were selected to include only those natural hazards that occurred in Louisiana. A 75% confidence interval was chosen to remove unlikely fire hazard detected by the MODIS satellite. Kernel density analysis with a 25-mi. radius applied to each dataset used to approximate the density of fire reports. More information follows below:

MODIS fire detection data for the current year (2012) are compiled by several sources, including: Terra and Aqua MODIS fire and thermal anomalies data generated from MODIS in near real-time direct readout data acquired by the USDA Forest Service Remote Sensing Applications Center, University of Wisconsin Space Science and Engineering Center, University of Alaska-Fairbanks Geographic Information Network of Alaska, the NASA Goddard Space Flight Center Direct Readout Laboratory, and NASA Goddard Space Flight Center MODIS Rapid Response System. These data are provided as the centroids of the 1km fire detections and are a composite dataset compiled from the listed sources. Direct readout products are subject to temporary system anomalies that may affect the acquisition of satellite data by one or all of the listed sources and, consequently, the completeness of this data product. GIS data are provided in ESRI shapefile and coverage formats and are updated hourly.

Four areas within the state are prevalent for fires. The highest densities are found along the western and southeastern parts of the state, where forestry and/ or agriculture is prominent, along with several national forests within the region.

WINTER WEATHER

Information on winter temperatures was gleaned from the same dataset used for extreme heat. The temperature data contains spatially gridded average monthly and annual maximum temperature for the climatological period 1981–2010. Measurements were interpolated using PRISM, and the grids were modeled on a monthly basis. Again, for the readability of this Plan Update, temperatures were converted from Celsius to Fahrenheit. A latitudinal decrease is evident in the average maximum daily January temperature for the state of Louisiana. The lowest (highest) average temperature was recorded in the northeastern (southeastern) portion of the state at 53.6 º F (63.4º F).

GEOLOGICAL/HUMAN-INFLUENCED HAZARDS

The data and approach for geological and human-influenced hazards will be described in the risk assessment's order of hazards:

- Geological/Human-Influenced Hazards
    - Coastal Hazards
        - Coastal Erosion
        - Saltwater Intrusion
        - Sea Level Rise
        - Subsidence
    - Dam Failure
    - Earthquake
    - Levee Failure
    - Sinkhole

COASTAL HAZARDS

Because the Coastal Protection and Restoration Authority has primary jurisdiction over profiling and risk assessment for coastal hazards, most mapping was taken from pre-existing sources, as indicated in the coastal hazards part of Section Two. This Plan Update did develop its own mapping for saltwater intrusion

SALTWATER INTRUSION

The data are available from LSU Center for Geoinformatics (through Josh Kent), Louisiana Geological Society, and USGS Water Resources Investigations Report 90-4060. The data consist of point- and polygon-based formats to reveal the shape and size of salt domes currently in use or abandoned in Louisiana on- and off-shore. In addition, 2005 and 2006 Digital Orthophoto Quarter Quads (DOQQs) from LSU Atlas and LOSCO Data Catalog are used to show the infrastructure risks (e.g., road networks, emergency routes, gas and oil wells, and underground pipes) associated near the salt domes.

Four hundred and twenty-five salt domes are identified in Louisiana, with 272 of them offshore. The majority of salt domes are found along the southern shores of Louisiana with small percentage occurring in the northern part of the state. Salt dome examples include Bayou Corne (Assumption Parish), Jefferson Island (Iberia Parish), Black Bayou (Cameron Parish), and Winnfield (Winn Parish). All indications are that infrastructure would be affected if salt dome were to collapse because of human or natural forcing mechanisms.

DAM FAILURE

The final dams database was obtained from the Department of Transportation and Development – this included over 500 dams across the state. Dams were mapped according to hazard type (low, significant, or high). Other properties, such as build type, were not mapped.

EARTHQUAKE

Extensive earthquake data for Louisiana were not found on the USGS earthquake database, but instead on the National Geophysical Data Center website. "Louisiana" was selected within the Earthquake Intensity Database and 96 earthquakes were found and extracted to a table. The table included city location, latitude/longitude coordinates, time, date, and magnitude (Modified Mercalli). Each earthquake was mapped using a graduate symbol technique based on intensity and fault lines obtained from the National Atlas were also mapped.

LEVEE FAILURE

Leveed areas were originally obtained through a Web Map Service (WMS) from the U.S. Army Corps of Engineers. The WMS can be linked directly into ArcGIS and any layers within the chosen path database can be mapped. Additional layers were available, but leveed areas and the leveed areas outline were the only layers needed. Two different levee district levels were used to map levee districts. First, the New Orleans and Vicksburg districts were used to delineate sections of the Red River and Mississippi River that were controlled by each district. Next, sub-districts (i.e. divisions) within Louisiana were downloaded directly from the USACE website as a single shapefile and mapped to show the extent of each division.

SINKHOLES

Data on sinkholes is extremely limited and relatively unreliable, and thus no mapping was used for this Plan Update.

RISK AND VULNERABILITY

To better mitigate against disaster, this Plan Update collates information on risk and vulnerability to determine jurisdictional vulnerability to hazards, as well as the composite risk on state-owned properties.

Jurisdictional vulnerability maps were created for nine different hazards: winter weather, tornadoes, lightning, hurricanes, high wind, hail, flooding, levees, and dams. The same methodology was utilized for all natural hazard vulnerability maps (winter weather, tornadoes, lightning, hurricanes, high wind, hail, and flooding). For these hazards, the Spatial Hazard Events and Losses Database for the United States (SHELDUS) was utilized to create tables that included parish-level information for (1) number of events, (2) number of fatalities, (3) number of injuries, and (4) cost of damage from 1987 to 2012. The tables were then merged with a shapefile of Louisiana parishes for mapping purposes. Each of the four categories were mapped based on adapted intervals. Chloropleth maps were produced to show the four categories for each of the seven hazards.

Jurisdictional maps for levees and dams utilized various methods. For levees, state-owned properties from the SLABS database were mapped if they were located within the leveed areas defined by the U.S. Army Corp of Engineers. Parishes that contained, bordered, or touched a leveed area were also identified and mapped since these parishes would be vulnerable to levee failure. Census tract data containing building values (extracted from HAZUS-MH) were mapped if they contained, bordered, or touched a leveed area and a chloropleth map was produced based on potential loss estimation for these census tracts. The population of the same census tracts was also mapped using a chloropleth technique to illustrate population levels in each potentially impacted census tract.

For dams, each dam location (obtained from the Louisiana Department of Transportation and Development) was aggregated to the parish level, and each parish was mapped based on the number of dams that were located within its boundaries. Census tracts where dams were located were also mapped showing the population in each of these potentially vulnerable census tracts. Building values for the same census tracts were extracted form HAZUS-MH and also mapped using a chloropleth technique. To map repetitive claim properties potentially vulnerable to dam failure, the all-inclusive repetitive claims database was used in conjunction with the location of significant and high hazard dams. If a repetitive claim property was within three mi. of a significant hazard dam or five mi. of a high hazard dam, then they were extracted from the original repetitive claims database. Next, only those with a lower elevation within the specified radii were considered when mapping the top 10 repetitive claim properties vulnerable to dam failure.

Composite risk maps were created based on four major categories from the SHELDUS and the 2006–2010 Social Vulnerability Index (SoVI) for each parish. The four main SHELDUS categories included injuries, fatalities, property damage, and number of events. SoVI measures individual parish vulnerability to environmental hazards based on social, economic, demographic, and housing characteristics, which are mainly derived from U.S. Census Bureau data.

Each of the five categories was re-scaled to reflect their relative values for each hazard on a scale of zero to one. For example, if the highest "injuries" value was "2.73" and the lowest value was "0.04," then all values were divided by the highest value (2.73). The highest value then becomes "1" and the lowest value becomes "0.01." An additional step was taken to re-scale SoVI values since values were both positive and negative. All values were converted to positive values by adding the lowest value, resulting in a new lowest value of zero. For example, if the lowest value is -5.15 and the highest value is 6.08, then 5.15 is added to every value resulting in a new highest value of 11.23 and a new lowest value of zero.

Values were subsequently re-scaled between zero and one. After re-scaling, each of the five values were added together to create a final composite score. Categories were divided into five classes: "<1.0" is **Very Low**, "1.01–1.5" is **Low**, "1.51–2.0" is **Medium**, "2.01–2.5" is **High**, and

“>2.5” is **Very High**. A score of 2.5 or higher indicated that an average of 50% or more of the highest possible values in each of the five categories was surpassed. A score between 2 and 2.5 indicated that an average of ~40–50% of the highest values in each of the five categories was surpassed. A score between 1.5 and 2 indicated that an average of ~30–40% of the highest values in each of the five categories was surpassed. A score of between 1 and 1.5 indicated that an average of ~20–30% of the highest values in each of the five categories was surpassed. A score lower than 1 indicated that an average of 20% of the highest values in each of the five categories was not surpassed.

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D. Plan Adoption

The Code of Federal Regulations requires that each state's hazard mitigation plan update be formally adopted by the state itself before it is submitted to the Federal Emergency Management Agency for final review and approval. This plan reproduces on the following page the statement of the plan's adoption by Kevin Davis, Director of the Governor's Office of Homeland Security and Emergency Management and the Governor's Authorized Representative for this action.

(Continued on Next Page)

Bobby Jindal
Governor

State of Louisiana

Governor's Office of Homeland Security and Emergency Preparedness

Kevin Davis
Director

March 31, 2014

STATEMENT OF PLAN ADOPTION

As Director of the Governor's Office of Homeland Security and Emergency Management (GOHSEP) , and the Governor's Authorized Representative, I the undersigned, am pleased to announce, and do hereby formally adopt the 2014 Louisiana State Multi-Hazard Mitigation Plan for the State of Louisiana.

In order for Louisiana to continue to be eligible for federal disaster assistance funding, GOHSEP is required to update the Plan at least once every three years. The Plan was initially approved by FEMA on April 28, 2005. In following updates, Louisiana received additional FEMA approval for the Plan on April 18, 2008 and April 6, 2011.

The 2014 Plan update continues to build upon Louisiana's commitment to reduce or eliminate the impacts of disasters caused by natural and human-caused hazards, and further identifies and documents progress made in hazard mitigation efforts, new or revised state and federal statutes and regulations, and emerging hazard conditions and risks that affect the State of Louisiana. The updated Plan is coordinated and maintained by GOHSEP, but the Plan is truly a collaborative partnership with numerous stakeholders from local, state and federal government agencies, private sector organizations, and residents of Louisiana.

In adopting the 2014 Plan, the State of Louisiana agrees to comply with all applicable state and federal statutes and regulations, as stipulated in previously documented assurances, and will update the plan at least once every three years. Through routine monitoring and updating, the Plan will remain the guide for Louisiana to follow in the state's commitment to significantly reduce or eliminate the impact of natural and human-caused disasters through a comprehensive hazard mitigation program that keeps Louisiana, and its visitors, safe from the hazards it faces.

Sincerely,

Kevin Davis
Director, Governor's Office of Homeland Security and Emergency Preparedness
Governor's Authorized Representative

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E. ENDNOTES

[i] During the development of this Plan Update, Assistant Project Manager T. Andrew Joyner, Ph.D., took a position as Assistant Professor of Geosciences at East Tennessee State University (ETSU). As a way to model the kind of civic–government engagement and awareness this Update hopes to foster, Dr. Joyner hosted a map competition among the students in his Cartography and Geographic Information Systems course (GEOG 2500) at ETSU. Students made a number of different maps (including state reference, average precipitation, flood zone, levee district, hurricane damage, flood vulnerability, and dam location maps), and the State Hazard Mitigation Planning Committee (SHMPC) adjudicated the competition, selecting a total of seven maps for inclusion in the Plan Update. The winners are named in the captions of their winning maps.
[ii] Vega, Grymes, Rohli 133.
[iii] 2010 Census.
[iv] United States Census Bureau Press Release, May 17, 2012 (http://www.census.gov/newsroom/releases/archives/population/cb12-90.html).
[v] The article may be accessed online (http://gis.cdc.gov/grasp/svi/A%20Social%20Vulnerability%20Index%20for%20Disaster%20Management.pdf).
[vi] §201.4(c)(2) of the Code of Federal Regulations (CFR).
[vii] Karl et al. 112.
[viii] "Effects of drought on groundwater resources," *The USGS Water Science School* (ga.water.usgs.gov).
[ix] NCDC, "Climate of 2011-July:U.S. Palmer Drought Indices," National Climatic Data Center, http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html#drought.
[x] Keim et al 2011.
[xi] Heat Wave Brochure (NOAA, FEMA, American Red Cross).
[xii] (source: http://www.nws.noaa.gov/om/hazstats.shtml)
[xiii] Vega, Grymes, Rohli 53.
[xiv] Thomas R. Karl, Jerr M. Meilillo, and Thomas C. Peterson, eds. Global climate change impacts in the United States, U.S. Global Climate Change Research Program (New York: Cambridge UP, 2009), 112.
[xv] Global Climate Change 2009 Report.
[xvi] Kunkle et al. 2013.
[xvii] NCDC 2010.
[xviii] FEMA, "National Flood Insurance Program - summary of coverage," Federal Emergency Management Agency, http://www.floodsmart.gov/floodsmart/pdfs/NFIP_Summary_of_Coverage.pdf.
[xix] Vega, Grymes, Rohli 76.
[xx] NWS, "National Weather Service Glossary".
[xxi] ASFPM, "Reducing flood losses: is the 1% chance (100-year) flood standard sufficient?," Washington D.C.: Assocation of State Floodplain Managers, 2004.

[xxii] Source: FEMA. The SFHA includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V.
[xxiii] Kunkel et al. 2013 and CPRA 2012 Master Plan.
[xxiv] Kunkel et al. 2013.
[xxv] All information comes from the NWS 2011 Flood Loss Report.
[xxvi] NCDC.
[xxvii] GOHSEP, 2011.
[xxviii] GOHSEP, Technical Publication 008: Repetitive Flood Loss Data Management, July 24, 2007.
[xxix] All top paid claims are established as such for all recorded history, as based on recent data.
[xxx] Vega, Grymes, and Rohli 121.
[xxxi] The Beaufort Wind Scale also provides guides for the appearance of wind effects on sea, as well.
[xxxii] http://www.nssl.noaa.gov/primer/lightning/ltg_climatology.html
[xxxiii] Per the National Lightning Safety Institute for the period 1999-2008.
[xxxiv] NCDC Storm Event Database.
[xxxv] Source: University of Louisiana, Monroe. http://www.ulm.edu/~pani/wx_hail.htm.
[xxxvi] Jensenius, Jr., John S. A Detailed Analysis of Recent Lightning Deaths in the United States (http://www.lightningsafety.noaa.gov/resources/RecentLightningDeaths.pdf)
[xxxvii] 2010 U.S. Census
[xxxviii] Vega, Grymes, Rohli 151, 164.
[xxxix] Waterspouts tend to die out faster and usually cause relatively little damage if they move to land because the relatively cool water surface provides less buoyancy (and thus weaker vortices) than a the hotter land surface would provide a land-based tornado. But tornadoes that form on land and then move to water are much more dangerous. On April 8, 1993, a waterspout that formed near Grand Isle moved over the island, leading to 3 deaths and 39 injuries (Vega, Grymes, Rohli 158).
[xl] Vega, Grymes, Rohli 170.
[xli] Vega, Grymes, Rohli 170.
[xlii] Vega, Grymes, Rohli 170.
[xliii] Source: NCDC.
[xliv] Vega, Grymes, Rohli 170.
[xlv] Vega, Grymes, Rohli 198.
[xlvi] Hurricanes can spawn an astonishing number of tornadoes. In 1967, for instance, Hurricane Beulah hit Texas with 115 observed tornadoes (Vega, Grymes, Rohli 157).
[xlvii] SCIPP, SurgeDat.
[xlviii] “Inland Strikes” are defined by a storm striking another state’s coast before moving into Louisiana.
[xlix] Direct and indirect.
[l] Vega, Grymes, Rohli 260.
[li] *The Federal Response to Hurricane Katrina Lessons Learned*, February 2006 and FEMA News Release 1603-414, March 23, 2006.
[lii] Louisiana Family Recovery Corps fact sheet, August 28, 2007, citing Federal Emergency Management Agency (FEMA) and Louisiana Recovery Authority (LRA) data.

[liii] Vega, Grymes, Rohli 259.
[liv] Vega, Grymes, Rohli 268.
[lv] It was later downgraded to a Category 3 hurricane.
[lvi] Vega, Grymes, Rohli 269.
[lvii] Vega, Grymes, Rohli 271–72.
[lviii] Vega, Grymes, Rohli 273.
[lix] National Climatic Data Center, 2010.
[lx] NCDC, 2011.
[lxi] NCDC, billion-dollar events.
[lxii] NCDC, 2012.
[lxiii] Bell et al. 2012 and Knutson et al. 2010.
[lxiv] Vega, Grymes, Rohli 188.
[lxv][lxv] Vega, Grymes, Rohli 187.
[lxvi] Vega, Grymes, Rohli 187.
[lxvii] Vega, Grymes, Rohli 56.
[lxviii] Vega, Grymes, Rohli 188–89.
[lxix] Subsidence is not specific to the coast, but it has its greatest impact there.
[lxx] "What's Causing the Crisis?" Coastal Protection and Restoration (coastal.louisiana.gov).
[lxxi] Restore or Retreat, restoreorretreat.org/why-restore/facts-and-figures/.
[lxxii] Source: http://news.nationalgeographic.com/news/2005/09/0919_050919_katrina_delta.html
[lxxiii] Source: http://farm2.staticflickr.com/1260/742099393_250e72716f_o.gif
[lxxiv] Parris et al. 2012. "Global sea level rise scenarios for the United States National Climate Assessment."
[lxxv] R. K. Dokka, "Modern-Day Tectonic Subsidence in Coastal Louisiana," *Geology*: 34, 2006.
[lxxvi] It is estimated by the Dam Safety Coalition that $10.1 billion is needed to address the nation's most critical dams. Needed repairs to publicly owned dams are estimated at $5.9 billion.
[lxxvii] Source: http://www.la.nrcs.usda.gov/programs/Watershed%20Programs/watershed_rehabilitation_louisiana.html
[lxxviii] "Isaac, threat of dam failure prompts mandatory evacuation near Tangipahoa River," *Times-Picayune*
[lxxix] Ruth Ingram, "Emergency crews stabilize, monitor dam at Percy Quin," *Clarion Ledger*
[lxxx] http://www.agiweb.org/environment/karstmap.pdf
[lxxxi] Source: History Channel.
[lxxxii] David Mitchell, "Residents spend year watching, waiting, worrying," *The Advocate* 8 Aug. 2013.
[lxxxiii] Source: http://jonathanturley.org/2013/09/01/buyou-corne-sinkhole-a-growing-enviornmental-disaster-in-louisiana/.
[lxxxiv] Source: Department of Culture, Recreation, and Tourism (http://crt.state.la.us/hp).
[lxxxv] Floods Insurance Study, City of Slidell, Louisiana (Community number 220204); Federal Emergency Management Agency; April 21, 1999.

[lxxxvi] See §201.4 of the Code for all federal requirements regarding State Mitigation Plans.
[lxxxvii] See Louisiana Revised Statutes §214.1(E).

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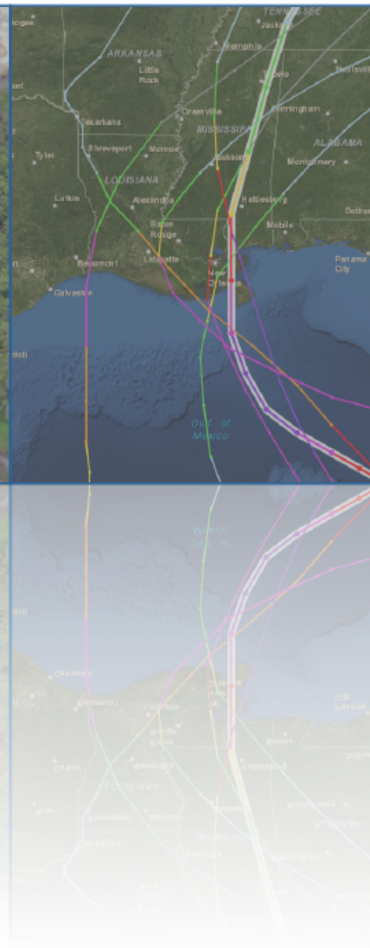

GOVERNOR'S OFFICE

HOMELAND SECURITY &
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