The State of Mississippi Standard Mitigation Plan

September 2010

Executive Summary

On behalf of the State of Mississippi, the Governor's Office and the Mississippi Hazard Mitigation Council, the Mississippi Emergency Management Agency is submitting this "State of Mississippi Standard Mitigation Plan" for review by the Federal Emergency Management Agency. This Plan is the result of the continued effort from stakeholders, staff and technical advisors to complete a document that updates the 2007 Standard Mitigation Plan. The updated Plan addresses natural hazards throughout the state with the expressed purpose of "saving lives and reducing future losses" in anticipation of future events.

Mississippi's Standard Mitigation Plan has been completed with a high degree of public participation. By continuing the relationships that we have established and developing new partnerships while strengthening existing ties with local, state and federal agencies, the Plan reflects the needs of the entire State. Most importantly, the Plan mirrors the mindset of the people of Mississippi, which was learned by carefully listening to ideas and initiatives for hazard mitigation.

"Mitigation Actions" that can be implemented to complete projects that are technically feasible, cost effective and environmentally sound are included within the Plan. It is a "living document" that will be constantly reviewed and updated thus reflecting current strategies and providing opportunities for evaluating the effectiveness of the projects and programs.

While this Plan is being reviewed by the Federal Emergency Management Agency, the State of Mississippi will prepare for full adoption of the plan. This will be accomplished with the following actions:

- The Mississippi Emergency Management Agency will review and respond to comments provided by the Federal Emergency Management Agency.
- The Mississippi Hazard Mitigation Council will review the record of the process and, at the appropriate time, will recommend the adoption of the Plan.
- The Office of the Governor, upon receipt of the Plan with addressed comments and recommendations, and by Executive Order, will adopt the plan for the State of Mississippi.

This Standard Plan, submitted to the Federal Emergency Management Agency in July 2010 in compliance with local, state and federal requirements, is for the benefit of the people of the State of Mississippi. It is evidence of a great effort by all participants, and the contribution of those involved is greatly appreciated.

The Mississippi Emergency Management Agency hereby submits this Standard Mitigation Plan for consideration by the Federal Emergency Management Agency.

Table of Contents

B - 2010 Mitigation Actions
C - 2007 Mitigation Actions Update

Summary of Changes

- Statistical information has been changed to reflect Mississippi at its current status.

- The narrative has been updated to reflect purposes set forth by the State of Mississippi.

1.0: Introduction

In the 2010 Mississippi State Hazard Mitigation Plan, the State identified the following hazards to be widely significant when carrying out its mission and commitment to saving lives and reducing future losses:

- Flooding
- Extreme Winter Weather
- Earthquakes
- Wildfires
- Hurricanes
- Tornadoes
- Dam and Levee Failures

In accordance with the Code of Federal Regulations 44 (CFR 44),the Disaster Mitigation Act of 2000, and Section 322 of the Robert Stafford Disaster Relief and Emergency Assistance Act, the State of Mississippi has completed this 2010 State of Mississippi Standard Mitigation Plan Update. The update continues to establish an effective framework in which state mitigation initiatives can be implemented in order to protect lives and property.

The 2007 Standard Mississippi Hazard Mitigation Plan cited the completion of a State of Mississippi Enhanced Hazard Mitigation Plan at the year's end. It was later determined that the State would be unable to complete the requirements of maintaining an enhanced plan due to its limited resources. At any rate, the State will continue to be efficient with its current resources and use them to approach the mitigation strategies, goals, and actions that are pertinent to Mississippi's safety.

The completion of the "2010 State of Mississippi Standard Mitigation Plan Update" is a pre-requisite for receiving some Federal disaster assistance. This disaster assistance includes Hazard Mitigation Assistance that is available to the State of Mississippi, as well as local Tribes, Cities and Counties. Participants of the 2010 Plan Update may be able to receive funds and use them to save lives and reduce future losses by planning for mitigation and implementation strategies.

In 2007, Governor Haley Barbour established a State of Mississippi Hazard Council by executive order. The Council is comprised of selected State Agency Officers and Directors and the Executive Directors of the organizations representing Counties and Cities throughout the State. Since 2007, it has inducted 2 new members. Vibrant, strong, and rich with ideals, the Council meets quarterly to track completed mitigation strategies and actions, to brainstorm new mitigation strategies, and to review current goals and initiatives. A listing of agencies represented by the council is available later in this document.

The Hazard Mitigation Council provides guidance in the development of the Plan. Nevertheless, the Council has not minimized the importance of sustaining an integrated and comprehensive approach to mitigation.   Therefore, this work is an effort coordinated with State and Local agencies, departments, and focus groups, as well as technical committees and representatives from Federal, State and Local agencies in the development of the Plan. This has been accomplished by first reviewing and incorporating all Local Hazard Mitigation Plans and planning efforts of State and Federal agencies. Then the efforts of others were carefully incorporated to ensure that an effective coordination of all initiatives is central to the implementation of the plan.

The “2010 State of Mississippi Standard Mitigation Plan Update” has been completed with a high degree of public participation by stakeholders, agencies and the general public. This was accomplished by developing a public participation process at the beginning of the planning process and effectively communicating the process as the project was developed. The result is that the concerns and ideas of the public are reflected in the Plan and mitigation action items have been developed to address the issues identified.

The “State of Mississippi Standard Mitigation Plan” is a “living document”. The Plan serves as a guide for hazard mitigation activities and provides a tool for implementing the most effective strategies. The Plan will be reviewed constantly as it is used and continuous improvement of the Plan will be reflected in updates and upgrades as needed, with a scheduled plan update to be completed at least every three years. Each section of the 2010 Mississippi Standard Hazard Mitigation Plan has been reviewed and/or updated to reflect changes from 2007, until now.

This plan, through its strategy of saving lives and reducing future losses, will contribute to the sustainability of the State of Mississippi. This sustainability will provide a balance in the economic, social and natural assets of the State resulting in a place that people want to be as they live, work and play.

Mississippi’s Standard Hazard Mitigation Plan – “Saving Lives and Reducing Future Losses.

1.1: State Characteristics

General Information

The State of Mississippi lies in the southern portion of the United States. Mississippi is the 32nd largest state in the United States with a total land area, including water, of 46,906.96 square miles. According to 2009 Census information, the state is 31st among other states with a population of 2,915,996. The name Mississippi is derived from Objibwe, a Native American or Algonquian language, and it means “Great River”. Mississippi is referred to as the “Hospitality State” and the “Magnolia State.” These nicknames are a reflection of the welcoming spirit of Mississippi’s residents and the beautiful magnolia trees found here. The State is diverse with each region exhibiting its own unique characteristic. Whether you are listening to the blues in the Delta or relaxing on the beaches of the Mississippi Gulf Coast, Mississippi has much to offer.

Mississippi’s flag was first adopted in a 1894 Special Session of the Mississippi Legislature. The official flag, which contains red, white and blue bars and stars, was chosen on April 17, 2001 by voters of the state. The stars, of which there are 13, represent the original states of the Union.

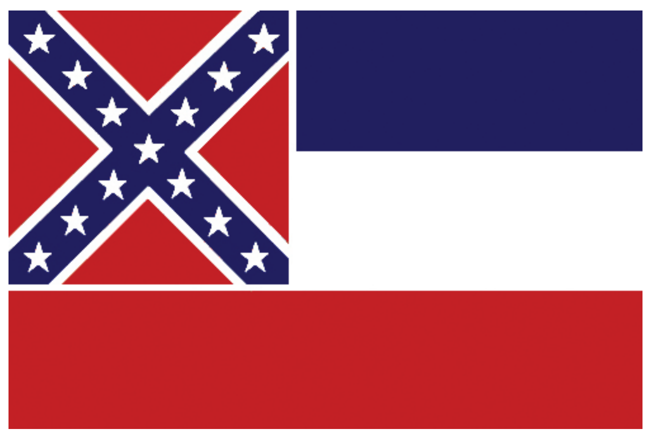
The state of Mississippi is rich in natural, architectural, and artistic beauty. It is home to the rolling hills in the northeast, the beautiful beaches of the Gulf Coast and some of the richest farmland in the world. It is also home to famous artists and musicians such as Walter Anderson, William Faulkner, Eudora Welty, John Grisham, and B.B. King. Cultural events are held throughout the state which showcase the rich cultural heritage here. Local cultural events include, but are not limited to: blueberry festivals, downtown festivals, parades, and founder’s day celebrations.

Table 1.1.1 identifies the different state symbols of Mississippi.

Table 1.1.1

State Symbols	
State Bird	Mockingbird
State Reptile	American Alligator
State Water Mammal	Bottlenosed Dolphin
State Fish	Largemouth or Black Bass
State Land Mammals	White Tailed Deer / Red Fox
State Wildflower	Coreopsis
State Butterfly	Spicebush Swallowtail
State Insect	Honeybee
State Fossil	Pre-historic Whale
State Stone	Petrified Wood
State Waterfowl	Wood Duck
State Shell	Oyster Shell
State Beverage	Milk
State Toy	Teddy Bear
State Flower / Tree	Magnolia
State Soil	Natchez Silt Loam (Typic Eutrudepts)
State Dance	Square Dance
State Language	English
State Grand Opera House	Grand Opera House of Meridian
State Song	“Go Mississippi”

Source: Mississippi Official and Statistical Register 2004-2008



MISSISSIPPI

State Capitol

The Mississippi State Capitol is located in Jackson, Mississippi. Jackson, the capitol city, is home to the Governor, Lt. Governor, House of Representatives and the State Senate. The existing capitol building, one of three capitol facilities built, was completed in 1903. The first building was completed in 1822 and the second one in 1833. The Old Capitol building of 1833 served three roles. Those roles were state capitol from 1839 to 1903, state office building from 1917 to 1959, and state historical museum from 1961 to present day. The first building, completed in 1850, was constructed to help ensure that Jackson would indeed be the capital city. The present day capitol building was designed by architect Theodore Link of St. Louis, Missouri. The architectural style is Beaux Arts. The focal point of the building is the 750 lights that illuminate four painted scenes and the rendition of a blind-folded lady which represents “Blind Justice.” The four painted scenes represent two Native American Indians, a Spanish explorer and a Confederate general. An eagle perched atop the capitol dome is made of solid copper overlain with gold leaf. The Mississippi capitol is a designated landmark building and is listed on the National Register of Historic Places.

Source:

Mississippi Department of Archives and History. http://www.mdah.state.ms.us/new_museum/history.html 2007;
Mississippi Legislature. http://billstatus.ls.state.ms.us/htms/cap_info.htm

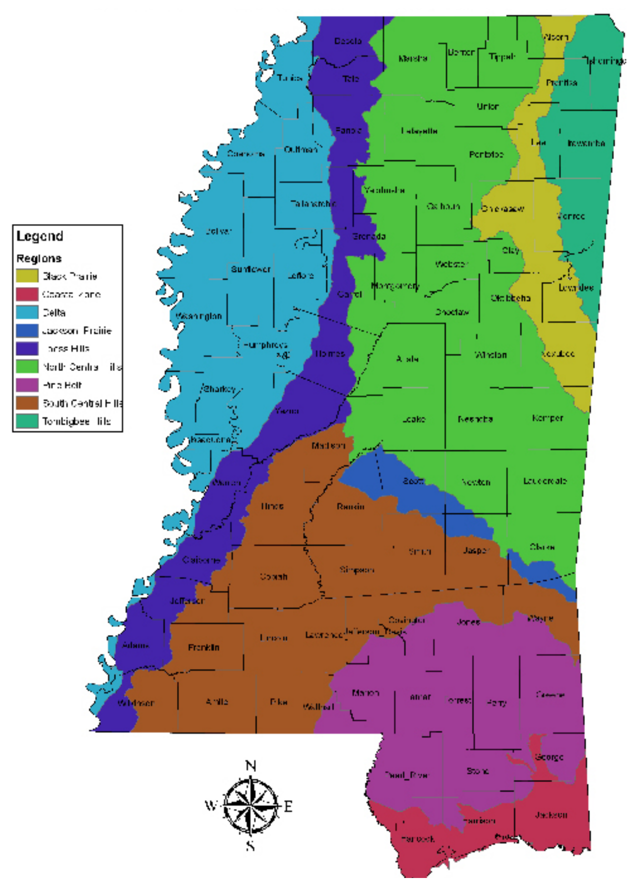
Geography

Mississippi is bordered by the states of Alabama, Tennessee, Louisiana, and Arkansas. A portion of the state boundary is delineated by the Mississippi River. This river is one of the largest water bodies in the continental United States. Other major water bodies within the state include the Pearl River, Big Black River, Yazoo River, Pascagoula River, and the Tombigbee River. An important fact about the State’s geography is that lakes makes up 3 percent of the total area. The major lakes in Mississippi are Sardis Lake, Grenada Lake, Arkabutla Lake, and the Ross Barnett Reservoir.

The highest point in the state is Woodall Mountain in Tishomingo County. This landform has a total elevation of 806 feet. On the other hand, the lowest point in the sate is the Gulf of Mexico, which is at sea level. The mean elevation for Mississippi is 300 feet. The state can be divided into nine physiographic regions—Black Prairie, Coastal Zone, Delta, Jackson Prairie, Loess Hills, North Central Hills, Pine Belt, South Central Hills, and Tombigbee Hills.

Figure 1.1.1

State of Mississippi Physiographic Regions



Black Prairies: this region extends from the northeastern corner of Noxubee County northward to Alcorn County and a small portion of Tishomingo County. The predominant soil type found in this region is clay. The topography in the Black Prairie region is flat.

Coastal Zone: this region covers portions of Pearl River, George, Hancock, Harrison, and Jackson counties. The predominant soil type in this region is acidic and sand with has areas of boggy soil high in organic content. Flat plains are the general topography.

Delta: this region covers the area of the state that borders the Mississippi River from a portion of DeSoto County down to the northeast corner of Wilkinson County. Flat plain is the general topography of the region. The Delta soil is characterized as mildly acidic to mildly alkaline.

Jackson Prairie: this region extends from portions of Wayne County to northern Rankin County. The predominant soil types in this region are both acidic and non-acidic. The topography is somewhat rolling with areas of ridges and valleys.

Loess Hills: this region extends from DeSoto County southward to Wilkinson County. The predominant soil type in this region is both acidic and non-acidic. This part of the state is also considered the brown loam region. The topography of this physiographic region is characterized by narrow ridges and steep-sided ravines.

North Central Hills: covering a large portion of Mississippi, this region extends from the northern portion of the state from Marshall County southward to northern Madison County then southwestward to Wayne County. The soils in this region are mostly acidic. The topography is characterized by both ridges and valleys.

Pine Belt: this region covers either all or portions of Walthall, Jefferson Davis, Jones, Covington, Lamar, Forrest, Perry, Greene, Pearl River, Stone, Wayne, and Harrison counties. The soil is acidic. The topography includes rolling hills as well as areas of steep-sided ridges and valleys. This region is also known for its abundance of hardwood trees.

South Central Hills: extending from southern Madison County to Wayne County and then southward to Wilkinson, Walthall, Amite, and Pike counties, the soil found here is primarily sandy loam. The topography includes rolling hills with broad valleys.

Tombigbee Hills: this region extends from Lowndes County northward to Tishomingo County. The soil is acidic and highly weathered. Topography in the Tombigbee Hills region is characterized by numerous streams, ravines and ridges, and contains the highest point in the state which is Woodall Mountain. The total height of this mountain is 806 feet.

Data Sources:

Mississippi State University Department of Geosciences – http://www.msstate.edu/dept/geosciences/faculty/brown/NWA_Journal/fig3.html
Delta State University Department of Biology and Environmental Sciences – http://www.marshdoc.com/physiography/physiography3/physiography3.html

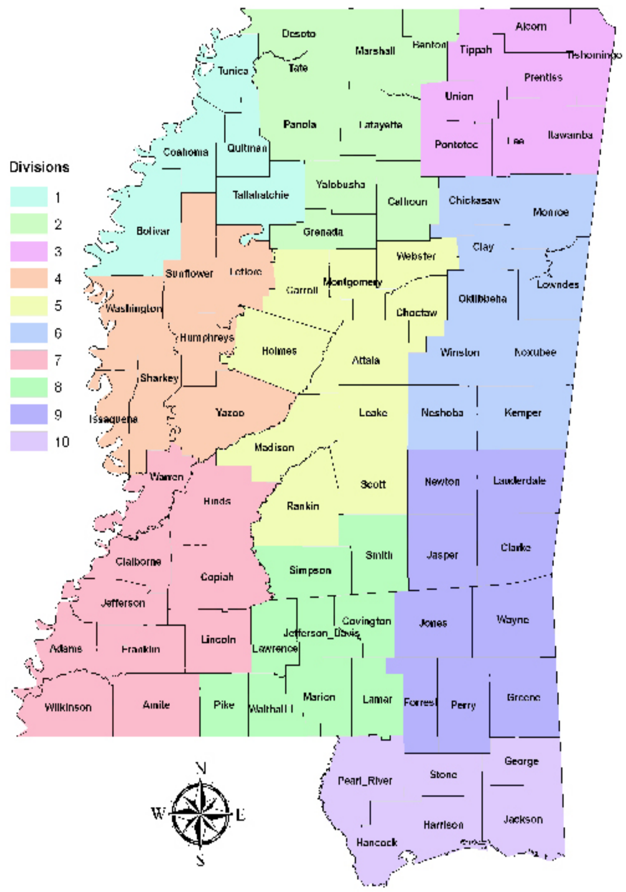
Climate

The State of Mississippi is located in the humid subtropical climate region of the United States, which is characterized by long, hot summers, temperate winters and rainfall that is evenly distributed throughout the year. The State is divided into 10 different climate zones: 1-Upper Delta; 2-North Central; 3-Northeast; 4-Lower Delta; 5-Central; 6-East Central; 7-Southwest; 8-South Central; 9-Southeast; and 10-Coastal. The normal mean annual temperatures range from 68 degrees along the coast to 62 degrees in the north. There have been occurrences where the temperature has dropped below 16 degrees and close to zero degrees in some areas. Mississippians have also routinely witnessed temperatures reaching 100 degrees in many areas. The record for the highest temperature was in Holly Springs, Miss., on July 29, 1930, when the temperature reached 115 degrees. The lowest temperature on record to date, minus 19 degrees, was set on January 30, 1966, in Corinth, Miss.

Normal precipitation ranges from 50 to 65 inches throughout the state. Traceable amounts of snow and sleet are typical in the northernmost counties. These northern counties have also experienced moderate and severe ice storms. A more detailed description of these occurrences can be found in Section 3.5

Figure 1.1.2

Climate Divisions of Mississippi



Recreation

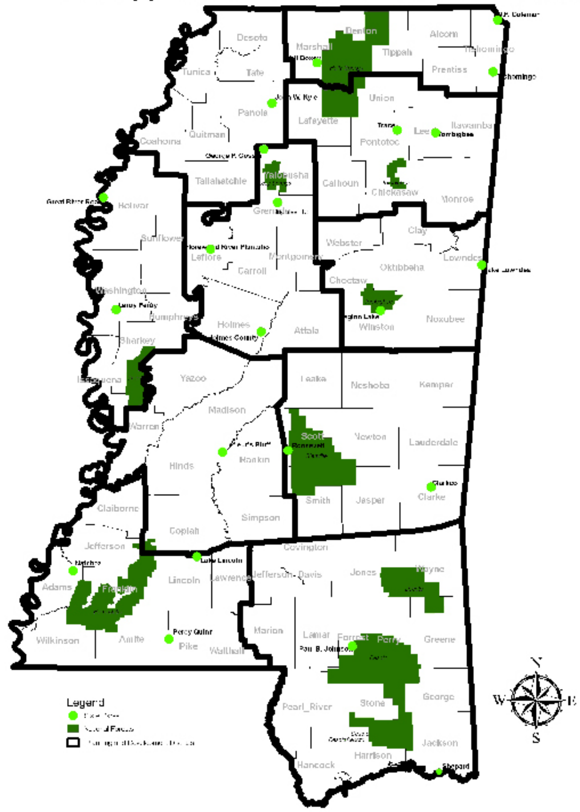
The State of Mississippi is home to over 20 state parks (Figure 1.1.3), which are easily accessible to the public. Each park offers a variety of recreational activities such as boating, wildlife watching, fishing, hiking, and swimming. It was estimated by a 2006 U.S. Fish and Wildlife Service Survey that approximately 1.1 million Mississippi residents and nonresidents participated in a wildlife-associated recreation with the State of Mississippi. Accordingly, the Bureau of Economic Analysis estimates that $609 million were spent on forestry, fishing, and related activities within Mississippi in 2007.

In a 2007study by the U.S. Departmment of Commerce, almost $1 billion were cureau of Econtributed to the state economy as a result of recreational activities. The Mississippi Department of Wildlife, Fisheries and Parks oversees the state's parks and fisheries and operates 24 fishing lakes that span 6,044 acres. This agency is also responsible for 38 Wildlife Management Areas reserved for public hunting. In addition to the substantial amount of parks and wildlife related activities, many municipalities across the state provide and maintain parks for residents and visitors. Golf serves as the recreation of choice for residents as well as tourists and business travelers.

The state has more than 140 public and private golf courses located statewide. The location and climate of Mississippi make golf one of the more popular forms of recreation. Many PGA sponsored events have been held in the state and have attracted top-ranked professionals. There are many other forms of recreational opportunities that exist other than the traditional forms. Among these are: disc golf, paintball, skateboarding, and bicycling.

Figure 1.1.3

Mississippi State Parks and National Forests



Data sources:

Mississippi Department of Wildlife, Fisheries and Parks – http://www.mdwfp.com 2007; Mississippi State University Extension Service – http://naturalresources.msstate.edu/stats/index.html 2007; Mississippi Development Authority/Tourism Division – Golf, Mississippi – http://visitmississippi.org 2007

Transportation

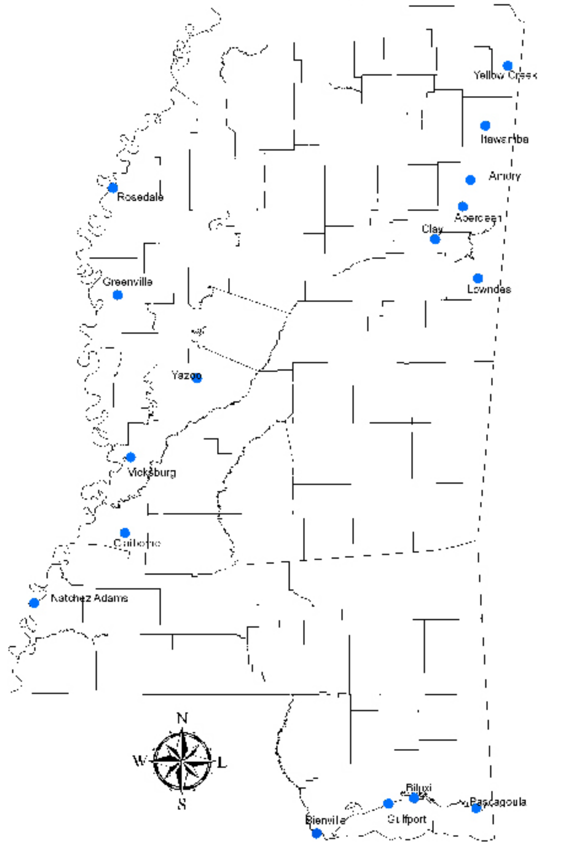
Mississippi's highway network includes approximately 73,500 miles and more than 16,000 bridges under the jurisdiction of federal, state, and local governments. The state's highway network characteristics support the view of Mississippi as a rural state. The Mississippi Department of Transportation (MDOT) is the state agency responsible for the "higher order" highway miles (Interstates, Freeways, Other Principal Arterials), and facilitates general overview/collaboration on highway connectivity with ports, airports and railroads. The highway system typically handles more than 35 billion vehicle miles of travel annually and is ranked 28th in the nation. County-owned highways make up 72 percent of the state's highway network, while state-owned and city-owned highways are the balance at 15 and 12 percent respectively. The remaining one percent of roadways in Mississippi fall under federal jurisdiction. While higher order highways comprise fewer highway miles than rural roadways, they carry the bulk of Mississippi's traffic.

There are 16 water ports located in Mississippi (Figure 1.1.4). Of this total, two are controlled by the state. All others are privately owned and operated. The ports are located along the Mississippi River, near the Gulf of Mexico, and on the Tennessee-Tombigbee River. The ports contribute $1.4 billion to the State's economy and account for 3 percent of the Gross State product. The ports located in the state generate 34,000 direct and indirect jobs that pay $765 million in wages and salaries.

Mississippi is home to 78 public-use airports. A large number of Mississippi's population live within one hour's drive of the seven airports which provide regularly scheduled passenger airline services. The remaining 71 public-use airports have a variety of purposes ranging from agricultural pesticide spraying to delivery services. The airport system accounts for $637 million of economic activity. It also supports 10,347 employees with salaries totaling $203.7 million.

Figure 1.1.4

State of Mississippi Port Locations



Sources:

Mississippi Department of Transportation – http://www.gomdot.com/aero/plan.htm 2007; Mississippi Department of Transportation – http://www.gomdot.com/localgov/planning/default.htm 2007

Population

The 2009 estimated population of Mississippi is 2,951,996. This number indicates a 2.2 percent increase from the 2000 figure of 2,848,666. The State of Mississippi is composed of 82 counties ranging in population from Issaquena, the smallest, with a total of 1,805 individuals to Hinds County, with 249,012. Based on the 2000 Census, the state averages 60.6 persons per square mile as compared to the United States with 79.6 persons per square mile. The counties that are most densely populated are DeSoto (224.3), Harrison (326.3) and Hinds (288.6).

The following is a breakdown of other population characteristics for the state:

- 38 cities have populations of 10,000 and above.
- 13 counties have populations of 50,000 and above.
- Four Metropolitan Areas, with the largest being the Memphis, Tenn., and DeSoto County Miss., that has a population of 1,135,614 and a population density of 377.7. This Metropolitan Statistical Area (MSA) ranked 43rd, which places it above Jacksonville, Fla., MSA, and Tucson, Arz., MSA. The next largest is Biloxi-Gulfport-Pascagoula MSA with a population of 363,988 and a population density of 203.9.
- The median age is 35.5 years.
- 48.5 percent of the population is male.
- 51.5 percent of the population is female.
- 72.7 percent of the population is 18 years old or older. Of this total, 67.6 percent is 21 and over.
- The largest race class is White/Caucasian at 60.8 percent followed by African American/Black at 36.5.
- Per capita income for 2005 was $32,938.
- The poverty rate in 2004 was 19.3 percent. This is slightly higher than the national average of 12.6 percent.
- Average household size is 2.61 persons.

Mississippi is classified as a mostly rural state. Sixty-three percent of the state is classified rural as compared to 36.9 percent for urban. The definition of urban is those areas that are densely populated in and around large cities having a population over 50,000. It is also defined as those residential areas outside of the cities with a population of 2,500 or greater. As stated previously, the majority of the state is classified as rural. Rural is defined as those areas outside of the city with a population under 2,500. There are a total of 258 Census Designated Places (CDP) in the State of Mississippi. Of this total, 223 (86.4 percent) are considered rural. A CDP is a community or city that meets criteria set by Census.

In order of size and based on 2006 estimates by the U.S. Census, the populations of the top seven cities in Mississippi are:

- Jackson 176,614
- Gulfport* 64,316
- Biloxi* 44,342
- Hattiesburg 48,012
- Greenville 37,801
- Meridian 38,200
- Southaven 41,295

* Does not include Post- Hurricane Katrina figures.

In late August 2005, the worst natural disaster in United States history struck Mississippi. This disaster was Hurricane Katrina. It affected (and to date is still negatively affecting) the lives of many along the Gulf Coast region. At landfall, this Category 3 storm wiped out entire towns and communities. The densely populated cities of the Coast were turned into "ghost towns." The aforementioned figures show that two of the larger cities were located on the Mississippi Gulf Coast. According to a population report completed by CLARITAS in January 2006, the counties of Harrison, Hancock and Jackson lost a total population of 47,666. Since that initial impact, 27,295 or 57.26 percent has returned. While those three counties lost population due to the initial stages of Katrina, the counties of Pearl River, Stone, and George gained population. The total number of initial population impact for all three combined was 19,140.

Housing

The total number of housing units in Mississippi as based on 2006 American Community Survey estimates was 1,235,496. Of this total, 87.7 percent or 1,084,034 were occupied. The total number of vacant housing units was 151,462 or 12.3 percent. This can be seen in Figures 1.1.5 and 1.1.6.

Figure 1.1.5

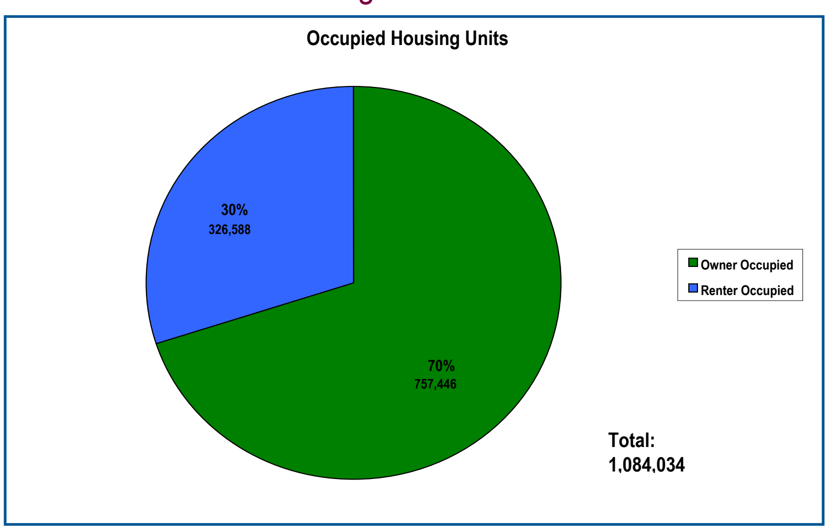
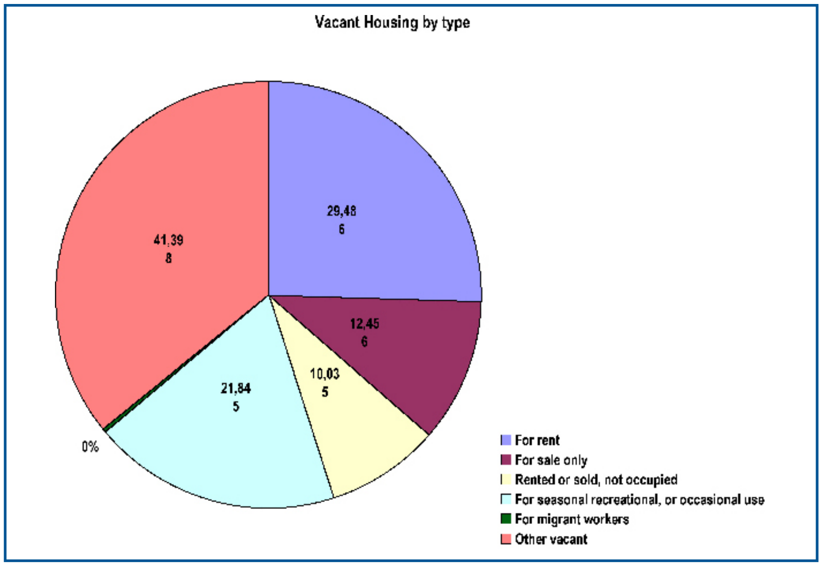


Figure 1.1.6



According to the 2005 American Community Survey, the total number of occupied housing increased from 1,046,034 to 1,084,034. Of this total, 69.7 percent was classified as one unit detached while the second most common type was mobile home/other housing at 15.3 percent. It can be deduced from these numbers that most Mississippians live in single-family housing or in mobile home/other forms of housing. However, 3.3 percent live in those structures that are classified as having 10 or more apartments.

Figure 1.1.7

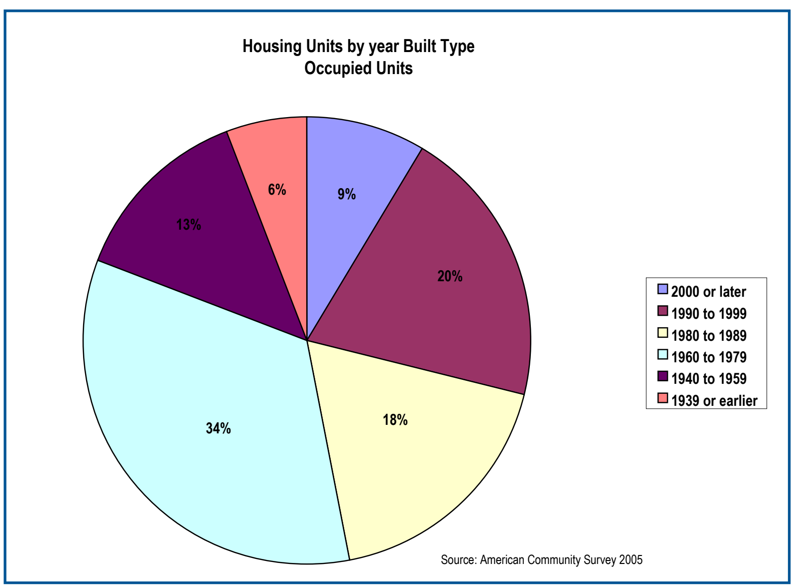
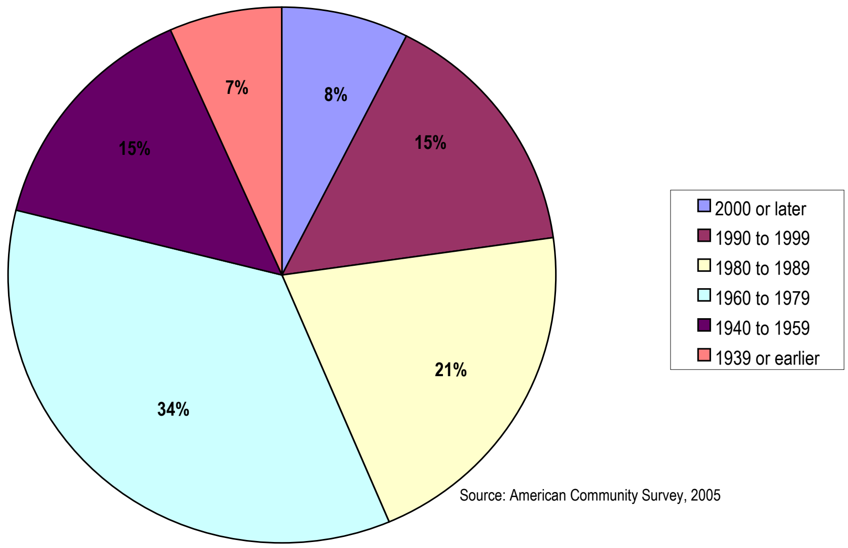


Figure 1.1.8

Housing Units by year
Renter Occupied

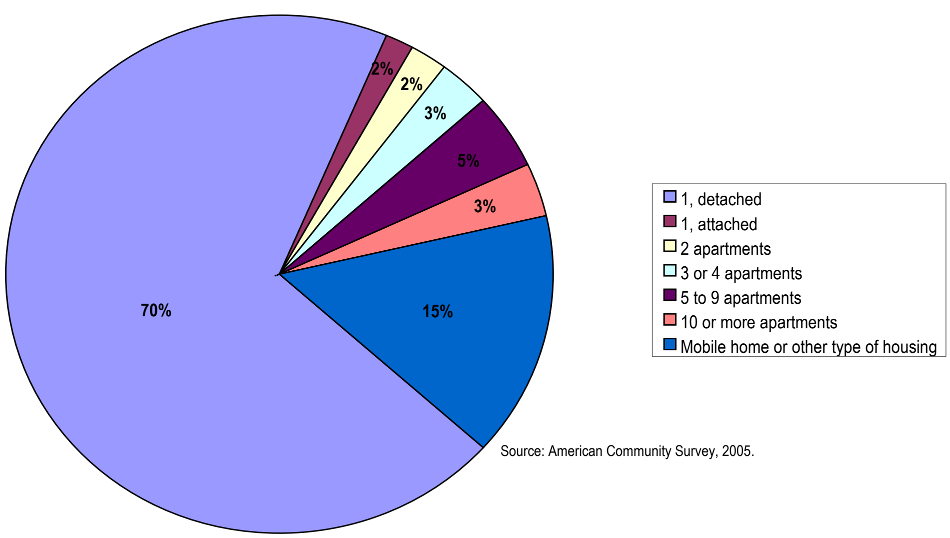


Source: American Community Survey, 2005

The majority of structures built took place between 1960 and 1979. This accounted for 33.9 percent of the total. This was followed by those built between the years of 1990 to 1999 at 20.2 percent. This shows that even though the housing stock tends to be older; newer homes are being built which signals progress and growth. Less than one percent of homes lacked plumbing facilities.

Figure 1.1.9

Housing units by Structure Type
Occupied Housing Units



Source: American Community Survey, 2005.

Economy

The State of Mississippi is home to many different industries. The industries range from agricultural based in the Delta to casino management on the Gulf Coast. The following is a list of the leading industries in the state:

Table 1.1.2

Industry Type	%
Accommodation and food services	5.2
Agriculture, forestry fishing and hunting	3.3
Arts, entertainment and recreation	3.1
Construction	7.6
Educational services	9
Finance, insurance, real estate and rental and leasing	4.9
Health care and social assistance	11
Information	1.9
Management of companies and enterprises	0

Industry Type	%
Manufacturing	18.1
Other services (except public administration)	4.8
Professional, scientific and technical services	3
Public administration	5.1
Retail trade	11.8
Transportation and warehousing and utilities	5.6
Waste Management Services	2.2
Wholesale Trade	3.5

Source:
Mississippi Development Authority. http://www.mississippi.org 2007

Table 1.1.2 above indicates that 18.1 percent of Mississippi's employment is through the manufacturing industry. Mississippi has large manufacturing plants such as Nissan North America, Northrop Grumman Ship Systems, Howard Industries and Cooper Tire and Rubber. These companies are also the leading employers in the state. Northrop Grumman has the largest number of employees at 11,570. It is followed closely by Nissan North America in Canton, MS which employs 3,200.

It should also be noted that Toyota Motor Manufacturing, Mississippi, Inc. has begun excavation of a new facility in Blue Springs, MS (located in the northeast section of the state). The plant is 97% complete. Production at the $1.3 billion plant was scheduled to begin by 2010 with 2,000 team members that will produce the Toyota Highlander SUV; annual vehicle capacity will be 150,000 units. This project was put on hold in 2008 due to economic downturn.

Companies do not choose to locate in areas lacking skilled workforce. Mississippi offers industries a population of workers willing to be trained through various programs. According to the State Department of Education, the state of Mississippi in 2004 had a total of 23,521 high school graduates. In addition to that total, there were 24,797 graduates from both four year and community colleges. These students are equipped to meet the needs of manufacturing companies through adequate public education at the high school and college level.

Summary

The State of Mississippi is divided into many different regions, as determined by climate and physiography. These regions face different threat levels of hazards related to these criteria. The topography ranges from the low-lying areas of the Mississippi Delta to the coastline of the Mississippi Gulf Coast. The Gulf Coast (Coastal Zone) is threatened annually by hurricanes. One of the worst disasters in U.S. history occurred along the State's coastline in August 2005: Hurricane Katrina, which destroyed homes as well as entire communities. Many areas of the Delta lie near the Mississippi River, which creates ideal conditions for flooding after large amounts of rain. The state's climate is characterized by long, hot summers and temperate winters. While the amount of rainfall is typically evenly distributed, the long hot, summers have led to the occurrence of droughts in the past while during the winter season, ice storms have occurred in the northeast region of the state.

The threat of any major hazard could greatly affect many of the state's industries. Among these are, but not limited to: tourism (both gaming and culturally based), transportation (state's ports contribute $1.4 billion annually to economy) and manufacturing (18.1% of state's industries). In addition, the state's recreation industry would suffer due to a major hazard. There are over 20 state parks in the state and almost $1.1 billion dollars are contributed to the economy by these type activities. In the aftermath of Katrina, the tourism and transportation industries were greatly affected by road and bridge closures, extensive damage to casinos, the permanent closure of some state parks and other devastating impacts. The population of the state increased from 2,848,666 to 2,951,996. This marked an increase of 2.1 percent. As the population continues to grow, the threat to loss of life and property damage rises as well. It is for this and the aforementioned reasons, that this plan takes into account the efforts of local government and addresses all hazard-related issues and their lasting impacts to lives and the landscape.

1.2: Plan Adoption

> 44 CFR §201.4(c)(6): The State mitigation strategy shall include the following elements:
>
> A Plan Adoption Process. The plan must be formally adopted by the State prior to submittal to FEMA for final review and approval.

The State of Mississippi Standard Mitigation Plan meets the requirements of Section 409 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (commonly referred to as the Stafford Act - Public Law 93-288 as amended). Additionally, this plan meets the minimum planning requirements under 44 Code of Federal Regulations (CFR), Part 78 (Flood Mitigation Assistance).

It is intended that this plan also meet the requirements of the Disaster Mitigation Act of 2000 (DMA2K), Section 322. Section 322 of the Act requires that states, as a condition of receiving federal disaster recovery funds, have a mitigation plan in place that describes the planning process for identifying hazards, risks and vulnerabilities; identifying and prioritizes mitigation actions; encouraging the development of local mitigation; and providing technical support for these efforts. In addition, the Act also requires local and tribal governments to have mitigation plans.

The development and implementation of this strategy is authorized and/or required by the following state statutes:

Mississippi Emergency Management Law, Mississippi Code of 1972, Title 33-15, as amended.

Executive Order(s) by the Governor

The final draft of the State of Mississippi Standard Mitigation Plan was submitted to the Governor's Authorized Representative (GAR) for review and recommendation. From here it was sent to Governor Haley Barbour for adoption by the State of Mississippi under the executive powers of the Governor on October 17, 2007. The Promulgation Statement issued by Governor Barbour is presented on the subsequent page.

1.3: Compliance with Federal Laws and Regulations

> 44 CFR 201.4(c)(7): The State mitigation strategy shall include the following elements:
>
> Assurances. The plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with CFR 13.11(c). The State will amend its plan whenever necessary to reflect changes in State or Federal laws and statutes as required in CFR 13.11(d).

44 CFR

Through the development and enforcement of this plan, the State of Mississippi will comply with all provisions in 44 Code of Federal Regulations:

I. Part 7, Nondiscrimination in Federally Assisted Programs.

II. Part 9, Floodplain Management and Protection of Wetlands.

III. Part 10, Environmental Considerations.

IV. Part 13, Uniform Administrative Requirements for Grants and Cooperative Agreements to States and Local Governments.

V. Part 14, Administration of Grants: Audits of State and local governments.

VI. Part 17, Government-Wide Debarment and Suspension and Government-Wide Requirements of Drug-Free Workplace.

VII. Part 18, New restrictions on lobbying.

VIII. Part 201, Mitigation Planning

IX. Part 206, Federal Disaster Assistance.

X. Subchapter B - Insurance and Mitigation.

XI. Subchapter D - Disaster Assistance.

XII. Subchapter F - Preparedness.

Additionally, the laws listed below are provided as documentation that the State or any subsequent sub-grantee (recipients) that receive federal grant funds will comply with all applicable State and Federal statutes and regulations. The State will amend the plan whenever necessary to reflect changes in federal statutes and regulations or material changes in state law, organization, policy, or state agency operations.

The following provisions apply to the award of assistance:

Federal Law

I. Public Law 93-288, Disaster Relief Act of 1974, as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance At of 1988, Public Law 100-707 and further amended by Disaster Mitigation Act of 2000, Public Law 106-390.

II. Public Law 93-234, Flood Disaster Protection Act of 1973.

III. Public Law 103-181, Hazard Mitigation and Relocation Assistance Act of 1993.

IV. Public Law 98-502, Single Audit Act.

V. Public Law 81-920, Federal Civil Defense Act.

VI. Title 31 CFR Part 205.6, Funding Techniques.

Executive Orders

I. Executive Order 11988, Floodplain Management.

II. Executive Order 11990, Protection of Wetlands.

III. Executive Order 12612, Federalism.

IV. Executive Order 12699, Seismic Safety.

V. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

Office of Management and Budget

I. OMB Circular A-21, Cost Principles for Educational Institutions.

II. OMB Circular A-87, Cost Principles for State and Local Governments.

III. OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs.

IV. OMB Circular A-102, Uniform Administrative Requirements for Grants and Cooperative Agreements with State and Local Governments.

V. OMB Circular A-110, Uniform Administrative Requirements for Grants and Agreements with Institutions of Higher Education, Hospitals, and other Non-Profit Organizations.

VI. OMB Circular A-122, Cost Principles for Non-Profit Organizations.

VII. OMB Circular A-133, Audits of Local Governments, and Non-Profit Organizations.

State Authorities

I. Mississippi Emergency Management Law, Mississippi Code of 1972, Title 33-15, as amended.

II. Other Applicable Mississippi laws, refer to “Compendium of Legislation” *Mississippi Administrative Plan,* Volume I to *Mississippi Emergency Management Plan.*

III. Executive Order(s) of the Governor:

- ◊ E. O. 252, August 11, 1977; Relocation of State Government.
- ◊ E. O. 573, March 3, 1987; Mississippi Emergency Response Commission.
- ◊ E. O. 653, 1990, et. Seq.; Emergency Management Responsibilities.
- ◊ E. O. 985, 2007; Mississippi State Hazard Mitigation Council.

2.0 The Planning Process

Section 201.4 (a) of the CFR reads as follows, “The mitigation plan is the demonstration of the State’s commitment to reduce risks from natural hazards and serves as a guide for State decisionmakers as they commit resources to reducing the effect of natural hazards.” Therefore, an effective planning process is the key to a strong mitigation strategy plan.

Mitigation planning can:

- help communities become more sustainable and disaster resistant,
- be incorporated as an integral component of daily government business,
- help focus efforts on particular hazards by determining and setting priorities for mitigation planning, and
- save money by providing a forum for engaging in partnerships.

The Mississippi Emergency Management Agency has taken great care in developing and executing a mitigation plan that fully serves the citizens of the State of Mississippi. This section is documentation of the State’s effort to save lives and property.

Summary of Changes - 2010 Planning Process

This entire section has been reviewed and updated by the MS Emergency Management Planning Team. Some of the information is still relevant and remains the same. All other information has been updated to reflect the current.
In 2008, the Council introduced 2 new members to aid in continued mitigation actions: Table 2.2.1 reflects these 2 changes.

Some changes have occurred on the development team.

FEMA has combined several programs to create the Hazard Mitigation Assistance Program.

Table 2.3.2.1 was revised to reflect changes in personnel.

New information has been added concerning the MS Band of Choctaw Indians.

Mississippi has acquired additional StormReady communities, and a map has been added to reflect the acquisitions.

2.1: Documentation of the Planning Process

> ***44 CFR 201.4(c): Plan Content. To be effective, the plan must include the following elements:***
>
> ***Description of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.***

Mitigation Planning is...

Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. Mitigation planning is a process for states and communities to identify policies, activities, and tools for implementing mitigation actions. The Mississippi Emergency Management Agency decided to continue with the following four basic steps or phases in updating its plan :

- organization of resources;
- assessment of risks;
- development of a mitigation plan; and
- implementation of the plan and monitoring progress.

Phase I: Organization of Resources

In 2007, the State of Mississippi made a firm commitment to identify and organize its resources through the Mississippi Hazard Mitigation Council. Established by Governor Haley Barbour under Executive Order 985, the Council has played a very major part in steering the State's mitigation strategy. The Council has served the people of Mississippi by providing a platform from which an integrated statewide plan could be developed to complete mitigation goals. The State continues to use this organization in the 2010 Hazard Mitigation Plan Update. The Council has in fact identified 2 new members since its conception. The members of the Council are further discussed in a later section of this document.

The Council is comprised of citizens who were jointly selected by MEMA's executive staff and Governor Barbour based upon the skills, knowledge, and abilities necessary for

- ◊ forging partnerships from among a broad range of groups,
- ◊ integrating existing plans and planning efforts,
- ◊ identifying and articulating needs to state and federal officials, and
- ◊ providing continuity in statewide planning that seeks to achieve a common goal.

Phase II: Assessment of Risks

The State of Mississippi is diverse by nature and climate. From severe weather to wildfires and flooding to unstable dams, Mississippians have faced their share of disasters throughout the years. The plan developers began an assessment of risks by researching historical records and learning from past hazardous events. This history has been used to assist in the assessing of today's risks by using a Hazard Ranking Worksheet. From this process, the past documented events were profiled and vulnerabilities identified. The plan developers then projected estimated potential future losses.

The Hazard Ranking Worksheet operates like this: The probability of each hazard is determined by assigning a level, from one to four, based on the likelihood of occurrence from historical data. The total impact value includes the affected area, primary impact and secondary impact levels of each hazard. These levels are then multiplied by an importance factor to obtain a score for each category. The probability score is multiplied by the sum of the three impact categories to determine the total score for the hazard. Based on this total score, the hazards were then separated into four categories based on the hazard level they pose to the communities. Those four categories are

- unlikely,
- possible,
- critical and
- highly likely.

This backbone of information forms the basis for MEMA's mitigation plan and helps to shape it in an economically feasible and environmentally sound manner.

Phase III: Development of a Mitigation Plan

Each phase of MEMA's planning process in developing Mississippi's Mitigation Plan is documented within this report. Statewide hazard mitigation goals and objectives have been developed by the Hazard Mitigation Council and presented to stakeholders, partnering agencies, and the general public for review and comment. Details of this process are included within the next section.

In addition, state capabilities have been identified and assessments have been made concerning current effectiveness. Alterations to existing plans based on the state's capabilities have been identified and analyzed and, if found deserving, have been included within the 2010 Hazard Mitigation Plan update. Finally, funding sources have been considered and where applicable, factored into the final document's operational procedures.

Phase IV: Implementation of the Plan and Monitoring Progress

Upon adoption of this plan, Mississippi's mitigation actions statewide will take on a more cohesive, stronger, and more easily recognized existence. Existing local and regional hazard mitigation plans will continue to move closer to statewide goals and objectives due to increased communications and understanding. Built in milestones for reviewing and tweaking the plan will help to ensure that stakeholders and the general public are afforded the opportunity for input. As the plan continually evolves, it will be altered to meet our ever changing environment. And while this plan is a good start, it is in fact the beginning of a more unified and thus more effective and economically feasible strategy for saving lives and reducing future losses.

In an effort to organize changes made from the 2007 to 2010 plan, a Table of Contents “Roadmap” for the 2007 to 2010 Update is provided in Appendix 7.2-A.

2.2: Coordination with Federal and State Agencies and Interested Groups in the Planning Process

44 CFR 201.4(b): Planning Process. An effective planning process is essential in developing and maintaining a good plan. The mitigation planning process should include coordination with other state agencies, appropriate federal agencies, and interested groups.

The State Hazard Mitigation Plan (the Plan) was prepared by the Mississippi Emergency Management Agency's (MEMA) Bureau of Mitigation with assistance from numerous state agencies, organizations, and concerned citizens.

Early in the update process, multi-level involvement was achieved by engaging mitigation specialists from all areas of the state. MEMA chose this approach in order to achieve the most effective mitigation plan possible - one that works in tandem with municipal, local, state, and federal entities.

Hazard Mitigation Council

Governor Haley Barbour, being highly supportive of the State's mitigation strategies, executed Executive Order # 985, creating the Mississippi Hazard Mitigation Council. Mississippi's Hazard Mitigation Plan is a living document, and has been reviewed and updated in quarterly meetings held by the Hazard Mitigation Council since January 2007.

The Council is effective in guiding mitigation goals and objectives for the State of Mississippi. Appointees to the council were carefully selected in order to provide representation from key state and local agencies capable of contributing resources, implementing mitigation actions, and integrating mitigation planning efforts. It is anticipated that the Hazard Mitigation Council will remain intact and continue to strengthen communications and working relationships by coordinating mitigation efforts between all levels of governmental agencies, private non-profit organizations, and the private sector for years to come. This in turn bolsters development, supports on-going maintenance, and improves planning efforts. A copy of Executive Order #985 is provided in this document on Section 2:26.

It is expected that the Council will remain intact indefinitely and that it will continue to assist in

- ◊ creating a vision for addressing future needs,
- ◊ accurately and quickly responding to economic and environmental changes,
- ◊ regularly evaluating the success of the state hazard mitigation plan, and
- ◊ providing necessary resources whenever possible for updating or changing goals and addressing new laws and regulations.

MEMA also established a well-rounded team of plan developers for the 2010 plan. Somewhat different from the 2007 team, plan developers included state employees, a consulting agency, and a state university to serve as plan developers for the 2010 Hazard Mitigation Plan. Through a series of workshops and meetings, many public entities have been involved in the planning process, and the mitigation actions of many stakeholders, emergency response organizations, and agencies have also been included in this plan. The State of Mississippi is therefore transitioning from many individualized mitigation strategies to a statewide planning effort.

STATE OF MISSISSIPPI

Office of the Governor

EXECUTIVE ORDER NO. 985

MISSISSIPPI HAZARD MITIGATION COUNCIL

WHEREAS, there are significant opportunities to save lives and reduce future losses resulting from natural and human-caused hazards through hazard mitigation planning; and

WHEREAS, Public Law 106-390, known as the Disaster Mitigation Act of 2000 (DMA 2000), was signed into law by the President on October 10, 2000; and

WHEREAS, the DMA 2000 provides funding for disaster relief and recovery, and reinforces the importance of mitigation planning and disaster preparation; and

WHEREAS, the DMA 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP) and is intended to facilitate cooperation between state and local authorities; and

WHEREAS, Section 322 of the DMA 2000 specifically addresses mitigation planning at the state and local level, identifies new requirements that allow HMGP funds to be used for planning activities, and increases the amount of HMGP funds available to states that have developed a comprehensive, enhanced mitigation plan prior to a disaster; and

WHEREAS, state governments have certain responsibilities for implementing Section 322 of the DMA 2000, including: preparing and submitting a standard or enhanced state mitigation plan; reviewing and updating the state mitigation plan every three years; providing technical assistance and training to local governments to assist them in applying for HMGP grants and in developing local mitigation plans; and reviewing and approving local plans if the state is designated as managing state and has an approved enhanced plan.

WHEREAS, the Enhanced Hazard Mitigation Plan can reduce or eliminate long-term risk to life and property from a hazard event; identify cost-effective and technically feasible mitigation measures that will reduce losses from future disasters in an environmentally sound manner; encourage long-term reduction of hazard vulnerability; build partnerships with sectors not previously involved; protect critical community facilities, reduce exposure to liability, minimize community disruption; facilitate funding priorities, especially following a disaster; and create more sustainable communities.

WHEREAS, establishing a Hazard Mitigation Council is in the best interest of the State of Mississippi;

NOW, THEREFORE, I, Haley Barbour, Governor of the State of Mississippi, by the authority vested in me by the Constitution and the Laws of this State, do hereby:

1. Direct that a Mississippi Hazard Mitigation Council ("Mitigation Council") be established and include representation from the following:

   a. Governor's Office;
   b. Mississippi Emergency Management Agency;
   c. Mississippi Department of Environmental Quality;
   d. Mississippi Department of Finance and Administration;
   e. Mississippi Department of Transportation;
   f. Mississippi Department of Public Safety;
   g. Mississippi Department of Marine Resources;
   h. Mississippi Levee Board;
   i. Mississippi Development Authority;
   j. Mississippi State Department of Health;
   k. Mississippi Department of Archives and History;
   l. Mississippi Municipal League;
   m. Mississippi Association of Supervisors;
   n. State Board for Community and Junior Colleges;
   o. Mississippi State Department of Education; and
   p. State Institutions of Higher Learning.

2. Declare that the Executive Director of MEMA shall serve as the Chairperson of the Mitigation Council.

3. Declare that MEMA's Executive Director may, as chairperson of the Mitigation Council, designate additional executive and non-executive branch personnel or quasi-governmental and non-governmental personnel to assist the Mitigation Council as needed for their expertise and counsel arises.

4. Declare that the Mitigation Council shall act as an advisory council in all matters related to Mississippi's Enhanced Hazard Mitigation Plan.

5. Require that the Mitigation Council review issues relating to the creation of Mississippi's Enhanced Hazard Mitigation Plan, as well as other mitigation efforts, as deemed appropriate by MEMA in cooperation with the Federal Emergency Management Agency (FEMA).

6. Direct that the Mitigation Council shall make recommendations for:

   a. An overall strategy for the adoption and use of Mississippi's Enhanced Hazard Mitigation Plan;
   b. Addressing potential technical, scientific, economic, security, privacy, and other issues related to the adoption of Mississippi's Enhanced Hazard Mitigation Plan;
   c. Identifying existing mitigation information resources, including funding sources, to support the development of Mississippi's Enhanced Hazard Mitigation Plan; and
   d. Supporting continuing, educational efforts to promote development of a population capable of being self-sustaining before, during and after a disaster event.

7. Direct all Executive branch departments, agencies, boards, and commissions and any other divisions of the Executive branch of state government, to fully cooperate with the Mitigation Council and provide staff support and any other assistance as requested.

8. Direct the Mitigation Council to meet periodically as needed to:

    a. Review Mississippi's Enhanced Hazard Mitigation Plan;
    b. Review statewide hazard mitigation goals and objectives; and
    c. Review priorities for categories of hazard mitigation projects.

9. Authorize the Mitigation Council to seek grants from government or private sources to achieve the goals and objectives set forth.

10. Deem that the Mitigation Council shall continue in existence until all of its objectives are achieved, unless otherwise directed by a future Executive Order.

IN TESTIMONY WHEREOF, I have hereunto set my hand and caused the Great Seal of the State of Mississippi to be affixed.

DONE at the Capitol in the City of Jackson, the 17th day of May, in the year of our Lord two thousand seven and of the Independence of the United States of America, the two hundred and thirty-first.

Haley Barbour

HALEY BARBOUR
GOVERNOR

BY THE GOVERNOR:

Eric Clark

SECRETARY OF STATE

Members of the Hazard Mitigation Council and the agencies and/or associations they represent are indicated in table 2.2.1.

Table 2.2.1
Mississippi's Hazard Mitigation Council

Agency	Representative
Office of the Governor	Governor
Mississippi Emergency Management Agency (MEMA)	Executive Director
Mississippi Department of Environmental Quality (MDEQ)	Executive Director
Mississippi Department of Finance and Administration (DFA)	Executive Director
Mississippi Department of Transportation (MDOT)	Executive Director
Mississippi Department of Public Safety	Commissioner
Mississippi Department of Marine Resources (DMR)	Executive Director
Mississippi Levee Board	Executive Director
Mississippi Development Authority (MDA)	Executive Director
Mississippi State Department of Health	State Health Officer
Mississippi Department of Archives and History	Executive Director
State Board for Community and Junior Colleges	Executive Director
Mississippi State Department of Education	Executive Director
State Institutions of Higher Learning (IHL)	Executive Director
Mississippi Municipal League (MML)	Executive Director
Mississippi Association of Supervisors (MAS)	Executive Director
Mississippi Department of Human Services	Executive Director
Mississippi Forestry Commission	Executive Director

To enhance the expertise and diversity of the Council, Governor Barbour added Mississiippi Department of Human Services and the Mississippi Forestry Commission representatives in 2008.

Team Approach

Alongside MEMA and the Council, the planning team for the Mississippi 2010 Update consisted of Neel -Schaffer, Delta State University Center for Interdisciplinary Geospatial Information Technologies, leaders of the MEMA staff, mitigation planners, and James Lee Whit Associates.

Initially, mitigation planners compiled the 92 FEMA approved local plans that cover the entire State of Mississippi and posted them on a shared intranet site. Results from 92 local mitigation plans (32 new mitigation plans, in addition to 60 plans included in the 2007 plan) were compiled to reflect natural hazard occurrences and risks.

On February 22, 2010, the hazard mitigation Council convened at 9 a.m. to again discuss the process of updating the State plan. The roles of the planning team were defined.

Council members meet to review and discuss its strategy for developing the 2010 Mississippi Hazard Mitigation Plan Update.

Neel-Schaffer reported on the compilation of data from all 92 local plans. Later the council deliberated on two methods to evaluate the Hazard Identification and Risk Assessment. The first method used Poisson distribution to calculate probability. The second method, which was used in the 2007 update, used values to calculate probability. The council decided to research the effectiveness and efficiency of the two methods, and vote during a subsequent meeting. Afterwards, the Mitigations Plans Bureau staff, oversaw the review of plan goals and objectives as well as the review of state capabilities. Finally, a timeline was set for the completion of the plan.

The Council, as well as plan developers convened for a second meeting on April 22, 2010. Findings from the risk assessment were presented by Neel-Schaffer. Also, research revealed that ranking hazards using the value probability of occurrence to be highly efficient, so the Council continued with the values method of calculating risk probability. Using historical data gathered from the USGS, local mitigation plans, and the risk assessment, a quorum of the Council evaluated significant natural hazards. Hazards were ranked based on the following factors: the probability of occurrence, the area affected by the hazard, primary impact or damage, and secondary impact to the community at large. Next, the mission statement, goals, objectives, and state capabilities were presented by MEMA's Mitigation Plans Bureau. The Council decided that these elements properly reflected the State's planning needs, and voted to continue them for the 2010 Mitigation Plan Update. Finally, members of the Council reported changes in the capabilities of their respected agencies. These reports are included in Section 4.2 of this document. From 2007 until now, members of the Council have continually updated profile and project information for their agencies over the 3 year period, using an Evaluation Report, Progress Report, and a Mississippi Action Profile. In 2009, these 3 forms were condensed for presentation in the 2010 Mitigation Plan Update. These new forms can be found later in this document.

MEMA mitigation planners, Neel Schaffer, and other members of the planning team were responsible to incorporate all updated and new information into every section of this plan.

The Mississippi Hazard Mitigation Council members meet again on April 22, 2010.

Plan developers worked diligently as a team throughout the Hazard Mitigation Plan update process. The group consisted of members of MEMA's executive staff, the MEMA Hazard Mitigation Bureau, Neel-Schaffer Consulting Firm and Delta State University.

Experts from various private, state and local entities statewide, as well as representatives from the Federal Emergency Management Agency (FEMA), were given the opportunity to participate in the planning process for the purpose of increasing integration with ongoing state hazard mitigation planning efforts.

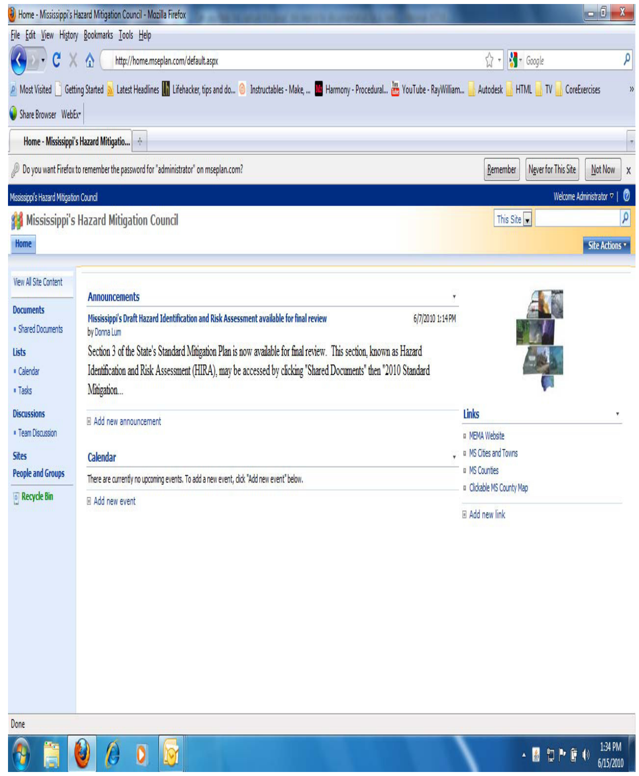
MEMA solicited participation from industry associations and volunteer agencies, as well as mitigation planners and specialists representing all levels of governments and numerous specialized areas. Table 2.3.2.1 lists these organization representatives. A status report of 2007 mitigation actions and local mitigation action analysis was provided along with educational materials. Afterward, participants were divided into focus groups by hazard. The purpose was to stimulate open discussion for updating existing mitigation actions, identifying lead agencies that might take ownership of particular actions, prioritizing the actions, and then developing a draft strategy for maintaining identified actions.

Thirty-two mitigation planners and specialists, which included members of the Hazard Mitigation Council, committed their time and energy to this meeting. As a result, the following accomplishments were realized:

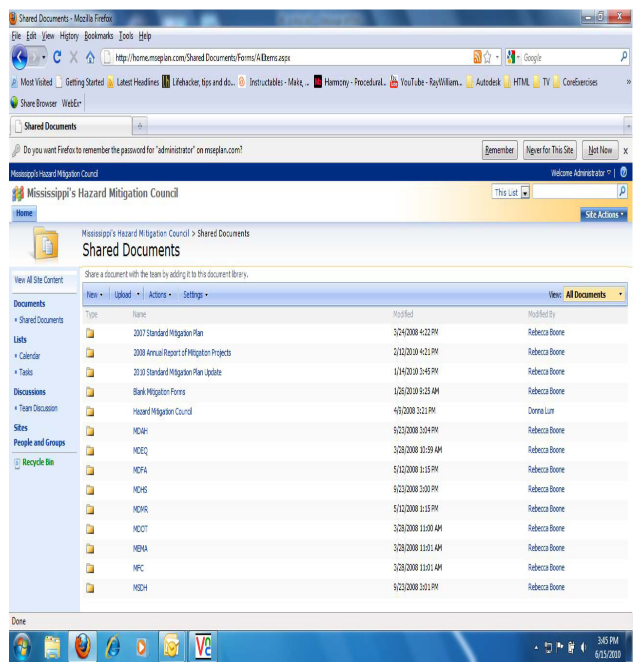
- insight into vulnerability assessment;
- an update of the state's capabilities;
- an update of Mississippi's State Mitigation Strategy, which includes updating of a mission statement and goals with feasible action steps for saving lives and minimizing damage to property, the economy, and the environment;
- recommendations for ways to increase participation by state agencies, local jurisdictions and private non-profit organizations;
- identification of groups/agencies that should be invited to participate in the process, and
- recommendations for improving the risk assessment.

Communication – the Key to a Cohesive Plan

A new strategy for integrating mitigation activities statewide was employed by MEMA during the planning process of Mississippi's 2007 Standard Mitigation Plan. All participants (including the Hazard Mitigation Council, individuals with technical expertise, and the plan developers) were kept informed and provided with the opportunity to review and make comments on the work in progress though a data-share site on the Internet. This has been a tremendous asset to the Council and has continued throughout the 2010 Mississippi Hazard Mitigation Plan Update.



Open access to all information generated allowed for transparency in the planning process by proving opportunities for review and comment while the work was in progress. In addition, the plan developers were automatically notified by email of updates, additions, or changes to the site. To simplify contact with plan developers, contact information was also listed on the site.



Public Participation Outreach Efforts

Associations

Plan developers involved various hazard mitigation stakeholders in the planning process by attending various Mississippi based conferences and providing information and accepting comments for use in the development of the 2007 Hazard Mitigation Plan. Conferences attended and objectives of each are listed in Table 2.2.2.

Table 2.2.2
Conference Outreach
Public Participation

Conference	Date/ Location 2010	Purpose
MS Association of Planning and Development Districts	April 20-23 Biloxi, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and invite participation through MEMA booth
Association of Floodplain Managers of MS	April 28-30 Gulfport, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and invite participation through MEMA booth
Mississippi Municipal League	June 27 – June 30 Biloxi, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and receive comments; MEMA is allotted a position as presenter during roundtable discussions
Mississippi Civil Defense Emergency Management Association	June 10-11 Flowood, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and receive comments; MEMA is allotted a position on conference agenda

A survey designed to provide plan developers with information concerning hazard mitigation issues from the local perspective was made available at each conference. A copy of the survey is located in Appendix 7.2-C and the survey results are tabulated in section 4.3 of this report.

Another measurable result of open communication and outreach efforts with the above mentioned associations was realization of written support of MEMA's efforts to develop a comprehensive statewide plan. The Public Works Association - Mississippi Chapter, the Mississippi Municipal League, and the Association of Floodplain Managers of Mississippi all adopted resolutions supporting the planning effort in 2007. These resolutions are still valid and copies of the resolutions can be found in the Planning Development Notebook. All in all, MEMA continued the same outreach strategy it used in 2007. However, the State was unable to attend the 2010 MS Chapter of the American Public Works Conference.

Business, Non-Profit and Professional Organizations

As a result of the successes noted from reaching out to governmental associations, plan developers used the same strategy to engage businesses, as well as non-profit and professional associations. Emails explaining the purpose and need of the mitigation plan and inviting participation in the process were sent to every business association listed for the State of Mississippi.

The email list was also used to provide information concerning public meeting dates, times, and location. By capitalizing on the name recognition and trust generated by business leaders who partnered with MEMA, the agency's message was received much more readily by the business community. Thus readership and response to emailed information tended to be higher and educational benefits, as well as increased participation in plan development, were higher than participation realized during the 2007 planning process.

Local, State, and Federal Agencies Engaged

While many of Mississippi's state agencies were invited to join the Mississippi Hazard Mitigation Council, others that typically had never been personally invited to develop mitigation planning strategies were sent letters from MEMA Executive Director Mike Womack urging participation. For example, agencies such as the Mississippi Automated Resource Information System and the Board of Animal Health were two of the agencies contacted. It is hoped that this contact will strengthen understanding and future partnership opportunities.

In addition to open invitations to participate in the planning process, plan developers met with the following statewide agencies and or organizations to review their mitigation plans and coordinate statewide activities. These outreach efforts included meetings with the following:

- ◊ Mississippi's Planning and Development Districts
- ◊ The Mississippi Department of Environmental Quality
- ◊ The United States Army Corps of Engineers and
- ◊ The Center for Community Earthquake Preparedness

Input and guidance was particularly sought from the Federal Emergency Management Agency (FEMA) – Region IV employees. FEMA responded by directing plan developers to various written materials available through the internet and provided input through one-on-one conversations, e-mails and letters. A complete list of federal agencies that plan developers consulted is found in section 2.3, in Table 2.3.2.1.

The Mississippi Band of Choctaw Indians

The Mississippi Band of Choctaw Indians has applied for and received a grant to develop a tribal Hazard Mitigation Plan. Under the Hazard Mitigation Grant Program, the plan will cover the populations of Choctaw Indians residing in MS as of October 2009, approximately 10,000 individuals. These individuals are officially enrolled as Tribal members according to the Tribal constitutional authority that have the requisite 50% Choctaw tribal quantum minimum requirement for Tribal membership.

The Tribe has eight (8) Federally-recognized Choctaw Indian communities scattered among six different counties in east central Mississippi. The Tribe has approximately 35,000 acres of Choctaw lands held in perpetual Federal trust for the benefit of the Choctaw Indian citizens of Mississippi; these are known commonly as the Choctaw Indian Reservation. The eight residential communities are long-standing, well established, and historically based population centers in the state for the Choctaw people. The Tribe owns and operates Choctaw business enterprises in some of these locations, and will include them in the multi-jurisdictional hazard mitigation plan.

The eight primarily residential Choctaw Tribal communities that will be covered under this multi-jurisdictional State level Tribal Hazard Mitigation Plan have received Federal-recognition are as follows:

1) Bogue Chitto, located in Neshoba and Kemper counties; and

2) Bogue Homa, located in Jones county; and

3) Conehatta, located in Newton county; and

4) Crystal Ridge, located in Winston county; and

5) Pearl River, located in Neshoba county; and

6) Red Water, located in Leake county; and

7) Standing Pine, located in Neshoba county; and

8) Tucker, located in Neshoba county.

The Tribal Council will officially adopt the Tribe's multi-jurisdictional plan in the form of a Tribal Council resolution. This legal action will cover all 8 Choctaw communities specified within the plan, as well as those additional Choctaw Tribal lands and infrastructure that are situated outside of the 8 major residential communities.

Public Meetings

The general public (with emphasis placed on notification by e-mail of business and industry association representatives) will be invited to participate in two open forum public meetings. MEMA's first meeting was held Thursday, June 2, 2010, from 5 p.m. until 7 p.m. at the Hinds County Emergency Operations Center centrally located in Jackson, Miss.

The first meeting was designed to be both educational and a means by which comments on the work in progress could be received. Over light refreshments, participants were invited to view work that had been completed to date. MEMA representatives were available to provide assistance. Attendance at this meeting was very low with only two individuals actually attending.

MEMA held the first of two open house public meetings in Jackson, Miss. Attendees were invited to review and provide comments on the state's draft 2010 Hazard Mitigation Plan.

In addition to feedback received during the meeting, the State Hazard Mitigation Plan was posted on the MEMA website for public review and feedback. Information provided at the public meeting was sent electronically for further dissemination statewide to the Mississippi Manufacturers Association, the Mississippi Department of Environmental Quality, the Mississippi Department of Transportation, and the Mississippi Association of Supervisors, therefore providing easy access for a large group of the population. Individuals that responded proved to be very interested and expressed a desire to participate in the current process as well as future planning efforts.

Other than educational information about hazard mitigation planning, the mitigation strategy mission statement developed jointly by the Hazard Mitigation Council and specialists statewide was made available. The mission statement listed proposed goals and action steps for hazard mitigation and was available for review and comment. The public was invited to rank the proposed goals to provide suggestions for new or amended action steps. Information received from approximately 207 completed forms is tallied on the subsequent page.

MEMA's second public meeting, will be held prior to plan adoption. The public will be provided an opportunity for review and comment of the draft 2010 Hazard Mitigation Plan. Participants will be invited to review the draft plan at their leisure and provide feedback to plan developers.

For both meetings, information concerning the times, dates, and locations will be sent by e-mail and made available in Mississippi's statewide newspaper - the Clarion-Ledger, as well as the Mississippi Business Journal and various state maintained web sites, e-newsletters, e-mails, meetings, and personal invitations. Sign-in sheets documenting the attendance of each meeting will be included in Appendix 7.2-F. Also included in the appendix is a list of volunteer organizations and individuals who participated in the 2010 plan update.

Mississippi's Standard Mitigation Plan

"Strategies for Saving Lives and Reducing Future Losses"

Mission: To create a disaster-resilient, sustainable Mississippi through the implementation of a comprehensive statewide mitigation strategy.

	percent indicating HIGH importance	percent indicating MEDIUM importance	percent indicating LOW importance
Goal 1: Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards			
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
Goal 2: Build and enhance local mitigation capabilities			
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
Goal 3: Improve public education and awareness			
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
Goal 4: Sustain and enhance a coordinated state mitigation program			
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%
[illegible]	0%	0%	0%

2.3: Integration with Other Planning Efforts, Programs and Initiatives

44 CFR 201.4(b): The Plan must discuss how the planning process was integrated to the extent possible with other ongoing state planning efforts, as well as other FEMA mitigation programs and initiatives.

As jurisdictions have realized a limited amount of resources, integration of programs, goals, and resources have become ever more necessary. From the initial 2004 Hazard Mitigation Plan to the 2007 Mitigation Plan until now, integration of programs and resources have significantly increased among local, state, and federal entities in the State of Mississippi. In addition to oversight of Hazard Mitigation Assistance, floodplain management, the Earthquake Program, and mitigation planning programs, MEMA follows and includes Mississippi Statutes in the hazard risk plans of the state departments of Public Safety, Development Authority, Transportation, Insurance, Corrections, Environmental Quality, Health, Human Services, Wildlife, Fisheries and Parks, the Office of Administration, Education, and the Public Service Commission. MEMA accomplishes many mitigation projects through collaboration. The Mississippi Development Authority partners with MEMA in joint funding of flood acquisition and drainage projects, and in storm shelter/saferoom projects. The Office of Geology in the Department of Environmental Quality and MEMA also partner in the NFIP Map Modernization Program, while the Department of Transportation and MEMA partner in highway and bridge development to ensure the floodplain management component is addressed.

Multi-jurisdictional and Local Mitigation Plans comprise another part of the program. As such, the development process for the state plan takes into consideration the mitigation goals and objectives identified therein. MEMA routinely works with numerous state and federal agencies on various issues, to include partnering with the Mississippi Development Authority; the American Red Cross for emergency sheltering; Department of Environmental Quality, Dam Safety Division on issues of high hazard dams; Mississippi Department's of Transportation and Public Safety on emergency evacuation issues; and the Mississippi Department of Homeland Security on all threats to the citizens of this state. MEMA extends an open-door policy to federal and state agencies, regional planning and development districts, and local governments to build stronger, more cohesive mitigation efforts whenever possible.

2.3.1 Integration of Local Plans

MEMA is the primary state coordinating agency for all local emergency operation plans and hazard mitigation plans. The Mitigation Bureau has the primary responsibility of working with regional and local governments in developing, reviewing, and updating multi-jurisdictional and local hazard mitigation plans. The Preparedness Training and Exercise Bureau has the primary responsibility of working with local governments in developing, reviewing, and updating local emergency operation plans.

As part of the state mitigation planning initiative, multi-jurisdictional and local mitigation plans are being developed in conjunction with counties and regions. These multi-jurisdictional plans address the mitigation issues and initiatives for unincorporated and incorporated jurisdictions. This helps ensure as many jurisdictions as possible remain involved in the mitigation planning process. The Local Hazard Mitigation Plan is normally a separate, stand-alone plan that represents a county or region. Any jurisdiction within a county may prepare a mitigation plan specific to that jurisdiction and separate from the county mitigation plan.

All of the 82 counties in the state have a Comprehensive Emergency Management Plan (CEMP) in place. These plans are scheduled for review and/or update by MEMA every five years. In addition, approximately 15 incorporated cities maintain separate CEMPs. These plans are included in the five-year MEMA review/update process.

The local governments and the Mississippi Planning and Development Districts (PDD) are using the information contained in the State Hazard Mitigation Plan to develop multi-jurisdictional and local hazard mitigation plans. As the local hazard mitigation plans are developed, the information provided through those planning efforts will be available to MEMA for incorporation into the State Hazard Mitigation Plan. This cooperative effort contributes to the continuous improvement of all the plans as they are reviewed and updated every three years (for the state) and every five years (for the local plans). A list of PDD employees contacted by MEMA and invited to participate in the 2007 plan update is included in Appendix 7.2-H.

2.3.2 Integrating Planning Information with Other Mitigation Partners

MEMA's continues its efforts to identify and engage mitigation partners. Efforts include engaging traditional partners through unique public involvement outreach efforts. MEMA invited mitigation planners/specialists from local, state, and federal agencies, as well as the private sector, to participate in the Hazard Mitigation Council workshop mentioned earlier in this report. Table 2.3.2.1 lists those agencies/associations invited to participate in the development of the 2010 Standard Mitigation Plan.

Table 2.3.2.1

Name	Title	Organization
Jerry Beaugez	President	Association of Floodplain Managers of Mississippi
Don Duncan	President	Building Officials Association of Mississippi
Jim Wilkinson	Director	Central United States Earthquake Consortium
Brandon Bolinski	Hurricane Program Manager, Region IV	Federal Emergency Management Agency
Jason Hunter	NFIP Program Specialist, Mitigation Division, Region IV	Federal Emergency Management Agency
Brad Loar	Mitigation Division Director, Region IV	Federal Emergency Management Agency
Clay Saucier	Hazard Identification and Risk Assessment	Federal Emergency Management Agency
Linda Myler	Mitigation and Planning Lead Specialist	Federal Emergency Management Agency
Joe Rachel	Earthquake Program Manager, Region IV	Federal Emergency Management Agency,

Name	Title	Organization
Brian Adam	Director	Hancock County Emergency Management Agency
Rupert Lacy	Director	Harrison County Emergency Management and Homeland Security Agency
Donald Langham	Director	Jackson County Civil Defense
Michael Bograd	State Geologist, Office of Geology	Mississippi Department of Environmental Quality
Steve Champlin	Geospatial Resources Division Director/Flood Map Modernization Project Manager	Mississippi Department of Environmental Quality
James MacLellan	State Dam Safety Coordinator	Mississippi Department of Environmental Quality
Charles Cupit	Hurricane Program Manager	Mississippi Emergency Management Agency
Al Goodman	NFIP State Coordinator	Mississippi Emergency Management Agency
Fred Griffin	Hazard Mitigation Grants Specialist	Mississippi Emergency Management Agency
Suzanne Lewis	Earthquake Program Manager	Mississippi Emergency Management Agency
Tom McAllister	Operations Branch Chief, Office of Response	Mississippi Emergency Management Agency
Chris Olson	Emergency Management Director	DeSoto County
Dennis Deautrive	Director of Conservation Education/Public Outreach	Mississippi Forestry Commission
Stephen Wilkinson	Warning Coordinator Meteorologist, Weather Office	National Weather Service
Homer Wilkes	State Conservationist	Natural Resource Conservation Service
Mickey Plunkett	District Chief	United States Geology Survey
Chris L. Mullen	Professional Engineer, Associate Professor, Department of Civil Engineering	University of Mississippi
Charles Swann	MS Mineral Resources Institute	University of Mississippi
Elaine Baxter	Chief of Planning Formulation Team	US Army Corps of Engineers, Mobile District

MEMA's participation in the Mississippi Civil Defense/Emergency Management Association (MCDEMA) is another strong indication of the state's commitment to integrate statewide planning initiatives with

local efforts. MCDEMA was originally organized by local Civil Defense Directors on May 21, 1961, for the purpose of seeking legislation and additional funding for local programs. Over the years, MCDEMA has continued to grow. A new initiative, which began in 2006, is a partnership between MEMA and MCDEMA to engage emergency management professionals in Alabama in the first Bi-State Hurricane Conference. This year, Louisiana joined the MS-AL Hurricane Conference which proved to be highly successful and had its second meeting in Mobile, Ala., in May 2010. Another meeting followed on April 27-29, 2009 at the MS Coast Civic Center (Coliseum) in Biloxi, MS. The meeting was held in the River Room Conference Center in Flowood, MS on June 10-11, 2010.

Today, MEMA and MCDEMA enjoy close working relationships which expand educational, communication, and partnership opportunities with concerned organizations at all levels of government. The association also actively promotes the sharing of information through training activities and meetings. Again this year, members of MEMA's Hazard Mitigation Plan Development Team addressed the assembly strictly for the purpose of providing information concerning the updating of the State Hazard Mitigation Plan and inviting participation from MCDEMA members in order to develop a stronger, more effective comprehensive mitigation strategy.

Developers of the Mississippi Standard Mitigation Plan addressed members of the Mississippi Civil Defense Emergency Management Association to encourage and invite participation in the planning process.

The MCDEMA has proven to be very effective in reaching stated goals, and it is anticipated, the annual conferences will continue into the foreseeable future.

In addition to working with FEMA in all aspects of hazard mitigation projects and plans, MEMA has worked with many planners to integrate mitigation steps into projects and plans. The Corp of Engineers,

Natural Resource Conservation Service, and Economic Development Administration partnered with LeFlore County, MEMA, FEMA, the Mississippi Development Authority, Central Mississippi Planning and Development District and the Greenwood/LeFlore Economic Development Association to develop a stormwater drainage plan and project that saved the major industry in this region. This achievement is significant in that it employees over 700 citizens within a 12-county area.

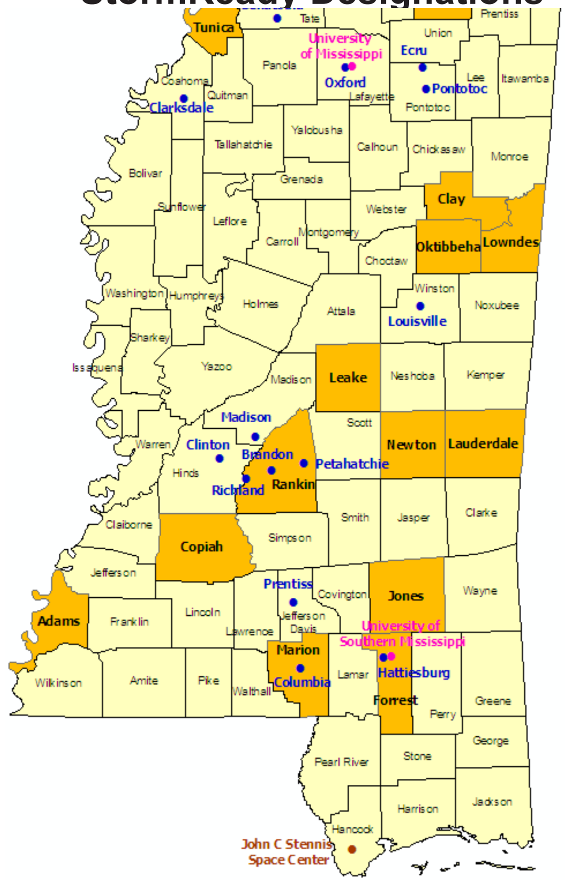
Some 312 Mississippi communities participate in the National Flood Insurance Program (NFIP) and 24 participate in the Community Rating System (CRS). All of these floodplain management activities are supported by the Association of State Floodplain Managers, the Building Officials Association of Mississippi, and the AFMM. The USCOE assists the state and local communities in establishing base flood elevations in areas that have not been studied.

The Mississippi Development Authority's (MDA) Community Development Block Grant Program (CDBG) has complemented the MEMA buyout program by removing homes and businesses from flood hazard areas throughout the state. Many local communities are unable to provide the non-Federal cost share. By working together, MEMA and MDA are assisting local communities in addressing flood risk areas and improving housing stock. The Mississippi Department of Environmental Quality has worked with MEMA on endangered species and fish and wildlife management issues associated with flood buyouts and water management and conservation questions. The Mississippi Department of Archives and History works with MEMA concerning the National Environmental Policy Act as it relates to historic issues.

The Mississippi Department of Insurance supports MEMA in promoting flood and earthquake insurance, preparedness, response, and mitigation issues and plans. The Mississippi Department of Environmental Quality (MDEQ) has worked with MEMA on flood buyouts, hazardous material planning, earthquake mitigation, and dam safety plans and issues. The Mississippi Department of Transportation, the US Department of Transportation, and the Federal Highway Administration have worked with MEMA on flood buyouts, open space restriction issues, and earthquake planning and bridge retrofits. In addition to the state and federal transportation agencies, the US Geological Survey, the Central US Earthquake Consortium (CUSEC), MDEQ, the Mississippi Department of Insurance, the American Society of Civil Engineers (ASCE), the Mississippi Society of Professional Engineers, the University of Mississippi Center for Community Earthquake Preparedness, the University of Memphis Center for Earthquake Research and Information (CERI), and the Earthquake Engineering Research Institute, New Madrid Chapter, work with MEMA on earthquake mitigation, including retrofits, public education, soil mapping, and seismic studies.

The National Weather Service (NWS), Mississippi Civil Defense and Emergency Management Association (MCDEMA), and MEMA support the NWS StormReady program in Mississippi with 14 counties, 14 communities, one university, and the John C. Stennis Space Center. The StormReady program has many mitigation measures included in that its plans (Figure 2.3.2.1). MEMA has also funded 3,000 storm shelters and safe rooms and 142 community shelters through the Hazard Mitigation Grant Program (HMGP). MEMA has also supported efforts to reduce injuries, fatalities and damages from severe weather events by funding weather radios to local schools and call-down systems to local governments for distribution to areas of high population concentrations such as schools, industries, and hospitals. MEMA's Statewide Coordinator has worked for years to educate local, state, and national voluntary organizations through the Disaster Recovery Partnership and Volunteer Organizations Active in Disaster (VOAD), concerning the importance of mitigation.

Figure 2.3.2.1
StormReady Designations



Gold Shading: Storm Ready County		**Blue Dot: StormReady Community**	
Adams	Lowndes	Brandon	Madison
Clay	Marion	Clarksdale	Oxford
Copiah	Newton	Clinton	Pelahatchie
Forrest	Oktibbeha	Columbia	Pontotoc
Jones	Rankin	Ecru	Prentiss
Lauderdale	Tippah	Hattiesburg	Richland
Leake	Tunica	Louisville	Senatobia
Purple Dot: StormReady University			
University of Mississippi and University of Southern Mississippi			
Brown Dot: StormReady Government Site			
John C Stennis Space Center			

Source: http://www.stormready.noaa.gov

2.3.3 Mitigation Programs and Measures

The following is a synopsis of the State, FEMA, and other program initiatives that are integrated into the Standard Mitigation Plan and will be utilized in the accomplishment of the strategies developed in this plan and local mitigation plans. New programs and initiatives will be added to this ongoing list in subsequent updates in compliance with 44 CFR 13.11(d).

> ***44 CFR 13.11(d): State Plans.***
>
> ***Amendments. A state will amend a plan whenever necessary to reflect: (1) New or revised federal statutes or regulations or (2) a material change in any state law, organization, policy, or state agency operations. The state will obtain approval for the amendment and its effective date but need submit for approval only the amended portions of the plan.***

Center for Community Earthquake Preparedness

During February of 1994, MEMA partnered with the Center for Community Earthquake Preparedness (CCEP) at the University of Mississippi in an effort to gain a more solid understanding of earthquake effects on structures. The final report, titled Evaluation of Earthquake Effects on Selected Structures and Utilities at the University of Mississippi: A Mitigation Model for Universities, was produced in October of 1999. This project was designed to determine responses of selected buildings and facilities to regional seismic activity at or near moment-magnitudes of four, six, and eight; identify potential mitigation that would minimize loss of lives during a regional seismic event; identify sites of potentially severe property damage resulting from a regional seismic event; increase the pool of technical experts capable of performing earthquake evaluations; establish general recommendations for earthquake hazards mitigation; and keep the issue of potential consequences of seismic activity before the public and the University of Mississippi administration. As a result of the partnership developed during this time, MEMA continues to work closely with CCEP to develop a profile on earthquakes in Mississippi, identifying the risk from regional earthquakes, assessing the vulnerability of regional earthquakes using HAZUS-MH, and identifying potential mitigation actions that could be implemented to mitigate the effects of earthquakes on the state. The partnership between MEMA and the CCEP will continue, and information from both entities will be mutually integrated to benefit the state's efforts to mitigate potential risks posed by the seismic hazards in Mississippi.

MEMA is also a participant in the New Madrid Seismic Zone Catastrophic Response Planning Project. Partners in this effort include the following:

- DHS/FEMA Headquarters (Response, Recovery, Mitigation, Private Sector, Critical Infrastructure, etc.)
- FEMA Regions IV, V, VI, VII
- Other federal agencies including USDOT, USGS, DHHS, DoD, and others
- CUSEC member states: AL, AR, IL, IN, KY, MS, MO, TN
- NORTHCOM

- Local governments
- Business, industry, and voluntary organizations
- Catastrophic planning personnel assigned to support each participating FEMA region and state
- MAE Center, Sandia National Lab, George Washington University (ICDRM)

The mission of the Project is to increase national readiness for a catastrophic earthquake in the New Madrid Seismic Zone (NMSZ). Specifically, this will be accomplished by developing a series of annexes or supplements to existing base plans for response and recovery to a series of major earthquakes in the NMSZ and integrating them into a single document with federal, regional, tribal, state, and local components. Additionally, the mission is to identify any issues that can not be resolved based on current capabilities and to propose recommended courses of action for decision makers involved in the Project.

Community Development Block Grants (CDBG)

Authorized to provide local match for the Hazard Mitigation Grant Program (HMGP), the Mississippi Development Authority is the grant recipient of the Community Development Block Grant (CDBG) funds on behalf of the State of Mississippi. The United States Congress allocated some $2 billion of CDBG funding for water, wastewater, electrical, homeowner grants, planning, and downtown revitalization. In some cases CDBG funds can be used as part of the local share for HMGP, as long as law does not preclude them.

The CDBG funds for homeowner grants were used to elevate homes that are now in new flood zones, as well as to upgrade homes to the new International Building Codes. Also, the funds will be used to buy-out property and thus hopefully change the use of the property from residential to green space and commercial uses.

Comprehensive Emergency Management Plans (CEMP)

The state and each county within the state (82 in all) to include the MS Band of Choctaw Indians have a Comprehensive Emergency Management Plan (CEMP). The plan serves as the operations and administrative guide for disaster preparedness, response, and recovery efforts. Select mitigation strategies such as employment of saferoom/stormshelters, evaluation and retrofitting of critical facilities, and public alert warning systems are a part of the CEMP.

The state plan and all county plans have been or are in the process of being updated by utilizing post-Katrina lessons learned, as well as incorporation of the guidelines contained in the National Response Framework.

Consolidated Plan for Housing and Community Development (CPHCD)

The Consolidated Plan for Housing and Community Development (CPHCD) is a requirement of the US Department of Housing and Urban Development (HUD) that consolidates the planning and application aspects of the Community Development Block Grant, Emergency Shelter Program, Home Investment Partnerships, and Housing Opportunities for Persons with AIDS formula programs. The CPHCD is a comprehensive planning document that identifies the state's overall needs for affordable and supportive housing and community development. In addition, the plan outlines a strategy to address those needs. The CPHCD development process represents an opportunity to involve citizens and community groups in the process of assessing the state's overall housing and community development needs, establishing strategic priorities, and developing a plan to meet the state's identified housing and community development goals. The CPHCD is updated on a five-year cycle with action plans being developed annually. Identified hazard areas and information on vulnerable populations and structures identified within the mitigation plan will be integrated into the CPHCD in an effort to ensure that action plans developed to meet housing and community development needs are reflective of the mitigation goals identified within the mitigation plan.

Emergency Management Preparedness Grant (EMPG)

The EMPG provides funding for state and local emergency management programs to include the Natural Hazards Program and the State Hazard Mitigation Program. The EMPG is the backbone for funding local emergency management capability. As a result of increased EMPG funding, all 82 counties now have active emergency management programs.

Forestry-Disaster Hazard Mitigation and Preparedness Plan (DHMPP)

The State of Mississippi Forestry Commission (MFC) has responsibilities for fire fighting (ESF4) duties during and following a disaster. MFC completed its initial Disaster Hazard Mitigation and Preparedness Plan (DHMPP), and is in the process of updating it. This plan will continue to provide specific information on preparedness resources and activities as ESF4 relates to hurricanes and wildfires. Additionally, the plan will provide detailed information on mitigation activities MFC will undertake to reduce the level of vulnerability to wildfire for the State of Mississippi.

Federal Dam Safety Program

This FEMA program is administered/enforced by the Mississippi Department of Environmental Quality. Strategies for expanding dam safety are discussed in Section 4.4. Additional information on dam safety and relevant issues will be discussed in subsequent updates of the State of Mississippi's Standard Mitigation Plan.

Hazard Mitigation Assistance (HMA)

Recently, the Federal Emergency Management Agency grouped together the its grant programs and their requirements in order to form the Hazard Mitigation Assistance Program. HMA consist of the following programs:

- Hazard Mitigation Grant Program (HMPG)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

- Repetitive Flood Claims (RFC)
- Severe Repetitive Loss (SRL)

This FEMA funded program serves as the main post-disaster mitigation utilized by the State of Mississippi. Over the past 10 years, over $45 million in mitigation projects have been funded in part through the HMGP. The following initiatives have been selected as high priority projects for current and future funding.

Retrofit of Critical Facilities – It is the intent of the Mitigation Bureau to assign a high priority to the retrofitting of critical facilities identified in state and local mitigation plans. Wind and flood events have proven to have the highest history of damage, although earthquake vulnerability analysis has identified cost-effective measures for both structural and non-structural mitigation.

Planning – It has long been the policy of the Mitigation Bureau to assign funding priority to those communities that have identified eligible mitigation projects through a planning process. Therefore, the funding of mitigation plans is the top funding priority.

Saferooms – Extreme windstorms, such as tornados and hurricanes, pose a serious threat to buildings and their occupants in many areas of Mississippi. Even a structure built "to code," may not withstand extreme wind events. A shelter can be built in one of several places – beneath a concrete slab-on-grade foundation, or in an interior room on the first floor. To protect its occupants, an in-house shelter must be able to withstand the forces exerted by high winds and remain standing, even if the rest of the house is severely damaged. A saferoom or storm shelter is key to this plan's mitigation strategy to save lives.

Funds are available to the qualified homeowner from the HMGP administered by the Mitigation Bureau, through private lenders, and the Federal Housing Administration (FHA). Homeowners are requested to contact their local Emergency Management Agency for further information.

Repetitive Flood Loss Structures – These structures represent less than 4 percent of the insured structures in the state but have incurred over 25 percent of the total dollars paid on claims. A priority of the HMGP has been to identify these structures and fund cost-effective acquisition, elevation, localized drainage or relocation of the structures.

Public Alert and Warning System – A special initiative funded through a five percent set aside and the tornado mitigation initiative allows the state to fund warning systems on college and university campuses where large numbers of student and faculty reside. This program is coordinated with local emergency managers.

Expanded Mitigation Strategies Planning Grant Pilot Guidance - The HMGP Expanded Mitigation Strategies Planning Grant Pilot will provide funds for eligible HMGP Applicants for identifying and planning feasible mitigation projects, and incorporating those projects into their Local Mitigation Plans (LMPs). The mitigation planning process assists eligible Applicants in setting short and long-range mitigation goals and objectives. Mitigation planning is a collaborative process whereby hazards affecting the community are identified, hazard vulnerability is assessed and analyzed, and consensus is reached on how to minimize or eliminate the effects of those hazards. Because LMPs are the foundation of a strong mitigation strategy, the Pilot will bridge the gap between mitigation planning strategies and the implementation of actual mitigation projects as part of the overall disaster recovery effort.

Pre-Disaster Mitigation-Competitive (PDM-C)

This FEMA program was authorized by the Disaster Mitigation Act of 2000, which amended the Stafford Act. PDM-C is a nationally competitive hazard mitigation program that is funded on an annual basis. States submit state level and community applications for funding of natural hazard mitigation measures. State and local governments are required to have an approved mitigation plan in order to receive funding under PDM-C.

Hazard Mitigation Technical Assistance Program (HMTAP)

The state has utilized Technical Assistance Task Orders to develop local and county plans, conduct regional workshops on Pre-Disaster Mitigation, publish a Mitigation Success Stories book, conduct community mitigation capability assessments to include community assistance visits and contacts, and to evaluate critical facilities in the wake of Tropical Storm Isidore and Hurricane Lili in September 2002. Significant to the development of this plan have been workshops at 10 Planning and Development Districts facilitated by an HMTAP Task Order, which is integral to the overall mitigation strategy for outreach and public involvement in the planning process.

National Flood Insurance Program (NFIP)

The US Congress established the National Flood Insurance Program (NFIP) with the passage of the National Flood Insurance Act of 1968. The NFIP is a federal program that enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on an agreement between communities and the federal government. If a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new and substantially improved construction in floodplains, the federal government will make flood insurance available within the community as a financial protection against flood losses. This insurance is designed to provide an insurance alternative to disaster assistance in order to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

The NFIP authorizes the Community Assistance Program (CAP), the Community Rating System (CRS), the Increased Cost of Compliance Insurance Program (ICC), and the Flood Map Modernization Initiative, all of which serve as mitigation incentives for reducing the cost of flood losses.

Community Assistance Program--State Support Services Element (CAP-SSSE)

The state's formal participation in the NFIP is through the FEMA funded Community Assistance Program (CAP). The CAP annual agreement provides partial funding for the state to establish and maintain an office responsible for providing NFIP technical assistance to state and local jurisdictions, for conducting NFIP compliance audits referred to as "Community Assistance Visits", and conduct training and public outreach/education. The Governor has designated MEMA as the state coordinating agency for the CAP program. The MEMA Floodplain Management Bureau Director serves as the state

NFIP Coordinator.

In Mississippi, the CAP is implemented through a five-year, long-term plan and a one-year action plan. These plans address NFIP compliance, public outreach/education, and mitigation of flood risk structures.

As of 5/15/10, there were 312 local communities participating in the NFIP. Of those 312 communities, 24 also participate in the Community rating System (CRS) program. The flood insurance policies found within these CRS communities equate to 61% of the policies within the state of Mississippi. Mitigation capability assessments have been conducted in all of these communities to ensure that local administrators are trained to become Certified Floodplain Managers (CFM).

Participating NFIP communities (with low to moderate flood risk) receive compliance visits every five years. Over 193 of the state's NFIP communities have been evaluated within the past three years. The majority of these communities have adopted the state model ordinance and community leaders/administrators have attended regional workshops.

The NFIP State Coordinator has developed a Local Flood Protection Ordinance Handbook, a Quick Guide, for local administrators and a model Flood Damage Prevention Ordinance that exceeds the FEMA standards for riverine and coastal communities. All of these tools are available in hardcopy and on the MEMA website. Statewide and regional NFIP workshops are conducted annually.

Section 2:46
MS Emergency Management Agency

The Association of Floodplain Managers of Mississippi (AFMM) was established in 1999 and became a state chapter of the Association of State Floodplain Managers in 2001. The association currently has over 100 members and in 2004 hosted the annual national conference of the Association of State Floodplain Managers. Members of the AFMM attaining their certification are now assisting the state with training and "peer to peer" assistance to other communities.

Increased Cost of Compliance (ICC)

ICC coverage provides for the payment of an additional claim to help pay for the increased costs to comply with state or community floodplain management laws or ordinances after a flood in which a building has been declared substantially damaged or repetitively damaged. When an insured building is damaged by a flood and the community declares the building to be substantially or repetitively damaged, this triggers the requirement to comply with its community floodplain management ordinance, ICC will help pay for the cost to floodproof (non-residential buildings only), relocate, elevate or demolish a structure up to a maximum of $30,000. This coverage is in addition to the building coverage for the repair of actual physical damages from flood under the policy, but the total paid cannot exceed the maximum limit set by Congress for that type of building.

The maximum limit of $30,000 helps property owners insured under the NFIP to pay for a portion, or in some cases, all of the costs of undertaking actions to protect homes and businesses from flood losses. In addition, an ICC claim payment can be used to complement and supplement funds under other mitigation programs such as the FMA and FEMA's HMGP, which assist communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings insured under the NFIP.

Flood Map Modernization Initiative

With the funding and implementation of the modernization plan, beginning in 2003, the flood hazard information provided to communities has become more accurate and extensive, resullting in safer communities. The plan established a five-year upgrade to the flood map inventory and an enhancement of products and services. The State of Mississippi serves as a Cooperating Technical Partner (CTP) with FEMA in the Flood Map Modernization Initiative. MEMA and the Mississippi Department of Environmental Quality (MDEQ) are the coordinating agencies. The digital flood insurance rate maps developed through this partnership serve as a layer in the Mississippi Digital Earth Model (MDEM). The MDEM will serve as a statewide GIS system that will serve as an efficient and effective source for planning, risk management, and mitigation.

The state has submitted its initial Risk MAP Scope of Work and has identified communities for funding for Fiscal Year 2009--Fiscal Year 2010, which includes those communities that require map maintenance work.

Homeland Security Plan

Findings from this plan wire integrated with the Mississippi Emergency Operations Plan, with particular emphasis on human-caused hazards. The Homeland Security Plan development was closely coordinated with this Hazard Mitigation Plan.

Natural Hazards Program

Located in the Preparedness, Training, and Exercise Bureau of MEMA, the Natural Hazards Program Manager develops and coordinates the State Hurricane Program and the State Earthquake Program, and coordinates the update of the Hurricane and Earthquake component of the plan.

Pre-Disaster Mitigation Planning Program (PDM-PL)

This FEMA program is being utilized to fund localities and Planning and Development Districts throughout the state to develop local and regional plans. Localities that have applied to bring their existing hazard mitigation plans into compliance with Sec. 322 standards may be funded based upon availability. These plans, when judged compliant, will be linked to Mississippi's Standard Hazard Mitigation Plan.

Pre-Disaster Mitigation Loans for Small Businesses

The Small Business Administration published a Final Rule on its Pre-Disaster Mitigation Loan Program in the Federal Register on October 7, 2002. After November 1, 2003, a business must be located in a community with a FEMA-approved mitigation plan in order to be eligible for this program. Eligible small businesses may borrow up to $50,000 each fiscal year at a fixed interest rate of four percent per year or less for mitigation measures approved in the loan request. Businesses proposing mitigation measures must be locate in a Special Flood Hazard Area. A written certification from a local emergency management official is required as part of the loan application to satisfy this requirement. This program will coordinate with the State of Mississippi Standard Mitigation Plan to provide capital necessary to fund hazard mitigation projects.

State Emergency Response Commission

Mississippi Emergency Management Agency is designated by executive order to implement the Superfund Amendments and Reauthorization Act, Title III (Public Law 99-499). Personnel involved in this ongoing planning effort coordinate Local Emergency Planning Commissions (LEPC) statewide. There is a particular emphasis on human-caused hazards as a result of the use or misuse of hazardous materials.

3.0: Risk Assessment

Overview of the Risk Assessment Process

Risk Assessment requires the collection and analysis of hazard-related data to enable state and local jurisdictions to identify and prioritize appropriate mitigation actions that will reduce losses from potential hazards. The FEMA State and Local Mitigation Planning How-to-Guide (How-to-Guide) identifies five Risk Assessment steps as part of the hazard mitigation planning process, including: 1) identifying hazards, which involves determining those hazards posing a threat to a study area, in this case, the State of Mississippi, 2) profiling hazards, which involves mapping identified hazards and their geographic extent, 3) identifying assets, which assigns value to structures and landmarks in the identified hazard areas, 4) assessing vulnerability, which involves predicting the extent of damage to assets, and 5) analyzing development trends, which assesses future development and population growth to determine potential future threat from hazards. This section also analyses hazards identified in the county, local and regional plans that have been completed throughout Mississippi. These steps are described in detail in the following sections.

Identifying Hazards

Requirement §201.4(c)(2)(i): The State risk assessment shall include the following elements:

An overview of the type and location of all natural hazards that can affect the State...

Hazards identification is the process of recognizing events that threaten a particular planning area. An event causes a hazard when it harms people or property or interferes with commerce and human activity. Such events would include, but not be limited to, hurricanes, floods, earthquakes, tornados and other hazards that affect populated areas. Natural hazards that have harmed the State in the past are likely to happen in the future. Consequently, the process of identifying hazards includes determining whether or not the hazard has occurred previously. Approaches to collecting historical hazard data include researching newspapers and other records, conducting a review of planning documents and report literature in all relevant hazards subject areas, gathering hazard-related GIS data, and engaging in discussions with relevant experts throughout the State.

A variety of sources were used to determine the full range of potential hazards within the State of Mississippi, including internet research and a careful evaluation of approved county, local and regional plans. Even though a particular hazard may not have occurred in recent history in the State of Mississippi, it is important to consider all hazards that may potentially affect the planning area during the hazard identification stage.

Profiling Hazards

Requirement §201.4(c)(2)(i): The State risk assessment shall include the following elements:

An overview of the type and location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate.

Hazard profiling involves describing the physical characteristics of past hazards such as magnitude, duration, frequency, and probability. This stage of the hazard mitigation planning process involves creating base maps of the State and collecting and mapping hazard event profile information obtained from various Federal, State, and local government agencies. The extent to which hazards are profiled is dependent on the availability of data. Some hazard profiles provide significantly more information than others based on the amount of prior research and data production identified. It is standard practice to use the best and most current available information. The Hazard Mitigation Council and consultant team obtained statewide maps and data available from a variety of sources. The hazard data were mapped to determine the geographic extent of the hazards in the State. The level of risk associated with each hazard was also estimated and assigned a risk level of high, medium or low (or variations thereof) depending on several factors unique to the particular hazard.

Identifying Assets and Assessing Vulnerability

Requirement §201.4(c)(2)(ii): The State risk assessment shall include the following elements:

An overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State-owned critical or operated facilities located in the identified hazard areas shall also be addressed.

The third step of the risk assessment process is to identify the assets throughout the state which are projected to be affected by each hazard type. Assets include state-owned structures or critical facilities such as hospitals, schools, and public infrastructure. An inventory of existing assets within the State was generated. The assets were then mapped on a regional basis (Appendix 7.3.0-C-1 through C-14) to show their locations and to determine their vulnerability to each hazard type, where practicable.

State-Owned Facilities - The Mississippi Department of Finance and Administration (MDFA) is tasked with compiling a comprehensive list of state-owned facilities as define as mitigation action *Multi-Hazard-15 Inventory of State-Owned Facilities* in the 2007 plan. As of this plan update, funding has not been made available to begin this project. As a result, this plan update utilized the best available data provided by the MDFA and HAZUS results from the 2007 plan. This data is provided in Appendix 7.3.0-D and 7.3.0-E and includes an estimated number of facilities and their estimated replacement values. In addition, the data provided did not include accurate physical locations for all properties which prevented the ability to map these facilities in this plan update.

The State of Mississippi developed the following definitions for Critical Facilities and Critical Infrastructure, with guidance from FEMA publication 386-2 and 42 U.S.C. 5195c. The intention of these definitions was to aid in the assessment of the vulnerability and operational necessity of facilities and systems within the state during the occurrence of a hazard event.

A Critical Facility is defined as any structure that provides or houses critical services necessary to ensure the health and welfare of the population following a natural or man-made hazard event, including any facilities designated by local governments in their Hazard Mitigation Plan. Types of critical facilities are presented in detail in Appendix 7.3.0-A.

Critical Infrastructure is defined as systems so vital to the State of Mississippi that the incapacity of those systems would have a debilitating impact on security, economics, public health, safety, or any combination of those factors, including any infrastructure designated by local governments in their Hazard Mitigation Plan. Types of critical infrastructure are presented in detail in Appendix 7.3.0-B.

These definitions were utilized to determine data collection criteria. All information included in the assessments of this plan is based on best-available data. The critical facilities which were documented for this report included all facilities listed as critical in existing local Hazard Mitigation Plans within the state. In accordance with the definition, available data was also collected for facilities that, in the event of a disaster: provide shelter and/or resources for displaced individuals, provide safe and reliable production or treatment of essential services, provide essential communication between emergency personnel and the general public, provide crucial public safety, serve as a central facility that houses officials providing leadership and guidance for essential community operations, provide primary health care, accommodate inter-modal transportation providing evacuation and/or distribution of supplies.

A CD is provided with this plan that contains the database of the critical facilities and infrastructure collected during this plan update. To improve the risk assessment for critical facilities and infrastructure, this database should be vetted for accuracy and entered into a GIS mapping system. The level of detail to update these data sets is similar in nature to those of the state-owned facilities and should therefore be considered as a mitigation action for this plan update.

Assessing Vulnerabilities - An asset is vulnerable if it is susceptible to damage from a hazard. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. A vulnerability analysis can also predict the extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment identifies the effects of hazards by estimating the relative exposure of population, land development, and infrastructure to hazardous conditions, giving significant attention to critical and state-owned facilities. This includes consideration of the indirect effects of hazards, which can be much more widespread and more damaging than the direct effects. For example, the loss of commerce due to road closures for an amount of time could significantly outweigh the cost of repairing the road. The assessment helps set mitigation priorities by allowing the State and its local jurisdictions to focus attention on areas most likely to be damaged or most likely to require early emergency response during a hazard event.

Estimating Losses

Requirement §201.4(c)(2)(iii): The State risk assessment shall include the following elements:

An overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State shall estimate the potential dollar losses to State-owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.

For the identified hazards that ranked the highest priority for concern by the Hazard Mitigation Council, losses were estimated for various hazard scenarios. For other identified hazards, where less data was available, a more simple, overall exposure analysis was conducted. Exposure analysis looks at the overall value of assets in the hazard area or ranked county, whereas loss estimation calculates anticipated losses from specific hazard scenarios (e.g. 100-year flood or Magnitude 7.7 Earthquake).

Property and Crop Damage Loss Estimates

The Tables below reflect total property and crop damages for each hazard profiled. This information was obtained from the National Climatic Data Center (NCDC). Additional loss estimates are reflected in each hazard profile within this section.

Property Damage

Hazard Type	2007	2008	2009
Hurricane & Tropical Storms	None Reported	$10,069,000	$1,000
Tornado	$6,995,000	$94,053,000	$23,669,000
Flood	$4,190,000	$17,096,000	$10,432,000
Extreme Winter Weather	None Reported	$1,320,000	None Reported
Earthquake	None Reported	None Reported	None Reported
Wildfire	None Reported	None Reported	None Reported
Dam/Levee Failure	Included in Flood	Included in Flood	Included in Flood

Crop Damage

Hazard Type	2007	2008	2009
Hurricane & Tropical Storms	None Reported	None Reported	None Reported
Tornado	None Reported	$6,245,000	$652,000
Flood	$150,000	$3,705,000	$2,950,000
Extreme Winter Weather	None Reported	$1,320,000	None Reported
Earthquake	None Reported	None Reported	None Reported
Wildfire	None Reported	None Reported	None Reported
Dam/Levee Failure	Included in Flood	Included in Flood	Included in Flood

Analyzing Development Trends

The final step of the risk assessment merges hazard information with proposed land uses and planned development within the State. Due to the difficulty in predicting where future development will take place, it should be noted that this section is not intended to provide a thorough analysis of future hazard areas. However, it does provide the groundwork for proposing mitigation strategies in the most likely locations for development and an opportunity to evaluate codes, regulations and standards within a hazard context in those areas. The intent of the analysis enables decision makers to protect areas of future development from damage due to future hazards.

For the 2010 plan update, the 2000 census data was used along with the 2008 estimated population.

Hazard Mitigation Software

The Hazards U.S. Multi-Hazard (HAZUS-MH) is software designed to evaluate potential losses resulting from natural disasters. Potential structural damage is classified for buildings, infrastructure, and critical facilities. For example, the HAZUS-MH code definition is as follows for steel frame buildings:

- **None:** No visible damage.
- **Slight:** Minor deformations in connections or hairline cracks in a few welds.
- **Moderate:** Some steel members have observable permanent rotations at connections; welded connections may exhibit major cracks through welds; bolts in bolted connections may be broken or have enlarged bolt holes.
- **Extensive:** Most steel members have significant permanent lateral deformation of the structure. Some of the structural members or connections may have permanent rotations at connections, buckled flanges and failed connections. Partial collapse of portions of structure is possible due to failed critical elements and/or connections.
- **Complete:** Some critical structural elements or connections have failed, resulting in dangerous permanent lateral displacement, partial collapse or collapse of the building.

3.1: Identifying Hazards

> ***44 CFR 201.4(c)(2)(i) – The State risk assessment shall include the following elements:***
>
> ***An overview of the type and location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate.***

Introduction

The State of Mississippi is vulnerable to a wide variety of natural and man-made hazards that threaten life and property. The publication Hazard Identification/ Hazard Analysis developed by Mississippi Emergency Management Agency (MEMA) addresses a wide variety of hazards. The Federal Emergency Management Agency (FEMA) has ranked Mississippi as the sixth most vulnerable State in the Nation due to risks from hurricanes, tornados, and other hazards.

List of Hazards

The Hazard Mitigation Council reviewed hazards from the existing plan and those listed in the FEMA How-to-Guide, and determined the prevalence of each hazard in the State of Mississippi, evaluating and prioritizing which hazards should be included in the Plan. All hazards identified by FEMA in the How-To-Guide were considered. They include: avalanche, hurricane/tropical storm, coastal erosion, dam failure, drought/water supply, earthquake, expansive soils, extreme heat, flooding, hailstorm, house/building fire, land subsidence, landslide, liquefaction, severe winter storm, tornado, tsunami, wildfire, windstorm, and volcano. All hazards identified in local plans were also considered for inclusion in the State Plan.

Hazard Identification Process

The Council worked with the consultant team to narrow the all-inclusive list of hazards to those most threatening to Mississippi, and to review the hazards profiled in the 2007 plan. During the screening process, the Council also considered which hazards could realistically be addressed at the State level in terms of mitigation. Many hazards are best addressed by county and local plans. It should be noted that the lack of a hazard's profile in this plan does not mean that the state will not provide adequate support to local jurisdictions in mitigating the affects of that particular hazard. Surveys and meetings with the general public were used to gather input and to ensure that the decisions of the Council were inclusive of public sentiment regarding which hazards pose the most significant threat and are realistic to address within the scope of this plan.

Some hazards are profiled together because of commonalities among the individual hazards and their effects. The final list of hazards to be profiled for the State of Mississippi was determined to be Flood, Hurricane, Wildfire, Tornado, Earthquake, Winter Weather, Drought, and Dam/Levee Failure.

Table 3.1.1 shows a summary of the hazard identification results for State of Mississippi followed by the results of the local plan review to support this plans initiatives.

Table 3.1.1
Summary of Hazard Identification Results

Hazard Type	Representative Data Collected for Hazard Identification	Reasons for Inclusion
Flood	FEMA FIRM Maps FEMA Q3 Flood Hazard Layer Base flood elevations (FEMA) Historical flood records and recent damage locations Repetitive Loss Data FEMA Hazards website HAZUS	Much of the State of Mississippi is located within the 100-year floodplain. Flash floods and other flood events occur regularly during rainstorms due to terrain and hydrology of the State of Mississippi. There have been numerous Disaster Declarations as a result of flooding in Mississippi, including both coastal and riverine.
Hurricane/Tropical Storm (wind and surge)	Historical Events Data Post-Katrina Awareness Mapping HAZUS wind data	Hurricanes are common and devastating in Mississippi.
Wildfire	Southern Wildfire Risk Assessment MS Forestry Commission Wildland-Urban Interface SILVIS Laboratory – University of WI National Fire Protection Association Historical fire records FEMA Hazards website	The State of Mississippi experiences wildfires on a regular basis, as historically presented in the Plan.
Tornado	NCDC Historical Tornado Damage and Disaster Declaration data	Tornados are common disasters in Mississippi.
Earthquake	USGS FEMA-HAZUS MH FEMA Hazards website M 3.3 in SW Alabama Mar 22, 2005 New hazard data New Madrid 7.7 ground shaking maps CUSEC Soils mapping - limited Liquefaction hazard mapping - limited SONS exercise New HAZUS runs (Annualized and 7.7)	Significant research points to the possibility of a damaging earthquake along the New Madrid Fault.

Hazard Type	Representative Data Collected for Hazard Identification	Reasons for Inclusion
Extreme Winter Weather	NCDC Historical Damage Data	There have been more than 47 damaging events between 1993 and 2009, with a reported $25 million in property damages and $5 billion in crop damages.
Drought/Water Supply	National Drought Monitor NCDC	Research indicates that the possibility of inadequate water supply as a result of prolonged drought conditions could impact the health of the population and jeopardize economic resources such as timber, livestock, and crops.
Dam/Levee Failure	FEMA-HAZUS MS Dept of Environmental Quality Dam Safety Division USACE levee locations MS Levee Districts Historical dam failure data FEMA FIRM maps FEMA Hazards website	High hazard dams require Emergency Action Plans which include Inundation mapping. There is a presence of some downstream development that could be impacted by a dam breach.

Local Plan Review

A review of the 92 local hazard mitigation plans confirmed that the eight hazards of concern - flood, hurricane, wildfire, tornado, earthquake, winter weather, drought, and dam/levee failure - are also concerns for counties. With the exception of drought, each of these hazards was identified in 60 percent of plans or more. All counties are concerned about tornado and flood. The results of the local hazard identification review are summarized in the chart below:

Hazards Identified in Local Plans for the 2010 Update

Hazard Type	No. of Plans	Percent of Plans
Flood	92	100%
Tornado	92	100%
Wildfire	66	71%
Earthquake	63	68%
Winter Weather (includes extreme cold)	61	66%
Hurricane/Tropical Storm	60	65%
Dam/Levee Failure	56	60%
Drought	45	49%

Excluded Hazards

During the review of hazards included in the 2007 Plan the Hazard Mitigation Council determined that a number of hazards would not be included in the 2010 Plan update. This decision was based on the belief that they were not prevalent hazards within the State of Mississippi as they were found to pose little or no threat to the State as compared to the other hazards. Table 3.1.2 gives a brief description of those hazards and the reason for their exclusion.

Table 3.1.2
Summary of Hazards Excluded from Hazard Profiling

Hazard Type	Description	Reason for Exclusion
Avalanche	A mass of snow moving down a slope. There are two basic elements to a slide; a steep, snow-covered slope and a trigger.	No avalanche history in Mississippi.
Expansive soils	Expansive soils shrink when dry and swell when wet. This movement can exert enough pressure to crack sidewalks, driveways, basement floors, pipelines and even foundations.	Expansive soils have not historically been a problem for most areas in Mississippi.
Extreme heat	Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks.	Only 33% of local mitigation plans identified extreme heat as a hazard to be profiled. While extreme heat can create emergencies in Mississippi, the state has concluded that it does not pose a significant state-level threat. The decision was also partially based on the fact that the impacts to state-owned or critical facilities would be little or none.
Hailstorm	Can occur during thunderstorms that bring heavy rains, strong winds, hail, lightning and tornadoes.	Not typically a state-wide occurrence, best addressed in local plans. Addressed in Section 3.10 – Non-Profiled Hazards, under Severe Thunderstorms, including probability of occurrences and estimated annual losses.
Land subsidence	Occurs when large amounts of ground water have been withdrawn from certain types of rocks, such as fine-grained sediments. The rock compacts because the water is partly responsible for holding the ground up. When the water is withdrawn, the rocks fall in on themselves.	Soils in the State are mostly compact. Presents a minor threat. No significant historical record of this hazard in the region.

Hazard Type	Description	Reason for Exclusion
Landslide / Coastal Erosion	An abrupt movement of soil and bedrock downhill in response to gravity. Landslides can be triggered by an earthquake or other natural causes. Coastal erosion is defined as wearing away of land or the removal of beach or dune sediments by wave action, tidal currents, wave currents, or drainage.	There is no extensive history of landslides in Mississippi. Landslide problems are typically in isolated areas and best addressed at the local level. Landslide was not identified as a hazard in local plans. Coastal erosion is primarily caused by hurricanes and coastal flooding, which are addressed in their respective sections.
Liquefaction	Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is completely filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles themselves are pressed together. Prior to an earthquake, the water pressure is relatively low. However, earthquake shaking can cause the water pressure to increase to the point where the soil particles can readily move with respect to each other.	Addressed in earthquake section.
Tsunamis	A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides, or volcanic activity. In the deep ocean, the tsunami wave may only be a few inches high. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high.	MEMA participates on the National Tsunami Hazard Mitigation Program (NTHMP). There is no identified history of tsunamis in the Gulf. No evaluation of threat of Tsunamis in the gulf was identified. Data is not available to predict probability. Concluded that tsunamis do not pose a measurable threat to Mississippi. Mitigation would be similar to that for large hurricanes which are addressed.
Volcano	A volcano is a mountain that is built up by an accumulation of lava, ash flows, and airborne ash and dust. When pressure from gases and the molten rock within the volcano becomes strong enough to cause an explosion, eruptions occur.	No active volcanoes in the State of Mississippi. No historical record of this hazard in the region.

Hazard Type	Description	Reason for Exclusion
Windstorm	A storm with winds that have reached a constant speed of 74 miles per hour or more.	Addresed extensively within the Hurricane and Tornado Sections. Addressed in Section 3.10 – Non-Profiled Hazards, under Severe Thunderstorms, including probability of occurrences and estimated annual losses.

Hazard Ranking

Once the Council identified the hazards to be included in the plan, they were ranked by priority of concern. Prioritization of the hazards that threaten the State was based on two separate factors:

- probability that the hazard will affect the State
- potential impacts when it does

Each hazard's total impact is made up of three separate factors:

- likely geographical extent of affected area
- primary impacts of the hazard event
- related secondary impacts

While primary impacts are a direct result of the hazard, secondary impacts can only arise subsequent to a primary impact. For example, a primary impact of a flood event might be road damage due to submerged pavement or eroded surface. A possible secondary impact in these circumstances would be restricted access of emergency vehicles to citizens in a particular area due to the road closure.

A formula was developed to assign a value for probability and impact for each of the hazards considered. The probability of each hazard was determined by assigning a level, from 1 to 4, based on the likelihood of occurrence (which itself is based on historical data). Additionally, interviews with Council members, subject experts, agency heads, as well as public/stakeholder surveys conducted early in the planning process was considered in the probability determination process. The total impact value includes the estimated size of the affected area and the primary impact and secondary impact levels of each hazard. These levels were then each multiplied by an importance factor to obtain a score for each category. The probability score was multiplied by the sum of the three impact categories to determine the total score for the hazard.

Based on the total calculated score, the hazards were separated into three categories based on the relative risk level they pose to the State: significant, moderate and limited. Those terms relate to the level of planning analysis and concern given to the particular hazard in the risk assessment process and do not indicate the anticipated level of impact. In order to focus on the most critical hazards, those assigned a level of Significant or Moderate are given more extensive attention in the remainder of this analysis (e.g. quantitative analysis or loss estimation), while those with a Limited planning consideration are addressed with more general or qualitative methods.

Man-made hazards are not addressed directly in the state plan but are acknowledged in the Local Plan Integration section in Chapter 5.0 of this plan. Analysis of local plans shows that fewer than 20% of the local plans in Mississippi include man-made hazards.

The hazard ranking was based on the overall probability and impact on the State as a whole. When examining various regions of the State, the same ranking does not always apply. The Council determined that natural disasters such as flood, wildfire and tornado can occur at any time and any given place with any severity and used that methodology as a benchmark for establishing probabily with the other hazards. In addition the Council determined a percent of impacted methodology for determining the affected area. For example, a large affected area will impact more than 75% of a community and an isolated area represents less than 25 percent.

As a result of the 2010 rankings, the probability of occurance for hurricane was downgraded and wildfire and extreme winter weather was upgraded. The overall increase in rankings for wildfire were based on the methodologies presented above and input shared by the Mississippi Forestry Commission at the Council meeting. It was determined that the state should examine more closely the impacts of wild/urban fire as it relates to other debris-generating events such as hurricane and tornado; critical facilities; and economic impacts on timber, livestock, and crops.

Table 3.1.3 below indicates the ranking established by the Council using the method described above and a comparision of ranking from the 2007 plan.

Table 3.1.3
Hazard Ranking and Planning Consideration

Hazard Type	2007 Total Score	2007 Hazard Planning Consideration	2010 Total Score	2010 Hazard Planning Consideration
Hurricane	70	Significant	53	Significant
Tornado	66	Significant	44	Significant
Flooding	58	Significant	56	Significant
Extreme Winter Weather	34	Moderate	24	Limited
Earthquake	33	Moderate	30	Limited
Wildfire	32	Limited	50	Significant
Dam/Levee Failure	21	Limited	21	Limited
Drought/Water Supply	Not Rated	Non-Profiled	22	Limited

The Hazard Identification and Ranking Worksheet is included as Appendix 7.3.1-A and contains all the calculations and formulas utilized.

Significant Hazards

As a result of the Council's hazard ranking for the 2010 Plan update, Flood, wildfire, hurricane, and tornado were identified by the Council as having a significant impact statewide and are presented in Sections 3.2 to 3.5 respectively. Complete analysis for each of these hazards is provided along with appropriate appendix data to support the findings presented.

Limited Hazards

Four natural hazards - earthquake, extreme winter weather, drought/water supply, and dam/levee failure - were categorized as limited hazards and are presented in Section 3.6 to 3.9 respectively. Complete analysis for each of these hazards is provided along with appropriate appendix data to support the findings presented.

Non-Profiled Hazards

The Hazard Mitigation Council chose not to select and rank severe thunderstorms. This decision was based on the fact that they do not typically cause a statewide impact, requiring a state response, and typically would be mitigated at the local level. However, during review of the plan and based on the fact that 80% of local jurisdictions indicated that severe thunderstorms (wind, lightening and hail) were of significant concern, the State opted to expand the profile and assessment of this hazard under Section 3.10 Non-Profiled Hazards for the 2010 Plan update. In this section, a general discussion of vulnerability was added along with a history of events and calculations of probability for thunderstorm wind, lightening and hail. Property damage, loss of life and injuries that can be expected statewide on an annual basis are also addressed generally. It is not possible to specifically address expected losses to critical facilities or state-owned facilities with the limited data that was available. Hazards such as tornado, flood, and hurricane include impacts sustained through thunderstorm, hail, lightning, and high wind events and their impacts are included in the analysis for those hazard types.

Beach/Coastal erosion is also included as a non-profiled hazard and was determined not to pose a significant statewide threat to Mississippi and poses little or no threat to state-owned or critical facilities

For other hazards identified in local plans but not in the Hazard Mitigation Council ranking, a threshold was established. If 45% or fewer of the local plans identified the hazard it was deemed to not pose a significant threat to the state.

Hazard Identification Sources

In addition to the sources identified in Table 3.1.1, hazard data and input were collected from direct communication with various agencies, discussions with consultant team in-house experts, historical records and Internet searches. Specific sources included but were not limited to:

- Mississippi Emergency Management Agency
- Association of Floodplain Managers of Mississippi
- Natural Resources Conservation Service

- Mississippi State Department of Health
- Mississippi Department of Education
- Building Officials Association of Mississippi
- University of Mississippi
- Mississippi Department of Public Safety
- Mississippi Department of Finance and Administration
- Mississippi Automated Resource Information System
- U.S. Army Corp of Engineers, Memphis, Mobile and Vicksburg District
- Mississippi Development Authority
- Mississippi Department of Transportation
- Mississippi Department of Marine Resources
- National Weather Service
- Mississippi Department of Archives and History
- Mississippi Association of Supervisors
- State Board of Community and Junior Colleges
- United States Forest Service (USFS)
- National Oceanographic and Atmospheric Administration (NOAA)
- Input from local jurisdictions, districts and agencies

Local Risk Assessments and the State Plan

This State Plan also considers risks that have been identified outside this process in order to be more aware of the hazards facing local jurisdictions. Chapter 5: Coordination of Local Mitigation Planning, covers in detail, hazards identified and addressed in over 80 local plans. Generally, the hazards selected and profiled in this plan coincide well with the highest ranked local hazards.

A review of local plans revealed that thunderstorm (hail, lightning, high wind) was identified and addressed by 80% of the local plans. All other hazards were addressed by a smaller percentage (less than 33%) of the local plans. Thunderstorm mitigation is best addressed at the local level but is addressed under Section 3.10 Non-Profiled Hazards along with high winds and hail. In addition, these hazards are also addressed in this plan in the hurricane and tornado sections as applicable.

In the 2007 plan, drought was addressed in 45% of the local plans and was included as a non-profiled hazard as it can have statewide impacts, but is best mitigated by local practices. Since drought was included in 49% of the local plans, the Council determined that it should be classified as a limited hazard and is presented in Section 3.8. Excessive Heat, although a statewide threat is also best addressed by local mitigation and as such not addressed in this plan.

Hazards identified and addressed in local plans which are not included in this plan will receive the support of the state mitigation program.

2010 Plan Update

General Observations Regarding Natural Hazards and the Identification of Critical Facilities and Infrastructure

A prime factor in determining the risk associated with any natural hazard is the ability to understand prior events and use prior severity and frequency of occurrence to predict the probability of a future event. This presents a challenge as it depends on the ability to detect an event, the length of the historic record, and our ability to correctly recognize and contextualize longer-term patterns (ex., the effect of climate change on severe weather phenomena). As the overarching purpose of this plan is to enable planners to set into motion actions which will mitigate the effects of the hazards described herein, it is best to err on the side of over-estimating the risk of a hazard within the bounds of judiciousness than to underestimate.

This basic tenet was applied throughout this plan update. For example, it was noted that the number of reported tornado, wind, and hail events for Hinds County and the metropolitan Jackson area were significantly higher than most all other places in the state. Rather than accept these reports at face value, greater insight into the source of this anomaly was sought by seeking answers to some basic questions:

1. Was the reported number of tornado events accurate?
2. What is it about Hinds County and metropolitan Jackson that would force the compeling mechanisms required to cause a tornado, strong wind, or hail event to occur with higher frequency?
3. If the number of reported events were accepted, what would this imply for the interpretation of information for the rest of the Mississippi?

The conclusions arrived at suggest that:

1. This region is the most populated and, in terms of weather radar coverage, the best protected in the State. It is likely that the number of reported events is accurate as there are substantially more observers and observations.
2. There are no reasonable mechanisms (ex., a dramatic change in geography) that support the level of anomalous increase in tornado, wind, and hail events observed.
3. The population density and weather radar coverage are substantially lower in other parts of the State.

Drawing from these conclusions, it would be reasonable and prudent to suggest the number of tornado, hail, and wind events are likely underestimated in other parts of the State. This led to a greater general observation: the distribution of hazard occurrence by type will follow one of two trends. The first trend, as exemplified by tornado, wind, and hail events, is that all areas of the state share the same basic risk for event to happen. The second trend is that for other hazards, such as earthquake and hurricane, the risk is related to a distance decay function. That is to state that the greater the distance from the point of strongest origin, the lesser the probability of damage. For example, the likelihood of Jackson experiencing significant damage from an earthquake is significantly less than that of Southaven because it is further from the New Madrid seismic zone.

Although every attempt has been made to identify the precise location and accurately describe the nature of critical facilities/infrastructure elements, it is important to understand the limitations of such data and the limitations of this plan to accurately predict the failure of interdependent systems. The following premises regarding critical infrastructure should be considered with regard to the purpose of this plan:

- Critical facility is designed to support the populace and, as such, where possible and practical is more concentrated in areas of higher populations. For instance the city of Jackson has more hospitals per square mile than anywhere else in Mississippi.
- Critical infrastructure is interdependent. The failure of one system often leads to the failure or compromise of another system. An example would be the loss of electrical power which may lead to the failure of communications, water, and sewerage systems. At present, an analysis of this aspect of interdependence is not within the scope of this plan.
- The overwhelming majority of critical facility/infrastructure is privately held. Access to this data is sketchy and may create significant "blind spots" in understanding how any given threat will greater endanger the people and property of Mississippi.

It is important to understand these limitations in terms of seeking guidance from the state-wide hazard mitigation plan. Each community should continue to work toward identification of critical assets within their community in order to improve the accuracy of the state-wide plan.

Summary of Changes - 2010 Hazard Identification and Risk Assessment

The 2004 and 2007 plans presented data and analysis on a regional basis by grouping counties into their respective Planning and Development Districts (PDD). A majority of cities and counties have developed their mitigation plans individually rather than through a regional concept such as by PDD. For the 2010 plan update it made sense to eliminate the PDD breakdown and present data at a county level.

As previously stated in the Risk Assessment (section 3.0), the 2010 plan update does not include updated/improved data for state-owned facilities, critical facilities, and critical infrastructure. Notations are made within each profiled hazard as to whether default or new HAZUS data was utilized, or if the data presented in the 2007 plan was the best available.

Flood (section 3.2) - All tables and graphics/figures were updated with new data. The Repetitive and Severe Repetitive Loss Properties sections include comparisons to the 2007 data to reflect progress made in mitigation strategies. Data is presented by river basin rather than PDD, and each river basin includes repetitive and severe repetitive loss data and economic losses.

Hurricane (section 3.3) - All tables and graphics/figures were updated with new data. County-wide data were presented individually rather than by PDD grouping.

Wildfire (section 3.4) - All tables and graphics/figures were updated with new data.

Tornado (section 3.5) - This analysis was broadened to discourage the assumption that certain areas of the state are more prone to tornado events than others. All counties are equally vulnerable to tornado activity. The number of mobile homes in each county was added to the data to further identify vulnerability to tornado events throughout the state.

Earthquake (Section 3.6) - This section did not receive a significant update because liquifaction studies have not been conducted since the 2007 plan, and no events causing damage have occured. However, this section does include improved graphics, an enhanced historical events table, information regarding improvements to bridge structures located in northwest Mississippi and earthquake effects to high hazard and significant dams.

Extreme winter weather (section 3.7) - All tables and graphics/figures were updated with new data.

Drought (section 3.8) - This hazard was upgraded from “non-profiled” to “limited”. Historical information was updated and graphics have been added to support past occurances.

Dam/Levee (section 3.9) - A revised list of significant and high hazard dams and levee locations as provided by the Mississippi Department of Environmental Quality (MDEQ) and the U.S. Army Corps of Engineers (USCOE) Vicksburg and Memphis Districts.

Non-profiled hazards (section 3.10) - Additional data regarding probabilities for wind and hail is presented with supporting figures. Updated historical information for thunderstorm, lightning, hail and coastal/beach erosion is also provided.

Growth trends (section 3.11) - All tables and graphics/figures were updated with new data.

3.2: Flood Risk Assessment
Significant Hazard

Hazard Description

Flooding causes ninety percent of all natural disaster damages. The effects of a flood can be devastating. Between the inundation and the force of the current, both lives and property can be lost. People and animals can be drowned or injured by the floodwaters and current-borne debris. This same debris causes structural damage to buildings, roads, bridges, and railroads. Sanitary and storm sewers, water and utility installations can be damaged from flooding debris and their systems interrupted for extended periods of time. Crops can be carried away by the current or destroyed by prolonged submergence. Farmlands may be deeply eroded by new channels, resulting in the loss of valuable topsoil.

A flood is any general or temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal waters or the unusual and rapid accumulation or run-off of surface waters from any source.

Flooding is a natural and inevitable occurrence. Floods occur seasonally with general or torrential rains associated with tropical storms that later drain into river basins and fill them with an abundance of water. Rivers, lakes and other water bodies have always overflowed their normal beds to inundate nearby land. The land adjacent to these bodies of water is called the floodplain. There are generally four leading causes/ types of flooding. Mississippi is vulnerable to each as will be explained in the following section.

River (Riverine or Stream) Flooding:

Riverine floods occur along rivers, streams, or channels primarily when there is heavy or prolonged rainfall. Other contributing factors include: (1) the elimination of ground cover on drainage slopes as a result of tree cutting or wildfires, land development, or overgrazing; (2) the simultaneous arrival of flood crests from major tributaries; and (3) blocked drainage by items such as debris; dams or inadequately sized drainage structures. Floods from these sources can be "flash" or rapid, but are usually more gradual and have longer duration than flash floods. Riverine floods occur in all nine river basins in Mississippi.

Flash Flooding (Rapid):

Flash floods are a result of heavy, localized rainfall, possibly from slow-moving intense thundestorms that cause small creeks, streams, branches and rivers to overflow. They are most common when rain falls on areas with steep slopes or built-up areas where impervious surfaces, gutters, and storm sewers speed up the flow of run-off. The torrential nature of flash floods makes this hazard particularly lethal, especially in or near river- and streambeds, city streets, coastal areas and narrow valleys which contribute to the development of rapid water movement. Rapid or flash flooding occurs in all nine river basins in Mississippi.

Coastal (Tidal) Flooding:

All lands bordering the Mississippi Sound, such as various bays, estuaries or lakes are prone to tidal effects/flooding. Coastal lands, such as sand bars, barrier islands, and deltas provide a buffer zone to help protect human life and real property relative to the sea, much as floodplains provide a buffer zone along rivers or other bodies of water. Coastal floods usually occur as a result of abnormally high tides or tidal waves, storm surge and heavy rains in combination with high winds, tropical storms or hurricanes.

Storm surge is caused by high water from wind and the low air pressure differences that acompany a storm. Storm surge is not a tidal wave or sudden rush of water; rather it is more of a gradual increase in water surface elevation. A surge can be as high as 20 feet above normal water levels, flooding normally dry areas far inland. A storm surge is associated with a tropical storm or hurricane. Most of the fatalities and damage caused by a tropical storm or hurricane are the result of surge and its associated flooding, not high winds. The effects of coastal flooding can be worsened due to erosion. Coastal dunes and beaches provide natural protection by causing waves to break close to the shore, but these features can be worn down, exposing areas farther inland to storm damage. Tidal flooding occurs within three basins in Mississippi: the Pearl River, the Gulf Coast and the Pascagoula River.

Drainage

Drainage flooding occurs primarily in urban or developed areas when the volume of run-off exceeds the capacity of the drainage system. Flooding of this nature can be the result of increased development, inadequate drainage, riverine flooding, flash flooding or a combination of these. Drainage flooding occurs in all ten river basins.

Education and Outreach

Flood Awareness Week occurs in the month of March. For more information on flood awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. weekdays.

Hazard Profile

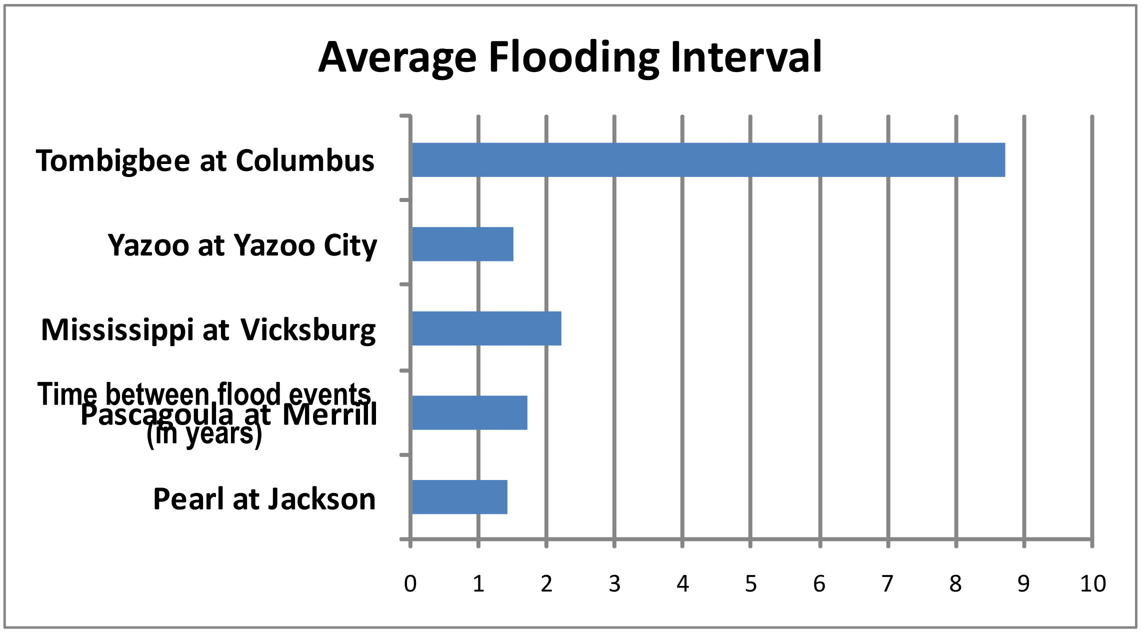
Mississippi is situated in a region where water is a bountiful natural resource, tying with Louisiana as the "wettest" state in the union considering the average amount of precipitation over the State's area. The statewide average of above 56 inches over nearly 31 million acres produces a volume in excess of 144 million acre-feet of water delivered to the State by the atmosphere annually, providing both surface and groundwater in abundance. Though Mississippi has no natural large inland lakes, flood control dams in the Yazoo-Tallahatchie basin and water supply reservoirs at Jackson and Meridian have formed large lakes in the north, and these have added to the fishing and recreational resources of the State. All the larger streams flow year-round.

Flood season in Mississippi is considered to primarily occur between the months of November through June (the period of greatest rainfall), while the months of March and April are considered to be the months of greatest flood frequency. The first six months of the year is the season of high flows in the Mississippi River. In other rivers and streams, flooding sometimes occurs during the summer from persistent thunderstorms, or in the late summer and early fall from the heavy rains associated with tropical storms originating in the Gulf of Mexico.

Local overflows occur on many streams three or four times a year in association with extended rainy spells and saturated soil conditions. Severe general flooding occurs about once in two years from upstream run-off. (See Table 3.2.1 below for the average flooding interval at selected points in five of Mississippi's major rivers.) The only important contribution to the Mississippi River within the State is from the Yazoo Basin. A system of levees prevents major damage from Mississippi River floods.

Source: National Climatic Data Center, U.S. Department of Commerce

Table 3.2.1
Major Flood Intervals for the Tombigbee,
Yazoo, Mississippi, Pascagoula, and Pearl Rivers
1984 – 2009



Note: The Tombigbee River at Columbus is protected from flooding by a major flood control structure.

Source: United States Geological Survey

Maximum Flood Threat

The flood of record within the state occurred on the Mississippi River in 1927. At that time, the flood resulted in 246 deaths, 650,000 homeless, and caused $284.1 million in property damages.

The flood of record on the Pearl River in 1979 affected about 500 people, contributed to the deaths of four people and resulted in an estimated $400 million in property damages. A worst-case scenario today would equal or double those numbers.

On April 6, 2003, many counties in Mississippi experienced a 125-year rainfall event. To put the entire event into perspective, areas north of Interstate 20 and extending west and east across the entire state were impacted. The 16 counties impacted include: Hinds, Scott, Rankin, Yazoo, Grenada, Leflore, Lee, Warren, Choctaw, Madison, Leake, Winston, Newton, Neshoba, Lauderdale and Kemper. Rainfall totals averaged 7 to 12 inches in a period of 18 hours. River flooding quickly became a major problem due to the large amounts of rainfall. Pelahatchie Creek experienced a 100-year flood event. The Chunky River at Chunky set a new record. This river actually flooded a portion of Interstate 20 which had to be closed for a few hours. The Chickasawhay River at Enterprise also set a record. In addition to the flash flooding, river flooding caused major damage to homes and numerous roads.

On August 29, 2005, Hurricane Katrina made landfall resulting in widespread flash flooding across the state. The 26 counties impacted by this event include: Newton, Scott, Neshoba, Leake, Kemper, Winston, Attala, Noxubee, Oktibbeha, Choctaw, Lowndes, Clay, Forrest, George, Greene, Lamar, Perry, Stone, Wayne, Marion, Prentiss, Covington, Jefferson Davis, Jones, Jasper and Smith. This storm dropped five to eight inches of rain over a six to ten hour period. This rainfall event caused many county roads and other secondary roads to remain flooded for a period of time with a number of roads being closed. Additionally, several roads had small sections washed out or nearly washed out due to their locations in low lying areas near creeks and creek-bottoms.

Location/Past Occurrences

Seven of Mississippi's severe flooding events of the past century are:

- 1892 - Tombigbee River
- 1927 - Mississippi River
- 1948 - Tombigbee River
- 1961 - Pearl River
- 1969 - Hurricane Camille
- 1973 - Mississippi River
- 1979 - Easter Flood on the Pearl River
- 2003 - 125-year rainfall event in Central Mississippi
- 2005 - Hurricane Katrina

These floods impacted approximately 90% of the state's counties.

Under provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (PL 93 – 288 as amended) and its predecessor, the Disaster Relief Act of 1970 (PL 91-606), 18 floods have resulted in federally declared "Major Disasters" since 1984. (See Table 3.2.2)

Table 3.3.2
Federal Disaster Declarations Due to or Including Flooding
1984 – 2009

Date	Description	Designation	Funds Extended
March 1987	Severe Storms, Floods	FEMA-7687	Not available
February 1990	January – March Floods	FEMA-859	$7,901,304
May 1991	April – May Floods	FEMA-906	$7,390,442
May 1995	Response 1995	FEMA-1051	$996,257
June 1997	Mississippi River Floods	FEMA-1178	$264,979
September 1998	Hurricane Georges	FEMA-1251	$32,124,060
April 2001	Severe Storms	FEMA-1365	$3,639,060
June 2001	Tropical Storm Allison	FEMA-1382	$2,356,352
November 2001	Severe Storms	FEMA-1398	$7,338,928
October 2002	Tropical Storm Isidore and Hurricane Lili	FEMA-1436	$9,700,101
April 2003	Severe Storms	FEMA-1459	$6,470,877
September 2004	Hurricane Ivan	FEMA-1550	$15,599,059
July 2005	Hurricane Dennis	FEMA-1594	$1,691,481
August 2005	Hurricane Katrina	FEMA-1604	$2,021,733,061
March 2008	Severe Storms	FEMA-1753	Not available
April 2008	Severe Storms	FEMA-1764	$4,190,069
September 2008	Hurricane Gustav	FEMA-1794	$8,651,472
May 2009	Severe Storms, Floods	FEMA-1837	$1,480,628

Source: Federal Emergency Management Agency

Mississippi has 299 communities that have federally identified Special Flood Hazard Areas (SFHA) or floodplains. These areas are depicted on the Flood Insurance Rate map (FIRM) as zones A, A1-A30, AE, AH, AO, A99, V, VI-V3, and VE, and are also known as the "100-Year Floodplain". These areas indicate the water surface elevation resulting from a flood that has a one percent or greater chance of being equaled or exceeded in any given year.

There are 305 Mississippi communities that are members of the National Flood Insurance Program (NFIP), including 15 communities that are in the emergency plan. Additionally, 23 communities also participate in the Community Rating System (CRS). Details on the communities that participate in the program are found in Appendix 7.3.3-A.

There are 82 counties within the state; all of which suffered at least one disaster declaration since 1993. The number of instances of declarations for each of the counties is indicated in Table 3.2.3.

Table 3.2.3
Declaration Instances by County
Mississippi Flood History 1993 – October 2009

County	Number of Events	Deaths	Injuries	Property Damage
Adams	19	0	0	1,926,192
Alcorn	23	1	0	1,171,500
Amite	7	0	0	526,666
Attala	13	0	0	2,361,000
Benton	3	0	0	12,000
Bolivar	32	0	0	2,339,690
Calhoun	13	0	0	17,000
Carroll	10	0	0	63,000
Chickasaw	4	0	0	3,000
Choctaw	8	0	0	475,000
Claiborne	10	0	0	1,397,190
Clarke	15	0	0	804,000
Clay	8	0	0	105,500
Coahoma	17	1	0	153,500
Copiah	15	0	0	1,570,500
Covington	16	0	0	895,000
DeSoto	40	3	0	5,141,500
Forrest	40	1	0	2,560,000
Franklin	10	0	0	539,000
George	17	0	0	17,000
Greene	19	0	0	45,000
Grenada	31	0	0	2,106,500
Hancock	16	0	0	860,000

County	Number of Events	Deaths	Injuries	Property Damage
Harrison	22	1	0	6,313,333
Hinds	65	0	0	24,915,000
Holmes	11	0	0	12,923,000
Humphreys	12	0	0	527,000
Issaquena	10	0	0	1,406,857
Itawamba	9	0	0	15,000
Jackson	18	0	0	958,333
Jasper	16	0	0	852,000
Jefferson	10	0	0	2,234,190
Jefferson Davis	16	0	0	622,000
Jones	27	0	0	245,000
Kemper	8	0	0	600,000
Lafayette	14	1	0	114,500
Lamar	36	0	0	8,481,666
Lauderdale	29	0	0	53,529,000
Lawrence	15	0	0	994,000
Leake	12	0	0	10,612,000
Lee	29	1	0	442,500
Leflore	21	0	0	476,500
Lincoln	25	0	0	3,569,000
Lowndes	18	0	0	3,846,000
Madison	41	0	0	51,960,500
Marion	34	0	0	18,829,667
Marshall	11	1	0	132,500
Monroe	14	0	0	54,000
Montgomery	10	0	0	20,000
Neshoba	16	0	0	1,690,000
Newton	18	0	0	31,084,000
Noxubee	9	0	0	293,000
Oktibbeha	9	0	0	261,000
Panola	14	1	0	114,500
Pearl River	21	0	0	1,518,333

County	Number of Events	Deaths	Injuries	Property Damage
Perry	13	0	0	67,000
Pike	11	0	0	1,046,667
Pontotoc	13	0	0	29,000
Prentiss	14	0	0	86,000
Quitman	4	0	0	62,000
Rankin	43	0	0	38,855,000
Scott	12	1	0	51,214,000
Sharkey	9	0	0	360,000
Simpson	12	0	0	324,000
Smith	13	0	0	356,000
Stone	20	0	0	573,000
Sunflower	17	0	0	243,500
Tallahatchie	12	0	0	750,000
Tate	18	3	0	108,500
Tippah	8	1	0	102,500
Tishomingo	9	2	0	34,000
Tunica	4	2	0	101,500
Union	17	0	0	52,000
Walthall	8	0	0	78,333
Warren	24	0	0	4,702,190
Washington	22	0	0	1,410,190
Wayne	10	0	0	89,000
Webster	6	0	0	300,000
Wilkinson	5	0	0	150,000
Winston	8	0	0	780,000
Yalobusha	6	0	0	6,000
Yazoo	18	0	0	16,105,000
Total Events	1,362	20	0	$382,709,497

Source: National Climatic Data Center, U.S. Department of Commerce

Probability of Future Flood Events

Based on available historical data, major floods occur within the state of Mississippi every two to three years, resulting in a calculated probability of reoccurrence of from one-in-two to one-in-three. One in six acres in Mississippi is found within the designated floodplain.

The Flood Insurance Studies (FIS) and their accompanying Flood Insurance Rate Maps (FIRMs) provide a means to identify the probability of future flood events. Through use of the flood profiles for each river and stream, summary of discharge tables, and floodway data tables, each community's future event probability can be adequately identified. The flood levels that can be predicted consist of the ten-year, 50-year, 100-year and 500-year Base Flood Elevation (BFE) depths.

Another means of prediction of future events is the examination of past events, as this also establishes a probability of reoccurring floods or repetitive flooding. There have been 13 federally declared disasters in Mississippi since 1998 and 12 Small Business Administration (SBA) flood declarations. Each event contained some measure of the four types of flooding identified in the flood hazard description of this plan. These statistics place the state of Mississippi within the top tier of disaster prone states. The 25 events are listed in Table 3.2.4.

Table 3.2.4
Federally and SBA Declared Flood Events Since 1998

Disaster Designation	Initial Date of Declaration	Number of Counties Declared
FEMA 1251	October 1998	16
FEMA 1265	January 1999	33
FEMA 1360	March 2001	50
FEMA 1365	April 2001	5
FEMA 1382	June 2001	5
SBA (Flooding)	August 2001	1
FEMA 1398	December 2001	23
FEMA 1436	October 2002	10
FEMA 1443	November 2002	5
FEMA 1459	April 2003	28
SBA (Flooding)	August 2003	7
SBA (Flooding)	August 2004	2
SBA (Flooding)	April 2005	18

Disaster Designation	Initial Date of Declaration	Number of Counties Declared
FEMA 1604	August 2005	82
SBA MS-00009	November 2006	13
SBA MS-00021	March 2008	12
FEMA 1753	May 2008	15
SBA MS-00020	May 2008	9
FEMA 1794	August 2008	20
SBA MS-00026	August 2008	63
SBA MS-00028	March 2009	4
FEMA 1837	March 2009	10
SBA MS-00034	March 2009	82
SBA MS-00033	April 2009	18
SBA MS-00029	May 2009	7

Source: U.S. Small Business Administration

Assessing Vulnerability by Jurisdiction/Estimating Potential Losses

Methodology

It has been a long-standing policy of the State of Mississippi to focus flood mitigation efforts on its most vulnerable communities. Those communities are identified based on past flood damages to insured structures. In 2004, 50 communities were identified as the most vulnerable based primarily on how many insured repetitive loss properties existed within their boundaries. In the 2007 update of the plan, additional information was used to supplement the vulnerability assessment, including updated insured loss payments, numbers of repetitive loss properties and claims, and HAZUS-MH countywide flood loss estimations.

During the 2010 plan update, the state used the most recent release of FEMA's loss estimation software, HAZUS-MH MR4, to model flood loss for every county in Mississippi. HAZUS-MR4 can assess flood loss for an entire county if digital terrain data exists. Since digital elevation models (DEMs) were available for the entire State of Mississippi, the state was able to use HAZUS-MR4 to develop computer-generated floodplain boundaries for the flood elevation that has a one-percent chance of being equaled or exceeded each year (hereafter referred to as the "base flood," also known as the 100-year flood) on major streams in each county. HAZUS-MR4 computes the potential flood impact on a building inventory database based on the extent and depth of the modeled floodwaters, enabling a consistent methodology for a county-by-county assessment of potential flood losses.

The HAZUS-MR4 flood analysis was a significant undertaking for the state. Producing a HAZUS-MR4 flood run is very computer-resource intensive. Processing a single county takes a minimum of 12 hours from start to finish, depending on the size of the county, density of the stream network, and density of census blocks. Several machines dedicated to running HAZUS-MR4 were used continually over a period of two months.

To develop countywide probabilistic analyses for each county, the following parameters were used:

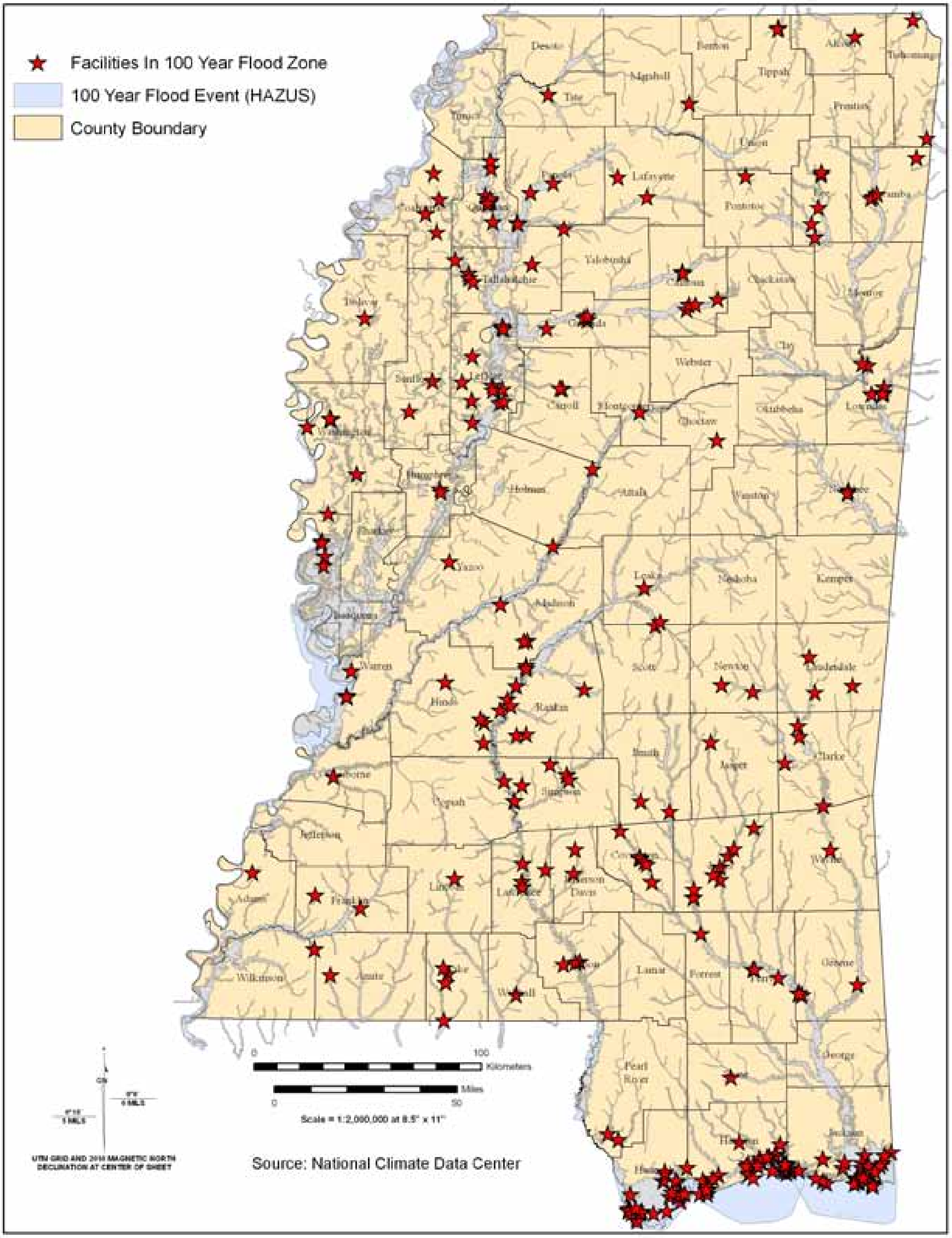
- Thirty-meter (30-m) resolution DEMs as the terrain base to develop hydrologic and hydraulic models.
- Streams and rivers with a minimum drainage basin area of ten square miles all experiencing a base flood at the same time.
- U.S. Geological Survey hydrologic regional regression equations and stream gage data included in HAZUS-MR4.
- HAZUS-MR4 building inventory defaults summarized to the census-block level with 2006 building valuations.

HAZUS-MH produces a flood polygon and flood depth grid that represents the base flood. While not as accurate as official flood maps, such as digital flood insurance rate maps, these floodplain boundaries are available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program. A statewide digital flood hazard layer was created by appending floodplain boundaries created in each county run.

Flood damage is directly related to the depth of flooding. For example, a two-foot deep flood generally results in about 20 percent damage to the structure (which translates to 20 percent of the structure's replacement value). HAZUS-MR4 takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). The HAZUS-MR4 reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes in HAZUS-MR4 include agriculture, commercial, education, government, industrial, religion, and residential. Damage percent classes are grouped by ten percent increments: 1-10 percent, 11-20 percent, etc., up to 50 percent. Buildings that sustain more than 50 percent damage are considered to be "substantially" damaged. For example, in Quitman County, HAZUS-MR4 predicts 44 buildings will be substantially damaged in a base flood.

The HAZUS-MR4 methodology provides the number of buildings impacted, estimates of the building repair costs, and the associated loss of building contents and business inventory. Building damage can also cause additional losses to a community as a whole by restricting the building's ability to function properly. Income loss data accounts for losses such as business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by HAZUS-MR4 using a methodology based on the building damage estimates.

Figure 3.2.1
Critical Facilities in 100 Year Flood Zone



Data Limitations

Default HAZUS-MR4 data was used to develop the loss estimates. Thus, the potential losses derived from HAZUS-MR4, the best available data, may contain some inaccuracies. One obvious limitation is that the building inventory is based on 2006 counts. Some additional risk modeling was done in a GIS environment using the state facility list and the boundaries generated by HAZUS-MR4. However, the state facility list contained an insufficient number of attributes to be fully integrated into HAZUS-MR4.

The damaged building counts generated by HAZUS-MR4 are susceptible to rounding errors and are likely the weakest output of the model due to the use of census blocks for analysis. The HAZUS-MR4 "Building Damage Count by General Building Type" report includes this disclaimer:

> "Unlike the earthquake and hurricane models, the flood model performs its analysis at the census block level. This means that the analysis starts with a small number of buildings within each census block and applies a series of distributions necessary for analyzing the potential damage. The application of these distributions and the small number of buildings make the flood model more sensitive to rounding errors that introduces uncertainty into the building count results. Please use these results with suitable caution."

The counts of buildings at risk collected from flood insurance policy data and biennial reports could potentially provide a more realistic estimate of the actual numbers of buildings in the base-flood hazard areas (see the Flood Insurance Claims Analysis that follows), but the information in the biennial reports could contain errors as well.

There could be errors and inadequacies associated with the hydrologic and hydraulic modeling of the HAZUS-MR4 model. In several counties, the HAZUS-MR4 model underestimated the hydrologic discharges for a 100-year event. In these cases, discharge values were edited to match discharges on streams from flood insurance studies (FIS), where the information was available. In most cases, this FIS data was only available for a limited number of stream reaches, thus the model may underestimate overall results for these counties. Where an FIS was not available, www.weather.gov stream gage records for the "flood of record" were used, or, in some cases, discharges were estimated from HAZUS-MR4 or flood insurance studies from a neighboring county if the stream crossed county boundaries. A tracking system was developed to capture what counties stream reaches, were edited with improved base-flood discharge values (Appendix 7.3.4-B).

HAZUS-MR4 may or may not account for levee protection, depending on whether the levees are detected on the 30m resolution digital elevation model (DEM). In some counties, notably Coahoma County, HAZUS-MR4 modeled the base flood on the Mississippi River as completely contained within levees. There may be levees in other counties that were not detected on the DEM, or where HAZUS-MR4 did not model the flood within the levee. This is more likely due to deficiencies in the DEM than representative of levee inadequacies. In those cases, HAZUS-MR4 is modeling damage from the worst-case scenario, which is essentially no levee protection.

HAZUS-MR4 can analyze additional impacts, including what type of infrastructure could be affected and how severely. Project files for each county are available for use by local governments and the state if more details on the impacts discussed here, or information about other impacts, such as vehicle losses, agricultural losses, utility system losses, essential facility impacts, and transportation impacts, are desired.

Vulnerable Jurisdictions

The intent of this analysis was to enable the state to estimate where flood losses could occur and the degree of severity, county by county, using a consistent methodology. The computer modeling helps quantify risk along known flood hazard corridors such as along the Mississippi and Pearl rivers. In addition, flood losses are estimated for certain lesser streams and rivers where the flood hazard may not have been previously studied.

HAZUS-MR4 impact analyses were run for direct economic losses for buildings and societal impacts (displaced people and shelter needs) to see which counties ranked the highest on these risk indicators (these losses and impacts are illustrated in the maps and tables that follow). Using GIS, HAZUS-MR4 flood results were mapped to show flood loss potential and how it varies across the state. The primary indicators used to assess flood losses were:

- direct building losses combined with income losses,
- loss ratio of the direct building losses compared to overall building inventory, and
- population displaced by the flood and shelter needs.

The results display the potential base-flood losses to each county. The results show potential losses and loss ratios as highest along the Gulf Coast counties of Hancock, Harrison, and Jackson, and Desoto county where coastal and riverine flood hazards are extensive. Counties along the Pearl and Mississippi river corridors are likely to experience significant flood losses. The loss ratio analyses indicate that counties along the Tallahatchie and Yazoo river corridors (Quitman, Panola, Tallahatchie, Leflore, and Humphreys) could experience significant damage and large numbers of displaced populations. It should be noted that there are levees in these counties that may not be represented in the HAZUS-MR4 model, and that the model may represent little or no levee protection (Figures 3.2.2 and 3.2.3 and Table 3.2.5.). Detailed results by county (all counties) can be referenced in Appendix 7.3.2-C.

Figure 3.2.2
HAZUS-MH Countywide Summary
100-Year Flood Scenarios: Building and Income Loss

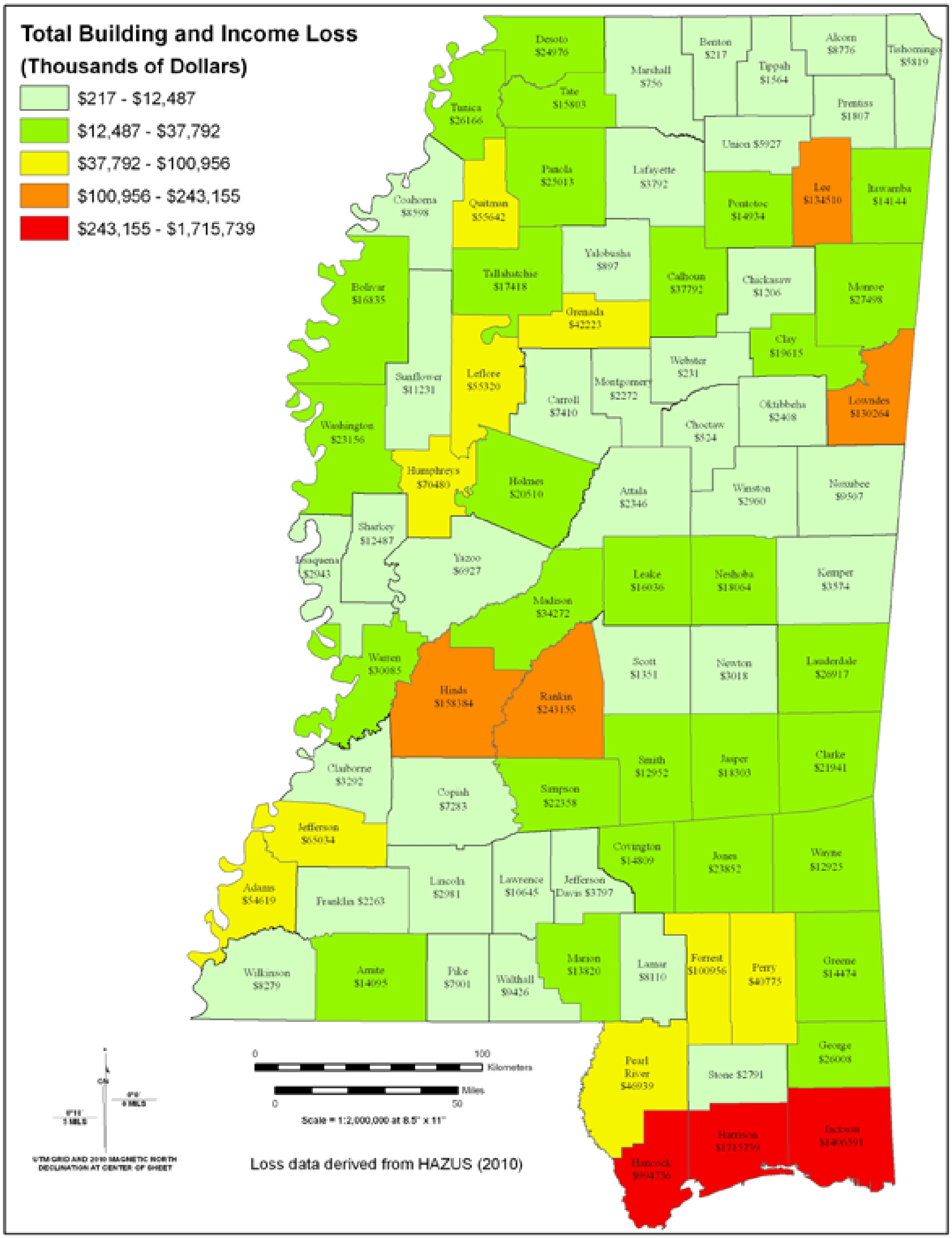


Figure 3.2.3
HAZUS-MH Countywide Summary
100-Year Flood Scenarios: Loss Ratio

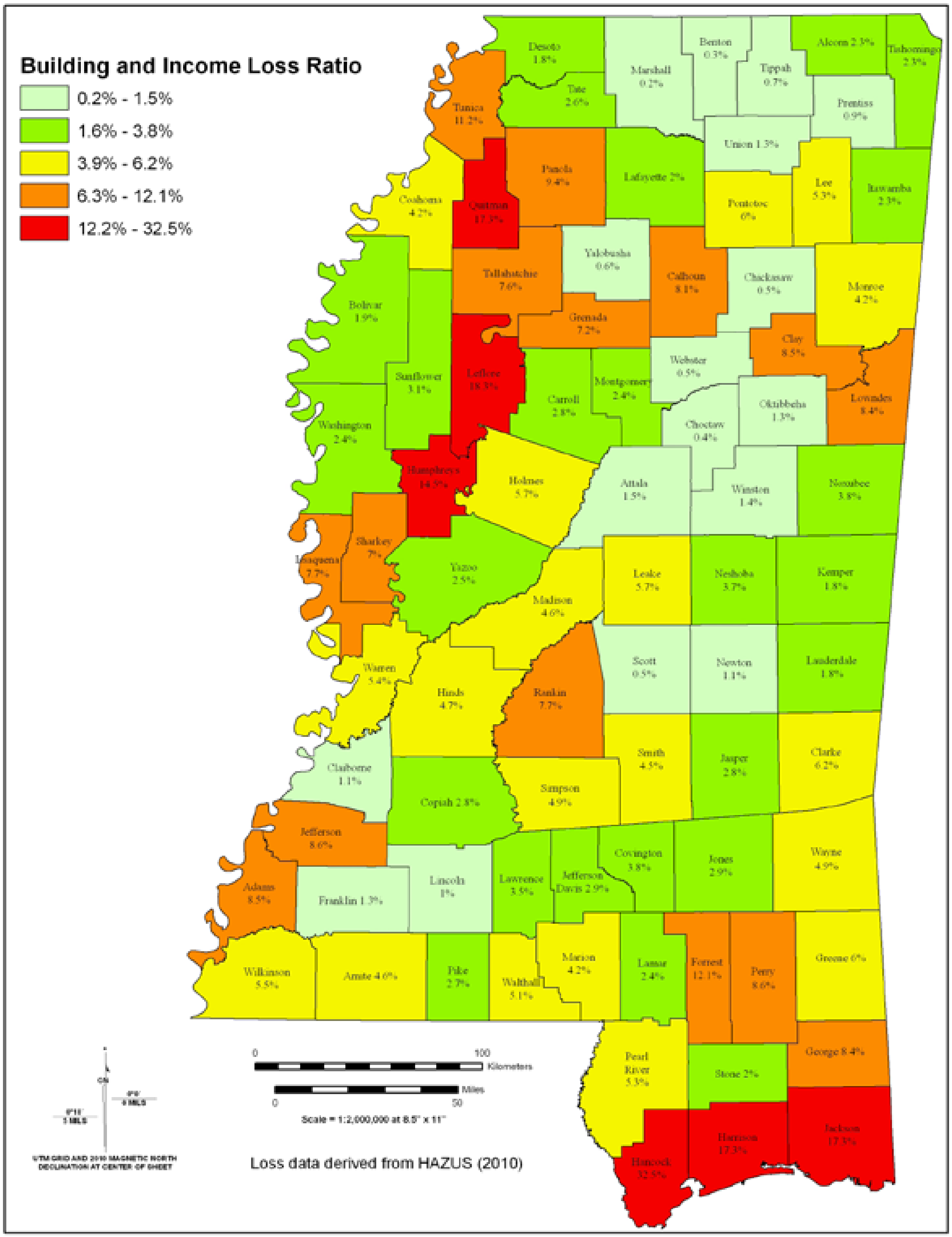


Table 3.2.5
HAZUS-MH 100-Year Flood Loss Estimation
Results: Building Impacts by County, Ranked by Highest Total Building Losses
(Top Ten Counties Depicted)

County	Total Building Loss	Total Income loss	Total Building and Income Loss
Harrison	$1,703,818,000	$11,921,000	$1,715,739,000
Jackson	$1,397,087,000	$9,504,000	$1,406,591,000
Hancock	$989,489,000	$5,247,000	$994,736,000
Rankin	$240,975,000	$2,180,000	$243,155,000
Hinds	$155,795,000	$2,589,000	$158,384,000
Lee	$133,120,000	$1,390,000	$134,510,000
Lowndes	$129,615,000	$649,000	$130,264,000
Forrest	$100,557,000	$399,000	$100,956,000
Humphreys	$69,759,000	$721,000	$70,480,000
Jefferson	$64,787,000	$247,000	$65,034,000

HAZUS-MH 100-Year Flood Loss Estimation
Results: Building Impacts by County, Ranked by Highest Total Building Loss Ratio
(Top Ten Counties Depicted)

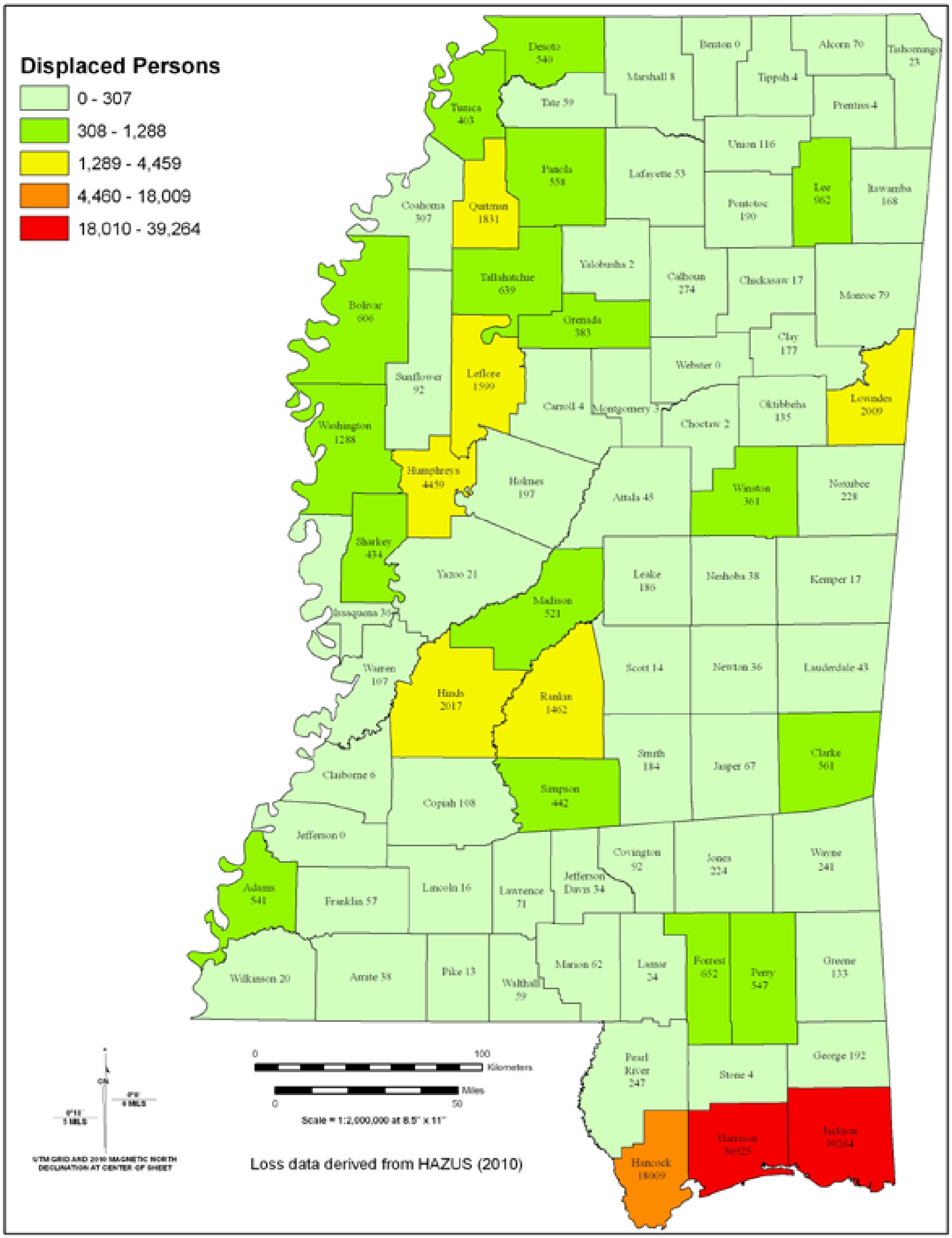
County	Building Loss Ratio
Hancock	32.5%
Leflore	18.3%
Harrison	17.3%
Jackson	17.3%
Quitman	17.3%
Humphreys	14.5%
Forrest	12.1%
Tunica	11.2%
Panola	9.4%
Jefferson	8.6%

The displaced population is based on the inundation area. Individuals and households will be displaced from their homes even when the home has suffered little or no damage either because they were evacuated (i.e., a warning was issued) or there was no physical access to the property because of flooded roadways. Displaced people using shelters will most likely be individuals with lower incomes and those who do not have family and friends within the immediate area. Age plays a secondary role in shelter use in that there are some individuals who will go to a public shelter even if they have the financial means to go elsewhere. These will usually be younger, less established families and elderly families (HAZUS-MR4 Users Manual). HAZUS-MR4 does not model flood casualties given that flood-related deaths and injuries typically do not have the same significant impact on the medical infrastructure as those associated with earthquakes. Table 3.2.6 and the map depicted in Figure 3.2.4 compare the potential impacts of floods on Mississippi citizens for the top ten impacted counties. Detailed results for all counties can be referenced in Appendix 7.3.2-C.

Table 3.2.6
Flooding Impacts on Populations
(Ranked by Displaced People)

County	Number of households	Number of people needing shelter
Jackson	15,078	39,264
Harrison	13,902	36,925
Hancock	7,991	18,009
Humphreys	1,666	4,459
Hinds	825	2,017
Lowndes	944	2,009
Quitman	857	1,831
Leflore	757	1,599
Rankin	708	1,462
Washington	588	1,288

Figure 3.2.4
Displaced Population



Local Critical Facility Floodplain Analysis

For the 2010 plan update, local critical facilities were inventoried and geolocated where possible by region and are presented in Appendix 3.0-C. Information regarding the facility type and location were available, but valuations were not. The statewide HAZUS-MH-derived base-flood layer was overlaid, using GIS, on the geolocated critical facilities. The number and types of facilities located in a possible flood hazard area were summarized by county in Table 3.2.7. Note the number of facilities such as fire stations and emergency operations centers located in floodplains. A high number of wastewater facilities are in the floodplain as well, but this is not unusual with these gravity-fed systems. These results are for general planning purposes only as there could be errors in the location of critical facilities as well as errors in HAZUS-MH modeled flood hazard boundaries noted previously.

Table 3.2.7
Critical Facilities Potentially Within a Base-Flood Hazard Area

County	Number of Facilities at Risk	County	Number of Facilities at Risk	County	Number of Facilities at Risk
Adams	1	Humphreys	2	Panola	2
Alcorn	1	Issaquena	5	Pearl River	2
Amite	3	Itawamba	3	Perry	3
Attala	1	Jackson	44	Pike	4
Bolivar	1	Jasper	1	Pontotoc	1
Calhoun	4	Jefferson Davis	2	Quitman	15
Carroll	2	Jones	12	Rankin	5
Choctaw	1	Kemper	1	Scott	1
Claiborne	1	Lafayette	2	Simpson	5
Clarke	4	Lauderdale	3	Smith	1
Clay	1	Lawrence	3	Stone	1
Coahoma	3	Leake	2	Sunflower	3
Copiah	3	Lee	6	Tallahatchie	8
Covington	7	Leflore	11	Tate	1
Forrest	1	Lincoln	1	Tippah	3
Franklin	2	Lowndes	7	Tishomingo	3
Greene	4	Madison	5	Walthall	1
Grenada	6	Marion	4	Warren	4
Hancock	31	Marshall	1	Washington	7
Harrison	49	Montgomery	2	Wayne	1
Hinds	10	Newton	2	Yalobusha	1
Holmes	2	Noxubee	3	Yazoo	1

Flood Insurance Claims Analysis

In addition to the HAZUS-MR4 flood runs and local plans, the state analyzed National Flood Insurance Program (NFIP) flood-loss data to determine areas of Mississippi with the greatest flood risk. Mississippi flood-loss information was culled from FEMA's "Policy and Loss Data by Community with County and State Data," which documents losses from 1978 to the present (this analysis is based on the report dated February 8, 2010).

There are several limitations to this data, including:

- only insured losses to participating NFIP communities are represented,
- communities joined the NFIP at various times since 1978,
- the number of flood insurance policies in effect may not include all structures at risk to flooding, and
- some of the historical loss areas have been mitigated with property buyouts.

Despite these limitations, the data depict a pattern of historical flood losses in the state. The greatest losses continue to be located in the counties along the Gulf Coast: Harrison, Hancock, and Jackson. In the 2007 Plan, Forrest and Pearl River Counties were ranked 7th and 10th and are now ranked 12th and 13th respectively.

Table 3.2.8 details the ten Mississippi counties with the greatest historical dollar losses. Figures 3.2.5 and 3.2.6 that follow show the geographic distribution of flood payouts and claims by county across the entire state. Details on flood insurance policies by county can be referenced in Appendix 7.3.2-D.

Table 3.2.8
NFIP Historic Dollars Paid
Top 10 Counties

County	Total Current Policies	Total Flood Claims	Total Dollars Paid (Historical)
Harrison	21,408	14,156	$1,252,613,247
Hancock	9,382	8,914	$716,866,445
Jackson	20,268	9,165	$672,700,294
Rankin	6,561	4,209	$57,278,380
Madison	5,842	4,412	$55,498,511
Hinds	5,240	3,826	$52,209,268
Warren	450	2,562	$25,034,954
Washington	2,571	1,478	$18,397,371
Wilkinson	79	1,731	$15,316,919
Bolivar	525	1,044	$9,285,235

Figure 3.2.5
Dollars Paid Historically for Flood Insurance Losses in Mississippi by County, 1978-2010

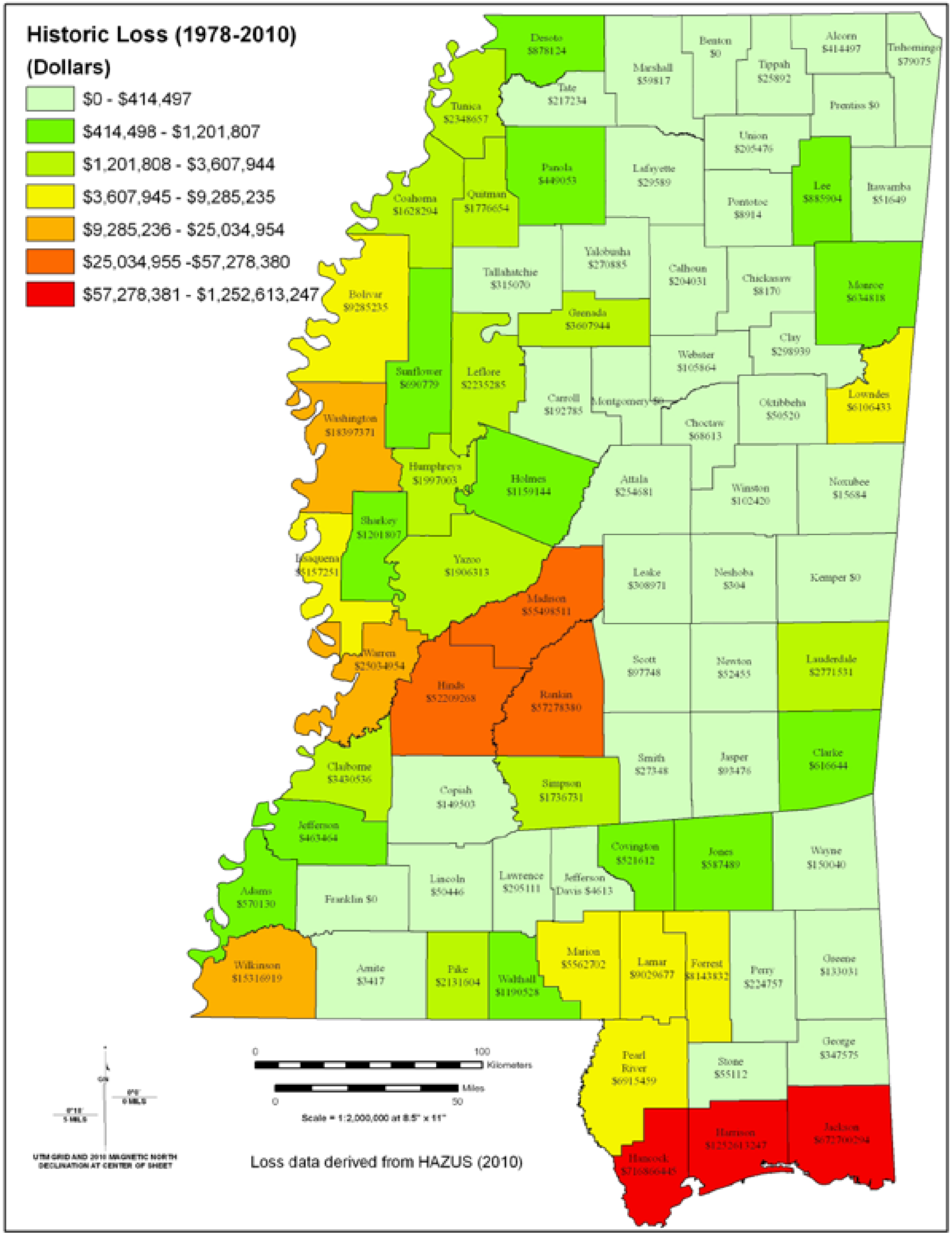
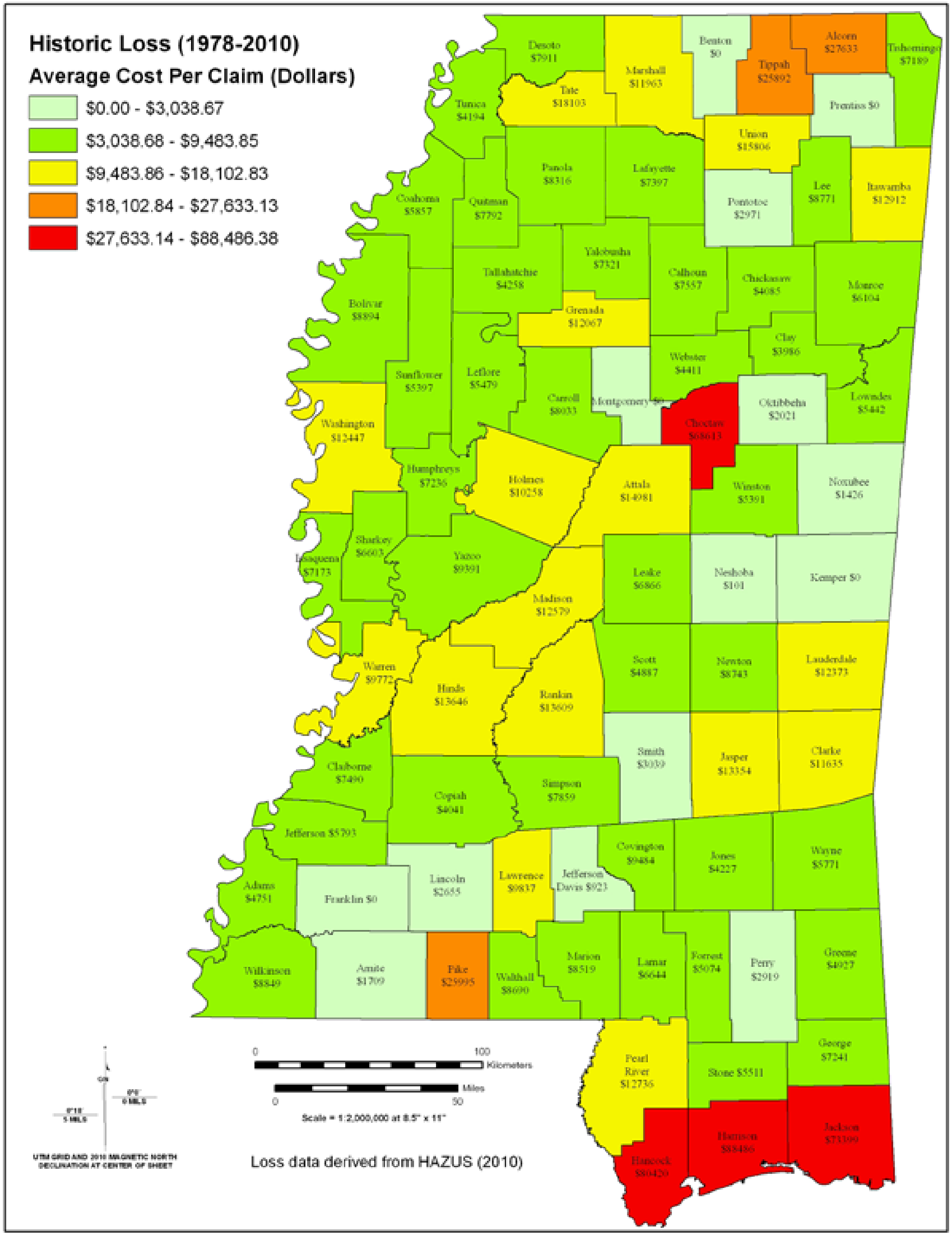


Figure 3.2.6
Average Cost Per Flood Loss Claims in Mississippi by County, 1978-2010



Repetitive Loss Property Analysis

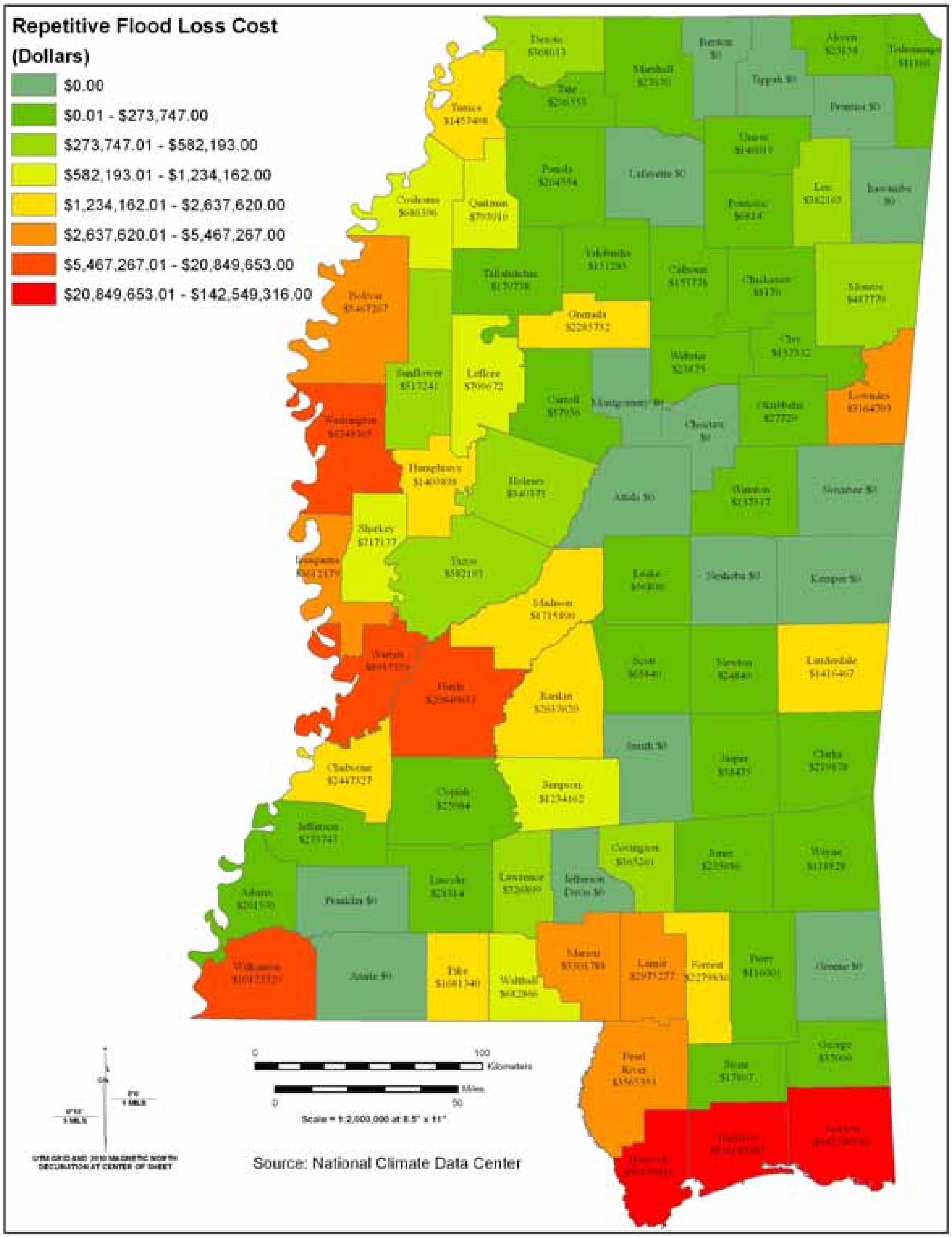
A high priority in Mississippi and nationwide is the reduction of losses due to repetitive loss structures. These structures strain the National Flood Insurance (NFIP) Fund. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. At least two of the claims must be more than ten-days apart." Table 3.2.9 and Figure 3.2.7 illustrate the number and location (by county) of Mississippi's top ten repetitive loss properties. The table ranks counties by repetitive loss dollars paid between 1978 and February 2010. A detailed table by County is provided in Appendix 7.3.2-E and a summary of properties is included under the River Basin Analysis section.

The table also includes the number of repetitive losses that have been mitigated. The data indicate that progress has been made in certain counties, such as Warren and Forrest, but opportunities for mitigation remain in counties such as Wilkinson, Washington, Bolivar and others. Note that the top three counties with repetitive losses are the coastal counties of Harrison, Jackson, and Hancock. The devastating impact of Hurricane Katrina may have mitigated future losses associated with many of these properties, assuming that they were largely wiped out by the storm surge and any rebuilding will be done to revised base-flood elevations.

Table 3.2.9
Mississippi's Top 10 Repetitive Loss Flood Claims by County

County	Repetitive Loss Flood Claims					
	No. of RL Properties	No. of Insured Properties	No. of Mitigated Properties	2007 Flood Claims	2009 Flood Claims	RL Dollars Paid (Historical)
Jackson	947	405	2	2,311	2284	$142,549,316
Harrison	724	448	210	3,247	2024	$116,189,385
Hancock	727	376	102	1,712	1743	$90,730,159
Hinds	388	188	0	988	961	$20,849,653
Wilkinson	208	14	0	708	741	$10,175,729
Warren	191	25	0	1,314	672	$8,937,359
Washington	162	38	0	467	530	$8,348,305
Bolivar	155	14	2	474	494	$5,467,267
Issaquena	133	15	0	351	378	$3,612,179
Pearl River	61	27	0	198	179	$3,565,353

Figure 3.2.7
Repetitive Loss Flood Claims
by County 1978 to 2010



Severe Repetitive Loss Property Analysis

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss. Severe repetitive loss (SRL) is defined as "a single family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claims payments have been paid under flood insurance coverage with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least two separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property."

Table 3.2.10 illustrates severe repetitive loss properties by county and has been expanded in the 2010 plan update to include the number of SRL claims from the 2007 plan to illustrate changes that have occurred. The counties are sorted by the highest total payments received and also include loss ratios. Loss ratio is the total payment divided by the total property value. A loss ratio greater than 1.0 indicates that more has been paid out in insurance claims than the properties, added together, are worth. Note again that the top three counties with severe repetitive losses continue to be the coastal counties of Harrison, Hancock, and Jackson. Details by county are also provided in the River Basin Analysis section of this plan.

Table 3.2.10
Mississippi's Severe Repetitive Loss Summary by County
(Ranked by Total Payment)

County	No. of SRL Properties	2007 Flood Claims	2009 Flood Claims	No. of Mitigated Properties	Total Property Value	Total Payments (Bldg and Contents)	Loss Ratio*
Harrison	72	389	311	39	$10,114,911	$14,319,497	1.42
Hancock	39	140	116	76	$4,686,697	$7,443,914	1.59
Jackson	26	135	146	2	$4,853,901	$4,759,282	0.98
Washington	14	83	94	14	$1,726,307	$1,717,318	0.99
Hinds	15	109	48	15	$872,771	$1,264,368	1.45
Warren	6	92	45	7	$739,689	$985,984	1.33
Claiborne	7	36	71	7	$390,720	$832,175	2.13
Pearl River	6	23	28	6	$838,010	$797,077	0.95
Lamar	6	75	35	0	$696,604	$784,034	1.13
Wilkinson	3	123	19	3	$240,936	$436,158	1.81
Bolivar	2	74	12		$222,791	$332,406	1.49
Humphreys	2	11	21	2	$105,741	$322,956	3.05
Lawrence	1	0	11	1	$133,187	$314,798	2.36
Issaquena	3	36	11	1	$280,652	$302,089	1.08
Lowndes	2	23	12	2	$247,874	$258,283	1.04

County	No. of SRL Properties	2007 Flood Claims	2009 Flood Claims	No. of Mitigated Properties	Total Property Value	Total Payments (Bldg and Contents)	Loss Ratio*
Forrest	2	49	18	8	$121,992	$163,699	1.34
Monroe	1	4	4	1	$122,850	$150,462	1.22
Marion	2	26	13	2	$360,480	$123,066	0.34
Sharkey	2	12	6	2	$197,840	$122,890	0.62
Sunflower	1	5	7	1	$74,232	$76,969	1.04
Tunica	1	4	2	1	$26,856	$40,037	1.49
Totals	**213**	**1,449**	**1,030**	**190**	**$27,055,041**	**$35,547,462**	**1.31**
Totals from 2007	308		1,449		$34,847,560	$31,407,591	0.90
Difference from 2007	(95)		(419)		($7,792,519)	$4,139,871	0.41

*Loss ratio = total payments divided by total property value

The State established a 'Top 50 At Risk' list to focus its limited resources on a manageable number of communities in the 2007 plan. For this plan update, it was determined that the number of insured repetitive loss properties should be presented by county. This information is provided in the River Basin Analysis section.

Flood Hazard and Repetitive Loss Risk Properties by River Basin

Up to this point, flood vulnerability has been summarized to the county level, with the most at risk counties identified. The state recognizes the importance of watershed planning and regional planning when implementing flood mitigation solutions. The following section summarizes vulnerability information by river basin and counties within each basin.

According to the HAZUS-MH results, the number of residential structures found within Mississippi's Special Flood Hazard Area (SFHA) is 45,362. The sum of all other structures within the SFHA is 251, for a total of 45,613.There have been 54,526 insured losses since 1978, with 4,985 of the total being insured repetitive losses.

With more than 5.2 million acres of floodplain (of a total landmass of 30,989,376 acres), Mississippi has the 5th largest floodplain in the United States. The State is in the process of updating and adopting Flood Insurance Rate Maps (FIRMS). It is anticipated that the floodplain area will increase in size and could potentially change the ranking for Mississippi. In order to visualize the state of Mississippi's floodplain, it is first necessary to examine and understand its nine distinct river basins.

The State of Mississippi is located within the Gulf of Mexico drainage area. The nine primary river basins within the state are categorized (from north to south) as the:

- North Independent Basin
- Tennessee River Basin
- Yazoo River Basin
- Tombigbee River Basin
- Big Black River Basin
- Pearl River Basin
- South Independent Basin
- Pascagoula River Basin
- Coastal River Basin

The state is primarily concerned with the risk associated with the floodplains found within the nine basins listed above. The local governments focus their risk assessments on the tributaries and secondary streams associated with the primary rivers located within their environs.

In terms of floodplain management, it is necessary to identify the eighty-two counties in conjuntion with their basin. The identified basins and their member counties are listed on the subsequent pages. The assigment of a county to a basin was based solely upon the placement of the majority of the county's landmass within the appropriate basin boundary. The counties are then run together in HAZUS-MR4.

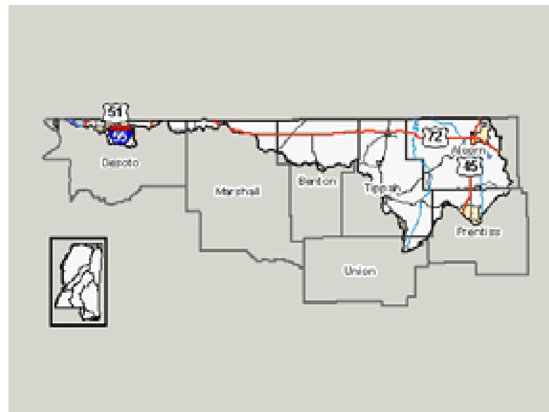
Added to this section in 2010 is a summary of vulnerabilities and loss estimations to flood and data regarding repetitive and severe repetitive loss properties by county. This information was previously presented in 2007 by Planning and Development District. Essential facilities at risk are also identified by county. These facilities include hospitals, fire and police stations, emergency operation centers, and schools. Based on the HAZUS-MH flood losses, the Yazoo River and Big Black River Basins are most at risk. Based on the number of repetitive and severe repetitive properties, the Coastal River and Pascagoula River Basins are most at risk.

North Independent River Basin

The North Independent Basin encompasses portions of Alcorn and Tippah counties. These counties have seven NFIP member communities within their borders. Flood losses associated with this basin are due primarily to the Hatchie, Tuscumbia and Little Hatchie Rivers, Muddy Creek, South Tippah Creek, and their tributaries.

HAZUS-MH has reported a total of 27 structures within this basin are considered at risk for a 100 year flood event scenario. There are no esssential facilities at risk within this basin. There have been a total of 16 flood insurance claims since 1978. Of this number, two have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Alcorn	401.3	3
Tippah	459.9	4
Totals	**861.2**	**7**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Alcorn	1	1	0	0	0	0	0	0
Tippah	0	0	0	0	0	0	0	0
Totals	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**

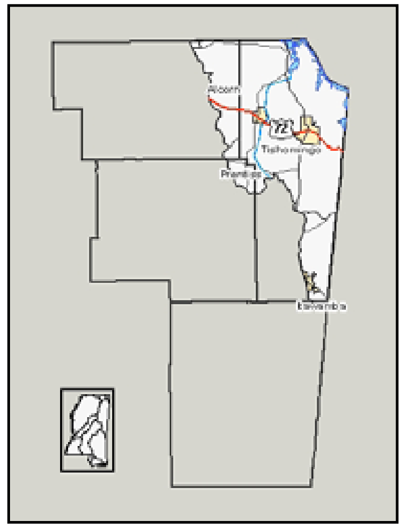
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Alcorn	$8,776,000	21	0	6	0	$1,727,826,000
Tippah	$ 1,564,000	0	0	0	0	$952,608,000
Totals	**$10,340,000**	**21**	**0**	**6**	**0**	**$2,680,434,000**

Tennessee River Basin

The Tennessee River Basin encompasses portions of Tishomingo County. This county has four NFIP member communities within its borders. Flood losses associated with this basin are due primarily to the Tennessee and Tombigbee Rivers, Bear Creek, Yellow Creek, and their tributaries.

HAZUS-MH has reported a total of nine structures within this basin are at risk. There is one essetial facility at risk within this basin. There have been a total of 11 flood insurance claims since 1978. Of this number, two have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Tishomingo	444.6	4



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Tishomingo	1	1	0	0	0	0	0	0

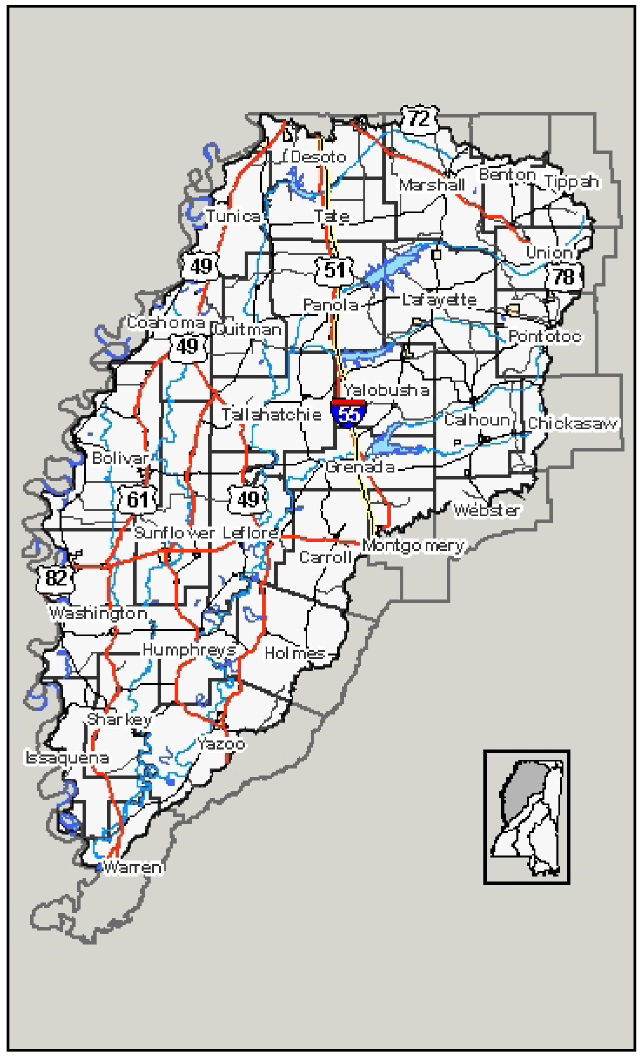
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Tishomingo	$ 5,819,000	9	0	0	1	$985,651,000

Yazoo River Basin

The Yazoo River Basin encompasses portions of the twenty-five counties listed below. These counties have 116 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Yazoo, Sunflower, Coldwater and Tallahatchie Rivers and their associated tributaries.

HAZUS-MH has reported a total of 3,490 structures within this basin are considered at risk for a 100 year flood event scenario. There are 19 essential facilities at risk within this basin. There have been a total of 6,280 flood insurance claims since 1978. Of this number, 2,441 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Benton	408.5	3
Bolivar	905.7	14
Calhoun	587.8	6
Carroll	634.3	4
Coahoma	583	7
Desoto	496.6	6
Grenada	449.2	2
Holmes	764	8
Humphreys	431.1	4
Issaquena	441.4	2
Lafayette	679.1	3
Leflore	606.2	6
Marshall	709.6	4
Panola	704.9	3
Pontotoc	500.9	2
Quitman	406.4	6
Sharkey	434.8	4
Sunflower	707.1	8
Tallahatchie	651.9	6
Tate	410.8	3
Tunica	480.7	2
Union	416.8	3
Washington	761.2	5
Yalobusha	494.8	2
Yazoo	933.9	3
Totals	**12,773**	**116**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Benton	0	0	0	0	0	0	0	0
Bolivar	157	155	14	4	15	2	1	1
Calhoun	5	5	1	0	2	0	0	0
Carroll	4	4	0	0	0	0	0	0
Coahoma	48	36	5	1	4	0	0	0
Desoto	14	15	6	0	2	0	0	0
Grenada	14	56	5	0	2	0	0	0
Holmes	11	11	3	0	0	0	0	0
Humphreys	40	41	11	3	3	2	2	2
Issaquena	128	133	15	4	9	3	1	1
Lafayette	0	0	0	0	0	0	0	0
Leflore	29	30	0	0	1	0	0	0
Marshall	1	1	0	0	0	0	0	0
Panola	7	7	1	0	0	0	0	0
Pontotoc	1	1	0	0	0	0	0	0
Quitman	21	21	2	0	0	0	0	0
Sharkey	20	25	5	0	2	2	0	0
Sunflower	19	17	1	1	1	1	1	1
Tallahatchie	9	9	1	0	0	0	0	0
Tate	1	2	2	0	0	0	0	0
Tunica	77	77	2	1	1	1	1	1
Union	3	3	0	0	0	0	0	0
Washington	152	162	38	14	16	14	11	1
Yalobusha	8	8	0	0	0	0	0	0
Yazoo	9	15	7	0	0	0	0	0
Totals	**821**	**834**	**119**	**28**	**56**	**25**	**17**	**17**

Economic Loss

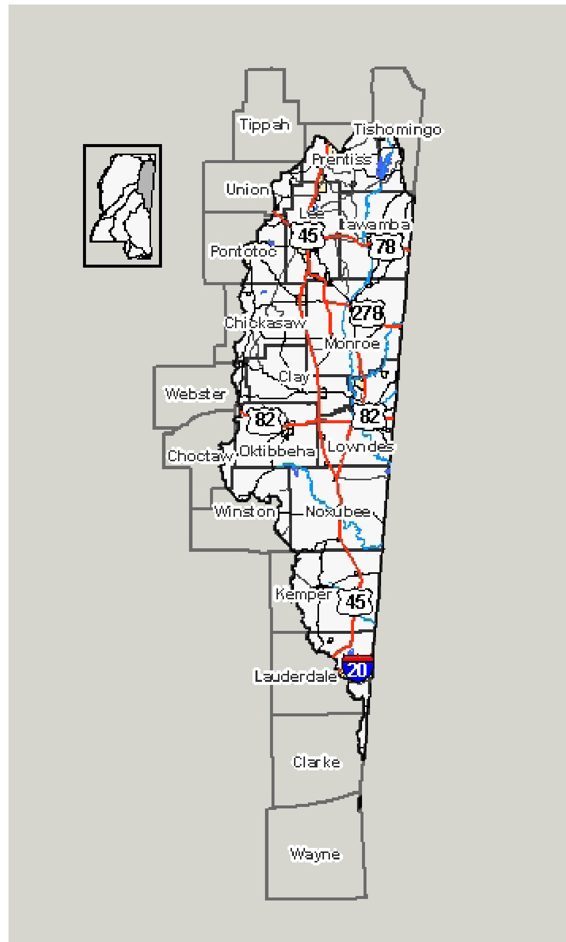
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Benton	$217,000	0	0	0	0	$298,093,000
Bolivar	$16,835,000	69	1	25	2	$1,511,484,000
Calhoun	$37,792,000	110	8	8	0	$643,212,000
Carroll	$7,410,000	33	0	11	1	$368,321,000
Coahoma	$8,598,000	39	0	6	0	$1,153,201,000
Desoto	$24,976,000	133	0	13	0	$6,717,782,000
Grenada	$42,223,000	103	3	27	0	$1,046,508,000
Holmes	$20,510,000	29	0	13	0	$599,672,000
Humphreys	$70,480,000	695	2	60	5	$377,678,000
Issaquena	$2,943,000	16	0	8	0	$60,543,000
Lafayette	$3,792,000	20	0	5	0	$2,242,249,000
Leflore	$55,320,000	309	2	75	1	$1,443,286,000
Marshall	$756,000	0	0	0	0	$1,304,139,000
Panola	$25,013,000	251	0	143	0	$1,162,900,000
Pontotoc	$14,934,000	69	0	26	0	$1,031,624,000
Quitman	$55,642,000	474	0	44	6	$1,845,792,000
Sunflower	$11,231,000	24	0	4	1	$1,051,934,000
Tallahatchie	$17,418,000	118	0	34	0	$391,215,000
Tate	$15,803,000	23	0	5	2	$1,025,833,000
Tunica	$26,166,000	214	1	100	0	$407,436,000
Union	$5,927,000	26	0	6	0	$1,071,842,000
Washington	$23,156,000	76	0	8	0	$2,653,193,000
Yalobusha	$897,000	3	0	1	0	$441,490,000
Yazoo	$6,927,000	14	0	3	1	$991,388,000
Totals	**$494,966,000**	**2,848**	**17**	**625**	**19**	**$29,840,815,000**

Tombigbee River Basin

The Tombigbee River Basin encompasses portions of the ten counties listed below. These counties have 34 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Tombigbee, Luxpalila, ant the Buttahatchee Rivers, the Bull Mountain, Mattubby and Yellow Creeks and their associated tributaries.

HAZUS-MH has reported a total of 1,196 structures within this basin are considered at risk for a 100 year flood event scenario. There are five essential facilities at risk within this basin. There have been a total of 1,444 flood insurance claims since 1978. Of this number, 450 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Chickasaw	504.2	5
Clay	416	2
Itawamba	540.5	3
Kemper	767.01	3
Lee	453.1	8
Lowndes	516.5	2
Monroe	772.1	5
Noxubee	700	2
Oktibbeha	461.8	2
Prentiss	418.2	2
Totals	**55,49.41**	**34**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Chickasaw	1	1	1	0	0	0	0	0
Clay	8	8	0	0	0	0	0	0
Itawamba	0	0	0	0	0	0	0	0
Kemper	0	0	0	0	0	0	0	0
Lee	5	4	3	0	0	0	0	0
Lowndes	120	125	30	2	3	2	1	1
Monroe	11	12	5	1	1	1	1	1
Noxubee	0	0	0	0	0	0	0	0
Oktibbeha	2	2	0	0	0	0	0	0
Prentiss	0	0	0	0	0	0	0	0
Totals	**147**	**152**	**39**	**3**	**5**	**3**	**2**	**2**

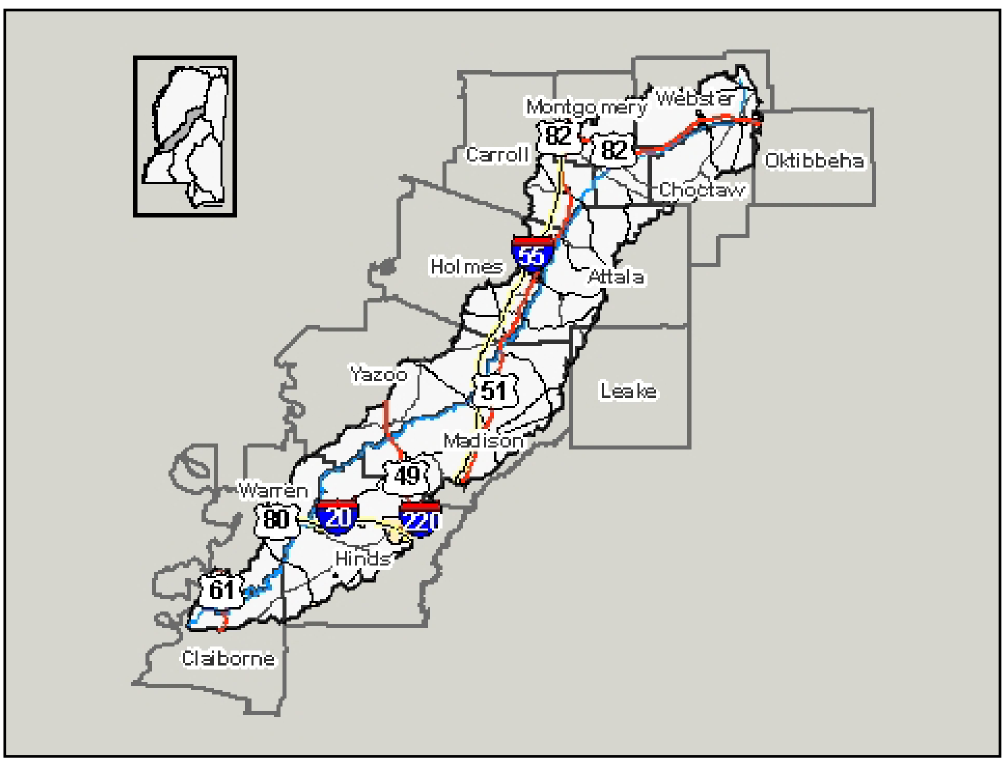
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Chickasaw	$1,206,000	1	0	0	0	$715,110,000
Clay	$ 19,615,000	116	0	44	0	$826,627,000
Itawamba	$14,144,000	65	0	17	0	$1,020,662,000
Kemper	$ 3,574,000	11	0	4	0	$382,982,000
Lee	$134,510,000	185	26	23	3	$4,634,013,000
Lowndes	$130,264,000	424	15	72	0	$2,901,505,000
Monroe	$ 27,498,000	70	0	17	2	$1,536,477,000
Noxubee	$9,507,000	62	0	21	0	$426,427,000
Oktibbeha	$ 2,408,000	11	0	6	0	$2,377,285,000
Prentiss	$1,807,000	5	0	1	0	$1,016,836,000
Totals	**$ 344,533,000**	**950**	**41**	**205**	**5**	**$15,837,924,000**

Big Black River Basin

The Big Black River Basin encompasses portions of the seven counties listed below. These couties have 25 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Big Black and the Bogue Chitto Rivers, the Deer, Black Poplar and Mulberry Creeks and their associated tributaries.

HAZUS-MH has reported a total of 1,098 structures within this basin are considered at risk for a 100 year flood event scenario. There are 3 essential facilities at risk within this basin. There have been a total of 10,842 flood insurance claims since 1978. Of this number, 1,776 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Attala	736.9	4
Choctaw	419.7	2
Hinds	877.1	7
Madison	741.7	5
Montgomery	407.1	3
Warren	618.7	2
Webster	423.2	2
Totals	**4,224.4**	**25**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Attala	0	0	0	0	0	0	0	0
Choctaw	0	0	0	0	0	0	0	0
Hinds	401	388	188	19	39	15	15	15
Madison	70	40	9	2	4	0	0	0
Montgomery	0	0	0	0	0	0	0	0
Warren	383	191	25	9	16	6	6	6
Webster	5	5	0	0	0	0	0	0
Totals	**859**	**624**	**222**	**30**	**59**	**21**	**21**	**21**

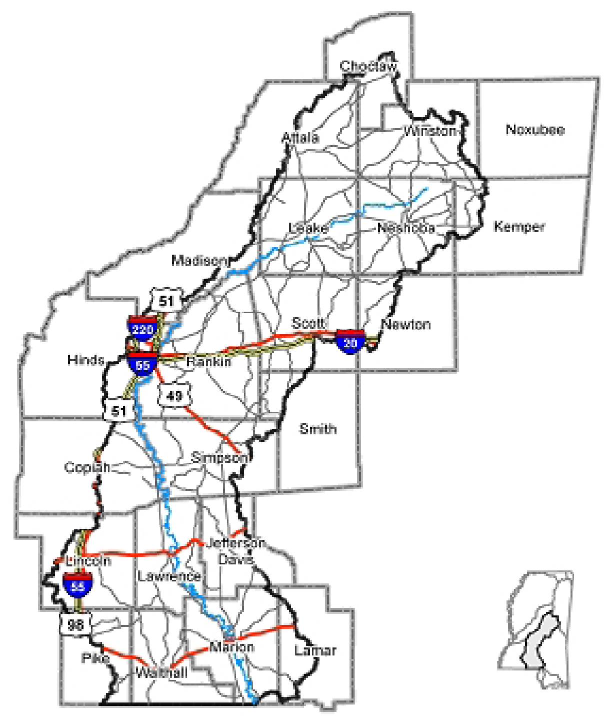
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Attala	$ 2,346,000	4	0	1	0	$759,560,000
Choctaw	$ 524,000	0	0	0	0	$368,030,000
Hinds	$158,384,000	470	15	63	2	$13,637,918,000
Madison	$34,272,000	209	0	62	1	$4,573,633,000
Montgomery	$ 2,272,000	5	0	1	0	$ 480,710,000
Warren	$30,085,000	178	0	90	0	$2,581,726,000
Webster	$231,000	0	0	0	0	$394,295,000
Totals	**$ 228,114,000**	**866**	**15**	**217**	**3**	**$22,795,872,000**

Pearl River Basin

The Pearl River Basin encompasses portions of the eleven counties listed below and the Pearl River Valley Water Supply District. These eleven counties have 36 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Pearl, Strong and Yockanookany Rivers and the Hobolochitta, Little, Richland, Pelahatchie, Culley, Bogue Chitto, Nanih Waiya and Big Slough Creeks and their associated tributaries.

HAZUS-MH has reported a total of 1,563 structures within this basin are considered at risk for a 100 year flood event scenario. There are 11 essential facilities at risk within this basin. There have been a total of 5,361 flood insurance claims since 1978. Of this number, 565 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Jefferson Davis	409	2
Lawrence	435.6	4
Leake	585.2	2
Lincoln	588	1
Marion	548.4	2
Neshoba	571.5	2
Rankin	805.9	9
Scott	610.2	5
Simpson	590.3	5
Walthall	404.3	2
Winston	610	2
Totals	**6,158.4**	**36**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Jefferson Davis	0	0	2	0	0	0	0	0
Lawrence	3	2	1	1	0	1	1	1
Leake	4	4	2	0	0	0	0	0
Lincoln	3	3	0	0	0	0	0	0
Marion	85	83	20	3	7	2	2	2
Neshoba	0	0	0	0	0	0	0	0
Rankin	67	47	9	0	0	0	0	0
Scott	3	3	0	0	0	0	0	0
Simpson	29	27	8	1	4	0	0	0
Walthall	19	19	6	0	1	0	0	0
Winston	0	2	2	0	0	0	0	0
Totals	**213**	**190**	**50**	**5**	**12**	**3**	**3**	**3**

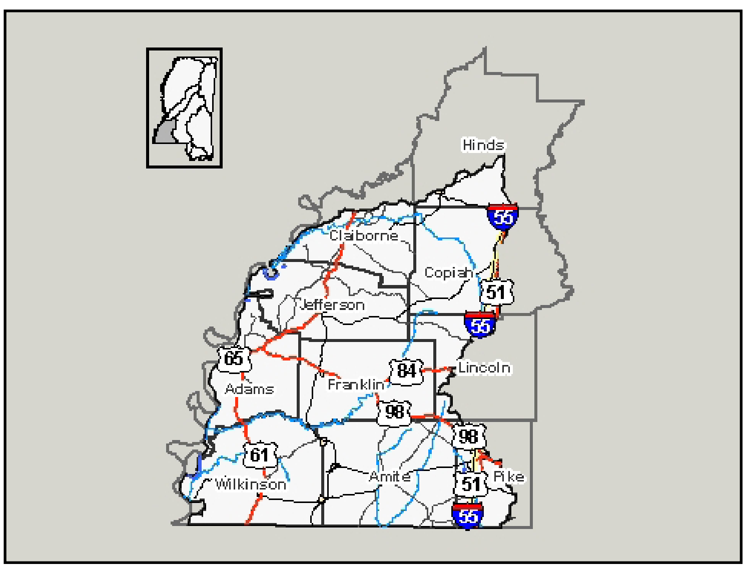
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Jeff-Davis	$3,797,000	15	0	2	0	$423,233,000
Lawrence	$10,645,000	46	0	11	0	$547,487,000
Leake	$16,036,000	65	0	7	1	$745,796,000
Lincoln	$2,981,000	2	0	0	0	$1,403,882,000
Marion	$13,820,000	45	0	12	2	$862,506,000
Neshoba	$18,064,000	26	0	6	2	$ 1,101,227,000
Rankin	$243,155,000	817	25	257	3	$ 6,404,976,000
Scott	$1,351,000	0	0	0	0	$918,483,000
Sharkey	$12,487,000	40	0	10	0	$233,070,000
Simpson	$ 22,358,000	107	0	17	3	$1,062,050,000
Walthall	$9,462,000	28	0	8	0	$451,719,000
Winston	$2,960,000	14	0	3	0	$765,268,000
Totals	**$ 357,080,000**	**1,205**	**25**	**333**	**11**	**$14,919,697,000**

South Independent River Basin

The South Independent Basin encompasses portions of the eight counties listed below. These eight counties have 20 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Mississippi, Buffalo, Homochitto Rivers, Bayou Pierre and the Second and St. Cathrine Creeks and their associated tributaries.

HAZUS-MH has reported a total of 815 structures within this basin are considered at risk for a 100 year flood event scenario. There are no essential facilities at risk within this basin. There have been a total of 2,510 flood insurance claims since 1978. Of this number, 1,116 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Adams	486.4	2
Amite	731.6	3
Claiborne	501.4	2
Copiah	779.2	5
Franklin	566.7	1
Jefferson	527.2	2
Pike	410.7	3
Wilkinson	687.8	2
Totals	**4,691**	**20**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Adams	14	11	0	0	4	0	0	0
Amite	0	0	0	0	0	0	0	0
Claiborne	79	80	12	7	7	7	5	5
Copiah	2	2	1	0	0	0	0	0
Franklin	0	0	0	0	0	0	0	0
Jefferson	9	10	0	1	1	0	0	0
Pike	10	16	6	1	0	0	0	0
Wilkinson	204	208	14	7	17	3	3	3
Totals	**318**	**327**	**33**	**16**	**29**	**10**	**8**	**8**

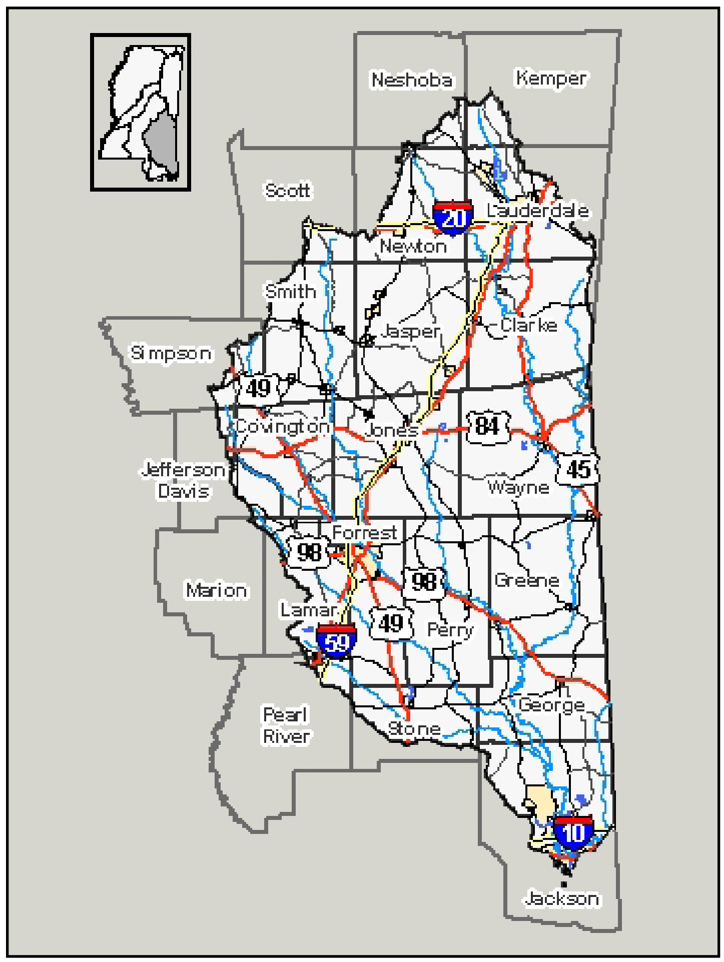
Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially Damaged	Essential Facilities at Risk	Countywide Building Exposure
Adams	$54,619,000	359	0	146	0	$1,685,219,000
Amite	$14,095,000	7	0	3	0	$524,887,000
Claiborne	$3,292,000	0	0	0	0	$399,165,000
Copiah	$ 7,283,000	35	0	12	0	$1,094,933,000
Franklin	$2,263,000	7	0	2	0	$341,323,000
Jefferson	$65,034,000	0	4	1	0	$384,256,000
Pike	$7,901,000	11	0	4	0	$1,684,025,000
Wilkinson	$8,279,000	130	0	94	0	$ 353,656,000
Totals	**$162,766,000**	**549**	**4**	**262**	**0**	**$6,467,464,000**

Pascagoula River Basin

The Pascagoula River Basin encompasses portions of the 15 counties listed below. These 15 counties have 50 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Pascagoula, Escatawpa, Chickasawhay, and Leaf Rivers, the Bogue Homa, Thompson, Tallahala, Tallahoma, Okatoma, Long, Okatibbee, and Sowashee Creeks and their associated tributaries.

HAZUS-MH has reported a total of 16,828 structures within this basin are considered at risk for a 100 year flood event scenario.. There are 55 essential facilities at risk within this basin. There have been a total of 12,810 flood insurance claims since 1978. Of this number, 2,854 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Clarke	693.4	5
Covington	414.8	4
Forrest	470	3
George	483.6	2
Greene	718.7	4
Jackson	1,043.30	5
Jasper	677.3	3
Jones	699.6	3
Lamar	500.3	4
Lauderdale	715.2	3
Newton	579.4	3
Perry	650.1	4
Smith	637.1	3
Stone	448	2
Wayne	813.4	2
Totals	9,544.2	50



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Clarke	4	3	1	0	0	0	0	0
Covington	10	11	3	0	0	0	0	0
Forrest	194	71	24	3	8	2	2	2
George	1	1	0	0	0	0	0	0
Greene	0	0	0	0	0	0	0	0
Jackson	960	947	405	29	23	26	24	24
Jasper	1	1	0	0	0	0	0	0
Jones	12	12	2	0	0	0	0	0
Lamar	36	36	14	4	11	6	4	4
Lauderdale	26	24	10	0	1	0	0	0
Newton	1	1	0	0	0	0	0	0
Perry	10	11	1	0	0	0	0	0
Smith	0	0	0	0	0	0	0	0
Stone	0	1	1	0	0	0	0	0
Wayne	2	3	1	0	0	0	0	0
Totals	**1,257**	**1,122**	**462**	**36**	**43**	**34**	**30**	**30**

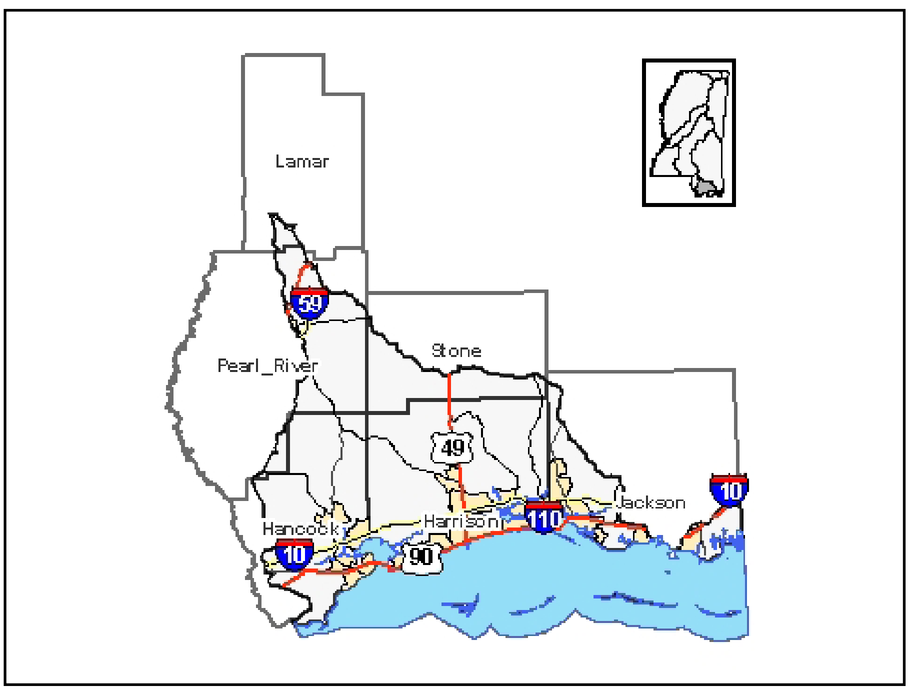
Economic Loss						
County	**Total Bldg and Income Loss**	**Residential at Risk**	**Other at Risk**	**Substantially damaged**	**Essential Facilities at Risk**	**Countywide Building Exposure**
Clarke	$21,941,000	160	0	47	0	$638,529,000
Covington	$ 14,809,000	43	0	10	0	$ 699,185,000
Forrest	$ 100,956,000	248	6	83	3	$3,385,873,000
George	$ 26,008,000	237	0	55	0	$801,401,000
Greene	$14,474,000	93	0	36	1	$ 413,804,000
Jackson	$1,406,591,000	13477	46	1737	42	$7,085,173,000
Jasper	$ 18,303,000	14	0	4	0	$588,727,000
Jones	$ 23,852,000	71	0	17	0	$2,581,386,000
Lamar	$ 8,110,000	14	0	0	2	$1,759,044,000
Lauderdale	$ 26,917,000	12	4	4	0	$3,597,091,000
Newton	$3,018,000	2	0	0	0	$895,799,000
Perry	$40,775,000	141	0	61	4	$408,564,000
Smith	$12,952,000	34	0	10	1	$623,057,000
Stone	$2,791,000	5	0	1	0	$529,183,000
Wayne	$12,925,000	102	0	54	2	$713,035,000
Totals	**$1,734,422,000**	**14,653**	**56**	**2,119**	**55**	**$24,719,851,000**

Coastal River Basin

The Coastal River Basin encompasses portions of Hancock, Harrison, and Pearl River Counties. These three counties have 12 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Wolf, Jourdan, Biloxi, Little Biloxi, and Tchautacabouffa Rivers, Rotten Bayou, Bayou La Croix, Bernard Bayou, Brickyard Bayou, Turkey and Tuxachanie Creeks, and their associated tributaries.

HAZUS-MH has reported a total of 27,088 structures within this basin are considered at risk for a 100 year flood event scenario. There are 44 essential facilities at risk within this basin. There have been a total of 23,613 flood insurance claims since 1978. Of this number, 3,946 have been repetitive loss claims.

County	Total Area in Square Miles	Number of NFIP Communities
Hancock	552.4	3
Harrison	975.9	6
Pearl River	818.7	3
Totals	**2347**	**12**



County	Repetitive Loss				Severe Repetitive Loss			
	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties	2007 No. of Properties	2009 No. of Properties	No. of Insured Properties	No. of SDF Properties
Hancock	695	727	376	34	28	39	27	27
Harrison	1,088	724	448	72	72	72	61	61
Pearl River	67	61	27	6	4	6	5	5
Totals	**1,850**	**1,512**	**851**	**112**	**104**	**117**	**93**	**93**

Economic Loss						
County	Total Bldg and Income Loss	Residential at Risk	Other at Risk	Substantially damaged	Essential Facilities at Risk	Countywide Building Exposure
Hancock	$ 994,736,000	8830	26	3767	20	$2,334,706,000
Harrison	$1,715,739,000	11821	74	2065	24	$11,029,985,000
Pearl River	$ 46,939,000	344	0	81	0	$ 2,073,577,000
Totals	**$2,757,414,000**	**20,995**	**100**	**5,913**	**44**	**$15,438,268,000**

Neighboring River Basin

Mississippi River Basin

The Mississippi River Basin encompasses small portions of the eleven counties listed in the table below. The flood losses associated with this slice of terrain adjacent to the Mississippi River are primarily structures known as "fish camps." These structures are secondary homes or weekend homes. A large percentage of the state's repetitive loss structures are thought to consist of such structures, which are constructed on the "wet side" of the levee system. The analyses of the counties will be included in the appropriate basin that contains the largest landmass as indicated.

County	River Basin
Adams	South Independent River
Bolivar	Yazoo River
Claiborne	South Independent River
Coahoma	Yazoo River
DeSoto	Yazoo River
Issaquena	Yazoo River
Jefferson	South Independent River
Tunica	Yazoo River
Warren	Big Black River
Washington	Yazoo River
Wilkinson	South Independent River

Assessing Vulnerability of State Facilities/Estimating Potential Losses

Methodology

The State of Mississippi Department of Finance and Administration's Bureau of Buildings, Grounds and Real Property provided the number and value of state-owned buildings located in floodplains. Plan developers know of no building located in a floodplain that is operated, but not owned, by the state.

Specific data on building elevation, location and vulnerability to flooding of varying depths was not available. Without such data it was not possible to accurately determine any degree of building damage and potential loss. Theoretically each building has a potential for total loss. During the 2007 and 2010 update, a percentage of loss, instead of total exposure, was applied to estimate potential losses. Damage is directly related to the depth of the flooding. Based on FEMA's depth-damage curves used in their benefit-cost models it can be inferred that a two-foot flood equates to roughly 20 percent loss of the structure value. For purposes of this plan, the value of 20 percent of building value is the estimate of potential loss.

Data Limitations

HAZUS-MH does not distinguish between federal, state or local ownership or operation in its inventory data on bridges. Therefore all bridges regardless of ownership are included in the assessment. At this time the State of Mississippi does not have a comprehensive list of state-owned or operated infrastructure, including bridges, sorted by county and keyed to location in floodplains. Without such data, plan developers determined that the HAZUS-MH default inventory data was the "best available data" even though all facilities are represented in the data not just state-owned or operated infrastructure.

Because of their potential vulnerability, bridges were chosen to represent infrastructure in the loss estimates. Due to time constraints only bridges, not all state-owned infrastructure, were addressed using HAZUS-MH inventory data. Additionally, the estimate of potential losses to bridges was limited to the top ten of the fifty most vulnerable communities. Vulnerable highways were noted but not included in the loss estimates.

The state has developed an ongoing strategy to address these data limitations for future plan updates. That strategy is included in the mitigation strategy section of the plan.

Table 3.2.11 serves as a summary of the potential losses to state-owned structures within the state of Mississippi. As new information regarding state-owned facilities was not available for the 2010 plan update, the follow information provided on Table 3.2.11 was not updated from the 2007 plan. Details by county are provided in Appendix 7.3.0-D.

Table 3.2.11
Summary of Potential Losses to State-Owned Facilities
(as presented in the 2007 plan)

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	Number in floodplain	Value in floodplain	Estimated Flood loss (value x 20%)
Hinds	904	$2,260,042,306	33	$178,181,405	$35,636,281
Harrison	70	$186,747,529	15	$140,446,473	$28,089,295
Bolivar	79	$302,700,858	14	$69,392,852	$13,878,570
Tate	59	$178,491,338	1	$3,417,488	$683,498
Leflore	91	$233,472,584	1	$1,999,620	$399,924
Wayne	4	$1,552,530	2	$1,241,730	$248,346
Humphreys	3	$786,660	3	$786,660	$157,332
Lawrence	2	$387,660	1	$376,320	$75,264
Walthall	3	$1,305,570	1	$376,320	$75,264
Claiborne	152	$368,387,264	1	$210,000	$42,000
Itawamba	6	$5,233,200	1	$161,700	$32,340
Copiah	89	$117,138,686	1	$90,720	$18,144

Table 3.2.12 serves as a summary of the potential losses to state-owned bridges. The bridges are located along state highways that serve as important transportation and evacuation routes. These bridges transverse portions of the state's delineated floodplains and are susceptible to flood damage. Additionally, portions of the roadways themselves are subject to inundation and 'overtopping' by events greater than a 100-year flood.

Included with HAZUS-MH is a database of bridges called the National Bridge Inventory, which was developed by the Federal Highway Administration. One of the database items includes a "scour index" that is used to quantify the vulnerability of bridges to scour during a flood. Bridges with a scour index between 1 and 3 are considered "scour critical," or a bridge with a foundation element determined to be unstable for the observed or evaluated scour condition. A query of the database was performed that identified the scour critical bridges. Out of 4,037 state-owned bridges in Mississippi, 225 met these criteria. The potential loss could include the replacement value of the structure if flooding resulted in bridge collapse. These are bridges that could benefit from mitigation projects or be thoroughly inspected following a flood event. There was no changes to this table for the 2010 plan update.

Table 3.2.12
Exposure and Flood Vulnerability of State Bridges by County
(Values in thousands of dollars)
(as presented in the 2007 plan)

County	Bridge Count	Value	Scour Critical	County	Bridge Count	Value	Scour Critical
Adams	16	59,354.35	0	Issaquena	8	12,409.80	0
Alcorn	72	99,883.86	0	Itawamba	74	152,459.10	9
Amite	41	33,621.93	1	Jackson	56	649,903.65	2
Attala	46	39,324.78	11	Jasper	42	28,508.17	1
Benton	54	60,391.36	4	Jefferson	11	6,913.09	0
Bolivar	28	22,534.88	2	Jefferson Davis	21	20,112.19	2
Calhoun	63	45,618.08	4	Jones	91	135,897.51	8
Carroll	43	43,183.27	7	Kemper	48	61,903.86	0
Chickasaw	51	36,397.28	9	Lafayette	72	64,338.53	1
Choctaw	20	14,146.20	2	Lamar	34	38,973.09	2
Claiborne	19	55,342.46	1	Lauderdale	141	208,051.89	1
Clarke	70	65,280.27	12	Lawrence	17	22,141.20	2
Clay	25	54,115.41	3	Leake	54	79,850.72	3
Coahoma	28	29,869.61	0	Lee	131	204,006.54	23
Copiah	49	43,717.27	0	Leflore	32	45,578.98	0
Covington	40	39,545.24	7	Lincoln	60	61,895.46	1
Desoto	72	119,180.45	1	Lowndes	90	191,660.50	6
Forrest	56	80,733.65	2	Madison	82	101,987.37	4
Franklin	35	52,053.90	0	Marion	51	67,208.34	2
George	27	55,277.87	2	Marshall	85	117,323.02	4
Greene	28	101,453.50	1	Monroe	76	188,235.90	1
Grenada	48	51,207.33	4	Montgomery	57	53,470.84	1
Hancock	26	145,699.13	0	Neshoba	41	34,011.07	1
Harrison	82	460,275.88	1	Newton	70	64,145.34	3
Hinds	185	399,360.16	6	Noxubee	24	39,135.99	3
Holmes	79	84,795.11	9	Oktibbeha	35	34,457.36	2
Humphreys	8	23,971.50	0	Panola	75	78,814.52	1
Pearl River	70	90,247.62	3	Tate	39	53,338.10	2

County	Bridge Count	Value	Scour Critical	County	Bridge Count	Value	Scour Critical
Perry	36	64,396.78	3	Tippah	26	25,323.31	2
Pike	54	58,800.65	3	Tishomingo	33	78,274.19	3
Pontotoc	54	42,949.87	6	Tunica	17	11,849.09	0
Prentiss	45	49,366.41	3	Union	65	73,748.68	3
Quitman	29	21,578.69	0	Walthall	27	26,061.52	1
Rankin	112	212,858.86	3	Warren	61	122,148.99	1
Scott	42	35,451.42	2	Washington	35	35,864.93	1
Sharkey	16	14,459.88	0	Wayne	30	42,152.86	2
Simpson	38	29,888.20	3	Webster	29	31,583.84	1
Smith	25	26,402.18	4	Wilkinson	19	65,158.54	0
Stone	22	31,987.16	2	Winston	40	33,227.70	0
Sunflower	23	29,934.05	0	Yalobusha	67	54,624.90	5
Tallahatchie	29	27,133.10	0	Yazoo	65	111,103.38	0
TOTAL					**4037**		**225**

Twenty state-owned or -operated (maintained) highways important to movement of people and freight and are potentially at risk to flooding because all of them have segments that traverse floodplains. These highways are:

Interstate 55	U.S. Highway 98
Interstate 10	U.S. Highway 84
Interstate 20	State Highway 18
Interstate 59	State Highway 80
U.S. Highway 90	State Highway 1
U.S. Highway 45	State Highway 302
U.S. Highway 82	State Highway 25
U.S. Highway 61	State Highway 49
U.S. Highway 72	State Highway 63
U.S. Highway 78	State Highway 11

3.3 Hurricane Risk Assessment
Significant Hazard

Hazard Description

A hurricane is warm-air tropical cyclone with pronounced rotary circulation around the “eye” or “core” in which maximum sustained surface wind is at least 74 MPH (64 knots). The Saffir-Simpson Hurricane Wind Scale is a one-to-five categorization based on the hurricane’s intensity at the indicated time. The scale provides examples of the type of damage and impacts associated with winds of the indicated intensity. In general, damage rises by about a factor of four for every category increase.

Unlike earlier versions, the most recent Saffir/Simpson Scale does not address the potential for other hurricane-related impacts such as storm surge, rainfall-induced floods and tornadoes. It should also be noted that to some degree the general damage descriptions are dependent upon the local building codes in effect and how well they have been enforced.

Saffir/Simpson Hurricane Wind Scale - 2010

Scale Number (Category)	Wind Speed (MPH)	Potential Damage
1	74 - 95	Moderate
2	96 - 110	Extensive
3	111 - 130	Devastating
4	131 - 155	Catastrophic
5	> 155	Catastrophic

Source: National Hurricane Center

Category One Hurricane:

Winds 74-95 mph (64-82 kt or 119-153 km/hr). *Very dangerous winds will produce some property damage.*

People, livestock and pets struck by flying or falling debris could be injured. Unprotected windows can break if left unprotected. Large branches of trees will snap and shallow-rooted trees can be toppled. Extensive damage to power lines and poles will likely result in power outages. Older (pre-1994) mobile homes could be destroyed, especially if they are not adequately anchored. Newer mobile homes can sustain damage involving the removal of shingle or metal roof coverings. Poorly constructed frame homes can experience major damage, including loss of roof covering and damage to gable ends, porches and awnings. Some apartment buildings, shopping centers and industrial buildings may have roof coverings partially removed. There will be occasional damage to commercial signage, fences and canopies.

Category Two Hurricane:

Winds 96-110 mph (83-95 kt or 154-177 km/hr). *Extremely dangerous winds will cause extensive damage.*

There is substantial risk of injury or death to people, livestock, and pets due to flying and falling debris. Older (mainly pre-1994 construction) mobile homes have a very high chance of being destroyed and the flying debris generated can shred nearby mobile homes. Newer mobile homes can also be destroyed. Poorly-constructed frame homes have a high chance of having their roof structures removed, especially if they are not anchored properly. Unprotected windows will have a high probability of being broken by flying debris. Well-constructed frame homes could sustain major roof and siding damage. Failure of aluminum, screened-in swimming pool enclosures will be common. There will be a substantial percentage of roof and siding damage to apartment buildings and industrial buildings. Unreinforced masonry walls can collapse. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger, even after the storm. Commercial signage, fences, and canopies will be damaged and often destroyed. Many shallowly-rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected, with outages that could last from several days to weeks. Potable water could become scarce as filtration systems begin to fail.

Category Three Hurricane:

Winds 111-130 mph (96-113 kt or 178-209 km/hr). *Devastating damage will occur.*

There is a high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. Most newer mobile homes will sustain severe damage with potential for complete roof failure and wall collapse. Poorly constructed frame homes can be destroyed by the removal of the roof and exterior walls. Unprotected windows will be broken by flying debris. Well-built frame homes can experience major damage involving the removal of roof decking and gable ends. There will be a high percentage of roof covering and siding damage to apartment buildings and industrial buildings. Isolated structural damage to wood or steel framing can occur. Complete failure of older metal buildings is possible, and older, unreinforced masonry buildings can collapse. Numerous windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Most commercial signage, fences, and canopies will be destroyed. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to a few weeks after the storm passes.

Category Four Hurricane:

Winds 131-155 mph (114-135 kt or 210-249 km/hr). *Catastrophic damage will occur.*

There is a very high risk of injury or death to people, livestock and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. A high percentage of newer mobile homes also will be destroyed. Poorly constructed homes can sustain complete collapse of all walls as well as the loss of the roof structure. Well-built homes also can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Extensive damage to roof coverings, windows and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will break most unprotected windows and penetrate some protected windows. There will be a high percentage of structural damage to the top floors of apartment buildings. Steel frames in older industrial buildings can collapse. There will be a high percentage of collapse to older unreinforced masonry buildings. Most windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months.

Category Five Hurricane:

Winds greater than 155 mph (135 kt or 249 km/hr). *Catastrophic damage will occur.*

People, livestock, and pets are at very high risk of injury or death from flying or falling debris, even if indoors in mobile homes or framed homes. Almost complete destruction of all mobile homes will occur, regardless of age or construction. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Extensive damage to roof covers, windows and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will occur to nearly all unprotected windows and many protected windows. Significant damage to wood roof commercial buildings will occur due to loss of roof sheathing. Complete collapse of many older metal buildings can occur. Most unreinforced masonry walls will fail, which can lead to the collapse of the buildings. A high percentage of industrial buildings and low-rise apartment buildings will be destroyed. Nearly all windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months.

Source: National Hurricane Center

Education and Outreach

Hurricane Preparedness Week occurs the last week in May of each year. For more information on hurricane awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. weekdays.

Hazard Profile

Location

The Gulf Coast of Mississippi is located in a high-hazard area for hurricanes, and is one of the more densely populated areas of the state. According to the 2000 U.S. Census, over 363,988 residents reside in the coastal counties of Hancock, Harrison, and Jackson. The second-tier of counties is comprised of George, Pearl River and Stone. These cuonties, located immediately upland from the coastal counties, had a combined population of 81,385 in 2000. The combined total population of all six counties was 445,373. The effects of Hurricane Katrina, which made landfall in August 2005, caused drastic population shifts as people sought shelter in non-coastal areas. As housing was built and employment centers and schools were re-built many residents returned to their homes. In 2008, the estimated population of these six counties was 422,785, a net loss of 22,588.

The three coastal counties are potentially at very high risk from the direct impact of a hurricane or tropical storm. Residents of the three upland counties are at high risk from strong winds, rain damage, flooding, severe storms and tornados generated from the hurricane.

Hurricanes also significantly impact the medium-risk Gulf Coast counties of Clarke, Covington, Forrest, Greene, Jasper, Jefferson Davis, Jones, Lamar, Lauderdale, Marion, Perry, Pike, Rankin, Simpson, Smith, Walthall, and Wayne counties. Each of these counties can all receive the effects of high winds, rain damage, severe storms, and flooding. Hurricane effects have also impacted, with less severity, the low risk counties of other further inland counties.

Hurricanes that move northeast across the Louisiana Delta or move inland between Mobile, Alabama and Panama City, Florida, usually are less damaging because these storms are located on the "weak side" of the storm. Even if a hurricane/tropical storm does not make landfall, the Mississippi Gulf Coast can suffer the damaging effects of high tide, rain, and wind from hurricanes/tropical storms that move in from the Gulf of Mexico.

Maximum Hurricane Threat

The greatest destruction to life and property occurs from a Category 5 hurricane striking Mississippi's Gulf Coast counties, as it did in August 2005, when Hurricane Katrina struck the entire gulf coastal area. The potential damages to public and private property modeled by HAZUS-MH show the greatest losses would result if the point of impact were Harrison County (see Assessing Vulnerability section that follows).

Past Occurrences

Since 1965 Mississippi has been struck by 14 hurricanes and 14 tropical storms/depressions. Table 3.3.1 reflects the history of hurricanes and tropical storms/depressions from 1965 to 2009 in Mississippi as well as the counties involved.

Table 3.3.1
Mississippi Hurricane & Tropical Storm History

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Storm Ike	9/11/2008	Hancock, Harrison, Jackson, Amite, Pearl River, and Pike	0	0	0
Hurricane Gustav	9/2/2008	Walthall and Wilkinson	0	0	$10,700,000
Tropical Depression Rita	9/25/2005	Coahoma and Tunica	0	0	$10,000
Hurricane Rita	9/24/2005	Adams, Bolivar, Carroll, Claiborne, Copiah, Franklin, Hinds, Holmes, Humphreys, Issaquena, Jefferson, Jefferson Davis, Lawrence, Leflore, Lincoln, Madison, Marion, Rankin, Sharkey, Simpson, Sunflower, Warren, Washington and Yazoo	0	0	$485,000
Tropical Storm Katrina	8/29/2005	Benton, Chickasaw, Coahoma, Desoto, Itawamba, Lafayette, Lee, Marshall, Monroe, Panola, Pontotoc, Prentiss, Tallahatchie, Tate, Tippah, Tishomingo, Tunica and Union	0	0	$420,000
Hurricane Katrina	8/29/2005	Adams, Attala, Bolivar, Carroll, Choctaw, Claiborne, Clarke, Clay, Copiah, Covington, Forrest, Franklin, George, Greene, Grenada, Hancock, Harrison, Hinds, Holmes, Humphreys, Issaquena, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Leflore, Lincoln, Lowndes, Madison, Marion, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pike, Rankin, Scott, Sharkey, Simpson, Smith, Stone, Sunflower, Walthall, Warren, Washington, Wayne, Webster, Wilkinson, Winston and Yazoo	235	N/A	$80 billion

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Depression Dennis	7/11/2005	Calhoun, Chickasaw, Itawamba, Lee and Union	0	0	$35,000
Hurricane Dennis	7/10/2005	Attala, Calhoun, Chickasaw, Choctaw, Clarke, Clay, Covington, Forrest, George, Greene, Hancock, Harrison, Hinds, Itawamba, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Leake, Lee, Lowndes, Madison, Monroe, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pontotoc, Rankin, Scott, Simpson, Smith, Stone, Wayne, Webster and Winston	0	0	$2,600,000
Hurricane Cindy	7/5/2005	Hancock, Harrison, Jackson and Pearl River	0	0	$9,000,000
Tropical Storm Cindy	7/5/2005	Forrest, George, Greene, Lamar and Stone	0	0	$200,000
Tropical Storm Arlene	6/10/2005	Clarke, Clay, Hancock, Harrison, Jackson, Kemper, Lauderdale, Lowndes, Noxubee and Oktibbhea	0	0	$445,000
Tropical Storm Matthew	10/9/2004	Hancock, Harrison and Jackson	0	0	$20,000
Tropical Storm Ivan	9/16/2004	Chickasaw, Itawamba, Lee and Monroe	1	0	$30,000
Hurricane Ivan	9/15/2004	Adams, Amite, Claiborne, Clarke, Clay, Copiah, Covington, Forrest, Franklin, George, Greene, Hancock, Harrison, Hinds, Jackson, Jasper, Jefferson, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Lincoln, Lowndes, Marion, Monroe, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pike, Rankin, Scott, Simpson, Smith, Stone, Walthall, Warren, Wayne, Wilkinson and Winston	1	0	$200,000,000

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Storm Bill	6/30/2003	Clarke, Covington, Forrest, Hancock, Harrison, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Marion, Newton, Pearl River and Smith	0	0	$1,200,000
Hurricane Lili	10/3/2002	Adams, Amite, Attala, Carroll, Covington, Hancock, Harrison, Hinds, Jackson, Jasper, Leake, Leflore, Madison, Pearl River, Pike, Scott, Smith, Walthall, Warren, Washington, Wilkinson and Yazoo	0	0	$13,900,000
Tropical Storm Isidore	9/25/2002	Amite, Clarke, Copiah, Forrest, Franklin, Hancock, Harrison, Hinds, Holmes, Jackson, Jasper, Jones, Lamar, Lauderdale, Leake, Lincoln, Madison, Marion, Neshoba, Pearl River, Pike, Scott, Simpson and Warren	1	0	$25,500,000
Tropical Storm Hanna	9/14/2002	Hancock, Harrison and Jackson	0	0	$0
Tropical Storm Bertha	8/4/2002	Hancock, Harrison and Jackson	0	0	$50,000
Tropical Storm Allison	6/21/2001	George, Hancock, Harrison, Jackson and Pearl River	0	0	0
Hurricane Georges	10/1/1998	Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jasper, Jefferson Davis, Jones, Lamar, Marion, Pearl River, Perry, Pike, Stone and Wayne	2	0	$674,000,000
Tropical Storm Hermine	9/19/1998	Hancock, Harrison, Jackson and Pearl River	0	0	$85,000
Tropical Storm Earl	9/2/1998	Hancock, Harrison and Jackson	0	0	$0
Hurricane Danny	7/17/1997	Hancock, Harrison and Jackson	0	0	$0
Hurricane Opal	10/4/1995	Hancock, Harrison and Jackson	0	1	$75,000
Hurricane Erin	8/20/1995	Greene, Perry and Wayne	0	0	$100,000

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Hurricane Elena	9/4/1985	Hancock, Harrison, Jackson and Pearl River	No Details Available		
Hurricane Frederic	9/13/1979	Clarke, Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jones, Lauderdale, Pearl River, Perry, Stone and Wayne	No Details Available		
Hurricane Camille	8/18/1969	Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jasper, Jones, Lamar, Marion, Pearl River, Perry, Rankin, Simpson, Smith, Stone, Walthall and Wayne	152	No Details Available	
Hurricane Betsy	9/25/1965	No County Information	No Details Available		

Source; National Climatic Data Center

Hurricane Katrina

In 2005, the state of Mississippi was seriously impacted by Hurricane Katrina. To help understand the total effects of this catastrophic event, a storm surge and HAZUS final wind field maps are portrayed in this section as Figures 3.3.1 and 3.3.2 as well as a brief narrative of the impact Katrina left on the state below.

Hurricane Katrina, although eventually downgraded by experts to a Category 3 hurricane, is widely accepted as the worst natural disaster in recent American history. The storm made landfall on the Mississippi Gulf Coast at approximately 10:00 am on Monday, August 29, 2005, with winds in excess of 130 mph and a storm surge of more than 35 feet. While hurricanes are no stranger to Mississippi, not since Hurricane Camille on August 17, 1969, has the state and its citizens witnessed and experienced a storm with such catastrophic consequences.

Prior to Katrina, our citizens and communities widely viewed hurricanes as coastal events. Except for widespread rainfall and spin-off tornadoes typically associated with downgraded tropical systems as they make landfall, our inland communities and their citizens were ill-prepared for the statewide consequences of Hurricane Katrina, which produced hurricane force winds as far inland as Laurel, Jackson, and Meridian.

With all 82 counties eventually being included in the Presidential Disaster Declaration, the impacts of Hurricane Katrina, both direct and indirect, continue to be felt today, and have resulted in significant challenges facing our citizens, local governments and the state. Never before have we experienced the total destruction of communities and cities. Virtually every element of society that makes a community - homes, business, schools, places of worship, healthcare and government were destroyed in Bay St. Louis, Waveland, Pass Christian and Long Beach. The challenges of rebuilding these communities that experienced total loss of their tax base and sales tax revenues continue today. Affordable housing and total rebuilding of infrastructure continue to strain resources available to many local governments. Cities and counties throughout the state wrestle with increased population as a result of evacuees who have decided not to return to areas of Louisiana and the Mississippi Gulf Coast, straining availability of affordable housing, inadequate infrastructure, and the ability of local governments to provide basic services.

The physical scars of Hurricane Katrina are still very much evident throughout the state and the emotional toll that the storm has taken on families who have lost everything will likely continue for an entire generation. The Mississippi Gulf Coast is still very fragile as the physical and economic recovery continues, but the challenge remains to build stronger communities that can withstand the next storm and improve preparedness through public education.

Figure 3.3.3 provides a summary of historical tropical storm/hurricane events that have impacted Mississippi from 1851 to 2008.

Figure 3.3.1
Hurricane Katrina Storm Surge Map

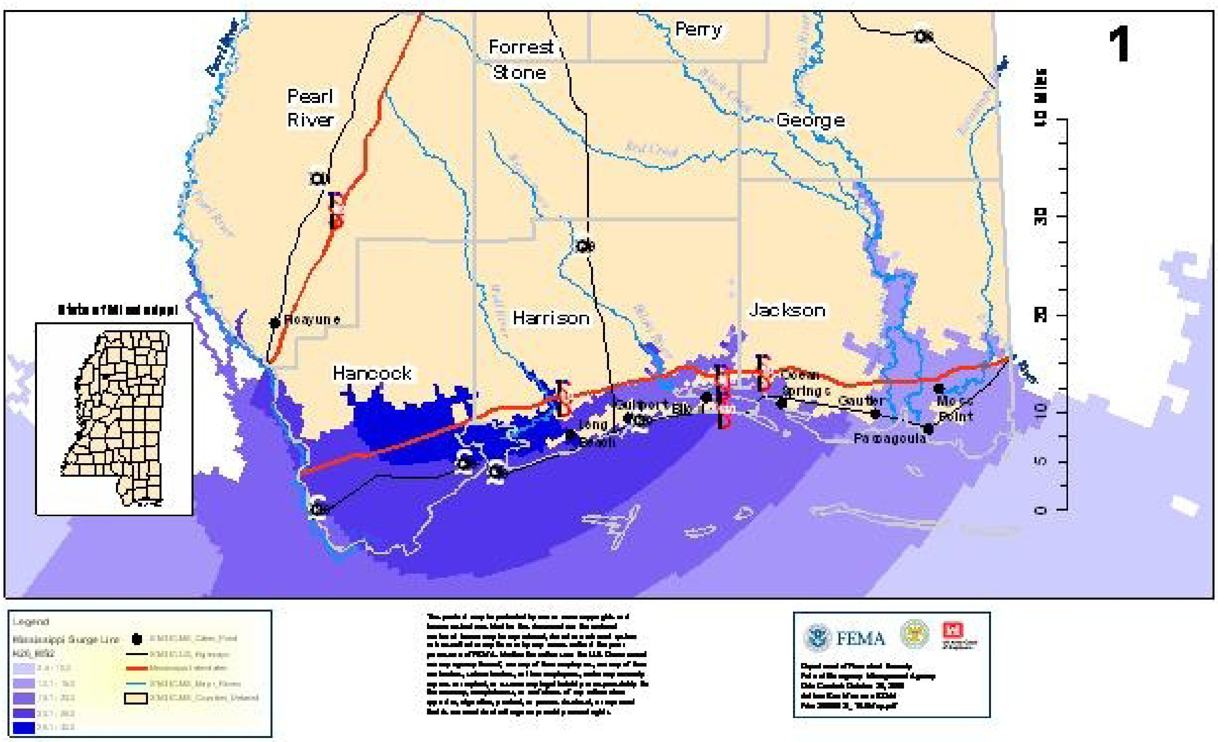


Figure 3.3.2
Hurricane Katrina

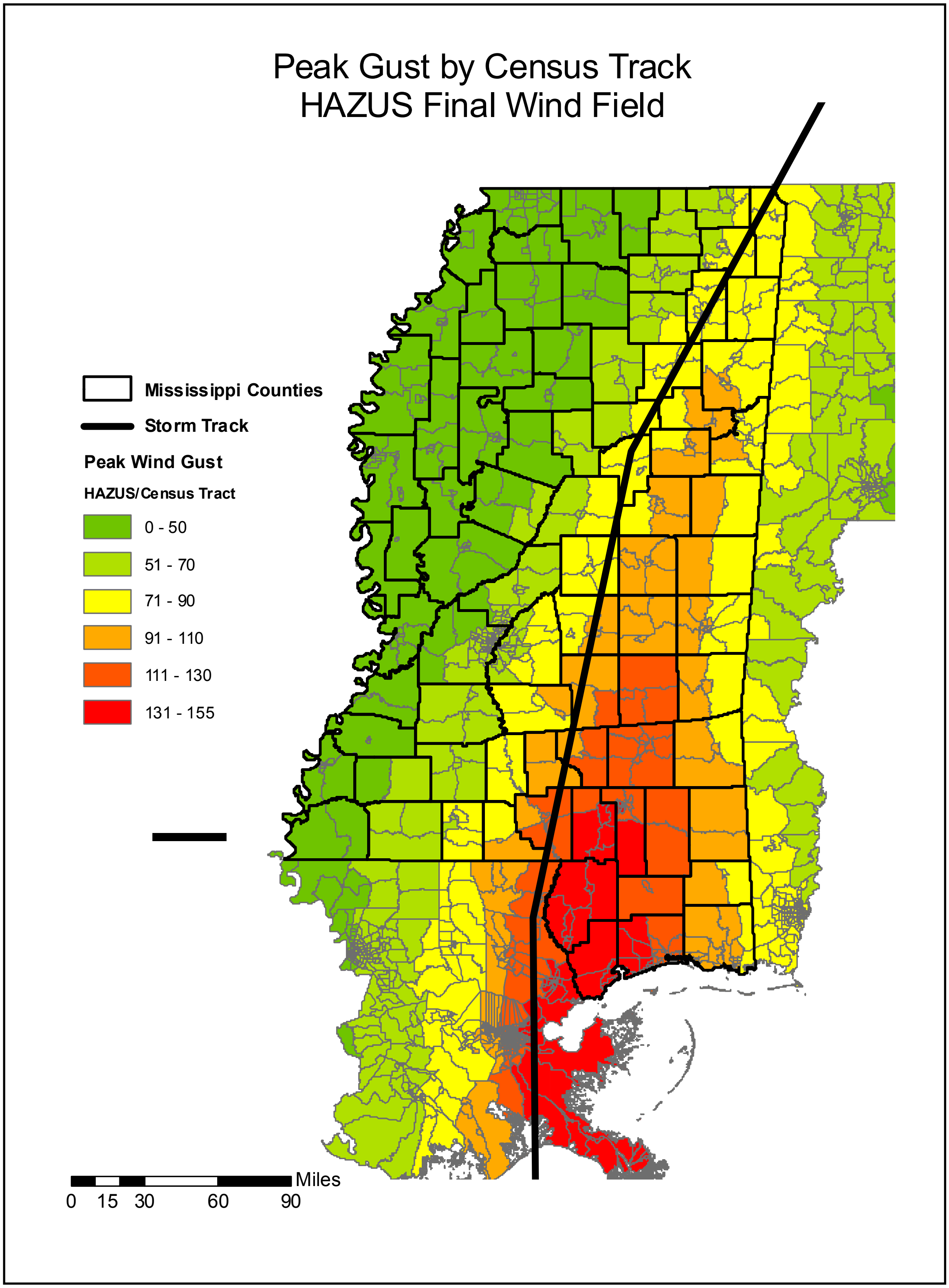
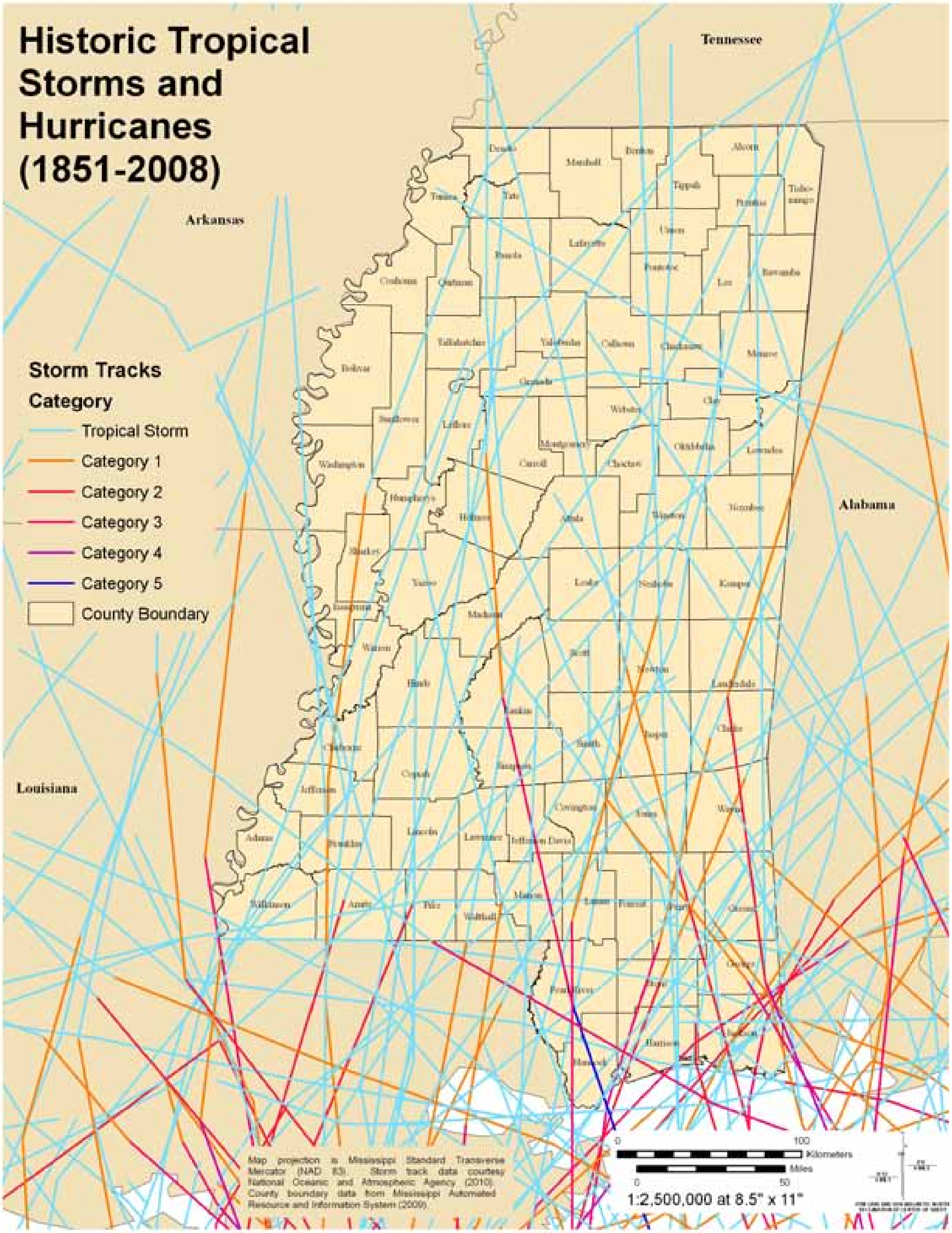


Figure 3.3.3
Historic Tropical Storms and Hurricanes
1851-2008



Probability of Hurricane Future Events

Researchers have studied the probability of a tropical cyclone landfall and guest calculations for eleven regions from Brownsville, Texas to Eastport, Maine. A web page that displays this information has been created and was recently updated to include the probability of coastal states being impacted by hurricanes and major hurricanes. The web page is a joint project between the Tropical Meteorology Project at Colorado State University, Fort Collins, Colorado, and the GeoGraphics Laboratory at Bridgewater State College, Bridgewater, MA.

According to the researchers at Colorado State, information obtained through November 2009 indicates that the 2010 Atlantic hurricane season will be somewhat more active than the average 1950-2000 season. Tables 3.3.2 and 3.3.3 break down the probability by county for 2010 and for the next 50 year period.

Table 3.3.2
2010 Hurricane Landfall Probability

County	George	Hancock	Harrison	Jackson	Pearl River	Stone
Probability of 1 or More Named Storms Making Landfall	5.6%	4.7%	6.2%	6.8%	5.8%	5.5%
Probability of 1 or more named Hurricanes Making Landfall	2.8%	2.3%	3.1%	3.4%	2.9%	2.7%
Probability of 1 or more intense Hurricanes Making Landfall	1.3%	1.1%	1.4%	1.5%	1.3%	1.2%
Probability of Tropical Storm Force (>= 40 mph) Wind Gusts	41.6%	41.6%	41.6%	41.6%	41.6%	41.6%
Probability of Hurricane Force (>=75 mph Wind Gusts	13.4%	13.4%	13.4%	13.4%	13.4%	13.4%
Probability of Intense Hurricane-Force (>= 115 mph) Wind Gusts	4.6%	4.6%	4.6%	4.6%	4.6%	4.6%

Source: The United States Landfalling Hurricane Web Project--co-developed by William Gray's Tropical Meterology Research Project at Colorado State University and the GeoGraphics Laboratory at Bridgewater State College. http://hurricane.atmos.colostate.edu/

Table 3.3.3
50 Year Hurricane Landfall Probability

County	George	Hancock	Harrison	Jackson	Pearl River	Stone
Probability of 1 or More Named Storms Making Landfall	88.0%	82.7%	90.3%	92.5%	88.6%	87.4%
Probability of 1 or more named Hurricanes Making Landfall	64.2%	57.3%	67.6%	71.4%	65.0%	63.4%
Probability of 1 or more intense Hurricanes Making Landfall	36.9%	31.8%	39.7%	42.9%	37.6%	36.3
Probability of Tropical Storm Force (>= 40 mph) Wind Gusts	>99.9%	>99.9%	>99.9%	>99.9%	>99.9%	>99.9%
Probability of Hurricane Force (>=75 mph Wind Gusts	99.6%	99.6%	99.6%	99.6%	99.6%	99.6%
Probability of Intense Hurricane-Force (>= 115 mph) Wind Gusts	82.3%	82.3%	82.3%	82.3%	82.3%	82.3%

Source: The United States Landfalling Hurricane Web Project--co-developed by William Gray's Tropical Meterology Research Project at Colorado State University and the GeoGraphics Laboratory at Bridgewater State College. http://hurricane.atmos.colostate.edu

Assessing Vulnerability

In assessing Mississippi's vulnerability to damage and loss of life from hurricanes and tropical storms, at the top of the list is loss of life and property due to flooding. Mississippi's citizens are vulnerable to hurricanes. The very young, the elderly and the handicapped are especially vulnerable to harm from hurricanes. Not only are resident's homes vulnerable to hurricanes, but also public buildings, infrastructure and natural resources are all subject to damage. In some cases, the damage to natural resources cannot be restored to pre-incident levels.

Damages from Flooding Due to Hurricanes

Torrential rains from hurricanes and tropical storms can produce extensive urban and riverine flooding. Winds from these storms located offshore can drive ocean water up the mouth of a river, compounding the severity of inland overbank flooding.

In addition to the combined destructive forces of wind, rain, and lightning, hurricanes can cause a "surge" in the ocean, which can raise the sea level as high as 25 feet or more in the strongest hurricanes. This "storm surge" also can have the opposite effect, in that the sea level can be lowered to below mean sea level at the backside of a hurricane. This phenomenon causes more destruction as storm surge waters are sucked back out to sea. For more information on flood-related losses from hurricanes see the flood section of the risk assessment.

Vulnerability of People to Hurricanes

For those who are unable to evacuate for medical reasons, there should be provision to take care of special-needs patients and those in hospitals and nursing homes. Many of these patients are either oxygen-dependent, insulin-dependent, or in need of intensive medical care. There is a need to provide ongoing treatment for these vulnerable citizens, either on the coast or by air evacuation to upland hospitals. The stress from disasters such as a hurricane can result in immediate and long-term physical and emotional health problems among victims.

A review of the 2000 Census shows that persons with a disability of age five and over amounted to 10,776 in Hancock County, 40,495 in Harrison County and 25,379 in Jackson County. Together these counties accounted for a total of 76,650 citizens with disabilities who would be in need of help to survive the effects of a hurricane. This number has likely decreased since Hurricane Katrina due to the exodus of some of the population following the hurricane. The exact number of remaining disabled population will not be known until after the 2010 U.S. Census.

Total population vulnerability in the high-risk counties has decreased somewhat post Hurricane Katrina, although there has been some growth since the previous Plan Update. Table 3.3.4 compares 2000 and 2008 populations. This area is in a state of flux in terms of its population as the recovery from Katrina is ongoing. See the discussion in growth and development trends in Section 3.11 for more detail on the population shifts as a result of Katrina.

Table 3.3.4
Vulnerable Populations in High Risk Counties Updated

County	City	2000 Population	2008 Estimated Population
Jackson	Pascagoula	26,200	23,609
	Moss Point	15,851	13,951
	Gautier	11,681	16,306
	Ocean Springs	17,255	17,148
	Jackson County (unincorporated area)	60,433	59,680
Jackson County Totals		**131,420**	**130,694**

County	City	2000 Population	2008 Estimated Population
Harrison	Biloxi	50,644	45,670
	Gulfport	71,127	70,055
	Pass Christian	6,579	3,993
	D'Iberville	7,608	7,928
	Long Beach	17,320	12,234
	Harrison County (unincorporated area)	36,320	38,580
Harrison County Totals		**189,598**	**178,460**
Hancock	Bay St. Louis	8,209	8,059
	Waveland	6,674	5,249
	Hancock county (unincorporated area)	28,084	26,832
Hancock County Totals		**42,967**	**40,140**

*Source: Based on 2000 U.S. Census Bureau figures and 2008 U.S. Census Bureau estimates
Total population includes cities and unincorporated areas.

The need for a speedy evacuation by Gulf Coast residents in their personally-owned vehicles has been expedited, utilizing the National Weather Service's storm surge model Sea, Lake, and Overland Surges from Hurricanes or SLOSH. Modelers examined the population density of each coastal county, the capability of evacuation roads to handle evacuees, and the topography (which areas would flood first in the event of a hurricane) to establish evacuation zones. These zones identify who should leave and in what order based on which areas are most vulnerable to storm surge. This assignment of evacuation zones enables local residents to assess their own vulnerability to a hurricane, given their location. Local officials can then call for an evacuation of the particular zone when the opportunity presents itself.

The model, developed in 2000, has been effectively implemented in an evacuation of people in their vehicles. If used in a timely basis, given sufficient warning, this SLOSH model is effective in saving lives in the Gulf Coast counties of Hancock, Harrison, and Jackson.

The Mississippi Department of Transportation's (MDOT) Statewide Traffic Management Center (TMC) provides coordination and timely management of all traffic conditions. In addition to keeping citizens safer and more informed during routine travel, the TMC improves better emergency event coordination and incident management than in previous years.

The TMC has enhanced MDOT's ability to respond to traffic-flow impediments resulting from adverse weather, debris in the roadway and the presence of hazardous materials. MDOT utilizes 260 traffic cameras located throughout the state to accomplish this. Once an incident is detected, the operations staff initiates an appropriate response by coordinating closely with other state and local agencies and disseminating real-time information to emergency responders and the public. In addition, the TMC has helped staff to establish close working relationships with similar TMC's in Border States to more efficiently coordinate regional responses as needed.

When the Traffic Engineering Desk at Mississippi Emergency Management Agency (MEMA) is operational, the TMC is capable of relaying incident information to contribute to MEMA's situational awareness. A similar working relationship exists with state and local law enforcement agencies to address any impediments to the flow of traffic during emergencies, especially during evacuation events.

Contraflow is the practice of turning traffic flow in one direction on controlled-access routes during times of emergency evacuation. It was first implemented in Mississippi during Hurricane Katrina. The purpose of contraflow in Mississippi is to quickly and efficiently assist the State of Louisiana in evacuating the greater New Orleans area by reversing southbound lanes of I-55 and I-59 to northbound flow. Contraflow is only implemented when requested by Louisiana and approved by the Governor of Mississippi. After Hurricane Katrina, MDOT's post-disaster evaluation results indicated that changes should be made to contraflow in to improve operations. The primary improvement included extending the termination point of I-59 contraflow to just south of Hattiesburg, Mississippi. During Hurricane Katrina, I-59 contraflow in Mississippi extended from the Mississippi/Louisiana state line to just south of Poplarville, Mississippi. Contraflow for I-55 began in Louisiana and extended into Mississippi to just south of Brookhaven. An evacuation map with primary and alternate evacuation routes is provided in Appendix 7.3.3-A.

Below is a list of other transportation improvements resulting from lessons learned after Katrina:

Development of specific traffic control plans for Hattiesburg, Miss, including the use of ITS messaging for customized traffic control during times of contraflow or other emergency events

Improvements to the Biloxi Bay Bridge and the Bay St. Louis Bridge that include reconstructing the bridges with hydro modeling to help them withstand anticipated storm surges and constructing them higher than before

Development of a process establishing contracts with pre-selected firms to conduct debris removal, roadway clearing, and monitoring of debris disposal

Improvements to the bid process, thus enabling MDOT to let need-based emergency contracts more quickly and efficiently

Loss of Life from Hurricanes

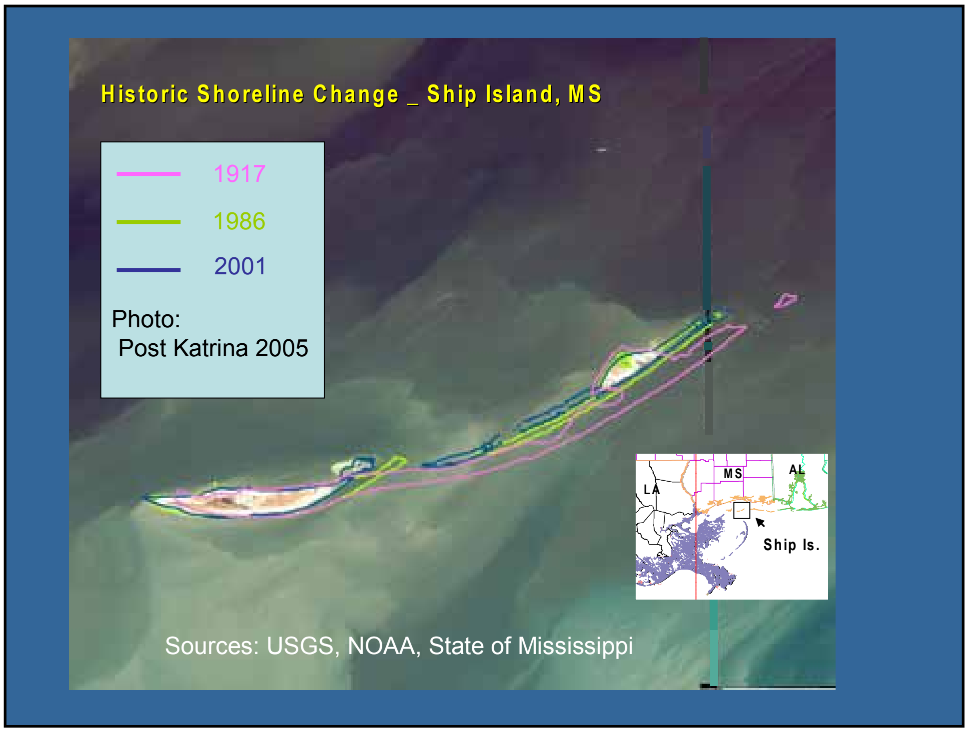
In general, loss of life and property due to high winds is confined to the coastal area. This loss of life is due to wind-borne glass, building materials, and limbs and shrubs. Upland losses can be attributed to rain damage and flooding as well as tornados. Flooded road crossings in upland and coastal areas seem to involve a greater loss of life to people in automobiles.

Most deaths due to hurricanes are flood-related. Both coastal and inland flooding is a common occurrence with hurricanes and tropical storms. The death toll from Mississippi hurricanes amounts to 391 persons. This includes 235 persons who died in Hurricane Katrina, 152 who died in Hurricane Camille and two who died upland in Hurricane Georges. Ninety percent of the deaths in hurricanes involve water-related or flooding deaths. The remaining deaths are due to the impacts of wind and wind-borne projectiles.

Effective warnings, and timely evacuation from coastal areas inundated by storm surge have shown a dramatic reduction in deaths. Evacuation ensures that nobody remains present in the hazard area.

Vulnerability of Natural Resources to Hurricanes

Natural resources, particularly beaches, are devastated by hurricanes. The erosion of the coastline is considerable due to the impact of wind, waves, and debris in a hurricane event. Beaches need to be replenished with appropriate materials to reduce erosion. Storm surge and subsequent erosion of the shoreline leads to the loss of property. The Barrier Islands - Cat, Horn, Petit Bois, and Ship - protecting the Mississippi Gulf Coast have seen damage from earlier events and are projected to disappear within years. An example of historical shoreline changes on Ship Island is provided below.



Inland rivers and lakes can become clogged with wind-blown debris and trees, thus slowing recovery from a hurricane. Obstructions, if not removed, can become a cause for flooding.

Trees that are blown down to the forest floor quickly become a target for infestation from insects that may spread to healthy trees. Water quality may suffer due to unwanted debris and vegetation blown in from a hurricane. Potential debris from fallen trees affected by hurricanes and tornados that often accompany them, can create wildfires when the area dries sufficiently to allow for burning through lightning or intervention by mankind. The Mississippi State Forestry Commission is quick to ensure, through proactive cutting and prescribed burns, that fallen trees and debris will not become fuel for a wildfire.

Vulnerability of Private Improvements to Hurricanes

Homes, businesses, and manufactured homes are especially vulnerable to the effects of a hurricane and the winds, rain, and tornados generated by a hurricane. The effects of storm surge can flatten a house.

Although hurricane winds can exert tremendous pressure against homes, a large fraction of hurricane damage is not from the wind itself, but from airborne missiles such as tree limbs and branches, signs and sign posts, roof tiles, metal siding and other pieces of buildings, including entire roofs in major storms. This wind-borne debris penetrates doors and windows, and allows the force of the wind to act against interior walls and ceilings not designed to withstand such forces, thus blowing the building apart.

Assessing Vulnerability by Jurisdiction

Mississippi has had 11 declared hurricane/tropical storm disaster declarations. Table 3.3.5 provides information on the coastal and inland counties that have been declared in previous hurricanes/tropical storm events in order to establish frequency and vulnerability to hurricane/tropical storm damage. In Camille and Katrina, for example, central Mississippi counties as well as coastal counties received damage. These incidents cover the period 1969 to 2009, a 40-year period.

Table 3.3.5
COUNTIES DECLARED IN HURRICANE/TROPICAL STORM EVENTS

County	Camille FEMA-271-DR	Frederic FEMA-599-DR	Elena FEMA-741-DR	Georges FEMA-1251-DR	T.S. Allison FEMA-1382-DR	T.S. Isidore FEMA-1436-DR	Ivan FEMA 1550-DR	Dennis FEMA 1594-DR	Katrina FEMA 1604-DR	Gustav FEMA-1794
Hancock	X	X	X	X	X	X	X	X	X	X
Harrison	X	X	X	X	X	X	X	X	X	X
Jackson	X	X	X	X	X	X	X	X	X	X
Pearl River	X	X	X	X	X	X	X	X	X	X
George	X	X		X	X	X	X	X	X	X
Forrest	X	X		X			X	X	X	X
Greene	X	X		X		X	X	X	X	
Jones	X	X		X	X		X	X	X	
Stone	X	X				X	X	X	X	X
Lamar	X			X	X		X	X	X	
Perry	X	X		X			X	X	X	
Wayne	X	X		X			X	X	X	
Covington	X	X					X	X	X	

County	Camille FEMA-271-DR	Frederic FEMA-599-DR	Elena FEMA-741-DR	Georges FEMA-1251-DR	T.S. Allison FEMA-1382-DR	T.S. Isidore FEMA-1436-DR	Ivan FEMA 1550-DR	Dennis FEMA 1594-DR	Katrina FEMA 1604-DR	Gustav FEMA-1794
Jefferson Davis				X			X	X	X	X
Marion	X			X			X		X	X
Pike					X	X	X		X	X
Amite						X	X		X	X
Clarke		X					X	X	X	
Copiah						X	X		X	X
Jasper	X						X	X	X	
Lauderdale	X						X	X	X	
Simpson	X						X	X	X	
Smith	X						X	X	X	
Walthall	X						X		X	X
Adams							X		X	X
Claiborne							X		X	X
Clay							X	X	X	
Franklin							X		X	X
Hinds							X	X	X	
Jefferson							X		X	X
Kemper							X	X	X	
Lawrence							X		X	X
Lincoln							X		X	X
Lowndes							X	X	X	
Monroe							X	X	X	
Neshoba							X	X	X	
Newton							X	X	X	
Noxubee							X	X	X	
Oktibbeha							X	X	X	
Rankin	X						X	X	X	
Scott							X	X	X	

County	Camille FEMA-271-DR	Frederic FEMA-599-DR	Elena FEMA-741-DR	Georges FEMA-1251-DR	T.S. Allison FEMA-1382-DR	T.S. Isidore FEMA-1436-DR	Ivan FEMA 1550-DR	Dennis FEMA 1594-DR	Katrina FEMA 1604-DR	Gustav FEMA-1794
Wilkinson							X		X	X
Winston							X	X	X	
Attala								X	X	
Calhoun								X	X	
Chickasaw								X	X	
Choctaw								X	X	
Issaquena									X	X
Itawamba								X	X	
Leake								X	X	
Lee								X	X	
Madison								X	X	
Pontotoc								X	X	
Warren							X		X	
Washington									X	X
Webster								X	X	
Alcorn									X	
Benton									X	
Bolivar									X	
Carroll									X	
Coahoma									X	
Desoto									X	
Grenada									X	
Holmes									X	
Humphreys									X	
Lafayette									X	
Leflore									X	
Marshall									X	
Montgomery									X	

County	Camille FEMA-271-DR	Frederic FEMA-599-DR	Elena FEMA-741-DR	Georges FEMA-1251-DR	T.S. Allison FEMA-1382-DR	T.S. Isidore FEMA-1436-DR	Ivan FEMA 1550-DR	Dennis FEMA 1594-DR	Katrina FEMA 1604-DR	Gustav FEMA-1794
Panola									X	
Prentiss									X	
Quitman									X	
Sharkey									X	
Sunflower									X	
Tallahatchie									X	
Tate									X	
Tippah									X	
Tishomingo									X	
Tunica									X	
Union									X	
Yalobusha									X	
Yazoo									X	
Hurricane Betsy in 1965 is not included in the list above as historical data is not available										

Assessing Vulnerability by Jurisdiction Methodology/HAZUS-MR4 Modeling

HAZUS-MR4 hurricane loss modeling capabilities were used to quantify expected losses to the state and differentiate vulnerability by county. HAZUS-MR4 can model specific hypothetical or historical scenarios and probabilistic scenarios. Scenario results represent the expected damage from a single hurricane event, while probabilistic scenario results represent the range of probable losses estimated from a 100,000-year simulation of expected hurricane activity. The direct economic loss results for a probabilistic analysis include annualized loss estimates. Annualized losses are the total losses summed over the entire simulation period divided by 100,000 years.

As noted in the previous information on location of past hurricanes and tropical storms, Mississippi's highest risk of impact is in the coastal counties of Jackson, Hancock, and Harrison. As demonstrated by past events, the impact diminishes as storms move inland, but as witnessed with Katrina, even inland counties can experience damage from hurricanes. In 2004, Mississippi plan development staff used HAZUS-MH to run deterministic scenarios based on Hurricane Camille using a Level 1 analysis (only HAZUS-MH default data was used) to assess vulnerability and estimate losses of the state's counties and state-owned or operated facilities. In the 2007 update to this plan an annualized loss scenario was run for the entire state. For the purposes of the update, the probabilistic scenario was run to model annualized losses by county.

During the 2010 update to this plan an annualized loss scenario was again run for the entire state. For the purposes of the update, the probabilistic scenario was run to model annualized losses by county. This scenario was chosen over a deterministic analysis largely because the impacts from a severe hurricane are known due to Hurricane Katrina.

Camille's storm track served as the pattern for the 2010 deterministic scenarios but the initial point of impact was changed to strike in the center of each of the three coastal counties of Hancock, Harrison and Jackson and then track north. The impact points were chosen because the geographic locations and the record of past occurrences indicate they are the areas most likely to be struck. The scenarios for each of the three impact points were run for Category 5 Camille-based storms.

The Category 1 and 3 Camille-based storms were not run for the 2010 deterministic scenarios because it was determined that the probabilistic and annualized scenarios would provide a solid picture of potential losses throughout the state. Additionally, while the building inventory is slightly updated in HAZUS MR4, the census data has not changed. Therefore, the results from a Category 1 and 3 storm would not vary significantly from the 2007 runs (Appendix 7.3.3-B). The Category 5 storm runs allow for a closer analysis of the coast at a worst-case scenario, which combined with the probabilistic and annualized scenarios for the entire state provide a clear picture of risk and vulnerability.

HAZUS-MR4 does not include flood or storm surge damages in the estimation process, so damages from wind only were determined by scenarios. Flood damages incurred from potential storm surge are addressed in the flood section of the risk assessment.

SLOSH modeling provided depth of flooding information but did not provide damages or loss estimates. The State of Mississippi investigated correlating depth of flooding information from SLOSH models run and determined it was not possible to correlate flood data from the SLOSH modeling to the damage and loss information from the HAZUS-MR4 scenarios. Since no correlation was possible, SLOSH modeling is not included in the plan and damages and losses from storm surge is not specifically addressed. Damages and losses from flooding caused by storm surge and other hurricane-related flooding is addressed in the flood component of the risk assessment.

Data limitations

In 2004, the State of Mississippi did not have a comprehensive list of state-owned or operated facilities sorted by county that could be used with HAZUS-MH to conduct a Level 2 analysis, nor did the state have the human resources and time to conduct such an analysis. During the 2007 update, state facilities data were available in tabular form but did not include XY coordinates, and thus could not be incorporated into HAZUS-MH. The state does have a county-by-county listing of the total value of private property but does not have a listing of specific properties. During the 2010 update, state facilities data were available with geospatial coordinates but still lacked sufficient attribute data to truly be incorporated into HAZUS-MR4. Some additional risk modeling was done in a GIS environment using the facility list and the boundaries generated by HAZUS-MR4. As with state-owned or operated facilities, the state did not have the time and resources to input available data or gather the new data that would be required to complete a Level 2 analysis on private property damage and losses from a hurricane event.

The preparation of such data that could be used in future plan updates is a component of the mitigation strategy and explained further in the strategy section of the plan. At this juncture plan developers determined the default data available in HAZUS-MR4 was still the “best available data” and provided the basis for the scenarios.

According to operating instructions from HAZUS-MR4 Hurricane, “Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that, even with state-of-the-art techniques, uncertainties are inherent in any such estimation methodology. The next major hurricane to affect your area will likely be quite different than any “scenario hurricane” anticipated as part of a hurricane lost estimation study. Hence, the results of a scenario analysis should not be looked on as a prediction, but rather as an indication of what the future may hold. Probabilistic analyses can be used to develop estimates of long-term average losses, (annualized losses), as well as the expected distribution of losses (return period losses). These estimates reflect the full spectrum of hurricane tracks and intensities that are likely to occur in your region of interest. However, due to the limited history of actual hurricane observations, limited knowledge of actual building characteristics, modeling simplifications, and other factors, there are also significant uncertainties inherent in the results produced by a probabilistic analysis. To overcome these limitations, ranges of losses should be evaluated by conducting multiple analyses and varying certain input parameters to which the losses are most sensitive. Despite the limitations noted above the HAZUS-MH scenarios still provide a solid basis for assessing Mississippi’s vulnerability to wind damage from hurricane events. An explanation of damage states (Table 3.3.6) and the results of the scenarios are in the pages that follow.

Table 3.3.6
DAMAGE STATES FOR RESIDENTIAL CONSTRUCTION CLASSES
(Similar criteria were applied to other building types by the HAZUS-MR4 model)

DAMAGE STATE	QUALITATIVE DAMAGE DESCRIPTION
0	No Damage or Very Minor Damage
	Little or no damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.
1	Minor Damage
	Maximum of one broken window, door, or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.
2	Moderate Damage
	Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.

DAMAGE STATE	QUALITATIVE DAMAGE DESCRIPTION
3	Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.
4	Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.

Source: Table 6.9 HAZUS-MH MR Technical Model, page 6-49.

During the 2007 update of this plan, the Hazard Mitigation Council concluded that re-running these HAZUS-MH scenarios with the latest version of HAZUS-MH (HAZUS-MH MR2 released in May 2006) would not provide much value, particularly since much of the high risk building inventory was destroyed in Hurricane Katrina. The main difference between the HAZUS-MH MR2 and HAZUS-MH MR1 is that MR2 has building values adjusted to 2005 valuations, but the count of buildings remains based on 2002 data. The Hazard Mitigation Council did see value in running a statewide probabilistic scenario to estimate average annualized losses county by county. The scenarios were re-run during the 2010 update utilizing HAZUS MR4 (released in September 2009), Based on to the updated datasets, it was felt that HAZUS MR4 begins to take into account the effects of Hurricane Katrina. Updated data includes 2006 building inventory (RS Means for residential and Dun & Bradstreet for Commercial/Industrial), 2000 census data, 2005-2007 transportation data, and 2005-2006 public school data.

The results of the annualized loss modeling are presented in the maps (Figures 3.3.4 and 3.3.5) and Table 3.3.7 that follow, by county. Results shown are annualized total dollar losses, which include property damage and business interruption losses, and annualized loss ratio, which is the percent of the building structure value that could be damaged from hurricanes in any given year. The table lists counties in order of greatest annualized total dollar losses. The top ten counties ranked by annualized loss ratio are highlighted. The results indicate that risk decreases with distance from the coast, but that inland counties, including urbanized areas in northern Mississippi, are not immune to hurricanes and related losses.

Figure 3.3.4

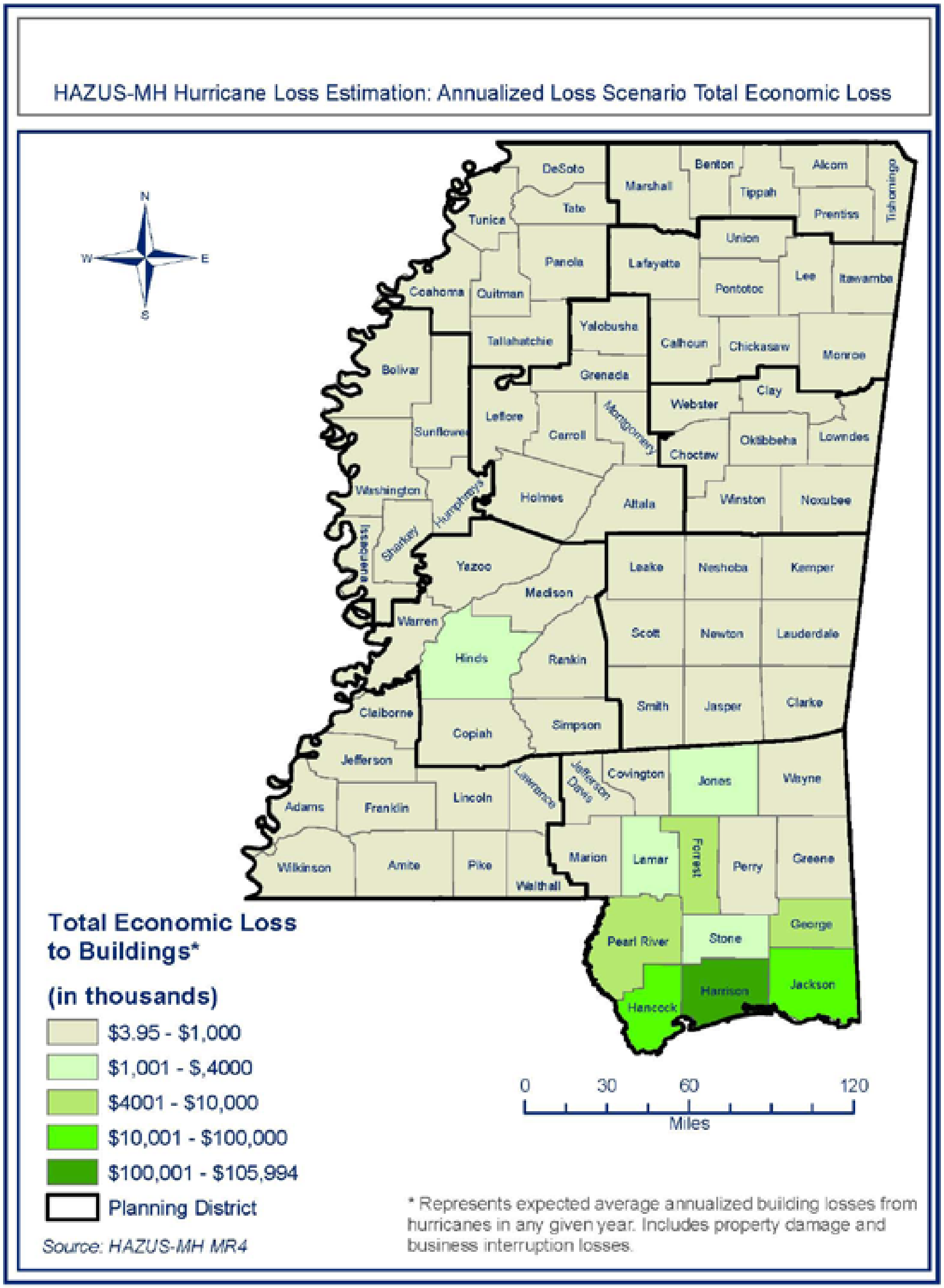
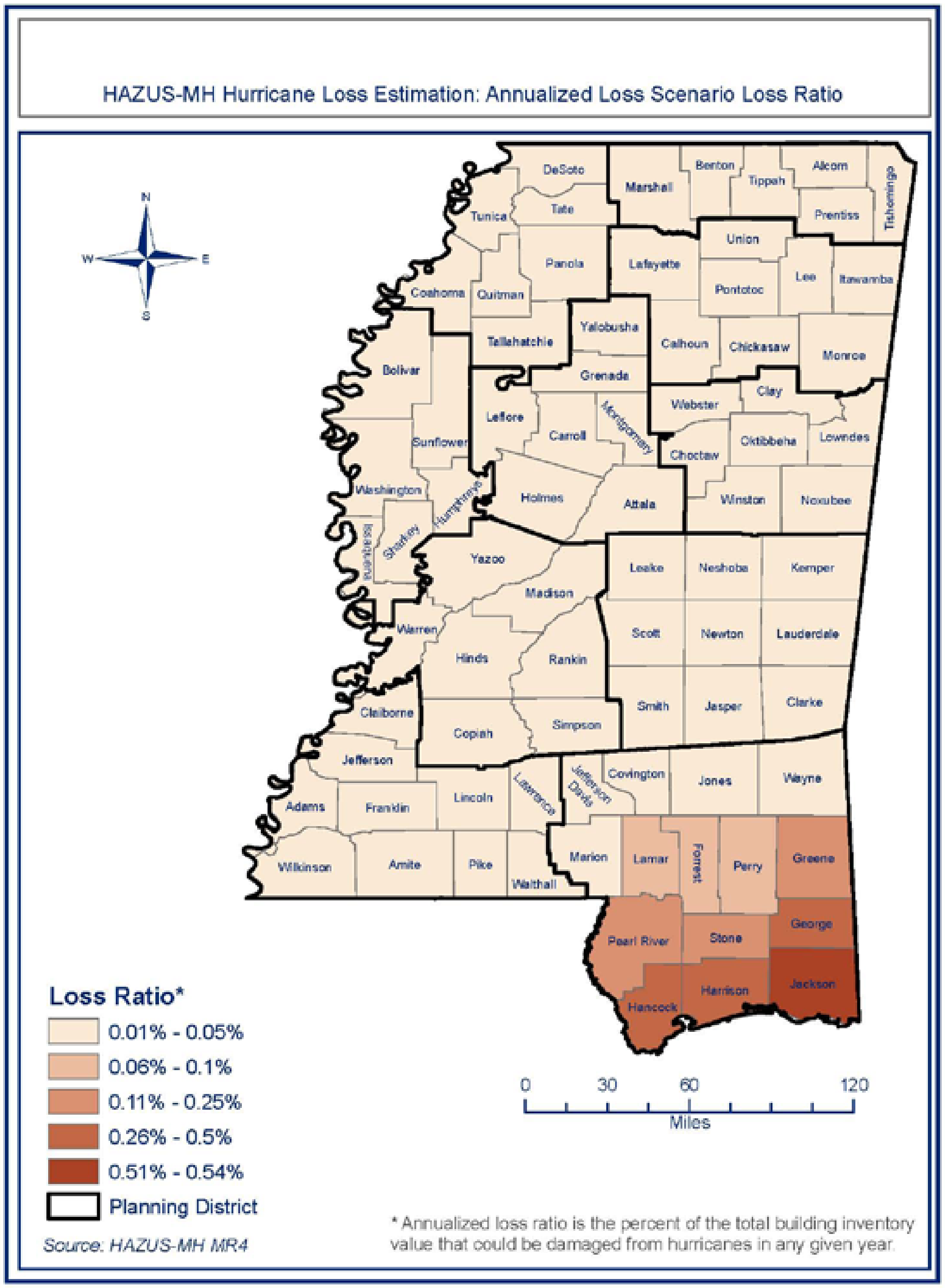

HAZUS-MH Hurricane Loss Estimation: Annualized Loss Scenario Total Economic Loss
DeSoto
Marshall
Benton
Alcorn
Tippah
Tishomingo
Tate
Tunica
Prentiss
Union
Panola
Lafayette
Lee
Itawamba
Coahoma
Quitman
Pontotoc
Yalobusha
Tallahatchie
Calhoun
Chickasaw
Monroe
Bolivar
Grenada
Clay
Webster
Leflore
Montgomery
Sunflower
Carroll
Choctaw
Oktibbeha
Lowndes
Washington
Humphreys
Holmes
Attala
Winston
Noxubee
Issaquena
Sharkey
Yazoo
Leake
Neshoba
Kemper
Madison
Warren
Scott
Newton
Lauderdale
Hinds
Rankin
Smith
Jasper
Clarke
Claiborne
Copiah
Simpson
Jefferson
Jefferson Davis
Covington
Jones
Wayne
Adams
Franklin
Lincoln
Lawrence
Marion
Lamar
Forrest
Perry
Greene
Wilkinson
Amite
Pike
Walthall
Pearl River
Stone
George
Hancock
Harrison
Jackson
N
S
E
W
Total Economic Loss to Buildings*
(in thousands)
$3.95 - $1,000
$1,001 - $,4000
$4001 - $10,000
$10,001 - $100,000
$100,001 - $105,994
Planning District
0
30
60
120
Miles
* Represents expected average annualized building losses from hurricanes in any given year. Includes property damage and business interruption losses.
Source: HAZUS-MH MR4

Figure 3.3.5



HAZUS-MH Hurricane Loss Estimation: Annualized Loss Scenario Loss Ratio
N
S
E
W
DeSoto
Marshall
Benton
Tippah
Alcorn
Tishomingo
Tunica
Tate
Prentiss
Union
Panola
Lafayette
Lee
Itawamba
Coahoma
Quitman
Pontotoc
Yalobusha
Tallahatchie
Calhoun
Chickasaw
Monroe
Bolivar
Grenada
Clay
Webster
Leflore
Montgomery
Carroll
Lowndes
Oktibbeha
Sunflower
Choctaw
Washington
Humphreys
Holmes
Attala
Winston
Noxubee
Sharkey
Issaquena
Yazoo
Leake
Neshoba
Kemper
Madison
Warren
Scott
Newton
Lauderdale
Hinds
Rankin
Smith
Jasper
Clarke
Claiborne
Simpson
Copiah
Jefferson
Covington
Jones
Wayne
Jefferson Davis
Lawrence
Adams
Franklin
Lincoln
Marion
Lamar
Forrest
Perry
Greene
Wilkinson
Amite
Pike
Walthall
Pearl River
Stone
George
Harrison
Jackson
Hancock
Loss Ratio*
0.01% - 0.05%
0.06% - 0.1%
0.11% - 0.25%
0.26% - 0.5%
0.51% - 0.54%
Planning District
0
30
60
120
Miles
Source: HAZUS-MH MR4
* Annualized loss ratio is the percent of the total building inventory value that could be damaged from hurricanes in any given year.

Table 3.3.7
HAZUS-MH Annualized Hurricane Loss Estimation
Results: Building Impacts by County, Ranked by Highest Building Losses
(All dollar values are in thousands)

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)	Loss Ratio Rank
Jackson	39,884	0.53	16,405	11,461	67,751	1
Harrison	60,796	0.46	26,125	19,073	105,994	2
Hancock	9,232	0.34	3,412	2,608	15,251	3
George	2,676	0.28	972	748	4,395	4
Stone	1,530	0.23	599	501	2,630	5
Pearl River	4,395	0.17	1,562	1,251	7,208	6
Greene	600	0.13	167	164	931	7
Perry	430	0.09	114	112	656	8
Forrest	2,929	0.07	834	890	4,654	9
Lamar	1,327	0.07	362	385	2,074	10
Wayne	384	0.04	87	102	572	11
Marion	467	0.04	118	136	721	12
Walthall	228	0.04	54	61	343	13
Jones	1,134	0.03	258	303	1,695	14
Covington	243	0.03	51	60	354	15
Jefferson Davis	122	0.03	22	29	173	16
Pike	464	0.02	93	121	678	17
Clarke	163	0.02	29	33	225	18
Jasper	127	0.02	20	27	174	19
Amite	107	0.02	15	19	141	20
Lawrence	109	0.02	17	21	148	21
Smith	118	0.02	18	21	157	22
Simpson	203	0.02	38	43	285	23
Wilkinson	67	0.01	9	12	88	24
Lincoln	255	0.01	42	55	352	25
Lauderdale	592	0.01	111	139	842	26
Newton	129	0.01	21	25	175	27

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)	Loss Ratio Rank
Franklin	43	0.01	5	7	55	28
Adams	216	0.01	34	44	294	29
Copiah	142	0.01	21	27	190	30
Noxubee	47	0.01	10	11	67	31
Scott	112	0.01	17	22	151	32
Rankin	635	0.01	93	101	828	33
Kemper	37	0.01	5	6	48	34
Neshoba	109	0.01	16	22	147	35
Madison	458	0.01	80	78	617	36
Hinds	1,180	0.01	185	223	1,588	37
Claiborne	33	0.01	5	5	43	38
Jefferson	28	0.01	4	6	38	39
Leake	62	0.01	8	11	81	40
Winston	50	0.01	6	9	65	41
Humphreys	22	0.00	4	4	30	42
Issaquena	3	0.00	0	0	4	43
Sharkey	13	0.00	2	2	17	44
Warren	145	0.00	14	22	181	45
Attala	39	0.00	4	6	49	46
Yazoo	52	0.00	7	8	67	47
Lowndes	145	0.00	20	26	190	48
Clay	41	0.00	6	7	54	49
Oktibbeha	77	0.00	10	15	102	50
Choctaw	16	0.00	1	2	20	51
Holmes	27	0.00	3	5	34	52
Sunflower	43	0.00	7	9	58	53
Carroll	12	0.00	1	1	14	54
Webster	14	0.00	1	2	17	55
Monroe	56	0.00	7	9	71	56
Montgomery	16	0.00	1	2	20	57
Leflore	54	0.00	8	11	73	58

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)	Loss Ratio Rank
Washington	83	0.00	11	13	106	59
Bolivar	43	0.00	6	8	57	60
Tallahatchie	11	0.00	1	2	13	61
Calhoun	17	0.00	2	2	21	62
Chickasaw	25	0.00	4	5	33	63
Quitman	8	0.00	1	1	10	64
Lee	107	0.00	16	19	142	65
Grenada	24	0.00	2	3	29	66
Pontotoc	23	0.00	2	3	29	67
Panola	24	0.00	3	4	31	68
Yalobusha	10	0.00	1	2	13	69
Itawamba	20	0.00	1	3	24	70
Union	20	0.00	2	3	25	71
Coahoma	20	0.00	2	3	26	72
Prentiss	16	0.00	1	2	20	73
Tate	15	0.00	1	2	18	74
Tunica	6	0.00	1	1	8	75
Lafayette	23	0.00	1	3	28	76
Tishomingo	12	0.00	1	1	14	77
Alcorn	22	0.00	2	3	27	78
Benton	4	0.00	0	0	4	79
Tippah	11	0.00	0	1	13	80
Marshall	15	0.00	1	1	17	81
Desoto	70	0.00	3	5	79	82

Source: HAZUS-MH MR4

Note: *Loss ratio is the percent of the total building inventory value that could be damaged from hurricanes in any given year.

**Total income loss includes relocation loss, capital-related loss, wages loss, and rental income loss.

The total hurricane wind losses to Mississippi annualized over time equal around $250 million in any given year. The expected losses by hurricane return period are provided in Table 3.3.8 that follows. Note that HAZUS-MR4 estimated total losses, even to a 1,000-year event ($24.6 billion), are less than the losses that resulted from Hurricane Katrina ($80 billion). One explanation for this is that HAZUS-MR4 models wind damage only and not flood damage. Another analysis limitation could be deficiencies in the default HAZUS-MR4 inventory, which may not include the casinos on the Gulf Coast. This annualized HAZUS-MR4 model, run in 2010, did not change the ranking of risk county by county but now estimates what the average annual hurricane losses could be statewide.

Table 3.3.8
Summary Impacts to State by Return Period Updated

NUMBER OF RESIDENTIAL BUILDINGS DAMAGED					
Return Period	Minor	Moderate	Severe	Destruction	Total
10	5,179	340	4	2	5,526
20	23,580	3,826	199	116	27,721
50	124,300	27,600	2,265	1,448	155,613
100	61,777	40,631	12,672	7,140	122,221
200	77,734	54,868	23,967	15,583	172,152
500	32,375	31,804	33,747	37,556	135,482
1,000	63,496	56,459	49,256	49,443	218,654
NUMBER OF BUILDINGS DAMAGED					
Return Period	Minor	Moderate	Severe	Destruction	Total
10	5,569	379	8	2	5,957
20	25,191	4,300	261	118	29,870
50	132,572	31,245	2,976	1,473	168,266
100	65,340	44,623	15,179	7,225	132,368
200	82,390	60,021	28,220	15,767	186,397
500	34,238	34,467	39,615	38,103	146,422
1,000	67,490	61,338	57,588	50,110	236,527

SHELTER REQUIREMENTS		
Return Period	Displaced Households (No. of Households)	Short-term Shelter (No. of People)
10	18	4
20	464	126
50	3,473	985
100	16,149	4,383
200	35,509	9,476
500	68,933	18,452
1,000	94,807	25,394

ECONOMIC LOSS (X 1,000)				
Return Period	Residential	Total	Business Interruption	Total loss
10	54,268	58,937	6,722	65,659
20	308,474	350,631	66,754	417,385
50	1,740,502	2,134,679	482,832	2,617,511
100	3,958,728	5,048,822	1,222,935	6,271,757
200	7,136,343	9,091,747	2,041,280	11,133,026
500	11,554,740	15,314,757	3,051,828	18,366,585
1,000	15,747,553	20,507,175	4,102,696	24,609,871
Annualized	**146,506**	**185,471**	**39,198**	**224,670**

The scenario reports include detailed county-by-county data on structure damage and estimated losses to damaged structures. Included in the scenario reports are damage to residential, agriculture, commercial, educational, government, industrial, and religious structures, essential facilities and infrastructure.

The damage and loss tables in the assessing vulnerability by jurisdiction section that follows address building losses and highlight residential damage. Other damaged buildings are grouped under the single heading called "Other". Damage to structures in the "other" categories was far less significant than residential damage. Plan developers determined grouping them together would still provide a clear picture of potential damage while keeping the plan less cumbersome. Structures in the other category include the following: Agriculture, Commercial, Educational, Government, Industrial, and Religious.

Plan developers also decided the total economic losses reported by the scenarios would be an important factor in assessing vulnerability by jurisdiction. In addition to structure damage costs the scenario reports also includes economic losses to building contents and inventory, relocation costs, capital related losses, wage and rental income losses.

In the assessing vulnerability of state-owned or state-operated facilities sections the tables list damages and losses to government-owned or -operated buildings, critical facilities and infrastructure. For additional information on the methodology employed in assessing vulnerability of state facilities refer to Section 3.0 of the plan.

As expected from the scenario initial points of impact and the northward track of the scenario storms, the data shows that the three very high risk coastal counties and three high risk counties directly north of the coastal counties were the most heavily damaged. The scenarios also bear out the diminishing damage as experienced in past events as the storms moved further north and inland to the medium- and low-risk counties.

In the Category 5 storm scenarios, most counties within the state received some damage. After viewing the HAZUS-MR4 damage by building type and the economic loss reports, plan developers decided to establish a threshold to determine which counties would be addressed in detail in each component of the vulnerability analysis. For purposes of this plan if the county received over $500,000 dollars in building damage it was included in the analysis, and data for those counties is provided in the damage and dollar loss in the tables that follow.

Tables 3.3.9, 3.3.10 and 3.3.11 illustrate vulnerability by jurisdiction to a Category 5 hurricane. The tables document numbers of buildings damaged by structure type and degree of damage for each of the three HAZUS-MR4 deterministic scenarios. In addition, wind speed of Category 5 hurricanes are provided as Figures 3.3.6. to Figure 3.3.8.

Table 3.3.9
Point of Impact Hancock County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 161

This storm event was based upon Hurricane Camille parameters from 1969 with the exception of landfall. Though there was damage in other counties, 43 counties received more than $50,000 in damage in this scenario. Those counties were Attala, Carroll, Copiah, Covington, Desoto, Forrest, George, Grenada, Hancock, Harrison, Hinds, Holmes, Humphreys, Jackson, Jasper, Jefferson Davis, Jones, Lafayette, Lamar, Lawrence, Leake, Leflore, Lincoln, Madison, Marion, Marshall, Montgomery, Newton, Panola, Pearl River, Perry, Pike, Quitman, Rankin, Scott, Simpson, Smith, Stone, Tallahatchie, Tate, Walthall, Yalobusha and Yazoo.

Number of Structures Damaged

TOTAL BUILDINGS DAMAGED ALL COUNTIES					
OCCUPANCY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
Total Residential	83,465	40,085	19,098	18,765	161,413
Total	5,482	3,966	3,121	202	12,771
TOTAL	**88,947**	**44,051**	**22,219**	**18,967**	**174,184**

BUILDINGS DAMAGED BY COUNTY (TOTALING $500,000 OR MORE)

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
ATTALA					
Total Res	126	6	0	0	132
Total Other*	5	0	0	0	5
Total	**131**	**6**	**0**	**0**	**137**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
CARROLL					
Total Res	210	10	0	0	220
Total Other*	5	0	0	0	5
Total	**214**	**10**	**0**	**0**	**225**
COPIAH					
Total Res	295	15	0	0	309
Total Other*	19	2	0	0	21
Total	**313**	**16**	**0**	**0**	**330**
COVINGTON					
Total Res	2,778	1,077	164	117	4,136
Total Other*	143	96	33	2	274
Total	**2,920**	**1,173**	**197**	**119**	**4,409**
DESOTO					
Total Res	16	0	0	0	16
Total Other*	11	0	0	0	11
Total	**27**	**0**	**0**	**0**	**27**
FORREST					
Total Res	3,462	538	16	6	4,022
Total Other*	294	78	7	0	378
Total	**3,756**	**615**	**23**	**7**	**4,401**
GEORGE					
Total Res	1	0	0	0	2
Total Other*	2	0	0	0	2
Total	**3**	**0**	**0**	**0**	**3**
GRENADA					
Total Res	144	5	0	0	150
Total Other*	13	1	0	0	14
Total	**157**	**6**	**0**	**0**	**163**
HANCOCK					
Total Res	2,410	5,515	6,142	6,869	20,936
Total Other*	107	355	846	64	1,373
Total	**2,517**	**5,871**	**6,988**	**6,933**	**22,308**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
HARRISON					
Total Res	15,347	7,332	2,567	1,803	27,049
Total Other*	1,022	773	440	21	2,256
Total	**16,369**	**8,104**	**3,007**	**1,824**	**29,305**
HINDS					
Total Res	14,476	2,482	88	74	17,120
Total Other*	1,104	395	41	1	1,542
Total	**15,580**	**2,877**	**129**	**76**	**18,661**
HOLMES					
Total Res	896	105	2	4	1,007
Total Other*	40	8	1	0	49
Total	**936**	**113**	**3**	**4**	**1,056**
HUMPHREYS					
Total Res	4	0	0	0	4
Total Other*	2	0	0	0	2
Total	**6**	**0**	**0**	**0**	**6**
JACKSON					
Total Res	188	8	0	0	196
Total Other*	24	1	0	0	25
Total	**213**	**9**	**0**	**0**	**221**
JASPER					
Total Res	11	0	0	0	12
Total Other*	**2**	**0**	**0**	**0**	**2**
Total	**14**	**0**	**0**	**0**	**14**
JEFFERSON DAVIS					
Total Res	1,923	1,935	939	755	5,552
Total Other*	38	56	50	2	147
Total	**1,961**	**1,992**	**989**	**757**	**5,699**
JONES					
Total Res	333	15	0	0	349
Total Other*	29	3	0	0	32
Total	**362**	**18**	**1**	**0**	**381**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
LAFAYETTE					
Total Res	10	0	0	0	10
Total Other*	4	0	0	0	4
Total	**14**	**0**	**0**	**0**	**14**
LAMAR					
Total Res	5,321	2,355	543	341	8,559
Total Other*	336	265	114	5	721
Total	**5,657**	**2,620**	**657**	**346**	**9,280**
LEAKE					
Total Res	88	3	0	0	91
Total Other*	7	0	0	0	7
Total	**94**	**3**	**0**	**0**	**98**
LEFLORE					
Total Res	324	13	0	0	337
Total Other*	25	2	0	0	27
Total	**349**	**15**	**0**	**0**	**364**
LINCOLN					
Total Res	9	0	0	0	9
Total Other*	4	0	0	0	4
Total	**13**	**0**	**0**	**0**	**13**
MADISON					
Total Res	7,063	1,958	205	202	9,429
Total Other*	557	327	77	3	965
Total	**7,620**	**2,286**	**283**	**205**	**10,394**
MARION					
Total Res	3,218	3,341	1,638	1,177	9,374
Total Other*	198	326	334	18	875
Total	**3,416**	**3,667**	**1,972**	**1,195**	**10,249**
MARSHALL					
Total Res	4	0	0	0	4
Total Other*	3	0	0	0	3
Total	**7**	**0**	**0**	**0**	**7**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
MONTGOMERY					
Total Res	38	1	0	0	39
Total Other*	5	0	0	0	5
Total	**42**	**1**	**0**	**0**	**44**
NEWTON					
Total Res	2	0	0	0	2
Total Other*	2	0	0	0	2
Total	**4**	**0**	**0**	**0**	**4**
PANOLA					
Total Res	76	2	0	0	78
Total Other*	10	0	0	0	11
Total	**86**	**2**	**0**	**0**	**89**
PEARL RIVER					
Total Res	3,261	6,016	5,678	6,390	21,345
Total Other*	167	448	911	72	1,599
Total	**3,428**	**6,464**	**6,589**	**6,462**	**22,944**
PERRY					
Total Res	10	0	0	0	11
Total Other*	2	0	0	0	2
Total	**12**	**0**	**0**	**0**	12
PIKE					
Total Res	6	0	0	0	6
Total Other*	5	0	0	0	5
Total	**11**	**0**	**0**	**0**	**11**
QUITMAN					
Total Res	2	0	0	0	2
Total Other*	1	0	0	0	1
Total	**3**	**0**	**0**	**0**	**3**
RANKIN					
Total Res	13,731	4,443	533	497	19,204
Total Other*	854	541	138	6	1,539
Total	**14,586**	**4,984**	**671**	**502**	**20,743**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
SCOTT					
Total Res	355	22	0	0	377
Total Other*	23	3	0	0	25
Total	**378**	**24**	**1**	**0**	**403**
SIMPSON					
Total Res	4,172	2,470	553	508	7,704
Total Other*	243	242	120	6	612
Total	**4,416**	**2,713**	**673**	**514**	**8,315**
SMITH					
Total Res	679	86	4	4	773
Total Other*	18	4	1	0	23
Total	**697**	**91**	**4**	**4**	**796**
STONE					
Total Res	494	41	1	0	536
Total Other*	37	6	1	0	44
Total	**531**	**47**	**1**	**0**	**580**
TALLATCHIE					
Total Res	41	1	0	0	42
Total Other*	3	0	0	0	3
Total	**44**	**1**	**0**	**0**	**45**
TATE					
Total Res	16	0	0	0	17
Total Other*	4	0	0	0	4
Total	**21**	**0**	**0**	**0**	**21**
WALTHALL					
Total Res	444	36	1	1	481
Total Other*	28	6	1	0	35
Total	**472**	**42**	**1**	**1**	**516**
YALOBUSHA					
Total Res	18	0	0	0	19
Total Other*	3	0	0	0	3
Total	**21**	**0**	**0**	**0**	**22**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
YAZOO					
Total Res	349	22	1	0	371
Total Other*	21	3	0	0	25
Total	**370**	**25**	**1**	**0**	**396**

FIGURE 3.3.6

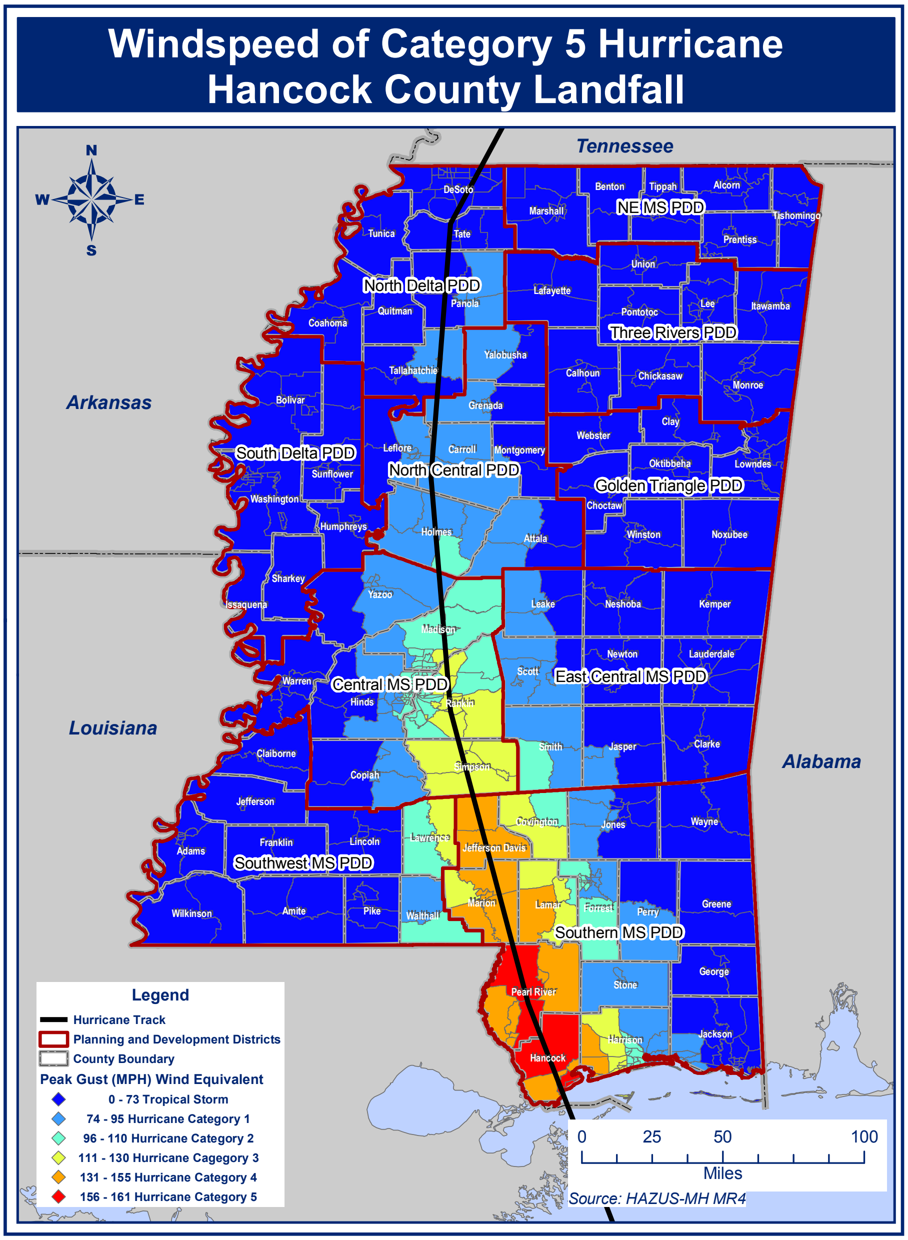


Table 3.3.10
Point of Impact Harrison County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 233

This storm event was based upon Hurricane Camille parameters from 1969 with the exception of landfall. Though there was damage in other counties, 51 counties received more than $500,000 in damage in this scenario. Those counties were Amite, Attala, Calhoun, Carroll, Chickasaw, Choctaw, Clarke, Copiah, Covington, Forrest, Franklin, George, Greene, Grenada, Hancock, Harrison, Hinds, Holmes, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Lincoln, Madison, Marion, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pike, Pontotoc, Rankin, Scott, Simpson, Smith, Stone, Tippah, Union, Walthall, Wayne, Webster, Winston and Yazoo Counties.

Number of Structures Damaged

TOTAL BUILDINGS DAMAGED ALL COUNTIES					
OCCUPANCY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
Total Residential	63,872	44,049	37,530	52,675	198,126
Other*	409	448	1,051	168	2,076
TOTAL	**64,281**	**44,497**	**38,581**	**52,843**	**200,202**

BUILDINGS DAMAGED BY COUNTY
(TOTALING $500,000 OR MORE)

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
AMITE					
Total Res	64	2	0	0	66
Total Other*	5	0	0	0	5
Total	**69**	**2**	**0**	**0**	**71**
ATTALA					
Total Res	248	10	0	0	258
Total Other*	12	1	0	0	13
Total	**260**	**11**	**0**	**0**	**271**
CALHOUN					
Total Res	39	1	0	0	40
Total Other*	4	0	0	0	4
Total	**43**	**1**	**0**	**0**	**44**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
CARROLL					
Total Res	1	0	0	0	1
Total Other*	0	0	0	0	0
Total	**2**	**0**	**0**	**0**	**2**
CHICKASAW					
Total Res	2	0	0	0	2
Total Other*	3	0	0	0	3
Total	**5**	**0**	**0**	**0**	**5**
CHOCTAW					
Total Res	62	2	0	0	64
Total Other*	2	0	0	0	2
Total	**64**	**2**	**0**	**0**	**66**
CLARKE					
Total Res	616	57	2	1	676
Total Other*	30	5	1	0	36
Total	**646**	**63**	**2**	**1**	**712**
COPIAH					
Total Res	29	0	0	0	29
Total Other*	5	0	0	0	6
Total	**34**	**1**	**0**	**0**	**35**
COVINGTON					
Total Res	3,120	1,489	284	204	5,098
Total Other*	161	137	60	3	360
Total	**3,281**	**1,626**	**344**	**207**	**5,458**
FORREST					
Total Res	6,563	8,590	5,462	4,699	25,314
Total Other*	441	897	1,213	85	2,636
Total	**7,004**	**9,487**	**6,675**	**4,784**	**27,949**
FRANKLIN					
Total Res	5	0	0	0	5
Total Other*	1	0	0	0	1
Total	**6**	**0**	**0**	**0**	**6**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
GEORGE					
Total Res	8	123	915	7,591	8,637
Total Other*	2	15	400	272	688
Total	**9**	**138**	**1,315**	**7,862**	**9,325**
GREENE					
Total Res	841	1,405	1,365	2,071	5,683
Total Other*	24	59	159	20	263
Total	**865**	**1,465**	**1,524**	**2,092**	**5,946**
GRENADA					
Total Res	3	0	0	0	3
Total Other*	3	0	0	0	3
Total	**6**	**0**	**0**	**0**	**6**
HANCOCK					
Total Res	5,574	3,653	1,866	6,129	17,222
Total Other*	269	307	420	133	1,129
Total	**5,844**	**3,959**	**2,286**	**6,262**	**18,351**
HARRISON					
Total Res	23,231	13,443	4,782	4,592	46,048
Total Other*	1,499	1,482	1,027	61	4,070
Total	**24,730**	**14,925**	**5,809**	**4,653**	**50,117**
HINDS					
Total Res	313	13	0	0	326
Total Other*	59	2	0	0	61
Total	**372**	**15**	**0**	**0**	**387**
HOLMES					
Total Res	16	0	0	0	17
Total Other*	3	0	0	0	3
Total	**19**	**1**	**0**	**0**	**19**
JASPER					
Total Res	2,484	845	120	80	3,529
Total Other*	108	73	25	2	207
Total	**2,592**	**917**	**145**	**82**	**3,736**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
JACKSON					
Total Res	5,182	7,022	7,498	28,581	48,283
Total Other*	258	568	1,802	1,150	3,778
Total	**5,440**	**7,589**	**9,300**	**29,732**	**52,061**
JEFFERSON DAVIS					
Total Res	1,564	347	29	22	1,962
Total Other*	31	13	2	0	46
Total	**1,595**	**360**	**31**	**22**	**2,008**
JONES					
Total Res	10,252	6,439	1,735	1,072	19,499
Total Other*	608	680	398	17	1,702
Total	**10,860**	**7,119**	**2,133**	**1,089**	**21,201**
KEMPER					
Total Res	6	0	0	0	6
Total Other*	1	0	0	0	1
Total	**7**	**0**	**0**	**0**	**7**
LAMAR					
Total Res	3,194	4,181	3,397	3,756	14,529
Total Other*	189	382	635	55	1,261
Total	**3,384**	**4,563**	**4,032**	**3,811**	**15,791**
LAUDERDALE					
Total Res	429	25	1	0	454
Total Other*	44	3	0	0	47
Total	**473**	**27**	**1**	**0**	**501**
LAWRENCE					
Total Res	413	32	1	1	447
Total Other*	23	4	1	0	27
Total	**436**	**36**	**1**	**1**	**474**
LEAKE					
Total Res	872	72	1	2	947
Total Other*	39	7	1	0	46
Total	**911**	**79**	**2**	**2**	**993**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
LINCOLN					
Total Res	218	10	0	0	228
Total Other*	21	2	0	0	22
Total	**239**	**11**	**0**	**0**	**250**
MADISON					
Total Res	313	12	0	0	325
Total Other*	37	2	0	0	39
Total	**349**	**14**	**0**	**0**	**364**
MARION					
Total Res	3,732	2,483	814	578	7,606
Total Other*	250	271	177	8	706
Total	**3,982**	**2,753**	**990**	**586**	**8,312**
MONTGOMERY					
Total Res	22	1	0	0	22
Total Other*	3	0	0	0	3
Total	**25**	**1**	**0**	**0**	**25**
NESHOBA					
Total Res	502	33	0	0	536
Total Other*	21	2	0	0	24
Total	**524**	**35**	**0**	**0**	**560**
NEWTON					
Total Res	1,714	272	11	13	2,010
Total Other*	103	34	5	0	142
Total	**1,817**	**305**	**16**	**14**	**2,152**
NOXUBEE					
Total Res	1	0	0	0	1
Total Other*	1	0	0	0	1
Total	**2**	**0**	**0**	**0**	**2**
OKTIBBEHA					
Total Res	14	0	0	0	14
Total Other*	5	0	0	0	5
Total	**19**	**0**	**0**	**0**	**19**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
PEARL RIVER					
Total Res	39	372	2,258	19,744	22,413
Total Other*	4	33	880	770	1,688
Total	**43**	**406**	**3,138**	**20,515**	**24,101**
PERRY					
Total Res	902	1,344	1,156	2,022	5,423
Total Other*	33	69	141	19	261
Total	**934**	**1,412**	**1,297**	**2,042**	**5,684**
PIKE					
Total Res	1,839	198	6	6	2,049
Total Other*	140	33	4	0	176
Total	**1,979**	**231**	**9**	**6**	**2,225**
PONTOTOC					
Total Res	8	0	0	0	8
Total Other*	4	0	0	0	4
Total	**11**	**0**	**0**	**0**	**11**
RANKIN					
Total Res	1,416	90	1	2	1,508
Total Other*	99	13	1	0	114
Total	**1,514**	**103**	**3**	**2**	**1,622**
SCOTT					
Total Res	2,238	399	18	25	2,681
Total Other*	147	54	9	1	210
Total	**2,385**	**453**	**27**	**26**	**2,891**
SIMPSON					
Total Res	1,841	362	18	20	2,241
Total Other*	122	49	8	0	179
Total	**1,963**	**410**	**26**	**21**	**2,420**
SMITH					
Total Res	2,191	693	92	63	3,038
Total Other*	66	42	12	1	121
Total	**2,256**	**734**	**104**	**63**	**3,159**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
STONE					
Total Res	0	18	345	5,529	5,892
Total Other*	0	3	214	345	562
Total	**1**	**20**	**559**	**5,874**	**6,454**
TIPPAH					
Total Res	2	0	0	0	2
Total Other*	2	0	0	0	2
Total	**4**	**0**	**0**	**0**	**4**
UNION					
Total Res	9	0	0	0	9
Total Other*	4	0	0	0	4
Total	**13**	**0**	**0**	**0**	**13**
WALTHALL					
Total Res	2,157	1,010	224	171	3,562
Total Other*	120	106	55	4	284
Total	**2,277**	**1,115**	**280**	**174**	**3,846**
WAYNE					
Total Res	2,067	562	63	45	2,737
Total Other*	136	64	15	1	216
Total	**2,203**	**626**	**78**	**46**	**2,953**
WEBSTER					
Total Res	34	1	0	0	34
Total Other*	3	0	0	0	3
Total	**36**	**1**	**0**	**0**	**37**
WINSTON					
Total Res	78	2	0	0	80
Total Other*	8	0	0	0	8
Total	**85**	**3**	**0**	**0**	**88**
YAZOO					
Total Res	3	0	0	0	3
Total Other*	2	0	0	0	2
Total	**5**	**0**	**0**	**0**	**5**

FIGURE 3.3.7

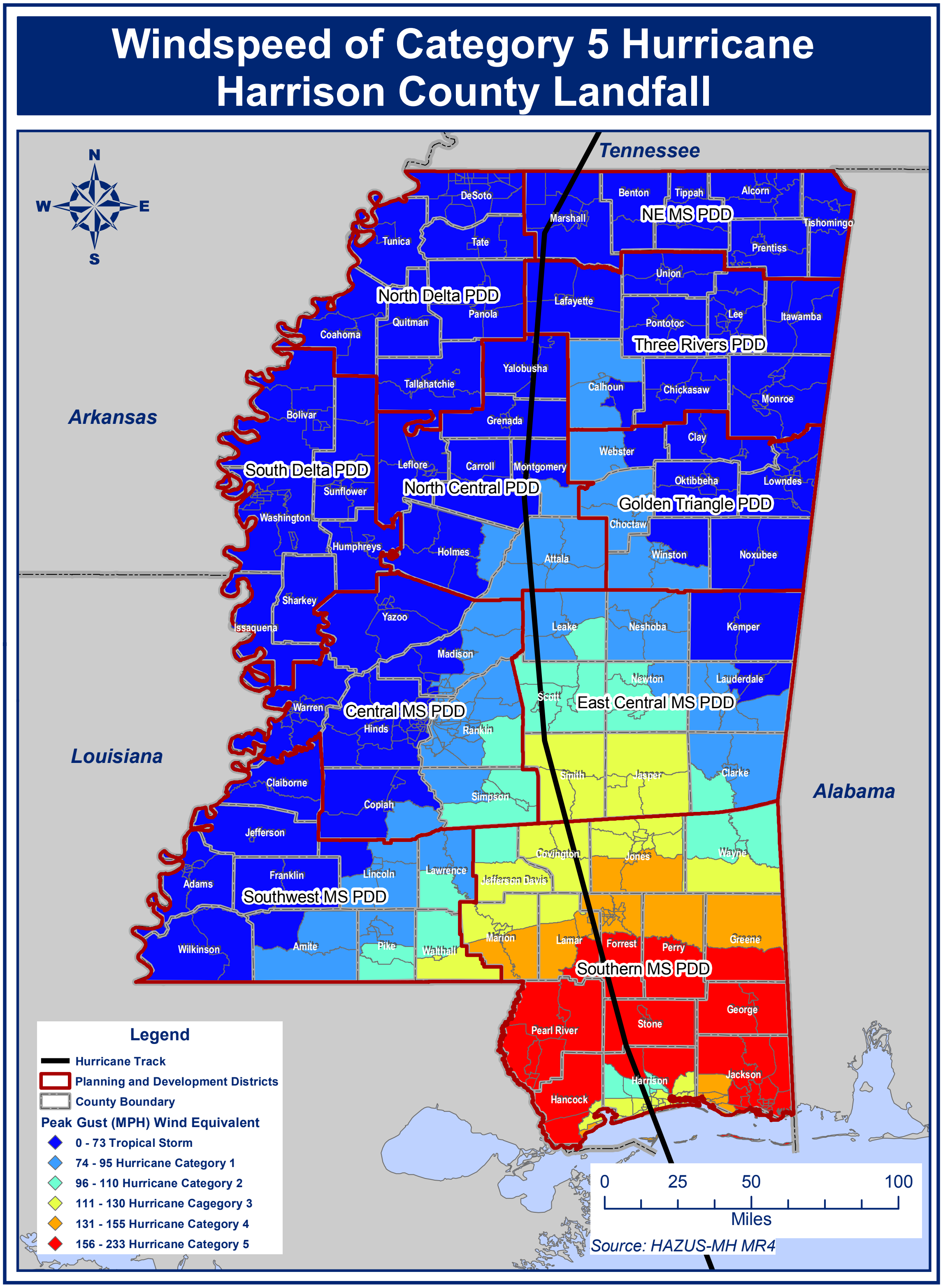

Windspeed of Category 5 Hurricane
Harrison County Landfall
Tennessee
Arkansas
Louisiana
Alabama
N
S
E
W
NE MS PDD
North Delta PDD
Three Rivers PDD
South Delta PDD
North Central PDD
Golden Triangle PDD
Central MS PDD
East Central MS PDD
Southwest MS PDD
Southern MS PDD
Legend
Hurricane Track
Planning and Development Districts
County Boundary
Peak Gust (MPH) Wind Equivalent
0 - 73 Tropical Storm
74 - 95 Hurricane Category 1
96 - 110 Hurricane Category 2
111 - 130 Hurricane Cagegory 3
131 - 155 Hurricane Category 4
156 - 233 Hurricane Category 5
0 25 50 100
Miles
Source: HAZUS-MH MR4

Table 3.3.11
Point of Impact Jackson County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 234

This storm event was based upon Hurricane Camille parameters from 1969 with the exception of landfall. Though there was damage in other counties, 47 counties received more than $500,000 in damage in this scenario. Those counties were Alcorn, Attala, Chickasaw, Choctaw, Clarke, Clay, Covington, Forrest, George, Greene, Hancock, Harrison, Itawamba, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Lee, Lincoln, Lowndes, Madison, Marion, Monroe, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Pike, Pontotoc, Prentiss, Rankin, Scott, Simpson, Smith, Stone, Union, Walthall, Wayne, Webster, and Winston Counties.

Number of Structures Damaged

TOTAL BUILDINGS DAMAGED ALL COUNTIES					
OCCUPANCY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
Total Residential	58,627	38,432	32,537	147,339	276,934
Other*	3,653	3,760	8,854	6,447	22,714
TOTAL	**62,280**	**42,192**	**41,390**	**153,786**	**299,648**

BUILDINGS DAMAGED BY COUNTY
(TOTALING $500,000 OR MORE)

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
ALCORN					
Total Res	5	0	0	0	5
Total Other*	5	0	0	0	5
Total	**10**	**0**	**0**	**0**	**10**
ATTALA					
Total Res	25	0	0	0	25
Total Other*	3	0	0	0	3
Total	**28**	**0**	**0**	**0**	**28**
CHICKASAW					
Total Res	36	1	0	0	37
Total Other*	7	0	0	0	7
Total	**43**	**1**	**0**	**0**	**44**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
CHOCTAW					
Total Res	47	2	0	0	49
Total Other*	2	0	0	0	2
Total	**49**	**2**	**0**	**0**	**51**
CLARKE					
Total Res	2,836	1,149	203	132	4,321
Total Other*	139	104	35	1	279
Total	**2,976**	**1,253**	**238**	**133**	**4,600**
CLAY					
Total Res	34	0	0	0	34
Total Other*	4	0	0	0	4
Total	**37**	**1**	**0**	**0**	**38**
COVINGTON					
Total Res	1,612	315	20	16	1,963
Total Other*	94	38	7	0	138
Total	**1,706**	**352**	**26**	**17**	**2,101**
GEORGE					
Total Res	13	187	1,174	7,262	8,636
Total Other*	3	20	441	224	688
Total	**16**	**207**	**1,614**	**7,487**	**9,324**
FORREST					
Total Res	8,499	8,493	3,890	2,573	23,454
Total Other*	595	941	866	37	2,440
Total	**9,094**	**9,434**	**4,756**	**2,610**	**25,895**
GREENE					
Total Res	364	1,103	1,646	2,870	5,983
Total Other*	10	43	189	29	271
Total	**374**	**1,146**	**1,835**	**2,899**	**6,254**
HANCOCK					
Total Res	844	2,736	5,556	12,120	21,256
Total Other*	41	185	989	187	1,402
Total	**885**	**2,920**	**6,545**	**12,307**	**22,658**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
HARRISON					
Total Res	68	848	8,315	64,017	73,247
Total Other*	11	96	3,147	3,186	6,440
Total	**79**	**944**	**11,462**	**67,202**	**79,687**
ITAWAMBA					
Total Res	2	0	0	0	2
Total Other*	2	0	0	0	2
Total	**4**	**0**	**0**	**0**	**4**
JACKSON					
Total Res	4	113	2,199	47,826	50,142
Total Other*	1	16	1,295	2,612	3,924
Total	**5**	**128**	**3,494**	**50,439**	**54,066**
JASPER					
Total Res	2,641	982	155	104	3,882
Total Other*	110	75	25	1	211
Total	**2,750**	**1,057**	**180**	**106**	**4,093**
JEFFERSON DAVIS					
Total Res	108	3	0	0	111
Total Other*	2	0	0	0	3
Total	**110**	**3**	**0**	**0**	**113**
JONES					
Total Res	10,177	6,069	1,572	983	18,801
Total Other*	611	653	365	15	1,643
Total	**10,787**	**6,722**	**1,936**	**998**	**20,444**
KEMPER					
Total Res	279	19	0	1	300
Total Other*	9	1	0	0	11
Total	**288**	**21**	**0**	**1**	**310**
LAMAR					
Total Res	5,353	3,425	1,120	667	10,565
Total Other*	331	363	227	10	931
Total	**5,683**	**3,788**	**1,348**	**677**	**11,496**

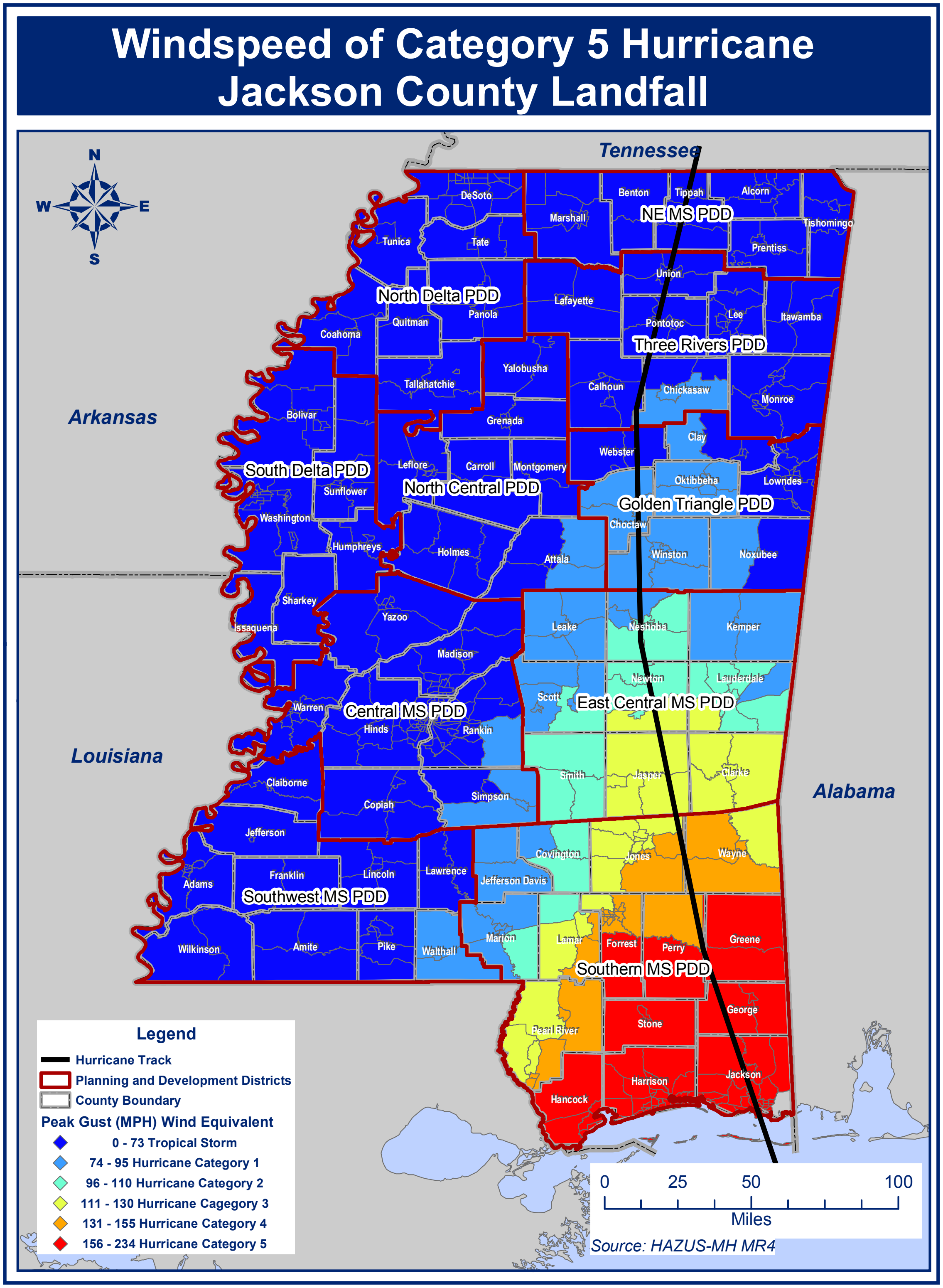
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
LAUDERDALE					
Total Res	6,863	1,530	93	45	8,532
Total Other*	553	246	39	1	839
Total	**7,416**	**1,776**	**133**	**47**	**9,371**
LAWRENCE					
Total Res	4	0	0	0	4
Total Other*	2	0	0	0	2
Total	**6**	**0**	**0**	**0**	**6**
LEAKE					
Total Res	278	12	0	0	291
Total Other*	13	1	0	0	15
Total	**291**	**14**	**0**	**0**	**305**
LEE					
Total Res	78	1	0	0	79
Total Other*	20	0	0	0	21
Total	**98**	**2**	**0**	**0**	**100**
LINCOLN					
Total Res	3	0	0	0	4
Total Other*	3	0	0	0	3
Total	**7**	**0**	**0**	**0**	**7**
LOWNDES					
Total Res	19	0	0	0	20
Total Other*	9	0	0	0	9
Total	**28**	**1**	**0**	**0**	**29**
MADISON					
Total Res	8	0	0	0	8
Total Other*	8	0	0	0	8
Total	**16**	**0**	**0**	**0**	**16**
MARION					
Total Res	959	99	3	3	1,063
Total Other*	69	14	2	0	84
Total	**1,027**	**113**	**5**	**3**	**1,148**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
MONROE					
Total Res	6	0	0	0	6
Total Other*	5	0	0	0	5
Total	**10**	**0**	**0**	**0**	**10**
NESHOBA					
Total Res	1,627	211	5	7	1,850
Total Other*	74	17	2	0	93
Total	**1,701**	**229**	**7**	**7**	**1,943**
NEWTON					
Total Res	2,494	561	40	43	3,137
Total Other*	145	65	13	1	224
Total	**2,638**	**627**	**52**	**44**	**3,361**
NOXUBEE					
Total Res	63	2	0	0	65
Total Other*	4	0	0	0	4
Total	**67**	**3**	**0**	**0**	**70**
OKTIBBEHA					
Total Res	265	14	0	0	279
Total Other*	23	2	0	0	25
Total	**288**	**16**	**0**	**0**	**304**
PEARL RIVER					
Total Res	6,863	5,897	2,628	2,028	17,416
Total Other*	363	516	456	24	1,359
Total	**7,225**	**6,414**	**3,084**	**2,051**	**18,774**
PERRY					
Total Res	640	1,428	1,494	2,074	5,637
Total Other*	22	66	164	16	269
Total	**662**	**1,495**	**1,658**	**2,091**	**5,905**
PIKE					
Total Res	10	0	0	0	11
Total Other*	6	0	0	0	6
Total	**16**	**0**	**0**	**0**	**17**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
PONTOTOC					
Total Res	7	0	0	0	7
Total Other*	4	0	0	0	4
Total	**10**	**0**	**0**	**0**	**10**
PRENTISS					
Total Res	6	0	0	0	6
Total Other*	3	0	0	0	3
Total	**9**	**0**	**0**	**0**	**9**
RANKIN					
Total Res	23	0	0	0	23
Total Other*	12	0	0	0	13
Total	**35**	**1**	**0**	**0**	**36**
SCOTT					
Total Res	716	62	1	2	780
Total Other*	49	8	1	0	58
Total	**765**	**70**	**2**	**2**	**839**
SIMPSON					
Total Res	145	7	0	0	152
Total Other*	14	1	0	0	15
Total	**159**	**8**	**0**	**0**	**167**
SMITH					
Total Res	1,017	154	9	7	1,187
Total Other*	35	12	2	0	49
Total	**1,052**	**166**	**11**	**7**	**1,236**
STONE					
Total Res	66	461	1,504	3,855	5,886
Total Other*	7	43	418	91	559
Total	**72**	**504**	**1,922**	**3,946**	**6,444**
UNION					
Total Res	30	0	0	0	30
Total Other	26	0	0	0	26
Total	**56**	**0**	**0**	**0**	**56**

COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
WALTHALL					
Total Res	101	4	0	0	104
Total Other*	8	1	0	0	9
Total	**109**	**4**	**0**	**0**	**114**
WAYNE					
Total Res	3,038	2,524	908	704	7,175
Total Other*	176	229	171	10	586
Total	**3,214**	**2,754**	**1,079**	**714**	**7,761**
WEBSTER					
Total Res	7	0	0	0	7
Total Other*	1	0	0	0	1
Total	**8**	**0**	**0**	**0**	**8**
WINSTON					
Total Res	346	15	0	0	362
Total Other*	21	2	0	0	23
Total	**367**	**17**	**0**	**0**	**385**

FIGURE 3.3.8


Windspeed of Category 5 Hurricane
Jackson County Landfall
Tennessee
Arkansas
Louisiana
Alabama
NE MS PDD
North Delta PDD
Three Rivers PDD
South Delta PDD
North Central PDD
Golden Triangle PDD
Central MS PDD
East Central MS PDD
Southwest MS PDD
Southern MS PDD
Legend
Hurricane Track
Planning and Development Districts
County Boundary
Peak Gust (MPH) Wind Equivalent
0 - 73 Tropical Storm
74 - 95 Hurricane Category 1
96 - 110 Hurricane Category 2
111 - 130 Hurricane Cagegory 3
131 - 155 Hurricane Category 4
156 - 234 Hurricane Category 5
0 25 50 100
Miles
Source: HAZUS-MH MR4

Estimating Potential Losses by Jurisdiction

Tables in this plan section show total potential losses to counties based on the expected dollar losses to the numbers of damaged buildings listed previously, by HAZUS-MH scenario. Each of the four degree of damage categories are included in the loss estimates. These tables also provide the HAZUS-MR4 estimation of the total building value in each of the jurisdictions and a building loss ratio. The building loss ratio is an average of the loss ratios for each of the three scenarios. When compared with the potential losses the total building value and loss ratios add to the understanding of the impact of hurricane events. Only those counties sustaining total building damages of $500,000 in one or more of the scenarios are included in the estimates.

Tables 3.3.12 and 3.3.13 show the total economic losses that could be sustained. Included in the total economic loss tables are building damages, economic losses to building contents and inventory, relocation costs, capital related losses, wage and rental income losses. Only those counties sustaining total building damages of $500,000 in one or more of the scenarios are included in the estimates.

The tables provide a clear picture of the losses that could be sustained from each of the three scenarios for the three categories of event. Apparent in the data to the point of not needing to be stated is the very high vulnerability of three coastal counties and diminishing vulnerability of counties as the storms moved northward.

Table 3.3.12
Damaged Buildings Losses in Mississippi Counties from Category 5 Hurricane
(Expressed In Thousands Of Dollars)

TOTAL LOSSES TO BUILDINGS DAMAGED - ALL COUNTIES			
Occupancy	Hancock Scenario	Harrison Scenario	Jackson Scenario
Total Losses	4,822,457	14,678,214	25,602,153

DAMAGED BUILDINGS LOSSES BY COUNTY					
County	Hancock Scenario ($)	Harrison Scenario ($)	Jackson Scenario ($)	Total Building Value ($)	Average Building Loss Ratio (%)
Adams	0	0	0	2,102,922	0.00
Alcorn	0	0	285	2,215,184	0.00
Amite	0	1,177	0	613,327	0.06
Attala	1,399	2,563	686	908,007	0.17
Benton	0	20	0	357,060	0.00
Bolivar	0	0	0	1,829,325	0.00
Calhoun	0	855	37	750,090	0.04

DAMAGED BUILDINGS LOSSES BY COUNTY

County	Hancock Scenario ($)	Harrison Scenario ($)	Jackson Scenario ($)	Total Building Value ($)	Average Building Loss Ratio (%)
Carroll	1,874	98	0	412,214	0.16
Chickasaw	0	120	952	1,123,958	0.03
Choctaw	0	827	683	430,529	0.12
Claiborne	0	0	0	496,880	0.00
Clarke	0	4,526	45,190	786,682	2.11
Clay	0	41	943	1,048,550	0.03
Coahoma	0	0	0	1,400,593	0.01
Copiah	3,073	920	0	1,479,171	0.09
Covington	40,372	61,785	13,431	838,000	4.60
Desoto	1,543	0	0	7,903,378	0.04
Forrest	44,661	1,351,272	903,154	4,413,794	17.36
Franklin	0	220	0	381,860	0.02
George	72	875,896	858,738	954,965	60.55
Greene	0	236,388	305,639	471,925	38.28
Grenada	2,094	139	0	1,262,312	0.06
Hancock	1,399,791	886,439	1,987,056	2,701,697	52.72
Harrison	775,325	1,578,673	12,059,526	13,110,388	36.65
Hinds	184,250	11,633	0	16,727,302	0.39
Holmes	5,218	385	0	779,541	0.24
Humphreys	202	0	0	456,609	0.01
Issaquena	0	0	0	70,837	0.00
Itawamba	0	0	82	1,278,969	0.00
Jackson	5,763	4,933,046	7,191,300	7,477,316	54.08
Jasper	347	31,816	34,408	674,984	3.29
Jefferson	0	0	0	444,947	0.00
Jefferson Davis	117,639	11,048	1,211	479,948	9.02
Jones	5,093	395,825	364,071	3,460,598	7.37
Kemper	0	220	2,100	444,383	0.17
Lafayette	271	47	0	2,042,059	0.01
Lamar	122,916	750,004	246,494	2,020,306	18.47

DAMAGED BUILDINGS LOSSES BY COUNTY

County	Hancock Scenario ($)	Harrison Scenario ($)	Jackson Scenario ($)	Total Building Value ($)	Average Building Loss Ratio (%)
Lauderdale	0	7,805	83,152	4,743,048	0.64
Lawrence	10,711	3,490	242	644,034	0.75
Leake	1,377	5,753	2,556	978,724	0.33
Lee	0	0	3,115	5,207,272	0.02
Leflore	3,665	0	0	1,984,395	0.06
Lincoln	389	3,627	60	1,800,417	0.08
Lowndes	0	0	928	3,552,285	0.01
Madison	174,113	8,743	144	5,819,504	1.05
Marion	264,978	143,222	7,231	1,132,955	12.22
Marshall	312	0	0	1,592,078	0.01
Monroe	0	0	321	2,017,470	0.01
Montgomery	722	508	21	587,210	0.07
Neshoba	34	4,519	11,822	1,336,316	0.41
Newton	86	13,592	24,242	1,111,930	1.14
Noxubee	0	65	865	498,234	0.06
Oktibbeha	0	393	3,751	2,053,195	0.07
Panola	1,751	0	0	1,393,691	0.01
Pearl River	1,177,202	2,342,016	512,290	2,546,003	52.78
Perry	346	212,091	237,873	459,402	32.67
Pike	203	14,665	501	2,131,888	0.24
Pontotoc	0	440	330	1,317,896	0.02
Prentiss	0	0	243	1,292,454	0.01
Quitman	75	0	0	364,116	0.05
Rankin	319,535	22,087	1,421	7,582,414	1.51
Scott	3,335	17,657	5,528	1,193,799	0.74
Sharkey	0	0	0	276,403	0.00
Simpson	133,428	16,936	1,967	1,320,508	3.85
Smith	5,699	29,341	8,668	712,085	2.05
Stone	4,024	623,841	515,840	663,682	57.44
Sunflower	26	0	0	1,252,043	0.00

DAMAGED BUILDINGS LOSSES BY COUNTY					
County	**Hancock Scenario ($)**	**Harrison Scenario ($)**	**Jackson Scenario ($)**	**Total Building Value ($)**	**Average Building Loss Ratio (%)**
Tallahatchie	651	0	0	446,726	0.02
Tate	724	0	0	1,171,451	
Tippah	0	164	28	1,168,843	0.01
Tishomingo	0	0	0	1,196,846	
Tunica	0	0	0	480,580	
Union	0	434	102	1,293,967	0.01
Walthall	3,287	45,299	1,310	594,424	2.80
Warren	0	0	0	3,143,937	0.00
Washington	0	0	0	3,324,576	0.00
Wayne	0	23,472	158,103	892,060	6.78
Webster	0	572	257	485,701	0.06
Wilkinson	0	49	0	453,116	0.00
Winston	0	1,337	3,256	973,752	0.16
Yalobusha	544	22	0	621,514	0.03
Yazoo	3,338	87	0	1,253,838	0.09
TOTAL	**4,822,457**	**14,678,214**	**25,602,153**	**159,417,392**	**9.43**

Assessing Vulnerability of State Facilities/Estimating Potential Losses

Methodology for Assessing Vulnerability of State Facilities

The methodology and HAZUS runs for assessing vulnerability of state facilities was not updated for the 2010 plan update due to the fact that the inventory has not been improved.

State plan developers also elected to use the HAZUS-MH Level 1 scenarios as explained in the section on Assessing Vulnerability by Jurisdiction to assess the vulnerability of State-owned critical or operated facilities located in hurricane hazard areas.

The HAZUS-MH scenarios provided damage states and loss estimates for government buildings but not for the HAZUS-MH inventory categories of Transportation Lifeline Systems, Lifeline Utility Systems and Essential Facilities.

As stated in the section on Critical Facilities and Infrastructure at the beginning of the risk assessment, Critical Facilities are addressed under the category of Essential Facilities and Infrastructure is addressed under the categories of Transportation Lifeline Systems and Lifeline Utility Systems. Other state-owned or operated buildings are addressed under the category of Government-owned Buildings.

The HAZUS-MH scenarios returned a building stock potential loss ratio for each county in each of the scenarios. The ratio is the percentage of property damage (building and contents damage and inventory loss) to the HAZUS-MH inventory. In the absence of damage and loss information for the HAZUS-MH categories as noted above, plan developers decided to total the value of the overall inventory of each of the categories and apply the loss ratio to the total to determine potential losses. Though HAZUS-MH did return damage and losses for government-owned buildings, to remain consistent in the analysis the loss ratio was also applied to total inventory value in this category to determine potential losses.

Tables 3.3.13, 3.3.14 and 3.3.15 were created to display the data. They list the number and value of facilities under the four categories:

- **Government Buildings -** city, county, state and federal buildings and emergency response facilities not contained in other categories.
- **Transportation Lifeline Systems -** air, road, rail and water systems; (Note: The HAZUS-MH inventory for roads lists road segments not single roads thus the large number of facilities listed in this category).
- **Utility Lifeline Systems -** potable water, wastewater, oil, natural gas, electric power and communication systems;
- Essential Facilities - schools, police and fire station, emergency management and medical facilities.

The value of all four types of facilities was totaled in the tables and the loss ratio is applied to the total by county to produce the estimate of potential losses.

As in the tables illustrating Vulnerability by Jurisdiction only those counties receiving total damages of $500,000 or more were included in this analysis.

With the limitations noted below, the tables provide a clear picture of the losses that could be sustained from each of the three scenarios for the three categories of event. Apparent in the data is the very high vulnerability of state-owned or operated facilities in the three coastal counties and diminishing vulnerability of such as the storms moved northward.

Data Limitations:

For the category of government buildings HAZUS-MH does not distinguish between federal, state or local ownership or building operation. Nor does it distinguish between federal, state, local or private ownership in the three other categories of facilities addressed the assessment. Therefore all facilities regardless of ownership are included in the assessment.

The State of Mississippi does not have a comprehensive list of state-owned or operated buildings, critical facilities and infrastructure sorted by county that could be input into HAZUS-MH to conduct a Level 2 analysis. During the 2007 update state facilities data was available in tabular form from the Department of Finance and Administration, but did not include XY coordinates, and thus could not be incorporated into

HAZUS-MH. Given those limitations, plan developers determined that the HAZUS-MH default inventory data was the “best available data,” even though all facilities are represented in the data, not just state-owned or operated buildings, critical facilities and infrastructure.

Transportation Lifeline Systems/Roads: Data in the HAZUS-MH inventories is listed by census tracts for all facilities with the exception of road segments in the Transportation Lifeline Systems. The road segment inventory is listed by Federal Information Processing Standards (FIPS) Codes. Due to time constraints during plan development the state was unable to cross reference highways segments listed by FIPS codes to Mississippi Counties. Therefore the number and value of road segments are not included in the data tables under Transportation Lifeline Systems.

It was also apparent that HAZUS-MH does not have a complete listing of state-owned or operated facilities in its default database. The state has a continuing strategy to address these data limitations for future plan updates. That strategy is included in the mitigation strategy section of the plan.

A tabular-based analysis of the 2007 state facilities inventory was conducted in lieu of GIS-based facilities data to analyze potential losses to the state (Table 3.3.13). The inventory of facilities and replacement value by county was analyzed using the average building loss ratios from the Category 5 Hurricane HAZUS-MH scenario to model worst case losses. This loss ratio was multiplied by the total replacement value to estimate potential loss. Based on this methodology the state could incur $1 billion in losses to state facilities. The details by county, ranked in order of potential loss, are presented below for the counties analyzed in the Category 5 Hurricane scenario. Also included in this table are the estimated number of state facilities that were destroyed by Hurricane Katrina. Note that some of the higher risk areas for state facility losses are not coastal counties.

Table 3.3.13
Potential Loss to State Facilities based on a Category 5 Hurricane (Ranked by Potential Loss)

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	HAZUS-MH Category 5 Hurricane Building Loss Ratio %	HAZUS-MH Category 5 Hurricane potential $ Loss	Number destroyed in Katrina
Hinds	904	$2,260,042,306	39.51	$892,942,715	31
Forrest	468	$826,616,644	9.52	$78,693,904	20
Harrison	70	$186,747,529	39.54	$73,839,973	37
Pearl River	73	$124,168,038	22.97	$28,521,398	1

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	HAZUS-MH Category 5 Hurricane Building Loss Ratio %	HAZUS-MH Category 5 Hurricane potential $ Loss	Number destroyed in Katrina
Jones	111	$111,053,719	4.63	$5,141,787	
Rankin	181	$407,397,838	0.95	$3,870,279	8
Marion	42	$32,622,457	9.21	$3,004,528	1
Lamar	7	$12,002,573	12.04	$1,445,110	
Simpson	64	$54,879,521	2.53	$1,388,452	12
Hancock	7	$2,642,640	44.4	$1,173,332	
Newton	119	$121,425,667	0.96	$1,165,686	5
Covington	4	$16,994,408	6.1	$1,036,659	
Oktibbeha	492	$1,564,880,015	0.06	$938,928	10
Holmes	84	$130,428,429	0.53	$691,271	
Jackson	8	$2,052,890	32.35	$664,110	
Lauderdale	72	$139,658,554	0.29	$405,010	6
Copiah	89	$117,138,686	0.25	$292,847	
George	4	$1,449,000	16.04	$232,420	
Kemper	50	$95,680,386	0.24	$229,633	1
Leflore	91	$233,472,584	0.08	$186,778	1
Madison	13	$21,106,017	0.87	$183,622	
Lowndes	57	$313,749,777	0.03	$94,125	6

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	HAZUS-MH Category 5 Hurricane Building Loss Ratio %	HAZUS-MH Category 5 Hurricane potential $ Loss	Number destroyed in Katrina
Perry	6	$751,484	10.58	$79,507	1
Attala	3	$16,569,000	0.41	$67,933	
Stone	2	$277,200	19.87	$55,080	
Greene	2	$783,720	6.61	$51,804	
Pike	49	$103,333,019	0.05	$51,667	1
Jefferson Davis	1	$766,080	5.78	$44,279	
Yazoo	18	$11,604,369	0.25	$29,011	
Wayne	4	$1,552,530	1.75	$27,169	2
Smith	2	$840,000	2.09	$17,556	
Walthall	3	$1,305,570	1.05	$13,708	
Scott	5	$955,468	1.15	$10,988	
Lincoln	15	$11,571,284	0.08	$9,257	
Warren	14	$27,137,459	0.03	$8,141	1
Jasper	3	$414,540	1.68	$6,964	
Lawrence	2	$387,660	1.42	$5,505	1
Neshoba	6	$1,097,460	0.45	$4,939	
Washington	78	$45,673,795	0.01	$4,567	
Clarke	3	$663,264	0.52	$3,449	

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	HAZUS-MH Category 5 Hurricane Building Loss Ratio %	HAZUS-MH Category 5 Hurricane potential $ Loss	Number destroyed in Katrina
Leake	4	$1,326,192	0.25	$3,315	
Noxubee	11	$2,323,460	0.14	$3,253	1
Grenada	8	$2,787,960	0.1	$2,788	
Carroll	5	$791,742	0.18	$1,425	
Winston	3	$372,771	0.32	$1,193	
Choctaw	3	$516,600	0.23	$1,188	
Humphreys	3	$786,660	0.15	$1,180	3
Webster	3	$766,500	0.1	$767	
Montgomery	4	$1,212,412	0.06	$727	
Sunflower	4	$973,140	0.04	$389	
Clay	3	$549,675	0.04	$220	
Monroe	25	$17,188,366	0	$0	
Sharkey	3	$1,002,120	0	$0	
Bolivar	79	$302,700,858	0	$0	3
TOTAL				**$1,096,650,537**	

Table 3.3.14
Point of Impact Hancock County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 175

Though there was damage in other counties, 42 counties received more than $500,000 in total damage in this scenario. Those counties were Attala, Carroll, Choctaw, Clarke, Copiah, Covington, Forrest, George, Grenada, Hancock, Harrison, Hinds, Holmes, Humphreys, Jackson, Jasper, Jefferson Davis, Jones, Lamar, Lauderdale, Lawrence, Leake, Leflore, Lincoln, Lowndes, Madison, Marion, Montgomery, Neshoba, Newton, Pearl River, Perry, Pike, Rankin, Scott, Simpson, Smith, Stone, Sunflower, Walthall, Wayne, Washington, Winston and Yazoo Counties.

(Values in Thousands of Dollars)

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE										
	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES			
	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Total Estimated Loss
All Counties	332	381,608	9,662	14,062,314	521	15,160,614	1,451	1,426,130	31,030,666	1,953,370

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES		
County By PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value
SOUTHERN MISSISSIPPI PPD									
Covington	0	758	207	115,139	9	283,390	19	13,345	412,632
Forrest	4	4,352	221	215,457	20	381,021	30	27,540	628,370
George	2	2,537	231	209,041	6	187,340	44	29,580	428,498
Hancock	14	14,772	103	375,077	4	57,707	34	30,685	478,241
Harrison	34	37,146	320	1,388,120	21	716,975	129	228,055	2,370,296
Jackson	48	50,154	487	3,215,788	42	1,179,460	113	74,120	4,519,522
Jefferson Davis	0	428	114	142,023	5	114,232	16	22,950	279,633
Jones	8	7,921	295	304,494	18	492,303	54	40,545	845,263
Lamar	2	2,672	109	104,806	8	235,365	30	28,220	371,063
Marion	1	1,507	179	192,342	9	228,548	15	14,790	437,187
Pearl River	12	12,364	251	497,115	7	226,695	42	39,355	775,529
Perry	0	148	119	129,452	5	170,842	16	14,960	315,402
Stone	0	515	108	85,747	11	114,827	7	4,590	205,679
SOUTHWEST MISSISSIPPI PPD									
Lawrence	0	879	113	91,188	6	227,452	6	11,220	330,739
Lincoln	2	2,195	322	156,945	3	56,780	21	16,745	232,665
Pike	5	7,824	220	114,162	16	660,025	31	27,115	809,126
Walthall	3	3,037	131	118,710	5	58,633	10	8,840	189,220
CENTRAL MISSISSIPPI PPD									
Copiah	2	3,278	292	194,163	11	396,610	25	19,465	613,516
Hinds	80	93,345	679	947,782	58	1,643,458	191	186,660	2,871,245
Madison	6	8,655	361	510,344	20	653,378	51	33,405	1,205,782
Rankin	12	13,206	399	542,425	21	568,718	75	65,705	1,190,054

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County By PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Simpson	1	965	211	193,031	5	226,525	29	20,485	441,006	5.67	25,005
Warren	11	11,426	190	344,205	14	292,315	40	45,645	693,591	0.09	624
Yazoo	6	6,280	408	457,300	17	662,635	24	17,340	1,143,555	0.55	6,290
EAST CENTRAL MISSISSIPPI PDD											
Jasper	2	1,822	185	146,458	12	266,535	18	17,000	431,815	0.15	648
Lauderdale	14	15,738	495	498,954	24	294,848	60	87,380	896,920	0.03	269
Leake	1	1,480	138	140,628	5	113,475	17	14,620	270,203	0.59	1,594
Neshoba	8	9,336	198	233,180	6	226,610	24	27,625	496,751	0.18	894
Newton	5	5,228	198	129,196	7	339,745	23	22,015	496,184	0.19	943
Scott	5	5,481	167	72,874	8	283,305	16	14,790	376,450	0.86	3,237
Smith	5	5,981	139	96,732	2	113,220	11	8,670	224,603	1.17	2,628
GOLDEN TRIANGLE PPD											
Choctaw	2	1,390	94	68,778	8	357,085	10	12,155	439,408	0.10	439
Winston	3	2,996	143	91,650	7	227,537	16	21,505	343,688	0.11	378
NORTH CENTRAL MISSISSIPPI PPD											
Attala	1	2,095	175	105,508	9	265,438	18	15,725	388,766	0.40	1,555
Carroll	1	1,788	196	198,804	2	113,220	8	6,545	320,357	0.27	865

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County By PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Grenada	2	2,445	149	180,194	5	170,000			352,639	0.06	212
Holmes	3	3,831	250	278,225	12	397,537	31	27,540	707,133	0.51	3,606
Leflore	6	7,535	134	145,916	19	697,170	29	29,325	879,946	0.16	1,408
Montgomery	2	2,467	291	176,037	9	283,390	24	20,740	482,634	0.16	772
SOUTH DELTA PPD											
Humphreys	0	1,776	91	115,676	6	170,927	11	9,690	298,069	0.29	864
Sunflower	13	12,207	162	122,245	19	567,707	37	33,575	735,734	0.09	662
Washington	6	11,648	387	616,403	20	437,631	46	35,870	1,101,552	0.03	330

Table 3.3.15
Point of Impact Harrison County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 177

Though there was damage in other counties, 43 counties received more than $500,000 in damage in this scenario. Those counties were Attala, Carroll, Choctaw, Clarke, Copiah, Covington, Forrest, George, Greene, Hancock, Harrison, Hinds, Holmes, Jackson, Jasper, Jefferson Davis, Jones, Kemper, Lamar, Lauderdale, Lawrence, Leake, Leflore, Lowndes, Madison, Marion, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Rankin, Scott, Simpson, Smith, Stone, Walthall, Wayne, Webster, Winston and Yazoo Counties.

(Values in Thousands of Dollars)

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE										
	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES			
	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Total Estimated Loss
All Counties	338	380,307	9,492	13,887,347	489	14,209,788	1,419	1,394,425	29,690,158	4,745,059

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
SOUTHERN MISSISSIPPI PPD											
Covington	0	758	207	115,139	9	283,390	19	13,345	412,632	11.35	46,834
Forrest	4	4,352	221	215,457	20	381,021	30	27,540	628,370	23.07	144,965
George	2	2,537	231	209,041	6	187,340	44	29,580	428,498	1.33	5,699
Greene	5	5,382	163	186,112	5	170,842	15	10,625	478,241	0.39	1,865
Hancock	14	14,772	103	375,077	4	57,707	34	30,685	2,370,296	39.35	932,711
Harrison	34	37,146	320	1,388,120	21	716,975	129	228,055	4,519,522	70.43	3,183,099
Jackson	48	50,154	487	3,215,788	42	1,179,460	113	74,120	279,633	25.67	71,782
Jefferson Davis	0	428	114	142,023	5	114,232	16	22,950	845,263	1.39	11,749
Jones	8	7,921	295	304,494	18	492,303	54	40,545	371,063	5.97	22,152
Lamar	2	2,672	109	104,806	8	235,365	30	28,220	437,187	23.45	102,520
Marion	1	1,507	179	192,342	9	228,548	15	14,790	775,529	1.28	9,927
Pearl River	12	12,364	251	497,115	7	226,695	42	39,355	315,402	8.03	25,327
Perry	0	148	119	129,452	5	170,842	16	14,960	205,679	8.48	17,442
Stone	0	515	108	85,747	11	114,827	7	4,590	191,252	48.11	92,011
Wayne	3	3,810	135	113,330	4	57,707	17	16,405	191,252	0.20	383
Lawrence	0	879	113	91,188	6	227,452	6	11,220	330,739	0.15	496
Walthall	3	3,037	131	118,710	5	58,633	10	8,840	189,220	0.09	170

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
CENTRAL MISSISSIPPI PDD											
Copiah	2	3,278	292	194,163	11	396,610	25	19,465	613,516	0.07	429
Hinds	80	93,345	679	947,782	58	1,643,458	191	186,660	2,871,245	0.24	6,891
Madison	6	8,655	361	510,344	20	653378	51	33,405	1,205,782	0.55	6,632
Rankin	12	13,206	399	542,425	21	568,718	75	65,705	1,190,054	0.68	8,092
Simpson	1	965	211	193,031	5	226,525	29	20,485	441,006	1.84	8,115
Yazoo	6	6,280	408	457,300	17	662,635	24	17,340	1,143,555	0.17	1,944
EAST CENTRAL MISSISSIPPI PDD											
Clarke	1	1,209	189	144,122	8	172,779	19	15,555	333,665	0.13	434
Jasper	2	1,822	185	146,458	12	266,535	18	17,000	431,815	1.48	6,391
Kemper	2	1797	155	123,844	4	114,232	8	5,015	244,888	0.15	367
Lauderdale	14	15,738	495	498,954	24	294,848	60	87,380	896,920	0.13	1,166
Leake	1	1,480	138	140,628	5	113,475	17	14,620	270,203	1.01	2,729
Neshoba	8	9,336	198	233,180	6	226,610	24	27,625	496,751	0.55	2,732
Newton	5	5,228	198	129,196	7	339,745	23	22,015	496,184	0.81	4,019
Scott	5	5,481	167	72,874	8	283,305	16	14,790	376,450	1.79	6,738
Smith	5	5,981	139	96,732	2	113,220	11	8,670	224,603	4.33	9,725

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
GOLDEN TRIANGLE PDD											
Choctaw	2	1,390	94	68,778	8	357,085	10	12,155	439,408	0.26	1,142
Lowndes	18	17,922	196	416,281	13	434,512	47	42,840	911,555	0.02	182
Noxubee	2	2,357	169	254,303	4	170,757	10	12,410	439,827	0.08	352
Oktibbeha	9	10,278	178	131,194	8	113,730	26	19,720	274,922	0.05	137
Webster	5	5,465	166	105,677	5	170,000	12	14,365	295,507	0.11	325
Winston	3	2,996	143	9,1650	7	227,537	16	21,505	343,688	0.31	1,065
NORTH CENTRAL PDD											
Attala	1	2,095	175	105,508	9	265,438	18	15,725	388,766	0.52	2,022
Carroll	1	1,788	196	198,804	2	113,220	8	6,545	320,357	0.20	641
Holmes	3	3,831	250	278,225	12	397,537	31	27,540	707,133	0.30	2,121
Leflore	6	7,535	134	145,916	19	697,170	29	29,325	879,946	0.07	616
Montgomery	2	2,467	291	176,037	9	283,390	24	20,740	482,634	0.19	917

Table 3.2.16
Point of Impact Jackson County
Category 5 Storm Vulnerability
Peak Gust Wind Speed (MPH) 174

Though there was damage in other counties 37 counties received more than $500,000 in damage in this scenario. Those counties were Attala, Choctaw, Clarke, Clay, Covington, Forrest, George, Greene, Hancock, Harrison, Hinds, Holmes, Jackson, Jasper, Jones, Kemper, Lamar, Lauderdale, Leake, Lowndes, Madison, Monroe, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Pearl River, Perry, Rankin, Scott, Simpson, Smith, Stone, Wayne, Webster, and Winston Counties.

(Values in Thousands of Dollars)

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE										
	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES			
	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Total Estimated Loss
All Counties	322	360,498	8,410	12,959,449	441	12,259,955	1,337	1,304,070	26,883,972	4,187,970

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
SOUTHERN MISSISSIPPI PPD											
Covington	0	758	207	115,139	9	283,390	19	13,345	412,632	0.34	1,403
Forrest	4	4,352	221	215,457	20	381,021	30	27,540	628,370	2.73	17,155
George	2	2,537	231	209,041	6	187,340	44	29,580	428,498	46.72	200,194
Greene	5	5,382	163	186,112	5	170,842	15	10,625	372,961	19.77	73,734
Hancock	14	14,772	103	375,077	4	57,707	34	30,685	478,241	0.24	1,148
Harrison	34	37,146	320	1,388,120	21	716,975	129	228,055	2,370,296	19.86	470,741
Jackson	48	50,154	487	3,215,788	42	1,179,460	113	74,120	4,519,522	70.72	
Jones	8	7,921	295	304,494	18	492,303	54	40,545	845,263	7.52	63,564
Lamar	2	2,672	109	104,806	8	235,365	30	28,220	371,063	0.54	2,004
Pearl River	12	12,364	251	497,115	7	226,695	16	22,950	759,124	0.08	607
Perry	0	148	119	129,452	5	170,842	16	14,960	315,402	22.96	72,416
Stone	0	515	108	85,747	11	114,827	7	4,590	205,679	8.28	17,030
Wayne	3	3,810	135	113,330	4	57,707	17	16,405	191,252	5.44	10,404
CENTRAL MISSISSIPPI PDD											
Hinds	80	93,345	679	947,782	58	1,643,458	191	186,660	2,871,245	0.03	861
Madison	6	8,655	361	510,344	20	653,378	51	33,405	1,205,782	0.08	965
Rankin	12	13,206	399	542,425	21	568,718	75	65,705	1,190,054	0.08	952

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Simpson	1	965	211	193,031	5	226,525	29	20,485	441,006	0.08	353
EAST CENTRAL MISSISSIPPI PDD											
Clarke	1	1,209	189	144,122	8	172,779	19	15,555	333,665	1.41	4,705
Jasper	2	1,822	185	146,458	12	266,535	18	17,000	431,815	3.42	14,768
Kemper	2	1,797	155	123,844	4	114,232	8	5,015	244,888	0.55	1,347
Lauderdale	14	15,738	495	498,954	24	294,848	60	87,380	896,920	0.85	7,624
Leake	1	1,480	138	140,628	5	113,475	17	14,620	270,203	0.61	1,648
Neshoba	8	9,336	198	233,180	6	226,610	24	27,625	496,751	1.00	4,968
Newton	5	5,228	198	129,196	7	339,745	23	22,015	496,184	1.87	9,279
Scott	5	5,481	167	72,874	8	283,305	16	14,790	376,450	0.80	3,012
Smith	5	5,981	139	96,732	2	113,220	11	8,670	224,603	0.78	1,752
GOLDEN TRIANGLE PDD											
Choctaw	2	1,390	94	68,778	8	357,085	10	12,155	439,408	0.33	1,450
Clay	0	1,181	242	316,611	15	227,375	30	22,270	567,437	0.09	511
Lowndes	18	17,922	196	416,281	13	434,512	47	42,840	911,555	0.07	638
Noxubee	2	2,357	169	254,303	4	170,757	10	12,410	439,827	0.33	1,451
Oktibbeha	9	10,278	178	131,194	8	113,730	26	19,720	274,922	0.13	357
Webster	5	5,465	166	105,677	5	170,000	12	14,365	295,507	0.13	384

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE

	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County by PDD	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Winston	3	2,996	143	91,650	7	227,537	16	21,505	343,688	0.55	1,890
NORTH CENTRAL PDD											
Attala	1	2,095	175	105,508	9	265,438	18	15,725	388,766	0.31	1,205
Holmes	3	3,831	250	278,225	12	397,537	31	27,540	707,133	0.08	566
Montgomery	2	2,467	291	176,037	9	283,390	24	20,740	482,634	0.10	483
THREE RIVERS PDD											
Monroe	3	3,742	243	295,937	11	321,292	47	34,255	655,226	0.03	197

Category 3 and Category 1 Storm Vulnerability: Potential Losses to State Facilities

Summaries of the potential losses to state facilities for Category 3 and Category 1 hurricanes are below. The details can be found in Appendix 7.3.3-B.

Category 3 Storm Vulnerability: Potential Losses to State Facilities

Point of Impact Hancock County: Peak gust Wind Speed (MPH) 148—Though there was damage in other counties, 20 counties received more than $500,000 in damage in this scenario. Those counties were Copiah, Covington, Forrest, Hancock, Harrison, Hinds, Jackson, Jasper, Jefferson Davis, Jones, Lamar, Lawrence, Marion, Pearl River, Rankin, Scott, Simpson, Smith, Stone and Walthall Counties.

Point of Impact Harrison County: Peak Gust Wind Speed (MPH) 149—Though there was damage in other counties, 20 counties received more than $500,000 in damage in this scenario. Those counties were Covington, Forrest, George, Hancock, Harrison, Hinds, Jackson, Jasper, Jefferson Davis, Jones, Lamar, Lawrence, Marion, Pearl River, Perry, Rankin, Scott, Simpson, Smith and Stone Counties.

Point of Impact Jackson County: Peak Gust Wind Speed (MPH) 148—Though there was damage in other counties, 17 counties received more than $500,000 in damage in this scenario. Those counties were Clarke, Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jasper, Jones, Lamar, Lauderdale, Newton, Perry, Smith, Stone and Wayne Counties.

Category 1 Storm Vulnerability: Potential Losses to State Facilities

Point of Impact Hancock County: Peak Gust Wind Speed (MPH) 105—Though there was damage in other counties, 12 counties received more than $500,000 in damage in this scenario. Those counties were Covington, Forrest, Hancock, Harrison, Jackson, Jefferson Davis, Jones, Lamar, Marion, Pearl River, Stone and Walthall Counties.

Point of Impact Harrison County: Peak Gust Wind Speed (MPH) 104—Though there was damage in other counties, 13 counties received more than $500,000 in damage in this scenario. Those counties were Covington, Forrest, George, Green, Hancock, Harrison, Jackson, Jones, Lamar, Pearl River, Perry, Stone and Wayne Counties.

Point of Impact Jackson County: Peak Gust Wind Speed (MPH) 103—Though there was damage in other counties, 11 counties received more than $500,000 in damage in this scenario. Those counties were Forrest, George, Greene, Hancock, Harrison, Jackson, Jones, Lamar, Perry, Stone and Wayne Counties.

3.4: Wildfire Risk Assessment
Significant Hazard

Hazard Description

A wildfire is any fire that burns uncontrollably in a natural setting (such as, grasslands, forest, and brush land). Prescribed burnings are the only exception to a wildfire. Wildfires can be either man-made or natural. The typical cause of natural wildfires is lightning.

Prescribed burning, also known as controlled burning, is the deliberate use of fire under specified and controlled conditions. Prescribed burns are used by forest management professionals and individual landowners to accomplish one or more of the following tasks:

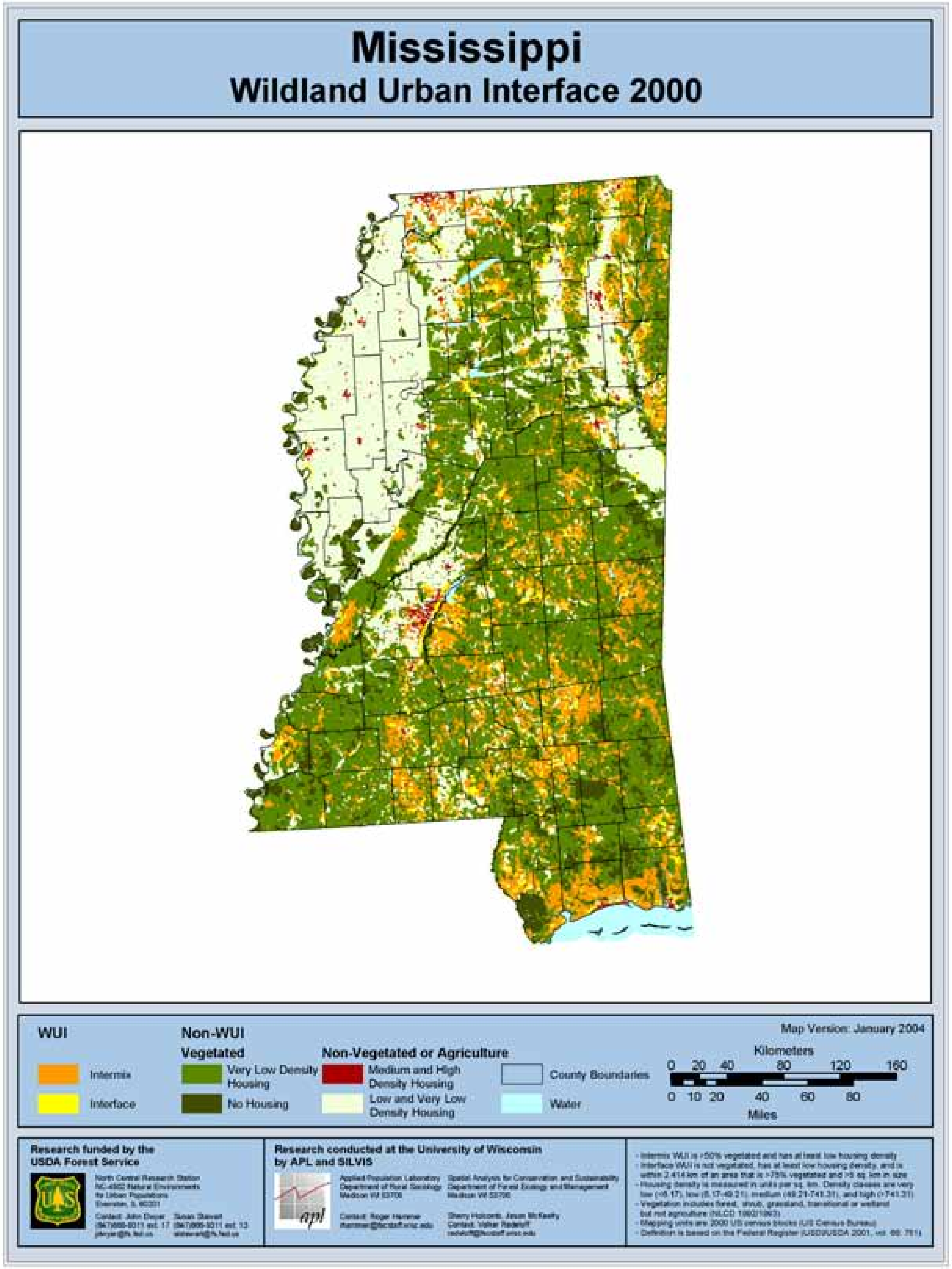
- **Fuel reduction:** The reduction of the accumulated grass, weeds, pine needles, and hardwood leaves that threaten wildfires in young stands and hinder regeneration of older stands.
- **Hardwood control:** Prevents hardwood trees from competing with pines for nutrients and moisture, impeding visibility and access through the stands and interfering with natural regeneration in areas where the land is better suited for growing pines.
- **Site preparation:** Reduces the number of small diameter hardwood and exposes mineral soil before harvest cutting.
- **Wildlife habitat improvement:** Prescribed burns in young stands encourages fresh, low vegetation for wildlife, removes heavy brush, and encourages growth of annual plants.
- **Disease control:** Burns done to reduce fuel before thinning trees may help control disease.
- **Harvest cutting area improvement:** Reducing brush growing low to the ground prior to harvesting trees. This increases visibility and expedites the marking and cutting of the selected trees. This form of prescribed burning can lower costs for the landowner and the logging professional.

Hazard Profile

Wildland/Urban Interface

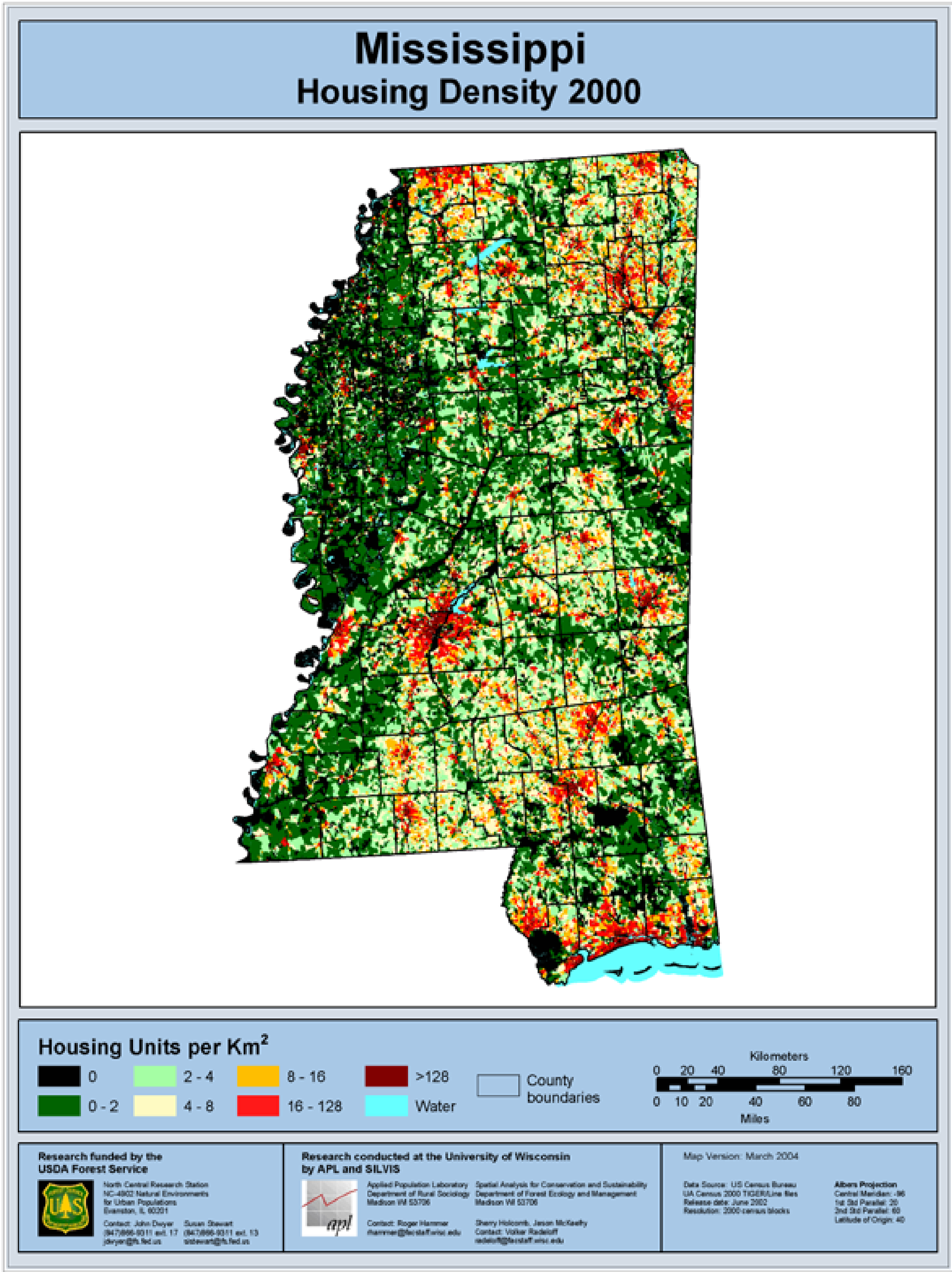
Mississippi averages 3,000 wildfires a year, more than most western states. As the population in rural areas increases, so do the issues facing Wildland/Urban Interface (WUI). Wildland/Urban Interface is the development of residential and commercial areas adjacent to or commingled with vegetative areas. In 2000, more than 56% of the homes in Mississippi were considered to be part of a WUI. As further development in forested areas has occurred, this number has increased, and wildfires in urban areas threaten human life, structures and wildland resources. As shown in Figure 3.4.1, WUI is broken into two categories, intermix and interface. Intermix defines housing and commercial development that is mixed in with wildland vegetation. Interface describes housing and commercial development in proximity to wildland vegetation. In addition, Figure 3.4.2 represents housing density.

Figure 3.4.1



Mississippi
Wildland Urban Interface 2000
WUI
Intermix
Interface
Non-WUI
Vegetated
Very Low Density Housing
No Housing
Non-Vegetated or Agriculture
Medium and High Density Housing
Low and Very Low Density Housing
County Boundaries
Water
Map Version: January 2004
Kilometers
0 20 40 80 120 160
0 10 20 40 60 80
Miles
Research funded by the USDA Forest Service
Research conducted at the University of Wisconsin by APL and SILVIS

Figure 3.4.2



Mississippi
Housing Density 2000
Housing Units per Km²
0
0 - 2
2 - 4
4 - 8
8 - 16
16 - 128
>128
Water
County boundaries
Kilometers
0 20 40 80 120 160
0 10 20 40 60 80
Miles
Research funded by the USDA Forest Service
Research conducted at the University of Wisconsin by APL and SILVIS
Map Version: March 2004
Data Source: US Census Bureau
Albers Projection

Mississippi Forest Facts

See *Mississippi Forest Facts* below to gain an understanding of the hazards wildfire poses to lives, homes, other structures and state's forestry industry. This information is provided by the Mississippi Forestry Commission.

MISSISSIPPI FOREST FACTS

Forestland and Type

- Total land area of Mississippi is 30.2 million acres.
- Total forest acreage is 20 million.
- Of the forestlands, 18.4 million acres are available for commercial use.
- Commercial forestland in the State consists of 49% hardwood, 11% oak/pine, 40% pine.
- The most prevalent hardwood forest types are oak/hickory.
- The most prevalent pine forest types are loblolly/shortleaf.

Commercial Forestland Ownership

- Government owned forest 12%.
- Forest industry 10%.
- Private non-industrial owners 78%.

Forest Economy

- Forestry directly creates 15,163 jobs statewide and supports a total of 123,659 jobs.
- Mississippi forests create a $17.4 billion value added to the economy each year.
- Forest products include paper and allied products, wood furniture and related products, and lumber and wood products.

Forest Protection Responsibility

The Mississippi Forestry Commission (MFC) is responsible for protecting 18.6 million acres of private non-industrial forestland within the State.

Forest Protection System

MFC provides forest protection through the placement of county fire crews. A crew consists of a tractor-plow unit with an operator and helper. The number of crews located in a county is determined by wildland fire activity within that county as well as workload. The crews are dispatched for initial attack through one of six district offices located around the State. Wildland fires are reported to the district offices by toll-free telephone. The MFC also uses aircraft to patrol for wildland fires when the right conditions exist.

There are 756 county, municipal, and volunteer fire departments located in the State. The MFC crews coordinate with these departments (usually through a Unified Command) during wildland fire suppression activities. Administrative contacts are handled through the State Fire Coordinator and county fire coordinators.

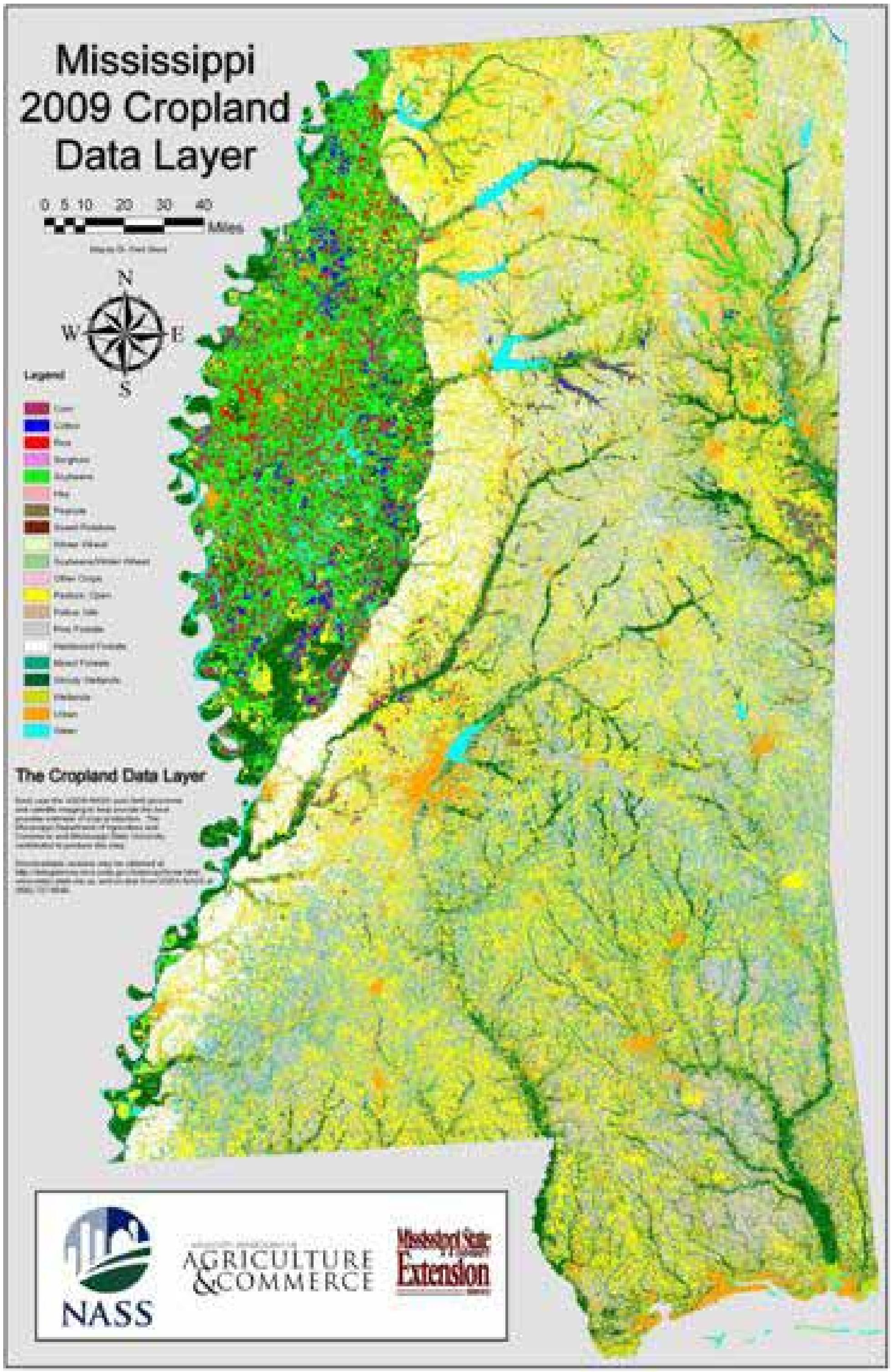
The MFC also works closely with Federal agencies through cooperative agreements and MOUs. Timber companies assist with wildland fires on their property and at times on private lands, but most companies have drastically reduced the amounts of equipment and personnel. Very few timber company crews are available to assist.

Wildland Fire Activity

Mississippi traditionally has two wildland fire seasons each year. The first season usually begins in late October with the first frost and hardwood leaf drop and runs through December. The second season usually begins in February and runs to mid-April or until spring green-up. These seasons vary from year to year, depending on rainfall, wind, and other weather factors. The southern one-third of the State generally tends to have the most wildland fire activity. The five-year average for wildland fires in Mississippi is 3,256 wildland fires and 55,820 acres. Average wildland fire size is close to 15.9 acres.

Although Mississippi has its share of WUI areas, relatively few homes and structures are lost to wildland fires. An average of 12 homes and eight other structures are lost each year to wildland fires. Another four homes and two structures are damaged each year. There are usually 15 vehicles damaged or destroyed by wildland fire each year.

Figure 3.4.3



Mississippi
2009 Cropland
Data Layer
0 5 10 20 30 40
Miles
N
W
E
S
Legend
The Cropland Data Layer
NASS
AGRICULTURE
&COMMERCE
Extension

Potential Damages from Wildfires

Agriculture is Mississippi's number one industry, employing 29% of the state's workforce either directly or indirectly. With approximately 42,000 farms in the state covering 11 million acres, wildfires in Mississippi could not only threaten human life, but economic viability as well. Table 3.4.1 presents Mississippi's top ten agricultural crops ranked and listed with their respective revenue for 2009. Mississippi's six main crops are cotton, corn, rice, soybean, wheat and hay. All of these crops have a significant impact on the state's economy. In 2008, all of Mississippi's field and miscellaneous crops had a $2 billion impact on Mississippi's economy.* As shown by the map in Figure 3.4.3, agriculture makes a significant impact in all of Mississippi's 82 counties.

*Source: United States Department of Agriculture

Table 3.4.1
Mississippi's Top Ten Agricultural Crops

Rank	Agricultural Crop	2009 Revenue
1	Poultry/Eggs	$2.3 billion
2	Forestry	$817 million
3	Soybeans	$432 million
4	Corn	$380 million
5	Rice	$214 million
6	Catfish	$182 million
7	Hay	$143 million
8	Cattle & Calves	$138 million
9	Cotton	$98 million
10	Horticulture	$93 million

Source: Mississippi Department of Agriculture and Commerce

Mississippi is comprised of over 19 million acres of timber and uncultivated lands. In 2006, forestry-related employment (i.e. direct, indirect, and induced) accounted for 8.5 percent of all jobs in Mississippi. Total industry output related to the forest products industry exceeded $17.37 billion. Forestry-related industry provided more than 51,000 jobs and $2.1 billion in wages in 2006, and generated over $1.66 billion in tax revenue. Federal government non-defense taxes exceeded $1 billion. (See jobs and wages Table 3.4.2) Timber is the leading agricultural crop in 40 of the 82 counties. With commercial forests making up 61% of Mississippi's total land area, wildfires pose a serious threat to the economic viability of the state's timber industry.

Table 3.4.2
Direct Impact of Mississippi's Forest Industry on Jobs and Wages

Forest Industry Sector	Wages Paid (in Millions)	Jobs
Miscellaneous Forest Products	$19.39	526
Logging	$133.44	6,427
Solid Wood Products	$594.91	14,679
Wood Furniture	$959.26	24,605
Pulp and Paper	$380.82	5,044
Totals	$2,087.82	51,281

Source: Forest and Wildlife Research Center, Mississippi State University

Education and Outreach

The state of Mississippi has several educational and outreach programs related to fire hazards. Listed below are 2010 awareness programs offered to the public:

Wildfire Prevention Month   March 2010

During the month of March, the Mississippi Forestry Commission launches a wildfire prevention campaign designed to raise the public's awareness of the threat of wildfire and to prevent wildfires caused by carelessness. Carlessness with debris burning is a leading cause of wildfire in Mississippi. To read more about Wildfire Prevention Month, go to www.mfc.ms.gov. This site also contains useful publications including homeowner guides, planning documents, and other useful documents.

Arson Awareness Week   May 2 – 8, 2010

The theme for the 2010 Arson Awareness Week will focus on community arson prevention. To learn more about this year's campaign, visit the U.S. Fire Administration web site at www.usfa.dhs.gov.

National Fire Prevention Week   October 3 – 9, 2010

Fire Prevention Week is the longest-running public health and safety observance on record, according to the National Archives and Records Administration. The program began 80 years ago to commemorate the Great Chicago Fire and to remind residents of public safety issues they can address to prevent future fire disasters. The National Fire Protection Association (NFPA) will announce the theme of the 2010 observance on Tuesday, June 1, 2010. To read more about the 2010 observance, go to www.nfpa.org.

Mississippi Firewise

Firewise is a program to educate homeowners and community leaders on how to design, construct, landscape and maintain a home or community to withstand wildfire without the aid of firefighting resources. Mississippi has three certified Firewise Community/USA communities: Snow Lake Shores in Benton

County, Lake Hillsdale Property Owners Association in Pearl River County and Gloster in Amite County. At publication of this plan update, the commission was working with two additional communities toward certification. The commission provides help toward Firewise certification for any entity requesting a program. The commission also partners with the Alabama Forestry Commission on Wildland Urban Interface (WUI) Critical Infrastructure Fuel Reduction, with pending participation by Jackson County, MS. For more information on Firewise or the WUI fuel reduction program, visit the commission's web site at www.mfc.state.ms.us/firewise.htm.

By educating the public on fire specific topics as noted above, the state hopes to deter wildfires as well as urban fires. For more information on these and other education and outreach programs call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. weekdays.

Summary of Events

Typically Mississippi's wildfires are started by man-made causes, such as arson, campfires, and equipment. Causing an average of 1,500 fires each year in Mississippi, arson is the state's biggest fire threat. Arson has been the number one source of fire-related hazards since 2001. The second most likely cause of wildfires in Mississippi is debris. Averaging 1,276 fires a year, debris fires increased dramatically in 2006. Acreage lost to wildfires statewide increased fourfold from 2005 to 2006. This increase in acreage burned can be attributed to the increased amount of fuel on the forest floors due to fallen timber from Hurricane Katrina. With the increase in fuel on the ground, fires become uncontrollable and difficult to contain.

Other man-made causes of wildfires in Mississippi include campfires, equipment, railroads, children, smoking, and other miscellaneous causes. Individually these elements do not pose a serious threat to Mississippi's natural resources, but combined they account for approximately 1,600 fires annually, about 10% of all fires.

As shown in Table 3.4.3, lightning strikes typically make up a small percentage of wildfires in Mississippi. Contributing to less than 25 fires out of the more than 3,000 wildfires ignited annually, lightning-ignited wildfires are not considered a serious hazard to the state.

Table 3.4.3
Mississippi Wildfires by Cause
2005 - 2009

Year	Number of Fires	Cause of Fire	Number of Acres Burned
2009	906	Incendiary/Arson	14,444
	769	Debris Burning	7,748
	12	Lightning	202
	4	Campfire	11
	9	Smoking	57
	18	Equipment	109

Year	Number of Fires	Cause of Fire	Number of Acres Burned
	5	Railroads	44
	9	Children	141
	164	Miscellaneous	2,254
	61	Re-ignition	743
Total	**1,957**		**25,753**
2008	814	Incendiary/Arson	16,312
	824	Debris Burning	9,470
	18	Lightning	407
	5	Campfire	26
	10	Smoking	91
	44	Equipment	208
	11	Railroads	564
	11	Children	133
	128	Miscellaneous	763
	60	Re-ignition	462
Total	**1,925**		**28,436**
2007	1452	Incendiary/Arson	30,840
	1344	Debris Burning	17,028
	28	Lightning	354
	6	Campfire	46
	19	Smoking	212
	59	Equipment	723
	20	Railroads	506
	12	Children	821
	186	Miscellaneous	1,789
	137	Re-ignition	1,750
Total	**3,263**		**54,069**

Year	Number of Fires	Cause of Fire	Number of Acres Burned
2006	2,651	Incendiary/Arson	78,804
	2,144	Debris Burning	33,916
	56	Lightning	1,148
	7	Campfire	34
	31	Smoking	311
	100	Equipment	1,241
	28	Railroads	327
	28	Children	818
	268	Miscellaneous	5,671
	462	Other	8402
Total	**5,747**		**130,672**
2005	1,768	Incendiary/Arson	30,306
	1,299	Debris Burning	12,145
	8	Lightning	50
	4	Campfire	19
	14	Smoking	211
	73	Equipment	919
	5	Railroads	29
	18	Children	71
	291	Other	3,074
Total	**3,480**		**46,824**

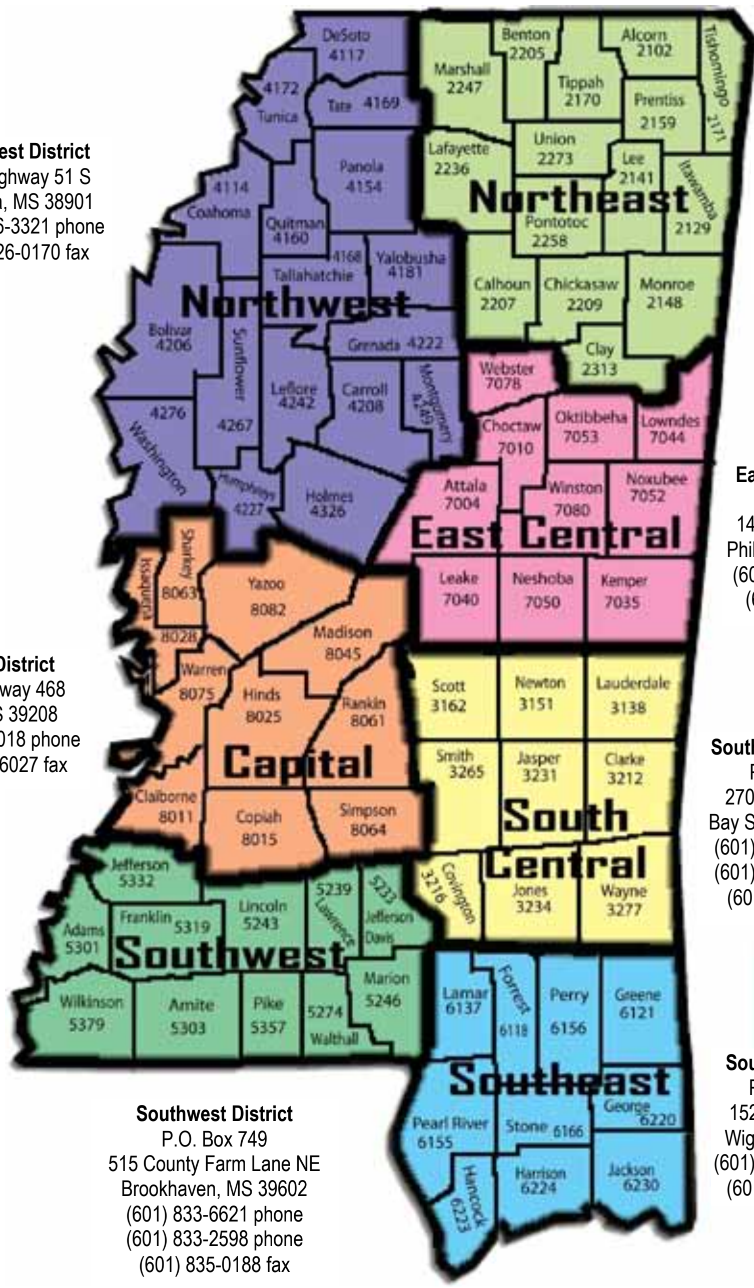
Source: MS Forestry Commission 2009

Location/Past Occurrences

The State of Mississippi is divided into seven Mississippi Forestry Commission districts, shown in Figure 3.4.4. The commission tracks wildfires by cause (Table 3.4.3) and by district (Table 3.4.4). Averaging almost 700 fires annually over the last three years, the Southeast District maintains the highest history of wildfires in the state. The areas with minimal amounts of previous wildfire events are along the Mississippi River. With the exception of one district in the northeast section of the state, Mississippi's three southernmost districts continue to experience the highest average number of wildfires. This trend is most apparent following major Gulf Coast storms, when forest floor litter is greatest.

Figure 3.4.4

Mississippi Forestry Commission
District/County Lines
Fiscal Year 2010



Northwest District
1801 Highway 51 S
Grenada, MS 38901
(662) 226-3321 phone
(662) 226-0170 fax

Northeast District
P.O. Box 703
1711 McCullogh Blvd.
Tupelo, MS 38802
(662) 842-5312 phone
(662) 680-9999 fax

East Central District
P.O. Box 429
14941 Highway 16 W
Philadelphia, MS 39350
(601) 656-1381 phone
(601) 656-9247 fax

Capital District
3139 Highway 468
Pearl, MS 39208
(601) 420-6018 phone
(601) 420-6027 fax

South Central District
P.O. Box 348
2705 Highway 15 S
Bay Springs, MS 39422
(601) 764-2711 phone
(601) 764-3061 phone
(601) 764-3037 fax

Southwest District
P.O. Box 749
515 County Farm Lane NE
Brookhaven, MS 39602
(601) 833-6621 phone
(601) 833-2598 phone
(601) 835-0188 fax

Southeast District
P.O. Box 430
1528 Azalea Drive
Wiggins, MS 39577
(601) 928-5261 phone
(601) 928-3174 fax

Revised 7/20/2009

Table 3.4.4
Mississippi Wildfires by District

District	2007	2008	2009	Total
Southeast	711	587	700	1,998
Northeast	718	130	262	1,110
Southwest	501	457	368	1,326
South Central	477	289	234	1,000
East Central	448	188	166	802
Capital	192	167	106	465
Northwest	216	107	121	444

With 100 state parks, national parks and forests, and wildlife management areas and refuges in 63 counties, a correlation between the locations of reserved lands to the location of previous wildfires was attempted in the *Southern Wildfire Risk Assessment***,** which is described in detail later in this section. Though some of the counties with the most previous wildfires in the state do have reserved land for parks and forests, the same can be said for some of the counties with few prior wildfire events. The conclusion is that Mississippi's prescribed burn techniques are producing forests that are not only healthy ecosystems, but are areas that do not encourage wildfires through ground litter but prevent them through natural buffers and clean forest floors.

Probability of Future Events

Debris accumulation from Hurricane Katrina in 2005 caused a 300% increase in wildfires in 2006 and a 200% increase over 2005 in 2007. Storm debris will continue to pose some threat toward future wildfires, but since Katrina, communities have worked with local emergency management agencies to remove debris and dead standing trees and numbers of wildfires are nearing the normal average. However, more and more people are moving to inland areas from the southern coast of Mississippi due to the threat of hurricanes. As this happens, more housing and other structures are built within wildland intermix and wildland interface areas, increasing the risk of wildfire to life and property. (See Figure 3.4.1)

Fire is a natural part of a healthy ecosystem. Future wildfires are inevitable. Mississippi may be able to decrease future wildfire events through continued education and outreach. Making well-informed decisions when recreating outdoors can reduce wildfire occurrences in the state. Increasing manpower to fight and deter arson can also lower Mississippi's threat of future wildfires.

Assessing Vulnerability

An assessment of Mississippi's vulnerability to wildfires is dependent on the proximity of development to natural wildland areas. The most common means of assessing wildfire threat is to quantify the amount of development (residential and non-residential structures) in proximity to or built within wildland areas. The best available information for assessing wildfire threat to Mississippi is contained in the Southern Wildfire Risk Assessment (SWRA). Using that data, the State of Mississippi used funding received after Hurricane Katrina to prepare County Wildfire Protection Plans (CWPPs) for the 15 lower counties in Mississippi. Following that initial effort, the state prepared CWPPs for 19 high-occurrence counties, making a total of 34 counties with prevention plans (Table 3.4.5). The Mississippi Forestry Commission maintains an electronic file of these completed plans. The CWPPs will also be incorporated into the update of local hazard mitigation plans as they are developed.

The development of Mississippi's Statewide Forest Resource Assessment and Forest Resource Strategy Plan was being conducted at the time of the 2010 plan update. This plan is a comprehensive analysis of forest-related conditions, trends, threats and opportunities and strategies to address them. The Mississippi Forestry Commission will submit the plan to the U.S. Forest Service for approval in 2010. The plan will be incorporated into future updates to the State's Hazard Mitigaiton Plan.

Table 3.4.5
County Wildfire Protection Plans

County	Plan Date	County	Plan Date
Amite	September 2008	Lawrence	September 2009
Attala	September 2008	Leake	July 2008
Benton	September 2009	Lincoln	September 2008
Carroll	September 2008	Marshall	September 2008
Clarke	September 2009	Panola	September 2008
Copiah	September 2009	Pearl River	December 2007
Covington	October 2008	Perry	October 2008
Forrest	October 2008	Pike	September 2009
George	December 2007	Simpson	September 2009
Greene	October 2008	Smith	September 2009
Hancock	October 2008	Stone	December 2007
Harrison	December 2007	Tippah	September 2008
Jackson	December 2007	Tishomingo	September 2008
Jasper	July 2008	Walthall	September 2008
Jeff Davis and Marion	October 2008	Wayne	October 2008
Lamar	October 2008	Winston	September 2008
Lauderdale	August 2008		

Southern Wildfire Risk Assessment

Fire managers in the U.S. Southern Region face complex challenges regarding current and future wildland fire risk assessment and management. These challenges are compounded by increasing fire intensities due to accumulation of vegetative materials, continued residential growth into wildland fire-prone areas, and increasing firefighting costs. In response, The Southern Group of State Foresters manages and updates a multi-state wildland fire risk assessment for the 13 Southern states. This critical assessment allows agencies and organizations at the national, state, and local levels to obtain a more comprehensive picture of what the overall potential is for wildland fire and its associated challenges. This project is called the Southern Wildfire Risk Assessment (SWRA). The USDA Forest Service, Southern Research Station has produced two reports as part of the SWRA. *Fire in the South 1*, published 2005, and *Fire in the South 2*, published in 2008 and updated in 2009. Both reports are available online at southernwildfirerisk.com. *Fire in the South 2* is included as Appendix 3.4.7-A of this plan

The purpose of the SWRA was to identify the potential for serious fires in the South and to help prioritize areas where mitigation options may be desirable. The data developed during this assessment was intended to be used by the states where interagency planning would assist in effectively managing wildland fire risk. This State Hazard Mitigation Plan is exactly that sort of solution.

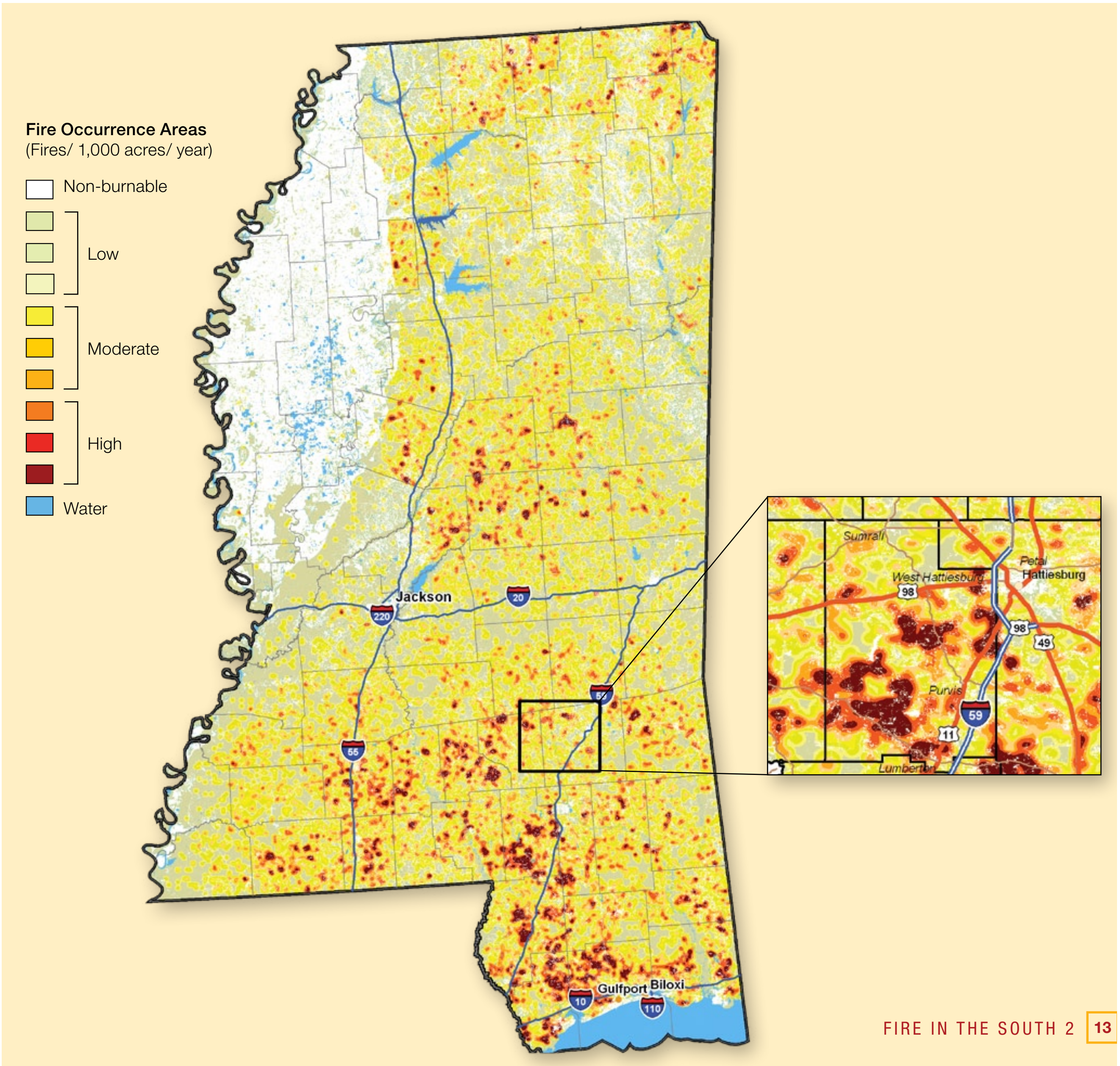
Data developed by the SWRA was used to identify those areas that have important values at risk to wildland fire. This data focused on three elements: transportation and infrastructure areas, wildland urban interface, and plantations. The wildland urban interface data is presented above in the hazard profile section.

Exposure Analysis of Critical Facilities

The State of Mississippi developed a definition for “critical facilities and infrastructure” as discussed in Section 3.0. Location data for these facilities were collected from various state agencies for the purposes of determining which facilities are at risk to various hazards. The critical facility categories deemed most pertinent to wildfire risk are: Emergency Operations Centers, Fire Stations, Police Stations, Medical and Power Facilities and Red Cross shelters and facilities.

Figure 3.4.5 was taken from *Fire in the South 2* published in 2008. This graphic reflects the potential for wildfires in Mississippi by charting “Fire Occurrence Areas” that show moderate-to-extreme potential for wildfire occurrence. The data points are driven by historic fires per 1,000 acres per year. In the 2007 plan, these facilities were overlaid (using GIS) with the Level of Concern data from the Southern Wildfire Risk Assessment (SWRA) to assess the Level of Concern for each of the critical facilities. However, this program is no longer funded by SWRA, so GIS critical facility overlay data was unavailable for this graphic. The Wildfire Occurrence Area map shows clearly that the potential for wildfire ignitions is moderate-to-high throughout much of the state. To compare the Fire Occurrence Areas to critical facility locations, refer to the regional maps in Appendix 7.3.0 – C.

Figure 3.4.5
Potential Wildfire Occurances



3.5 Tornado Risk Assessment
Significant Hazard

Hazard Description

Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300-miles per hour. Damage paths can be in excess of one mile wide and 50-miles long. Every state is at some risk from this hazard.

Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others (rain-wrapped). Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.

Before a tornado hits, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

The following are facts about tornadoes:

They may strike quickly, with little or no warning.

They may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel.

The average tornado moves Southwest to Northeast, but tornadoes have been known to move in any direction.

The average forward speed of a tornado is 30 MPH, but may vary from stationary to 70 MPH.

Tornadoes can accompany tropical storms and hurricanes as they move onto land.

Waterspouts are tornadoes that form over water.

Tornadoes are most frequently reported east of the Rocky Mountains during spring and summer months.

Peak tornado season in the southern states is March through May; in the northern states, it is late spring through early summer.

Tornadoes are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time.

Source: http://www.fema.gov/hazard/tornado

In February 2007, an Enhanced Fujita Scale, or EF-Scale, was approved by the National Weather Service as the means by which tornados are classified. The EF-Scale follows the rating system (F0-F5) of the older F-Scale but ranges in wind speed will be more accurate with the improved rating scale. The EF-Scale incorporates more damage indicators and degrees of damage than the original F-Scale, allowing more detailed analysis and better correlation between damage and wind speed. It will also provide more detailed guidelines that will allow the National Weather Service to more accurately rate tornadoes that strike in the United States. The improved standardizing and clarification of what was previously subjective and uncertain, also adds more types of structures as well as vegetation, expands degrees of damage, and better accounts for variables such as differences in construction quality.

Listed below is a correlation between the original F-Scale and the EF-Scale. This makes it possible to express ratings in terms of one scale to the other, preserving the historical database. Listed below is the Enhanced Fujita Scale (EF-Scale) chart that defines the ratings of tornadoes:

Enhanced F-Scale for Tornado Damage

FUJITA SCALE			DERIVED EF-SCALE		OPERATIONAL EF-SCALE	
F-Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF-Number	3 Second Gust (Mph)	EF-Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85	**0**	**65-85**
1	73-112	79-117	1	86-109	**1**	**86-110**
2	113-157	118-161	2	110-137	**2**	**111-135**
3	158-207	162-209	3	138-167	**3**	**136-165**
4	208-260	210-261	4	168-199	**4**	**166-200**
5	261-318	262-317	5	200-234	**5**	Over 200

Source: http://www.spc.noaa.gov/efscale

Hazard Profile

The hazard profile for tornados in Mississippi was been updated from the previous approved plan of 2007 to include current statistics regarding tornado activity and education programs conducted throughout the state. (See Mitigation Actions in Progress at the end of this section for additional information about the data used herein.)

During the years 1950 to 2009, Mississippi has had 2,011 tornadoes, accounting for 511 fatalities and 6,929 injuries. This averages to less than one fatality per tornado, but nearly four injuries during each event. The number of tornado events increased by 145 events which resulted in six fatalities and 125 injuries since the 2007 plan update.

The fewest tornados recorded during one year in Mississippi were 5 in 1964. The greatest number of tornados in Mississippi recorded by the National Weather Service was 120 in 2005. The increase in tornado activity was directly related to two hurricanes, Katrina and Rita, which impacted Mississippi in August and September respectively. Hurricane Katrina, the most catastrophic hurricane to hit the United States, produced 13 tornadoes while Hurricane Rita produced 54.

Tornados are not as easily spotted in Mississippi as they are in the Midwest where flat land and few trees make tornados more visible. Densely populated counties and communities throughout Mississippi tend to record more sightings of tornados than more rural and less populated areas. It should also be noted that tornados are often associated with severe weather events such as thunderstorms. Due to the climate conditions in Mississippi, tornados can occur in every month of the year, but have a greater frequency during the period of February through May, as well as November.

With regard to intensity, the National Weather Service has identified three types of tornados on the basis of the following characteristics and statistical data obtained for Mississippi over the past 59 years:

Weak Tornados (EFO – EF1)

Represent 63% of prior tornado events in Mississippi and resulted in 3% of tornado-caused fatalities in Mississippi. This classification represents a tornado with duration between one and ten plus minutes with wind speeds less than 112 mph. An EF-0 tornado (40-72 mph winds) will cause some damage to chimneys, branches broken off trees, shallow-rooted trees pushed over, and sign boards damaged. An EF-1 tornado (73-112 mph winds) will peel surface off roofs, push mobile homes off foundations or overturning them, and move or blow automobiles off roads.

Strong Tornados (EF2 – EF3)

Represent 32% of prior tornado events in Mississippi and resulted in 24% of tornado caused fatalities in Mississippi. The life expectancy of this classification of tornado is 20 minutes or longer with wind speeds from 113-207 mph. An EF-2 tornado (winds in the range of 113-157 mph) will cause severe damage and can result in roofs torn off frame houses, mobile homes demolished, boxcars overturned, large trees snapped or uprooted, light-object missiles generated, cars lifted off the ground. An EF-3 tornado (158-207 mph winds) may cause severe damage such as roofs and some walls torn off well-constructed houses, trains overturned, most trees in forests uprooted, and heavy cars lifted off the ground and thrown.

Violent Tornados (EF4 – EF5)

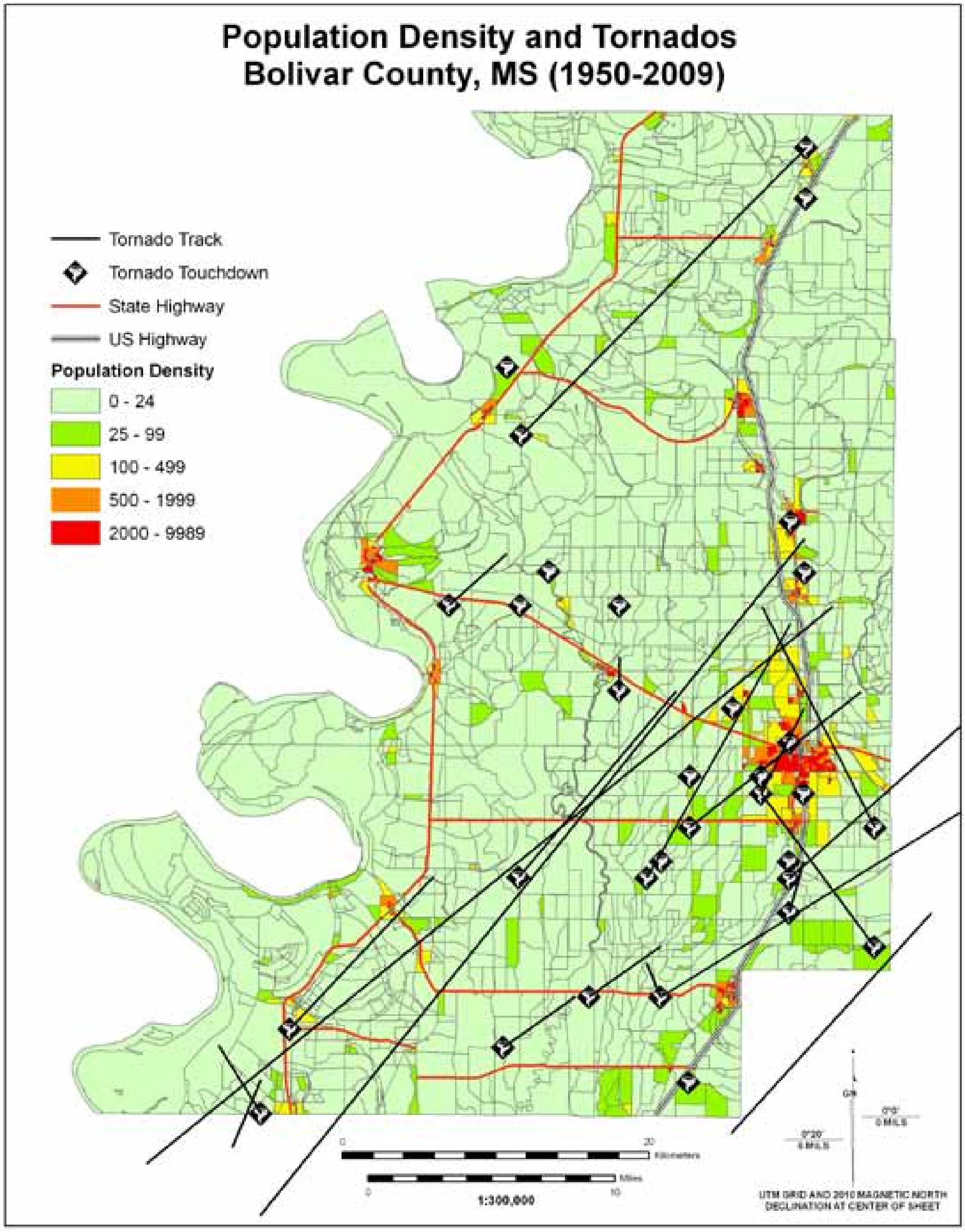
Represent 3% of prior tornado events in Mississippi and resulted in 72% of tornado caused fatalities in Mississippi. The life expectancy of this classification of tornado is one hour or more with wind speeds greater than 207 mph. An EF-4 (208-260 mph wind speeds) tornado will result in well-constructed houses leveled, structures with weak foundations blown some distance away, cars thrown and large missiles generated. An EF-5 tornado (wind speeds in excess of 261 mph) will result in strong frame houses leveled off foundations and swept away, automobile-sized missiles flying through the air in excess of 100 meters (109 yds), and trees debarked. Incredible phenomena will occur.

Location / Past Occurrences

Data about prior tornado occurrences likely underestimates the number of events. While still somewhat supposition, this theory is strongly supported when the available “observation power” is analyzed. Along the lines of “If a tree falls in the woods and nobody is there to hear it fall, does it still make a sound?”, if a tornado occurs when and where nobody sees it or the resulting damage, did it truly occur? This is an important concept as prior number of events relate to future performance – if the total number of historical count is missing events, then future predictions are likely to underestimate true risk. The likelihood that a tornado event is “missed” is supported through two means.

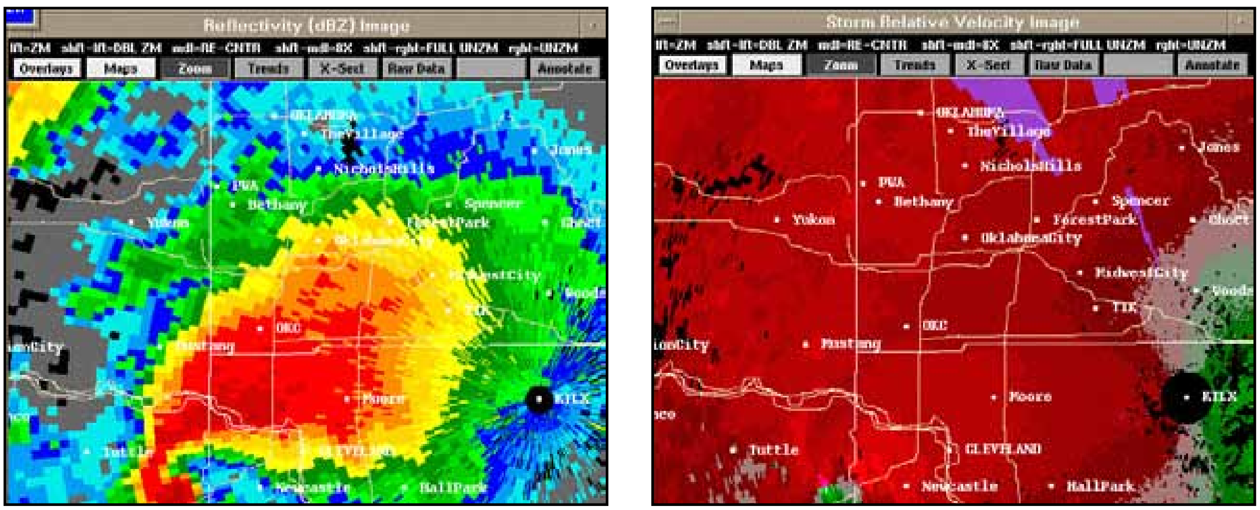
The first means is simple to understand – Mississippi is mostly a rural state with low population densities throughout. Figure 3.5.1 provides an example of this by comparing population density to tornado paths in Bolivar County. This figure illustrates the clustering of reported tornados around populated areas such as Cleveland. It stands to reason that tornados occur just as regularly in sparsely populated areas, but as no one is there to observe the tornado, the event is never recorded.

Figure 3.5.1



While the advent and use of advanced weather radar systems has greatly improved warning times for tornados, these systems are prone to blind spots and false positives. Weather radar projects a powerful beam of radiation upward at a very slight angle, typically 0.5 degrees from the horizontal. When this beam strikes objects in the atmosphere, such as water molecules and debris, it is reflected back toward the radar system. The intensity of this return is measured as reflectivity in decibels as shown in Figure 3.3.2a. More advanced radar systems, such as the Wx88-D NEXRAD system, are capable of determining whether rain or debris suspended in the atmosphere is moving toward the radar or away from it and at what speed the object is moving (storm relative velocity). Concentrated areas of opposing winds such as those presented in Figure 3.3.2b suggest the presence of a tornado. This permits radar systems and their operators to detect rotating updrafts, hook echos (Figure 3.3.2), and similar features associated with tornadic storms.

Figure 3.5.2a and b



As with population density, the density of Wx88-D NEXRAD systems is limited – these systems are not inexpensive. Figure 3.5.3 shows the location of Wx88-D NEXRAD radar stations in the United States. As previously mentioned, radar beams from these sites travel upward at a minimum angle of 0.5 degrees. This renders the maximum range of these systems to approximately 124 miles (Figure 3.5.4). A review of Figure 3.5.3 shows a dense concentration of weather radar sites along the Eastern Seaboard and the Midwest (Tornado Alley). While Mississippi has consistently ranked at the top of the list for tornado events, there is only ONE National Weather Service weather radar system in the state. As suggested by Figure 3.5.5 for northwestern Mississippi, this leaves potentially significant gaps in coverage, especially when one considers the "surfaced-based" nature of convective storms producing tornados in Mississippi (the base altitude or ceiling for tornado-producing thunderstorms can be as low as 500-1,000 feet above ground level) – a tornado can, quite literally, "sneak under the radar".

Figure 3.5.3

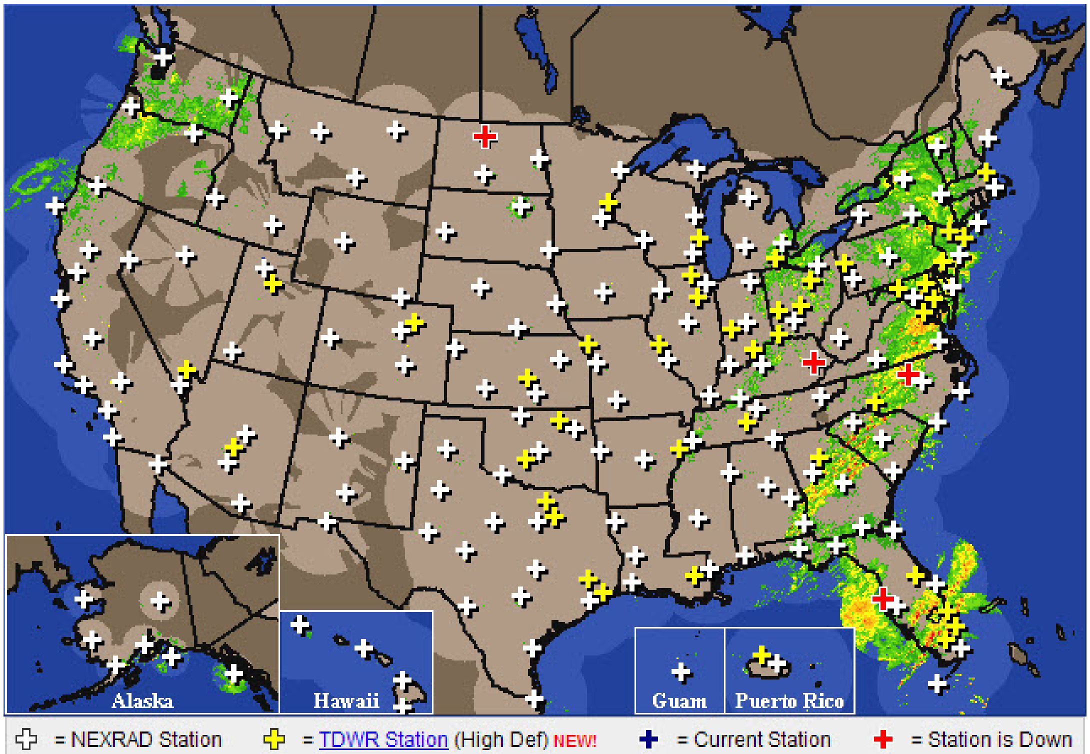


Figure 3.5.4

BEAM HEIGHT WITH DISTANCE (AGL)

$$H=\left(\sqrt{r^2+(k_e a_e)^2+2r k_e a_e \sin(\theta_e)}\right)-k_e a_e+h_a$$

r : distance *k_e : 4/3 (Standard refraction coefficient)*

a_e : Earth radius *θ_e : Elevation angle*

h_a : Height of radar above ground

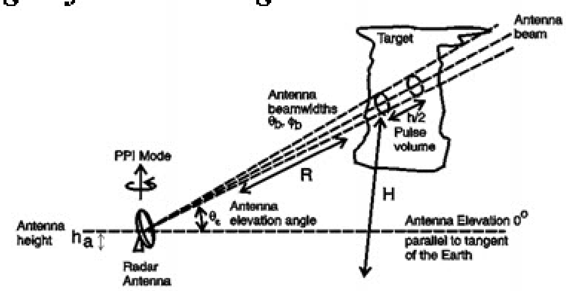
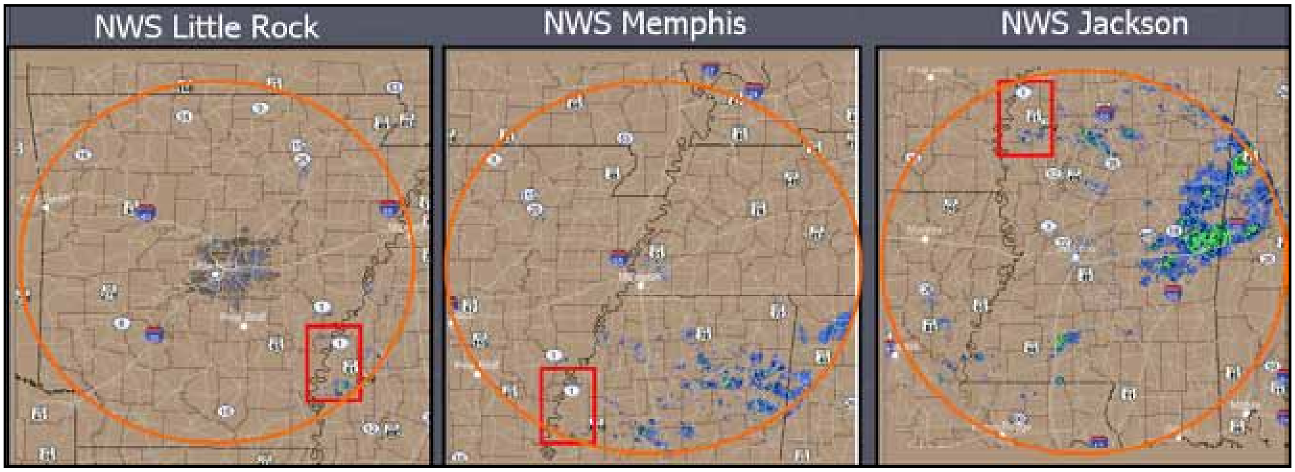


Figure 3.5.5



The evidence for this effect is supported by national-level data sets. While Mississippi is not traditionally included in the definition of "Tornado Alley" it holds several ominous records during the November-December and late February-March time period when, warm, moist air-masses from the Gulf of Mexico collide with Arctic cold-fronts to produce raging thunderstorms and tornados. For example, during the 1840-2005 time period, three of the ten deadliest tornados in American history occurred in Mississippi as provided in Table 3.5.1 below.

Table 3.5.1
Ten Deadliest Tornados In U.S. History

Rank	State(s)	Date	Time	Dead	Injured	F-Scale	Town(s)
1	MO-IL-IN	March 18, 1925	13:01	695	2027	F5	Murphysboro, Gorham, DeSoto
2	LA-MS	May 7, 1840	13:45	317	109	F?	Nachez
3	MO-IL	May 27, 1896	18:30	255	1000	F4	St., Louis, East St. Louis
4	MS	April 5, 1936	20:55	216	700	F5	Tupelo
5	GA	April 6, 1936	8:27	203	1600	F4	Gainesville
6	TX-OK-KS	April 9, 1947	18:05	181	970	F5	Glazier, Higgins, Woodward
7	LA-MS	April 24, 1908	11:45	143	770	F4	Amite, Pine, Purvis
8	WI	June 12, 1899	17:40	117	200	F5	New, Richmond
9	MI	June 8, 1953	20:30	115	844	F5	Flint
10	TX	May 11, 1953	16:10	114	597	F5	Waco

A cumulative examination of the number of tornados having occurred in 30km x 30km grid cells across the U.S. for the 1950-2002 time period reveals further evidence supporting the theory that tornados are underestimated in Mississippi. Figure 3.5.6 shows the occurrence of severe thunderstorms during this time period and it should be noted that higher numbers of events, as evidenced by brown and red shading, are highly clustered along Interstate Highway routes and more densely populated places. Areas such as the Mississippi Delta, a region where land use is predominately agricultural and thus has low population densities, indicate a "hole" in the number of recorded severe storm events. Likewise, Figure 3.5.7 shows the location of tornados recorded during this time period and a similar "hole-effect". Yet these areas do not align with those where injuries (Figure 3.5.8) and deaths (Figure 3.5.9) have been reported in association with tornados.

Figure 3.5.6

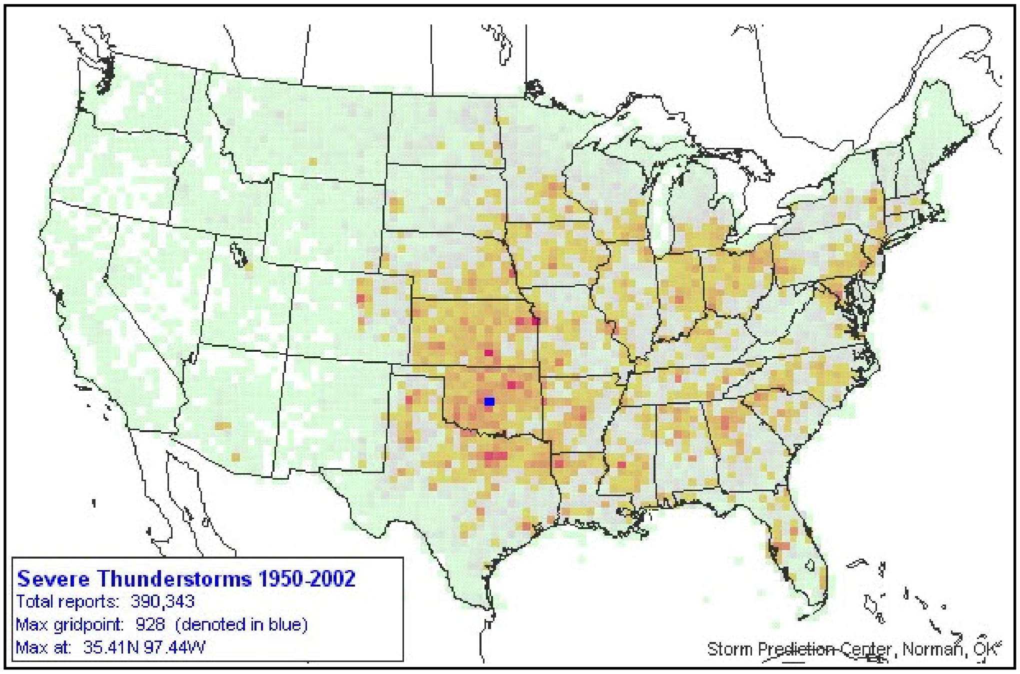


Figure 3.5.7

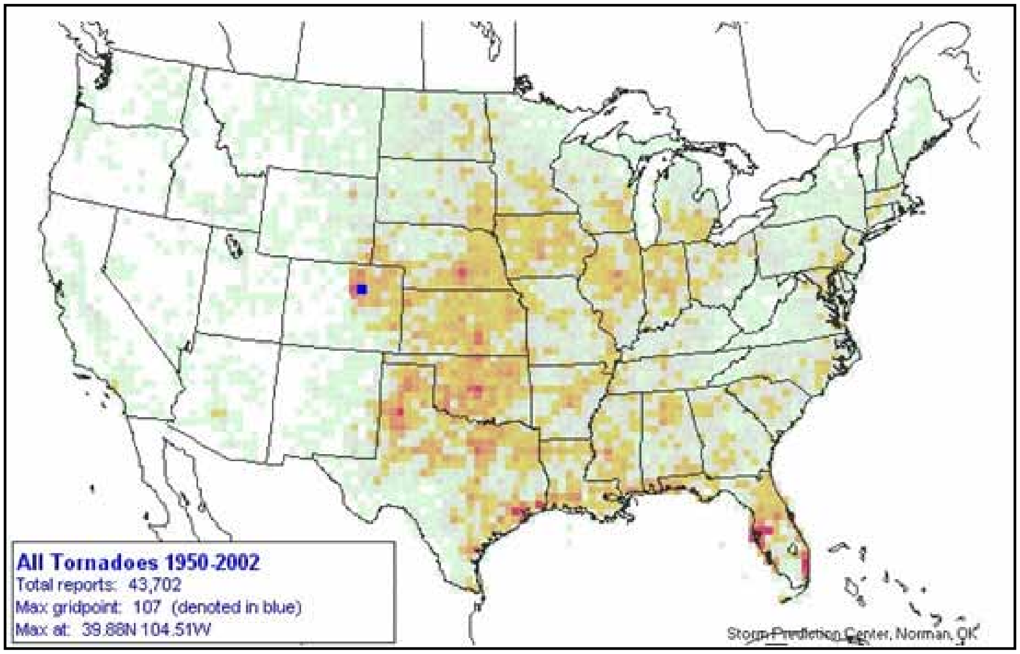


Figure 3.5.8

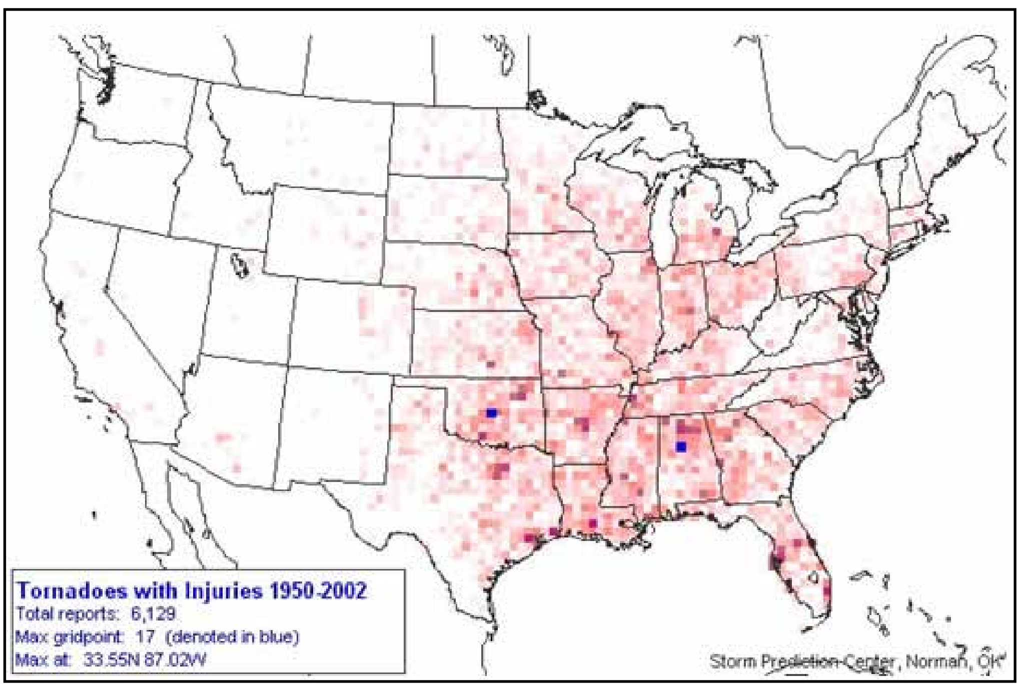
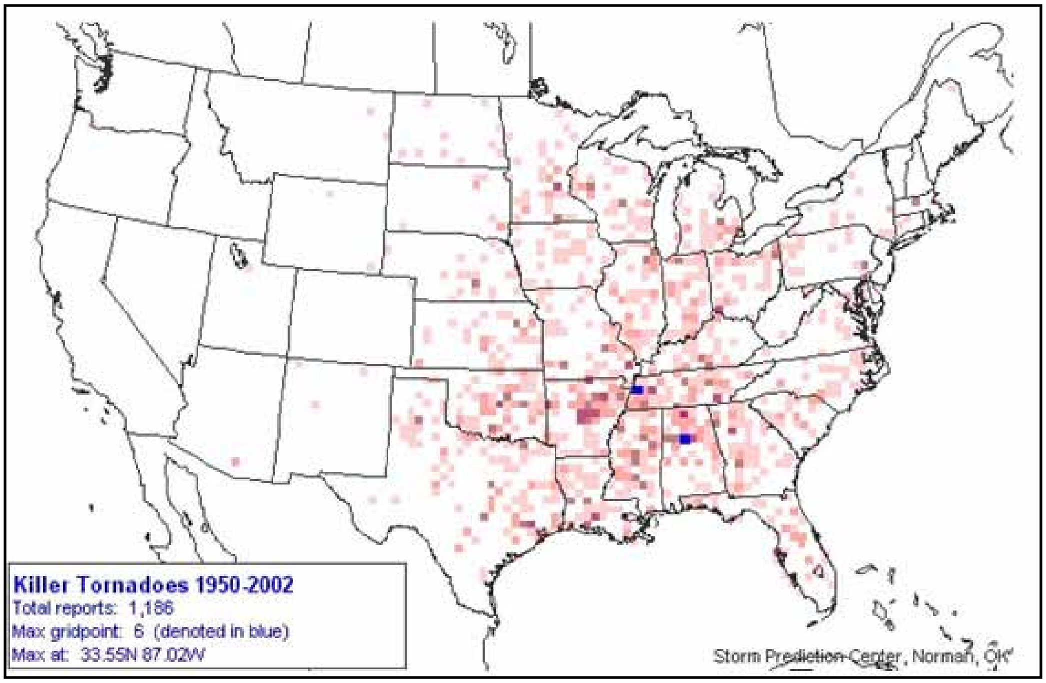


Figure 3.5.9



Several statistical approaches were attempted in an effort to quantify how much tornado rate of occurrence has been historically underestimated, but there were significant flaws in each method. In short, a well funded research effort is required to make this determination. This proposed work is extremely important as the number of historical events and their spatial distribution is required to predict the probability of future events and thus the ability to correctly assess the overall risk of tornados in Mississippi.

While the total number of tornados is likely to have been underestimated, the distribution of tornado intensity is likely an accurate reflection of the overall distribution of tornado intensity by Fujita scale as shown in Table 3.5.2.

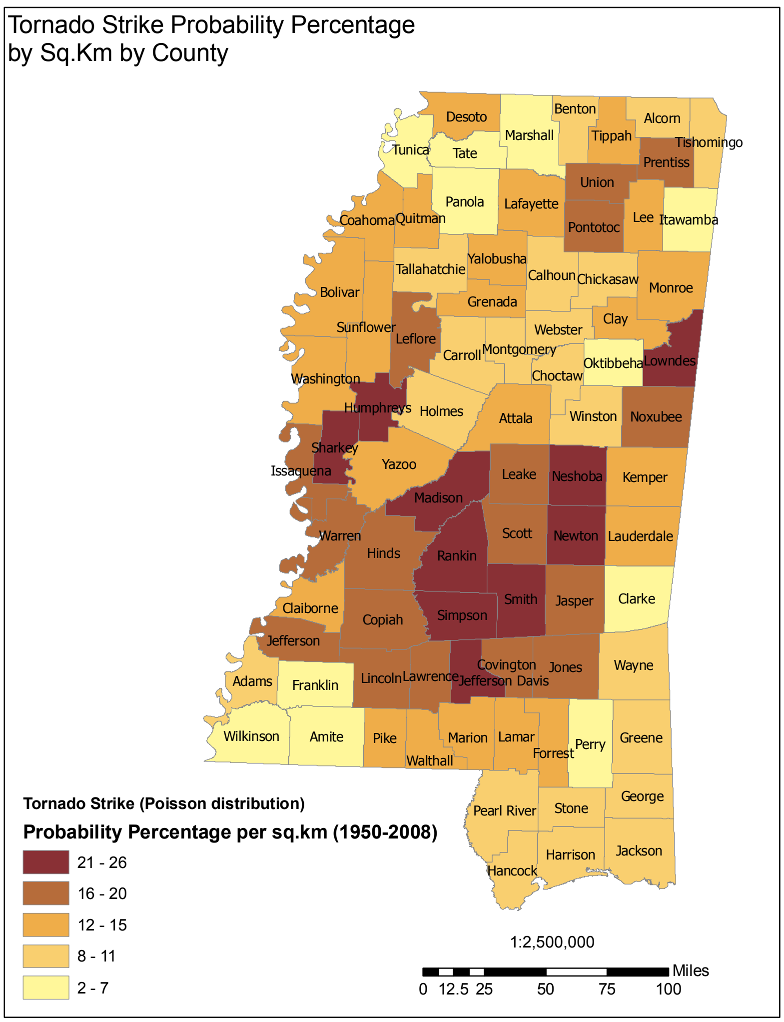
Table 3.5.2
Percentage of Tornados Encountered over 59 Years by Fujita Scale

Fujita Scale	Percent of Occurrences
F-0	27%
F-1	36%
F-2	22%
F-3	11%
F-4	3%
F-5	< 1%

The probability of a tornado strike can be predicted using the existing information pertaining to the location and frequency of historic tornados. Consumers of the following information should be mindful that the data presented regarding probability of future events is likely an underestimation because the total number of prior events is underestimated. Tornados are considered statistically discreet and rare events and thus the appropriate statistical approach is to perform an analysis that calculates the frequency of event for a given time period within a given grid square. The resulting calculation, called lambda, is used to calculate future probability based on the Poisson distribution. In this instance, 1km x 1km grid squares were derived from the U.S. National Grid coordinate system. The total number of events occurring within each grid square were tallied and compared as described. Figure 3.5.10 reports the likelihood of a tornado occurring within 1km of any given point within a county during the next 50 years.

Users of this information may derive secondary values based on the aerial extent of features. For example, the probability of a tornado occurring within 1km of any given point in Bolivar County is approximately 13%. Given that the City of Cleveland is occupies approximately 8 square kilometers, the probability of a tornado effecting Cleveland is 13% x 8 = 104, or 100%.

Figure 3.5.10



Assessing Vulnerability of People to Tornados

As described above, virtually any person who works in a building above ground and who lives in a dwelling above ground is vulnerable to the wrath of a tornado. Those who live in mobile homes (Table 3.5.3) are particularly vulnerable, for without the appropriate warning, or access to a tornado shelter, they can rapidly become involved in a life-threatening situation.

The people who are particularly vulnerable to tornado hazards are those outside of the warning area of sirens, have no link to conventional communications such as telephone, and do not have a NOAA weather radio. People with special needs and who are homebound due to medical problems are especially vulnerable. Those people reliant on medical care such as insulin and oxygen are likely dependent on electricity and ventilation systems. This makes them especially vulnerable to tornados in the event they cause a disruption in electrical service. Patients in nursing homes and hospitals, and patients in need of home health care are particularly vulnerable to loss of power and disruption in public services that may result from a tornado event.

Inadequate individual warning and inadequate shelter during an event contribute to the number of fatalities resulting from a given tornado. Often due to mobility problems or inability to hear or understand warnings, the very young, the elderly, and the handicapped are especially vulnerable to tornados. It is imperative that institutions housing these individuals develop a severe weather action plan and conduct frequent drills.

According to the National Weather Service pamphlet: Who's at Risk?, those at risk include people in automobiles as well as the elderly, very young, and the physically or mentally impaired. In addition, they include people in mobile homes and people who may not understand the warning due to a language barrier.

Loss of Life from Tornados

Windborne glass, debris, signs, and shrubs are major causes of injury and death during tornados. Virtually any object that is not tied down or tethered to the ground, including an automobile, can become a deadly airborne projectile.

The western part of the state seems to have suffered a larger number of "killer tornados" compared to the rest of the state. Some of the deadliest tornados to date occurred in Vicksburg on March 2, 1966, with 58 fatalities and in the delta region on February 21, 1971 with 118 fatalities (known as the Delta Outbreak). As mentioned previously, 2005 had the most recorded tornados when 120 hit the State of Mississippi.

Information from the National Weather Service (National Climactic Data Center) for the period 1950 to 2009 recorded 511 deaths, 2,011 tornados and $3,520,736,573 (2007 value) in damage within the State of Mississippi. Annual averages equate to over eight deaths, over 117 injuries, and $6,2870,295 in damages per year.

Table 3.5.3
Mobile Homes by County

County	No. of Mobile Homes	County	No. of Mobile Homes	County	No. of Mobile Homes	County	No. of Mobile Homes
Adama	1,613	Grenda	1,459	Lincoln	3,327	Simpson	3,080
Alcorn	2,425	Hancock	3,953	Lowndes	3,527	Smith	2,024
Amite	1,880	Harrison	9,843	Madison	2,140	Stone	1,207
Attala	1,698	Hinds	3,954	Marion	2,077	Sunflower	751
Benton	709	Holmes	2,265	Marshall	3,573	Tallahatchie	1,375
Bolivar	1,867	Humphreys	514	Monroe	3,239	Tate	2,033
Calhoun	1,172	Issaquena	265	Montgomery	813	Tippah	1,681
Carroll	1,407	Itawamba	2,116	Neshoba	2,608	Tishomongo	1,621
Chickasaw	2,095	Jackson	6,572	Newton	2,152	Tunica	826
Choctaw	813	Jasper	2,143	Noxubee	1,457	Union	1,961
Claiborne	1,272	Jefferson	1,257	Oktibbeha	2,876	Wahthall	1,692
Clarke	2,248	Jefferson Davis	1,321	Panola	4,343	Warren	3,329
Clay	1,494	Jones	5,607	Pearl River	4,902	Washington	2,102
Coahoma	996	Kemper	1,191	Perry	1,655	Wayne	2,983
Copiah	2,487	Lafayette	3,058	Pike	3,302	Webster	716
Covington	2,456	Lamar	2,456	Pontotoc	2,363	Wilkinson	1,776
Desoto	2,995	Lauderdale	5,187	Prentiss	1,670	Winston	1,353
Forrest	3,050	Lawrence	1,413	Quitman	614	Yalobusha	1,689
Franklin	1,146	Leake	1,827	Rankin	8,820	Yazoo	1,854
George	1,862	Lee	4,667	Scott	3,160		
Greene	1,529	Leflore	1,252	Sharkey	547	**Total**	**192,792**

Source: 2000 Census

Vulnerability of Natural Resources to Tornados

Trees and decorative vegetation are all subject to damage from tornados. The force of a tornado is powerful enough to uproot trees and vegetation and deposit the debris in standing water, resulting in a polluted drinking water supply.

Wildlife and farm animals are not likely to survive the force of tornado winds and may be carried to distant ground, or deposited in some body of water that may result in a polluted drinking water supply.

Streams can become clogged with wind-blown debris and downed trees, causing flooding and resulting in a slow recovery. Habitat for local wildlife may become destroyed, resulting in a reduction of species. If debris is not removed from the forest floor, it can then become fuel for a wildfire. Forestry Commission officials will engage a "strike team" to clear debris in an effort to reduce this vulnerability.

Vulnerability of Private Improvements to Tornados

Older houses and mobile homes are particularly vulnerable to tornados. If houses are not built to high wind standards, the likelihood of significant roof damage, if not devastation of the roof structure, is bound to occur. Unless mobile homes are built on an anchored foundation, the force of tornado winds is likely to lift the structure and turn it over. Damaged mobile homes are not likely to be returned to habitable status.

Private improvements such as houses with roofs and mobile/manufactured homes, are vulnerable to tornados and the straight-line winds that often accompany them. Homes built below grade or underground are likely to remain the safest retreat from tornados.

Assessing Vulnerability by Jurisdiction Methodology

During the 2007 plan, To assess each county's vulnerability to tornado events, the State of Mississippi devised a system to establish four ratings based on the following factors: number of past tornado occurrences, total valuation of private property in each county, population density of each county, and past tornado damage values (see Appendix 7.5.3-A for a listing of these values by county). Each of these ratings were summed to determine an overall vulnerability rating for each county relative to the other counties.

The four ratings were :

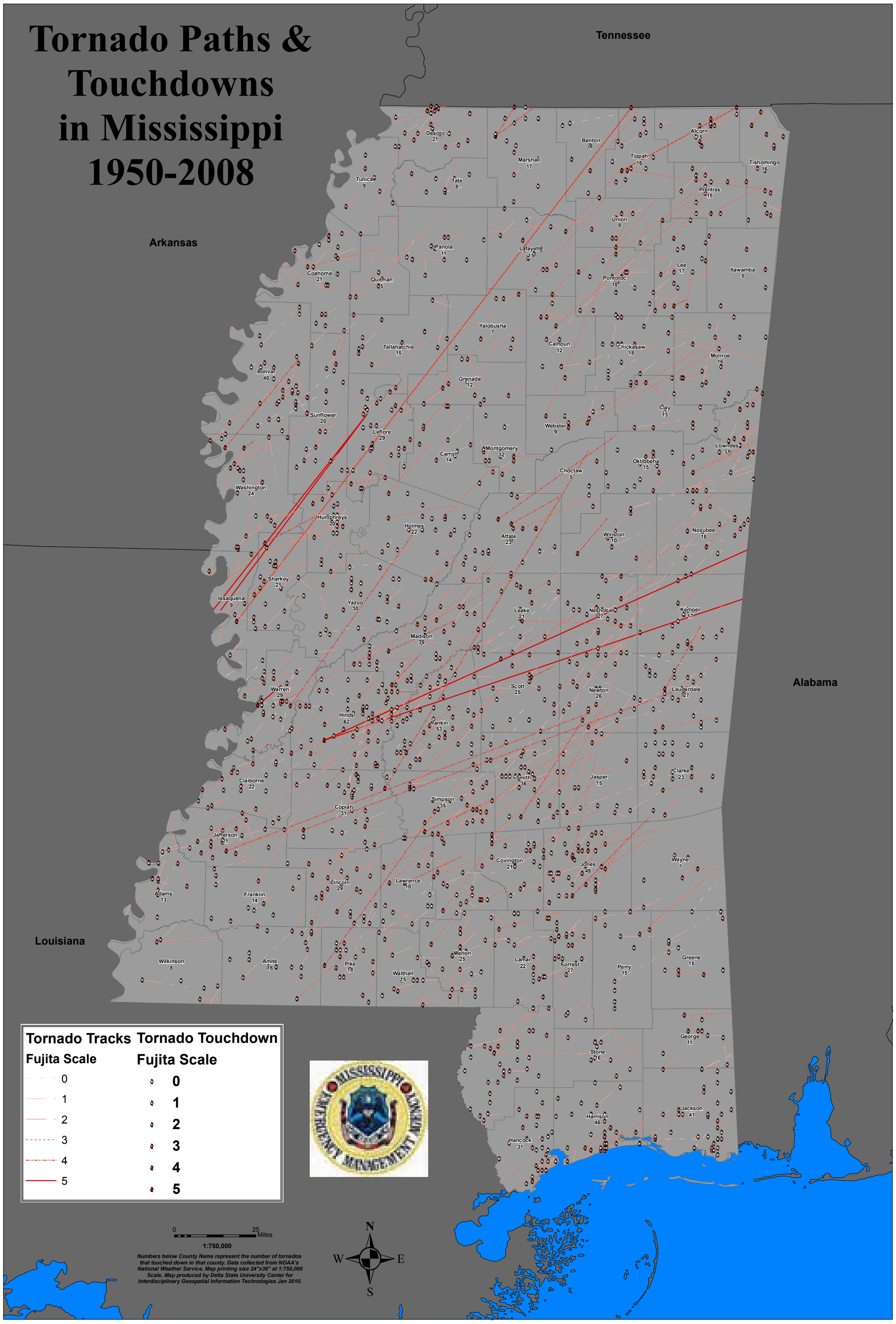
1. Prior Event Rating (based on the number of past tornado occurrences)
2. Private Property Valuation Rating (based on the total valuation of private property in the county)
3. Population Density Rating (based on the population density of the county)
4. Tornado Damage Rating (based on past damage amounts inflated to present day dollar values)

These four factors and the method for rating them are described in detail below.

1. Prior Event Rating - As previously suggested, the total number of tornados reported is likely strongly dependent upon population density and weather radar coverage. For the purposes of this plan, it is reasonable to assume that the overall frequency of tornados does not vary significantly across the state in any means other than seasonality – southern portions of Mississippi appear to experience a higher number of tornados during the spring severe weather season whereas the northern portions experience their peak in the fall severe season.

Thus the prudent approach is to assume that the number of past occurrences are in fact similar to the rates experienced by Hinds county (where the reported maximum number of events has happened). As counties are different sizes, this maximum was normalized by county based on land area and compared with the number of events predicted by the Poisson distribution. This analysis proved favorable and the two methods correlated well and thus a default value of 10 was used for prior event rating. This value should be revisited if and when a means to prove the correlation between reported events and population density/ radar coverage is better documented and a means to interpolate likely values from the historic record are developed. The actual location of tornado touchdowns is shown in Figure 3.5.11 on the subsequent page.

Figure 3.5.11



Tornado Paths & Touchdowns in Mississippi 1950-2008
Tennessee
Arkansas
Alabama
Louisiana
Tornado Tracks
Fujita Scale
0
1
2
3
4
5
Tornado Touchdown
Fujita Scale
0
1
2
3
4
5
0
25
Miles
1:750,000
Numbers below County Name represent the number of tornados that touched down in that county. Data collected from NOAA's National Weather Service. Map printing size 24"x36" at 1:750,000 Scale. Map produced by Delta State University Center for Interdisciplinary Geospatial Information Technologies Jan 2010.
N
W
E
S

2. Private Property Valuation Rating — In order to relatively compare the amount of assets vulnerable to loss by winter storm damage in each county, the State of Mississippi turned to assessment data from the Mississippi Tax Commission. The values were obtained from the "Mississippi State Tax Commission Annual Report Fiscal Year Ending June 30, 2009."

The Annual Report provides private property assessments in two categories. These are "Real Property" and "Personal Property." The "Real Property" assessment represents the true value of all taxable land and improvements thereto including residential, commercial and industrial property. The "Personal Property" assessment represents the value of the following: business inventories; furniture, fixtures, machinery and equipment for non-residential property; mobile homes and automobiles. To determine the Total Valuation of Property for each county, the "True Value" from the "Personal Property assessment was added to the "True Value" from the Real Property" assessment. This total private property valuation dollar value in itself is an indicator of the total value of each county's property (tangible assets).

The total range of total private property valuations by county were divided into ten equal ranges shown in the chart below. The ranges were numbered one through ten in ascending order and this became the Property Valuation Rating.

Property Valuation Range		Rating	Property Valuation Range		Rating
$120,983,577	$1,387,622,988	1	$6,454,180,711	$7,720,820,140	6
$1,387,622,989	$2,654,262,418	2	$7,720,820,141	$8,987,459,571	7
$2,654,262,419	$3,920,901,849	3	$8,987,459,572	$10,254,099,001	8
$3,920,901,850	$5,187,541,279	4	$10,254,099,002	$11,520,738,432	9
$5,187,541,280	$6,454,180,710	5	$11,520,738,433	$12,787,377,862	10

Summary of Private Property Valuations:

The Total Property Valuation ranged from $120,983,557 in Issaquena County to $12,538,050,214 in Harrison County. Five counties (Desoto, Harrison, Hinds, Jackson and Rankin) received the highest Property Valuation Rating of 10, while more than half (53) of the counties in Mississippi received the lowest Property Valuation Rating of 1. See Table 3.5.4 for details by county.

3. Population Density Rating—Population density was determined to be a more meaningful component of vulnerability assessment than total county population. The population density for each county was calculated by dividing the best available total population estimate for each county by the land area of that county.

The land area in square miles of each county was obtained from the 2000 Census. Total estimated population for each county was obtained from the U.S. Census Bureau Population density indicates the amount of people at risk to hazards. The total range of countywide population density values were divided into ten equal ranges shown below. The ranges were numbered one through ten in ascending order, and this became the Population Density Rating as shown in the chart on the subsequent page.

Population Density Range		Rating
4.01	35.99	1
35.99	67.97	2
67.97	99.95	3
99.95	131.93	4
131.93	163.91	5
163.91	195.89	6
195.89	227.87	7
227.87	259.85	8
259.85	291.83	9
291.83	323.84	10

Summary of Population Density:

The lowest population density is found in Issaquena County with an estimated 4.01 people per square mile. Coincidentally, Issaquena is estimated to have the lowest overall population of 1,759 people over 413 square miles. Desoto County has the highest population density with an estimated 323.84 people over 477 square miles. Harrison County has the second highest population density of 307.17 people over 580 square miles. Hinds County is estimated to have the highest overall population with 247,650 over 869 square miles. Desoto and Harrison Counties were the only two counties to receive the highest Population Density rating of 10 and Hinds County was the only county to receive the 2nd highest Population Density rating of 9. See Table 3.5.4 for details by county.

4. **Tornado Damage Rating** — Total damages of past tornados was determined to be an important factor in assessing vulnerability. The National Weather Service database that listed past events also provided damage estimates from those events. These damage estimates were presented in actual values for the given year of the tornado event. In order to more accurately compare the damage values, they were converted to present day dollar values using the Mitigation BCA (Benefits Cost Analysis) Toolkit provide by FEMA. The annual rate of inflation used in this Toolkit is 3%.

The inflated values indicate that the State received a total of $3,641,492,562 (present day value) in tornado damages from 1950 to 2009. That is an average of $61,720,213 per year (present day value). A table containing the yearly calculations is provided as Appendix 3.5.3-B.

The total range of countywide tornado damage values was divided into ten equal ranges shown below. The ranges were numbered one through ten in ascending order, and this became the Tornado Damage Rating as shown in the chart on the subsequent page.

Tornado Damage Range		Rating
$562,492	$33,193,223	1
$33,193,223	$65,823,953	2
$65,823,953	$98,454,684	3
$98,454,684	$131,085,415	4
$131,085,415	$163,716,146	5
$163,716,146	$196,346,876	6
$196,346,876	$228,977,607	7
$228,977,607	$261,608,338	8
$261,608,338	$294,239,068	9
$294,239,068	$326,869,799	10

Summary of Tornado Damage Rating

Rankin County continues to suffer the greatest loss with $326,869,799 worth of damages. The least amount of damage was in Benton County with $562,492 worth of damages. Rankin was the only county to receive a Tornado Damage Rating of 10. Harrison and Leake Counties continue to report a Tornado Damage Rating of 9. See Table 3.5.4 for details by county.

Vulnerability Rating:

After rating each county in each of the above mentioned four categories (past occurrences, property valuation, population density, and past tornado damage), the rating values were totaled, producing a total vulnerability rating for each county. The range of overall vulnerability rating values was divided into five equal ranges to determine each county's Tornado Vulnerability. These ranges and corresponding levels of vulnerability are shown in the chart below.

Vulnerability Rating Ranges		Tornado Vulnerability
4	11.20	Low
11.20	18.4	Medium Low
18.4	25.6	Medium
25.6	32.8	Medium High
32.8	40	High

Summary of Vulnerability Rating

Harrison, Hinds, and Rankin Counties received a high Tornado Vulnerability. Desoto, Jackson, Jones, and Madison County were in the medium high vulnerability category. See Figure 3.5.12 and Table 3.5.4 for details by county.

Figure 3.5.12
Tornado Vulnerability Rating by County

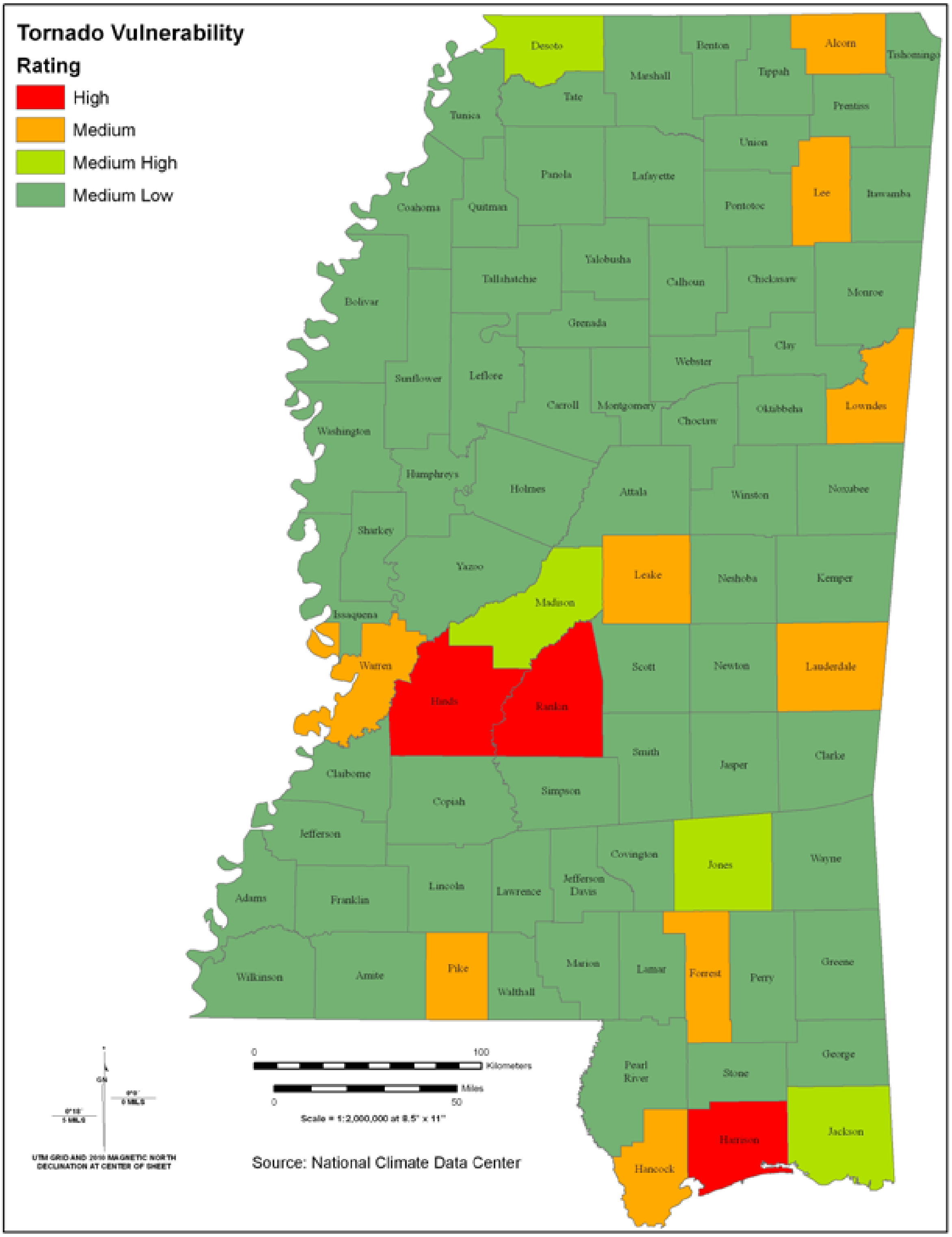


Table 3.5.4
Tornado Vulnerability Ratings By County

County	Prior Event Rating	Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Adams	10	1	3	1	15	Medium Low
Alcorn	10	1	3	5	19	Medium
Amite	10	5	1	2	18	Medium Low
Attala	10	1	1	2	14	Medium Low
Benton	10	1	1	1	13	Medium Low
Bolivar	10	2	2	1	15	Medium Low
Calhoun	10	1	1	1	13	Medium Low
Carroll	10	1	1	1	13	Medium Low
Chickasaw	10	1	2	1	14	Medium Low
Choctaw	10	1	1	2	14	Medium Low
Claiborne	10	1	1	3	15	Medium Low
Clarke	10	1	1	2	14	Medium Low
Clay	10	1	2	1	14	Medium Low
Coahoma	10	1	2	4	17	Medium Low
Copiah	10	1	2	1	14	Medium Low
Covington	10	1	2	2	15	Medium Low
DeSoto	10	10	10	1	31	Medium High
Forrest	10	4	6	1	21	Medium
Franklin	10	1	1	1	13	Medium Low
George	10	1	2	1	14	Medium Low
Greene	10	1	1	1	13	Medium Low
Grenada	10	2	2	1	15	Medium Low
Hancock	10	4	3	3	20	Medium
Harrison	10	10	10	9	39	High
Hinds	10	10	9	7	36	High
Holmes	10	1	1	1	13	Medium Low
Humphreys	10	1	1	1	13	Medium Low
Issaquena	10	1	1	1	13	Medium Low
Itawamba	10	1	2	1	14	Medium Low

County	Prior Event Rating	Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Jackson	10	10	6	1	27	Medium High
Jasper	10	1	1	2	14	Medium Low
Jefferson	10	1	1	1	13	Medium Low
Jefferson Davis	10	1	1	1	13	Medium Low
Jones	10	10	3	5	28	Medium High
Kemper	10	1	1	3	15	Medium Low
Lafayette	10	3	3	2	18	Medium Low
Lamar	10	3	3	1	17	Medium Low
Lauderdale	10	4	4	2	20	Medium
Lawrence	10	1	1	1	13	Medium Low
Leake	10	1	2	9	22	Medium
Lee	10	6	6	1	23	Medium
Leflore	10	2	2	3	17	Medium Low
Lincoln	10	2	2	1	15	Medium Low
Lowndes	10	5	4	3	22	Medium
Madison	10	9	4	5	28	Medium High
Marion	10	1	2	1	14	Medium Low
Marshall	10	2	2	1	15	Medium Low
Monroe	10	2	2	1	15	Medium Low
Montgomery	10	1	1	1	13	Medium Low
Neshoba	10	1	2	5	18	Medium Low
Newton	10	1	2	2	15	Medium Low
Noxubee	10	1	1	1	13	Medium Low
Oktibbeha	10	2	3	1	16	Medium Low
Panola	10	2	2	3	17	Medium Low
Pearl River	10	3	3	1	17	Medium Low
Perry	10	1	1	1	13	Medium Low
Pike	10	2	3	4	19	Medium
Pontotoc	10	2	2	2	16	Medium Low
Prentiss	10	1	2	1	14	Medium Low
Quitman	10	1	1	3	15	Medium Low

County	Prior Event Rating	Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Rankin	10	10	6	10	36	High
Scott	10	1	2	1	14	Medium Low
Sharkey	10	1	1	5	17	Medium Low
Simpson	10	1	2	2	15	Medium Low
Smith	10	1	1	3	15	Medium Low
Stone	10	1	1	1	13	Medium Low
Sunflower	10	1	2	1	14	Medium Low
Tallahatchie	10	1	1	3	15	Medium Low
Tate	10	1	2	1	14	Medium Low
Tippah	10	1	2	1	14	Medium Low
Tishomingo	10	1	2	1	14	Medium Low
Tunica	10	2	1	1	14	Medium Low
Union	10	1	2	2	15	Medium Low
Walthall	10	1	2	1	14	Medium Low
Warren	10	4	3	7	24	Medium
Washington	10	2	3	2	17	Medium Low
Wayne	10	1	1	2	14	Medium Low
Webster	10	1	1	1	13	Medium Low
Wilkinson	10	1	1	1	13	Medium Low
Winston	10	1	1	1	13	Medium Low
Yalabusha	10	1	1	2	14	Medium Low
Yazoo	10	1	1	1	13	Medium Low

Education and Outreach

The State of Mississippi has declared November as Tornado Awareness Month as part of the state's effort to educate the public on tornado safety. In addition, annual statewide testing of tornado warning systems is conducted. The purpose of this test is to encourage schools, government agencies and businesses throughout the state to participate in an annual tornado drill. The test is usually in conjunction with Severe Weather Awareness Week held in February. For more information on these and other education and outreach programs call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. weekdays.

Mitigation Actions In Progress

The Mississippi Emergency Management Agency partnered with the Federal Emergency Management Agency to undertake an effort to improve tornado warning capabilities through participation in a storm siren grant program. This program required localities to provide minimum matching funds, document a proposed site and the effective range and population that would be warned should the project be funded, and assume responsibility for future maintenance of a funded system. Numerous grants were awarded statewide. An analysis of the impact of this action in terms of total increase in capacity to warn individuals of an impending tornado and the number of lives potentially saved by this system is underway.

Lastly, two different data sets, one for GIS use and the other through a tabular reporting system, were obtained from the National Climatic Data Center and used in the writing of this section of the plan. It should be clear that while these two data sets were drawn from the same source, they differed significantly. In accordance with the spirit and intent of this plan, numbers and statistics which err on the side of protection of life and property were used. For example, the GIS data set reported a total of 1,644 events and the tabular-driven reporting system reported 2,011. In this instance, 2,011 is the number reported in this section. It is recommended that these data be reconciled in future planning efforts.

Exposure Analyses

The following section consists of three exposure analyses, using three different sets of data. Exposure analyses are different from loss estimates in that they present facilities and structures that may be exposed to tornados but do not attempt to estimate the amount of damages to be incurred during a tornado event. Loss estimations are discussed in the Potential Losses section following the exposure analyses.

Exposure Analysis of State-Owned Facilities

This analysis has not been updated from the 2007 plan as the inventory of state-owned facilities has not been improved. The data received from the Mississippi Department of Finance and Administration in 2007 contained building inventory information on 67 state institutions/agencies on which they had records on. The number of state-owned facilities by county and their estimated replacement values is provided in Appendix 7.3.0-D.

As previously discussed in this section, all counties were given the same prior event rating of ten because tornados may strike anytime and anywhere in Mississippi with any severity. Thus for the puposes of this plan, all state-owned facilities located within each county are vulnerable to exposure of a tornado event.

Exposure Analysis of Critical Facilities and Infrastructure

The State of Mississippi developed a definition for "critical facilities and infrastructure" as discussed in Section 3.0. Location data for these facilities were collected from various state agencies for the purposes of determining which facilities are at risk to various hazards. However, because this data came from multiple sources, the need to validate the location information and building replacement values is vital to producing accurate assessments for future planning.

For planning and assessment purposes, Appendix 7.3.0-C-1-14 provides regional maps with overlaid critical facilities and infrastructure to assist with identifying the proximity of their locations. As previously discussed in this section, all counties were given the same prior event rating of ten because tornados may strike anytime and anywhere in Mississippi with any severity. Thus for the puposes of this plan, all assets listed within each county are vulnerable to exposure of a tornado event.

3.6: Earthquake Risk Assessment
Limited Hazard

Hazard Description

An earthquake can be defined as a sudden ground motion or vibration of the earth produced by the rapid release of stored-up energy along an active fault. The released energy is transferred to the surrounding materials as vibratory motion known as seismic waves. As the seismic waves pass from one type of geological material to another, they may be amplified or dampened based on the composition of the new material. Also the energy will decrease with distance.

The hazard of an earthquake lies in seismic waves. Once the vibrations reach the ground surface they are transferred to man-made buildings, infrastructure and critical facilities. If the waves are strong enough, and the structure is not designed or built to accommodate the shaking, the vibrations can cause damage to or failure of buildings, infrastructures and critical facilities.

Seismic waves may also create other earthquake-related hazard such as liquefaction and slope failure. Liquefaction may occur where loose sand and silt that is saturated with water is shaken by earthquake energy. The mixture takes on the qualities of a liquid when shaken and can result in a lack of structural support and eventual failure of a structure built upon the liquid-like soil. In Mississippi, liquefaction is more likely to occur where there is a significant floodplain. The rivers with significant floodplains of concern in Mississippi include the Mississippi River, Yalobusha River, Yocona River, Tallahatchie River and Coldwater River. As shown in Table 3.6.1, counties were evaluated based on their location within the aforementioned floodplains and seismic zone. This data has not been updated since the 2007 plan. The liquefaction potential listed in the table references the HAZUS scenario for liquefaction potential in each county. Since the liquifaction data has not changed, the 2007 HAZUS scenario will remain the same.

A definition of technical terms is found in Appendix 7.3.6-A.

Table 3.6.1

High Liquefaction Hazard by County			
County	Seismic Source[1]	Geographic Area of Concern[2]	Liquefaction Potential
Benton	NMSZ	CRFP, WoRFP	Very High, Very Low
Bolivar	NMSZ	MRFP	Very High
Carroll	NMSZ, WRFZ	MRFP	Very High, Very Low
Coahoma	NMSZ, WRFZ	MRFP	Very High
Desoto	NMSZ, WRFZ	MRFP, CRFP	Very High, Very Low
Grenada	NMSZ, WRFZ	MRFP, YaRFP	Very High, Very Low
Holmes	NMSZ	MRFP	Very High, Very Low
Humphreys	NMSZ	MRFP	Very High
Issaquena	NMSZ	MRFP	Very High
Lafayette	NMSZ, WRFZ	TRFP	Very High, Very Low
Leflore	NMSZ, WRFZ	MRFP, YaRFP	Very High
Marshall	NMSZ, WRFZ	CRFP	Very High, Very Low
Panola	NMSZ, WRFZ	MRFP, TRFP, YRFP	Very High, Very Low
Quitman	NMSZ, WRFZ	MRFP, CRFP, TRFP, YRFP	Very High
Sharkey	NMSZ	MRFP	Very High
Sunflower	NMSZ, WRFZ	MRFP	Very High
Tallahatchie	NMSZ, WRFZ	MRFP, TRFP	Very High, Very Low
Tate	NMSZ, WRFZ	MRFP, CRFP	Very High, Very Low
Tunica	NMSZ, WRFZ	MRFP, CRFP	Very High
Union	NMSZ	TRFP	Very High, Very Low
Washington	NMSZ	MRFP	Very High

1NMSZ = New Madrid Seismic Zone
WRFZ = White River Fault Zone
2MRFP = Mississippi River Floodplain
CRFP = Coldwater River Floodplain
TRFP = Tallahatchie River Floodplain
YRFP = Yocona River Floodplain
WoRFP = Wolf River Floodplain (Major River originating in Tennessee)
YaRFP = Yalobusha River Floodplain

Slope failure during a seismic event can result in extensive damage. The areas most likely to experience slope failure during an earthquake are the bluffs that bound the Mississippi River floodplain, river banks, steep slopes in the Bluff Hills, levees, earth-filled embankments and transportation embankments.

Magnitude and intensity are two ways earthquakes are measured. Magnitude measures the energy released at the source of an earthquake and is measured by a seismograph. Intensity is a measure of the shaking produced by an earthquake at a certain location. A comparison of magnitude and intensity is shown in the chart below.

Magnitude	Modified Mercalli Intensity*
1.0 - 3.0	I
3.0 - 3.9	II - III
4.0 - 4.9	IV - V
5.0 - 5.9	VI - VII
6.0 - 6.9	VII - IX
7.0 and higher	VIII - or Higher

*Based on a typical maximum Modified Mercalli Intensity Scale- Definition of scale is found on the subsequent page.

Source: USGS Earthquake Hazards Program

Intensity is gauged by how an earthquake affects people, structures and the natural environment. The Modified Mercalli Intensity Scale is the standard scale used in the United States to measure intensity. Below are the abbreviated descriptions for each intensity level.

I. Not felt except by a very few under especially favorable conditions.

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 motor cars may rock slightly. Vibrations are similar to the passing of a truck. Duration estimated.

IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation is like a heavy truck striking building. Standing motor cars rocked noticeably.

V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage is 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.

VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.

IX. Damage considerable in specially-designed structures; well–designed, frame structures thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off foundations.

X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

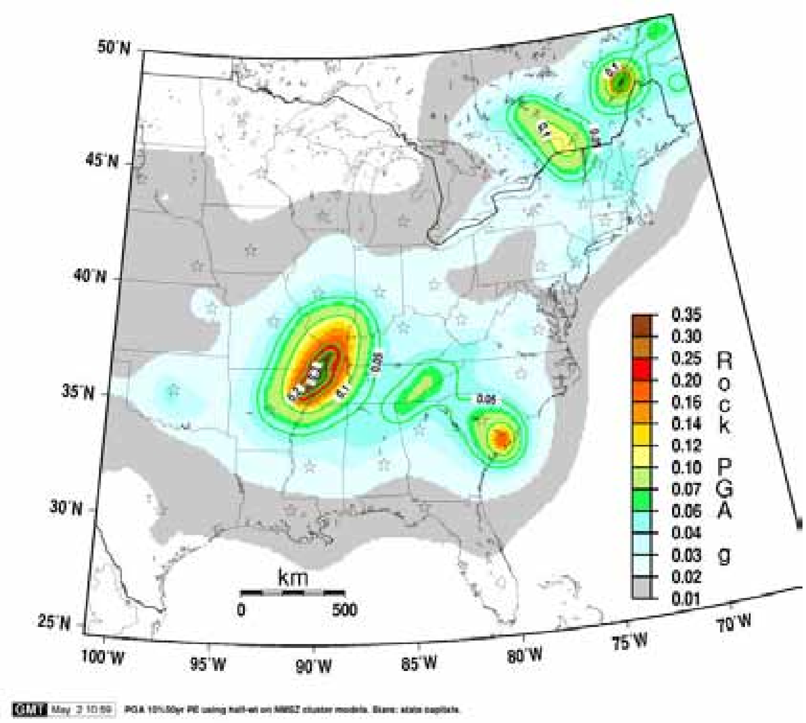
XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.

XII. Damage total. Lines of sight and level are distorted. Objects are thrown into the air.

Potential Damages from Earthquakes

The potential for an earthquake to produce damage arises from many factors, such as condition and/or construction of the affected structures, soil characteristics, and earthquake characteristics. Earthquake characteristics include magnitude, peak ground acceleration, and distance from the epicenter. The epicenter of an earthquake is located on the ground surface directly above the focus, or the location, where the earthquake begins. In most cases, the damage incurred by an earthquake is greatest near the epicenter and decreases with distance. Peak Ground Acceleration (PGA) is the maximum acceleration of a particle during an earthquake. More simply, PGA is the measure of the strength of ground movement. An earthquake's PGA is greatest near its epicenter, which helps explain why earthquake damage is greatest near the epicenter. Figure 3.6.1 provides the PGA potential for a ten percent in 50-year rupture of the New Madrid Fault along with the frequency at which the ground will shake. Figures 3.6.2-a-b on the subsequent page provide spectral acceleration for one and five hertz rupture.

Figure 3.6.1
Peak Ground Acceleration
Rupture of the New Madrid Fault
Ten Percent in 50 Years Probability



Acceleration measured as a percent of the acceleration due to gravity (g's)

Figure 3.6.2-a
Spectral Acceleration at one Hz
Rupture of the New Madrid Fault
Two Percent in 50 Years Probability

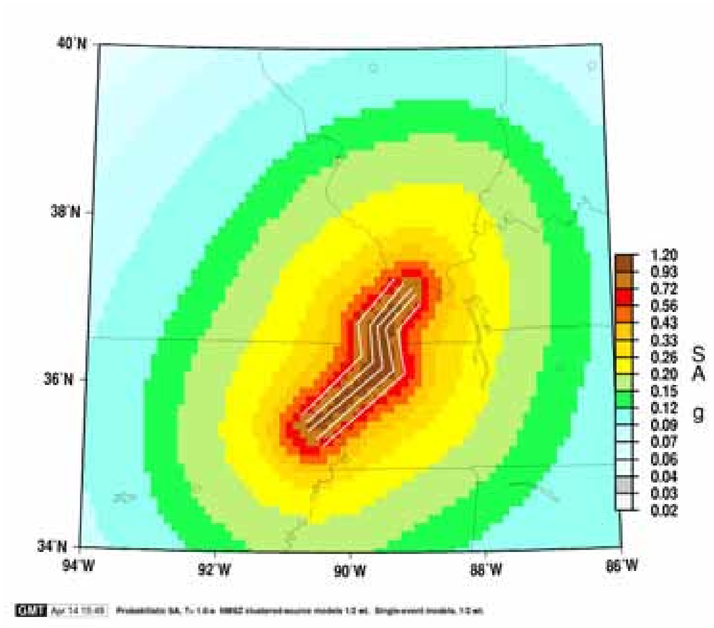
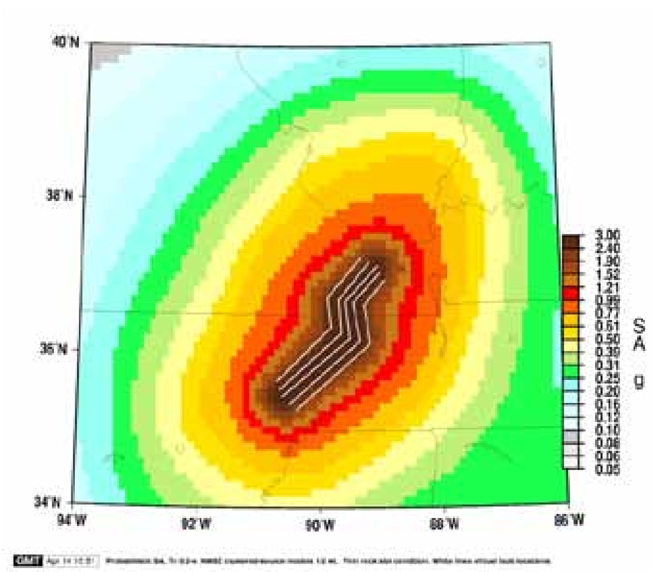


Figure 3.6.2-b
Spectral Acceleration at five Hz
Rupture of the New Madrid Fault
Two Percent in 50 Years Probability
Hz: Hertz, or cycles per second (frequency of ground shaking)
SA measured in g's



Hazard Profile

History of Mississippi Earthquakes

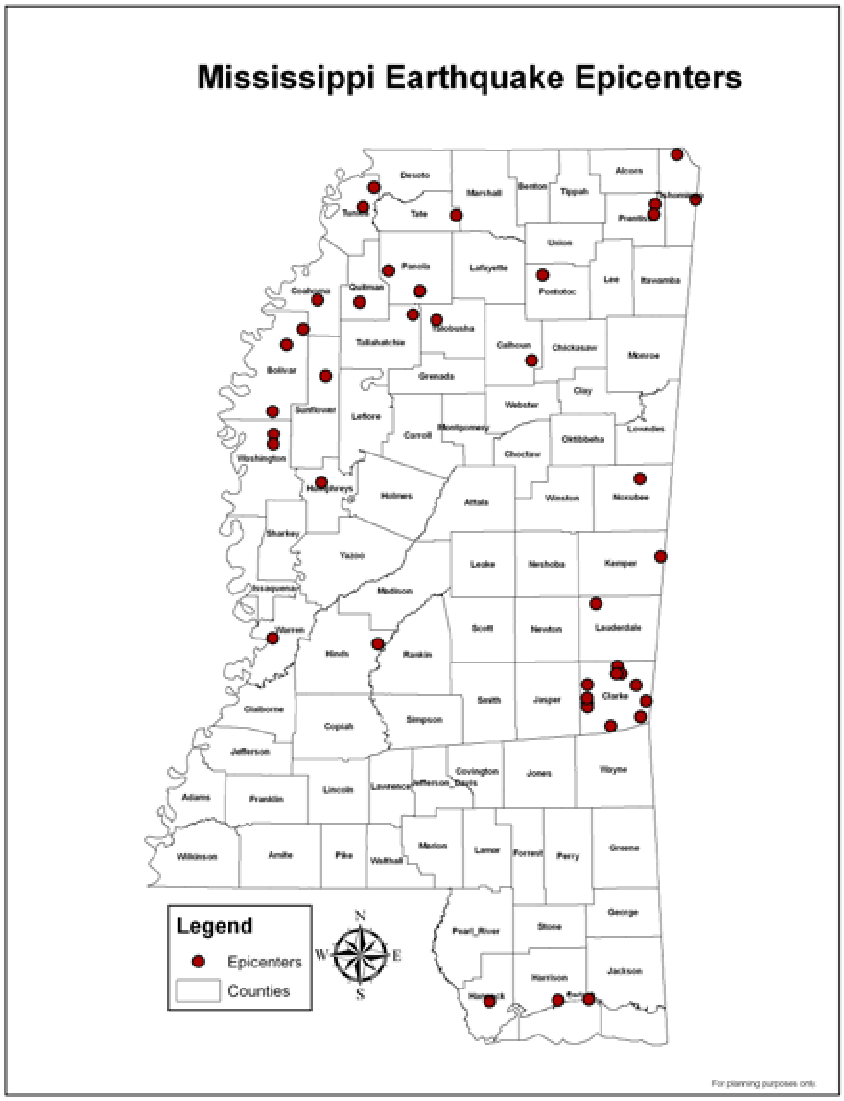
Historically, not many earthquakes are centered within Mississippi. As seen in Table 3.6.2 many earthquakes that originated in Mississippi had a magnitude of 3.5 or less. Damage typically begins to occur when an earthquake reaches a magnitude of 4 or greater. Nevertheless, every earthquake is unique and potentially dangerous. Past seismicity in an area is an indication that earthquakes may occur again in the future. Potential for damage at a location is dependent upon the distance from the epicenter and the magnitude; a lower magnitude event close to your location may cause more damage to your site than a higher magnitude earthquake that is farther away. Table 3.6.2 has been expanded in the 2010 plan update to include additional events that have originated in Mississippi. A complete listing of events (outside of Mississippi) from 1699 to 2010 is provided as Appendix 7.3.6-E. Figure 3.6.3 on the subsequent page shows the epicenter distribution of events originating in Mississippi.

Table 3.6.2
Mississippi Earthquakes

Date	Latitude	Longitude	Magnitude	City/Town
March 31, 1911	34	-91.8	4.7	Tutwiler
March 27, 1923	34.6	-89.8	Not available	Barr
October 28, 1923	34.9	-88.1	Not available	Eastport
November 13, 1927	32.8	-90.2	Not available	Linwood
December 17, 1931	33.8	-90.1	4.6	Oxberry
June 28, 1941	32.4	-90.9	Not available	Vicksburg
February 1, 1955	30.4	-89.1	Not available	Gulfport
September 27, 1956	31.9	-88.5	Not available	Shubuta
June 1, 1962	34.98	-90.18	Not available	Walls
October 22, 1964	31.23	-89.56	Not available	Pine Grove
June 4, 1967	33.55	-90.84	4.4	Shaw
June 29, 1967	33.55	-90.81	Not available	Shaw
January 1, 1973	33.78	-90.62	3.5	Ruleville
May 25, 1973	33.94	-90.63	Not available	Lombardy
September 9, 1975	30.66	-89.25	2.9	Riceville
October 23, 1976	32.2	-88.73	3	Meridian
November 4, 1977	33.83	-89.28	3.4	Calhoun City
June 9, 1978	32.09	-88.58	3.3	Quitman
October 12, 1980	34.26	-89.13	Not available	Turnpike
February 5, 1983	34.7	-88.37	2.9	Cairo

Date	Latitude	Longitude	Magnitude	City/Town
September 25, 1984	34.06	-89.82	Not available	Long Branch
August 11, 1996	33.58	-90.87	3.5	Meltonia
February 25, 1999	34.1	-89.87	2.9	Oakland
August 11, 2002	34.34	-90.17	2.8	Batesville
October 26, 2002	34.03	-90.68	3.1	Duncan
May 10, 2008	34.35	-88.83	3.1	Sherman

Figure 3.6.3
Mississippi Epicenters



Earthquakes originating in Mississippi are not the only threat; those originating in surrounding states have also affected Mississippi in the past. The greatest threat to Mississippi from earthquakes is from a strong event in the New Madrid Seismic Zone. The earthquakes of 1811-1812, which originated along the New Madrid fault zone, shook many areas in Mississippi, reaching as far south as the Gulf Coast. The vibrations from these earthquakes were so powerful they rang church bells in Boston, Massachusetts more than 1,000 miles away. Table 3.6.3 shows a sampling of earthquakes that have originated in other states but have been powerful enough for residents of Mississippi to feel the effects of the vibrations.

Although the New Madrid Seismic Zone (NMSZ) is the primary seismic activity source for the Southeastern United States, there are other potential earthquake sources in Mississippi. The U.S. Geological Survey (USGS) has recorded more than 40 earthquakes originating within the boundaries of Mississippi since 1911. Though none of these Mississippi-centered earthquakes have inflicted severe damage, they should not be disregarded.

One area of notable earthquake activity is in east-central Mississippi in Lauderdale and Clarke counties. This area is not well known, but it has produced more than 14 earthquakes in the past 30 years, according to data gathered from the Mississippi Department of Environmental Quality (MDEQ). Most of these events occurred within the boundaries of Clarke County.

The White River Fault Zone (WRFZ) is another notable seismic zone that was identified in 1944. The Charleston earthquake of 1931 in Tallahatchie County, Mississippi may have been centered along this fault. This is the largest recorded Mississippi-centered earthquake at a magnitude of 5.0. The WRFZ runs from Grenada, Mississippi northward to Newport, Arkansas, approximately 280 miles. Many of Mississippi's epicenters are in the northwest quadrant of the state; some may be associated with the WRFZ. The WRFZ is an area that should be assessed as a significant seismic hazard.

Earthquakes do not occur solely from naturally active faults. Volcanoes and oil and gas production are also potential sources of earthquakes. Mississippi has not had volcanic activity for millions of years; therefore, this impact is minimal. Oil and gas production is common in Mississippi, but might produce only relatively small earthquakes that have minimal hazard.

Table 3.6.3
Earthquakes Affecting Mississippi

Date	Origin	Magnitude	Maximum Intensity	Intensities Reported in MS	Counties Affected
1811-1812	New Madrid Seismic Zone	7.8 - 8.1	XI	Not available	Affected counties as far as the Gulf Coast
March 29, 1972	New Madrid Seismic Zone	Not available	IV	I, II, III, IV	Bolivar, Desoto, and Panola

Date	Origin	Magnitude	Maximum Intensity	Intensities Reported in MS	Counties Affected
April 29, 2003	8 miles ENE of Fort Payne, AL	4.6	V	I, II, III, IV	Alcorn, Chickasaw, Clay, Desoto, Hancock, Harrison, Itawamba, Lafayette, Lauderdale, Lee, Lowndes, Monroe, Oktibbeha, Panola, Prentiss, Tate, Tishomingo, and Yalobusha
November 7, 2004	25 miles SW of Tuscaloosa, AL	4.0	V	I, II, III, IV	Clay, Coahoma, Desoto, Lauderdale, Leake, Oktibbeha, Monroe, Newton, and Scott
February 10, 2005	22 miles WSW of Blytheville, AR	4.1	V	I, II, III	Alcorn, Benton, Coahoma, Desoto, Itawamba, Jones, Lafayette, Lee, Marshall, Pontotoc, Prentiss, Tate, Tippah, Tishomingo, Tunica, and Union
May 1, 2005	15 miles WSW of Blytheville, AR	4.1	IV	I, II, III	Bolivar, Tate and Tunica
June 2, 2005	10 miles NNW of Dyersburg, TN	4.0	III	I	Alcorn, Desoto, Tate, Tishomingo, Tunica and Yalobusha
September 10, 2006	253 miles SSW of Apalachicola, FL	6.0	VI	I, II, III, IV	Alcorn, Bolivar, Covington, Desoto, Forrest, George, Hancock, Harrison, Hinds, Jackson, Jones, Lauderdale, Lee, Marion, Pearl River, Rankin, Scott, Walthall, Warren and Webster

Source: USGS and MDEQ Office of Geology

2010 Plan Update

Earthquake Effects on Dams

In reviewing potential impacts of earthquakes during the 2010 plan update, it was determined that vulnerability of dams should be addressed.

To assess this potential threat, Figure 3.6.4 was created based on the historic events (1699-2010) for the area in and around Mississippi as presented in Tables 3.6.2 and 3.6.3 and Appendix 3.6.B. Significant and high hazard dam locations are presented along with the historical events to provide a "what could/would" happen should one of the historical events repeat itself. The inventory of dams is provided in Appendix 7.3.8-A. Levees were not included as the probability a 100- year flood event occuring at the same time of a significant earthquake is highly unlikely.

Bridge Retrofit Program

The Mississippi Department of Transportation (MDOT) conducts ongoing biennial inspections for all bridge structures. In anticipation of a future earthquake resulting from activity in the New Madrid Fault, it also monitors and inspects bridges that it has "retrofitted," or upgraded, to perform better as a result of newer technology developed to address a seismic event. The bridge retrofit program is concentrated on primary and secondary access routes in Northwest Mississippi. Retrofit activities consist basically of securing bridge caps to piers, thus increasing the probability of the structure remaining standing after an earthquake. The budget for this maintenance initiative is $1,000,000. Today, all new bridges are constructed using earthquake technology.

Table 3.6.4 provdes a listing of bridges in Northwest Mississippi that have been upgraded to seismic retrofit.

Figure 3.6.4
Location of Significant and High Hazard Dams
In Relationship to Historical Events

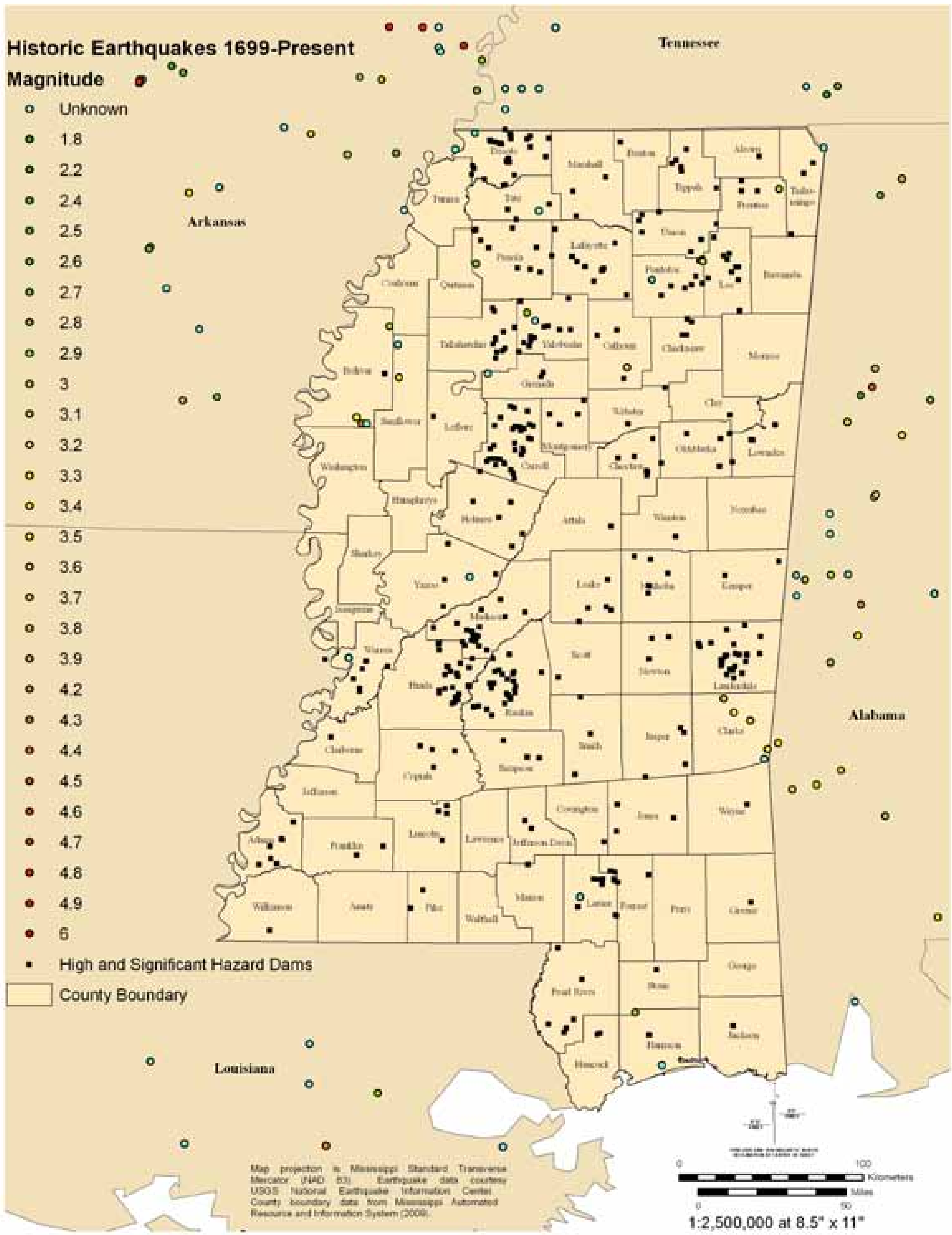


Table 3.6.4
Bridges Retrofitted in Northwest Mississippi

Bridge ID	Feature Intersected	County	Facility Carried
10932	Creek	Desoto	US 51
10941	Lake Cormorant	Desoto	US 61
10950	Coldwater River	Desoto	US 78
10951	Coldwater River	Desoto	US 78
10970	Horn Lake Creek	Desoto	SR 302
10983	Coldwater River	Desoto	SR 305
13155	Barrow Creek	Marshall	US 78
13156	Barrow Creek	Marshall	US 78
13167	Spring Creek	Marshall	US 78
13172	Spring Creek	Marshall	US 78
13173	Chewalla Creek & BN RR	Marshall	US 78
13176	Chewalla Creek & BN RR	Marshall	US 78
13197	Burlington Northern RR	Marshall	SR 4
13200	Burlington Northern RR	Marshall	SR 7
13217	Pigeon Roost Canal	Marshall	SR 309
13232	Coldwater River	Marshall	SR 311
14611	Canal & Shands Bottom Road	Tate	I-55
14612	Canal & Shands Bottom Road	Tate	I-55
14615	Hickahala Creek	Tate	I-55
14616	Hickahala Creek	Tate	I-55
14617	Hickahala Relief	Tate	I-55
14618	Hickhala Relief	Tate	I-55
14621	Coldwater River	Tate	I-55
14622	Coldwater River	Tate	I-55
14631	Coldwater River	Tate	SR 3
14633	Arkabutla Canal	Tate	SR 3
13634	CNIC RR	Tate	SR 3
15413	Johnson Creek	Desoto	US 61

Maximum Threat

The New Madrid Seismic Zone (NMSZ) is considered the most likely source of seismic activity that could cause substantial damage to the State of Mississippi. This zone is considered the linear area of seismic activity extending from the southern portion of Illinois to Marked Tree, Arkansas, which is situated approximately 45 miles north of the Mississippi state line.

During the 2007 State Hazard Mitigation Plan update, the information regarding the maximum threat was revised to reflect the “characteristic” earthquake defined by the USGS. A recurrence of an earthquake with a magnitude of 7.7 is considered to be the “characteristic” earthquake event, similar to the 1811-1812 events. For some counties, smaller events on fault zones within the state may generate larger, local ground motions even if the earthquake magnitude is smaller. Cost estimates generated by the HAZUS-MH code also indicate that a magnitude 7.7 event along the New Madrid would be the most costly scenario to Mississippi ($3.9 billion in total economic loss) compared to other scenarios that have epicenters located in Mississippi. This scenario was not rerun for the 2010 plan.

Probability of Future Events

The Central U.S. does not have as many earthquakes as the Western U.S. As a result, statistically valid data are not yet available for determining probabilities of future earthquake events in this region. The USGS has stated that there are marked differences in determining probabilities of future earthquakes in California as opposed to along the New Madrid Seismic Zone. On the west coast, locations of future earthquakes can be anticipated based on measurements of land deformation. Such predictions are much more difficult with earthquakes along the New Madrid. The New Madrid Fault Zone generates very little surface deformation over time; therefore, as seismic events occur along the New Madrid, data are collected and probabilities can be calculated. According to a study by the Center for Earthquake Research and Information (CERI) at the University of Memphis in 2002, the probability of a repeat of the 1811-1812 earthquakes in a 50-year time period is 7-10%. In the same study, the probability of a magnitude 6.0 or greater earthquake within a 50-year time period was estimated to be 25-40%.

Vulnerability Assessment Methodology/HAZUS-MH Modeling

2010 UPDATE: HAZUS-MR4 is now available, but was not utilized for this analysis. Detailed liquefaction data was not available during the 2010 plan update, so a new HAZUS analysis would not have yielded data as accurate as the previous 2007 runs.

There have been several efforts to assess earthquake vulnerability in Mississippi. Perhaps the most significant concern regarding these efforts is that they all use different methodologies and therefore all have differing results.

An early effort to quantify the earthquake-generated ground-motion risk was published in 1984. This work by Algermissen and Hopper is perhaps the most widely used assessment in Mississippi at the present. It features a map relating Modified Mercalli Intensity (MMI) to a hypothetical 7.6 magnitude earthquake originating from the New Madrid Seismic Zone. The study predicts that 40 counties in Mississippi could experience earthquakes with MMI values between VII and IX. An earthquake with an MMI value of IX results in considerable damage to masonry structures built with earthquake resistance, great damage and perhaps partial collapse of some ordinary masonry structures, and serious damage to reservoirs and underground pipes. An earthquake with an MMI value of VII may result in considerable damage to poorly constructed buildings. Although the methodology was crude, it provided a regional view of potential vulnerabilities so multiple states could use data generated using a common methodology.

Current computer-based methodologies provide considerable improvement to vulnerability assessment. The HAZUS computer model was developed by FEMA in cooperation with the National Institute of Building Sciences to estimate losses associated with a given magnitude earthquake at a specified epicenter (FEMA, 2001; Coburn and Spence, 2002). HAZUS has been updated to include multiple natural hazards, resulting in the addition of an "MH" to the name, i.e. HAZUS-MH. An advantage of the HAZUS-MH model is that it provides a uniform methodology of loss estimation.

The HAZUS-MH model was used here to determine risk, which was in turn, used to determine vulnerabilities. Due to time and budget constraints, the data used for all analyses are from the HAZUS-MH default database. The database is the most fundamental part of the analyses, so errors in the database will be reflected in the results.

The basic steps in the vulnerability analysis are briefly described below. For sake of brevity, many details are not discussed.

1. **Identification of potential earthquake sources** - This work consisted of a literature review and discussions with geologists to determine known earthquake-producing faults as well as faults that could potentially produce earthquakes. Discussions also considered the size earthquake a particular fault or fault system could produce.

2. **HAZUS-MH analysis of earthquake scenarios** - Using the information from the geological analyses, a set of earthquake scenarios were created and run through HAZUS-MH. These scenarios included a New Madrid Seismic Zone earthquake in Marked Tree, Arkansas, and earthquakes in Benton County, Panola County, and Clarke County, Mississippi. Additional details regarding the scenarios are discussed under the heading of "Estimating Potential Losses by Jurisdiction."

As part of the risk assessment update in 2007, two new earthquake analyses were run, both using the May 2006 release of HAZUS-MH MR2, which includes 2005 building valuations. An annualized loss scenario that enabled an "apples to apples" comparison of earthquake risk for each county was run. A second deterministic scenario was run to model impacts from a magnitude 7.7 earthquake on the southwest arm of the New Madrid Seismic Zone. U.S. Geological Survey ground shaking maps specific to this event were used in this scenario that analyzed 41 counties in northern Mississippi. This analysis included more detailed soils and liquefaction data for certain counties in northwest Mississippi that are most at risk. This scenario replaces the Marked Tree magnitude 8.0 scenario from the 2004 plan due to the enhanced hazard inputs (level 2) used in this scenario.

3. **Determination of Risk Factors from HAZUS-MH results** – Risk may be defined in several ways. Coburn and Spence (2002) define it as "...the expected losses to given elements at risk, over a specified future time period." FEMA (2001) defines it in a similar manner: "The estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." FEMA (2001) points out that risk can be defined in relative terms such as high, medium, or low likelihood of damage exceeding a threshold level or can be described in terms of monetary loss.

Here, HAZUS-MH computations were used to evaluate risk factors at the county, planning and development district, and state levels. Monetary loss, exposure, PGA, and other parameters were considered. Percent loss (or loss ratio) is a particularly useful parameter as it incorporates many other parameters in its derivation.

4. **Application of risk factors to determine vulnerability** - Risk factors for all earthquake scenarios were analyzed. The percent loss factor and total economic losses are the primary factors in the overall vulnerability determinations. The counties with the highest building loss potential were considered most vulnerable. The annualized loss scenario's economic losses and percent loss results are presented as supplemental to the vulnerability rankings.

5. **Analysis of vulnerabilities by jurisdiction** - The vulnerabilities were analyzed at the county and the planning and development district (PDD) level. This set of analyses should allow priorities to be set as to which counties and PDDs are most vulnerable to earthquake-generated damage and monetary loss. As Mississippi's PDDs vary in size and geographic location, Table 3.6.5 has been prepared to summarize their composition and as a legend for the PDD numbers used in Table 3.6.9.

Table 3.6.5
Planning and Development Districts (PDD) in Mississippi

ID	PDD	NO. COUNTIES	COUNTIES
1	Northeast MS	6	Alcorn, Benton, Marshall, Prentiss, Tippah, Tishomingo
2	North Delta	7	Coahoma, Desoto, Panola, Quitman, Tallahatchie, Tate, Tunica
3	Three Rivers	8	Calhoun, Chickasaw, Itawamba, Lafayette, Lee, Monroe, Pontotoc, Union

4	North Central	7	Attala, Carroll, Grenada, Holmes, Leflore, Montgomery, Yalobusha
5	South Delta	6	Bolivar, Humphreys, Issaquena, Sharkey, Sunflower, Washington
6	Golden Triangle	7	Choctaw, Clay, Lowndes, Noxubee, Oktibbeha, Webster, Winston
7	Central MS	7	Copiah, Hinds, Madison, Rankin, Simpson, Warren, Yazoo
8	East Central	9	Clarke, Jasper, Kemper, Lauderdale, Leake, Neshoba, Newton, Scott, Smith
9	Southwest MS	10	Adams, Amite, Claiborne, Franklin, Jefferson, Lawrence, Lincoln, Pike, Walthall, Wilkinson
10	Southern MS	15	Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jefferson Davis, Jones, Lamar, Marion, Pearl River, Perry, Stone, Wayne

HAZUS-MH Loss Estimation Scenarios

Since the 2004 plan, the development of digital maps of ground shaking, soil amplification, and liquefaction potential in the central United States has enabled more accurate modeling of a magnitude 7.7 event with an epicenter on the southwest arm of the New Madrid Seismic Zone. This scenario replaces an earlier level 1 analysis of a magnitude 8.0 event with an epicenter near Marked Tree, Arkansas. A magnitude 7.7 scenario was chosen because that is the magnitude of a "characteristic" event that the U.S. Geological Survey (USGS) determined would be similar to the 1811-1812 earthquake sequence. The USGS recommended this scenario to the Central United States Earthquake Consortium (CUSEC) to use in the recent planning of a multi-state earthquake emergency response exercise. If the southwest arm of the New Madrid Seismic Zone were to rupture, it would do the most damage in Mississippi.

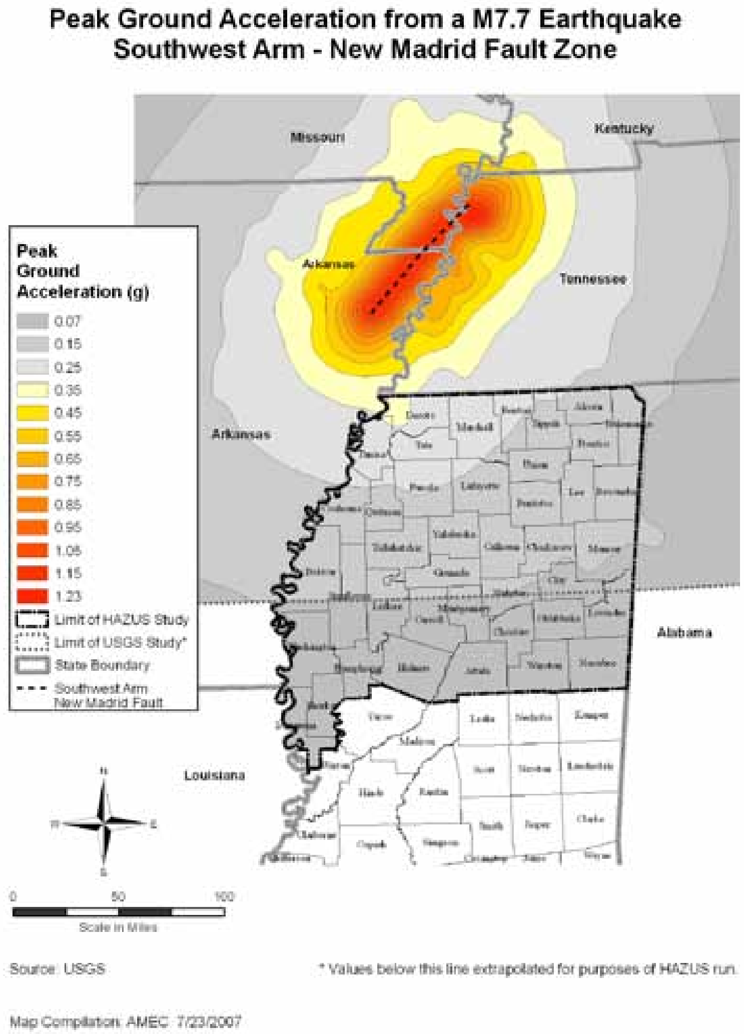
The following user-supplied data inputs were used in this analysis:

USGS deterministic ground motion maps for a magnitude 7.7 event on southwest arm of the New Madrid Seismic Zone, including potential ground acceleration, potential ground velocity, and spectral acceleration at 1 second and .03 second frequencies (Appendix 7.3.6-B)

Liquefaction susceptibility map, based on a 1:250,000 CUSEC soils map, assigned a liquefaction proxy by FEMA, and extrapolated by plan developers to include Mississippi River valley alluvium in northern Mississippi

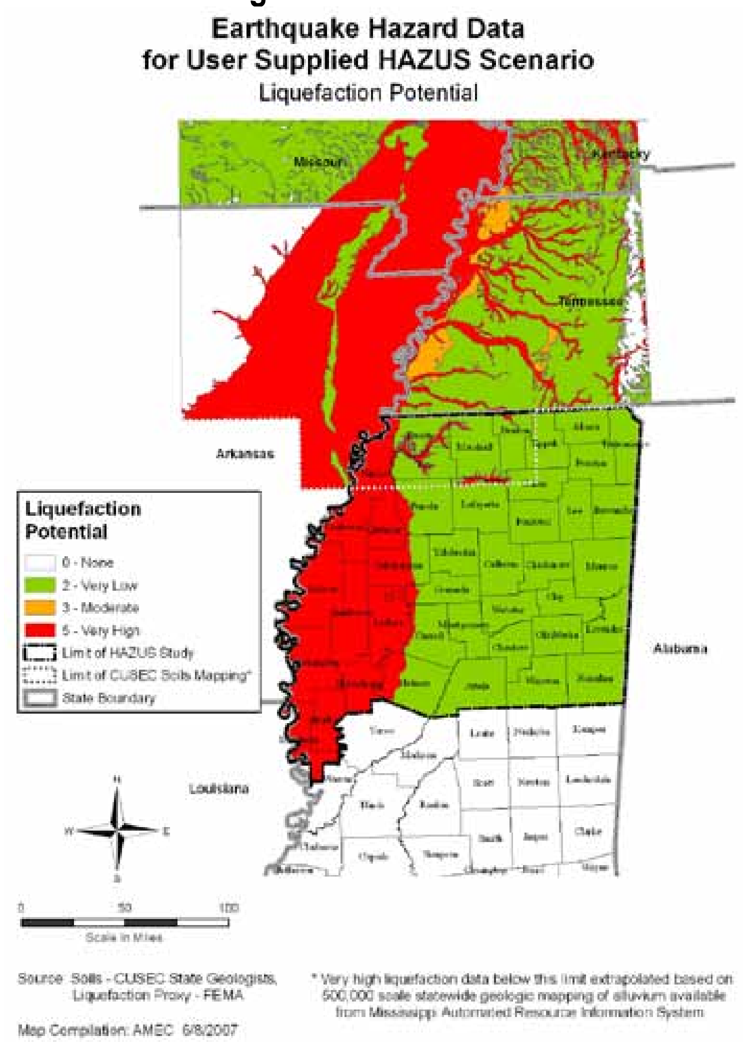
The ground shaking data exist for an area that covers about 30 counties in northern Mississippi, and the detailed liquefaction hazard data covered only about 4 counties. Although they do not cover the entire state, they do cover the most earthquake-prone region. The USGS ground motion maps are critical inputs. Without these inputs, ground motion is cut off prematurely based on existing regression equations within HAZUS-MH, and soil amplification is not included. Ground motion mapping was extrapolated to include a 41-county region covering the entire northern half of Mississippi, including the PDDs of Northeast Mississippi, Golden Triangle, North Central, North Delta, South Delta, and Three Rivers. The Peak Ground Acceleration (PGA) values and study region limit are shown in Figure 3.6.5. Where data did not exist in this region, the outermost ground motion value was extrapolated to fill the gap.

Figure 3.6.5
Ground Shaking Input for New Madrid Magnitude 7.7 Scenario



The liquefaction susceptibility map (Figure 3.6.6) is another critical input for the scenario. Without it, HAZUS-MH is unable to model the impacts of permanent ground deformation on the transportation system and other infrastructure. The regional scale liquefaction mapping available extended into the Mississippi counties of Tunica, Desoto, Tate, Marshall, and Benton. Based on information in the 2004 plan (Counties Containing a Liquefaction Hazard, in the earthquake hazard profile), the liquefaction data layer was extrapolated to include all the counties in the northern half of Mississippi (Figure 3.6.6). This extrapolation was based on 500,000 scale geologic mapping of Mississippi available from the MARIS web site. The polygon representing Mississippi River valley alluvium was added to the liquefaction layer to extend the hazard along the river valley. The remaining polygon that covered areas not mapped for alluvium was classified as low liquefaction potential. There is still a need for more detailed liquefaction hazard mapping in northern Mississippi, but this interim layer was used as the best available data when this plan was updated in 2007 and 2010.

Figure 3.6.6
Liquefaction Hazard Input for New Madrid
Magnitude 7.7 Scenario



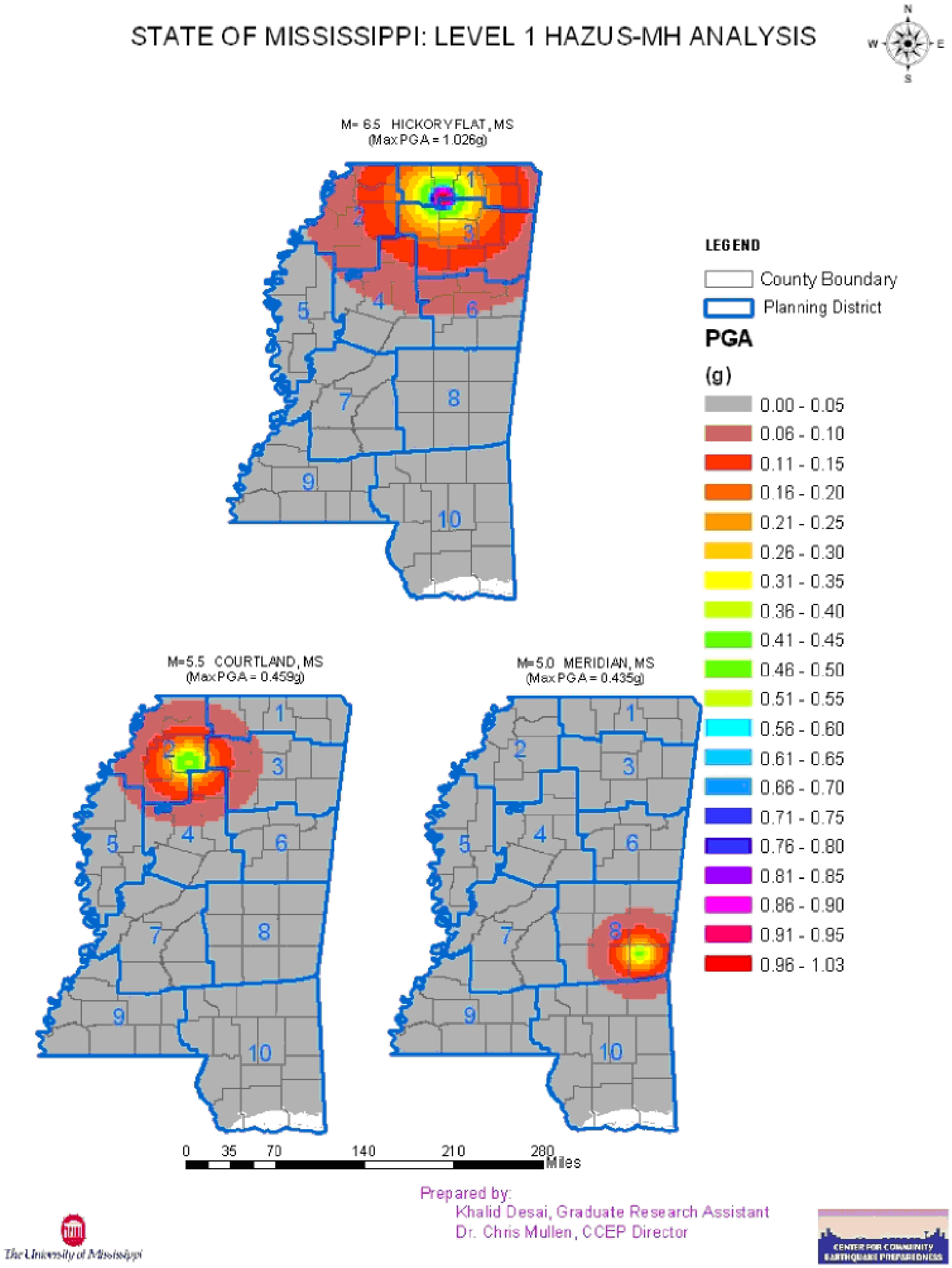
The Hickory Flat earthquake scenario (Benton County) is named for a small town in Benton County. This scenario is based on the recent work by Hough and Martin (2002), which suggested one of the larger earthquakes (magnitude 6.5) was associated with the 1811-1812 New Madrid Seismic Zone events and occurred somewhere in northern Mississippi. If this is true, then this seismic event is within Mississippi rather than in the New Madrid Seismic Zone. It further suggests that an unrecognized fault in northern Mississippi is capable of generating substantial earthquakes within the State. Hough and Martin presented an ideal geographic location near the town of Hickory Flat, Mississippi. The epicenter may have occurred elsewhere in northern Mississippi, but the Hickory Flat coordinates were used in the HAZUS-MH modeling. The value of this scenario is to evaluate the losses that may be expected from a major earthquake originating in northern Mississippi (Figure 3.6.7).

The Courtland earthquake scenario (Panola County) is named for the small town of Courtland. A series of small earthquakes occurred in the Panola County area and are believed to be associated with the White River Fault Zone. Swann, Bograd, and Hudson (1999) suggest that the largest historical earthquake to occur within Mississippi may have been associated with the White River Fault Zone (the Charleston, Mississippi, earthquake of 1931). The 1931 event is estimated to have had a magnitude of 4.7. Since the White River Fault Zone is of significant length, it was judged that it may be capable of magnitudes larger than the historic 4.7 event. For this scenario, a 5.5 magnitude event was modeled with its epicenter located at the same location as the 1999 Courtland earthquake. The value of this scenario is to evaluate losses from an area of known earthquake activity within the State (Figure 3.6.7).

The Meridian earthquake scenario (Clarke County) is named for the city of Meridian. This scenario was selected because of the tightly clustered epicenters located in the Clarke County area. These small earthquakes represent perhaps the best-defined cluster of earthquake epicenters in Mississippi. The Clarke County scenario modeled a magnitude 5.0 event, with an epicenter in this tight cluster of earthquake epicenters. It has also been noted that Gilliland and Harrelson (1980) identified faults in the area. The value of this scenario is to evaluate losses that may occur from an earthquake in this seismically active area of Mississippi (Figure 3.6.3).

An annualized loss scenario that enabled an "apples to apples" comparison of earthquake risk for each county was run in 2007. The annualized expected loss (AEL) addresses key components of risk: the probability of hazard occurring in the study area, the consequences of the hazard (largely a function of building construction type and quality), and the intensity of the hazard event. By annualizing estimated losses, the AEL factors in historical patterns of frequent small events with infrequent larger events to provide a balanced presentation of the risk. In HAZUS-MH, losses are annualized over eight earthquake return periods (100, 200, 500, 750, 1,000, 1,500, 2,000, and 2,500 years).

Figure 3.6.7
PGA From Other Scenarios used in Vulnerability Assessment



Scenario Results

The results of the New Madrid magnitude 7.7 scenario include total losses of approximately $3 billion in building and income losses, with overall economic losses approximating $3.9 billion. Over 25 percent of the total number of buildings in the state would be at least moderately damaged. Fifteen percent of the building and income losses would be related to business interruption. Table 3.6.6 summarizes the results from the HAZUS-MH run for the entire state (Appendix 7.3.6-C HAZUS-MH Earthquake Event Summary Report). Additional results from this scenario can be found in Appendix 7.3.6. More detail on impacts specific to state infrastructure and facilities are detailed in the Estimating Potential Losses of State Facilities and Infrastructure section.

The maps that follow depict the modeled earthquake impacts by county. The loss-ratio map (Figure 3.6.8) depicts the ratio of the building structure and non-structural damage to the value of the entire building inventory. Loss ratio is a measure of the disaster impact to community sustainability, which is generally considered at risk when losses exceed 10 percent of the built environment (FEMA). The loss-ratio map depicts considerable losses in northwestern Mississippi, which is consistent with this area's close proximity to the New Madrid Seismic Zone, high liquefaction potential, and populated areas. The next map (Figure 3.6.9) depicts building losses, which include structural and non-structural damage, content and inventory loss, and wage and income loss. Table 3.6.7 summarizing the building-related losses by county follows the maps.

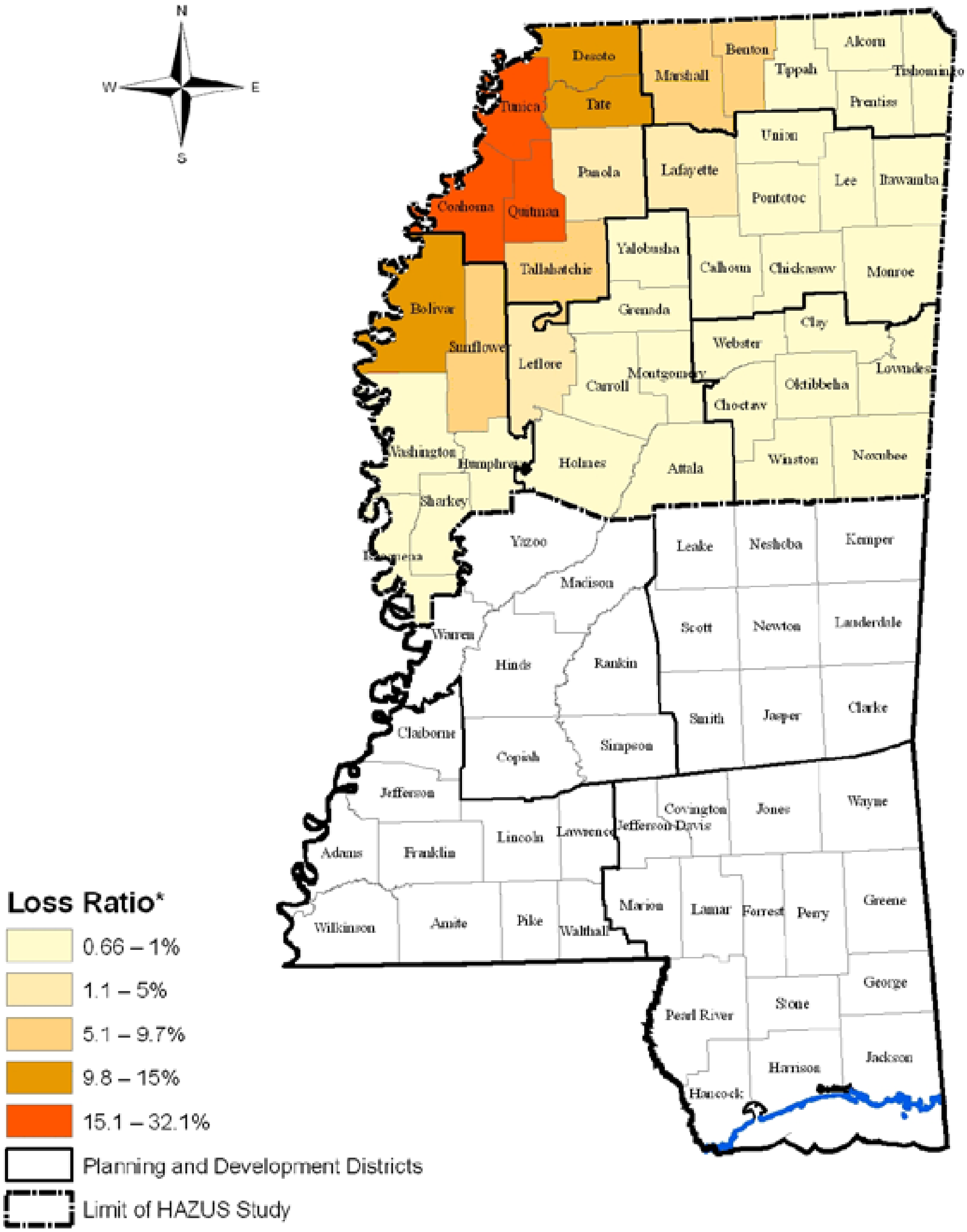
Counties that have a high liquefaction hazard and are closest to the New Madrid Seismic Zone would experience considerable losses. Lateral spreading (ground failure due to liquefaction) could lead to impassable roadways, ruptured utility lines, and damaged port facilities. Bridge damage could be significant, potentially isolating some communities.

Table 3.6.6
HAZUS-MH Earthquake Loss Estimation: New Madrid Southwest Arm M7.7 Scenario Results Summary of Overall Impacts

Type of Impact	Impacts to Region
Total Buildings Damaged	Slight: 75,497 Moderate: 24,910 Extensive: 6,695 Complete: 8,337
Building and Income Related Losses	$3 billion
Total Economic Losses (includes building, income and lifeline losses)	$3.9 billion
Casualties (based on 2 a.m. time of occurrence)	Without requiring hospitalization: 2,350 Requiring hospitalization: 566 Life threatening: 52 Fatalities: 94

Type of Impact	Impacts to Region
Casualties (based on 2 p.m. time of occurrence)	Without requiring hospitalization: 2,240 Requiring hospitalization: 579 Life threatening: 81 Fatalities: 146
Casualties (based on 5 p.m. time of occurrence)	Without requiring hospitalization: 2,082 Requiring hospitalization: 572 Life threatening: 162 Fatalities: 135
Damage to Schools	61 with at least moderate damage
Damage to Hospitals	6 with at least moderate damage
Damage to Transportation Systems	67 highway bridges, at least moderate damage 0 highway bridges, complete damage 0 railroad bridges, moderate damage 1 airport facility, moderate damage
Households without Power/Water Service (based on 407,337 households)	Power loss, Day 1: 8,537 Water loss, Day 1: 71,053 Water loss, Day 3: 65,903 Water loss, Day 7: 53,970 Water loss, Day 30: 2,596 Water loss, Day 90: 0
Displaced Households	8,816
Shelter Requirements	2,722 people out of 1,112,469 total population in region
Debris Generation	1 million tons
Source: HAZUS-MH MR2	

Figure 3.6.8
Map of New Madrid M7.7 Scenario Results: Loss Ratio

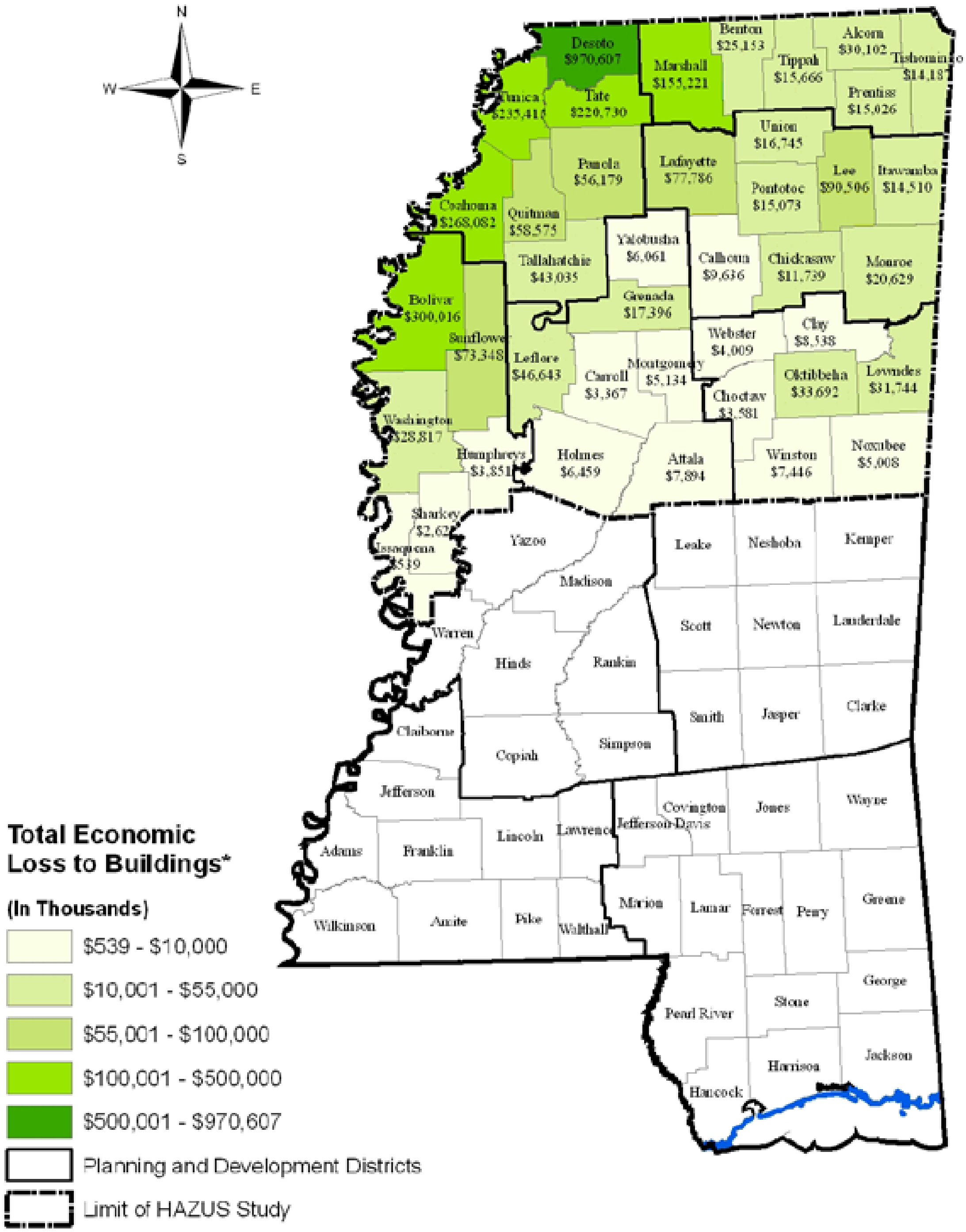


Source: HAZUS - MH

* Loss ratio is the percentage of the total value of structures in the county that could be damaged by this earthquake.

Map Compilation: AMEC 6/8/2007

Figure 3.6.9
Map of New Madrid M7.7 Scenario Results: Total Economic Loss to Buildings



Source: HAZUS - MH

* Includes property damage and business interruption losses.

Map Compilation: AMEC 6/8/2007

Table 3.6.7
HAZUS-MH Earthquake Loss Estimation: New Madrid Southwest Arm M7.7 Scenario Results: Building Impacts by County, Ranked by Highest Building Losses

(All dollar values are in thousands)

County	Structural Damage ($)	Non Structural Damage ($)	Total Direct Loss ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)	Total Building Loss ($)**	Loss Ratio Rank
Desoto	158,414	498,621	657,035	9.78	176,905	136,667	970,607	6
Bolivar	47,387	168,737	216,123	14.30	52,601	31,292	300,016	5
Coahoma	42,518	142,698	185,217	16.06	45,731	37,134	268,082	2
Tunica	27,913	102,990	130,903	32.13	31,712	72,799	235,415	1
Tate	35,600	112,483	148,083	14.44	39,550	33,098	220,730	4
Marshall	29,245	79,587	108,832	8.35	25,912	20,477	155,221	7
Lee	10,160	38,930	49,090	1.06	22,725	18,690	90,506	14
Lafayette	7,724	34,671	42,395	1.89	26,874	8,517	77,786	13
Sunflower	11,891	41,892	53,783	5.11	12,745	6,820	73,348	10
Quitman	10,512	33,222	43,374	15.88	9,353	5,488	58,575	3
Panola	8,598	29,401	37,999	3.27	11,882	6,297	56,179	11
Leflore	7,351	24,980	32,331	2.24	8,125	6,188	46,643	12
Tallahatchie	7,789	23,480	31,268	7.99	7,375	4,392	43,035	8
Oktibbeha	4,613	15,403	20,016	0.84	6,715	6,961	33,692	27
Lowndes	5,160	14,741	19,901	0.69	5,732	6,111	31,744	33
Alcorn	3,352	14,837	18,189	1.05	7,683	4,230	30,102	15
Washington	4,595	13,297	17,892	0.67	5,287	5,637	28,817	40
Benton	4,491	12,667	17,158	5.76	4,235	3,761	25,153	9
Monroe	2,635	10,727	13,362	0.87	5,211	2,056	20,629	26
Grenada	2,023	8,223	10,246	0.98	4,433	2,717	17,396	18
Union	2,041	8,193	10,234	0.95	4,419	2,092	16,745	19

County	Structural Damage ($)	Non Structural Damage ($)	Total Direct Loss ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)	Total Building Loss ($)**	Loss Ratio Rank
Tippah	1,880	7,970	9,849	1.03	4,197	1,619	15,666	17
Pontotoc	1,892	7,727	9,619	0.93	3,971	1,483	15,073	22
Prentiss	1,826	7,603	9,429	0.93	3,874	1,724	15,026	23
Itawamba	1,707	7,611	9,318	0.91	3,958	1,235	14,510	24
Tishomingo	1,675	7,278	8,953	0.91	3,761	1,473	14,187	25
Chickasaw	1,739	5,693	7,432	1.04	2,952	1,354	11,739	16
Calhoun	1,196	4,875	6,070	0.94	2,597	969	9,636	20
Clay	1,441	4,188	5,629	0.68	1,539	1,370	8,538	36
Attala	1,446	3,911	5,357	0.71	1,399	1,137	7,894	32
Winston	1,270	3,772	5,042	0.66	1,377	1,027	7,446	41
Holmes	1,309	3,313	4,622	0.77	1,053	784	6,459	29
Yalobusha	853	3,293	4,146	0.94	1,463	451	6,061	21
Montgomery	836	2,407	3,242	0.67	896	996	5,134	39
Noxubee	994	2,366	3,360	0.79	845	802	5,008	28
Webster	699	1,979	2,678	0.68	734	597	4,009	38
Humphreys	702	1,884	2,586	0.68	770	496	3,851	34
Choctaw	631	1,870	2,501	0.68	629	451	3,581	37
Carroll	647	1,872	2,519	0.68	570	278	3,367	35
Sharkey	517	1,211	1,729	0.74	470	424	2,622	30
Issaquena	108	322	429	0.71	87	22	539	31

Source: HAZUS-MH MR2

Note: *Loss ratio is the percentage of the total value of structures in the county that could be damaged by this earthquake.
**Total income loss includes relocation loss, capital-related loss, wages loss, and rental income loss.

Limitations to the HAZUS-MH loss modeling include inability to accurately assess the impact to long-span bridges, such as those crossing the Mississippi River. Damage to major infrastructure, such as power and other utility distribution systems, is estimated based on a proxy of the population within the study area and not on actual data representing these systems. Improvements to future HAZUS-MH runs may include using more extensive geologic mapping (as it becomes available), using more extensive ground shaking mapping, adding utilities infrastructure, and adding groundwater depth maps to the analysis. More extensive geologic and ground shaking mapping in northern Mississippi would enable more accurate representation of the earthquake hazard in the northern half of the state.

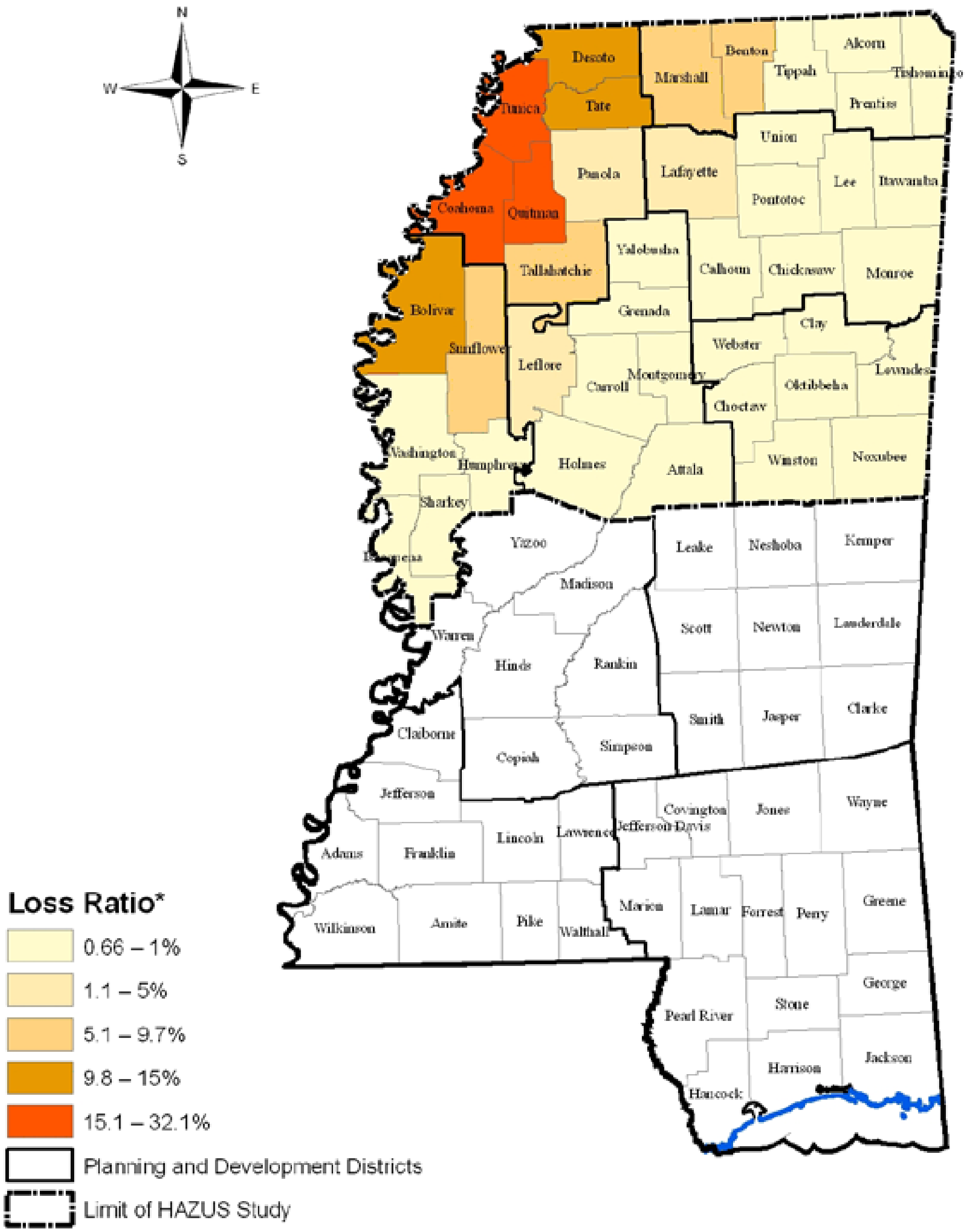
There are limits to the HAZUS-MH inventory, which is mostly based on 2002 building inventories. Desoto County is rapidly growing as a bedroom community to Memphis. Tate and Tunica counties have grown in population between 2000 and 200. More residential, commercial, and school buildings have been added in the past several years. The HAZUS-MH inventory may not represent the roughly $3 billion in casinos in Tunica County. Also, there has also been a resurgence in manufacturing in northern Mississippi in recent years (source: Center for Community Earthquake Preparedness, verbal discussion). Thus, the impacts are likely underestimated, as the HAZUS-MH results do not reflect recent changes in development and population.

For the in-state scenarios, HAZUS-MH estimates building-related total direct losses for the entire state to be:

- $1.33 billion Hickory Flat scenario
- $0.17 billion Courtland scenario
- $0.04 billion Meridian scenario

The results of the updated annualized loss scenario are shown in the following figures. The first map (Figure 3.6.10) shows loss ratio, which is the ratio of the average annualized losses divided by the entire building inventory by county. The second map (Figure 3.6.11) shows total economic losses to buildings. The trend shows annualized losses (and loss ratios) to be most significant in the northwest corner of the state, but even urbanized areas in middle and southern Mississippi could have earthquake-related losses. The losses in the northwestern portion of the state are consistent with the state's proximity to the New Madrid Seismic Zone and the fact that the more-developed areas in the region are likely to suffer the most building losses, particularly where there are large numbers of unreinforced masonry buildings.

Figure 3.6.10
Annualized Loss Scenario Results: Loss Ratio

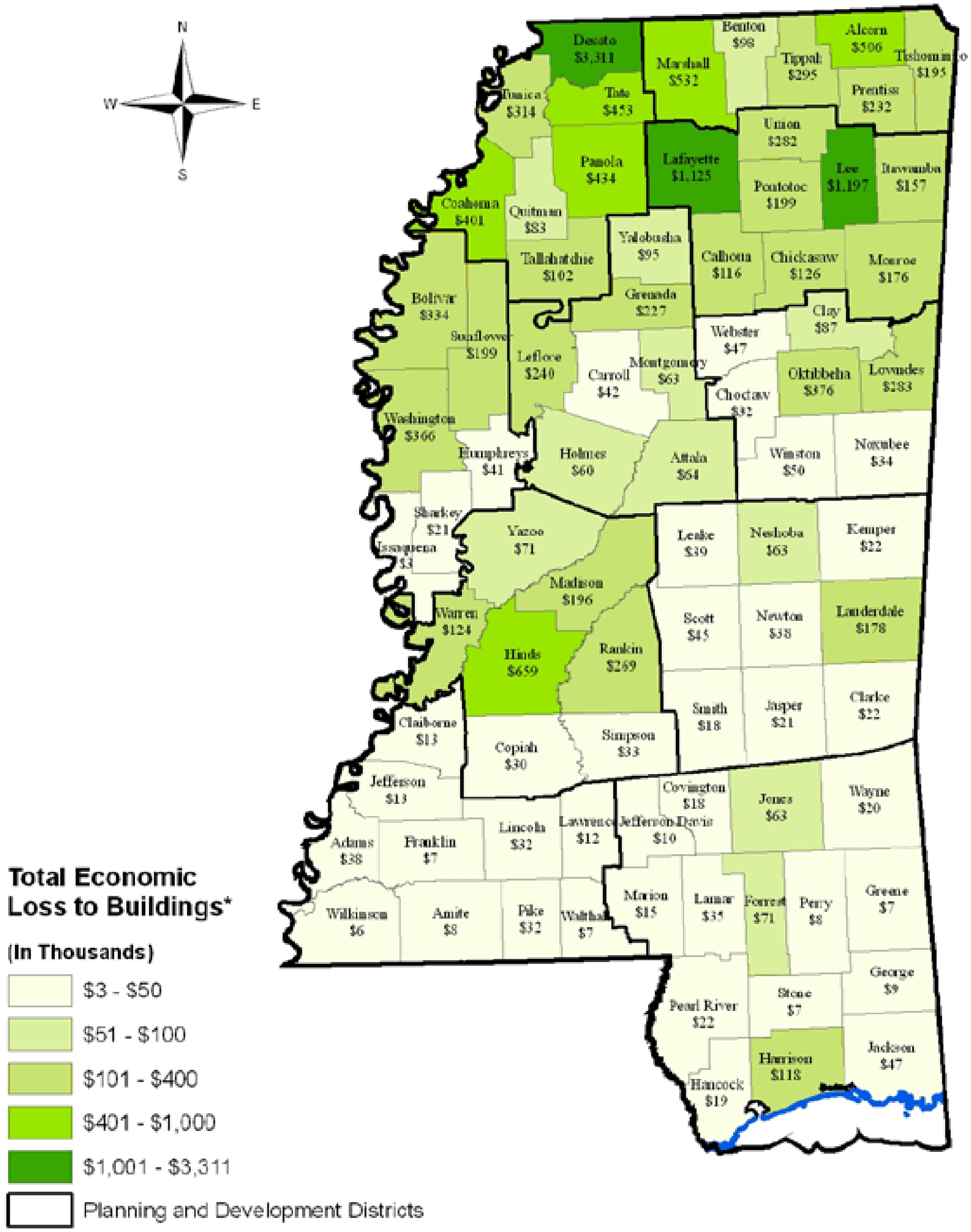


Source: HAZUS - MH

* Loss ratio is the percentage of the total value of structures in the county that could be damaged by this earthquake.

Map Compilation: AMEC 6/8/2007

Figure 3.6.11
Annualized Loss Scenario Results: Total Economic Loss



Source: HAZUS - MH

* Includes property damage and business interruption losses.

Map Compilation: AMEC 6/8/2007

Vulnerability of People to Earthquakes

Examination of the HAZUS-MH modeling suggests that most of the State's vulnerabilities are within three PDDs: North Delta, Three Rivers, and Northeast Mississippi. These PDDs also correlate with concentrations of population resulting largely from "spill over" from the Memphis, Tennessee, metropolitan area. These PDDs account for 637,000 or 22 percent of the state's 2.84 million people (2000 Census Data), and Desoto County alone accounts for 8 percent of the state total. Desoto, Tunica, and Tate counties in northwestern Mississippi have all grown, 34 percent, 12 percent, and 5 percent, respectively, since 2006. Thus, the population at risk to earthquakes in Mississippi is increasing.

The individual county emergency managers typically plan evacuation routes, but not explicitly for earthquake scenarios. Failure of the transportation network after a major seismic event would greatly increase the vulnerabilities for people in these PDDs.

Loss of Life from Earthquakes

Unlike hurricanes and tornados, earthquakes strike without warning and seismic waves arrive and depart in a matter of seconds rather than hours or minutes, respectively. Loss of life depends on the time of day and where people are located at the time of arrival of the seismic waves. The HAZUS-MH code allows for "time-of-day" considerations.

Panhorst and Swann, (2004), examined preparedness issues regarding hospitals and the medical profession. They reported that for the worst case scenario (magnitude 8 NMSZ earthquake) projected loss of life in Mississippi varied from 55 to 136, depending on the time the earthquake occurred. Other scenarios were not reported on in this article.

The magnitude 7.7 earthquake scenario and the others included in the vulnerability analysis are summarized in Table 3.6.8 below. Scenario names reflect the different HAZUS-MH scenarios.

Table 3.6.8
Loss of Life as a Function of Time of Occurrence

Scenario	Magnitude	2 a.m.	2 p.m.	5 p.m.
New Madrid 7.7	7.7	94	146	135
Hickory Flat	6.5	15	23	22
Courtland	5.5	1	2	1
Clarke County	5.0	0	0	0

Examination of Table 3.6.8 clearly indicates that the SW New Madrid Seismic Zone event will be the most costly in terms of loss of life. This loss of life is due to the concentration of population near Memphis, Tennessee, particularly in Desoto County. The 2 p.m. occurrence time results in more loss of life in all scenarios except the Clarke County event, where no loss of life is predicted.

Vulnerability of Natural Resources to Earthquakes

Natural resources are not as vulnerable to earthquakes as they are to hurricanes and tornadoes. Most resources are somewhat resilient to the effects of ground shaking. Large ground shaking can lead to surface rupture which might cause damage depending on what is located on or near the plane of the rupture. Liquefaction and slope movement is particularly important with oil and gas pipelines. Both are either not included or poorly represented in the HAZUS-MH data base. A failure of a levee on the Mississippi River or one of several large dams in north Mississippi could lead to major flooding of farmlands in the low Mississippi River flood plain.

Vulnerability of Private Improvements to Earthquakes

None of the existing building inventory and infrastructure in north Mississippi has been tested under the major shaking of earthquakes that occurred almost 200 years ago. Performance of the built environment will be highly variable and difficult to predict. Mississippi has shown no consistency in adoption of seismic resistant building codes. The state has adopted one building code, counties another or none at all, and cities often adopt different codes than the county they lie in.

Homes, businesses, and manufactured homes are especially vulnerable to the effects of an earthquake. Many structures are constructed which are not designed by a registered professional architect or an engineer. Many have been built without the requirement to satisfy a building code, none having been adopted by the local jurisdiction. Where a building code has been adopted, the number of qualified building inspectors and peer review professionals may not be sufficient to ensure enforcement of the often complex seismic provisions. Private improvements have the same vulnerability to earthquake-induced fire and flooding that natural resources do. They are also vulnerable to gas explosions from broken gas pipelines with or without fire.

Assessing Vulnerability and Estimating Losses by Jurisdiction

The following section explains how the HAZUS-MH-estimated building losses and percent loss were utilized to rank and assess vulnerability by jurisdiction at the county level. Total direct building losses are the estimated costs to repair or replace the damage, both structural and non-structural, caused to the facility and its contents by the earthquake. Not included in direct losses are the indirect economic losses as a result of the earthquake. In particular, business interruption losses are those associated with the inability to operate a business if customers cannot reach the place of commerce. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of an earthquake.

Economic exposure includes the dollar value of the buildings. The loss ratio (LR) is a non-dimensional measure of severity of the earthquake scenario at the local level. An LR of 100 percent implies total destruction of the built environment. This is not inconceivable and has likely occurred at a local level in developing countries during large earthquakes. For the scenarios considered, however, HAZUS-MH estimates for LR do not approach this value.

The vulnerability of counties and planning districts depends on the exposure of facilities and economic bases within the hazardous region. To establish a basis for differentiating levels of vulnerability, multiple risk factors discussed in the assessment of risk by jurisdiction have been considered. Total direct loss (TDL) and loss ratio (LR) incorporate most of the risk factors through the manner in which they are estimated. For the purposes of this plan, vulnerability ranking by jurisdiction has been determined based on the following estimated economic risk factor ranges, based on any one of the four HAZUS-MH scenarios:

- Very High: TDL $100+ million or LR 10+ percent
- High: TDL $50-$100 million or LR 5-10 percent
- Moderate: TDL $10-$50 million or LR 2-5 percent

At the county level, the eleven counties in the most vulnerable category (very high) are listed below with the most vulnerable county (Desoto) listed first with decreasing vulnerability. The counties are ranked in order of direct building losses, giving preference to the losses modeled from the New Madrid magnitude 7.7 scenario. As a result of the modeling in 2007 of the magnitude 7.7 New Madrid event, the list of counties in the 'very high' category increased from nine to eleven. Additions to the list in 2007 include Coahoma (formerly 'high'), Quitman (formerly 'moderate'), and Bolivar (formerly 'moderate'). These changes are due to the incorporation of liquefaction mapping and more detailed ground shaking in the magnitude 7.7 New Madrid scenario. Vulnerability decreased in some instances: Panola dropped from 'very high' to 'high', Alcorn changed from 'high' to 'moderate' and Yalobusha changed from 'moderate' to 'low.' As illustrated in Table 3.6.9, counties in the other categories also have significant vulnerabilities. Apparently, the HAZUS-MH database has omitted the gaming industry in Tunica County, so it is ranked number five. This county, however, has the highest loss ratio of 32%. Vulnerability ranking is likely to change with improvements to the database and more refined HAZUS-MH studies.

Very High earthquake vulnerable counties

- Desoto County*
- Bolivar County**
- Coahoma County**
- Tate County*
- Tunica County*
- Marshall County
- Lee County*
- Quitman County**
- Lafayette County*
- Union County*
- Tippah County

* These counties all experienced 5% or more population growth between 2000-2006.

** These counties lost 5% or more of their population between 2000-2006

Table 3.6.9
Vulnerability and Loss by Jurisdiction Detail
(ranked by total direct losses –NMSZ scenario)

	Exposure		Scenario								Vulnerability Rank
	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
		GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
County	Population[1]	($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M, L**
Desoto	107,199	7,379	657	9.8	78.3	1.1	5.6	-	-	-	VH
Bolivar	40,633	1,993	216.1	14.3	2.5	0.1	1	-	-	-	VH
Coahoma	30,622	1,542	185.2	16	4.3	0.3	2.6	-	-	-	VH
Tate	25,370	1,412	148	14.4	21.6	1.5	6.3	-	-	-	VH
Tunica	9,227	556	130.9	32.1	4.8	0.9	1.2	-	-	-	VH
Marshall	34,993	1,587	108.8	8.35	112	7.1	1.4	-	-	-	VH
Lee	75,755	5,997	49	1	169	2.8	2.5	-	-	-	VH
Quitman	10,117	433	43.7	15.8	2.1	0.5	3.9	0.9	-	-	VH
Lafayette	38,744	3,055	42.3	1.9	225	7.4	24.9	0.8	-	-	VH
Union	25,362	1,477	10.2	0.9	271	18	0.9	-	-	-	VH
Tippah	20,826	1,193	9.8	1	109	9.1	-	-	-	-	VH
Sunflower	34,369	1,497	53.8	5.1	1.9	0.1	0.7	-	-	-	H
Panola	34,274	1,616	37.9	3.3	22.6	1.4	97.5	6	-	-	H
Tallahatchie	14,903	612	31.2	7.99	3.1	0.5	5.6	0.9	-	-	H
Benton	8,026	393	17.1	5.8	62.6	15	-	-	-	-	H
Pontotoc	26,726	1,402	9.6	0.9	65.2	4.7	0.8	-	-	-	H
Leflore	37,947	1,949	32.3	2.24	3.8	0.2	1.3	0.1	-	-	M
Oktibbeha	42,902	3,193	20	0.8	13.6	0.4	0.8		-	-	M
Lowndes	61,586	3,751	19.9	0.7	9.7	0.3	-	-	-	-	M
Clarke	17,955	896	-	-	-	-	-	-	19.8	2.2	M
Alcorn	34,558	2,153	18.1	1	32.4	1.5	-	-	-	-	M
Monroe	38,014	2,032	13.3	0.8	14.6	0.7	-	-	-	-	M
Lauderdale	78,161	4,737	-	-	-	-	-	-	13.2	0.3	M
Grenada	23,263	1,419	10.2	0.9	8.7	0.6	3.5	0.2	-	-	M
Prentiss	25,556	1,410	9.4	0.9	29.9	2.1	2	-	-	-	M
Itawamba	22,770	1,297	9.3	0.9	12.6	1	-	-	-	-	M

County	Exposure		Scenario								Vulnerability Rank
	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
		GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
	Population[1]	($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M, L**
Tishomingo	19,163	1,227	8.9	0.9	9.6	0.8	-	-	-	-	M
Chickasaw	19,440	998	7.4	1	12	1.2	0.5	-	-	-	M
Calhoun	15,069	898	6	0.9	10.8	1.2	1	-	-	-	M
Newton	21,838	1,138	-	-	-	-	-	-	0.8	0.1	L
Jasper	18,149	841	-	-	-	-	-	-	1.1	-	L
Clay	21,979	1,139	5.6	0.7	5.1	0.4	-	-	-	-	L
Yalobusha	13,051	646	4.1	0.9	7.8	1.2	7.6	1.2	-	-	L
Montgomery	12,189	666	3.2	0.7			-	-	-	-	L
Webster	10,294	553	2.7	0.7	2.7	0.5	-	-	-	-	L
Carroll	10,769	503	2.5	0.7			-	-	-	-	L
Choctaw	9,758	502	2.5	0.7	1.1	0.2	-	-	-	-	L

[1]Population = 2000 Census data aggregated by county

[2]GBS = Replacement value estimate for General Building Stock ONLY!

[3]TDL = Total Direct Loss

[4]LR = Loss Ratio = TDL/$Exp

[2]Losses appearing in table have been rounded and some counties with minor costs do not appear.

* Added to table in 2007, replacing Marked Tree scenario results ** VH = Very High, H= High M= Moderate, L= Low

The PDDs can be ranked in a similar manner. The listing below contains the three PDDs that are the most vulnerable. They are listed in order of decreasing vulnerability. Any data base omissions will, of course, be reflected in the PDD ranking as well as the counties. (Table 3.6.10)

- North Delta Planning & Development District
- Three Rivers Planning & Development District
- Northeast Mississippi Planning & Development District

Table 3.6.10
Earthquake Vulnerability Summary
by County and Planning Development District Vulnerability and Loss by Planning Development District Detail

Jurisdiction		Exposure		Scenario								Vulnerability Rank VH, H, M, L
Regional	Local	People		7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
PDD	County	Population[1]	GBS[2] ($M)	TDL[3] ($M)	LR[4] (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	
Three Rivers	Lee	75,755	5,997	49	1	168.6	2.8	2.5	-	-	-	VH
Three Rivers	Lafayette	38,744	3,055	42.3	1.9	225.4	7.4	24.9	0.8	-	-	VH
Three Rivers	Monroe	38,014	2,032	13.3	0.8	14.6	0.7	-	-	-	-	M
Three Rivers	Union	25,362	1,477	10.2	0.9	270.6	18.3	0.9	-	-	-	VH
Three Rivers	Pontotoc	26,726	1,402	9.6	0.9	65.2	4.7	0.8	-	-	-	H
Three Rivers	Itawamba	22,770	1,297	9.3	0.9	12.6	1	-	-	-	-	M
Three Rivers	Chickasaw	19,440	998	7.4	1	12	1.2	0.5	-	-	-	M
Three Rivers	Calhoun	15,069	898	6	0.9	10.8	1.2	1	-	-	-	M
Three Rivers	**TOTAL (8)**	**261,880**	**17,157**	**147.1**	**0.9**	**780**	**4.5**	**31**	**0.2**	**-**	**-**	
North Delta	Desoto	107,199	7,379	657	9.8	78.3	1.1	5.6	-	-	-	VH
North Delta	Panola	34,274	1,616	37.9	3.3	22.6	1.4	97.5	0.6	-	-	H
North Delta	Coahoma	30,622	1,542	185.2	16	4.3	0.3	2.6	-	-	-	VH
North Delta	Tate	25,370	1,412	148	14.4	21.6	1.5	6.3	-	-	-	VH
North Delta	Tunica	9,227	556	130.9	32.1	4.8	0.9	1.2	-	-	-	VH
North Delta	Quitman	10,117	433	43.7	15.8	2.1	0.5	3.9	0.9	-	-	VH
North Delta	Tallahatchie	14,903	612	31.2	7.99	3.1	0.5	5.6	0.9	-	-	H
North Delta	**TOTAL (7)**	**231,712**	**13,549**	**1233.9**	**9.1**	**134**	**1**	**122.7**	**2.4**	**-**	**-**	

Jurisdiction		Exposure		Scenario								Vulnerability Rank VH, H, M, L
Regional	Local	People		7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
PDD	County	Population[1]	GBS[2] ($M)	TDL[3] ($M)	LR[4] (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	
Northeast	Alcorn	34,558	2,153	18.1	1	32.4	1.5	-	-	-	-	M
Northeast	Marshall	34,993	1,587	108.8	8.3	112.3	7.1	1.4	-	-	-	VH
Northeast	Prentiss	25,556	1,410	9.4	0.9	29.9	2.1	2	-	-	-	M
Northeast	Tishomingo	19,163	1,227	8.9	0.9	9.6	0.8	-	-	-	-	M
Northeast	Tippah	20,826	1,193	9.8	1	108.7	9.1	-	-	-	-	VH
Northeast	Benton	8,026	393	17.1	5.8	62.6	15	-	-	-	-	H
Northeast	**TOTAL (6)**	**143,122**	**7,963**	**172.1**	**2.2**	**356**	**5**	**1.6**	**-**	**-**	**-**	
North Central	Leflore	37,947	1,949	32.3	2.2	3.8	0.2	1.3	0.1	-	-	M
North Central	Grenada	23,263	1,419	10.2	0.9	8.7	0.6	3.5	0.2	-	-	M
North Central	Montgomery	12,189	666	3.2	0.7			-	-	-	-	L
North Central	Yalobusha	13,051	646	4.1	0.9	7.8	1.2	7.6	1.2	-	-	L
North Central	Carroll	10,769	503	2.5	0.7			-	-	-	-	L
North Central	**TOTAL (5)**	**138,489**	**5,184**	**52.3**	**1**	**20**	**0.4**	**12**	**0.2**	**-**	**-**	
Golden Triangle	Lowndes	61,586	3,751	19.9	0.7	9.7	0.3	-	-	-	-	M
Golden Triangle	Oktibbeha	42,902	3,193	20	0.8	13.6	0.4	0.8		-	-	M
Golden Triangle	Clay	21,979	1,139	5.6	0.7	5.1	0.4	-	-	-	-	L
Golden Triangle	Webster	10,294	553	2.7	0.7	2.7	0.5	-	-	-	-	L
Golden Triangle	Choctaw	9,758	502	2.5	0.7	1.1	0.2	-	-	-	-	L
Golden Triangle	**TOTAL (5)**	**146,519**	**9,139**	**50.7**	**0.6**					**-**	**-**	

Jurisdiction		Exposure		Scenario								Vulnerability Rank VH, H, M, L
Regional	Local	People		7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
PDD	County	Population[1]	GBS[2] ($M)	TDL[3] ($M)	LR[4] (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	TDL ($M)	LR (%)	
South Delta	Bolivar	40,633	1,993	216.1	14.3	2.5	0.1	1	-	-	-	VH
South Delta	Sunflower	34,369	1,497	53.8	5.1	1.9	0.1	0.7	-	-	-	H
South Delta	**TOTAL (2)**	**75,002**	**3,490**	**269.9**	**7.7**	**4.4**	**0.1**	**.8**	**-**	**-**	**-**	
East Central	Lauderdale	78,161	4,737	-	-	-	-	-	-	13.2	0.3	M
East Central	Neshoba	28,684	1,460	-	-	-	-	-	-	-	-	L
East Central	Newton	21,838	1,138	-	-	-	-	-	-	0.8	0.1	L
East Central	Clarke	17,955	896	-	-	-	-	-	-	19.8	2.2	M
East Central	Jasper	18,149	841	-	-	-	-	-	-	1.1	-	L
East Central	Smith	16,182	774	-	-	-	-	-	-	-	-	L
East Central	Kemper	10,453	515	-	-	-	-	-	-	-	-	L
East Central	**TOTAL (7)**	**191,422**	**10,361**	**-**	**-**	**-**	**-**	**-**	**-**	**34.9**	**2.6**	

[1]Population = 2000 Census data aggregated by county

[2]GBS = Replacement value estimate for General Building Stock ONLY!

[3]TDL = Total Direct Loss

[4]LR = Loss Ratio = TDL/$Exp

[2]Losses appearing in table have been rounded and some counties with minor costs do not appear.

* Added to table in 2007, replacing Marked Tree scenario results

Other Risk Factors for Estimating Potential Loss

In the 2007 update to this plan, text regarding PGA risk factor, damage risk factor, and total economic loss risk factor was removed, as this information is taken into account by the total dollar loss, total economic loss, loss ratio, and annualized losses discussed previously.

Assessing Vulnerability of State Facilities

The same approach to vulnerability assessment has been used for state facilities as has been for jurisdiction. Because of data limitations on HAZUS-MH classification of state facilities, a slight adjustment of the estimation procedure was required as discussed in the following section, "Estimating Potential Losses of State Facilities and Infrastructure." Based on this methodology, the ranking of most vulnerable counties in terms of state facilities has been adjusted and is as follows (each having an estimated total loss of $30- 100 million):

Vulnerability to State Facilities Based on HAZUS-MH Inventory*

- Benton County
- Desoto County
- Marshall County
- Coahoma County
- Lee County
- Pontotoc County
- Tippah County
- Lafayette County
- Union County

*Note discussion on data limitations that follows

Estimating Potential Losses of State Facilities and Infrastructure

Methodology

During the 2007 State Hazard Mitigation Plan update, tabular data specific to state facilities was available that was aggregated to the county level. A tabular-based analysis of the 2007 state facilities inventory was conducted in lieu of GIS-based facilities data to analyze potential earthquake losses to the state. The inventory of facilities and replacement value by county was analyzed using the average building loss ratios from the magnitude 7.7 New Madrid Seismic Zone HAZUS-MH scenario to model worst case losses. This loss ratio was multiplied by the total replacement value to estimate potential loss. Based on this methodology, the state could incur $140 million in losses to state facilities from a New Madrid Seismic Zone event. The details by county, ranked in order of potential loss, are presented in Table 3.6.11 for the counties analyzed in the New Madrid scenario.

Table 3.6.11
Potential Loss to State Facilities based on a M7.7 New Madrid Seismic Zone Earthquake (Ranked by Potential Loss)

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	New Madrid M 7.7 scenario loss ratio (%)	Earthquake potential $ loss
Bolivar	79	$302,700,858	14.30	$43,282,475
Lafayette	271	$1,706,642,337	1.89	$32,267,845
Tate	59	$178,491,338	14.44	$25,765,937
Coahoma	39	$86,790,891	16.06	$13,939,577
Oktibbeha	492	$1,564,880,015	0.84	$13,175,975
Leflore	91	$233,472,584	2.24	$5,230,001
Lowndes	57	$313,749,777	0.69	$2,152,002
Holmes	84	$130,428,429	0.77	$1,005,262
Panola	23	$14,625,685	3.27	$477,912
Desoto	14	$4,433,574	9.78	$433,627
Lee	67	$34,608,922	1.06	$366,628
Tunica	4	$1,038,912	32.13	$333,787
Washington	78	$45,673,795	0.67	$308,009
Tishomingo	14	$24,130,365	0.91	$219,185
Quitman	2	$1,071,000	15.88	$170,041
Monroe	25	$17,188,366	0.87	$149,478
Marshall	4	$1,435,140	8.35	$119,764
Attala	3	$16,569,000	0.71	$116,861
Tallahatchie	2	$1,002,792	7.99	$80,150
Sunflower	4	$973,140	5.11	$49,755
Benton	3	$840,000	5.76	$48,349
Itawamba	6	$5,233,200	0.91	$47,776

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	New Madrid M 7.7 scenario loss ratio (%)	Earthquake potential $ loss
Grenada	8	$2,787,960	0.98	$27,297
Noxubee	11	$2,323,460	0.79	$18,309
Alcorn	9	$1,673,914	1.05	$17,621
Pontotoc	20	$1,546,846	0.93	$14,423
Union	4	$991,411	0.95	$9,466
Montgomery	4	$1,212,412	0.67	$8,177
Chickasaw	5	$780,570	1.04	$8,113
Sharkey	3	$1,002,120	0.74	$7,433
Yalobusha	3	$696,192	0.94	$6,537
Tippah	5	$630,525	1.03	$6,519
Calhoun	3	$676,200	0.94	$6,381
Prentiss	6	$585,144	0.93	$5,426
Carroll	5	$791,742	0.68	$5,415
Humphreys	3	$786,660	0.68	$5,386
Webster	3	$766,500	0.68	$5,206
Clay	3	$549,675	0.68	$3,743
Choctaw	3	$516,600	0.68	$3,511
Winston	3	$372,771	0.66	$2,456

The following methodology explains how losses to state facilities and infrastructure was done using default HAZUS-MH inventory in 2004. The HAZUS-MH Level 1 scenarios for earthquakes as explained previously have also been used for State-owned critical or operated facilities located in earthquake hazard areas.

As stated in the section on Critical Facilities and Infrastructure at the beginning of the risk assessment, Critical Facilities are addressed under the category of Essential Facilities, and Infrastructure is addressed under the categories of Transportation Lifeline Systems and Lifeline Utility Systems. Other state-owned or operated buildings are addressed under the category of Government-owned Buildings.

The summary reports from the HAZUS-MH scenarios provided loss estimates by county for Transportation and Utility Lifeline Systems. The results for the worst-case scenario in each county have been used to estimate losses for lifeline systems.

In the case of buildings, losses are provided by tract only for general and specific occupancies of buildings. In order to obtain results for Essential Facilities and Government-owned Buildings, it is necessary to first aggregate the results by specific occupancy categories (as described in more detail below) and then by county. The considerable effort needed to do this does not seem justified considering the Data Limitations stated in more detail below.

A simpler approach for Essential Facilities and Government Buildings has been adopted here whereby only the exposure values have been extracted from the HAZUS-MH database for each specific occupancy category. The losses have then been estimated by multiplying these exposure values by the worst-case county-specific loss ratio already obtained for the entire General Building Stock given in Table 3.6.11.

For reference, the government building exposure by county from the default HAZUS-MH inventory database is shown in Figure 3.6.12, and the educational buildings exposure is shown in Figure 3.6.13.

Data Limitations

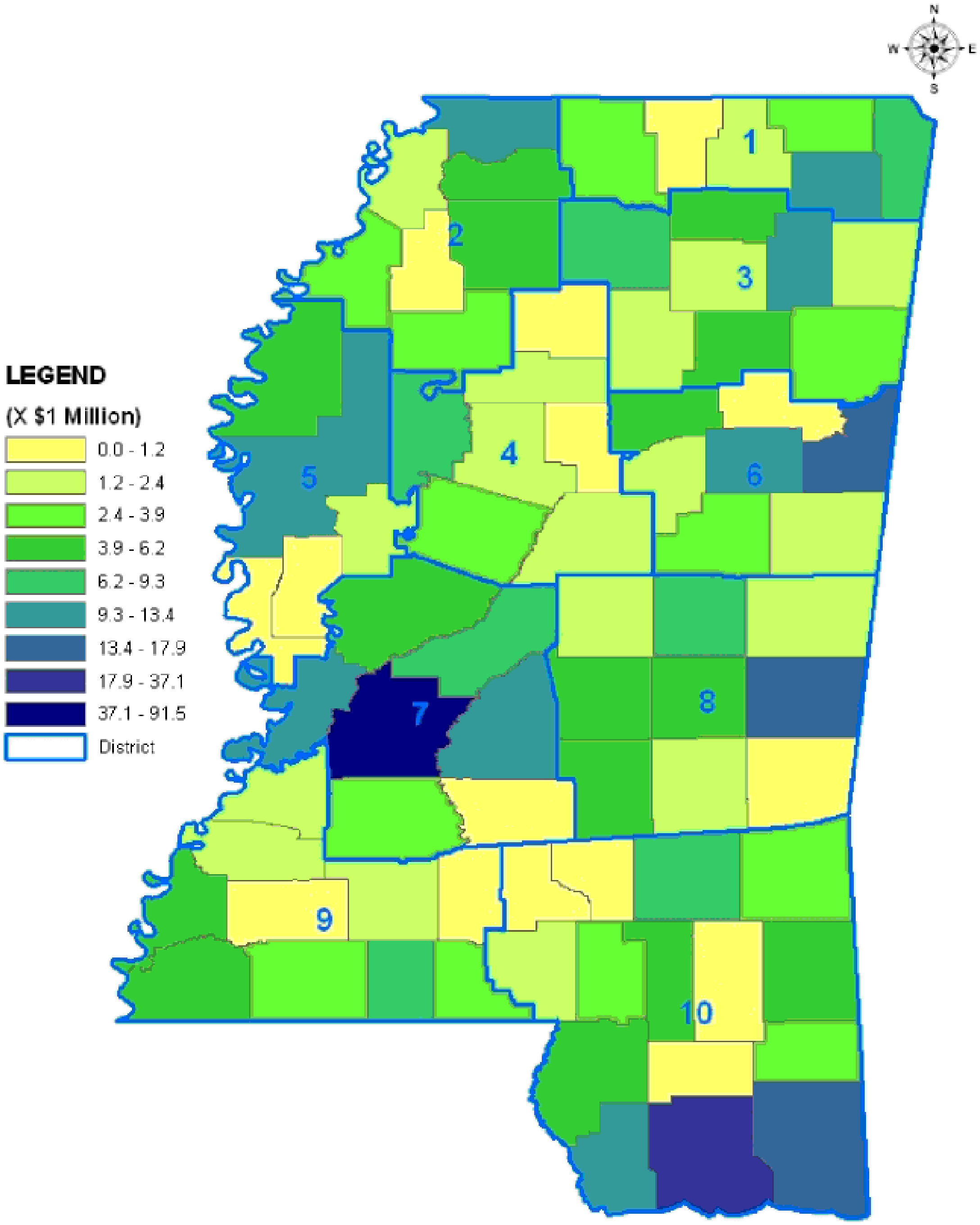
For all categories of facilities used in the assessment HAZUS-MH does not distinguish between federal, state or local ownership or building operation. Therefore all facilities regardless of ownership are included in the assessment.

At this time the State of Mississippi does not have a comprehensive list of state-owned or operated buildings, critical facilities and infrastructure sorted by county that could be inputted into HAZUS-MH as required to conduct a Level 2 analysis nor does it have the human resources and time to conduct such an analysis. Given those limitations plan developers determined that the HAZUS-MH default inventory data was the “best available data” even though all facilities are represented in the data not just state-owned or operated buildings, critical facilities and infrastructure.

Transportation Lifeline Systems/Roads: Data in the HAZUS-MH inventories is listed by census tracts for all facilities with the exception of road segments in the Transportation Lifeline Systems. The road segment inventory is listed by Federal Information Processing Standards (FIPS) Codes. Due to time constraints during plan development the state was unable to cross reference highways segments listed by FIPS codes to Mississippi Counties. Therefore the number and value of road segments are not included in the data tables under Transportation Lifeline Systems.

It was also apparent that HAZUS-MH does not have a complete listing of state-owned or operated facilities in its default database. The state has developed a preliminary strategy to address these data limitations for future plan updates. That strategy is included in the mitigation strategy section of the plan.

Figure 3.6.12
Total dollar exposure of government buildings



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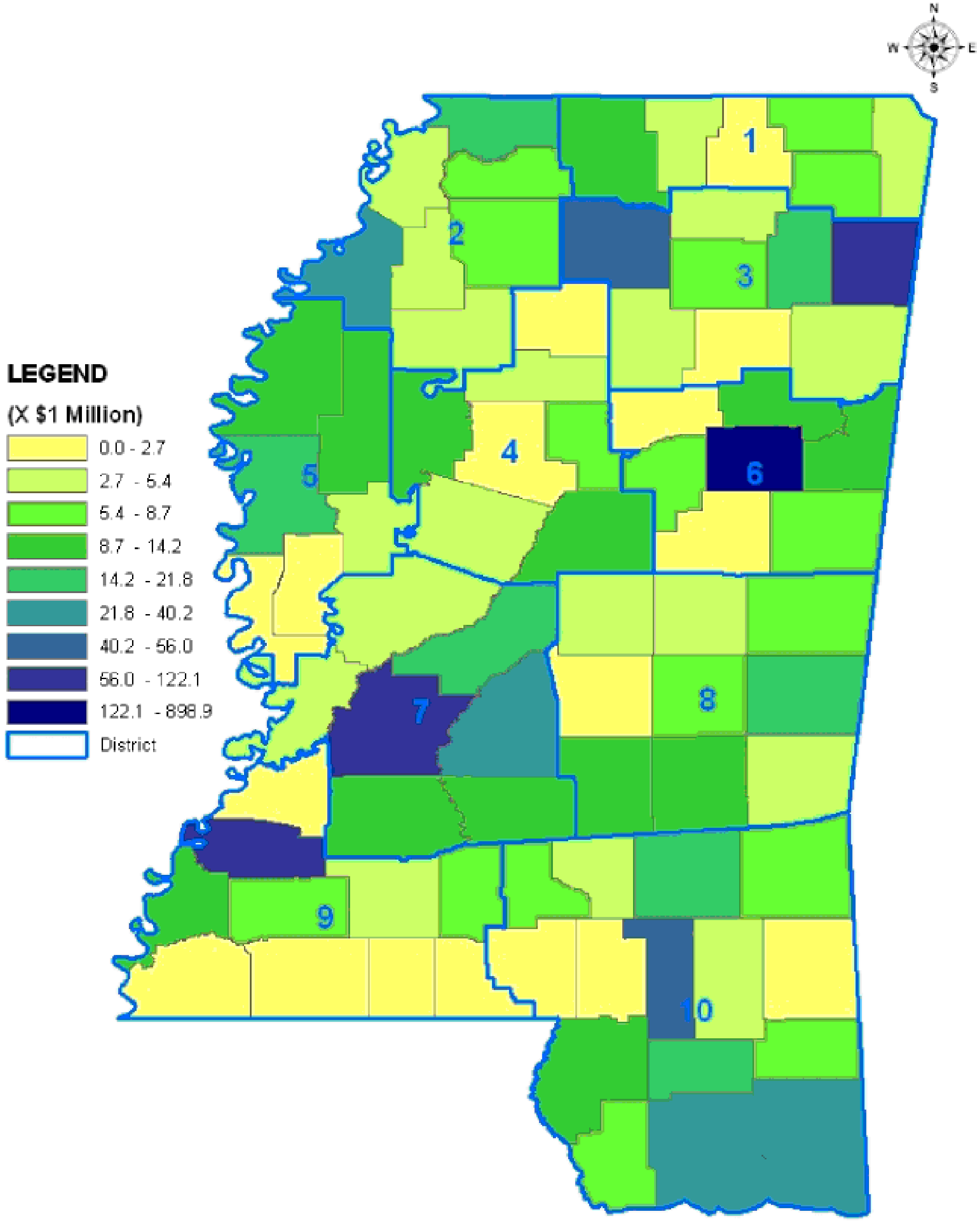
The University of Mississippi

CENTER FOR COMMUNITY EARTHQUAKE PREPAREDNESS

Figure 3.6.13
Total dollar exposure of education buildings



The University of Mississippi

Prepared by:
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CENTER FOR COMMUNITY EARTHQUAKE PREPAREDNESS

From Figure 3.6.12, it is seen that Lowndes County carries the highest government exposure of those in the northern half of the state, followed by five other high-exposure counties, Oktibbeha, Lee, Prentiss, Desoto, and Sunflower. Lauderdale County has the highest exposure in the Clarke County scenario. Its exposure is classed the same as Lowndes County. The counties at risk having higher education exposure include Lafayette, Itawamba and Oktibbeha as shown in Figure 3.6.13.

Table 3.6.12 summarizes the losses for building categories corresponding to government and essential facilities (police, fire, medical, schools) estimated using the loss ratio for general building stock in Table 3.6.12 and the exposure. Note that the GOV2 category includes police stations, fire stations, and emergency operations centers, the COM 6 and COM 7 categories include hospitals and medical offices/clinics, respectively, and EDU 1 and EDU 2 include grade schools and colleges/universities, respectively.

Table 3.6.13 summarizes the losses for transportation and utility lifeline systems which were direct outputs from the HAZUS-MH scenarios. A total loss and loss ratio have been computed for reference.

Table 3.6.12
State Building Exposure / Loss ($1,000)

	Government		Medical	Educational		Total		
Jurisdiction	GOV1	GOV2	COM6/7	EDU1	EDU2	Value	LR1	Loss
THREE RIVERS PDD								
Lee	21,474	5,002	857,729	32,854	12,358	929,417	2.8	26,024
Lafayette	7,514	7,724	83,825	14,680	121,733	235,476	11.4	17,425
Monroe	5,932	1,940	16,572	8,256	0	32,700	14.6	4,774
Union	5,022	6,125	36,138	9,318	0	56,603	18.3	10,358
Pontotoc	4,494	0	10,128	12,508	0	27,130	4.7	1,275
Itawamba	4,254	0	9,088	5,882	196,562	215,786	1.0	2,158
Chickasaw	9,232	0	11,619	4,864	0	25,715	1.2	309
Calhoun	2,944	0	7,329	10,914	0	21,187	1.2	254
NORTH DELTA PDD								
Desoto	7,552	17,966	169,025	36,136	7,540	238,219	9.8	23,345
Panola	9,714	3,130	45,047	12,826	0	70,717	3.3	2,333
Coahoma	6,360	0	83,696	53,230	0	143,286	16	22,925
Tate	7,350	3,470	34,595	11,840	4,300	61,555	14.4	8,864
Tunica	1,806	1,905	5,014	6236	0	14,961	32.1	4,802
Quitman	1,354	0	0	7,072	0	8,426	15.8	1,331
Tallahatchie	5,616	0	22,017	8,836	0	36,469	7.9	2,881

Jurisdiction	Government		Medical	Educational		Total		
	GOV1	GOV2	COM6/7	EDU1	EDU2	Value	LR1	Loss
NORTHEAST PDD								
Alcorn	6,244	0	154,751	16,650	0	177,645	1.5	2,665
Marshall	7,926	0	10,206	19,746	10,895	48,773	8.3	4,048
Prentiss	5,832	21,980	5,906	16,464	0	50,182	2.1	1,054
Tishomingo	13,326	0	38,916	8,408	0	60,650	0.8	485
Tippah	2,544	1,600	53,812	2,338	0	60,294	9.1	5,487
Benton	1,572	0	16,204	6,330	0	24,106	15.9	3,833
NORTH CENTRAL PDD								
Leflore	9,692	6,722	46,131	22,974	745	86,264	2.2	1,897
Grenada	4,890	0	62,740	10,932	0	78,562	0.9	707
Montgomery	2,188	0	25,277	13,066	0	40,531	0.7	284
Yalobusha	1,084	0	0	2,208	0	3,292	1.2	40
Carroll	3,576	0	1,006	3,768	0	8,350	0.7	58
GOLDEN TRIANGLE PDD								
Lowndes	34,646	1,497	71,559	23,796	0	131,498	0.7	920
Oktibbeha	17,182	4,218	113,421	28,174	2,212,234	2,375,229	0.8	19,002
Clay	1,954	510	9,282	12,732	8,544	33,022	0.7	231
Webster	10,930	0	15,792	1,910	0	28,632	0.7	200

Table 3.6.13
State Facility Exposure / Loss ($1000)

Jurisdiction	State Buildings		Transportation		Utility		Total Value	Total Loss	Total LR (%)
	Value	Loss	Value	Loss	Value	Loss			
THREE RIVERS									
Lee	929,417	26,024	1,234,793	2444	546,975	29,557	2,711,185	58,025	2.1%
Lafayette	235,476	17,425	714,678	2144	170,255	18,789	1,120,409	38,358	3.4%
Monroe	32,700	4,774	1,110,601	1172	171,182	1,780	1,314,483	7,726	0.6%
Union	56,603	10,358	814,679	8766	57,792	16,191	929,074	35,315	3.8%
Pontotoc	27,130	1,275	836,982	2783	396,610	45,203	1,260,722	49,261	3.9%
Itawamba	215,786	2,158	909,199	1454	311,525	6,549	1,436,510	10,161	0.7%
Chickasaw	25,715	309	772,247	1800	226,695	7,215	1,024,657	9,324	0.9%
Calhoun	21,187	254	657,715	1107	226,525	5,401	905,427	6,762	0.7%
NORTH DELTA									
Desoto	238,219	23,345	1,070,801	11397	433,585	56,442	1,742,605	91,184	5.2%
Panola	70,717	2,333	980,693	2923	379,755	17,660	1,431,165	22,916	1.6%
Coahoma	143,286	22,925	763,432	3911	791,257	34,299	1,697,975	61,135	3.6%
Tate	61,555	8,864	498,206	4203	171,938	15,515	731,699	28,582	3.9%
Tunica	14,961	4,802	432,096	3618	113,220	13,130	560,277	21,550	3.8%
Quitman	8,426	1,331	384,097	2327	283,135	15,175	675,658	18,833	2.8%
Tallahatchie	36,469	2,881	683,963	1837	227,452	5,322	947,884	10,040	1.1%
NORTHEAST									
Alcorn	177,645	2,665	757,773	1991	199,572	8,958	1,134,990	13,614	1.2%
Marshall	48,773	4,048	1,257,417	8096	226,950	74,977	1,533,140	87,121	5.7%
Prentiss	50,182	1,054	684,551	797	113,475	4,446	848,208	6,297	0.7%
Tishomingo	60,650	485	738,740	1383	367,965	5,557	1,167,355	7,425	0.6%
Tippah	60,294	5,487	496,707	2537	170,255	39,475	727,256	47,499	6.5%

Jurisdiction	State Buildings		Transportation		Utility		Total Value	Total Loss	Total LR (%)
	Value	Loss	Value	Loss	Value	Loss			
Benton	24,106	3,833	572,801	4228	264,257	88,800	861,164	96,861	11.2%
NORTH CENTRAL									
Leflore	86,264	1,897	790,607	83	697,170	979	1,574,041	2,959	0.2%
Grenada	78,562	707	827,272	434	170,000	1,365	1,075,834	2,506	0.2%
Montgomery	40,531	284	807,496	109	113,390	332	961,417	725	0.1%
Yalobusha	3,292	40	733,305	1931	113,220	3,322	849,817	5,293	0.6%
Carroll	8,350	58	1,027,715	142	113,220	234	1,149,285	434	0.0%
GOLDEN TRIANGLE									
Lowndes	131,498	920	1,153,456	595	462,817	1,114	1,747,771	2629	0.2%
Oktibbeha	2,375,229	19,002	442,303	283	113,730	568	2,931,262	19,853	0.7%
Clay	33,022	231	540,834	296	57,035	316	630,891	843	0.1%
Webster	28,632	200	510,151	171	169,915	1,221	708,698	1592	0.2%

Estimating Vulnerability and Potential Losses of Local Critical Facilities

More detail about the impacts of the magnitude 7.7 scenario on local critical facilities, based on default HAZUS-MH inventories, are provided in Appendix 7.3.6-C. Plots of moderate damage exceedance probabilities for some of the specific local facility data are provided in Appendix 7.3.6.-D. These include essential facilities (hospitals, schools, police, fire stations, wastewater facilities and bridges). improved local critical facilities data collected during the 2007 update could be adjusted for use in HAZUS-MH. This will help improve vulnerability and loss estimation to local critical facilities in the future.

3.7: Extreme Winter Weather Risk Assessment
Limited Hazard

Hazard Description

The National Weather Service defines winter storms based on a total of three factors: cold air, moisture, and lift. In terms of weather, these terms can be described in the following manner:

Cold Air - Results from subfreezing temperatures near the ground and in the clouds creating a suitable environment for snow and ice.

Moisture - Necessary in the formation of clouds and precipitation. Air blowing across a body of water is an excellent source of moisture.

Lift - Necessary to raise the moist air to form clouds and cause precipitation. An example of lift is warm air colliding with cold air and rising.

When these three factors interact simultaneously, the result is a winter storm.

The impact of a winter storm includes strong winds creating blizzard conditions, blinding, wind-driven snow, severe snowdrift and dangerous "wind chill". Extreme cold causes damage to crops, freezes pipes and creates the conditions necessary for heavy snow, ice storms, and winter storms.

The National Weather Service in Jackson, Mississippi advises there are three categories of winter weather events. The criteria for winter events are classified as follows:

Heavy Snow - Two inches or more in a 12-hour period for the southern two thirds of the state and two to four inches or more in 12-hours for the northern one-third of the state.

Ice Storm - Any accumulation of ice one-quarter inch or more within a 12-24 hour period.

Winter Storm - Any combination of the ice or snow above. A mixture of snow and freezing rain would trigger a winter storm warning issued by the national Weather Service in Jackson.

Hazard Profile

The hazard profile for extreme winter weather in Mississippi has been updated from the previously approved plan of 2007 to include current statistics regarding winter activity throughout the state.

Maximum Winter Storm Threat

Severe winter storms can cause immense economic losses to the State of Mississippi. Hampered transportation routes caused by closed or blocked roads, airports, and waterways can prevent the movement of essential economic goods. An intense cold weather system during the winter of 1989 – 1990 brought about a widespread emergency in Central Mississippi. Unlike previous winter emergencies, this crisis occurred because manufacturers and product brokers were unable to gain access to essential transportation systems, such as pipelines, trucks and rail tankers, to move heating fuel; propane in particular. This lack of fuel had a cascading effect on the domestic and manufacturing economies.

Extreme winter weather in 2010 caused a similar disruption of the Central Mississippi economy. According to the National Weather Service (NWS), the winter of 2009/2010 was characterized by below-normal temperatures across the state of Mississippi. In Jackson, it was the fourth-coldest winter since temperature records were first collected in 1896. It was also the ninth-snowiest winter in Jackson, with one snowfall of 5.5 inches recorded by the NWS Forecast Office. In January, prolonged sub-freezing temperatures caused massive failure of water mains throughout Jackson and the Central Mississippi region, creating problems for residents and causing emergency conditions at hospitals, police precincts, businesses, restaurants, communications systems and state facilities. (See a recap of this event under the heading "Prolonged Sub-Freezing Temperatures – January 2010" later in this section.)

Timber, a vital asset to the state's economy, was severely impacted by the February 1994 ice storm (FEMA-1009-DR-MS). Damage to public facilities – coupled with $1.3 billion from timber losses – resulted in one of the costliest disasters of this type the state has ever experienced. Not only did the downed timber create a future problem from potential wildfires, but collapsed roofs and downed power lines, resulting in loss of heating, lighting, water and sewer systems.

Other secondary problems included flooding from melting ice and snow, and rainfall on heavily glazed and saturated surfaces. Icy, snow-covered areas can create a hazard to drivers and to walkers with increased accidents. Downed power lines can create a risk of electrocution to residents and to electric power workers. Finally, frozen and broken water lines in homes are not only costly to repair, but create additional hazards from electrocution.

Education and Outreach

Severe Weather Awareness Week occurs in the month of February and is set each year in coordination with the National Weather Service. For more information on severe weather awareness call the MEMA Public Information number (866-519-6362) between 8 a.m. and 5 p.m. weekdays.

Location / Past Occurrences

The following summary of winter storm events from 1993 to 2009 reveals that 50 winter-related events occurred. Total property damage reported for this 16 year period was $25,448,000 and crop damages totaling $5 billion were reported in Benton and Desoto counties in 1994. The National Weather Service data did not attribute any deaths or injuries to the events summarized in Table 3.7.1

Table 3.7.1
Mississippi Winter Storm Events 1993 - 2009

Year	Incident Type			Total Property Damage	Total Crop Damage	Deaths
	Heavy Snow	Ice Storm	Winter Storm			
1993	0	1	0	0	0	0
1994	0	1	0	$500,000	$5 Billion	0
1996	0	1	2	$3,500,000	$0	0
1997	1	0	0	$50,000	$0	0
1998	0	2	1	$16,699,000	$0	0
2000	3	4	2	$1,420,000	$0	0
2001	0	0	1	$0	$0	0
2002	1	0	3	$30,000	$0	0
2003	1	2	0	$148,000	$0	0
2004	1	1	2	$409,000	$0	0
2006	0	2	2	$1,372,000	$0	0
2007	0	0	2	$0	$0	0
2008	3	1	4	$1,320,000	$0	0
2009	2	0	4	$0	$0	0
Totals	**12**	**15**	**23**	**$25,448,000**	**$5 Billion**	**0**

The following map (Figure 3.7.1), “Mississippi Winter Storms 1994 – 2009”, indicates which counties were impacted by winter storms documented in Table 3.7.2 and the number of events that occurred in each county. As illustrated on the map, event occurrence follows a geographic pattern. Winter storms occur most frequently in the northern counties with frequency of occurrence diminishing in a southward pattern. See Figure 3.7.2, Historical Costs per County and Figure 3.7.3, Average county costs per event on the subsequent pages.

Snowfall in Mississippi occurs in the northern and central areas, but rarely in the southern areas. Snow in the northern counties is most frequent from December to March, with any accumulations lasting only one or two days.

Figure 3.7.1
Mississippi Winter Storms 1994 to 2009

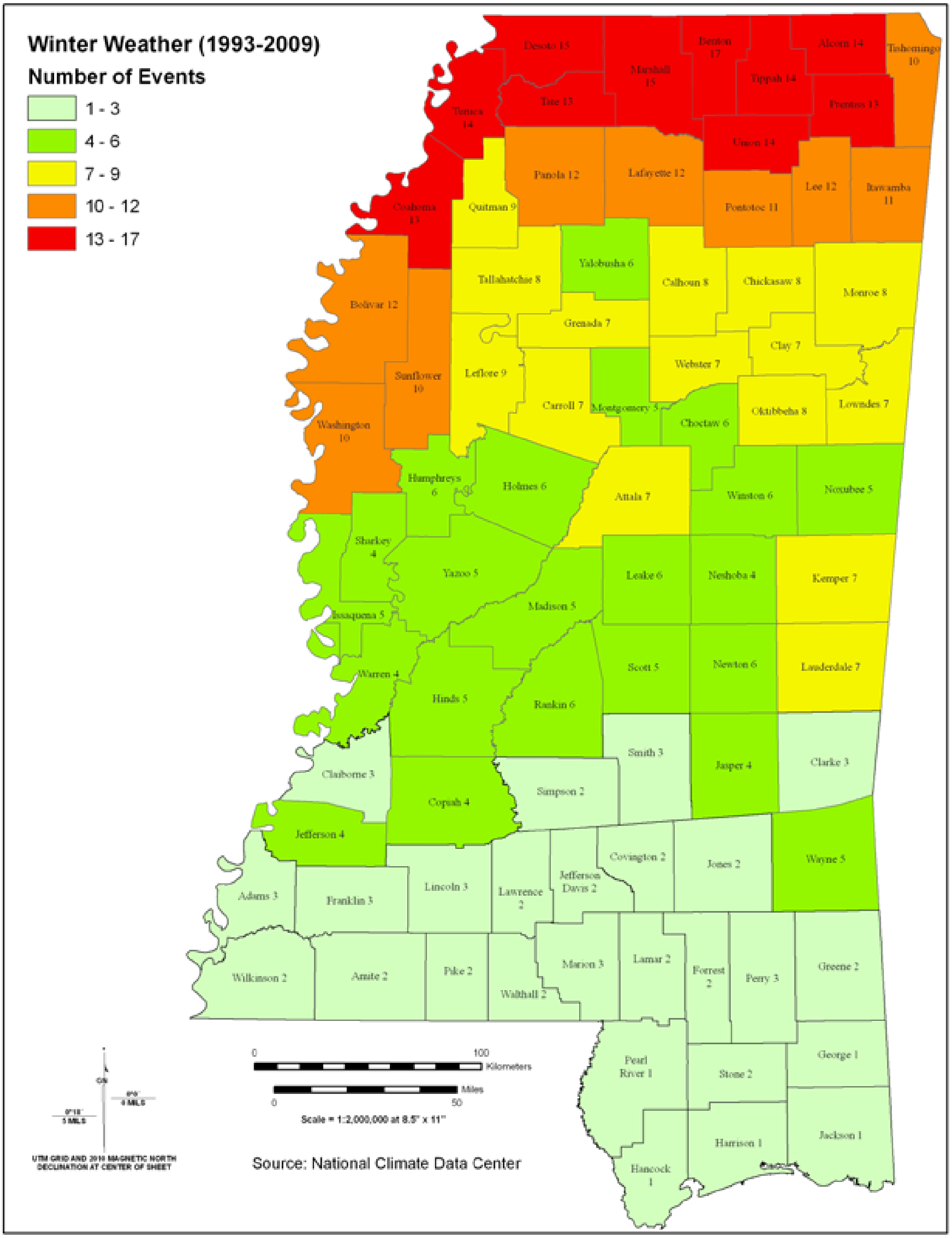


Figure 3.7.2
Historical Winter Storm Costs By County

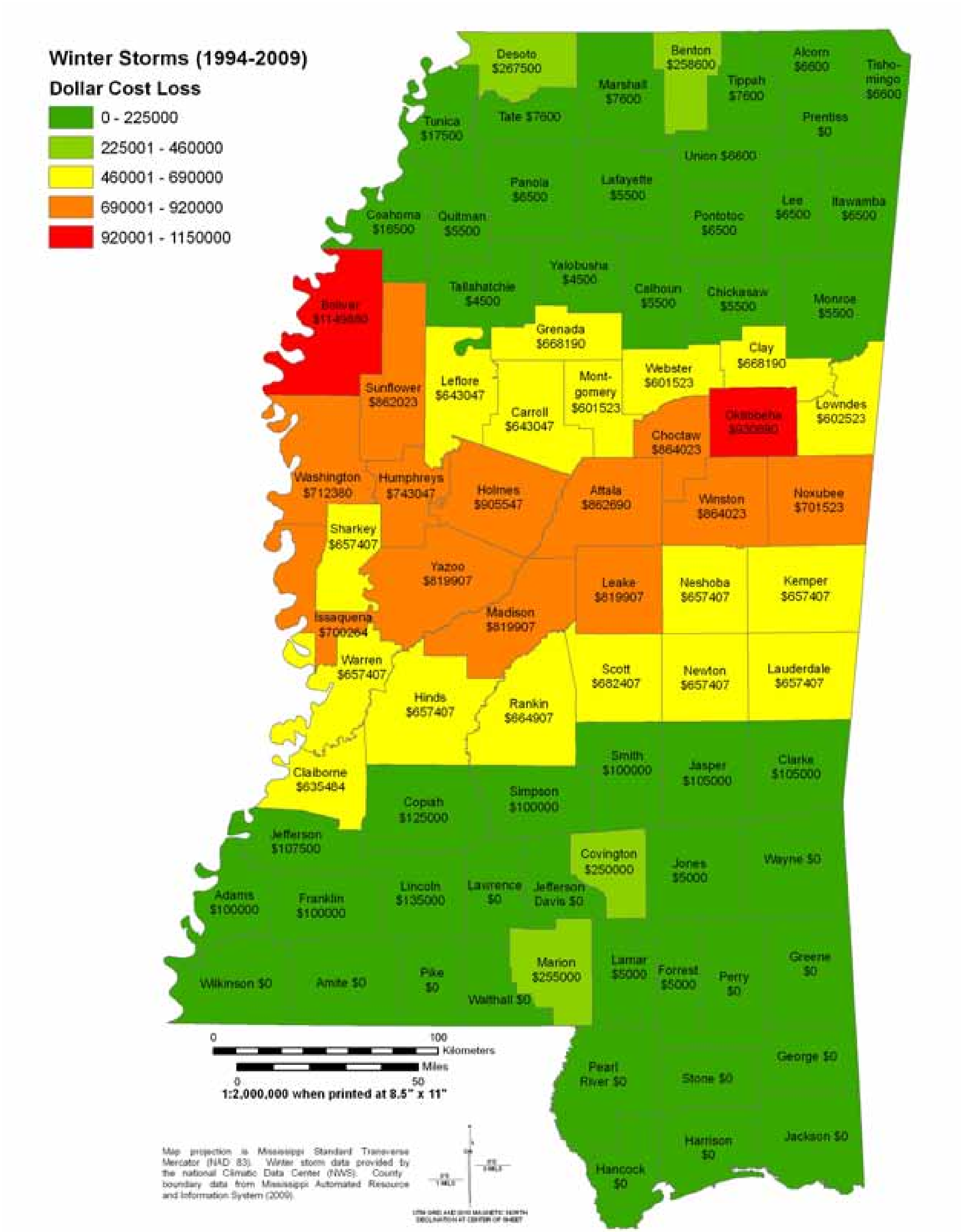
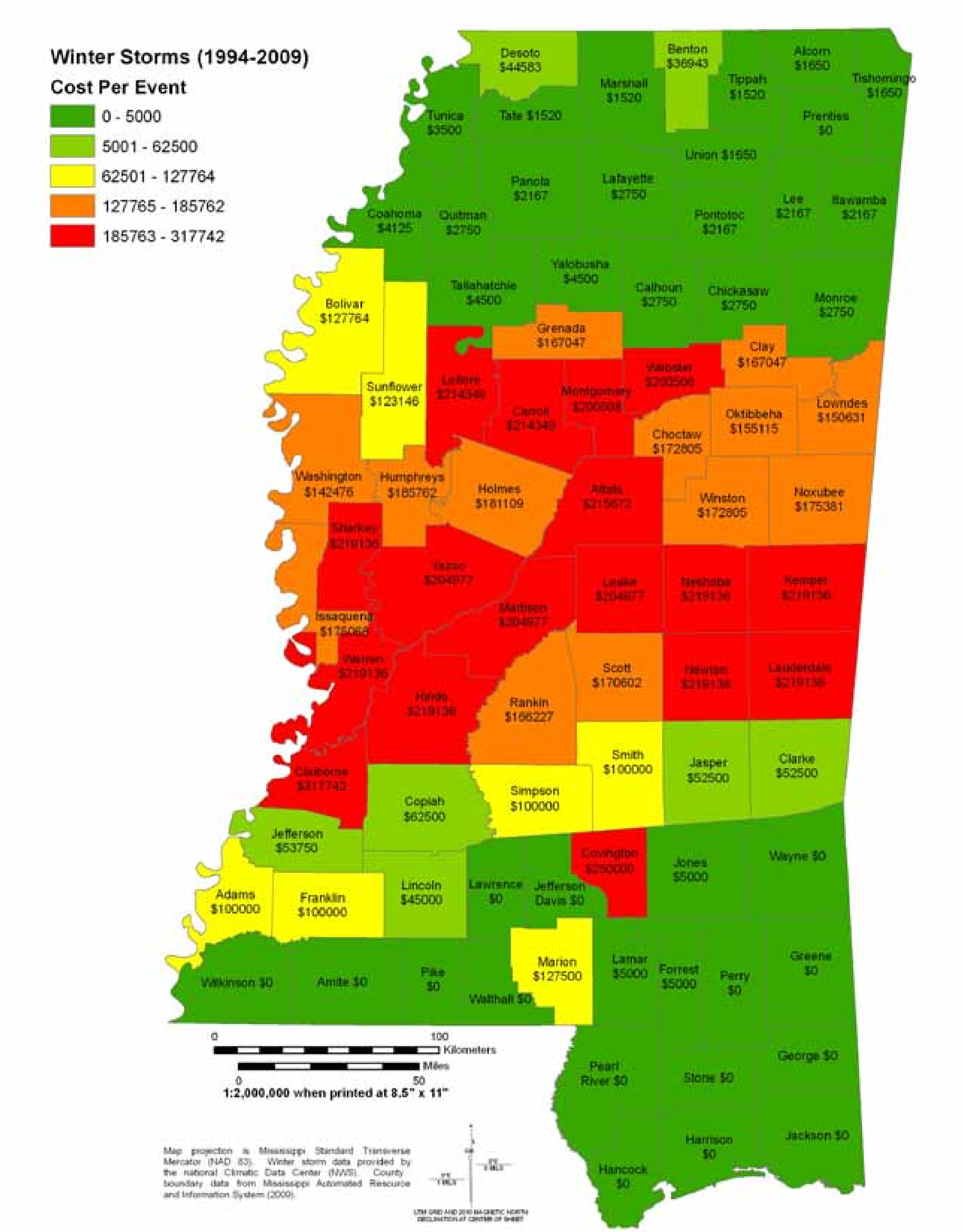


Figure 3.7.3
Historical Winter Storm Cost Per Event



Winter Storm Events 1994 – 2009

The following are reports of incidents from the National Weather Service at the National Climatic Data Center (NCDC) website for Ice and Snow Events in Mississippi. Only events with property or crop damage were included. Damage information provides an indication of event severity and impact.

Table 3.7.2
Winter Storm Events 1994 - 2009

Event Type	Date(s)	Property Damage	Crop	Counties Impacted	Description
Ice Storm	Feb 9-10, 1994	$500,000	$5 Billion	Benton, Desoto	Freezing rain for two days with ice accumulations up to 6 inches. Downed power lines and trees. 750,000 customers without electricity for up to one month. 491 water systems affected
Ice Storm	Feb 1-2, 1996	$3,000,000	$0.00	Adams, Attala, Choctaw, Claiborne, Clarke, Copiah, Franklin, Hinds, Holmes, Humphreys, Issaquena, Jasper, Jefferson, Kemper, Lauderdale, Leake, Lincoln, Madison, Neshoba, Newton, Noxubee, Oktibbeha, Rankin, Scott, Sharkey, Simpson, Smith, Warren, Winston and Yazoo	Freezing rain caused damage to trees and power lines. 100,000 customers without power. Most roads and bridges impassable
Winter Storm	Jan 15,1998	$10,000	$0.00	Calhoun, Chickasaw, Itawamba, Lee, Lowndes, Monroe, Pontotoc, Prentiss, Tishomingo and Union	Sleet and freezing rain over northeast Mississippi

Event Type	Date(s)	Property Damage	Crop	Counties Impacted	Description
Ice Storm	Dec 22-23, 1998	$99,000	$0.00	Alcorn, Benton, Calhoun, Chickasaw, Coahoma, Desoto, Itawamba, Lafayette, Lee, Marshall, Monroe, Panola, Pontotoc, Prentiss, Quitman, Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Union and Yalobusha	3 inches of ice accumulation. Trees and power lines down. Thousands without power for as long as one week
Ice Storm	Dec 22-25, 1998	$16,600,000	$0.00	Attala, Bolivar, Carroll, Choctaw, Claiborne, Clay, Grenada, Hinds, Homes, Humphreys, Issaquena, Kemper, Lauderdale, Leake, Leflore, Lowndes, Madison, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Rankin, Scott, Sharkey, Sunflower, Warren, Washington, Webster, Winston and Yazoo	Freezing rain and sleet several days. Tree and power line damage
Heavy Snow	Jan 27-28, 2000	$1,100,000	$0.00	Attala, Bolivar, Carroll, Choctaw, Clay, Grenada, Holmes, Humphreys, Leflore, Lowndes, Montgomery, Noxubee, Oktibbeha, Sunflower, Washington, Webster and Winston	Snow up to 12 inches. Some collapsed roofs and downed trees
Ice Storm	Jan 27-28, 2000	$285,000	$0.00	Hinds, Issaquena, Kemper, Lauderdale, Leake, Madison, Neshoba, Newton, Rankin, Scott, Sharkey, Warren and Yazoo	Mixed sleet, rain, snow. Some downed trees and power lines

Event Type	Date(s)	Property Damage	Crop	Counties Impacted	Description
Ice Storm	Dec 13, 2000	$13,000	$0.00	Bolivar, Sunflower and Washington	Minor tree and power line damage
Ice Storm	Dec 13, 2000	$30,000	$0.00	Coahoma, Desoto and Tunica	Numerous tree limbs down, some homes without power
Ice Storm	Dec 21, 2000	$12,000	$0.00	Choctaw, Clay, Grenada, Lowndes, Montgomery, Noxubee, Oktibbeha, Webster and Winston	Freezing rain, icy bridges and road surfaces
Heavy Snow	Jan 1-2, 2002	$30,000	$0.00	Clarke, Forrest, Jasper, Jones, Lamar and Marion	Three fatalities due to icy bridges
Heavy Snow	Feb 6, 2003	$3,000	$0.00	Alcorn, Benton and Tippah	4 inches of snow
Heavy Snow	Feb 25, 2003	$130,000	$0.00	Bolivar and Washington	Numerous tree limbs and power lines down
Ice Storm	Feb 26, 2003	$15,000	$0.00	Bolivar and Sunflower	Trees and power lines down
Heavy Snow	Feb 15, 2004	$700	$0.00	Alcorn, Benton, Marshall, Tate, Tippah, Tishomingo and Union	3 to 6 inches of snow
Ice Storm	Dec 22-23, 2004	$400,000	$0.00	Bolivar and Sunflower	Details not available
Winter Storm	Dec 22-23, 2004	$8,000	$0.00	Benton, Coahoma, Desoto, Marshall, Panola, Tate, Tippah and Tunica	Sleet and snow with accumulation up to 2 inches
Winter Storm	Feb 10, 2006	$5,000	$0.00	Benton, Desoto, Marshall, Tate and Tunica	4 inches of snow

Event Type	Date(s)	Property Damage	Crop	Counties Impacted	Description
Winter Storm	Feb 18, 2006	$17,000	$0.00	Alcorn, Benton, Coahoma, Desoto, Itawamba, Lafayette, Lee, Marshall, Panola, Pontotoc, Prentiss, Quitman, Tate, Tippah, Tishomingo, Tunica and Union	Snow and sleet with 1/4 inch of ice accumulation
Ice Storm	Feb 18, 2006	$60,000	$0.00	Bolivar and Sunflower	Bridges iced over
Ice Storm	Feb 20, 2006	$1,300,000	$0.00	Attala, Choctaw, Homes, Leake, Madison, Oktibbeha, Winston and Yazoo	Many bridges iced over
Heavy Snow	Jan 19, 2008	$500,000	$0.00	Covington and Marion	3-5 inches of snow, some power outages and traffic accidents reported
Ice Storm	Jan 25, 2008	$300,000	$0.00	Bolivar, Carroll, Holmes, Humphreys, Issaquena, Leflore, and Washington	1/4 inch of ice accumulated, numerous traffic accidents
Winter Storm	Jan 25, 2008	$200,000	$0.00	Clay, Grenada, and Oktibbeha	One fatality in Grenada County, numerous traffic accidents
Heavy Snow	March 7, 2008	$200,000	$0.00	Bolivar	3-6 inches of snow, 35 mph winds
Heavy Snow	March 7, 2008	$20,000	$0.00	Sunflower	2-3 inches of snow
Heavy Snow	Dec 11, 2008	$10,000	$0.00	Lincoln	Sleet changing to snow with 3 inches accumulated in portions of the county. Reports of downed trees and power lines

Event Type	Date(s)	Property Damage	Crop	Counties Impacted	Description
Heavy Snow	Dec 11, 2008	$50,000	$0.00	Copiah and Lincoln	Sleet changing to snow with 4 inches accumulated. Reports of downed trees and power lines
Heavy Snow	Dec 11, 2008	$15,000	$0.00	Jefferson Davis and Rankin	Sleet changing to snow with 3 inches accumulated. Reports of downed trees and power lines
Heavy Snow	Dec 11, 2008	$25,000	$0.00	Scott	Sleet mixed with rain turning to heavy snow accumulating up to 6 inches. Numerous trees, tree branches, and power lines down.

Data collection for the 2010 plan update for natural disasters includes events up to October 2009. While this plan update was underway, sub-freezing temperatures were experienced in Central Mississippi; in particular the City of Jackson. Listed below is a narrative that captures this event. The impacts are significant for identifying mitigation activities to address vulnerabilities in potential reoccurrences.

Prolonged Sub-Freezing Temperatures – January 2010

The Central Mississippi water supply failure of January 2010 is an example of how large metropolitan and lesser-populated areas can be affected by extreme cold weather events. Prior to January 11, 2010, Central Mississippi experienced 11 straight days of sub-freezing overnight temperatures and six days of overnight temperatures of 20 degrees or less. From the evening of January 7 to the morning of January 10, temperatures remained below 32 degrees. By January 10 the Jackson, Mississippi water supply system began losing pressure, and when the daily high temperature reached 48 degrees on January 11, it became apparent that Jackson and several other Central Mississippi towns and cities would experience major water-pressure problems due to water main breaks.

On January 11 Governor Haley Barbour issued an emergency declaration that was eventually expanded to include all affected areas. The state's Emergency Operations Center was partially activated January 13 to help cities and counties with the ongoing crisis. Staff specializing in public works and engineering, logistics management and public health went on 12-hour shifts. Mississippi Emergency Management Agency delivered bottled water to the affected areas.

The City of Jackson water system had sustained 80 major breaks and spewed 22 million gallons of water throughout the city. That number would eventually reach 150 broken water mains and an unknown quantity of wasted water. According to news reports, the City of Jackson reported up to 200,000 residents were without water. Adding to the problems, an electrical fire took a city water treatment plant off line and further diminished the city's capacity to pump water. Many Jackson residents were entirely without water for more than 24 hours. The cities of Madison, Ridgeland, Hattiesburg and Greenville offered water crews to help patch the leaks, and the city of Pearl furnished water for two of Jackson's largest hospitals.

On January 7 portions of Jackson and the City of Byram, located south of Jackson, were placed on a boil water notice that remained in effect until January 24. On January 11 the entire Jackson water system, including most of the metropolitan area, was placed under a boil water notice that lasted seven days. These requirements, combined with a lack water pressure, caused a multitude of problems including business, restaurant and school closures, relocation of two police precincts and adjournment of the Mississippi legislature, which was in session at the Capitol in Jackson. For locations that remained in operation, flushing toilets and other hygienic measures became a problem. The Jackson Convention Complex was forced to provide extraordinary water and restroom facilities for a 400-person Affordable Housing Conference. Fire departments delivered water to jails and other critical facilities. Portable toilets were in such demand that vendors had to go out of state to supply the crisis.

AT&T, which operates switching centers for its cell and land lines and for other providers that utilize the company's infrastructure, including emergency communications systems, was forced to park water-filled tanker trucks outside its facilities to cool equipment and provide fire protection. A National Guard tanker provided 5,000 gallons of water to cool computers for several state agencies providing essential services.

Mississippi State Department of Health (MSDH) went into emergency mode. Tasked with providing engineers for Emergency Support Function (ESF) #3 of the state's Comprehensive Emergency Management Plan (CEMP), MSDH also began emergency procedures to protect the health and safety of the public. That task included providing extra staff to sample and test potable water supplies from affected communities and to inspect food service providers such as restaurants, shelters, clinics and schools to ensure safe operation. The department temporarily closed some restaurants until they could adjust to emergency operation requirements.

State Agencies Impacted

On Sunday, January 17 the boil-water alert was cancelled for most of the city, ending a week of crises unequaled in recent Jackson history, but leaving behind a legacy of business losses, school days to be made up, huge potholes to be repaired where water crews accessed system breaks, and a large budgetary problem for the city of Jackson. Mitigation of future problems for Jackson's aging water main system was projected to cost over $75 million. With tax revenues in decline, the city's water supply problem was not a small one.

Affected cities and counties

The following numbers of residents of Central Mississippi cities and counties were affected by the January 2010 water supply emergency: Jackson (200,000); Lauderdale County (14,000); Port Gibson (10,500); Marks (2,300); Walnut (500); Vicksburg (250); Wayne County (150); Tunica County (number not available); Carroll County (number not available).

Source: Mississippi Emergency Management Agency, Mississippi State Department of Health, *The Clarion-Ledger* news reports

Winter Storm Events prior to 1993

The National Weather Service, via NCDC, has created a consistent database of winter events since 1993; however, there were many severe storms prior to this time period. The chart and two specific events below present some of the significant historical winter storms in Mississippi.

**SIGNIFICANT HISTORICAL SNOW STORMS
1940 TO 1974**

Year	Area	Inches
1940	Hinds County	10.6
1960	Hinds County	9.1
1966	Bolivar County	23
1967 – 1968	Tate County	25.2
1974	Gulf Coast	5

January 28 – February 5, 1951: Approximately $50 million in damages was incurred in Mississippi alone. Twenty-two people died in the storm throughout Mississippi, Louisiana and Arkansas.

January 11 – 15, 1982: An ice storm centered in the northern and eastern parts of the state, inflicted heavy damages in 44 counties and affected 25% of the states' nurseries. One death was reported.

Source: Mississippi Hazard Identification/Hazard Analysis, 1997. Mississippi Emergency Management Agency.

Probability of future winter storm events

The area most likely to receive an ice storm, heavy snow, or winter storm activity is the area north of Interstate 20, or the northern half of Mississippi. Historically based on data from the National Climatic Data Center (NCDC) website, winter events occur as early as mid-December and as late as mid-March. Fifty winter storm events have struck the state since 1993. No events impacted the state in 1995, 1999 and 2005. In 2000, the state was struck by nine events which varied in severity. Winter storms have an average probability of striking the state approximately three times each year.

Assessing Vulnerability

An assessment of Mississippi's vulnerability to winter storms reveals that advance warnings are often not heeded. Preparedness for a winter storm is paramount. As is the case with other natural hazards, the very young, the elderly, persons with special needs and handicapped people are vulnerable to winter storms. Officials also suggest that institutions housing these individuals develop a plan to include preparedness for lack of electricity, lack of water, and lack of fuel for heating.

Public buildings are not as vulnerable to winter storms as infrastructure such as electric transmission lines and utility poles that can all be weighed down by ice and freezing rain. During the 1994 ice storm 8,000 utility poles were downed by the weight of ice, 4,700 miles of power lines were downed, and 491 water systems were affected, while 741,000 customers were without water.

Vulnerability of People to Winter Storms

The public warning systems in place to alert the general public of an impending storm are the existing media outlets, the National Weather Service and NOAA weather radios. The oxygen- and insulin-dependent, the elderly, those whose medical conditions require regular visits by home health care workers and children living in these households make up the special needs group whose lives are most in danger when a power failure occurs. These citizens must rely on neighbors and relatives for contact, supplies and assistance throughout the disruption. Previous incidents have left remote areas of the state without power for up to a month.

Roads are often blocked by trees felled by heavy ice, and road and bridge conditions may prevent home healthcare workers from reaching their patients until emergency personnel can clear roads and offer transport by ambulance. Any unnecessary automobile or pedestrian travel during icy conditions by citizens not involved in emergency assistance increases the burden on emergency personnel during these crises.

Loss of Life from Extreme Cold in Mississippi

Although the National Weather Service does not record cold-related deaths along with winter storm event statistics, the following information collected by the Mississippi State Department of Health, Bureau of Health Statistics, provides an understanding of recorded deaths in Mississippi due to extreme natural cold. Table 3.7.3 below summarizes cold-related deaths over a 25-year period from the year 1984 to the year 2008. During that time, a total of 264 deaths occurred, an average of 10.6 deaths per year. Information on the location of the deaths was not available.

Table 3.7.3
Cold-Related Deaths
ICD-9 CODE*

Year	9010 Excessive Cold Due to Weather Conditions	9018 Excessive Cold, Other	9019 Excessive Cold of Unspecified Origin	Total
1984	5	0	5	10
1985	3	0	15	18
1986	3	0	7	10
1987	1	1	3	3
1988	6	1	9	16
1989	13	1	18	32

Year	9010 Excessive Cold Due to Weather Conditions	9018 Excessive Cold, Other	9019 Excessive Cold of Unspecified Origin	Total
1990	9	0	5	14
1991	4	0	1	5
1992	3	0	7	10
1993	2	2	6	10
1994	8	2	6	16
1995	3	0	6	9
1996	9	0	6	15
1997	3	0	2	5
1998	5	1	3	9

EXPOSURE TO EXCESSIVE NATURAL COLD
ICD-10 CODE X-31*

Year	X-31 Exposure to Excessive Natural Cold
1999	7
2000	14
2001	11
2002	9
2003	11
2004	14
2005	7
2006	3
2007	5
2008	2

Source: Mississippi Department of Health, Bureau of Health Statistics

*The tables above reflect the use of the International Class of Diseases (ICD) as used by the Mississippi State Department of Health. Beginning with the year 2003, ICD codes consolidated previous classifications relating to death due to cold into one category (ICD-10 Code X-31).

Vulnerability of Natural Resources to Winter Storms

Trees, crops, and decorative vegetation are all subject to damage from winter storms. Ice storms damage documented by the National Weather Service in 1994 caused damage to over 3.7 million acres of commercial forestland. The value of damaged timber was estimated at $27 million. The State's pecan crop was reduced by 25% over the following five-to-ten years at an estimated cost of $5.5 million per year.

Fallen timber and tree limbs during winter storms provide a possibility of wildfires later in the year. Forestry Commission officials and private landowners minimize the severity of wildfires by cutting and sawing fallen timber and debris to prevent the spread of fire.

Vulnerability of Private Improvements to Winter Storms

In Mississippi, occasionally roofs of businesses and homes are stressed or collapse due to the weight of snow and ice accumulations. Cars and their passengers are vulnerable when driving on icy or wet roads and surfaces. Decorative trees and shrubs can be expensive to replace should the weight of ice and snow force down or break limbs.

Businesses within the affected area are vulnerable to power outages when they are unable to open their doors for business, thus losing income due to closure. Communications facilities, such as telephone lines, microwave, and cellular telephone repeater towers have been disrupted if not downed in the past. The failure of nine fiber optic lines, 26 local telephone exchanges and several cellular telephone repeater towers was caused by vulnerablity to ice and snow accumulations as documented in the FEMA-1009-DR-MS (February 18, 1994) Hazard Mitigation Team Report.

Homes and businesses served by local firefighters are vulnerable in an ice storm where downed power lines have reduced the amount of water available to fight fires. Other municipal services such as sewer and water purification services are not available to municipal and other residents.

Assessing Vulnerability by Jurisdiction Methodology

To assess vulnerability by jurisdiction, the State of Mississippi devised a system to establish three ratings based on the following factors: number of past winter storm events, total valuation of private property in each county, and population density of each county. Each of these ratings was summed to determine an overall vulnerability rating for each county relative to the other counties.

The three ratings were:

- **Prior Event Rating** (based on the number of past winter storm events)
- **Private Property Valuation Rating** (based on the total valuation of private property in the county)
- **Population Density Rating** (based on the population density of the county)

Past damages are a significant indicator of vulnerability. However, county-by-county damage information was not available for winter storm damages. The National Weather Service provides a single dollar amount for all counties impacted by a particular winter storm event. It is inaccurate to average this amount across the impacted counties. Therefore, past damage was excluded from this assessment.

Prior Event Rating — Past occurrences are considered to be a legitimate indicator of vulnerability. The past event data was obtained from the National Weather Service (NWS) through the NCDC database covering the period of 1993 until 2009. Some information was gathered on winter weather events prior to 1993 but it is not consistent enough to use as a vulnerability indicator. Since, NWS data prior to 1993 was not available; the State of Mississippi did not have an accurate log of winter storm events prior to that year. The State recognizes that the period of record for winter storm events and this vulnerability assessment is relatively short given the known history. A discussion of significant winter storms prior to 1993 is included in the hazard profile above.

The data collected by NWS reflects what is known by the State in that the northern part of the state is significantly more impacted by winter storms than the southern part of the state. The number of winter events per county during the 1993 through 2009 time period were tallied and used to develop the first factor in the vulnerability assessment.

Prior Event Ratings were assigned based on the number of past winter storm events in each county. The number of past occurrences is a more significant factor in assessing vulnerability than the other two factors (property valuation and population density). Therefore the Prior Event Rating is based on a weighted factor of two. For each county, the number of past winter storm events is multiplied by two to develop the Prior Event Rating.

Without weighting this vulnerability factor, a densely populated coastal county with high property valuations but no past events could be rated more vulnerable than a less densely populated county with prior winter weather events. The remaining two vulnerability factors are not weighted.

Summary of Prior Event Ratings:

During the recorded period, Benton County had the greatest number of winter storm events totaling 17 events since 1993 with a Prior Event Rating of 34. A total of 49 counties received a Prior Event Rating of 10 and greater (or having 5 or more winter storm events). See Table 3.7.4 for details by county.

Private Property Valuation Rating — In order to relatively compare the amount of assets vulnerable to loss by winter storm damage in each county, the State of Mississippi turned to assessment data from the Mississippi Tax Commission. The values were obtained from the *"Mississippi State Tax Commission Annual Report Fiscal Year Ending June 30, 2009."*

The Annual Report provides private property assessments in two categories. These are "Real Property" and "Personal Property." The "Real Property" assessment represents the true value of all taxable land and improvements thereto including residential, commercial and industrial property. The "Personal Property" assessment represents the value of the following: business inventories; furniture, fixtures, machinery and equipment for non-residential property; mobile homes and automobiles. To determine the Total Valuation of Property for each county, the "True Value" from the "Personal Property" assessment was added to the "True Value" from the "Real Property" assessment. This total private property valuation dollar value in itself is an indicator of the total value of each county's property (tangible assets).

The total range of total private property valuations by county were divided into ten equal ranges shown in the chart on the subsequent page. The ranges were numbered one through ten in ascending order and this became the Property Valuation Rating.

Property Valuation Range		Rating	Property Valuation Range		Rating
$120,983,577	$1,387,622,988	1	$6,454,180,711	$7,720,820,140	6
$1,387,622,989	$2,654,262,418	2	$7,720,820,141	$8,987,459,571	7
$2,654,262,419	$3,920,901,849	3	$8,987,459,572	$10,254,099,001	8
$3,920,901,850	$5,187,541,279	4	$10,254,099,002	$11,520,738,432	9
$5,187,541,280	$6,454,180,710	5	$11,520,738,433	$12,787,377,862	10

Source: Mississippi State Commission Annual Report, Fiscal Year Ending June 30, 2009

Summary of Property Valuations:

The Total Property Valuation ranged from $120,983,557 in Issaquena County to $12,538,050,214 in Harrison County. Five counties (Desoto, Harrison, Hinds, Jackson and Rankin) received the highest Property Valuation Rating of 10, while more than half (53) of the counties in Mississippi received the lowest Property Valuation Rating of 1. See Table 3.7.4 for details by county.

Population Density Rating—Population density was determined to be a more meaningful component of vulnerability assessment than total county population. The population density for each county was calculated by dividing the best available total population estimate for each county by the land area of that county.

The land area in square miles of each county was obtained from the 2000 Census. Total estimated population for each county was obtained from the U.S. Census Bureau. Population density indicates the amount of people at risk to hazards. The total range of countywide population density values was divided into ten equal ranges shown in the chart below. The ranges were numbered one through ten in ascending order, and this became the Population Density Rating.

Population Density Range		Rating
4.01	35.99	1
35.99	67.97	2
67.97	99.95	3
99.95	131.93	4
131.93	163.91	5
163.91	195.89	6
195.89	227.87	7
227.87	259.85	8
259.85	291.83	9
291.83	323.84	10

Summary of Population Density:

The lowest population density is found in Issaquena County with an estimated 4.01 people per square mile. Coincidentally, Issaquena is estimated to have the lowest overall population of 1,759 people over 413 square miles. Desoto County has the highest population density with an estimated 323.84 people over 477 square miles. Harrison County has the second highest population density of 307.17 people over 580 square miles. Hinds County is estimated to have the highest overall population with 247,650 over 869 square miles. Desoto and Harrison Counties were the only two counties to receive the highest Population Density rating of 10 and Hinds County was the only county to receive the 2nd highest Population Density rating of 9. See Table 3.7.4 for details by county

Vulnerability Rating

After rating each county into three categories (past occurrences, property valuation, and population density) the rating values were totaled producing a total vulnerability rating for each county. The highest possible total vulnerability rating was 50. The total vulnerability ratings varied from a high of 50 for Desoto County to a low of 5 for George County. All 82 counties are listed in the table below, with their three rating values in order of most vulnerable to least vulnerable to winter storm events.

In the 2007 Plan update, the range of overall vulnerability rating values were divided into five equal ranges (including medium high and medium low). For the 2010 update, it was determined that the difference between a medium high to high and medium low to low was not significant for planning purposes. Therefore the range of overall vulnerability rating values was divided into three equal ranges to determine each county's Winter Storm Vulnerability. These ranges and corresponding levels of vulnerability are shown in the chart below.

Vulnerability Rating Ranges		Winter Storm Vulnerability
5	20	Low
20	35	Medium
35	50	High

Summary of Vulnerability Rating:

Desoto, Benton and Lee Counties received a high Winter Storm Vulnerability. A total of 24 counties received a medium vulnerability score while the remaining 55 counties received a low vulnerability. See Table 3.7.4 for details by county.

A complete table with values used to derive the ratings as in this section is provided in Appendix 7.3.7-A.

Table 3.7.4
Winter Storm Vulnerability Ratings By County

County	No. of Events	Estimated Total Losses (1994-2009)	Cost / Event	Prior Event Rating	Property Valuation Rating	Population Density Rating	Vulnerability Rating	Winter Storm Vulnerability
Adams	3	$100,000	$100,000	6	1	3	10	Low
Alcorn	14	$6,600	$1,650	28	1	3	32	Medium
Amite	2	$0	$0	4	5	1	10	Low
Attala	7	$862,690	$215,672	14	1	1	16	Low
Benton	17	$258,600	$36,943	34	1	1	36	High
Bolivar	12	$1,149,880	$127,764	24	2	2	28	Medium
Calhoun	8	$5,500	$2,750	16	1	1	18	Low
Carroll	7	$643,047	$214,349	14	1	1	16	Low
Chickasaw	8	$5,500	$2,750	16	1	2	19	Low
Choctaw	6	$864,023	$172,805	12	1	1	14	Low
Claiborne	3	$635,484	$317,742	6	1	1	8	Low
Clarke	3	$105,000	$52,500	6	1	1	8	Low
Clay	7	$668,190	$167,047	14	1	2	17	Low
Coahoma	13	$16,500	$4,125	26	1	2	29	Medium
Copiah	4	$125,000	$62,500	8	1	2	11	Low
Covington	2	$250,000	$250,000	4	1	2	7	Low
Desoto	15	$267,500	$44,583	30	10	10	50	High
Forrest	2	$5,000	$5,000	4	4	6	14	Low
Franklin	3	$100,000	$100,000	6	1	1	8	Low
George	1	$0	$0	2	1	2	5	Low
Greene	2	$0	$0	4	1	1	6	Low
Grenada	7	$668,190	$167,047	14	2	2	18	Low
Hancock	1	$0	$0	2	4	3	9	Low
Harrison	1	$0	$0	2	10	10	22	Medium
Hinds	5	$657,407	$219,136	10	10	9	29	Medium
Holmes	6	$905,547	$181,109	12	1	1	14	Low
Humphreys	6	$743,047	$185,762	12	1	1	14	Low

County	No. of Events	Estimated Total Losses (1994-2009)	Cost / Event	Prior Event Rating	Property Valuation Rating	Population Density Rating	Vulnerability Rating	Winter Storm Vulnerability
Issaquena	5	$700,264	$175,066	10	1	1	12	Low
Itawamba	11	$6,500	$2,167	22	1	2	25	Medium
Jackson	1	$0	$0	2	10	6	18	Low
Jasper	4	$105,000	$52,500	8	1	1	10	Low
Jefferson	4	$107,500	$53,750	8	1	1	10	Low
Jeff-Davis	2	$0	$0	4	1	1	6	Low
Jones	2	$5,000	$5,000	4	10	3	17	Low
Kemper	7	$657,407	$219,136	14	1	1	16	Low
Lafayette	12	$5,500	$2,750	24	3	3	30	Medium
Lamar	2	$5,000	$5,000	4	3	3	10	Low
Lauderdale	7	$657,407	$219,136	14	4	4	22	Medium
Lawrence	2	$0	$0	4	1	1	6	Low
Leake	6	$819,907	$204,977	12	1	2	15	Low
Lee	12	$6,500	$2,167	24	6	6	36	High
Leflore	9	$643,047	$214,349	18	2	2	22	Medium
Lincoln	3	$135,000	$45,000	6	2	2	10	Low
Lowndes	7	$602,523	$150,631	14	5	4	23	Medium
Madison	5	$819,907	$204,977	10	9	4	23	Medium
Marion	3	$255,000	$127,500	6	1	2	9	Low
Marshall	15	$7,600	$1,520	30	2	2	34	Medium
Monroe	8	$5,500	$2,750	16	2	2	20	Medium
Montgomery	5	$601,523	$200,508	10	1	1	12	Low
Neshoba	4	$657,407	$219,136	8	1	2	11	Low
Newton	6	$657,407	$219,136	12	1	2	15	Low
Noxubee	5	$701,523	$175,381	10	1	1	12	Low
Oktibbeha	8	$930,690	$155,115	16	2	3	21	Medium
Panola	12	$6,500	$2,167	24	2	2	28	Medium
Pearl River	1	$0	$0	2	3	3	8	Low

County	No. of Events	Estimated Total Losses (1994-2009)	Cost / Event	Prior Event Rating	Property Valuation Rating	Population Density Rating	Vulnerability Rating	Winter Storm Vulnerability
Perry	3	$0	$0	6	1	1	8	Low
Pike	2	$0	$0	4	2	3	9	Low
Pontotoc	11	$6,500	$2,167	22	2	2	26	Medium
Prentiss	13	$0	$0	26	1	2	29	Medium
Quitman	9	$5,500	$2,750	18	1	1	20	Medium
Rankin	6	$664,907	$166,227	12	10	6	28	Medium
Scott	5	$682,407	$170,602	10	1	2	13	Low
Sharkey	4	$657,407	$219,136	8	1	1	10	Low
Simpson	2	$100,000	$100,000	4	1	2	7	Low
Smith	3	$100,000	$100,000	6	1	1	8	Low
Stone	2	$0	$0	4	1	1	6	Low
Sunflower	10	$862,023	$123,146	20	1	2	23	Medium
Tallahatchie	8	$4,500	$4,500	16	1	1	18	Low
Tate	13	$7,600	$1,520	26	1	2	29	Medium
Tippah	14	$7,600	$1,520	28	1	2	31	Medium
Tishomingo	10	$6,600	$1,650	20	1	2	23	Medium
Tunica	14	$17,500	$3,500	28	2	1	31	Medium
Union	14	$6,600	$1,650	28	1	2	31	Medium
Walthall	2	$0	$0	4	1	2	7	Low
Warren	4	$657,407	$219,136	8	4	3	15	Low
Washington	10	$712,380	$142,476	20	2	3	25	Medium
Wayne	5	$0	$0	10	1	1	12	Low
Webster	7	$601,523	$200,508	14	1	1	16	Low
Wilkinson	2	$0	$0	4	1	1	6	Low
Winston	6	$864,023	$172,805	12	1	1	14	Low
Yalobusha	6	$4,500	$4,500	12	1	1	14	Low
Yazoo	5	$819,907	$204,977	10	1	1	12	Low

Exposure Analyses

The following section consists of three exposure analyses, using three different sets of data. Exposure analyses are different from loss estimates in that they present facilities and structures that may be exposed to winter storms, but do not attempt to estimate the amount of damages to be incurred during a winter storm event. Loss estimations are discussed in the Potential Losses section following the exposure analyses.

Exposure Analysis of State-Owned Facilities

This analysis has not been updated from the 2007 plan as the inventory for state-owned facilities has not been improved. The data received from the Mississippi Department of Finance and Administration in 2007 contained building inventory information on 67 state institutions/agencies on which they had records on. The number of state-owned facilities by county and their estimated replacement values is provided in Appendix 7.3.0-D.

As previously discussed in this section, state-owned facilitites are equally at risk to extreme winter weather events (including power outages that can be associated with this type of event). Like tornados, these events can occur anywhere and with any severity.

Exposure Analysis of Critical Facilities

The State of Mississippi developed a definition for "critical facilities and infrastructure" as discussed in Section 3.0. Location data for these facilities were collected from various state agencies for the purposes of determining which facilities are at risk to various hazards. However, because this data came from multiple sources, the need to validate the information is vital to producing accurate assessments for future planning. For planning and assessment purposes, Appendix 7.3.0-C provides regional maps with overlaid critical facilities and infrastructure to assist with identifying the proximity of their locations.

Like state-owned facilities, all critical facilities and infrastructure located within each county are are susceptible to extreme winter weather events including power outages that can be caused by these events. The impact of an extreme winter weater event can happen anywhere and with any severity.

Potential Losses

As discussed above, damage dollar amounts due to prior winter storm events were not available on a county-by-county basis. Therefore, the State of Mississippi is unable to develop potential loss estimates due to winter storm damage. The "Hazard Profile" section demonstrates that ice storms cause more property damage than heavy snow events. In 1998 an ice storm caused $16 million in damages across 31 counties. This shows that damages and losses due to winter storms may be significant in any given county.

In addition, secondary impacts such as business, state and local governments and school closures and/or closure of major thoroughfares result in significant lossess. These are difficult to quantify, but important to consider. A discussion of secondary impacts is included in the "Hazard Profile" section.

3.8: Drought Risk Assessment
Limited Hazard

Hazard Description

Based on the local plan roll-up of identified and ranked hazards, limited options for state level mitigation, and lack of historical need for state-level response, it was concluded that drought does not pose a serious statewide threat capable of being addressed by this plan. Droughts can and do, however, occur in Mississippi.

“Drought is a condition of moisture deficit sufficient to have an adverse effect on vegetation, animals, and man over a sizeable area” (USGS, 2000). Three significant types of drought can affect Mississippi: meteorological, agricultural, or hydrologic drought. Meteorological drought is simply a departure from a normal precipitation amount, and is reliant on no other factors. Agricultural drought describes a soil moisture deficiency to the extent it effects the needs of plant life, primarily crops. Hydrologic drought is defined in terms of shortfall of water levels of lakes and reservoirs, and stream flow in rivers, streams, and soils. Drought is a natural part of most climatic areas, but the severity of droughts differs based on duration, geographic extent, and intensity. In Mississippi, droughts can affect municipal and industrial water supply, surface water quality, recreation, power generation, agriculture, and forest resources.

A number of different indices have been developed to quantify drought. Two of the most commonly used are the Palmer Drought Severity Index (PDSI) and the Standard Precipitation Index (SPI). The PDSI has been the most commonly used drought index in the United States and was developed to measure the intensity, duration, and spatial extent of a drought. It treats all precipitation as rain, so the index does not perform as well at higher elevations in the western U.S. during winter, where much of the precipitation falls as snow. PDSI values are derived from measurements of precipitation, air temperature, and local soil moisture, along with prior values of these measures. Values range from -6.0 (extreme drought) to +6.0 (extreme wet conditions), and have been standardized to facilitate comparisons from region to region. This index has been used to evaluate drought impact on agriculture. Because of the time scale built into this index, it is not suitable for the determination of longer-term hydrologic drought such as those that impact stream flow, reservoirs, and aquifers.

The SPI is a simpler measure of drought than the PDSI and is based solely on the probability of precipitation for a given time period. The SPI was designed to enhance the detection and monitoring of drought. A key feature of the SPI is the flexibility to measure drought at different time scales. Short-term droughts are measured by meteorological instruments and are defined according to specific regional climatology. Values of SPI are derived by comparing the total cumulative precipitation for a particular station or region over a specific time interval with the average cumulative precipitation for that same time interval over the entire length of the record. For example, total precipitation in May of any given year for a given climate region would be compared to average total precipitation for that region for all Mays in the record. The severity of a drought can be compared to the average condition for a particular station or region. A drought event is defined when the SPI is continuously negative and reaches a value of -1.0 or less, and continues until the SPI becomes positive. Drought duration is defined by the interval between the beginning and end of that period and the magnitude of the drought event is measured by the sum of the SPI values for the months of the drought. The classification values for SPI values are:

- 2.00 and up extremely wet
- 1.50 to 1.99 very wet
- 1.00 to 1.49 moderately wet
- -0.99 to 0.99 near normal
- -1.00 to -1.49 moderately dry
- -1.50 to -1.99 severely dry
- -2.00 and less extremely dry

Droughts can increase the threat or likelihood of other disasters. Droughts can be accompanied by unusually hot weather, leading to heat-related illnesses and other hazards associated with extreme heat. Also droughts can make the risk of wildfire greater, both by drying vegetation making it more susceptible to fire, and by depleting water supplies needed to fight the fire.

Disaster History

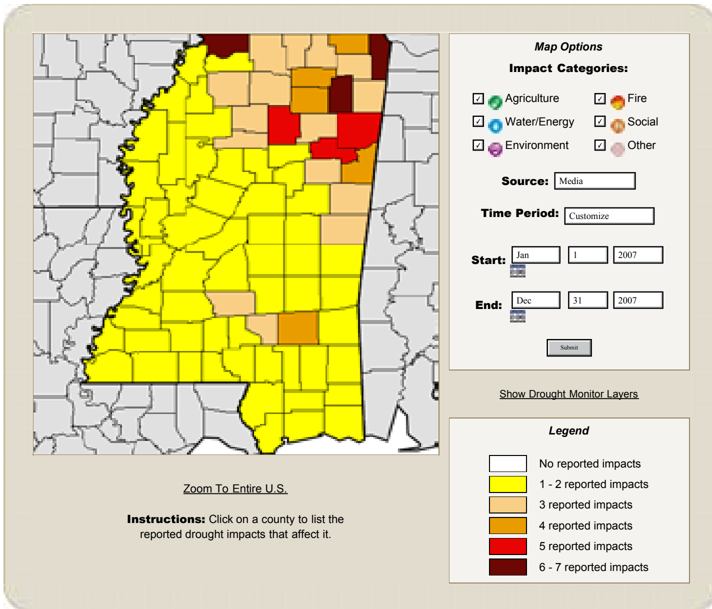
Drought The NCDC database reports drought events for Mississippi from October 2006 to October 2007. For that reporting period, Mississippi experienced 14 drought events with $50,000 property damage and $1.1 million in crop damage.

Another source for historical information on drought is the National Drought Center. Maps are produced by the Drought Impact Reporter that represents the number of reported drought impacts over a specified period of time as reported through the media. At the state level, the counties are also shaded in colors based on the number of reported impacts in each county. Figure 3.8.1 includes an analysis of reported events for the years 2007 to 2009.

Location and Extent/Probability of Occurrence and Magnitude

Limited historical data make precise estimating of probability unrealistic within the context of this planning process. However, the probability of future drought conditions is considered to be high, with the entire state being vulnerable.

Figure 3.8.1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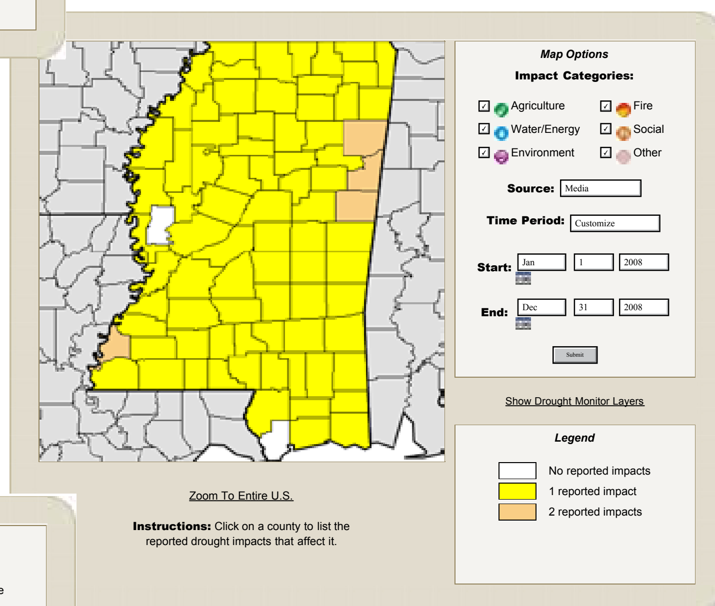
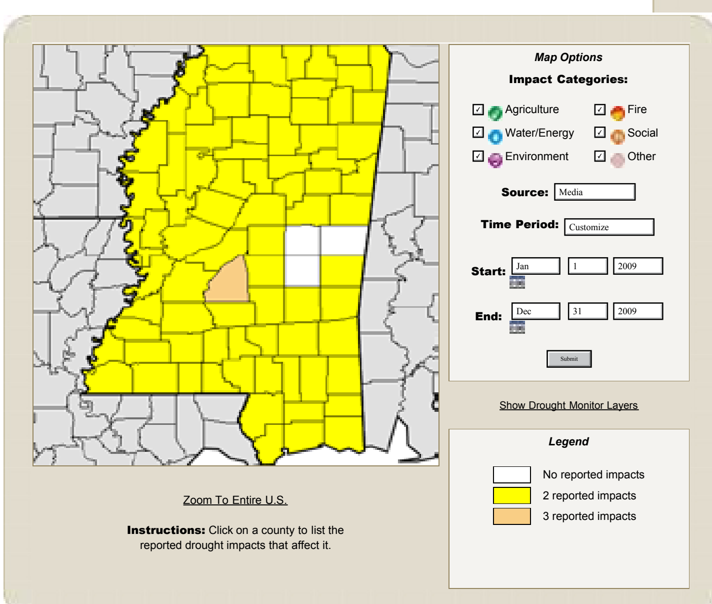
Impact Categories:
Agriculture
Fire
Water/Energy
Social
Environment
Other
Source: Media
Time Period: Customize
Start: Jan 1 2007
End: Dec 31 2007
Submit
Show Drought Monitor Layers
Legend
No reported impacts
1 - 2 reported impacts
3 reported impacts
4 reported impacts
5 reported impacts
6 - 7 reported impacts
Zoom To Entire U.S.
Instructions: Click on a county to list the reported drought impacts that affect it.


Map Options
Impact Categories:
Agriculture
Fire
Water/Energy
Social
Environment
Other
Source: Media
Time Period: Customize
Start: Jan 1 2008
End: Dec 31 2008
Submit
Show Drought Monitor Layers
Legend
No reported impacts
1 reported impact
2 reported impacts
Zoom To Entire U.S.
Instructions: Click on a county to list the reported drought impacts that affect it.


Map Options
Impact Categories:
Agriculture
Fire
Water/Energy
Social
Environment
Other
Source: Media
Time Period: Customize
Start: Jan 1 2009
End: Dec 31 2009
Submit
Show Drought Monitor Layers
Legend
No reported impacts
2 reported impacts
3 reported impacts
Zoom To Entire U.S.
Instructions: Click on a county to list the reported drought impacts that affect it.

Drought Vulnerability Discussion

It is very difficult to quantify the vulnerability of any given area to droughts, or to assess inventories of at-risk property for estimating exposure or losses. Areas of the most intense agricultural land use are most vulnerable. As noted above, drought was not selected by the Council for a full analysis due to the fact that it fell below the 49% threshold for local mitigation plans. Drought would have a negligible impact to state owned and critical facilities and public safety and was deemed not to pose a serious statewide threat that could be addressed by this plan. For that reason, this plan defers to local vulnerability assessments.

The most obvious primary impact from drought in Mississippi is crop damage which can and has resulted in significant secondary impacts (e.g. economic losses). Drought can also create conditions that promote the occurrence of other natural hazards such as wildfires and wind erosion. While dry conditions increase the likelihood of wildfires, low-flow conditions decrease the quantity and pressure of water available to firefighters to fight fires. The likelihood of flash flooding is increased if a period of severe drought is followed by a period of extreme precipitation.

Environmental drought impacts include those on both human and animal habitats and hydrologic units. During periods of drought, the amount of available water decreases in lakes, streams, aquifers, soil, wetlands, springs, and other surface and subsurface water sources. This decrease in water availability can affect water quality by altering the salinity, bacteria, turbidity, temperature, and pH levels. Changes in any of these levels can have a significant effect on the aquatic habitat of numerous plants and animals found throughout the State.

Low water flow may result in decreased sewage flows and subsequent increases in contaminants in the water supply. Decreased availability of water decreases the drinking water supply and the food supply. This disruption can work its way up the food chain within a habitat. Loss of biodiversity and increases in mortality can lead to increases in disease and endangered species.

3.9: Dam/Levee Failure Risk Assessment
Limited Hazard

Hazard Description

A dam is any artificial barrier, including appurtenant works, constructed to impound or divert water, waste-water, liquid borne materials or solids that may flow if saturated. All structures necessary to maintain the water level in an impoundment or to divert a stream from its course will be considered one dam.

A levee is an artificial embankment alongside a river. The main purpose of an artificial levee is to prevent flooding of the adjoining countryside; however, they also confine the flow of the river resulting in higher and faster water flow.

Dam Categories

The Surface Water and Dam Safety Divisions of the Office of Land and Water Resources, Mississippi Department of Environmental Quality (MDEQ) develop regulations on Dam Safety for the state. Dams are categorized according to what lies downstream, as well as the expected impact of dam failure. The following is taken from regulations for dams in Mississippi that will describe the statutory dam categories:

High Hazard (Category I, or Class C) - Dam failure may cause loss of life, serious damage to homes, industrial or commercial buildings, important public utilities, main highways or railroads. Dams constructed in residential, commercial, or industrial areas are classified as high hazard dams unless otherwise classified on a case-by-case business. For example, dams constructed where there is potential for development receive a high hazard classification. The term "High Hazard" does not speak to the quality of the structure, but rather the potential for a resultant death or exposure to property damage downstream in case of a failure. A dam can be as small as six feet in height, but if a homeowner lives within a reasonable distance of the structure, he would be considered vulnerable.

A high hazard dam is a class of dam in which failure may cause loss of life, serious damage to residential, industrial, or commercial buildings; or damage to, or disruption of, important public utilities or transportation facilities such as major highways or railroads. Dams proposed for construction in established or proposed residential, commercial, or industrial areas, and that meet the statutory thresholds for regulation, will be assigned this classification unless the applicant provides convincing evidence to the contrary.

Significant Hazard (Category II, or Class B) - A class of dam in which failure poses no threat to life, but which may cause significant damage to main roads, minor roads, or cause interruption of service of public utilities.

Low Hazard (Category III, or Class A) - A class of dam in which failure would at the most, result in damage to agricultural land, farm buildings (excluding residences), or minor roads. Without exception, all low hazard dams in Mississippi are earthen dams; some are considered to be properly engineered structures.

Hazard Profile

The hazard profile for dam failure in Mississippi includes current statistics regarding dam/levee failures and safety regulations that have been adopted by the State. According to the Mississippi Department of Environmental Quality - Dam Safety Division, there are 3,743 dams in Mississippi, of which 342 are classified as either High Hazard or Significant Hazard (Figure 3.9.1).

Dams have a design lifetime. Unlike U.S. Army Corps of Engineers dams, private dams are all too likely to go without the periodic maintenance essential to minimize failure. In spite of a five-year inspection period for high hazard dams, problems such as trees growing in the structure resulting in piping, animals using the dam structure for burrowing, and the appearance of sand boils can contribute to dam failure.

Catastrophic dam failure is characterized by the sudden, rapid, and uncontrolled release of impounded water produced by either overtopping or a break in the dam due to natural causes or human intervention. Lesser degrees of failure tend to lead up to or increase the risk of catastrophic failure. Management of such lesser degrees of failure normally can be accomplished if action is taken early and quickly.

Mississippi's dam safety program should ensure the safety of public and private dams arising from the extraordinary public safety risks posed by unsafe dams, the false sense of security that often arises from the presence of an upstream dam (no matter its function), and the tendency of localities and private landowners to want to develop areas that seem protected but in reality could be inundated if a dam fails or is breached.

Emergency Action Plans

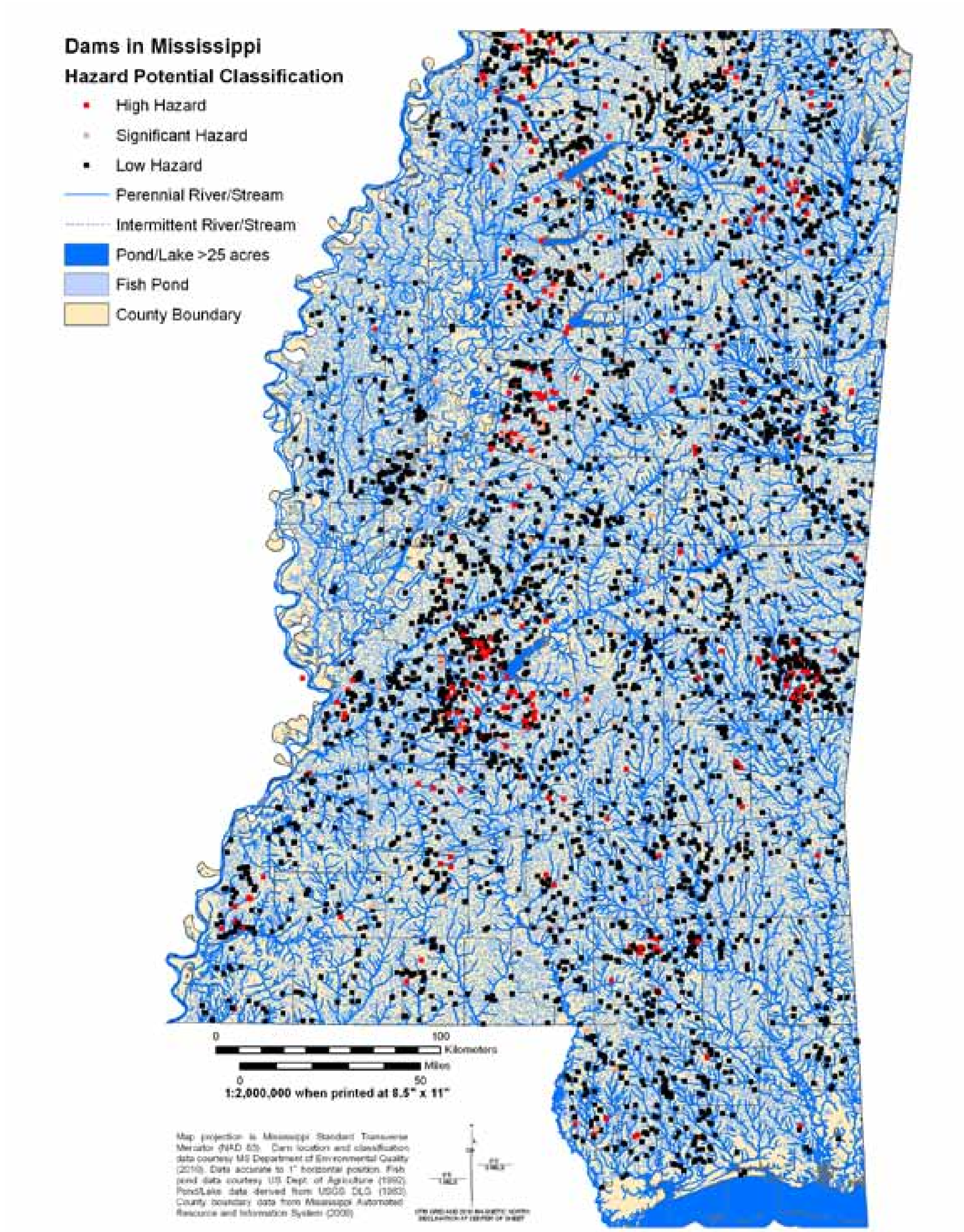
Section 51-3-39 of the Mississippi Code of 1972 charges dam owners with responsibility for maintaining and operating their dams in a safe condition. Dam Safety Regulations adopted by the Mississippi Commission on Environmental Quality in 2004 required all owners of High Hazard and Significant Hazard Dams to have their dams inspected by a registered professional engineer before March 2006. Additionally, the owners were required to prepare an Emergency Action Plan (EAP) for submission to MDEQ. Significant Hazard dams that may interrupt some roads or public utility services may also be required to have Emergency Action Plans in place, when needed.

The MDEQ Office of Land and Water Resources, Division of Dam Safety administers the state's dam safety program. During 2009, the Division completed a comprehensive file review and current hazard evaluation of all High Hazard dams on their inventory. The Division's list of dams can be found in Appendix 7.3.9-A. This list includes dams consisting of at least 50 acres of surface drainage area. Any size dam can be determined to be "High Hazard."

In 2009, there were 129 EAPs for High Hazard and eight for Significant Hazard dams approved and on file, an increase of 88 since the 2007 plan update. Several dams have been placed under reservoir-level restriction until repairs or modifications are completed to bring their dams into compliance with current safety standards. The Division staff anticipates that additional owners may be required to lower the water levels in their lakes and maintain the lower levels until they comply with the regulations.

The Dam Safety Division's goal is to have the owners of all High Hazard dams submit EAPs for review and approval. The approval process includes review and approval at the county level by the local Emergency Management Agency and all first responders that would be required to implement the plan. Division staff members responded to several dam emergencies during 2009, and were able to successfully handle each emergency and prevent damage to downstream properties.

Figure 3.9.1
Mississippi Dams



Changes in High Hazard Dam Classifications from 2007 Plan

The following dams were classified as high hazard in the 2007 plan and have been reclassified as provided in the chart below:

Dam Name	State Identifier	County	Classification
Moore Lake Dam	MS03690	Calhoun	Low
Adams Lake Dam	MS03688	Covington	Significant
Maywood Subdivision Sylvan Lake Dam	MS01513	Desoto	Low
Kyle's Lake Dam	MS01523	Desoto	Low
Riverline Lake Dam	MS00219	Harrison	Low
Engelhard Corporation Pond 4 Dam	MS01770	Hinds	Low
Engelhard Corporation Pond 3 Dam	MS03617	Hinds	Low
Spring Lake Dam	MS00128	Jackson	Low
Stocker Pond Dam	MS03349	Jasper	Low
Brookshire Lake Dam	MS02630	Lauderdale	Low
Hasson Pond Dam	MS02641	Lauderdale	Low
Bahala Creek Watershed Structure 5 Dam	MS02762	Lincoln	Low
Lake Pointe Dam	MS03233	Tate	Low
Arrowhead Lake Dam	MS01961	Union	Significant
Lake Walthall Dam	MS01158	Walthall	Low

According to MDEQ, Dam Safety Division, the following high hazard dams are “Not Required” (NR) to have an approved EAP at this time due to the following conditions noted:

Dam Name	State Identifier	County	Owner Type	Remarks
Willowwood Subdivison Lake Dam	MS02738	Hinds	P	*Lake no longer holding water
Oakland Heights Lake Dam	MS02659	Lauderdale	P	*Under lake level restriction
Long Creek Reservoir Dam	MS02676	Lauderdale	L	*Under lake level restriction
Peacock Lake Dam	MS00122	Simpson	P	*Dam destroyed, proposed for reconstruction

Mississippi Floodplain Management

The State of Mississippi is participating in FEMA's map modernization program, which means that the community flood maps are being updated and converted to digital format throughout the entire state. Estimated completion of this program is 2010. Currently, every acre in Mississippi is zoned according to its flood risk: low, moderate and high. The map modernization effort includes mapping of both accredited levees, which are shown as providing one-percent annual chance flood protection, also known as 100-year protection, and levees that meet provisional accreditation requirements.

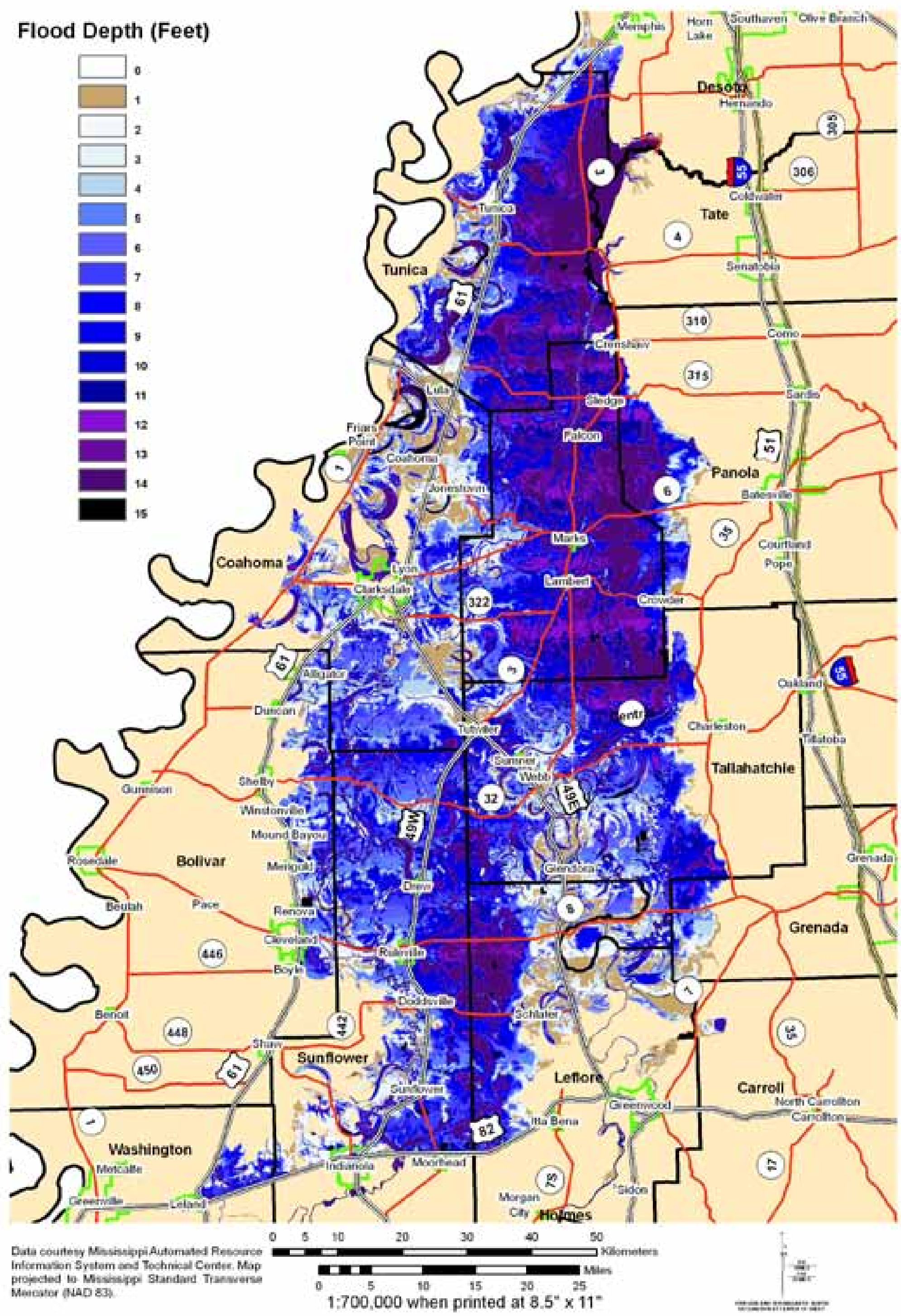
Mississippi has 5.2 million acres of high-risk flood zones, not counting the areas protected by certified levees. Mississippi has approximately 665 miles of major levees, which are generally located in the western border counties. All levees are constructed to provide a specific level of protection, such as the so called 100-year or 500-year flood. The 500-year flood level plus the additional freeboard height is considered a minimum protection standard for levees protecting urban areas. If a flood occurs that exceeds that design, the levee will be overtopped or otherwise fail from saturation, leakage, etc. When this happens, the results are catastrophic. The threat of earthquakes increases the risk of areas protected by levees.

Maximum Dam Failure Threat

The maximum threat to citizens of Mississippi from dam failure will not originate from state or privately owned dams, but from federal flood control structures such as the United States Corps of Engineers' Arkabutla, Sardis, Grenada, or Enid reservoirs. Simultaneous failure of these structures could occur due to an earthquake in the New Madrid Seismic Zone. Figure 3.9.2 depicts flooding that could be expected as a result of a Lake Arkabutla Dam Failure.

Information on Arkabutla Lake and Dam indicates that water from a dam failure originating in Desoto County and ending in Leflore County would take 45 days to travel to the Sunflower River and would involve untold damages to private and public properties. Because the movement of water would be slowed in its journey to the Sunflower, there would be ample warning to people downstream to enable evacuation, but estimated deaths would be in the hundreds because of the length of time water would continue to block roads and access. The disruption to business and the costs of recovery would range in the billions of dollars.

Figure 3.9.2
Lake Arkabutla Dam Failure Scenario



Mississippi Emergency Management Agency

Past Occurrences

High Hazard Dam Failure

The following information and photographs are presented as an example of the multi-county damages that occurred as a result of failure of one private dam:

- On March 12, 2004, the Big Bay Dam break in Lamar County yielded the following based on a preliminary damage assessment. High Hazard Dams appear in Table 3.8.1. Big Bay was classified a High Hazard Dam.
- Lamar County summary of damages:
  - ◊ Destroyed – 24 homes and 20 mobile homes
  - ◊ Major Damage – 15 homes and one mobile home
  - ◊ Minor Damage – one mobile home
- Marion County summary of damage:
  - ◊ Destroyed – one mobile home
  - ◊ Major Damage – 14 homes, two mobile homes, Pine Burr Church, and Pine Burr Volunteer Fire Department.
  - ◊ Minor Damage – 10 homes, three mobile homes, Hub Chapel Church

Description of Event: The dam failed shortly after noon on Friday, March 12, 2004. It was a 57 foot high earth dam that impounded the 1,100 acre Big Bay Lake. Approximately 3.5 billion gallons of water flowed through the breach. On Thursday, March 11, 2004, discolored water was observed coming from one of the dam's French Drains by an employee of the owner. An engineer working for the dam owner investigated the reported leak on the morning of Friday, March 12. The dam was not considered to be in imminent danger at the time. The engineer and crews were to return on Monday to make repairs.

Low-Hazard Dam Failure

On January 21, 2010 the Lake Getaway dam in Jones County failed. The dam is located on Poole Creek Road off Highway 84 East of Laurel, Mississippi. The massive slope failure of the 30-foot embankment appeared to have been a sheer failure due to a plane of weak clay, failure to mix layers well during construction, and poor maintenance. The dam, constructed in 2003 by the property owner, was rated as a low-hazard structure and therefore not subject to the strict design and inspection standards of high-hazard structures. Damage caused by the failure was minimal. Outflow from the lake caused overtopping of a lower dam downstream of the lake, and some erosion of the lower dam occurred, but the dam remained intact. There was also some timber loss associated with the failure. Dam experts studied the failure for Mississippi Department of Environmental Quality and confirmed initial findings.

Table 3.9.1
Dam Failures 1982 - 2010

DATE	LOCATION	STRUCTURE NAME	CAUSE OF FAILURE
December 1982	Leflore County	Pelucia Bayou	Overtopped
April 1983	Leflore County	Pelucia Bayou	Breached
April 1983	Pearl River County	Anchor Lake	Breached
April 1983	Adams County	Robins Lake	Breached
April 1983	Hancock County	Boy Scout Camp	Breached
April 1983	Lamar County	Lake Serene	Spillway Out
May 1983	Hinds County	Jackson County Club	Breached
May 1983	City of Carthage	State Highway 35	Overtopped
March 1984	Lauderdale County	Dalewood Shores	Minor Breach
March 1984	Panola County	Pine Lake	Breached
March 1984	Forrest County	Burketts Creek	Breached
March 1984	Forrest County	West Lake	Overtopped
March 1984	Rankin County	Ross Barnett Reservoir	Sandbags on Levee
April 1984	City of Clinton	Lakeview Lake	Breached
April 1984	Hinds County	Lake Laruel	Breached by Design
June 1989	Leflore County	Abiaca Creek	Breached
December 1991	Benton County	Porter Creek	Breached
July 1993	Jones County	Indian Springs Lake	Breached
April 1994	Desoto County	Strickland Lake	Breached by Regulators
November 1994	Hinds County	Spring Lake	Spillway Failure
January 1995	Panola County	Lake Village Dam	Spillway Failure
May 1995	Lauderdale County	Vise Lake Dam	Sand boils - problem with longevity of dam
April 2000	Hinds County	Whites Lake	Piping/Breached
September 2000	Warren County	Lake Haven	Animal penetration, causing dam to be drained
January 2001	Hinds County	Turtle Lake	Piping leading to dam being breached
March 2001	Lamar County	West Lake First Addition	Piping leading to dam being breached
May 2001	Madison County	Francis Calloway	Piping leading to dam being breached
May 2001	Madison County	Robinson Springs	Overtopping
July 2001	Lamar County	Bridgefield	Massive slides on downstream face leading to dam breach

DATE	LOCATION	STRUCTURE NAME	CAUSE OF FAILURE
January 2002	Lauderdale County	John Kasper Lake	Excessive seepage leading to dam breach
February 2002	Panola County	Unnamed Dam	Piping along primary spillway leading to dam breached
March 2002	Lauderdale County	Lake Tom Bailey	Deterioration for primary concrete spillway
April 2002	Carroll County	Billups Dam	Piping
July 2002	Lafayette County	Horseshoe Lake	Massive slides, erosion on downstream slope, leading to dam breach
August 2002	Lauderdale County	State Hospital Lake	Poor overall condition
September 2002	Madison County	Andover South	Piping
September 2002	Pike County	Lake Dixie Springs	Overtopping
October 2002	Harrison County	Windy Hills Lake	Piping along primary spillway conduit
December 2002	Lafayette County	Royal Oaks	Piping
January 2003	Madison County	Andover South	Piping
April 2003	Lauderdale County	Lake Evelyn	Piping
May 2003	Lauderdale County	Wild Duck Lake	Piping
July 2003	Lamar County	Emmit Graves	Piping
September 2003	Warren County	Lake Forrest	Piping
February 2004	Yazoo County	Dr. Freeman Lake	Piping
February 2004	Simpson County	Peacock Lake	Overtopping
March 2004	Lamar County	Big Bay Lake	Piping
April 2004	Pearl River County	Dove Lake	Piping
May / June 2004	Hinds County	Lake Dockery	Piping
2004	Lamar County	Bennett York	Dam owner attempted to lower water level by controlled breach but lost control
June 2004	Hinds County	Lake Dockery	Animal penetration. Dam failed near center. Controlled breach continued at the failed section
2005	Desoto County	Allen Subdivision Lake	Animal penetration, causing dam to breach
April 2005	Hinds County	Dennery Lake	Seepage, piping, biological growth caused section near center of dam to erode away
January 2010	Jones County	Lake Getaway	A plane of weak clay, failure to mix layers well during construction and poor maintenance

Source: Mississippi Department of Environmental Quality-Dam Safety Division

MDEQ no longer maintains a list of dam failures in Mississippi. The list is no longer required by the federal government because the national dam failure database has been discontinued. The data listed in Table 3.9.1 is the latest available.

Probability of Future Dam Failure Events

In the first half of the 2000 - 2010 decade, the probability of dam failure was considered high due to diminished inspection capabilities within state government, and a series of dam failures indicated a period of frequent failures could be expected. However, efforts within MDEQ to improve compliance with dam regulations and increase inspections seem to have paid off. The second half of the decade showed a greatly diminished number of dam failures.

While the structural weakness of a dam is apparent from outside observation, a sunny day event, without warning, can turn an earthen dam into a muddy whirlpool. There are ways to evaluate imminent failure of a structure, but these do not always provide the information needed to foretell future events. State policies that have been promulgated to provide for a periodic inspection period require five-year inspections for “high hazard” dams. The inventory of high hazard dams and the status of their respective Emergency Action Plan (EAP) must be taken into account.

Levee Failures

The most significant and damaging flood in the United States took place on April 21, 1927 when the failure of a levee along the Mississippi River near Mound Landing occurred. This flood overflowed all of the land from Beulah to Vicksburg; this break and adjustment is visible in the aerial photography shown in Figures 3.9.3 and 3.9.4 on the subsequent pages. In fact, practically the entire alluvial valley was under water. This devastating 1927 flood caused the loss of more than 246 lives; drowned out hundreds of cities, towns, and villages; drove 700,000 people from their homes, rendering them objects of charity dependent upon the Red Cross and other agencies; inundated 1,800 square miles; destroyed 1.5 million farm animals; caused losses amounting to many hundreds of millions of dollars; suspended interstate freight and passenger traffic; prevented telegraph and telephone communication; delayed the United States postal service; and paralyzed industry and commerce. As a result of this disaster to the valley, the Federal Congress on May 15, 1928, passed a general flood control act, wherein the government assumed the cost of all construction and for the first time enunciated the policy of the Federal Government assuming the construction of levees necessary for the protection of the valley.

Some examples of levee failures along the Mississippi River prior to the General Flood Control Act of 1928 are recounted by Walter Sillers below:

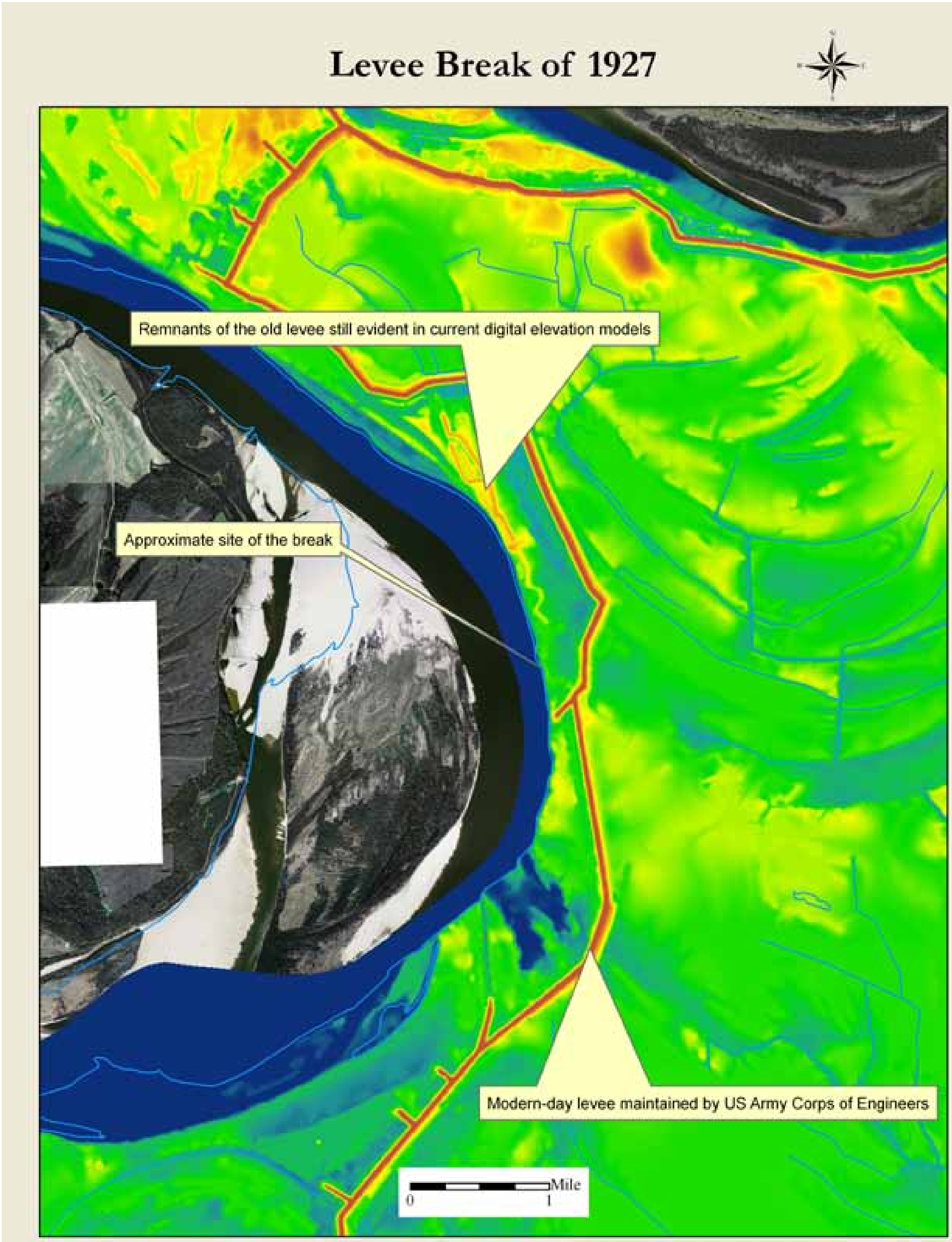
- In 1862 the small, inadequate levees, which had not been sufficiently enlarged, broke in several places east and northeast of the “old courthouse field”, about the center of the county, overflowing all the country east and southeast of the breaks.
- A section of the levee a mile long caved into the river just south of the town of Prentiss in 1865, and other levees, north and south, in Bolivar County, either caved in or broke; and as the stage of water was high for that day, a disastrous overflow swept over the country, drowning stock, sweeping away fences, destroying crops, and carrying destruction and disaster in its wake.

- A private levee along Lake Vermillion from Lake Beulah to Neblett's Landing was adopted as a part of the main levee system, in lieu of the abandoned levee. In spite of all the work and care given to this levee proper, there were many breaks in it; one in 1867, another in 1882, a third in 1884, a fourth in 1874…..more in 1897… A break occurred in the Catfish Point Levee in 1890, causing this entire Point with its improved plantations to be thrown outside the levee and abandoned…. and the most disastrous of all (for the time) in 1912. The water of 1912 was the highest on record at that time and caused a disastrous break in the levee four miles below Beulah.
- In 1922 the closure of the Cypress Creek levees on the Arkansas side raised the flood line to the extent that carried the water over the top of the Mississippi Levees from Kentucky Ridge to Mound Landing, causing a desperate struggle and a vast expenditure of money to top it off and hold it against the increased flood line of the river.

In 1926 Bolivar County was operating under the second Flood Control Act of 1923, under which act all the levee boards contributed one-third of the cost of construction of the levees and maintained the works after they were constructed.

Figure 3.9.3

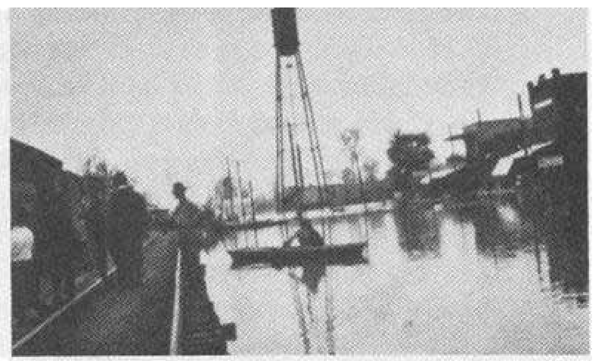
Figure 3.9.4



Levee Break of 1927
Remnants of the old levee still evident in current digital elevation models
Approximate site of the break
Modern-day levee maintained by US Army Corps of Engineers
Mile
0
1

Scrapers at work on the levee near Beulah, 1913

Convicts sacking Big Boil at Beulah, 28 April 1913



Near Beulah Break, 1912 (a) and Benoit, 1912

Shaw and the Mississippi Valley Railroad in 1912

Cypress trees, monarchs of the Delta's lakes and swamps, Lake Bolivar

Assessing Vulnerability

Life and property are vulnerable to dam and levee failures throughout Mississippi. Loss of life is the primary concern in assessing vulnerability to dam and levee failure. For this reason, a dam is considered high hazard if only one life is at-risk to inundation in the event of a failure. Residential homes as well as public buildings and infrastructure are vulnerable to damage if formerly-impounded waters are released due to dam or levee failure. In many cases a dam or levee failure results in property damage that cannot be returned to pre-incident levels.

Damages from Flooding as a Result of Dam Failure

Damages due to flooding can have an effect on crops and trees. The destructive force of water can destroy homes and businesses otherwise able to withstand wind and weather.

Vulnerability of People to Dam Failure

Homes built within the footprint of a “low hazard” dam suddenly may change the dam’s status to “high hazard” and unknowingly place homeowners and their families at risk. The design lifetime of an earthen dam is about 50 years. Often, the owner of a dam is located far from a dam and may be unable to arrange for a “dam tender”. In the event of an event signaling eminent failure with no residents on site, dam failure would occur with no warning to downstream properties.

Loss of Life from High Hazard Dam Failure

When water is released from a dam failure, its course and destination can become unpredictable. The National Weather Service will issue a Flash Flood Warning in the event of a dam failure. Drivers attempting to cross roads without benefit of a bridge or culvert may be caught in a flash flood with no hope of recovery. The Mississippi Department of Environmental Quality Dam Safety Division knows of no deaths directly attributable to dam failure. An indirect death occurred when a driver ignored a warning sign and drove into a ravine created by a dam failure from Tropical Storm Isidore a full six months earlier.

Vulnerability of Natural Resources to Dam Failure

Water that is impounded loses its dissolved oxygen. When a dam empties into a watercourse, fish in the watercourse suffocate and die as a result of a lack of biologically dissolved oxygen. Silt is often at the bottom of a dam impoundment and will enable water-borne bacteria and microbes to grow in an environment free of the cleansing action of sunlight. Mining operations utilize dams to impound tailings and may include processed water, process chemicals, and portions of un-recovered minerals, all of which are toxic to aquatic and human life. This does not imply that dams are a hazard to people and to the environment, but water-borne minerals and water without aeration need to remain impounded behind a dam.

Assessing Vulnerability to Dam Failure

The 2004 and 2007mitigation plans determined the most vulnerable areas to inundation by dam failure as those counties with the most high hazard dams. Information obtained for the 2010 update reveals that fifty-one of Mississippi’s eighty-two counties contain high hazard dams.

To further refine more specifically those areas vulnerable to dam failure, the State of Mississippi assessed the number of high hazard dams within specific census tract areas. Although this is more specific data than the land within an entire county, it is understood that without inundation mapping for existing dams and levees there is no accurate way to determine the number and location of vulnerable lives and built structures. The flow of water in the event of a dam or levee failure is not restricted by political boundaries or arbitrary boundaries on a map that reflects census data.

The census tract areas and related information such as numbers of residential and non-residential structures was obtained from FEMA's HAZUS-MH MR2 software for dams built prior to the 2007 plan. Census tract information for newer dams was obtained through GIS mapping using longitude and latitude coordinates. Although census tract areas are tied to political boundaries and not reflective of water flow, they usually encompass a smaller area than a county, which helps give a clearer picture of the development and population within close proximity to each dam.

Census Tracts with the Highest Frequency of High Hazard Dams

There are 605 census tracts in Mississippi. One hundred thirty-eight have at least one high hazard dam within their boundary. One census tract, located in Carroll County, has nine high hazard dams. Another census tract in Carroll County has twelve high hazard dams for a combined total of 21 dams that are considered high hazard in one county. The following chart indicates proximity of high hazard dams by demonstrating the frequency of multiple high hazard dams within given census tract areas.

Column A: Number of Dams per Census Tract	Column B: Number of Census Tracts that contain the number of dams in Column A
1	84
2	29
3	11
4	2
5	3
6	4
7	2
9	2
12	1
Total	**138**

High Hazard Dams and Demographics

Table 3.9.2 presents the census tracts (containing one or more high hazard dams) with a population greater than 10,000 people. These population estimates and demographics data were obtained from the HAZUS-MH software. Rankin County contains the most households (4,879) and the most residential structures (5,086) of all the census tracts containing high hazard dams.

Table 3.9.2
Census Tracts with Populations Over 10,000

County	Census Tract	Number of High Hazard Dams	Population	Number of Households	Number of Residential Structures	Number of Non-Residential Structures
Pearl River	28109950500	2	11,892	4,412	4,905	8
Lafayette	28071950500	3	11,294	4,306	4,044	3
Lamar	28073020300	3	11,260	4,497	3,609	93
Rankin	28121020201	1	11,178	4,879	5,086	11
Hancock	2804503060	1	11,037	3,971	4,641	11
Stone	28131020200	1	10,060	3,457	3,640	10

Table 3.9.3 provides the number of census tracts containing high hazard dams in each county and the total population, residential structures, households, non-residential structures, and high hazard dams within those census tracts.

A complete breakdown of each high hazard dam and its corresponding census tract and county may be found in Appendix 7.3.9-B.

Table 3.9.3
Census Tracts with High Hazard Dams by County

County	No. of Census Tracts with HH Dams	No. of HH Dams	Population*	No. of Households*	No. of Residential Structures*	No. of Non-Residential Structures*
Adams	2	7	9827	3852	3692	17
Alcorn	1	1	6498	2796	2208	81
Benton	1	1	5737	2125	2482	2
Bolivar	1	1	5352	1993	1596	11
Calhoun	2	10	7007	2795	3199	18

County	No. of Census Tracts with HH Dams	No. of HH Dams	Population*	No. of Households*	No. of Residential Structures*	No. of Non-Residential Structures*
Carroll	3	20	10769	4071	4485	11
Chickasaw	1	1	3808	1404	1488	7
Choctaw	1	3	6649	2473	2338	17
Claiborne	1	1	3775	1398	1455	5
Copiah	1	4	14218	5070	4956	24
Desoto	12	21	47857	17317	19248	191
Forrest	3	4	21034	7764	7723	79
Franklin	1	1	5486	2157	2690	10
Grenada	1	2	5798	2141	2472	35
Hancock	1	2	11037	3971	4641	11
Harrison	1	1	7272	2555	2675	0
Hinds	11	16	57027	21075	19875	521
Holmes	3	4	18060	6085	5668	37
Jasper	2	2	10596	3924	3935	12
Jefferson	2	2	13962	5177	4946	25
Jones	1	1	7791	2966	3248	10
Kemper	1	1	5465	1973	1873	12
Lafayette	2	4	20096	7732	8033	353
Lamar	5	10	34742	12845	12864	211
Lauderdale	10	27	46196	17381	17850	123
Lee	7	12	35896	13778	14334	79
Lincoln	1	2	4004	1492	1581	5
Lowndes	2	2	14489	5578	6276	33
Madison	8	15	26626	9239	9671	40
Marion	1	1	5847	2195	2403	2
Marshall	1	1	6876	2478	2804	5
Neshoba	1	1	3005	1168	1325	4
Newton	3	3	13049	4830	5101	23
Oktibbeha	1	1	4936	1888	1902	11
Panola	4	6	19619	7127	8111	96
Pearl River	2	3	18329	6762	7644	10

County	No. of Census Tracts with HH Dams	No. of HH Dams	Population*	No. of Households*	No. of Residential Structures*	No. of Non-Residential Structures*
Pike	2	2	9807	4032	3570	104
Pontotoc	2	6	13706	5266	4983	76
Prentiss	2	3	12148	4648	4836	21
Rankin	10	20	65075	25701	26656	167
Scott	1	1	4944	1872	2037	0
Simpson	2	2	9024	3272	3636	11
Smith	1	2	5953	2240	2308	3
Stone	1	1	10060	3457	3640	10
Tallahatchie	2	7	9238	3404	3878	6
Tate	1	1	8500	2988	3164	33
Tippah	2	3	10881	4253	4359	42
Tishomingo	2	2	9280	3787	4601	10
Union	2	3	9342	3559	3855	2
Walthall	1	1	6677	2485	1842	15
Warren	2	3	13477	4837	5117	10
Wayne	1	1	5437	1957	2049	0
Webster	2	2	6178	2361	2455	8
Yalobusha	3	7	19858	7798	5663	11
Yazoo	1	2	12548	3796	4013	8

*The demographic numbers reflect only the census tracts containing high hazard dams. They do not reflect demographics for the entire county.

Summary by County: High Hazard Dams

Desoto County has the largest number of Census tracts (12) with high hazard dams. Lauderdale County has the largest number of high hazard dams (27). Rankin County has the largest population (65,075), the largest number of households (25,701), and the largest number of residential structures (26,656) within census tracts containing high hazard dams. Hinds County has the largest number of non-residential structures (521) within census tracts containing high hazard dams.

Summary by County: All Dams

It is relevant to consider all dams in Mississippi in addition to the high hazard dams because development of even one residential structure in the inundation area of a dam may provide justification to change the dam's classification to high hazard. An inventory of all dams by county results in Lauderdale and Desoto Counties with the highest number of High Hazard Dams with 26 and 21 respectively. Hinds County has the highest number of dams with 186 total, with 170 classified as Low Hazard. Lauderdale County follows closely behind with 183 total dams, 155 of them classified as Ligh Hazard.

Table 3.9.4 lists the top ten counties in number of dams and gives the number of dams for each category.

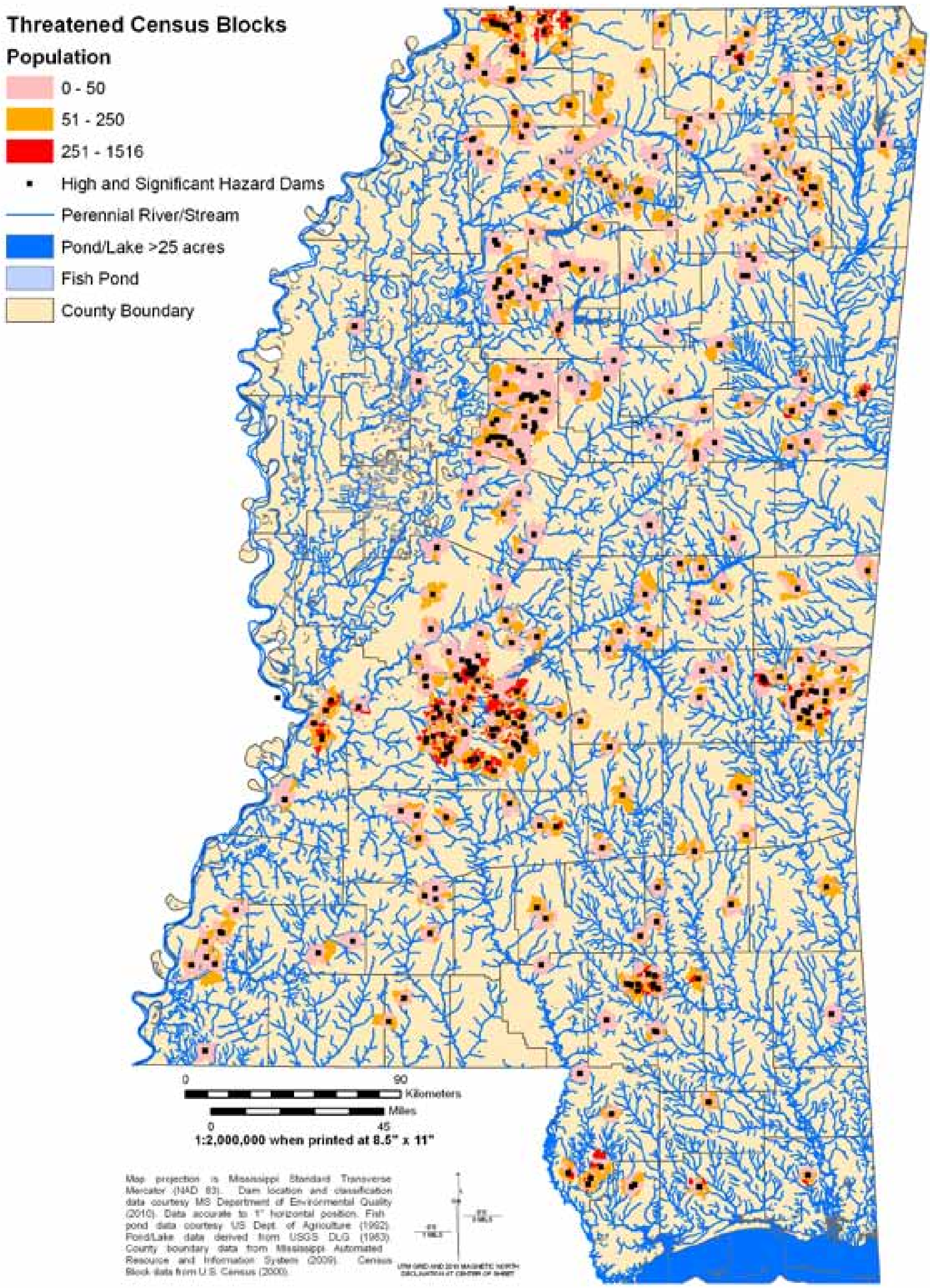
Table 3.9.4
Top Ten Counties in Number of Dams

County	High Hazard	Significant Hazard	Low Hazard	Total No. of Dams
Hinds	16	0	170	186
Lauderdale	26	2	155	183
Madison	15	5	137	157
Desoto	21	4	96	121
Carroll	20	3	82	105
Rankin	19	3	75	97
Yazoo	2	2	88	92
Lafayette	4	4	77	85
Benton	1	0	82	83
Oktibbeha	1	4	77	82

Limitations in this Vulnerability Assessment to Dam Failure

The ideal method for determining the population and assets at risk to vulnerability would be to overlay the inundation areas with population and structural asset information. This assessment uses census tract and county boundaries which do not reflect the flow of water in the event of a dam break. Lacking that level of detail, census blocks residing either within two miles down-stream distance or along potential backflow areas along known intermittent rivers and streams were identified as indicated in Figure 3.9.5. Two miles was selected, reasoning that, where a catastrophic failure may occur, flash flood waters would move at a speed of at least 30 miles per hour and a minimum of 4 minutes warning would be required for those in the potential flood zone to evacuate. The total population residing within such an area totals approximately 733, 817 (2000 Census).

Figure 3.9.5
Population Living Within Two-Miles and Threatened by a High or Significant Hazard Dam Failure



Assessing Vulnerability to Levee Failure

Inventory of Levees

The U.S. Army Corps of Engineers (USACE), Vicksburg and Memphis Districts, provides a partial inventory of all levees in Mississippi within their area of responsibility. This inventory was used to develop a risk rating for each levee in the following section. The location map (Figure 3.9.6) shows the available surveyed control points for levees in the Vicksburg and Memphis Districts available at the time of this plan update. There are no levees owned or constructed by the USACE in the Mississippi portions of the Mobile District. There are approximately 17,000 residents living within one mile of the main Mississippi River channel. Generally, these persons are living on the "river side" of the levee system and unless their homes are mitigated, they will suffer from repetitive losses. The terrain from Vicksburg southward is generally less susceptible to inland flooding from the Mississippi River as terrain features help prevent vast horizontal spread. In the Delta region (Vicksburg to Memphis), there are approximately 116,000 persons that would be directly affected by levee failure should it occur when the Mississippi River is above flood stage and water is present on the levee system. Water backing up tributaries such as the Big Sunflower River also presents a challenge, particularly in southern Delta counties.

Risk to Levee Failure

Using the levee inventory provided by USACE, the following risk factors were developed: certifiability, protected population, protected area. These are demonstrated in the chart below.

Protected Population	R1	Protected Area	R2	Certifiability	R3
Less than 10,000	1	Less than 5 square miles	1.0	Certified to FEMA 100 year level of protection	1
10,000 - 49,999	2	5 - 24 square miles	2.0	Believed to be certifiable to FEMA 100 year level of protection	2
50,000 - 99,999	3	25 - 49 square miles	3.0	Not certifiable to FEMA 100 year level of protection	3
100,000 - 499,999	4	50 - 74 square miles	4.0		

Protected Population (R1)

The available data described the protected population by each levee as a range. Each increment on the scale represents one point in the rating. The levees with the lowest range of population (less than 10,000) received a rating (R1) of 1, while the levees with the highest range of population (100,000 to 499,999) received a rating (R1) of 4.

Protected Area (R2)

The available data described the area protected by the levee as a range of square miles. Each increment on the scale represents one point in the rating. The levees protecting the least amount of area (less than 5 square miles) received a rating (R2) of 1, while the levees protecting the largest amount of area (greater than 100 square miles) received a rating (R2) of 6.

Certifiability (R3)

Levees certified to FEMA 100 year level of protection received a rating (R3) of 1 while levees deemed to be uncertifiable received a rating (R3) of 3.

Total Risk Rating

Each of the risk factors above are ranked such that the levees protecting the least population, the least area, and certified to FEMA 100 year level of protection will receive the lowest Rating (R1, R2, R3). The levees that protect large areas and large populations have more to lose in the event of a failure. Therefore, they receive higher risk ratings (R1, R2). Levees deemed to be uncertifiable have minimal guarantee for protection so they may be the most vulnerable to failure. For this reason they receive high risk ratings (R3).

A Total Risk Rating was calculated for each levee by summing the three risk ratings (R1 + R2 + R3). The highest possible Total Risk Rating was 13. One levee in Washington County received a Total Risk Rating of 12. Two levees (one each in Humphreys and Leflore Counties) received a Total Risk Rating of 11. The lowest Total Risk Rating received was 4. Five levees throughout Adams, Humphreys, Warren, and Washington Counties received the low Total Risk Rating of 4. A complete table of each levee and the risk rating may be found in Appendix 7.3.9-C.

Summary by County

Several counties contain more than one levee. Leflore county hosts five levees. Humphreys County hosts two levees. Quitman, Warren, Washington, and Yazoo Counties host three levees each. When the Total Risk Rating for all the levees in a given county is summed, Leflore County results in the highest Risk Rating of 37. Quitman, Washington, and Yazoo Counties have similar Risk Ratings among each other with 23, 22, and 21 respectively. The chart below demonstrates the Total Risk Rating by County.

Risk Rating by County			
Leflore	37	Holmes	10
Quitman	23	Sharkey	9
Washington	22	Tallahatchie	8
Yazoo	21	Rankin	7
Humphreys	15	Carroll	7
Warren	14	Adams	4

Limitations in this Vulnerability Assessment to Levee Failure

At the time of this plan update, only the locations of Corps-owned levees are known. There are many privately owned levees that may be at risk to failure. Inundation mapping was not available for the Corps-owned levees. The Map Modernization program administered by FEMA will provide more detailed information regarding the location of all levees (government and privately owned) for the next plan update.

Figure 3.9.6
Mississippi Levee System

3.10: Non-Profiled Hazards

As noted in Section 3.1.6, this State Plan also considers risks that have been identified outside of the process used in selecting hazards for analysis. Section 5: Coordination of Local Mitigation Planning covers in detail hazards identified and addressed in all local plans. More than 65% of all local plans identified and ranked the hazards selected for the state plan. Flood and tornado were included in all local plans.

The Hazard Mitigation Council chose not to select and rank severe thunderstorms. This decision was based on the fact that they do not typically cause a statewide impact requiring a state response, and typically would be mitigated at the local level. However, during review of the plan, and based on the fact that 80% of local jurisdictions indicated that severe thunderstorms (wind, lightening and hail) were of significant concern, the State opted to expand the profile and assessment of this hazard within this section. A general discussion of vulnerability, histories of events and calculations of probabilities are included for thunderstorms, wind, lightning, and hail. Property damage, loss of life and injuries that can be expected statewide on an annual basis are also addressed generally. It was not possible to specifically address expected losses to critical facilities or state owned facilities with the limited data that was available.

It was determined that hazards initially ranked and identified by 45 percent or fewer of local jurisdictions as being a hazard of concern do not pose a significant state-level threat to Mississippi. Those hazards are illustrated in the Table 3.10.1 below:

Table 3.10.1
Local Hazard Assessment

Hazard	Number of Plans	Percent of Plans
Thunderstorm (includes hail, lightning, high wind)	74	80%
Excessive Heat (heat wave)	30	33%
Expansive Soils	27	29%
Land Subsidence	19	21%
Radiological (nuclear power plant)	10	11%
Terrorism	16	17%
Bomb Threat	7	8%
Hazardous Materials Incident	14	15%
Coastal Erosion	9	10%
Gas/Oil Line Disturbance (pipeline)	9	10%

As noted earlier in the chapter, hazards identified and addressed in local plans that are not included in this plan will receive the support of the state mitigation program. Examples of the State's support to local hazard mitigation plans are the severe weather siren and saferoom programs. These mitigation programs satisfy multi-hazards by alerting the public and providing shelter not only from tornados but also severe thunderstorms.

Drought was listed as a non-profiled hazard in the 2007 because it was identified in 45 percent of the local plans - under the established threshold set by the Council. However, drought was listed in 49 percent of the local plans for the 2010 plan update and was therefore ranked by the Council as a limited hazard.

Severe Thunderstorm Hazard Description

The National Weather Service defines a thunderstorm as a local storm (accompanied by lightning and thunder) produced by a cumulonimbus cloud, usually with gusty winds, heavy rain, and sometimes hail. Non-severe thunderstorms rarely have lifetimes over two hours. The National Weather Service (NWS) considers a thunderstorm severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado. Severe thunderstorms are distinguished by stronger winds and heavier rain than the normal thunderstorm. These severe storms have the potential to produce damaging hail, spawn tornadoes, and initiate flash flooding. Thunderstorms may occur singly, in clusters, or in lines. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time.

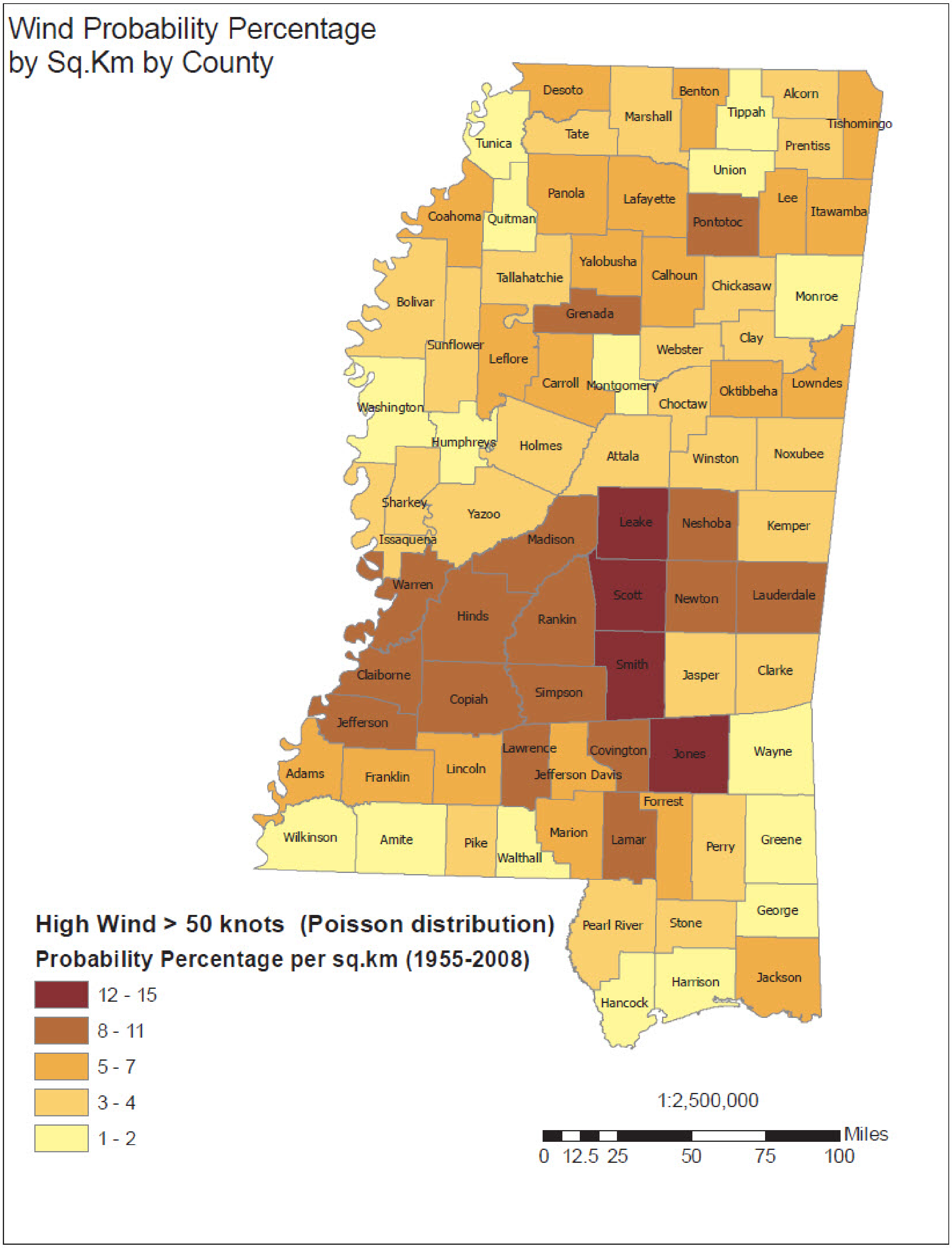
Wind can be one of the most destructive forces of nature. Strong winds can erode mountains and shorelines, and topple trees and buildings. The extent and degree of damages from a high wind event are primarily related to the intensity of the event, measured in terms of wind speed. Sustained high winds can be the most damaging, although a concentrated gust also can cause significant damage. As previously noted, wind damage estimations are addressed in the Tornado and Hurricane Sections of this HIRA.

Damaging wind events in the State of Mississippi typically occur in the form of tornadoes, straight line wind events, and severe thunderstorms. Depending on the type of wind event, the damage sustained can range from extremely localized to widespread and from moderate to devastating. The potential impacts of a severe wind event in the State depend on the specific characteristics of the storm, but can include broken tree branches and uprooted trees; snapped power, cable, and telephone lines; damaged radio, television, and communication towers; damaged and torn-off roofs; blown out walls and garage doors; overturned vehicles; totally destroyed homes and businesses; and serious injury and loss of life. Downed trees and power lines can fall across roadways and block key access routes, as well as cause extended power outages to portions of the State.

History of Thunderstorm Winds

Damaging thunderstorm winds occur in every county in Mississippi every year. The National Climatic Data Center (NCDC) database lists approximately 10,000 severe thunderstorm and high-wind events since 1950 across the state. In 2009 there were 551 reported thunderstorm and high-wind events covering all counties in Mississippi and causing reported property damages of $12.9 million, and crop damages of $2.3 million. The probability of wind in excess of 50 knots is presented in Figure 3.10.1.

Figure 3.10.1


Wind Probability Percentage
by Sq.Km by County
Desoto
Marshall
Benton
Tippah
Alcorn
Tishomingo
Tunica
Tate
Prentiss
Union
Panola
Lafayette
Lee
Itawamba
Coahoma
Quitman
Pontotoc
Yalobusha
Calhoun
Chickasaw
Monroe
Tallahatchie
Bolivar
Grenada
Sunflower
Leflore
Webster
Clay
Carroll
Montgomery
Oktibbeha
Lowndes
Washington
Choctaw
Humphreys
Holmes
Attala
Winston
Noxubee
Sharkey
Yazoo
Leake
Neshoba
Kemper
Issaquena
Madison
Warren
Scott
Newton
Lauderdale
Hinds
Rankin
Smith
Jasper
Clarke
Claiborne
Copiah
Simpson
Jefferson
Lawrence
Covington
Jones
Wayne
Adams
Franklin
Lincoln
Jefferson Davis
Forrest
Wilkinson
Amite
Pike
Walthall
Marion
Lamar
Perry
Greene
George
Pearl River
Stone
Harrison
Jackson
Hancock
High Wind > 50 knots (Poisson distribution)
Probability Percentage per sq.km (1955-2008)
12 - 15
8 - 11
5 - 7
3 - 4
1 - 2
1:2,500,000
Miles
0 12.5 25 50 75 100

Lightning

Lightning is a major threat during a thunderstorm. It is very unpredictable, which increases the risk to individuals and property. In the United States, 75 to 100 people are killed each year by lightning, although most lightning victims survive. People struck by lightning often report a variety of long-term, debilitating symptoms, including memory loss, attention deficits, sleep disorders, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and an inability to sit for long periods. It is a myth that lightning never strikes the same place twice. In fact, lightning will strike several times in the same place in the course of one discharge.

One of the most common hazards, severe thunderstorms can occur throughout the year, although historical records indicate that in Mississippi the majority occur between April and October. Records found in the NCDC database show that in the last 25 years (1984 – 2009), there were 15 reported deaths and 35 reported injuries from lightning in Mississippi. The same records indicate 203 events with damages of $10.4 million to property and $9,000 to crops.

Damaging Hail

Many strong thunderstorms produce hail. Large hail and the glass it may break can injure people and animals. Hail can be smaller than a pea, or as large as a softball, and can be very destructive to automobiles, glass surfaces (e.g., skylights and windows), roofs, plants, and crops. The size of hailstones is a direct function of the severity and size of the storm. Hailstorms occur more frequently in the late spring and early summer. The land area affected by individual hailstorms is not much smaller than that of a parent thunderstorm, an average of 15 miles in diameter around the center of a storm. The probability of hail in excess of 3.4 inch is presented by county in Figure 3.10.2.

Most of the hail incidents reported featured hail between .75 and 1 inch in diameter. There were thousands of hail incidents reported between 1950 and 2009 according to the NCDC database. Between April of 1958 and May of 2009 there were 200 reported events of hail with a two inch or greater diameter in Mississippi. NCDC began recording property and crop damages for hail events in 1993. Since that year, two inch or greater hail events caused $58.6 million in property damages and $8.3 million in crop damages.

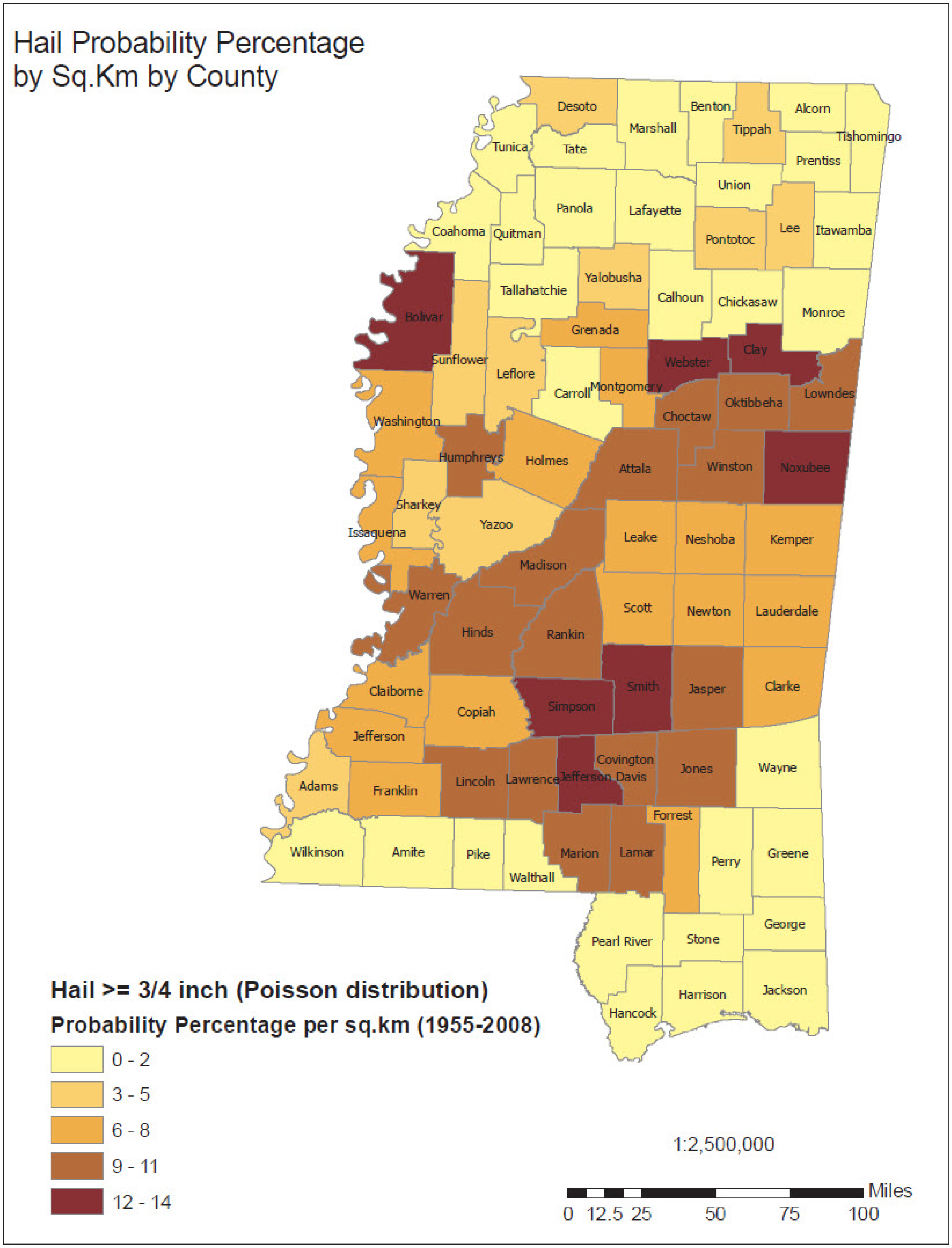
Location/Extent and Probability of Occurrence

Thunderstorms, including wind, lightning and hail damage occur in all parts of Mississippi.

Damaging events are typically isolated to relatively small areas. Historical records indicate that the entire state is vulnerable to severe thunderstorms. Trends in the data do not clearly indicate if portions of the state are more vulnerable than others. Based on available data, the Hazard Mitigation Council concluded that every county is vulnerable.

Based on events listed in the NCDC database, for 1999 through 2009, on average there have been 533 thunderstorm wind events each year. The annual probability of severe thunderstorm wind events capable of causing damage extends to all portions of Mississippi. Based on 51 years of record, on average, hail of two inches or greater diameter can be expected four times in any given year in Mississippi. Based on 15 years of record for lightning events, an average of 13.5 events can be expected statewide in any given year.

Figure 3.10.2



Hail Probability Percentage
by Sq.Km by County
Desoto
Marshall
Benton
Tippah
Alcorn
Tishomingo
Tunica
Tate
Prentiss
Union
Panola
Lafayette
Coahoma
Quitman
Pontotoc
Lee
Itawamba
Tallahatchie
Yalobusha
Calhoun
Chickasaw
Monroe
Bolivar
Grenada
Clay
Sunflower
Leflore
Webster
Carroll
Montgomery
Lowndes
Oktibbeha
Washington
Choctaw
Humphreys
Holmes
Attala
Winston
Noxubee
Sharkey
Yazoo
Issaquena
Leake
Neshoba
Kemper
Madison
Warren
Scott
Newton
Lauderdale
Hinds
Rankin
Smith
Jasper
Clarke
Claiborne
Simpson
Copiah
Jefferson
Covington
Jones
Wayne
Adams
Franklin
Lincoln
Lawrence
Jefferson Davis
Forrest
Wilkinson
Amite
Pike
Walthall
Marion
Lamar
Perry
Greene
George
Pearl River
Stone
Harrison
Jackson
Hancock
Hail >= 3/4 inch (Poisson distribution)
Probability Percentage per sq.km (1955-2008)
0 - 2
3 - 5
6 - 8
9 - 11
12 - 14
1:2,500,000
Miles
0 12.5 25 50 75 100

Severe Thunderstorm Vulnerability Discussion

Typically, damage associated with these hazards includes structural fires, broken glass, dented automobiles or siding, and personal injuries or even death. Wind damages (covered in other sections) typically include broken branches, uprooted trees, roofs blown off, walls blown down, small structures leveled, and in extreme cases, boats and airplanes being overturned. Although no specific areas of the State can be designated as having a higher risk of being affected by severe thunderstorms, there are a number of factors that contribute to a particular area's vulnerability to damages. Certain characteristics of an area or of a structure increase its resistance to damages due to high wind events, lightning and hail. Many of these factors are extremely specific to the particular location or the particular structure in question. Areas of higher population can be expected to experience more damage from hail, whereas more rural areas might be more vulnerable to fire from lightning due to longer response time for fire suppression. For these reasons, the State of Mississippi feels that it is important to include these hazards in local mitigation plans, as they are best able to be mitigated at that level.

When combining thunderstorm wind, lightening and hail damage to property, statewide on an annual average basis, Mississippi can expect approximately $16.5 million in damage in any given year. Mississippi can also expect three deaths and eight injuries from these perils in any given year based on the periods of record analyzed. There is no available data to determine potential damages to critical facilities and state owned facilities from severe thunderstorms at this time.

Coastal/Beach Erosion

The issue of beach erosion applies to three counties in Mississippi: Hancock, Harrison and Jackson Counties. Each of these Counties has had comprehensive beach maintenance and protection programs in place for many years. These programs have utilized locally budgeted funds that were occasionally supplemented with State and Federal. Hurricane Katrina damaged many of the beaches as well as the beach protection facilities. The United States Army Corps of Engineers completed an investigative report that identified major needed restoration and mitigation projects. This project received a supplemental appropriation for implementation. This project is being tracked as Mississippi Mitigation Action – Hurricane 6, USACOE Mississippi Coastal Improvements Program.

Additionally the United States Corps of Engineers is completing a Comprehensive Plan that identifies long term improvement strategies. This project is being tracked as Mississippi Mitigation Action – Hurricane 7, USACOE Mississippi Coastal Comprehensive Plan.

The Mississippi Department of Marine Resources serves as the lead agency for beach erosion initiatives. This agency is represented on the State Hazard Mitigation Council.

3.11: Growth and Development Trends Summary

Requirement §201.4(c)(2)(ii): [The State risk assessment shall include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events.

Update Requirement §201.4(d): Plan must be reviewed and revised to reflect changes in development.

Crosswalk Requirements: Does the updated plan reflect changes in development for jurisdictions in hazard prone areas?

As part of the plan update process, trends in growth and development were analyzed to determine how changing development and socio-economic trends could influence loss and vulnerability especially in Mississippi's hazard-prone areas. Historic, estimated and projected population, population density, housing units and housing unit density was studied at the state, regional and county level. Specific counties and regions of the state that have experienced significant changes are discussed in this section as well as the long-term effect of Hurricane Katrina on population and housing units. A special section on social vulnerability is also included.

In many cases population and population density offer insight into vulnerabilities, particularly where populations are concentrated in areas that are subject to natural hazards. Counties with the most assets, infrastructure and people are perceived as being the most vulnerable to damage and loss; however some hazards such as flooding is more directly related to topography and elevation. It is important to analyze all factors when assessing vulnerability.

Population

Mississippi is a relatively sparsely populated state. According to the 2009 U. S. Census Bureau estimate of the population Mississippi ranked 31st among the 50 states in population, 38th in rate of growth from the 2000 census, 31st in land area and 32nd in population density. The state is comprised of 46,906 square miles and had an estimated population of 2,951,996 in 2009. Historic population figures from the decennial census illustrate Mississippi's growth trends for the past five decades (see Table 3.11.1).

Table 3.11.1
Mississippi's Population Growth

Census	Total Population	Percent Change
1960	2,178,000	
1970	2,216,994	1.79%
1980	2,520,638	13.70%
1990	2,575,475	2.18%
2000	2,848,753	20.61%

Mississippi Quick Facts

Mississippi Population, 2009 Estimate	2,951,996
Area Square Miles	46,906.96
Mississippi Population, 2008 Estimate	2,940,212
Persons per Square Mile, 2008 Estimate	62.2
Number of Incorporated Cities, Towns and Villages	297
Number of Counties	82
Urban/Rural Population1	48.8% / 51.2%
Cities with a Population Greater than 500,000	0
Counties with a Population of 200,000 to 500,000	1 (Hinds)
Counties with a Population of 87,420 to 200,000	5 (Harrison, Desoto, Rankin, Jackson and Madison)
Counties with a Population of 49,309 to 87,419	7
Counties with a Population of 30,126 to 49,308	16
Counties with a Population of 15,971 to 30,125	27
Counties with a Population of 10,000 to 15,971	17
Counties with a Population of 1 to 10,000	9

[1]Note: 2000 data is used when no more recent information is available from the U.S. Census Bureau

Sources: Us Census Bureau 2000, 2008 and the Mississippi Development Authority

Between 2000 and 2008, 43 of Mississippi's 82 counties gained in population and 19 of these or 23 percent gained more than five percent. This growth was concentrated primarily in three areas of the state (coastal-south, central and extreme north-west).

Mississippi's ten most populous counties are listed in Table 3.11.2 and the ten least populous counties are listed in Table 3.11.3. Counties that have declined or grown in population are listed in Table 3.11.4 and those that have grown or declined by the greatest numbers and percentages are listed in Tables 3.11.5 followed by Figure 3.11.1. A demographic worksheet by county is provided in Appendix 7.3.11-A.

Table 3.11.2
Ten Most Populous Counties
Estimated 2008

County	2008 Population	County	2008 Population
Hinds	247,650	Madison	91,369
Harrison	178,460	Lee	81,139
Desoto	154,748	Lauderdale	79,425
Rankin	140,901	Forrest	78,180
Jackson	130,694	Jones	67,198

Source: US Census Bureau

Table 3.11.3
Ten Least Populous Counties
Estimated 2008

County	2008 Population	County	2008 Population
Humphreys	10,089	Quitman	8,724
Kemper	9,967	Franklin	8,316
Webster	9,887	Benton	8,116
Choctaw	9,090	Sharkey	5,556
Jefferson	8,872	Issaquena	1,658

Source: US Census Bureau

Forty-nine of the State's 82 counties experienced a decline during the period from 2000 through 2008 and eight counties experienced double digit decline. The area of the State most affected by declining populations is in the Delta—stretching from central Mississippi to within fifty miles of Memphis and just east of   are located in the Delta.

Table 3.11.4
Counties with the Greatest Population Losses and Gains (Numerical) 2000 – 2008

County	Population Loss 2000 - 2008
Harrison	-11,146
Washington	-7,898
Sunflower	-3,672
Bolivar	-3,438
Coahoma	-3,350
Hinds	-3,152
Adams	-3,033
Hancock	-2,829
Leflore	-2,762
Lowndes	-2,302

County	Population Gain 2000 - 2008
Desoto	47,549
Rankin	25,573
Madison	16,695
Lamar	10,053
Pearl River	8,847
Forrest	6,819
Lee	5,384
Lafayette	5,184
George	3,262
Stone	2,403

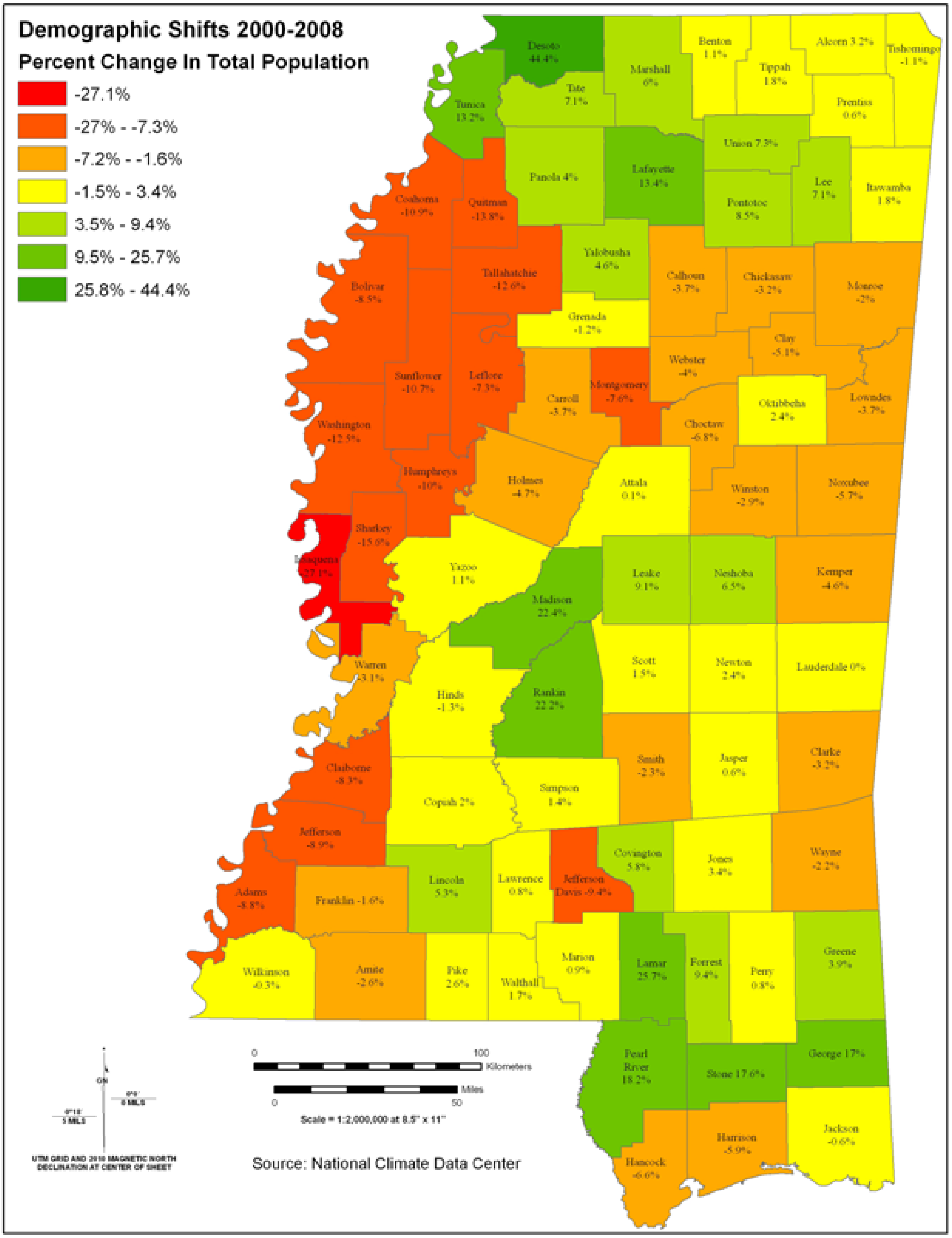
Source: US Census Bureau

Table 3.11.5
Counties with the Greatest Population Loss and Gain (Percent) 2000 – 2008

County	% Change	County	% Change
Issaquena	-27.1	Desoto	47,549
Sharkey	-15.6	Lamar	10,053
Quitman	-13.8	Madison	16,695
Tallahatchie	-12.6	Rankin	25,573
Washington	-12.5	Pearl River	8,847
Coahoma	-10.9	Stone	2,403
Sunflower	-10.7	George	3,262
Humphreys	-10.0	Lafayette	5,184
Jefferson Davis	-9.4	Tunica	1,221
Jefferson	-8.9	Forrest	6,819

Source: US Census Bureau

Figure 3.11.1
Counties with the Greatest Population Loss and Gain (Percent) 2000 – 2008



The US Census Bureau has released interim population projections using interim 2005 population numbers and revised numbers for 2006 through 2030. Table 3.11.6 summarizes those projections. Based on these projections, Mississippi will experience a slower than historic rate of growth through 2030.

Table 3.11.6
Interim Mississippi Population Projections
2005 – 2030

Year	Estimated Population	Percent Change
2005	2,915,696	2.50%
2006	2,910,540	-0.18%
2010	2,971,412	2.09%
2015	3,014,409	1.45%
2020	3,044,812	1.01%
2025	3,069,420	0.81%
2030	3,092,410	0.75%

Source: US Census Bureau

Housing Units

The total number of housing units is another indicator of growth or decline and helps identify the geographical location where new development is occurring based on increases within discrete areas. According to the US Census Bureau, the number of estimated housing units in Mississippi increased 9.03 percent (105,278) between 2000 and 2008. Desoto County experienced the greatest percentage of increase of housing units between 2000 and 2008 with an increase of 47.78% during the eight year period. Madison and Rankin Counties were second and third with a 29.76% and 24.08% increase respectively. Tables 3.11.7 and 3.11.8 list the counties that have grown the most in terms of housing units by number and percent respectively. Figure 3.10.2 (percent change) illustrates the results statewide.

Table 3.11.7
Counties with the Greatest Estimated Housing Gains (Numeric)
2000 – 2008

County	2000	2008	Housing Unit Net Gain 2000 - 2008
Desoto	40,795	60,286	19,491
Rankin	45,070	55,923	10,853
Madison	28,781	37,345	8,564
Hinds	100,287	106,559	6,272
Jackson	51,678	57,159	5,481

County	2000	2008	Housing Unit Net Gain 2000 - 2008
Pearl River	20,610	25,512	4,902
Forrest	29,913	33,962	4,049
Oktibbeha	17,344	20,401	3,057
Lafayette	16,587	19,115	2,528
Lauderdale	33,418	35,501	2,083

Table 3.11.8
Counties with the Greatest Estimated Housing Unit Gains (Percent) 2000 – 2008

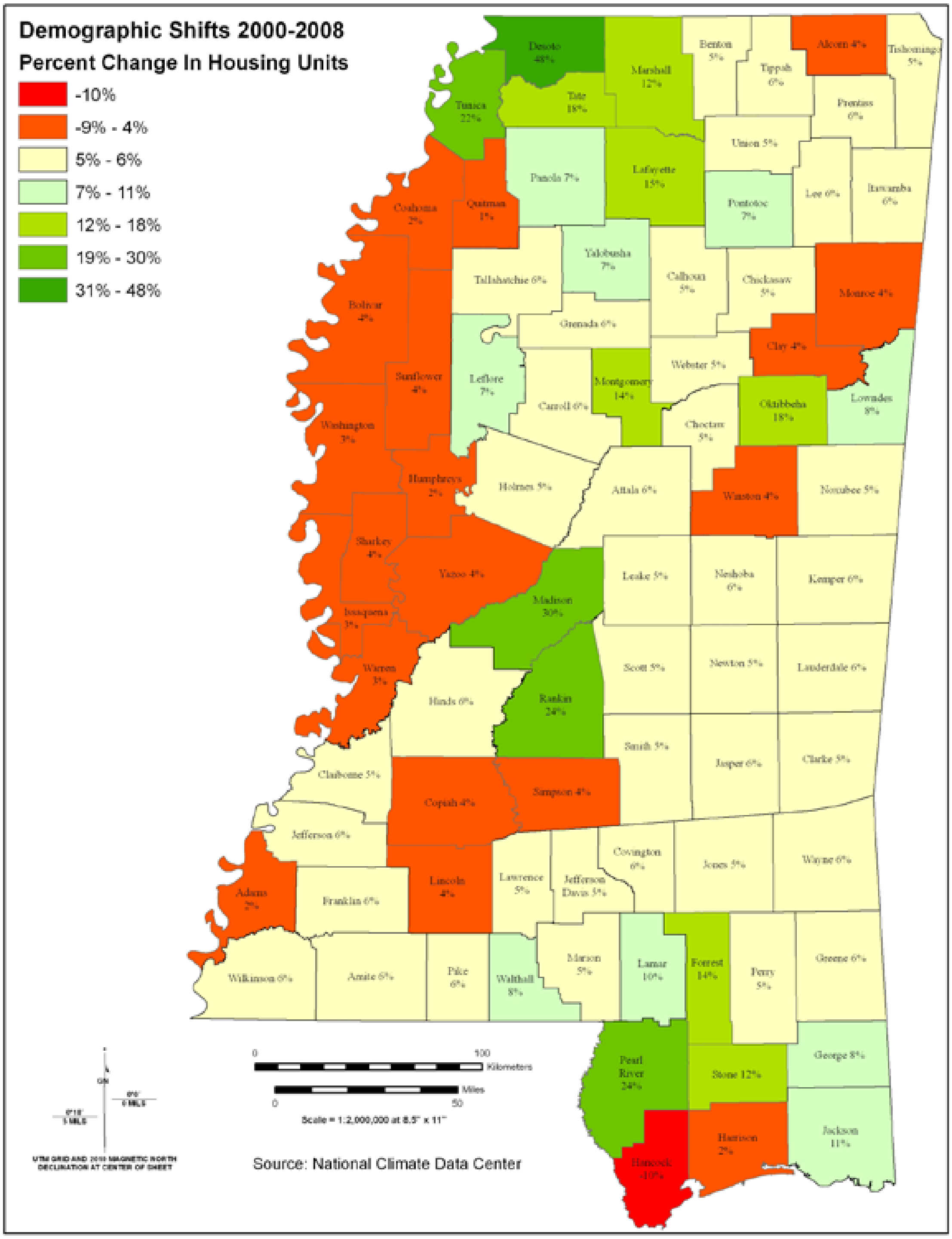
County	2000	2005	% Change
Desoto	40,795	60,286	47.78%
Madison	28,781	37,345	29.76%
Rankin	45,070	55,923	24.08%
Pearl River	20,610	25,512	23.78%
Tunica	3,705	4,522	22.05%
Tate	9,354	11,028	17.90%
Oktibbeha	17,344	20,401	17.63%
Lafayette	16,587	19,115	15.24%
Montgomery	5,402	6,176	14.33%
Forrest	29,913	33,962	13.54%

Seven of the 10 most densely populated counties (Table 3.11.10) also have the most housing units (Table 3.11.9). Increases in the total number of housing units usually tracks population growth.

Table 3.11.9
Top 10 Counties Ranked by Number of Housing Units (Estimated) 2008

County	2008	County	2008
Hinds	106,559	Madison	37,345
Harrison	80,920	Lauderdale	35,501
Desoto	60,286	Forrest	33,962
Jackson	57,159	Lee	33,749
Rankin	55,923	Jones	28,304

Figure 3.11.2
Counties with the Greatest Housing Loss and Gain (Percent) 2000 – 2008



Density

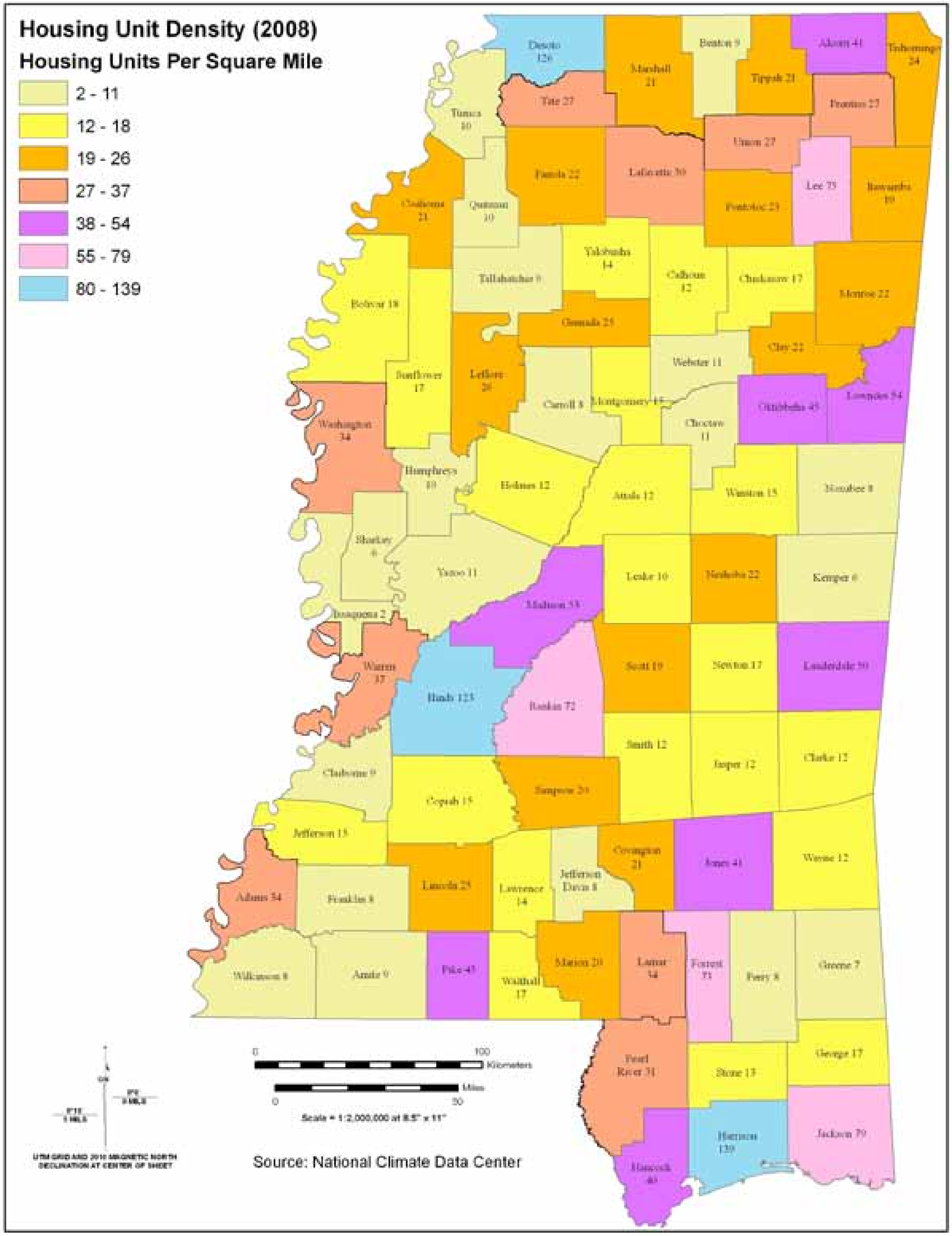
Density is a ratio between the total land area and the total population (population density) or the total number of housing units (housing unit density). As previously stated, Mississippi has a surface land area of 46,914 square miles and in 2008 had an estimated population of 2,918,700. The overall population density in the state is 62.2 per square mile and 26.6 housing units per square mile. Eight counties were among the top ten in total population, population density and housing density (see Table 3.11.10). Figure 3.11.3 illustrates density by county statewide.

Table 3.11.10
Top 10 Counties Ranked by Population/Housing Density, 2008

Geographic area	2008 Housing Units Density Per Square Mile
Mississippi	**26.6**
County:	
Harrison	139.28
Desoto	126.16
Hinds	122.60
Jackson	78.63
Lee	75.07
Forrest	72.79
Rankin	72.20
Lowndes	53.77
Madison	52.52
Lauderdale	50.46
Oktibbeha	44.57

Geographic area	2008 Population Density Per Square Mile
Mississippi	**62.2**
County:	
Desoto	300.53
Harrison	297.40
Hinds	288.83
Lee	176.43
Jackson	176.04
Forrest	165.33
Madison	122.51
Lowndes	118.48
Lauderdale	109.22
Pike	97.73
Jones	95.28

Figure 3.11.3
Housing Unit Density Per Square Mile 2008

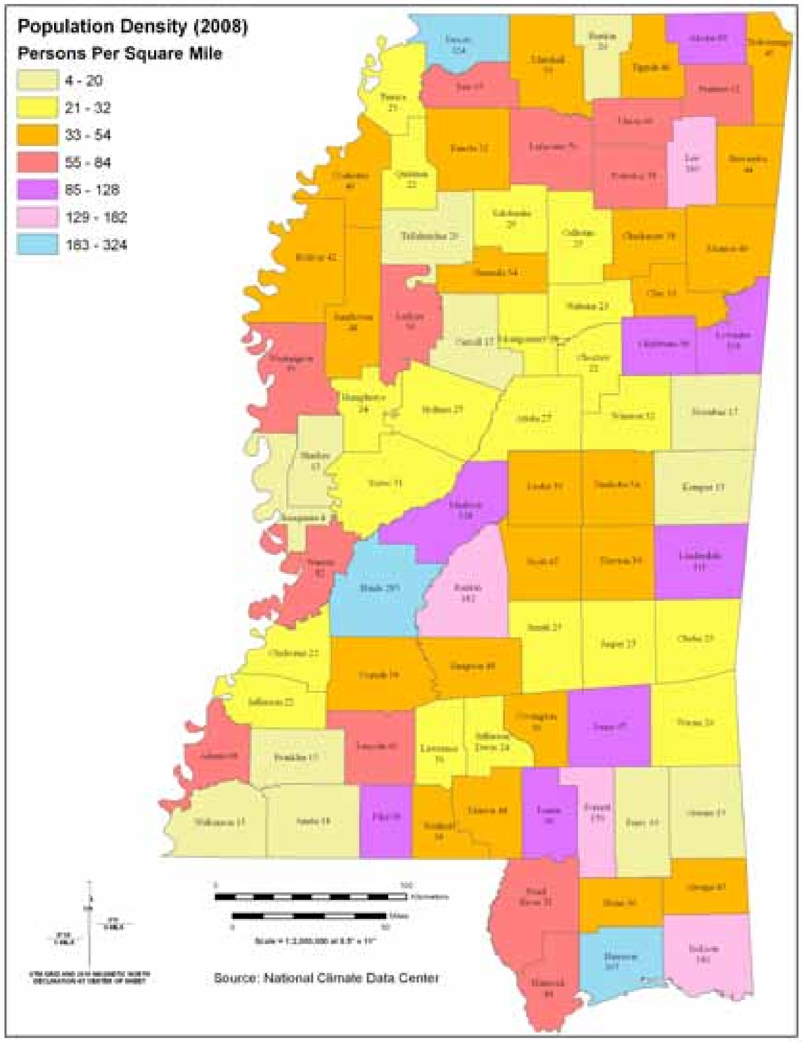


Typically, the fastest growing counties experience an increase in population density and housing density as new housing units are being built to accommodate the increased growth, although this may not always be the case due to the varying land area located within each county (see Table 3.11.11 and Figure 3.11.4).

Table 3.11.11
Counties with Greatest Estimated Population Density Gains
2000 - 2008

Geographic area	Population Density per square mile of land area		% Change
	2000	2008	
Mississippi	60.6	62.2	1.6%
Desoto	224.3	323.84	44.38%
Lamar	78.6	98.82	25.73%
Madison	104.1	128.49	26.43%
Rankin	148.9	181.92	22.18%
Pearl River	59.5	70.83	18.25%
Stone	30.6	35.98	17.59%
George	40.0	46.85	17.12%
Lafayette	61.4	69.59	13.35%
Tunica	20.3	22.97	13.16%
Forrest	155.6	170.23	9.40%

Figure 3.11.4
Population Density Per Square Mile 2008



Effect of Hurricane Katrina on Population and Housing Units

Prior to the devastation of Hurricane Katrina in August 2005, the coastal counties of Hancock, Harrison and Jackson counties were experiencing steady population growth. According to the Census Bureau the combined population in 1970 was 239,944 and by 2000 the population had increased to 363,988, a net increase of 124,044. Significant population shifts were seen as an immediate response to Hurricane Katrina and the damage it inflicted on the residents of Mississippi. The Census Bureau estimated that the coastal counties lost 40,334 people immediately after the Hurricane. Figure 3.11.2 identifies the Mississippi Counties which experienced the most significant population shifts as a result of Hurricane Katrina.

Post-Katrina, the population changes and shifts have continued with the population returning to the Mississippi Gulf Coast. By January of 2006 the three coastal counties had recaptured approximately 11,028 people. By July 2007 the population was estimated to be 345,890, and by July 2009 the population was estimated to be 349,294 which is a net loss of 14,694 people since the 2000 census.

According to a 2006 study conducted by the John C. Stennis Institute of Government some former residents of coastal Mississippi have relocated and may never return to their former hometown areas; however, this is thought to be the exception rather then the rule as native Mississippians have a very strong, emotional bond to their home place and their land.

Re-building efforts in the gulf coast region has been significant with federal, state and non-profit funding channeled toward critical infrastructure, housing and major employment centers. As evidenced by the population increased post-Katrina, it is expected that this region will continue to be one of the most economically viable of the State.

Social Vulnerability

The University of South Carolina's Department of Geography's Hazards and Vulnerability Research Institute has compiled a Social Vulnerability index which measures the social vulnerability of U.S. counties to environmental hazards. The purpose of this measure is to examine the differences in social vulnerability among counties. Based on national data sources (primarily the 2000 Census), 42 socioeconomic and built environment variables which research suggests contribute to the reduction in a community's ability to prepare for, respond to and recover from hazards (i.e. social vulnerability).

Social vulnerability is partially a product of social inequalities—those social factors and forces that create the susceptibility of various groups to harm, and in turn affect their ability to respond, and bounce back (resilience) after the disaster. . (Susan L. Cutter, Bryan. J. Boruff, and W. Lynn Shirley, 2003. "Social Vulnerability to Environmental Hazards," Social Science Quarterly 84 (1):242-261.)

Additionally, eleven composite factors have been identified that differentiate counties according to their relative level of social vulnerability. These eleven factors include: personal wealth, age, density of the built environment, single sector economic dependence, housing stock and tenancy, race, ethnicity, occupation and infrastructure dependence.

This index can be applied to the State of Mississippi demographics to help determine where social vulnerability and exposure to hazards overlap and how and where mitigation resources might best be invested. Figure 3.11.5 displays Mississippi's geographic variation in social vulnerability. According to the index, the following twenty Mississippi counties (Table 3.11.12) are the most vulnerable counties in the State.

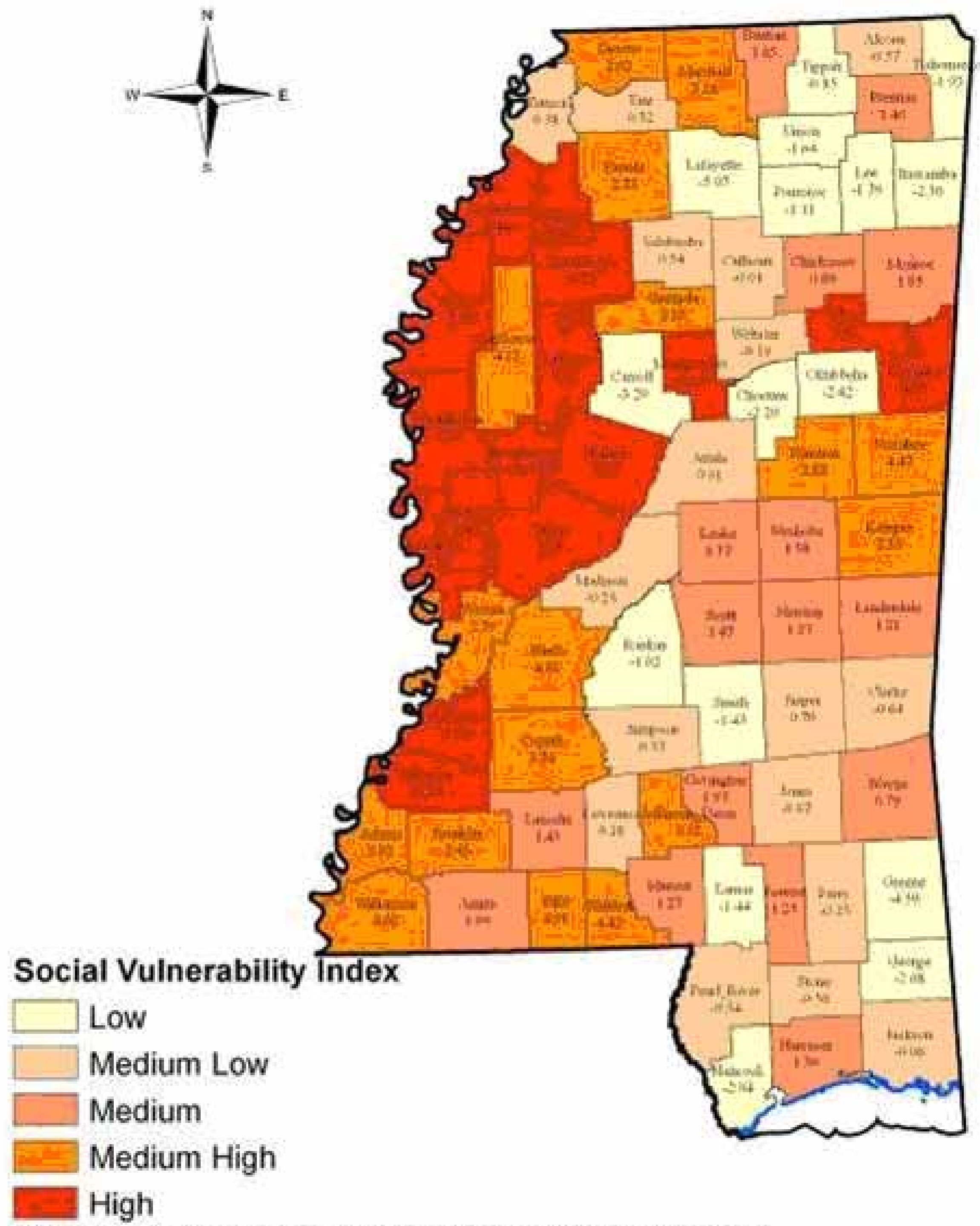
Table 3.11.12
Top Twenty Counties based on Social Vulnerability to Environmental Hazards, County Comparison within the State, 2000

County	SOVI 2000	National Percentile Ranking	County	SOVI 2000	National Percentile Ranking
Issaquena	12.7	99.4	Montgomery	6.86	96.2
Jefferson	10.54	98.8	Claiborne	6.57	95.7
Coahoma	9.44	98.3	Clay	5.42	93.1
Sharkey	9.4	98.3	Tallahatchie	5.32	92.8
Holmes	9.21	98.2	Yazoo	5.28	92.8
Humphreys	8.89	97.9	Lowndes	4.93	91.2
Quitman	8.02	97.4	Pike	4.91	91.1
Bolivar	7.98	97.3	Wilkinson	4.66	90.3
Washington	7.78	97.1	Hinds	4.61	90.1
Leflore	7.28	96.7	Noxubee	4.47	89.5

Summary

The fastest growing counties in the state and the most populous are located in extreme northwest Mississippi immediately south of Memphis; central Mississippi around the State Capital in Hinds County and south-coastal areas. Recent natural disasters have heightened interest in consistent building codes throughout the state as well as sustainable development outside of wetlands and flood zones. FEMA recently completed new flood maps for Mississippi and newly adopted building codes along the gulf coast impose more stringent standards on new construction, although travel trailers and mobile home parks still remain. Concentrations of older homes and mobile homes in areas prone to high winds and tornadoes remain a concern. Storm shelters and waning sirens are in place in most urban areas.

Figure 3.11.5
Social Vulnerability Index 2008



Source: Hazards and Vulnerability Research Institute, University of South Carolina

4.0: Comprehensive State Hazard Mitigation Program

It is essential that State and local mitigation policies be directed to reduce or eliminate the risk of future devastation and the corresponding impact on the citizens of the State of Mississippi. This can only be accomplished by establishing workable goals and objectives that integrate the efforts of state and local governments into one cohesive mitigation strategy that also takes full advantage of public-private partnerships.

Development of a sound mitigation strategy provides a focus that assists State and local governments in identifing priorities and channeling limited resources toward critical mitigation projects. This process helps government at all levels make the most effective use of available resources. "Local governments" include any county, municipality, city, town, township, public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity. Eligible governmental entities would also include all institutions, authorities, bodies or boards created under Federal, state or local authority to manage, oversee or regulate for a public purpose such as, but not limited to, special water/sewer districts, levee boards, floodplain management authorities, and agricultural or forestry boards.

The State of Mississippi will enhance its ability to complete its goals and objectives by taking maximum advantage of the mitigation resources available, both present and future, to reduce the impact of natural and human caused disasters on the citizens and infrastructure. The State will also vigorously pursue methods to augment existing state and local programs by involving other opportunities, such as public-private partnerships. Involvement of a wide range of participants in mitigation efforts, increases the feasibility of implementing mitigation projects as resources become available.

The State will provide, promote, and support education and training on the benefits of a comprehensive statewide hazard mitigation program for state agencies, local governments and private enterprises. Throughout the process, Mississippi's citizens will remain a priority. With a comprehensive overview of the hazards that threaten Mississippi, goals and objectives have been developed to mitigate potential losses from those hazards.

Summary of Changes - 2010 Comprehensive State Hazard Mitigation Program

In updating the 2004 State of Mississippi Hazard Mitigation Plan, a total of 60 local plans were reviewed. An additional 32 approved local hazard mitigation plans were reviewed for the 2010 plan. This section was updated with a commitment to improve on ways to reduce losses from natural hazards and to adequately reflect changes in development. A summary of changes is listed below:

Comprehensive State Hazard Mitigation Program (section 4.0) - Agencies included as “local governments” were updated.

Goals and Objectives (section 4.1) - Goals and objectives are described based on the updated hazard identification risk assessment and reconderation of goals and objectives from previously approved plan. Goals and objectives of local plans were reviewed. All tables and graphics/figures were updated with new data.

State Capabilities (section 4.2) - State agencies reviewed their capabilities and provided updates describing how their means and resources can aid mitigation efforts. All information was updated based on agency response. All tables were reviewed for update.

Local Capabilities Assessment (section 4.3) - Local capabilities were reviewed, analyzed, and evaluated for effectiveness and for improvement. All tables and graphics/figures were updated with new data.

Mitigation Measures (section 4.4) - Mitigation projects were combined, deleted, reassigned, and completed. All tables and graphics/figures were updated with new data.

4.1: Goals and Objectives

> ***44 CFR 201.4(c)(3)(i) - The State mitigation strategy shall include the following elements:***
>
> ***A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:***
>
> ***A description of State goals to guide the selection of activities to mitigate and reduce potential losses.***

This section describes the mission, goals, and objectives of the Mississippi State Hazard Mitigation Plan and the process used to update the goals and objectives in the 2010 update planning process. The state is tracking progress toward accomplishing the plan goals and improving alignment with local mitigation strategies (goals, objectives, and actions). The framework of the state's mitigation strategy has four parts: mission, goals, objectives, and actions, which are defined as the following:

- The **mission** is a philosophical or value statement that states the purpose and primary function of the plan.
- The **goals** describe the overall direction that the State will take to reach their mission.
- The **objectives** link the goals and actions and help organize the plan for efficient implementation and evaluation.
- The **actions** describe the activities or projects used to support the accomplishment of the goals and mission.

During the 2010 update process, the Hazard Mitigation Council reviewed the mission statement and the goals and objectives from the previously approved 2007 hazard mitigation plan. The Hazard Mitigation Council determined that the mission, goals, and objectives remain valid. The 2010 mission, goals, and objectives are the following:

Mission: To create a disaster-resilient, sustainable Mississippi through the implementation of a comprehensive statewide mitigation strategy.

Goal 1 - Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards

Objective 1.1 Protect critical facilities, infrastructure, and systems

Objective 1.2 Reduce the number of at-risk and repetitive loss properties

Objective 1.3 Reduce potential damage to future buildings and infrastructure

Objective 1.4 Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation

Objective 1.5 Identify needs and appropriate projects from post disaster damage assessments

Objective 1.6 Preserve, create, and restore natural systems to serve natural mitigation functions

Objective 1.7 Protect historic and cultural resources

Objective 1.8 Provide state and local agencies statewide communications with an interoperable, highly reliable, fast access, public safety-grade communication system for use during events that threaten the health and welfare of the citizens of Mississippi.

Goal 2 - Build and enhance local mitigation capabilities

Objective 2.1 Support and provide guidance for local hazard mitigation planning and projects

Objective 2.2 Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning

Objective 2.3 Provide and promote technical assistance and training to local governments

Objective 2.4 Identify and provide financial incentives and funding opportunities

Goal 3 - Improve public education and awareness

Objective 3.1 Develop and improve outreach programs and materials to increase awareness to the public and private sector about risk and mitigation in Mississippi

Objective 3.2 Promote and utilize existing hazard and mitigation education programs from state, federal, and nonprofit sources

Objective 3.3 Develop tailored outreach strategies for vulnerable populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents

Goal 4 - Sustain and enhance a coordinated state mitigation program

Objective 4.1 Strengthen coordination, communication, capabilities, and partnerships with all levels of government, the private sector, and nonprofit organizations

Objective 4.2 Institutionalize hazard mitigation as integrated state policy

Objective 4.3 Implement, monitor, and assess the effectiveness of the mitigation strategy and promote successes

Process for Updating Goals and Objectives

The goals and objectives of the 2004 plan were a compilation of previous goals and objectives from the Mississippi 409 plan, as well as those being implemented through other state agencies involved in the mitigation planning process. As part of the 2007 plan update, the goals and objectives from the 2004 plan were reviewed and revised to addressed current and anticipated future conditions. On April 22, 2010 the Hazard Mitigation Council met to assessed the goals and objectives from the previously approved 2007 hazard mitigation plan. The Council determined that the goals and objectives still remain valid and would not be changed in the 2010 update. The review for the 2010 update was based on the following:

- The updated statewide risk assessment, which includes changes in growth and development, recent disasters, enhanced vulnerability assessments, and analysis of local risk assessments;
- Assessment of changes and challenges in state and local capabilities since the 2007 plan;
- Types and status of mitigation actions from the 2007 state plan;
- Analysis of the similarities and differences of the state mitigation plan goals with local mitigation plan goals and objectives; and
- The development of a more integrated strategic plan framework for aligning goals, objectives, and actions.

As a result of this review, the Hazard Mitigation Council reaffirmed the mission statement, goals, and objectives from the 2007 hazard mitigation plan.

The key issues identified in the statewide risk assessment and the analysis of local risk assessments can be found in Section 3 Risk Assessment. Information on the changes in state and local mitigation capabilities is summarized in Sections 4.2 State Capability Assessment and 4.3 Local Capability Assessment. The following section describes how the local mitigation plan goals and objectives were reviewed and considered during the 2010 update. Section 4.4 Mitigation Actions includes detailed and updated mitigation measures designed to meet the designated goals and objectives. Progress on these actions is evaluated in Sections 4.4 and Section 4.5 Effective Use of Available Mitigation Funding.

Review of Local Goals and Objectives

The Hazard Mitigation Council analyzed the goals and objectives of FEMA-approved local hazard mitigation plans in Mississippi to assess their consistency with state goals and objectives. The analysis involved calculating the percentage of local plans (out of a total of 92 plans) that have a similar goal or objective to each of the goals and objectives in the 2007 Mississippi State Hazard Mitigation Plan. There were an additional 32 plans to review since the 2004 update. The data collection involved some interpretation because many local goals and objectives addressed multiple issues. The results of the analysis are presented in Table 4.1.1.

Table 4.1.1: Local Plans with a Goal or Objective Similar to State Plan Goals and Objectives

2007 Mississippi State Mitigation Goals (G) and Objectives (O)	Local Plans with Similar Goal	Local Plans with Similar Objective	Local Plans with Similar Goal or Objective	Relation to 2010 Updated Goals and Objectives
G1 Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards	92%	7%	99%	Goal is the same

2007 Mississippi State Mitigation Goals (G) and Objectives (O)	Local Plans with Similar Goal	Local Plans with Similar Objective	Local Plans with Similar Goal or Objective	Relation to 2010 Updated Goals and Objectives
G2 Build and enhance local mitigation capabilities	72%	24%	96%	Goal is the same
G3 Improve public education and awareness	88%	10%	98%	Goal is the same
G4 Sustain and enhance a coordinated state mitigation program	32%	1%	33%	Goal is the same
O1.1 Protect critical facilities, infrastructure, and systems	80%	15%	95%	Objective is the same
O1.2 Reduce the number of at-risk and repetitive loss properties	35%	55%	90%	Objective is the same
O1.3 Reduce potential damage to future buildings and infrastructure	26%	26%	52%	Objective is the same
O1.4 Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation	34%	56%	90%	Objective is the same
O1.5 Identify needs and appropriate projects from post disaster damage assessments	28%	53%	81%	Objective is the same
O1.6 Preserve, create, and restore natural systems to serve natural mitigation functions	16%	18%	34%	Objective is the same
O1.7 Protect historic and cultural resources	1%	10%	11%	Objective is the same
O2.1 Support and provide guidance for local hazard mitigation planning and projects	17%	76%	93%	Objective is the same
O2.2 Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning	39%	42%	81%	Objective is the same
O2.3 Provide and promote technical assistance and training to local governments	19%	53%	72%	Objective is the same

2007 Mississippi State Mitigation Goals (G) and Objectives (O)	Local Plans with Similar Goal	Local Plans with Similar Objective	Local Plans with Similar Goal or Objective	Relation to 2010 Updated Goals and Objectives
O2.4 Identify and provide financial incentives and funding opportunities	13%	20%	33%	Objective is the same
O3.1 Develop and improve outreach programs and materials to increase awareness to the public and private sector about risk and mitigation in Mississippi	53%	43%	96%	Objective is the same
O3.2 Promote and utilize existing hazard and mitigation education programs from state, federal, and nonprofit sources	26%	64%	90%	Objective is the same
O3.3 Develop tailored outreach strategies for vulnerable populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents	4%	50%	54%	Objective is the same
O4.1 Strengthen coordination, communication, capabilities, and partnerships with all levels of government, the provate sector, and nonprofit organizations	66%	14%	80%	Objective is the same
O4.2 Institutionalize hazard mitigation as integrated state policy	2%	2%	4%	Objective is the same
O4.3 Implement, monitor, and assess the effectiveness of the mitigation strategy and promote successes	1%	48%	49%	Objective is the same

The state goals most represented in local plans are Goal 1 and Goal 3. State Goal 1: Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards. When compared to local goals and objectives, ninety-nine percent of local plans had a goal or objective to minimize loss from natural hazards.

Eighty-eight percent of local plans have a goal similar to State Goal 3: Improve public education and awareness. In addition, the state objective 3.1 to develop and improve outreach programs and materials to increase awareness to the public and private sector about risk and mitigation in Mississippi received the highest percentage of similar objectives in local plans (96 percent). Objective 3.3 to develop tailored outreach strategies for vulnerable populations, such as tourists, disabled persons, children and the elderly, non-English speakers, and low-income residents received the lowest of the three objectives with 54 percent.

The Hazard Mitigation Council also analyzed other goals and objectives that occur commonly in local plans; some differ from state goals and objectives. Table 4.1.2 lists common goals and objectives in local plans and the percent of plans that contain the similar goal or objective. Because most local plans were developed by Mississippi's Planning and Development Districts, many plans of jurisdictions in the same district have the same goals and objectives.

Table 4.1.2: Other Goals and Objectives Common in Local Plans

Common Goals and Objectives in Local Plans	Percentage of Local Plans with Goal or Objective
Protect/improve critical facilities	90%
Promote local hazard mitigation plans	76%
Improve emergency response operations	46%
Increase local capacity for mitigation and emergency management	79%
Involve and/or educate public officials in natural hazards mitigation	36%
Enhance public warning and information systems	68%
Monitor effectiveness of measures and initiatives	48%
Identify and address repetitive loss properties	51%
Reduce damage to future buildings and infrastructure	21%
Increase property acquisitions	21%
Integrate mitigation in land use planning	20%
Promote the National Flood Insurance Program	52%
Encourage jurisdictions to implement and share GIS system	15%
Improve and retrofit public buildings	25%
Protect business continuity and economic vitality	34%
Improve sheltering capabilities	34%
Plan for continuity of local government operations	26%

Common Goals and Objectives in Local Plans	Percentage of Local Plans with Goal or Objective
Plan for vulnerable populations	13%
Develop or improve stormwater/drainage programs	28%
Improve communications systems	64%
Support State identified initiatives	63%
Improve evacuation capabilities	26%
Seek funding for mitigation	14%

Protect/improve critical facilities was the issue most common in local plans. Objective 1.1 in the state plan also addresses this issue. Increasing local capacity for mitigation and emergency management was another common issue (79 percent). Promoting local hazard mitigation plans was common and usually occurred in county plans in reference to local municipalities. State Goal 2 and Objective 2.1 share this common issue. Enhancing public warning and information systems was a frequent goal or objective in local plans (68 percent), as well as improving communications systems (64 percent). Sixty-three percent of local plans seek to support state identified initiatives.

4.2: State Capabilities

44 CFR 201.4(c)(3)(ii) - The State mitigation strategy shall include the following elements:

A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:

A discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas.

4.2.1 State Policy and Programs

The State of Mississippi authorizes local governments to regulate development in flood-prone hazard areas. The State has not assumed authority to oversee development in flood-prone or hazard areas. Similarly, while the State has passed enabling legislation for local governments to zone and to adopt building codes, it has not sought the authority to do so.

All state agencies with state-owned or leased buildings that are located in a special flood hazard area are required to carry the maximum amount of flood insurance. The premiums are paid out of the agencies operating budget.

State funding capabilities for hazard mitigation projects: mitigation projects require a non-federal match of 25% or more. Mitigation projects do not have a State identified funding source. Projects throughout the State are implemented with a non-federal match from budgeted funds, CDBG funds or in-kind match. The applicant or sub-grantee will be provided administrative and technical assistance to implement a proposed project. Administrative and management cost are available to the state and local governments that participate in federal mitigation grant programs.

The following are eligible federal funds available to contribute to the 75 / 25 local matches for overall funding:

- U.S. Department of Housing and Urban Development Community Development Block Grant Funds,
- Appalachian Regional Commission Funds,
- Indian Health Service Funds,
- Increased Cost of Compliance (ICC) to fund elevation, relocation, demolition, and floodproofing costs,
- Small Business Administration funds, and
- Federal Home Administration loan funds.

Each state agency from the 2007 plan was afforded the opportunity to review their mitigation capabilities from the existing standard plan and provide updates to their current agency capabilities. This was accomplished by personal contact with agencies represented at the Hazard Mitigation Council meetings. For those agencies who were not physically present at these events, an email which included a copy of their 2007 capability response and instructions as to how to evaluate their 2007 capabilities requesting them to review for update. The agencies who did not have changes are noted as no change from the 2007 submittal in the agency capabilities listed below.

Mississippi Emergency Management Agency (MEMA)

Authority for mitigation: Miss. Code 1972, Annotated. 33-15-7 Et. Seq.

The Office of Mitigation is responsible for coordinating disaster loss reduction programs, initiatives, and policies throughout the State of Mississippi. Disaster loss reduction measures are carried out through disaster reduction programs, initiatives, and policies through the development of State and local Hazard Mitigation plans and the implementation of strategies identified in the plans.

The Office of Mitigation administers the Hazard Mitigation Grant program, the National Flood Insurance Program's Community Assistance Program and Map Modernization program, the Flood Mitigation Assistance Program, and the Pre-Disaster Mitigation program, and Severe Repetitive Loss Program. The Office of Mitigation's Staff has grown from six to thirty personnel. Floodplain Management, Grants and Planning Staff are assigned to all nine districts in the state. Mitigation Bureau Staff have been extensively trained in Benefit Cost Analysis, Grants Management, National Flood Insurance Program, Plan review, CAV, CAC, environmental, project application review, HAZUS and NEMIS Entry.

The Mitigation Grants Management Bureau administers hazard mitigation grants to State and local governments. These grants include mitigation planning grants, drainage projects, acquisition of high-risk flood structures, retrofitting critical facilities, warning systems, saferooms and storm shelters, and other cost-effective measures identified in the State and local government's Hazard Mitigation Plan. The Mitigation Grants Management Bureau has developed a web site, www.MitigationMS.org that allows local governments/eligible applicants to submit applications online.

The Floodplain Management Bureau serves as the only compliance/regulatory focused bureau within the Agency. It is charged with the management of the Community Assistance Program - State Support Services Element (CAP-SSSE) which consists of providing oversight for the 312 participating National Flood Insurance Program (NFIP) communities and the 24 Community Rating System (CRS) members within the state.

A compliant community membership in the NFIP provides both the citizens and their communities with the opportunity to utilize the federally subsidized flood policies to protect their property and qualify for various grant and disaster assistance programs. As of 2/23/10, this program has resulted in 76,020 individual flood insurance policies that equate to an insured flood damage coverage of $15.5 billion dollars. There have been 54,526 claims paid since 1978, in the amont of $2.8 billion dollars. Of those claims, 1,511 policyholders filed additional Increased Cost of Compliance (ICC) claims for substantially damaged structures. Those actions resulted in payments of $30.2 million dollars, which resulted in the 1,511 flood damaged structures being elevated or demolished (mitigated) within two years of damage.

The Bureau's staff conducts an average of 55 Community Assistance Visits (CAV) compliance inspections per year. These inspections ensure the compliance of the communities with the NFIP, which enables them to participate in the five Hazard Mitigation Assistance (HMA) programs, the state's Hazard Mitigation Planning process, and the various disaster assistance programs administered by the federal government. Additionally, there is an average of 47 FPM training sessions or workshops conducted per year, as well as numerous technical assistance actions to state and local associations and to community governments.

The FPM Bureau is also tasked with coordinating the agency's portion of the Mississippi Flood Map Modernization Initiative. This five-year, $19.5 million dollar flood map modernization initiative is a federal and state cooperating technical partnership that provides funding and technical assistance for the development of the flood insurance rate maps for the state's 82 counties (including all incorporated communities within the counties). With these updated maps, which are both in digital and the traditional paper format, communities can better identify and regulate development in their special flood hazard areas. This effort consists of scheduling and conducting the various meetings and the public flood risk open houses associated with the map delivery process. Each community is visited at a minimum of three times over a course of two years, which includes a review of their local flood damage prevention ordinance and assistance in the map adoption process.

The Floodplain Management Bureau continues to conduct specialized training for state and local officials, such as offering the national Certified Floodplain Manager examination as a tool to both increase the professionalism and knowledge base within the floodplain management field. Since the inception of the CFM program within the United States, there have been 129 Mississippians certified as floodplain managers (as of 2/1/2010).

The Mitigation Planning Bureau is responsible for maintaining and updating the State of Mississippi Standard Mitigation Plan, which documents statewide hazard risk and the capability to mitigate the risk. The Planning Bureau also works with other state agencies, regional planning authorities and local governments in the development of mitigation plans and strategies. State funding capabilities for hazard mitigation projects: It is the policy of the State of Mississippi to provide technical assistance to local governments and state agencies, and administer federally funded mitigation programs.

Department of Agriculture and Commerce

Authority for Mitigation: Miss. Code 1972, Annotated. 69-1-1 (1972) Et. Seq.

The Department performs a regulatory function in the areas of sanitary inspections of grocery stores; agriculture theft; meat inspection; fruit and vegetable inspection; feed, seed, fertilizer and soil and plant inspection; weights and measure. The Department operates a seed testing laboratory, a metrology laboratory, and a grain moisture testing laboratory. The mitigation function of the agency is to ensure a sanitary food supply where the Department has authority.

Department of Archives And History

(No change from the 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 39-5-1.

This agency has custody of and maintains care of all state records and material pertaining to the history of Mississippi. It also administers the State Records Management Program. It aids mitigation by supplying information on the frequency and severity of past disasters and the effectiveness of recovery efforts. It also supplies historical information on sites of proposed mitigation projects. Archives and History is a first response agency and is responsible for responding after a disaster to retrieve and stabilize record recovery for government offices. According to Federal Section 106 Review – Archives and History is required to make comment on debris removal on any project involving federal funding. The agency is collaborating with MEMA to develop a GIS data system in order to have that data (what is in place/existing) prior to a disaster.

Department Of Audit

(No change from 2007 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. V, 134.

The State Auditor's Office conducts and maintains inventories of all state property. It aids mitigation by providing information on the state's physical and financial resources and their locations.

Information Technology Services

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 25-53-5.

This agency is responsible for: the cost effective acquisition of data processing equipment and services for use by state agencies; computer communication facilities to provide necessary services to state government; engaging in the long-term planning of equipment acquisition for state agencies, and training state personnel in the use of equipment and programs. Information Technology Services (ITS) aids mitigation by maintaining communication and information networks and ensuring adequately trained personnel to operate them.

As a member of the Mississippi Coordinating Council for Remote Sensing (RS) and Geographic Information Systems (GIS), ITS maintains the Mississippi Geospatial Clearinghouse, which is designed to house the Mississippi Digital Earth Model (MDEM). The MDEM is comprised of the following GIS data layers: Geodetic Control, Elevation and Bathymetry, Orthoimagery, Hydrography, Transportation, Government Boundaries, and Cadastral. The Mississippi Geospatial Clearinghouse will be accessible to local governments, state and federal agencies, planning and development districts, and private entities in support of disaster mitigation, planning, and recovery.

Mississippi Development Authority

(No change from 2007 submittal)

Marketing and Communications Division

Authority for mitigation: Miss. Code 1972, Annotated 33-15-2 and 33-15-3 (2005)

Timely communication during and after a disaster to prevent loss of life and to mitigate public danger and property damage. Specifically, mitigation of business-related damage.

The MDA Communications Director serves also as the State's CIO/Public Information Officer (PIO) acting as a key member of the agency's emergency response team to perform essential functions including handling all media inquiries, organizing press conferences and press releases, and responding to information inquiries from Mississippi businesses and industries.

Under MEMA ESF 11 and 15, the PIO coordinates where appropriate with the Joint Information Center at MEMA and may provide communication support to MEMA during and after a disaster. When needed, the agency may activate a call center. The PIO will assist in the staffing and operation of the call center.

Mitigation and minimization of damage through timely communication is a key objective of this function.

Community Services Division

Authority for mitigation: Miss. Code 1972, Annotated. 57-1-5 (1984 supplement).

Administration of Community Development Block Grant (CDBG) Program funding for the non-Federal share of mitigation projects.

The Community Services Division creates a climate favorable to community growth and development. It administers the Community Development Block Grant Program (CDBG) and aids mitigation by funding the non-Federal share of hazard mitigation projects.

Energy Division

Authority for mitigation: Miss. Code 1972, Annotated. 57-39-3 (1984 supplement).

This agency aids mitigation by developing plans for efficient energy use.

Department Of Environmental Quality

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 49-2-9 Et. Seq.

The Department of Environmental Quality promulgates rules and regulation; receives and expends state and federal funds, conducts studies on alternate uses of natural resources; and responds to incidents that threaten them. It aids mitigation by protecting the state's natural resources and regulating their use. The Dam Safety Division is housed in the agency. MDEQ and MEMA serve as State Technical Partners in the Map Modernization Program and in active participants in the Mississippi Digital Earth Model and Remote Sensing Initiative.

MDEQ in collaboration with MDA, is administering the use of HUD CDBG funds designated for the development and enhancement of new water, wastewater and storm water infrastructure on the Gulf Coast. Key in the development of the Master Plan for this program was providing infrastructure in areas less likely to be impacted by storms. Additionally, MDEQ has expanded ability to respond and collaborate with our State and Federal Partners in natural disaster related impacts such has debris disposal management, hazardous material management and wastewater treatment system recovery.

Department Of Marine Resources

(No change from 2007 submittal)

Authority for Mitigation: Miss Code 1972, Annotated. 49-15-11 (1972)

This agency aids hazard mitigation through (1) buyout programs, (2) preservation, creation, restoration, and enhancement activities, (3) education and outreach programs, and (4) our Mississippi Coastal Preserves Program. With buyouts, we partner with federal and state agencies, environmental organizations, and the private sector to identify susceptible, repetitive-loss properties and move them into public ownership through donation, purchase, or other means. These partnerships also facilitate our preservation, creation, restoration, and enhancement programs. DMRs current plan, which has been endorsed by Governor Barbour, is to preserve, create, restore, or enhance over 15,000 acres of coastal marsh, wetlands, or forests, to double the footprint of Deer Island, and to restore our offshore barrier islands (Petit Bois, Horn, Ship, and Cat Islands) to their pre-Camille footprint and functionality. Our education and outreach programs are through partnerships with local academic institutions, other state and federal agencies, and the private sector. We focus on environmental conservation, principles and practices of smart growth and smart code, sustainable development, and sound environmental stewardship. Our Coastal Preserves Program is a partnership with the MS Secretary of State and the MS Legislature through which parcels of land are identified as complimentary to increased environmental protection and conservation, those parcels are acquired through purchase, donation, or other means, and funds are provided to manage and enhance those properties.

Department Of Public Safety

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 45-1-1 Et. Seq.

The Department of Public Safety (DPS) aids mitigation by enforcing traffic laws and regulations on Mississippi highways and roads. It issues and renews driver's licenses, furnishes qualified personnel to take part in investigations, and provides assistance to communities during emergencies and disasters.

This department also houses the Office of Homeland Security. The Mississippi Office of Homeland Security assists by providing funding to state and local agencies. This funding is used to purchase preparedness equipment, provide training and certification to first responders, develop plans and standard operating guidelines for agencies and response teams, and to exercise and evaluate these response plans.

DPS also works with MDOT and Louisiana State Police during emergencies to provide logistical and security support consistent with contraflow operations on our Interstates. DPS also now has the capability to feed and fully support our first responders when deployed to a disaster area. DPS has also added an additional helicopter designated to assist in search and rescue operations as well as having a heavy lift capability.

Department Of Wildlife, Fisheries, And Parks

(No change from the 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 49-4-1 Et. Seq.

The Department of Wildlife, Fisheries and parks aids in hazard mitigation through its conservation and protection of wildlife and marine habitats.

Institutes Of Higher Learning

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 37-101-1.

Mississippi Institutions of Higher Learning, through its eight universities, continues mitigation efforts to provide safe environments for its employees, faculty, students and guests. Additionally, Mississippi Institutions of Higher Learning contributes to statewide hazard mitigation efforts though education, research, technical assistance, community service and facilities.

Mississippi Insurance Department

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 83-1-1 Et. Seq.

The Insurance Department executes all laws relative to insurance companies, corporations, associations, and their agents and adjusters. It aids mitigation by licensing and regulating manufacturers and dealers of mobile homes; enforcing the LP gas inspection program; and administering the Standard Fire Code. The State Fire Marshal's office is located in the Department of Insurance.

Since 2005, the following changes have been created, made, or supported by the Mississippi Insurance Department (MID) which support hazard mitigation:

- The creation and continued progress of the MID Hurricane Katrina Mediation Program which can now be used to mediate future disaster claims.
- The creation and continued progress of the MID Hurricane Katrina Arbitration Program which may also be used in arbitration of future claims.
- The development and continued use of a Flood Insurance Outreach program.
- The development and continued use of an updated Storm Preparedness web site.
- Support from MID and the State Fire Marshal's office of the state legislation which created the Building Codes Council which advocates stronger building codes for coastal counties

- Regulation which now requires the licensing of public adjusters in Mississippi
- Policy holder Bill of Rights regulation which will assist consumers in completely understanding homeowner policy coverage
- Working with Governor's office in securing CDBG grant funds to assist funding for the Mississippi Windstorm Underwriting Association, which will aid in lowering premium costs for both homeowner's and businesses
- Championed passage of the Wind Pool Bill which sets in place future state funding for the program

*NOTE: The State Fire Academy, a sub-agency of the Mississippi Insurance Department, submitted its plans separately.

Mississippi Library Commission

(No change from 2007 submittal)

Authority for mitigation: Mississippi Code 1972, Annotated, 39-3-107.

The Library Commission gives advice to libraries and communities on establishing and maintaining libraries; accepts and uses funds to establish, stimulate, increase, improve, and equalize library services; adopts rules/regulations relative to the allocation of state aid funds to public library systems; and operates a library to support libraries, state government, and the public. The agency's mission is "Commitment – through leadership, advocacy, and service – to strengthening and enhancing libraries and library services for all Mississippians."

To accomplish this mission, the Library Commission:

1. Operates a secure, state-of-the-art 62,000 sq. ft. facility at 3881 Eastwood Drive in Jackson, MS.

   The five-story building, of poured concrete and steel, includes: one below-ground level; wired and wireless high-speed Internet connectivity; a natural gas-powered generator to support basic functions, including data center, in power outages; 100+ windows throughout the building that open; meeting rooms equipment with distance learning capabilities and kitchen facilities; computer training facilities; public access computers; large parking lots; large, open research facilities; and a state-of-the-art data center to support Internet services to Mississippi public libraries & the agency's networking needs.

2. Operates a large library with traditional and electronic information resources and a highly qualified research staff to respond to requests for information and in-depth research. Provides interlibrary loan services for specific titles and loans materials on a short-term and long-term basis to libraries, state government, and the general public. Serves as the only library for the blind and physically handicapped in the state. Is the only patents and trademarks library in the state. Is a depository for federal publications and the depository of all publicly-released publications of state government.

3. Provides consulting services to library staffs, trustees, and local governments on establishing and maintaining library services.

4. Provides grant funds, federal and state, to public libraries.

5. Works with public libraries statewide.

   People have access to public library services in all 82 MS counties. All 241 public libraries are managed by trained, dedicated staff with local community knowledge, skills to assist the public and high-speed Internet capabilities available through multiple public access computers. Most have meeting room facilities with kitchen facilities, large reading rooms, comfortable seating, study tables, etc.

6. Is a member of the statewide cultural alliance comprised of the MS Arts Commission, the MS Department of Archives & History, the MS Humanities Council, and the Library Commission.

   The purpose of the "Culture Club" is to coordinate responses in case of an emergency; to encourage local cooperation among cultural organizations (i.e. libraries, museums, visual & performing arts groups, etc.); to secure funds, supplies, manpower, and facilities to protect cultural heritage such as local histories, city & county records, art works, buildings, etc. before and after a disaster.

In case of an emergency, the Library Commission:

- Serves as clearinghouse for evacuated or stranded public library employees and public library systems to ensure communication outside disaster area.
- Provides public library systems with access to remote office space/equipment/supplies to ensure business continuity.
- Secures and delivers needed resources (supplies, equipment, labor, library materials, etc.) to affected libraries.
- Identifies and seeks outside funding and assistance.
- Connects affected libraries with funders, opportunities, suppliers, vendors, counselors, etc.
- Advocates for libraries at local, state, and national levels on:
    - ◊ Central, community roles of libraries including communications; connectivity; comfortable, safe environment; staff trained to assist; meeting facilities; etc.
    - ◊ Funding needs.
    - ◊ Role of libraries as early responders in times of disaster.
- Modifies rules & regulations to accommodate affected libraries & libraries serving the affected public (evacuees, law enforcement, military, relief workers, volunteers, etc,).
- Serves as spokesperson with state, national, and international media.
- Seeks speaking opportunities to tell library story and story of lessons learned.
- People turn to libraries in times of emergency for information, for access, for comfort, and for a place of refuge. After Katrina, this fact was validated as evacuees sought shelter further inland or returned to affected areas.

- Supports work of libraries serving the affected public in many ways including:
    - ◊ Reestablishing public library service as quickly as possible.
    - ◊ Setting up alternate ways to deliver services through temporary facilities, donated bookmobiles, information kiosks, satellite Internet connectivity, etc.
    - ◊ Using trained library staff to assist people, relief workers, city/county government, etc.
    - ◊ Serving as communication centers; volunteer coordination centers; relief centers and early responders.
    - ◊ Expanding library hours to accommodate people in need;
    - ◊ Issuing library cards to anyone temporarily living in community;
    - ◊ Designating library computers for relief-efforts-only to for completion of FEMA and insurance forms online, to contact friends and family, and to search for assistance;
    - ◊ Offering free photocopy and fax services.
    - ◊ Using library facilities to accommodate relief workers and relief efforts. Serving as relief centers for water/ice, blue tarp distribution, makeshift shower facilities, food stamp card distribution, etc.

The Mississippi Library Commission and the Mississippi library community have a great deal to contribute to mitigation before and after an emergency. The library garners public trust: despite being a public institution, it is not perceived as "the government". Several factors make libraries ideal as early responders to emergencies: the library staff is trained to assist the public; libraries have multiple points-of-access to high speed connectivity, which facilitates communication; and in many instances, the facilities can accommodate larger groups of people.

Mississippi Automated Resource Information Systems (MARIS)

(No change from the 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 57-13-23.

Mitigation capability: MARIS stores, processes, extracts, and disseminates useful information on the state's resources. The Policy Committee is made up of representatives from 22 state agencies. The agency aids mitigation by developing uniform standards for geographic information systems used in state agencies.

Mississippi Department Of Transportation

Authority for mitigation: Miss. Code 1972, Annotated. 65-1-13.

The following is a brief description of the Mississippi Department of Transportation's (MDOT) on-going hazard mitigation capabilities.

1. Construction, reconstruction and maintenance of transportation facilities vital to evacuation, response, and re-entry. This includes but is not limited to seismic retrofitting of bridges, the upgrading of traffic control devices after destruction, construction of transportation facilities to avoid flood prone areas whenever possible, and other precautionary design work – including wetlands mitigation – which reduces risk before, during and after an emergency.

2. Education and communication outreach programs to include information provided to the general public concerning Contraflow, pet evacuation, and general preparedness.

3. Training for MDOT response personnel at all levels for a wide range of natural and man-made hazards.

4. In-house emergency coordination staff increased from 4 in 2005 to 15 today; this group is MDOT's ESF-1 representative at the State Emergency Operations Center.

5. Maintenance of a Comprehensive Emergency Transportation Response Plan which is updated regularly.

6. Emergency preparedness for a 72-hour window of self-sufficient after a disaster. This is accomplished through improvements made to emergency supplies, storage facilities, acquiring sufficient fuel reserves, as well as housing, food and water for transportation emergency workers.

7. Improvements in communication capabilities through the purchase of additional satellite radio units to serve as redundant communications backup. In addition, a mobile communications platform and a command/control center have been made operational.

8. Evaluation of standard operating procedures in all areas, but specifically within procurement to enable the agency to function more efficiently and quickly in the purchase of emergency supplies.

9. Provision of remote traffic sensing, which will aid in traffic management during evacuations and re-entries.

10. Development of partnerships with various state, federal and/or local agencies to save lives and reduce future losses. These include:

    a) The GIS Coordinating Council in the development of the Mississippi Digital Earth Mapping Initiative.

    b) Key emergency response agencies to aid in providing fuel. These agencies include the Mississippi Emergency Management Agency, Mississippi Department of Health, and Wildlife, Fisheries and Parks.

11. Acquiring travel trailers to provide housing accommodations for transportation emergency workers during extended events.

12. Placement of three Mobilization Centers in northwest Mississippi to provide for command/control

and serve as a base of operations to support earthquake emergency response activities.

Mississippi Authority for Educational Television (d/b/a Mississippi Public Broadcasting)

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 37-63-1 Et. Seq.

Mitigation capability: Mississippi Public Broadcasting (MPB) is a public service agency, providing the citizens of the state with Educational, Public Service and Informative programming. Mississippi Public Broadcasting aids mitigation by serving as the primary source for statewide Emergency information utilizing its network of Radio and Television transmitters and towers. MPB supports MEMA with technical and production staff and broadcast equipment to offer video and audio to all outside news organizations from MEMA's Press Room and aids in the operation of the Joint Information Center. The Mississippi Department of Transportation, in partnership with MPB, has identified MPB FM frequencies on evacuation route signs. When a mandatory evacuation is ordered, MPB is required to provide updates every 15 minutes via its statewide Radio network. In the event of a state of emergency, MPB Radio will broadcast crucial information as long as a need for information exists.

Mississippi State Forestry Commission

(No change from 2007 submittal)

Authority for Mitigation: Miss. Code 1972, Annotated § 49-19-1.

The Mississippi Forestry Commission (MFC), by statute, has the responsibility "To take such action so as to provide and maintain the organized means, as deemed necessary and expedient, to prevent, control and extinguish forest fires. This responsibility extends to cover approximately 18 million acres of private, school trust and other state-owned forest and non-forest lands. The MFC has apportioned Mississippi into five (5) administrative districts, each with a compliment of staffed dozer/plow units. Each district has a dispatch center and aerial detection resources to provide the capability of coordinating wildland fire mitigation efforts. The MFC embraces and uses the Incident Command System when engaged in wildland suppression efforts and other disaster emergencies that impact the state and where the agency's resources are needed to support mitigation and/or recovery efforts.

The Public Outreach arm of the Mississippi Forestry Commission provides the capability to inform and educate the public and private sectors. A full time Firewise Coordinator is actively engaged in promoting the means by which individual and communities can take measures to protect personal property.

Office Of The Attorney General

(No change from the 2007 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. VI, 173.

The Attorney General's Office has a staff of attorneys to represent state agencies and officials in the areas of litigation, opinion processing, governmental affairs, public integrity investigations, and public interest advocacy. It aids mitigation by interpreting state law and providing legal counsel to state agencies.

Office of the Governor

(No change from 2007 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. V, 116.

In response to Hurricane Katrina, the Governor created the **Governor's Commission on Recovery, Rebuilding and Renewal.** The commission brought together citizens, community officials, business leaders, non-profits, and other experts to formulate plans and make recommendations to establish a framework for rebuilding areas damaged by Hurricane Katrina. Recovery plans and recommendations dealt with mitigation issues and redevelopment that avoids the impact of hurricanes and other natural disasters. Publications issued by the Governor's Commission include "After Katrina: Building Back Better Than Ever", "Mississippi Renewal Forum Summary Report", and "A Pattern Book for Rebuilding Gulf Coast Neighborhoods." These publications and the commission's mass planning effort ensured the smart redevelopment of damaged areas and encouraged planning that considered the impact of future natural disasters.

After the commission issued its final report in December 2005, the Governor created the Office of Recovery and Renewal within the Governor's Office. The office coordinates government recovery assistance at all levels and offers advisory help to state agencies and local jurisdictions. The office is assigned four overarching tasks:

1. Obtaining the maximum amount of disaster assistance funds and maximizing the use of credit in-lieu of cash
2. Providing policy advice to the Governor, his staff, other state agencies, and local governments
3. Providing technical assistance, education, and outreach to organizations tasked with recovery
4. Identifying responsible entities and facilitating the implementation of the recommendations in the Governor's Commission final report as directed by the Governor

The Governor is coordinating both the distribution and use of Hurricane Katrina disaster funds and overall recovery policy in a manner that is cognizant of the threat of future hurricanes and other natural disasters.

Office of the Lieutenant Governor

(No change from the 2007 submittal)

Authority for mitigation: Miss. Constitution, 1890. Art. V, 128.

The Lieutenant Governor will preside over the Senate, rule on points of order, assign bills to committees, nominate standing committees of the senate, and appoint all select and conference committees as passed by the Senate. An ex officio member of the Senate Rules Committee and member of the Legislative Budget Committee. May vote only in the case of a tie, may speak from the floor while the Senate is in Committee of the Whole, and signs all finally adopted bills and resolutions.

Public Service Commission

Authority for Mitigation: Miss. Code 1972, Annotated. 77-1-1 (1990).

The duty and responsibility of the Public Service Commission is to regulate communication, electric, gas, water and sewer utilities that are under the supervision and regulation of the commission. Primary mitigation responsibility is to insure that the facilities constructed or acquired are required for the convenience, safety and necessity of the public. The Public Service Commission also helps to identify threats to public utilities by natural hazards.

Soil And Water Conservation Commission

(No change from the 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 69-27-2 (1984 supplement).

This agency is responsible for coordinating the programs of soil and water conservation districts. It aids mitigation by securing cooperation and assistance from Federal and other State agencies. The agency studies, evaluates, and classifies land use problems and needs; distributes funds, and manages the agricultural and non-point source pollution program. The Commission's contribution to hazard mitigation is to develop an awareness and to mitigate local pollution problems.

State Board for Community and Junior Colleges

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 37-4-3 (1986 supplement).

These institutions can contribute to hazard mitigation through their educational programs to prepare for and overcome natural disasters. This could be accomplished through community service programs and career technical programs in the various districts. Due to the many locations statewide, community colleges could also provide facilities for the delivery of shelter and supplies to victims.

State Department Of Health

(No change from the 2007 submittal)

Authority for Mitigation: Miss. Code 1972, Annotated. 41-3-15 (1972).

Providing protection to the public from threats to health and safety from unsanitary conditions relating to food, drinking water and sewage, unnecessary exposure to radiation and unhealthy and unsafe conditions in health care facilities, childcare facilities, and the workplace. Helps identify threats to potable water supply caused by natural hazards.

State Fire Academy

(No change from 2007 submittal)

Authority for mitigation: Miss. Code 1972, Annotated. 45-11-7 (1988 supplement).

The Fire Academy trains and educates persons engaged in municipal, county, and industrial fire protection and trains local law enforcement officers in arson investigation.

The Fire Academy is in compliance with the National Incident Management Systems (NIMS) under the Presidential Directive. Also, the Academy offers NIMS courses state-wide to all emergency response personnel through a federally funded grant.

Water Development Districts

(No change from 2007 submittal)

Pat Harrison Water Management District, Pearl River Valley Water Supply District and Tombigbee River Valley Water Management District

Authority for mitigation: Miss. Code 1972, Annotated. 51-13-103, 51-15-103, 51-9-105.

These watershed management districts are responsible for regulating the waters within their jurisdictions in order to conserve, protect, and develop them to provide adequate, sanitary water supply, control flooding, and ensure irrigation water when needed.

Board Of Animal Health

(No change from the 2007 submittal)

Authority for Mitigation: Miss. Code of 1972, Annotated. § 69-15-1.

To deal with all contagious and infectious diseases of animals in the opinion of the Board as may be prevented, controlled, or eradicated with power to make, promulgate, and enforce such rules so as to prevent the introduction and spread of those diseases.

Department of Finance and Administration

Authority for mitigation: Miss. Code 1972, Annotated. 33-15-307(5)

The Department of Finance and Administration (DFA) is responsible for managing and administering state finances and programs. Its primary mitigation responsibility is to ascertain if amounts requisitioned by the Mississippi Emergency Management Agency (MEMA) from the Disaster Assistance Trust Fund are within the limits set forth in statute and transfer appropriate amounts from the Working Cash Stabilization Fund to the Disaster Assistance Trust Fund. DFA also administers the Disaster Recovery Fund and the Emergency Aid to Local Government Loand and Grant Program, provides administrative support to the Governor's Authorized Representative (GAR)/MEMA in connection with the Special Community Disaster Loan Program (SCDL), and provides daily support to MEMA insofar as routine and extraordinary fiscal, budget and procurement activities.

Post-Katrina, DFA has developed and is in the process of finalizing, its formal Continuity of Operations Plan (COOP) and Business Continuity Plan (BCP), both of which will interface with its successfun pre-Katrina Business Resumption Plan (BRP).

4.2.2 Evaluation of Mitigation Actions and Activities

The Hazard Mitigation Council will review the mitigation actions and activities included in the 2010 Plan on a quarterly basis. The evaluation process will include project status and update such items as time-line, funding source and responsible entity. In addition, the Council will also review current programs and initiatives listed in Table 4.2.2.1 (details of these programs are outlined in Section 2.3.3 of this Plan). Any desired or necessary changes to the mitigation actions or programs will be communicated to MEMA and other stakeholders.

TABLE 4.2.2.1
Mitigation Programs

Center for Community Earthquake Preparedness	Emergency Management Preparedness Grant	Hazard Mitigation Technical Assistance Program	Pre-Disaster Mitigation-Competitive
Community Development Block Grants	Forestry-Disaster Hazard Mitigation and Preparedness Plan	Homeland Security Plan	Pre-Disaster Mitigation Planning Program
Comprehensive Emergency Management Plans	Federal Dam Safety Program	National Flood Insurance Program	Pre-Disaster Mitigation Loans for Small Businesses
Consolidated Plan for Housing and Community Development	Hazard Mitigation Assistance	Natural Hazards Plan	State Emergency Response Commission

As events dictate; such as a pre- and post-disaster review and other situations that may affect the progress of the mitigation actions, the Council will conduct additional meetings. The Council may determine new actions and/or funding opportunities that may develop upon the course of events. The Council will communicate to MEMA any necessary changes they deem necessary.

The Administrative Plan for the Hazard Mitigation Grant Program (Section 404) defines applicant eligibility criteria, describes the application process, and outlines the resources and procedures for management of Hazard Mitigation Grant Program (HMGP) projects and their associated program funding. Although the HMGP funding is disaster declaration-dependent, many mitigation projects are identified through the local hazard mitigation plans and may be implemented with available funding as determine by the State. The Administrative Plan provides the process in which to manage post-disaster programs

4.2.3 Hazard Management Capabilities

MEMA has responded to the challenges that Hurricane Katrina brought forth by increasing their hazard management capabilities. For example, MEMA completed construction of a state-of-the-art facility to house their headquarters. This facility provides the resources necessary in preparing and responding to impending disasters. They also recognized the need for additional, trained staff to accomodate the increase in mitigaton projects and developed a website, www.MitigationMS.org, to assist local governments and eligible applicants in completing mitigaton applications online. A complete description of MEMA's and other state agencies capabilities can be reviewed in Section 4.2.1.

4.3: Local Capabilities Assessment

> ***44 CFR 201.4(c)(3)(ii) - The State mitigation strategy shall include the following elements:***
>
> ***A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:***
>
> ***A general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.***

The local capability assessment provides a general description of local mitigation capabilities in Mississippi, including examples of successful policies and programs, and an analysis of the effectiveness of these capabilities based on local evaluations. Local capabilities are the existing programs and policies through which local governments implement mitigation actions to reduce potential disaster losses. The assessment concludes with a discussion of challenges and opportunities to implementing and strengthening local capabilities.

Methodology

The State analyzed the local capabilities identified in FEMA-approved local hazard mitigation plans in Mississippi to provide an updated general description of local mitigation capabilities and to assess the challenges and opportunities to improving local capabilities. Additional information on the effectiveness of local mitigation capabilities and opportunities and challenges for building local capabilities was gathered through a survey distributed at the Mississippi Association of Planning and Development Districts Annual Conference on April 20-23, 2010, the annual conference of the Association of Floodplain Managers of Mississippi, April 28-30, the Mississippi Association of Supervisors annual conference June 14–18, the Mississippi Municipal League June 27–July 1, and the Mississippi Civil Defense Emergency Management Association June 10-11.

Local Policies, Programs, and Capabilities

Planning, building, zoning, floodplain management, and fire codes are functions of local government. State law authorizes local governments to undertake these activities but does not require them to do so. Regulations and their enforcement will vary between communities throughout the state. The effectiveness of local mitigation policies, programs, and capabilities is directly related to the level of adoption and degree of enforcement. The State has encouraged communities to adopt codes and ordinances and has provided Model A and Model B-E ordinances for this purpose. Through mitigation planning, local governments can identify the strengths and weaknesses in their mitigation capabilities and implement strategies to improve these. A general description of the types of local mitigation capabilities in Mississippi follows.

Land Use Planning

Authority: <u>Miss Code 1972</u>, Annotated. 17-1-11 et. seq.

Title 17, Chapter 1 permits municipal and county governments to adopt zoning regulations for the purpose of ensuring the most appropriate use of community lands and to provide for the preparation, adoption, amendment, extension, and carrying out of a comprehensive plan for the purpose of bringing about coordinated physical development in accordance with present and future needs. Chapter 1 also authorizes the establishment of local planning commissions to advise municipal and county governments in matters pertaining to physical planning, subdivision of land, zoning ordinances, building set back lines, and enforcement of regulations. Title 17 further authorizes any two or more counties or municipalities to establish regional planning commissions composed of representatives from the participating counties and municipalities. Regional planning commissions are established for the purpose of advising local governments on problems related to acquisition, planning, construction, development, financing, control, use, improvement, and disposition of buildings and other structures, facilities, goods, and services.

No local land use plans are mandated by state law. State law does specify that the city or county legislative body must legally adopt a comprehensive plan to put it into effect. The state also requires that the zoning be based upon and consistent with the legally adopted plan. If a local government chooses to develop and adopt a comprehensive plan, the law does specify a list of elements that must be included, but no natural hazards element is required.

Building, Fire, and Other Codes

Authority: Miss. Code 1972, Annotated. 19-5-9.

Title 19, Chapter 5 authorizes certain counties to adopt, as minimum standards, building codes published by a nationally recognized code group.

Authority: Miss Code 1972, Annotated. 2 1-19-25.

Under Title 21, Governing authorities of any municipality are authorized to adopt building, plumbing, electrical, gas, sanitary, and other codes to protect the public health, safety, and welfare.

Authority: Miss. Code 1972, Annotated. 21-19-21.

Title 21, Chapter 19 authorizes municipal authorities to pass fire safety regulations relating to structures and buildings used as residences or businesses. Chapter 19 further permits local authorities to inspect all buildings and land and take down, remove, or rehabilitate, at the owner's expense, properties found to be unsafe with respect to fire hazard.

Mississippi does not adopt or enforce a statewide building code for all structures, nor does it mandate a code for residential construction. It is up to local jurisdictions to adopt and enforce building codes.

House Bill 1406, passed in 2006, creates the Mississippi Building Code Council. It also requires five coastal counties, Jackson, Harrison, Hancock, Stone, and Pearl River, and the municipalities located there, to enforce all the wind and flood mitigation requirements prescribed by the 2003 International Residential Code and the 2003 International Building Code. The Mississippi Building Codes Council adopted the 2003 International Building Code and 2003 International Residential Code for the state, but does not require local jurisdictions to adopt building codes, but requires that they use the International Codes if they do adopt codes.

Local Emergency Management

Authority: Miss Code 1972, Annotated. 33-15-17.

Local governments are authorized to establish organizations for emergency management with a director having responsibility for the organization's administration and operation. Local emergency management organizations may be composed of a single county or municipality or two or more counties or municipalities. Local emergency management organizations are further authorized to enter into mutual aid agreements with other public and private agencies in the state.

Authority: Miss. Code 1972, Annotated. 2 1-19-23.

Municipal governments may enter into reciprocal assistance agreements on the assignment of equipment, supplies, and materials in the event of an emergency or disaster.

All 82 counties in Mississippi now have a full or part-time emergency management program as well as a designated emergency management or civil defense director. In addition all 82 counties are in the process of updating their Comprehensive Emergency Management Plan (CEMP) and they will be on file with the Mississippi Emergency Management Agency (MEMA).

Water Management and Flood Control Districts

Authority: Miss. Code 1972, Annotated. 51-29-1 et. Seq.; 51-31-1 Et seq.

Counties may form drainage districts for the purpose of developing, maintaining, and improving drainage systems to prevent flood-related damage.

Authority: Miss. Code 1972, Annotated. 51-35-101 Et seq.

Counties may form flood control districts for the purpose of cooperating with the federal government in the construction, maintenance, and operation of dams, reservoirs, and other flood control projects.

Authority: Miss. Code 1972, Annotated. 51-35-301.

Municipalities of 100,000 or more and urban counties of 100,000 or more and adjacent areas are authorized to establish urban flood and drainage districts.

***Autho*rity: Miss. Code 1972, Annotated. 5 1-8-1 Et seq.**

Chapter 8 authorizes the formation of master water management districts composed of two or more existing drainage or water management districts, parts of existing districts, or territory not included in any district. Formation of a master water management district is contingent on the approval of a certain percentage of landowners within the proposed district. Master water management districts may cooperate with federal agencies in projects designed to prevent flood damage, improve drainage, and foster conservation of water resources.

Flood Insurance

Authority: <u>Miss. Code 1972,</u> Annotated 43-41-11.

The National Flood Insurance Program (NFIP) has identified flood hazards in Mississippi communities. Presently, 79 counties, one water supply district (Pearl River Valley), and 232 municipalities participate in the NFIP, for a total of 312 "communities". Authority was granted at the local level by the state legislature to administer the NFIP using the local government's "police power" to regulate land use.

Tables of Community Mitigation Capability Assessment

Table 4.3.1 in the previously-approved 2007 Mississippi Hazard Mitigation Plan displayed local capabilities related to existing planning and policy mechanisms. The table provided status for each county and city on the following capabilities:

- National Flood Insurance Program (NFIP) participation
- Number of Flood Insurance Policies within NFIP participating jurisdictions
- Community Rating System (CRS) participation
- Comprehensive/master/general plan
- Hazard mitigation plan
- Residential building code
- Commercial building official
- Building Code Effectiveness Grading System (BCEGS) rating for residential buildings
- Building Code Effectiveness Grading System (BCEGS) rating for commercial buildings
- Zoning code
- Subdivision regulations
- Fire code rating

During the 2010 update process, information was collected from 92 approved local hazard mitigation plans and was used to update the table and provide additional information on capabilities. These fields were updated and additional information was collected on CRS participation and rating and building code type. Some local plans did not provide information on each of these capabilities. Table 4.3.1 displays the number of counties and cities that reported whether they had each capability or not, and of those counties and cities, the percent with each capability. The complete updated table is included in Appendix 7.4.3-A.

Table 4.3.1:
Mitigation Capabilities of Counties and Cities Identified in Local Plans

Capability	Counties		Cities	
	Number Reporting	Percent with Capability	Number Reporting	Percent with Capability
Comprehensive Plan	38	46%	107	41%
Building Code	23	28%	93	36%
Building Official	8	10%	27	10%
Zoning Ordinance	13	16%	105	41%
Subdivision Ordinance	20	24%	84	33%
Floodplain Ordinance*	82	96%	232	90%

*Adoption of floodplain ordinance is assumed based on participation in the NFIP, as calculated from the NFIP Community Status Book Report, May 10, 2010.

As shown in Table 4.3.1, a greater percentage of cities have each of the capabilities in place than counties, with the exception of comprehensive plan and floodplain ordinance. Besides comprehensive emergency management plans, floodplain ordinances are the capability, of those tracked, that the highest percentage of counties (96 percent) and cities (90 percent) have in place. In approved local plans that identified whether building codes had been adopted or not, 28 percent of counties and 36 percent of cities had adopted building codes.

All 82 counties have adopted comprehensive emergency management plans and all have FEMA-approved local hazard mitigation plans. There are a total of 92 hazard mitigation plans. By reviewing and incorporating these local hazard mitigation plans with the state plan, a more comprehensive approach to reducing future losses from natural hazards is implemented. All levels of government can effectively prepare for, respond and recover from emergencies and disasters.

Table 4.3.2 shows the changes in local participation in the NFIP, CRS, and BCEGS from 2007 to 2010. The NFIP Participation total has increased by thirty-six communities. BCEGS Rating increased from 37 cities and counties to 44 cities and counties.

Table: 4.3.2
Change in Select Capabilities since the 2007 Plan

Capability	2007	2010
NFIP Participation Total	276	312
NFIP Participation Suspended	4	3
NFIP Not in Program with Hazard Area Identified	33	29
CRS Participation	19, 0 rescinded	24, 0 rescinded
BCEGS Rating	37 cities and counties	44 cities and counties

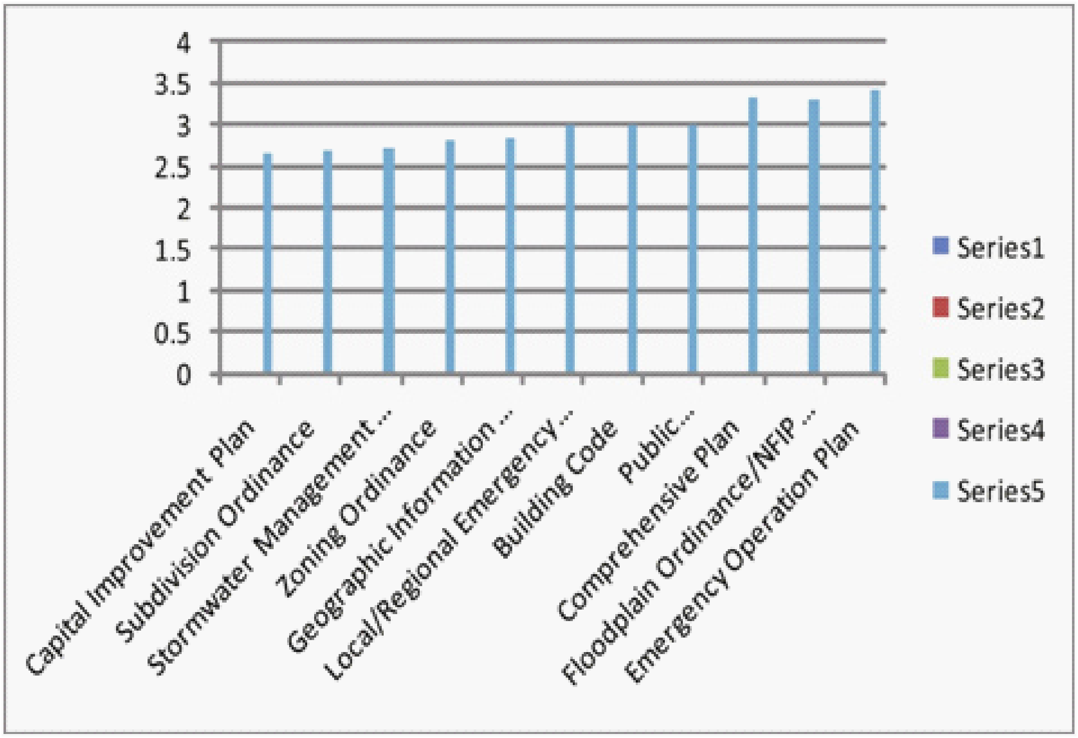
NFIP Community Status Book Report as of May 10, 2010; CRS report current as of October 1, 2009.

Effectiveness of Local Mitigation Capabilities

At the Mississippi Association of Planning and Development Districts Annual Conference, the Mississippi Association of Supervisors annual conference, the Mississippi Municipal League annual conference, the annual Mississippi Civil Defense Emergency Management Association conference, and the annual conference of the Association of Floodplain Managers of Mississippi, MEMA distributed a paper survey. The survey was designed to gather information about opinions on the effectiveness of local mitigation capabilities. Forty-seven completed surveys were evaluated. It is important to note that this data is limited by the small sample size.

The survey asked respondents to give their opinion on the level of effectiveness of different types of local capabilities (e.g., tools, policies, programs) for implementing mitigation actions in their community or region. Respondents ranked local capabilities on a scale from one to four, with one being the least effective and four being the most effective. The capability among those listed, which was ranked as most effective by the highest number of respondents (55 percent) was emergency operations plan. This was followed by floodplain ordinance/NFIP participation (48 percent),comprehensive plan (38 percent), and public information/education programs (32 percent). The capability that the most number of respondents (17 percent) ranked as least effective for mitigation was capital improvement plan. Figure 4.3.1 shows the average ranking of each capability.

Figure 4.3.1:
Average Ranking of Effectiveness of Local Capabilities



Challenges and Opportunities for Improving Local Capabilities

Survey respondents were asked two open-ended questions about 1) the challenges or weaknesses in hazards mitigation capabilities in their region and 2) the opportunities for improvement in local capabilities. The most common response to the question about challenges or weaknesses was communication and education. The lack of building codes and ordinances, availability of funding; and lack of public cooperation were also cited by more than one respondent as challenges. Another challenge or weakness identified was buy-out programs not being desirable due to the fact that land is taken off tax rolls.

Flood prevention plan, community notification, and building code adoption were the improvement opportunities most identified by respondents, followed by more education on plans and anything dealing with emergencies. Another opportunity for improving mitigation capabilities identified by a respondent included having a statewide program where MEMA would issue printed materials for the local communities.

Based upon the survey data and the analysis of local programs, policies, and capabilities from local plans and state resources, the following challenges and opportunities for strengthening local capabilities were identified:

Planning and Development Districts

The use of Planning and Development Districts (PDDs) in Mississippi to facilitate local mitigation planning has been effective; more information is provided in Chapter 5: Local Mitigation Planning Coordination. The PDDs provide important planning and technical resources to local governments. Regional planning efforts also are an opportunity to coordinate land use issues to prevent one jurisdiction from adversely affecting the other and to integrate the mitigation plan with other regional plans. For example, the East Central Planning and Development District maintains the Comprehensive Economic Development Strategy for its nine-county district and incorporates projects identified in the hazard mitigation plan into this strategy, as applicable, as part of its overall planning process. As local governments begin to update their local hazard mitigation plans, the PDDs provide an opportunity for the state to exchange and reinforce information on mitigation capabilities with local governments.

Intergovernmental Assistance and Coordination

Support from the state and the federal government is critical to improving local mitigation capabilities. Training and workshops may be the most important types of assistance the state and federal government can provide, particularly related to planning and program grant applications and in developing effective mitigation projects. When survey respondents identified factors that contributed to the successful implementation of mitigation projects, all responses were related to incentive programs and partnerships with the state and federal government, many associated with Hurricane Katrina recovery.

Coordination with other Planning Efforts

Some local plans describe other planning projects that implement mitigation measures. These include watershed plans and coastal impact assistance plans. Coordination with these other planning efforts can improve local governments' capabilities through accomplishing multiple objectives and leveraging additional funding sources.

Adoption and Enforcement of Codes and Ordinances

Codes and ordinances may be the greatest opportunity and challenge for local governments. With the exception of floodplain ordinances, less than half of approved plans identify the adoption of land use ordinances. Although many plans emphasize the importance of land use planning and regulations for mitigation, many also comment on the unlikelihood of getting them adopted due to the rural nature of their area and the perceived stigma attached to zoning by many rural residents. Several plans describe the difficulty in inspecting buildings and enforcing codes due to lack of staffing and funding capabilities.

An example of an implementation program that has been successful is in Pearl River County, Mississippi. The mitigation plan for Pearl River County discusses the Building Code Implementation Plan developed by the county and the cities of Poplarville and Picayune. They are working toward consolidating building permits and inspections as a mitigation tool to ensure uniform enforcement of standards for construction in flood hazard zones, wind construction standards, and building codes. The three jurisdictions and the Lower Pearl River Valley Foundation contributed funding for a comprehensive and coordinated step-by-step guide to implement the International Building Codes countywide to protect lives and minimize damage to property.

Floodplain Management

There are 29 communities in Mississippi with identified flood hazard areas that do not participate in the NFIP. The state and many local governments recognize floodplain management and the NFIP as highly effective local mitigation capabilities and as primary opportunities to strengthen local capabilities. The state can do this through continuing to enhance its program that provides information and support for new communities to participate in the NFIP and CRS and for existing participants to promote and enforce their floodplain management programs.

Local Funding

Funding for mitigation planning and projects remains one of the greatest challenges for improving local capabilities. Local plans indicate that most local governments use federal funds for mitigation and have met match requirements through in-kind services or their general operating fund. A dedicated tax revenue source for mitigation is difficult to implement as tax increases are unpopular with the public. A tax designated to targeted, tangible benefits, such as funding an emergency manager position and/or an advance warning system, may be more acceptable to the public. The state can improve local success with federal funding programs by efficiently managing the programs and providing assistance to local governments with applications, ideas for meeting match requirements, and continued eligibility.

One approach communities are using to overcome the funding obstacle is improving integration with other local plans and programs, such as capital improvement plans and stormwater management programs, to help achieve mitigation through other community objectives. Improved public education and awareness of hazard vulnerabilities and mitigation options also may help to garner more funding for mitigation through tax dollars and private sources. The best time to implement this approach is often in the window of opportunity after a disaster.

Impact of Hurricane Katrina

Many local plans were written prior to Hurricane Katrina. In fact, several of the plans in the Southern PDD were approved in August of 2005, the same month the hurricane made landfall on the Mississippi coast. Since then, the following changes have been made:

- Intergovernmental agency communication has improved.
- Additional emergency generators to operate critical facilities during and after a disaster.
- Increased emergency sheltering capabilities.
- Redundancy on local communications.
- Hardening of emergency shelters.
- Widening of road systems and development of unincorporated areas to smart codes.
- Hardening infrastructure, sewer systems, etc.
- Adoption of higher standards for reconstruction to create more disaster-resistant structures.

4.4: Mitigation Measures

44 CFR 201.4(c)(3)(iii) – State plans shall include an identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.

The State of Mississippi through the Mississippi Standard Mitigation Plan has identified and prioritized mitigation measures. These measures are grouped by the following types:

- Dam
- Earthquake
- Flood
- Hurricane
- Multi-Hazard
- Tornado
- Wildfire
- Winter Storm

These measures are classified in the following strategies:

- Prevention
- Property Protection
- Public Education and Awareness
- Technical Assistance
- Natural Resource Protection
- Emergency Services
- Structural Projects

After each profile was identified, prioritized and classified, it was evaluated against the goals and objects adopted by the Hazard Mitigation Council as described in Section 4.1. In order to warrant a mitigation action profile, the project had to address one or more of the goals and tie specifically to an objective within the goal. Listed below is a recap of the goals reassessed and adopted by the Hazard Mitigation Council for the 2010 update.

- Goal 1 - Minimize loss of life, injury, and damage to property, the economy, and the environment from natural hazards
- Goal 2 - Build and enhance local mitigation capabilities
- Goal 3 - Improve public education and awareness
- Goal 4 - Sustain and enhance a coordinated state mitigation program

The following Table (4.4.1) gives information about these measures with each measure uniquely identified by the following parameters:

Project Number – Each measure is numbered sequentially within each type.

Type – Each measure is listed by type of hazard with general measures or those addressing more than one hazard listed by type "multi-hazard".

Project Name – Each measure has been given a name that briefly describes the measure.

Agency – A State agency with primary responsibility has been identified even though more than one Federal, State or Local agency may be involved. Each agency identified is a member of the Mississippi Hazard Mitigation Council.

Funding Strategy – A primary funding source has been identified. Additional funding sources may be utilized to supplement the primary funds. Section 4.5 provides information regarding the funding sources including type of assistance and agency/contact in Table 4.5.1. The table has been updated from the 2007 plan to include programs not identified or available in the 2007 plan. These programs include the reference ***"2010 Plan Update"*** in the Program/Activity column.

Completion – The year of completion has been identified. Some measures are completed on an annual basis. In addition, Appendix 7.4.3-C includes a table of mitigation strategies identified in the 2007 plan and the status of each project.

Priority – Each measure has been ranked as high, medium or low priority. The basis of the rankings are identified below:

- High - Activities for which funding sources are readily available or are vital to the state's reconstruction or recovery efforts.
- Medium - Assigned to activities that are identified as long-range in nature or for which funding is not presently available but may be in the relatively near future.
- Low - Assigned to activities for which there is no clear method of funding, or may not ever be funded, and are not critical to the state's reconstruction and recovery efforts.

Table 4.4.1 is not intended to capture all the pertinent data regarding the mitigation action. Project profile/ progress reports are provided in Appendix 7.4.3-A which gives additional data including objectives referenced in Section 4.1. These project profile/progress reports serve as an interactive information sheet to communicate the latest information regarding the mitigation action. Some of the profiles will be added as projects are further defined and refined. Appendix 7.5.3-A and Section 5.3 Funding Priority and Prioritizing Alternatives also describe pritization process for mitigation actions.

In updating the state hazard mitigation plan, a number of mitigation projects identified in the 2007 state plan were either deleted, reclassified, or combined with other projects. The deleted, reclassified, and combined projects with the reasons for the actions are provided in Table 4.4.2 Deleted, Combined, and Reclassified Mitigation Actions.

Table 4.4.1 is also provided in Appendix 7.4.3-B. The mitigation tables and project profiles will be used interchangeably to assist with implementation of the projects. The sorted tables include a summary of each mitigation action. Details are given in the project profiles which includes the goals and objectives of each mitigation profile. MEMA maintains a Mitigation Action Notebook that includes updated information as it is available. This information is being incorporated into each of the 63 project profiles, which are updated with information from MEMA and other lead agencies.

Local Mitigation Actions

The state has developed a database of all mitigation actions identified in FEMA-approved local hazard mitigation plans. Because of the large size of the database, it is not incorporated as part the plan document but is available at MEMA.

The database allows the state to sort local actions by hazards addressed, project type, funding source, cost estimate, and additional variables. It will be used to link state actions to local actions and to help identify new state actions. For instance, the state has an action to promote the National Weather Service's StormReady certification program for local communities. The local actions database can be used to quickly identify which local governments have identified mitigation actions related to the StormReady program.

The state also plans to use this database as part of a more comprehensive system of prioritizing local projects for funding, tracking those projects that have been funded, and monitoring the effectiveness of implemented local projects. As new local hazard mitigation plans are approved, the identified mitigation actions will be added to the database, so that it remains current.

The mitigation actions compiled in this database have been identified and prioritized by local governments based upon their unique processes for determining actions that are technically feasible, cost effective, and environmentally sound. Prior to any funding from state or federal sources, more detailed benefit-cost analysis of actions will occur during the project development and grant application phases. In addition to the review of local mitigation actions, the Mississippi Hazard Mitigation Council used the STAPLE/E(Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to analyze the cost-effectiveness of each project. Mitigation actions were screened for implementation with consideration that they must comply with federal and state requirements. Each project was reviewed to determine if it was environmentally sound, and technically feasible. The updated projects resulted from a number of council meetings. Some projects have been more effective than others. Based upon progress on mitigation actions, updated risk assessment, and review of mitigation priorities, effective mitigatioin actions have been identified. Although there were no new mitigation actions in this 2010 update, a number of mitigation actions were reclassified and combined as reflected in Table 4.4.2. Changes were considered and approved by the Hazard Mitigation Council.

Table 4.4.1
Mississippi Mitigation Actions Sorted By Type

PROJECT NO.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
1	Dam Safety	Prevention	Permitting New Dams and Regulatory Compliance	MDEQ	$40,000	Budget	Annual	H
2	Dam Safety	Outreach and Education	Public Education and Outreach	MDEQ	$60,000	Budget	Annual	H
3	Dam Safety	Prevention	Inundation Maps for High Hazard Dams	MDEQ	$500,000	Private	2012	H
5	Dam Safety	Structural	Repair and Rehab Federally Constructed Dams	MDEQ	$10,000,000	Grants	2017	H
7	Dam Safety	Prevention	Enforce Implementation of 2006 Dam Safety Legislation	MDEQ	$20,000	Budget	Annual	H
9	Dam Safety	Technical Assistance	Information Management for Inundation Area Vulnerabilities	MDEQ	$100,000	HMGP	Annual	H
1	Earthquake	Technical Assistance	Review and Update HAZUS-MH Data Base	MEMA	$70,000	HMGP	2010	H
2	Earthquake	Prevention	HAZUS-MH Project Implementation for Local Initiatives	MEMA	$10,000,000	HMGP	2017	H
3	Earthquake	Technical Assistance	Compile New Soil Evaluations	MDEQ	$40,000	Budget	Annual	M
5	Earthquake	Technical Assistance	HAZUS-MH Update with Pipeline Locations	MEMA	$10,000	Budget	2010	M
6	Earthquake	Outreach and Education	Partnership Programs for Collaborating Programs with other States	MEMA	$10,000	Budget	Annual	H
10	Earthquake	Technical Assistance	Monitor State of Comprehensive Infrastructure Retrofit	MDOT	$10,000	Budget	Annual	H
11	Earthquake	Technical Assistance	Information Management System for Critical Infrastructure	MDEQ	$50,000	HMGP	2010	H
1	Flood	Outreach and Education	Map Modernization: New Firm Adoption by Communities	MEMA	$20,000	CAP	2010	H
4	Flood	Technical Assistance	Community Rating System: Program Implementation	MEMA	$7,000	CAP	Annual	M

PROJECT NO.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
5	Flood	Property Protection	Repetitive Loss Structures: Target Group Mitigation	MEMA	$10,000,000	FMA	2017	M
6	Flood	Technical Assistance	NFIP Implementation: Model Ordinance Adoption	MEMA	$7,000	CAP	Annual	M
7	Flood	Outreach and Education	NFIP Implementation: Floodplain Management Workshops	MEMA	$7,000	CAP	Annual	M
8	Flood	Technical Assistance	NFIP Implementation: Certified Floodplain Manager Accreditation	MEMA	$7,000	CAP	Annual	H
9	Flood	Outreach and Education	NFIP Implementation: State Floodplain Management Association	MEMA	$7,000	CAP	Annual	M
11	Flood	Technical Assistance	NFIP Implementation: Community Assistance Contact and Visit	MEMA	$7,000	CAP	Annual	H
12	Flood	Outreach and Education	NFIP Implementation Education and Outreach	MEMA	$7,000	CAP	Annual	H
13	Flood	Technical Assistance	Assessing Vulnerability by Jurisdiction	MEMA	$100,000	FMA	2010	H
15	Flood	Technical Assistance	Information Management System for Critical Infrastructure	MEMA	$100,000	FMA	2010	H
16	Flood	Structural	Community Assistance for Flood Warning Systems	MEMA	$1,000,000	FMA	2017	H
21	Flood	Property Protection	Continue to Support floodproofing and hardening of water/wastewater systems	MDEQ	$100,000,000	CDBG	2017	H
23	Flood	Technical Assistance	Support updating of stormwater ordinances to address future	MEMA	$7,000	CAP-SSSE	2010	H
24	Flood	Technical Assistance	Support Local Capital Improvement Infrastructure Planning	MDEQ	$7,000	CAP-SSSE	2010	H
26	Flood	Technical Assistance	GIS Inventory of Hazardous Waste/ Materials Storage Facilities	MDEQ	$150,000	HMGP	2010	H
28	Flood	Technical Assistance	Provide HAZUS flood runs to each county	MEMA	$7,000	Budget	2008	H
30	Flood	Technical Assistance	Develop a comprehensive GIS based inventory of levees	MDEQ	$50,000	PDM	2010	H

PROJECT NO.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
31	Flood	Property Protection	Implement Flood Mitigation projects	MEMA	$10,000,000	USACOE	2017	H
2	Hurricane	Outreach and Education	Public Information Forums and Fairs Statewide	MEMA	$7,000	Budget	Annual	H
4	Hurricane	Technical Assistance	Local Review of Building Codes and Flood Protection Ordinances	MEMA	$7,000	Budget	Annual	H
5	Hurricane	Technical Assistance	State Modernization Team Review of Coastal Flooding	MEMA	$50,000	CAP	2010	H
6	Hurricane	Structural	USACOE Mississippi Coastal Improvements Program	MDMR	$160,000,000	USACOE	2017	H
7	Hurricane	Technical Assistance	USACOE Mississippi Coastal Comprehensive Plan	MDMR	$3,000,000	USACOE	2010	H
11	Hurricane	Structural	Implement Regional Utility Systems	MDEQ	$200,000,000	CDBG	2017	H
12	Hurricane	Structural	Support Mitigation with Natural Barriers	MDMR	$100,000,000	USACOE	2017	H
2	Multi-Hazard	Outreach and Education	HMA Grant Application Training	MEMA	$7,000	Budget	Annual	H
4	Multi-Hazard	Outreach and Education	“Storm Ready” Community Education	MEMA	$27,000	Budget	Annual	H
6	Multi-Hazard	Technical Assistance	Develop Local Hazard Mitigation Planning	MEMA	$7,000	HMGP	Annual	H
9	Multi-Hazard	Emergency Services	Provide Auxiliary Power Source for All Critical Facilities	MEMA	$10,000,000	HMGP	2017	H
11	Multi-Hazard	Technical Assistance	Coordinated Emergency Action Plans for Health Care Facilities	MEMA	$10,000	HMGP	Annual	H
13	Multi-Hazard	Natural Resources Protection	Wet Debris Management for Access, Water Quality and Environmental	MDMR	$10,000,000	USACOE	2017	H
15	Multi-Hazard	Technical Assistance	Complete/enhance inventory of state owned/operated facilities	MDFA	$300,000	HMGP	2010	H
18	Multi-Hazard	Emergency Services	Increase Shelter Capacity in each County	MEMA	$1,000,000	HMGP	Annual	H

PROJECT NO.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
20	Multi-Hazard	Technical Assistance	Prepare Information Management System for Plan Updates for 2010	MEMA	$20,000	Budget	Annual	H
21	Multi-Hazard	Emergency Services	Track Project Implementation Progress for Mitigation Actions	MEMA	$20,000	Budget	Annual	H
22	Multi-Hazard	Emergency Services	Develop GIS Database for Archives and History on Cultural Resources	MEMA	$100,000	HMGP	2010	H
25	Multi-Hazard	Structural	Encourage Use of Non-Hazardous Materials in Critical Facilities	MDEQ	$ 7,000	Budget	Annual	H
26	Multi-Hazard	Outreach and Education	Yearly Information Meetings for Medical Community	MSDH	$50,000	Budget	Annual	M
27	Multi-Hazard	Technical Assistance	Sheltering needs assessment	MDHS	$50,000	HMGP	2010	H
29	Multi-Hazard	Prevention	Mitigation Grants to Eligible Applicants for Emergency Warning Systems	MEMA	$196,836	HMGP	2010	H
30	Multi-Hazard	Structural	Individual Assistance for "Safe Room" Program	MEMA	$500,000	HMGP	2017	H
1	Tornado	Technical Assistance	Implement Wind Retrofit Projects	MEMA	$7,000	Budget	Annual	M
7	Tornado	Outreach and Education	Public Outreach and Education for Homebuilders and Developers	MEMA	$7,000	Budget	Annual	H
1	Wildfire	Outreach and Education	Firewise Program Workshops	MFC	$100,000	USFC	Annual	H
2	Wildfire	Technical Assistance	Community Wildfire Protection Plans	MFC	$240,000	USFC	Annual	H
3	Wildfire	Outreach and Education	Train Local VFD's in Firewise	MFC	$100,000	USFC	Annual	H
4	Wildfire	Outreach and Education	Communication and Partnership Initiatives with VFD's	MFC	$100,000	USFC	Annual	H
5	Wildfire	Technical Assistance	Information Management for Areas at Risk Based on County Wildfire Plans	MFC	$100,000	USFC	Annual	H

PROJECT NO.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
2	Winter Storm	Outreach and Education	Public Education and Outreach	MEMA	$7,000	Budget	Annual	H
TOTAL PROJECT COSTS					$628,419,836			

Table 4.4.2 Deleted, Combined, & Reclassified Mitigation Actions

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Pri-ority	Approved Changes by HMC
D-3	Dam Safety	Prevention	Inundation Maps and Emergency Actions Plans for High Hazard Dams	MDEQ	$ 500,000	Private	2012	H	Includes D-4 by Council vote 10-14-08
D-4	Dam Safety	Prevention	Development of Owner Emergency Action Plans						Combined with D-3 by Council vote 10-14-08
D-6	Dam Safety	Structural	Establish Revolving Loan Program to Fund Dam Rehabilitation						Deleted by Council vote 10-14-08
D-7	Dam Safety	Prevention	Implement and enforce significant 2004 and 2005 regulatory revisions to the Dam Safety Program designed to better protect lives and property	MDEQ	$ 80,000	Budget	Annual	H	Includes D-8 by Council vote 10-14-08
D-8	Dam Safety	Outreach and Education	Educate Dam Owners about 2006 Dam Safety Regulation						Combined with D-7 Council vote 10-14-08
E-4	Earth-quake	Outreach and Education	Yearly Information Meet-ings for Medical Commu-nity						Reclassified as MH-26 by Council vote on 10-14-08
E-7	Earth-quake	Technical AssTstance	Information Management System System with Site Specific Information						Deleted by Council 10-14-08
E-8	Earth-quake	Outreach and Education	Partnership Programs for Utilizing CCP Data						Deleted by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Pri-ority	Approved Changes by HMC
E-9	Earthquake	Technical Assistance	Information Management System for Critical Facilities						Reclassified and included in MH-15 by Council 10-14-08
E-12	Earthquake	Technical Assistance	Complete Local Building Vulnerability Analysis						Deleted by Council vote 10-14-08
F-1	Flood	Outreach and Education	Map Modernization Program Implementation	MEMA	$20,000	CAP	2010	H	Includes F-2 and F-3 by Council vote 01-28-09
F-2	Flood	Outreach and Education	Map Modernization: Early FIRM Adoption by Communities						Combined with F-1 by Council vote 01-28-09

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
F-3	Flood	Technical Assistance	Map Modernization: Program Implementa-tion						Combined with F-1 by Council vote 01-28-09
F-5	Flood	Property Protection	Repetitive Loss and Severe Repetitive Loss Property Mitiga-tion	MEMA	$ 10,000,000	FMA	2017	M	Includes F-14, F-19 and F-20 by Council vote 10-14-08
F-6	Flood	Technical Assistance	NFIP Implementation: Model Ordinance Adoption	MEMA	$ 7,000	CAP	Annual	M	Includes F-10 by Council vote 01-28-09
F-10	Flood	Technical Assistance	NFIP Implementation: Higher Regulatory Standard Adoption						Combined with F-6 by Council vote 01-28-09
F-14	Flood	Prevention	Repetitive and Se-vere Repetitive Loss Properties						Combined with F-5 by Council vote 10-14-08
F-17	Flood	Technical Assistance	Support Reconstruc-tion Pilot Program	MEMA	$ 7,000	HMGP	Annual	H	Deleted by Council 05/2010
F-18	Flood	Technical Assistance	Support Global Match Initiative						Deleted by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Priority	Approved Changes by HMC
F-19	Flood	Property Protection	Support Implementation of Local Repetitive and Severe Repetitive Loss Acquiaition Program						Combined with F-5 by Council vote 10-14-08
F-20	Flood	Property Protection	Support Implementation of Local Elevation, and Flood Proofing Programs						Combined with F-5 by Council vote 10-14-08
F-22	Flood	Structural	Support Acquistion of Generators at Existing WWTPs						Deleted by Council vote 01-28-09 (duplication of MH-9)
F-25	Flood	Technical Assistance	Develop a Statewide Floodplain Management Standard						Deleted by Council vote 10-14-08
F-27	Flood	Technical Assistance	Sheltering needs assessment						Reclassified as MH-27 by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Pri-ority	Approved Changes by HMC
F-27	Flood	Technical Assistance	Sheltering Needs Assessment						Reclassified as MH-27 by Council vote 10-14-08
F-29	Flood	Technical Assistance	Use HAZUS/HIRA Flood Data to Update or Confirm top 50 Communities						Deleted by Council 10-14-08
H-1	Hurricane	Structural	Wind Resistant and Flood Resistant Critical Facilities						Reclassified as MH-28 by Council vote 01-28-09
H-2	Hurricane	Outreach and Education	Trophical Weather Outreach and Education	MEMA	$ 14,000	Budget	Annual	H	Includes H-13 by Council vote 01-28-09
H-3	Hurricane	Outreach and Education	Building Product Demonstrations	MEMA	$ 7,000	Budget	Annual	H	Deleted by Council 05/2010
H-8	Hurricane	Property Protection	Develop Acquistion Relocation						Reclassified as F-31 by Council vote 10-14-08
H-9	Hurricane	Technical Assistance	Encourage Local Adoption of Minimum Building Codes						Combined with MH-5 by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
H-10	Hurri-cane	Structural	Encourage Use of Non-Hazardous Materials in Critical Facilities						Reclassified as MH-25 by Council vote 10-14-08
H-13	Hurri-cane	Outreach and Education	Outreach to Local Coastal Officials on Preparedness for HIRA Findings						Combined with H-2 by Council vote 01-28-09
MH-1	Multi-Hazard	Technical Assistance	Inventory of State Buildings, Critical Facilities and Infra-structure						Combined with MH-15 by Council vote 10-14-08
MH-3	Multi-Hazard	Outreach and Education	Mitigation Grant Education	MEMA	$ 7,000	HMTAP	Annual	H	Deleted by Council 05/2010
MH-4	Multi-Hazard	Outreach and Education	“Storm Ready” Com-munity Education and Certification	MEMA	$ 27,000	Budget	Annual	H	Includes MH-16 by Council vote 10-14-08
MH-5	Multi-Hazard	Outreach and Education	Adoption and En-forcement of Building Codes	MEMA	$ 14,000	Budget	2010	H	Includes H-9 by Council vote 10-14-08
MH-7	Multi-Hazard	Outreach and Education	Workshops for Evalu-ating Wind and Flood Damaged Buildings	MEMA	$ 20,000	HMGP	Annual	H	Deleted by Council 05/2010
MH-8	Multi-Hazard	Outreach and Education	Develop, Train and Implement Strate-gies for State Owned Buildings						Combined with MH-15 by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
MH-9	Multi-Hazard	Emergency Services	Provide Mitigation Grants to Eligible Applicants for Auxil-liary Power Sources at Critical Facilities	MEMA	$ 10,000,000	HMGP	2017	H	Includes WS-1 and F-22 by Council vote 01-28-09
MH-10	Multi-Hazard	Technical Assistance	Utilize NEMIS to Up-date Historical Data for Disasters						Deleted by Council vote 10-14-08
MH-12	Multi-Hazard	Technical Assistance	Develop Methodology for Future Develop-ment Trends for Vul-nerability Analysis	MEMA	$ 10,000	Budget	2010	H	Deleted by Council vote 10-14-08
MH-14	Multi-Hazard	Technical Assistance	Debris Management Plans						Deleted by Council vote 10-14-08
MH-15	Multi-Hazard	Technical Assistance	Complete/Enhance Inventory of State Owned/Operated Facilities	MDFA	$ 4,817,886	HMGP	2010	H	Includes E-9, MH-1, MH-8 and MH-19 by Council vote 10-14-08
MH-16	Multi-Hazard	Emergency Services	Promote Storm Ready Certification by NOAA						Combined with MH-4 by Council vote 1-14-08
MH-17	Multi-Hazard	Technical Assistance	Update Statewide Standards for Compre-hensive Planning and Land Use Regulations						Deleted by Council vote 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
MH-18	Multi-Hazard	Emergency Services	Mitigation Grants to Eligible Applicants for FEMA 320 and FEMA 361 Shelters	MEMA	$ 1,000,000	HMGP	Annual	H	Includes T-2 by Council vote on 01-28-09
MH-19	Multi-Hazard	Technical Assistance	Compile Additional Data Regarding State Owned Critical Infra-structure						Combined with MH-15 by Coun-cil vote 10-14-08
MH-21	Multi-Hazard	Prevention/ Property Protection	Hazard Mitigation Council Progress/ Evaluation of Mitigation Actions	MEMA	$ 49,976	Budget	Annual	H	Includes MH-24 by Council vote 10-14-08
MH-23	Multi-Hazard	Emergency Services	Statewide Interoper-able Communication System						Not accepted by FEMA as a miti-gation project
MH-24	Multi-Hazard	Prevention/ Property Protection	Progress/Evaluation of Mitigation Actions						Combined with MH-21 by Coun-cil vote 10-14-08
MH-25	Multi-Hazard	Structural	Encourage Use of Non-Hazardous Materials in Critical Facilities	MDEQ	$ 7,000	Budget	Annual	H	Reclassified from H-10 by Council vote 10-14-08
MH-26	Multi-Hazard	Outreach and Educa-tion	Yearly Information Meetings for Medical Medical Community	MSDH	$ 50,000	Budget	Annual	M	Reclassified from E-4 by Council vote 120-14-08
MH-27	Multi-Hazard	Technical Assistance	Sheltering Needs As-sessment	MDHS	$ 50,000	HMGP	2010		Reclassified from F-27 by Council vote 0n 10-14-08

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
MH-28	Multi-Hazard	Structural	Wind Resistant and Flood Resistant Critical Facilities	MEMA	$ 10,000,000	HMGP	2017	H	Reclassified from H-1 by Council vote 01-28-09
MH-29	Multi-Hazard	Prevention	Mitigation Grants to Eligible Applicants for Emergency Warning Systems	MEMA	$ 196,836	HMGP	2010	H	Reclassified from T-3 and includes T-4 by Council vote on 01-28-09
MH-30	Multi-Hazard	Structural	Individual Assistance for "Safe Room" Program	MEMA	$ 500,000	HMGP	2017	H	Reclassified from T-8 by Council vote on 01-28-09
T-2	Tornado	Structural	Public Access to Community Storm Shelters						Combined with MH-18 by Council vote 01-28-09
T-3	Tornado	Prevention	Warning System on College Campuses						Reclassified as MH-29 and includes T-4 by Council vote 01-28-09
T-4	Tornado	Prevention	Warning System for Communities						Combined with T-3 as MH-29 by Council vote 01-28-09

Project No.	Type	Strategy	Project Name	Agency	Project Cost	Funding Strategy	Completion	Prior-ity	Approved Changes by HMC
T-5	Tornado	Outreach and Education	Tornado Public Education and Outreach	MEMA	$ 7,000	Budget	Annual	H	Deleted by Council vote 10-14-08
T-6	Tornado	Prevention	Partnership Programs for Purchasing Weather Radios for Individuals	MEMA	$ 500,000	HMGP	2017	H	Deleted by Council 05/2008
T-8	Tornado	Structural	Individual Assis-tance for "Safe Room" Program						Reclassified as MH-30 by Council vote 01-28-09
WS-1	Winter Storm	Structural	Placement of Auxilliary Power Sources at Criti-cal Facilities						Combined with MH-9 by Council vote 01-28-09

4.5: Funding Sources

> ***44 CFR 201.4(c)(3)(iv) - The State mitigation strategy shall include the following elements:***
>
> ***A mitigation strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include:***
>
> ***Identification of current and potential sources of Federal, State, local or private funding to implement mitigation activities.***

The State of Mississippi has received $434 million in Hazard Mitigation Grant Program (HMGP) funds and $4 billion in Community Development Block Grant (CDBG) funds from Congress in a separate appropriation. The CDBG funds are being used to help affected families rebuild homes that were damaged or destroyed as a result of Hurricane Katrina. In addition, the Mississippi Alternative Housing Program is the result of the efforts of the State. This program provides selected eligible applicants with housing for up to two years at no cost.

Statewide Initiatives generated by Hurricane Katrina

The following statewide initiatives were funded through HMGP funds:

- The Statewide Generator Initiative - provides funding for generators for critical facilities.
- The Statewide College/University and Municipality Siren Initiative - provides funding for warning systems on junior and senior colleges as well as funding for counties and cities.
- The Statewide Saferoom/Storm Shelter Initiative - provides funding for individual and community storm shelters so that during a tornado or severe thunderstorm, the citizens of Mississippi have a safe place to go.

Since the previous plan (August, 2004) was approved, the State under MEMA's guidance, has funded in addition to the statewide initiatives, the following projects:

- Acquisition Projects
- Drainage Projects
- Planning Grants
- Retrofits and Codes

- Standards Projects

Under the Flood Mitigation Assistance, the State has providing funding for the following:

- Acquisition Projects
- Planning Grants.

MEMA has also provided funding for Mitigation.MS.org, a web-based program that allows eligible applicants to submit project applications online.

The State Hazard Mitigation Plan Update/Upgrade is being funded under the Pre-Disaster Mitigation Program.

As can be seen from a review of the successful mitigation projects in Mississippi, it is very typical to leverage projects with multiple sources of funding. Table 4.5.1 provides a matrix that addresses the current and potential sources of funding for federal/state/local hazard mitigation programs, activities, and initiatives. The matrix identifies the program activity, type of assistance, and the responsible agency and point of contact.

The following "Programs/Activities" are addressed in the matrix on the following pages:

- General Emergency grants, loans, and assistance;
- Floods/Flood Control grants, loans, and assistance;
- Earthquake grants, loans, and assistance;
- All-Hazard Mapping grants, loans, and assistance;
- Ancillary Flood & Natural Resource Projects grants, loans, and assistance;
- Basic and Applied Research/Development grants, loans, and assistance;
- Other Planning Information, including Demographics, Societal Data, Transportation, Agricultural, Industrial, and Other Commercial Economic Statistics;
- Business Continuity Planning;
- Grants, loans, and technical assistance in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) Facilities and equipment needs in primarily low income rural areas.

This table has been updated from the 2004 plan to include programs/activities that were not defined or available and are designated with the notation of ***"2007 Plan Update".***

Table 4.5.1
Funding Sources

Program / Activity	Type of Assistance	Agency & Contact
General Emergency Grants, Loans & Assistance	**Pre/Post Disaster Mitigation, Relief, Recovery, Training, & Technical Assistance**	
Hazard Mitigation Grant Program	Provides grants to states and communities for the implementation of long-term hazard mitigation measures following a major disaster declaration.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Disaster Mitigation Planning and Technical Assistance	Provides technical and planning assistance for capacity building and mitigation project activities focusing on creating disaster resistant jobs and workplaces	Department of Commerce (DOC), Economic Development Administration (EDA) www.doc.gov/eda N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Pre-Disaster Mitigation	Provides funding and technical assistance to communities and states to implement pre-disaster mitigation projects and planning.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
Emergency Management I Mitigation Training	Offers training in disaster mitigation, preparedness, planning.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Post -Disaster Economic Recovery Grants and Assistance	Provides grant funding to assist in the long-term economic recovery of communities, industries, and firms adversely impacted by disasters.	Department of Commerce (DOC), Economic Development Administration (EDA) N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426 www.doc.gov/eda
Economic Development Program ***"2007 Plan Update"***	Provides grants to communities and counties affected by Hurricane Katrina and located in the Go Zone for the purpose of providing infrastructure to support economic development.	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Community Revitalization Program ***"2007 Plan Update"***	Provides grants to local governments located in Pearl River, Stone, George, Hancock, Harrison, and Jackson counties for the purpose of rebuilding their downtown areas that were damaged or destroyed by Hurricane Katrina	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Community Revitalization Program Go Zone ***"2007 Plan Update"***	Provides grants to local governments located in Go Zone that were negatively impacted by Hurricane Katrina for the purpose of rebuilding their downtown areas that were damaged or destroyed by Hurricane Katrina	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179

Program / Activity	Type of Assistance	Agency & Contact
Planning Program ***"2007 Plan Update"***	Provides grants to local governments located in Pearl River, Stone, George, Hancock, Harrison, and Jackson counties for the purpose of assisting in preparing community plans.	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Building Inspection Grant Program ***"2007 Plan Update"***	Provides grants to local governments in the Gulf Region counties (listed above) to improve public structural inspection services.	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Gulf Coast Regional Water and Wastewater Program ***"2007 Plan Update"***	Identifies water, wastewater, and storm water infrastructure needed in the Gulf Region counties (listed above) and makes improvements for long-term recovery.	Mississippi Department of Environmental Quality Tel: (601) 961-5171
Homeowner Assistance Program (Phases I and II) ***"2007 Plan Update"***	Provides funds to homeowners who received structural and storm surge damage to primary residence from Hurricane Katrina	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Public Housing Program ***"2007 Plan Update"***	Assists the five coastal housing authorities with rebuilding or repairing public housing damaged by Hurricane Katrina	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Ratepayer and Wind Pool Mitigation Program ***"2007 Plan Update"***	Helps utility and gas companies defray excessive costs as a result of damaged infrastructure and emergency response services	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179
Small Rental Program ***"2007 Plan Update"***	Provides loans to owners of small rental properties on coast to assure affordable rental housing is provided	Mississippi Development Authority Katrina Supplemental CDBG Program Tel: (601) 359-3179

Program / Activity	Type of Assistance	Agency & Contact
Disaster Unemployment Assistance ***"2007 Plan Update"***	Issues disaster unemployment assistance for self-employed and newly employed who are ineligible for unemployment insurance	Department of Labor (866) 487-2365 Mississippi Department of Employment Security (888) 844-3577 http://mdes.ms.gov/wps/portal/#null
Temporary Housing Program ***"2007 Plan Update"***	Provides temporary housing for storm victims	FEMA (800) 621-3362 www.fema.gov
Small Business Disaster Bridge Loan Program ***"2007 Plan Update"***	Provides loans to qualifying businesses that experienced physical damage as a result of Hurricane Katrina.	Mississippi Development Authority Tel: (601) 359-3179
Rural Business Enterprise Grants (RBEG) ***"2007 Plan Update"***	Creates jobs and stimulate rural economics by providing real estate improvements, equipment, and working capital.	U.S. Department of Agriculture (USDA) State Office (601) 965-4316
Economic Development Initiative (EDI) Program ***"2007 Plan Update"***	Provides grants to communities and counties for the purpose of providing infrastructure to support economic development.	HUD National Office Community Planning and Development, Office of Economic Development (800) 998-9999
Brownfields Economic Development Initiative (BEDI) Program ***"2007 Plan Update"***	Assists local governments with the redevelopment of abandoned, idled, and underused industrial / commercial facilities where expansion and redevelopment is burdened by real or potential environmental contamination	HUD National Office Community Planning and Development, Office of Economic Development (800) 998-9999
Rural Business Opportunity Grants (RBOG) ***"2007 Plan Update"***	Provides technical assistance, business development, and planning in rural communities with exceptional need	U.S. Department of Agriculture (USDA) State Office (601) 965-4316

Program / Activity	Type of Assistance	Agency & Contact
Rural Impact Fund Grant Program ***"2007 Plan Update"***	Provides grants to construct or improve public infrastructure to promote job creation in rural areas	Mississippi Development Authority Tel: (601) 359-3179
Small Municipalities and Limited Population Counties Grant Program ***"2007 Plan Update"***	Provides grants to promote economic growth by improving public infrastructure.	Mississippi Development Authority Tel: (601) 359-3179
Development Infrastructure Program (DIP) ***"2007 Plan Update"***	Provides grants to construct or improve public infrastructure to promote job creation in rural areas	Mississippi Development Authority Tel: (601) 359-3179
Water Resources, Flood Control, Pollution Abatement, and Soil Conservation Programs ***"2007 Plan Update"***	Acts as local sponsor for member counties on federal projects and programs associated with water resources, flood control, pollution abatement, and soil conservation. Provides limited financial assistance on such projects.	Pearl River Basin Development District (601) 354-6301
Capital Improvements Revolving Loan (CAP) Program ***"2007 Plan Update"***	Makes loans to counties or municipalities to construct or improve public infrastructure.	Mississippi Development Authority Tel: (601) 359-3179
Mississippi Economic Redevelopment Program ***"2007 Plan Update"***	Provides funding to counties or municipalities to remediate and develop an environmentally contaminated site	Mississippi Development Authority Tel: (601) 359-3179
Delta Regional Authority Grant Program ***"2007 Plan Update"***	Helps economically distressed communities in the DRA area to leverage other funds focused on improving infrastructure, transportation, and business development.	Mississippi Development Authority Office of Strategic Initiatives (601) 359-6656
Appalachian Regional Commission ***"2007 Plan Update"***	Provides matching funds for communities in the ARC area for making infrastructure improvements to encourage economic development and a higher quality of life.	Mississippi Development Authority Appalachian Regional Office (662) 842-5413

Program / Activity	Type of Assistance	Agency & Contact
Community Disaster Loan Program ***"2007 Plan Update"***	Provides funds to communities in an designated disaster area that has suffered a substantial loss of tax and other revenue	FEMA (800) 621-3362 www.fema.gov
Fire Management Assistance Grant Program ***"2007 Plan Update"***	Provides assistance for mitigation, management, and control of fires which threaten such destruction as would constitute a major disaster.	FEMA (800) 621-3362 www.fema.gov
Reimbursement for Firefighting on Federal Property ***"2007 Plan Update"***	Provides reimbursement to states and localities only for direct costs and losses over and above normal operating costs.	FEMA (800) 621-3362 www.fema.gov
Dry Fire Hydrant Program ***"2007 Plan Update"***	Assists communities within the district through funding assistance to increase rural fire protection where by dry fire hydrants are constructed at known water sources to fill up the equipment tanks of a rural fire department.	Pat Harrison Waterway District (601) 264-5951
Repetitive Flood Claims Program ***"2007 Plan Update"***	Provides funding to states and communities to reduce or eliminate long-term risk of flood damage to structures insured under the NFIP	FEMA (800) 621-3362 www.fema.gov
Mosquito Control Grant Program ***"2007 Plan Update"***	Provides funding to counties and communities in the Go Zone for the start-up or enhancement of an existing mosquito control program.	Mississippi Department of Health Office of Epidemiology (601) 576-7725
Transportation Enhancement Program ***"2007 Plan Update"***	Provides funding for various activities that enhance existing or historic transportation facilities including environmental mitigation of run-off pollution	Mississippi Department of Transportation Office of Intermodal Planning (601) 359-7025
Public Library Capital Improvement Subgrant Program ***"2007 Plan Update"***	Provide grants to public libraries for capital improvements, renovation and/or repair of existing facilities	Mississippi Library Commission (800) 647-7542

Program / Activity	Type of Assistance	Agency & Contact
Physical Disaster Loans and Economic Injury Disaster Loans	Provides disaster loans to non-farm, private sector owners of disaster-damaged property for uninsured losses. Loans can be increased by up to 20 percent for mitigation purposes.	(FEMA registration required prior to contacting SBA) FEMA (800) 621-3362 www.fema.gov Small Business Administration (SBA), National Headquarters Associate Administrator for Disaster Assistance: (202) 205-6734
Public Assistance Program (Infrastructure)	Provides grants to states and communities to repair damaged infrastructure and public facilities and to help restore government or government-related services. Mitigation funding is available for work related to damaged components of the eligible building or structure.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Community Development Block Grant (CDBG) Program State-Administered Public Infrastructure Grants	Public Facilities: Provides grants to counties and municipalities to improve infrastructure to eliminate an existing health threat to residents, primarily of low- and moderate-income households. (includes water and sewer facilities, flood and drainage facilities, fire protection, roads and bridges. Economic Development:. Provides grants to counties and municipalities to provide infrastructure on behalf of a business/industry that commits to job creation or job retention.	Mississippi Development Authority CDBG Program Community Services Division Tel: (601) 359-3179

Program / Activity	Type of Assistance	Agency & Contact
Community Development Block Grant (CDBG) Program Entitlement Communities Program	Provides grants to entitled cities to improve public infrastructure, primarily benefiting low- and moderate-income persons. Entitlement Communities include Jackson, Hattiesburg, Pascagoula, Moss Point, Biloxi, and Gulfport.	US Department of Housing and Urban Development (HUD) Entitlement Communities Division Office of Block Grant Assistance (202) 708-1577 State Field Office Community Planning and Development (601) 965-4700, ext 3140
Disaster Recovery Initiative	Provides grants to fund gaps in available recovery assistance after disasters (including mitigation).	HUD State Field Office Community Planning and Development (601) 965-4700, ext 3140 HUD National Office Community Planning and Development, Office of Block Grant Assistance (202) 708-3587, ext 4538 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Public Housing Modemization Reserve for Disasters and Emergencies	Provides funding to Public Housing Agencies for development, financing, and modemization needs resulting from natural disasters (including elevation, flood proofing, and retrofit).	HUD Director, Office of Capital Improvements: (202) 708-1640 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
Indian Housing Assistance (Housing Improvement Program)	Provides grants and technical assistance to substantially eliminate sub-standard Indian housing.	Department of Interior (DOI)-Bureau of Indian Affairs (BIA) Division of Housing Assistance, Office of Tribal Services: (202) 208-3100
Section 504 Loans for Housing	Offers repair loans, grants and technical assistance to very low-income senior homeowners living in rural areas to repair their homes and remove health and safety hazards.	US Department of Agriculture (USDA) - Rural Housing Service (RHS) State RHS Field Office (601) 965-4325 (800) 548-0071 or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Section 502 Loan and Guaranteed Loan Program	Provides loans, loan guarantees, and technical assistance to very low and low-income applicants to purchase, build, or rehabilitate a home in a rural area	USDA - RHS State RHS Field Office (601) 965-4325 (800) 548-0071 or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Farm Ownership Loans	Provides direct loans, guaranteed/insured loans, and technical assistance to farmers so that they may develop, construct, improve, or repair farm homes, farms, and service buildings, and to make other needed improvements	USDA-Farm Service Agency (FSA) FSA State Field Office (601) 965-4300 or FSA National Office (601) 720-3865

Program / Activity	Type of Assistance	Agency & Contact
HOME Investments Partnerships Program	Provides grant funding to States, local governments and consortia for permanent and transitional housing (including support for property acquisition and rehabilitation) for low-income persons.	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342 Mississippi Development Authority Community Services Division Tel: (601) 359-3179
Self-Help Homeownership Opportunity Program (SHOP) ***"2007 Plan Update"***	Provides grants to non-profit organizations to purchase home sites and improve infrastructure needed for volunteer-based homeownership programs for low-income families	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342
Homeownership Zone (HOZ) Program ***"2007 Plan Update"***	Provides grants to communities to reclaim vacant and blighted properties, to increase homeownership and to promote economic revitalization	HUD Community Planning and Development Office of Affordable Housing (877) 833-2483 (800) 225-5342
Rural Development Assistance - Housing	Provides grants, loans, and technical assistance in addressing rehabilitation, health and safety needs in primarily low-income rural areas. Declaration of major disaster necessary.	USDA - RHS State RHS Field Office (601) 965-4325 (800) 548-0071 or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Rural Development Assistance -- Utilities	Provide direct and guaranteed rural economic loans and business-enterprise grants to address utility issues and development needs	USDA-Rural Utilities Service (RUS) Program Support National Headquarters (202) 720-9540 State Rural Development Office (601) 965-5460

Program / Activity	Type of Assistance	Agency & Contact
Rural Development Assistance – Community Facilities Loans and Grants Program	Provides grants and loans in addressing rehabilitation, health, safety, and emergency (fire, ambulance, sirens, etc.) facilities and equipment needs in rural communities and primarily in low income areas	USDA - RHS State RHS Field Office (601) 965-4325 (800) 548-0071 or National RHS Headquarters Housing and Community Facilities Programs (202) 720-4323
Rural Community Fire Protection	Provides grants for rural fire projects, truck acquisition, or other assistance.	Mississippi State Fire Marshal (601) 359-3569 (888) 648-0877
Section 108 Loan Guarantee Program	Provides loan guarantees to public entities for community and economic development (including mitigation measures).	HUD State Field Office Community Planning and Development (601) 965-4757 HUD National Headquarters Section 108 Office (202) 708-1871
Floods/Flood Control Grants, Loans & Assistance	**Floods/Flood Control Technical/Planning Assistance and Program Support.**	
National Flood Insurance Program	Makes available flood insurance to residents of communities that adopt and enforce minimum floodplain management requirements.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
Flood Mitigation Assistance	Provides grants to States and communities for pre-disaster mitigation to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program. Requires flood mitigation plan to be developed by the applicant.	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Flood Control Planning Assistance	Provides technical and planning assistance for the preparation of comprehensive plans for the development, utilization, and conservation of water and related land resources.	Department of Defense (DOD) US Army Corps of Engineers (USACE) Floodplain Management Staff of Appropriate Regional Office: N. MS - Memphis District: (901) 544-3401 C. MS- Vicksburg District (601) 631-5126 S. MS - Mobile District: (334) 690-2495
Non-Structural Alternatives to Structural Rehabilitation of Damaged Flood Control Works	Provides direct planning and construction grants for non-structural alternatives to the structural rehabilitation of flood control works damaged in floods or coastal storms. $9 million FY99	DOD-USACE Emergency Management Staff of Appropriate Regional Office N. MS - Memphis District: (901) 544-3401 C. MS- Vicksburg District (601) 631-5126 S. MS - Mobile District: (334) 690-2495

Program / Activity	Type of Assistance	Agency & Contact
Floodplain Management Services	Provides technical and planning assistance at the local, regional, or national level needed to support effective floodplain management.	Department of Defense (DOD) US Army Corps of Engineers (USACE) Floodplain Management Staff of Appropriate Regional Office: N. MS - Memphis District: (901) 544-3401 C. MS- Vicksburg District (601) 631-5126 S. MS - Mobile District: (334) 690-2495 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Works Projects Grants Flood Control and Water Management	Assists communities within the district to eliminate long and short-term flooding and drainage problems.	Pat Harrison Waterway District (601) 264-5951
Land Protection	Provides technical assistance for run-off retardation and soil erosion prevention to reduce hazards to life and property.	USDA-Natural Resources Conservation Service (NRCS) Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 965-5196

Program / Activity	Type of Assistance	Agency & Contact
Dam Safety Programs	Provides technical assistance, training, and grants to help improve State dam safety programs.	FEMA Region IV NFIP & Mitigation (770) 220-5200 Mississippi Department of Environmental Quality (MDEQ) Dam Safety Tel: (601) 961-5642 Fax: (601) 354-6938 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Earthquake Grants, Loans & Assistance	**Earthquake Mitigation, Relief, Recovery, Technical/Planning/ Training Grant/Loan Assistance and Program Support.**	
National Earthquake Hazard Reduction Program	Provides technical and planning assistance for activities associated with earthquake hazards mitigation	FEMA, Dept. of the Interior (DOI), U. S. Geological Survey (USGS), National Institute of Standards and Technology FEMA Region IV NFIP & Mitigation Earthquake Program Manager (770) 220-5426 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
Geological Survey Program	Acquires, maintains and manages basic geological data; identifies and evaluates geological hazards. The Geological Survey Program assists citizens, industry, and government in the wise use of the state's minerals, land, and water resources.	Mississippi Department of Environmental Quality Office of Geology (601) 961-5500
Other Earthquake Hazards Reduction Programs	Provides training, planning and technical assistance under grants to States or local jurisdictions.	FEMA Region IV NFIP & Mitigation Earthquake Program Manager (770) 220-5426 DOI-USGS Earthquake Program Coordinator (888) 275-8747 Central U.S. Earthquake Consortium (901) 544-3570 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
All-Hazard Mapping Grants, Loans & Assistance & Technical Assistance	**All-Hazard Analysis & Mapping of Flood Plains, Watersheds, Earthquake Areas, At-Risk Populations.**	
National Flood Insurance Program: Flood Mapping;	Offers flood insurance rate maps and flood plain management maps for all NFIP communities;	FEMA Region IV NFIP & Mitigation (770) 220-5200 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org

Program / Activity	Type of Assistance	Agency & Contact
National Flood Insurance Program: Technical Mapping Advisory Council	Offers technical guidance and advice to coordinate FEMA map modernization efforts for the National Flood Insurance Program.	DOI-USGS National Mapping Division (573) 308-3802 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Mississippi Digital Earth Model	Develops topographic quadrangles for use in mapping of flood and other hazards.	DOI-USGS National Mapping Division (573) 308-3802 MDEQ Office of Geology and Geospatial Resources Division Remote Sensing and GIS. (601) 961-5506 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Stream Gaging and Flood Forecasting Network	Operates a network of over 7,000 stream gaging stations that provide data on river flood characteristics and issues flood warnings and river forecasts to reduce flood damages.	USGS / National Weather Service USGS National Office of Surface Water (703) 648-5977 USGS State Office (601) 933-2900 National Weather Service Office of Hydrology (301) 713-0006

Program / Activity	Type of Assistance	Agency & Contact
Mapping Standards Support	Provides expertise in mapping and digital data standards to support the National Flood Insurance Program.	DOI-USGS USGS National Mapping Division (573) 308-3802 MDEQ Office of Geology Geospatial Resources Division (601) 961-5506
National Earthquake Hazards Reduction Program	Provides seismic mapping for U.S.	DOI-USGS Earthquake Program Coordinator (703) 648-6785 FEMA, Region IV Mitigation Division Earthquake Program Manager (770) 220-5426 MEMA Office of Mitigation Tel: (601) 933-6362 Fax: (601) 933-6815 www.msema.org
Ancillary Flood & Natural Resource Projects Grants, Loans & Assistance	**Watershed Management, Clean Water, Conservation, Environmental, Forestry, Grant/Loan Assistance, Technical Aid, and Program Support**	
Natural Resources Financial Assistance	Assist communities with funding for projects that protect the natural environment.	MDEQ Tel: (601) 961-5158

Program / Activity	Type of Assistance	Agency & Contact
Environmental Quality Incentives Program (EQIP)	Provides technical, educational, and loan and grant assistance to encourage environmental enhancement. Air Pollution Control Environmental Services Hazardous Substance Emergency Relief Hazardous Waste Brownfields Pilot Projects, Fees and Taxes, Leaking Underground Storage Tank Cleanup, Natural Resources Damage Assessments, Petroleum Storage Tank Cleanup, Voluntary Cleanup Program Financial Incentives Solid Waste Management Technical Assistance Water Pollution Control State Construction Wastewater Grant Program State Revolving Loan Fund (SRF)	NRCS EQIP Program Manager (202) 720-8851 www.nrcs.usda.gov NRCS State Office (601) 965-5196 or NRCS County Offices Mississippi Department of Environmental Quality (601) 961-5171
Clean Water Act Section 319 Grants	Provides grants to states to implement non-point source programs, including support for non-structural watershed resource restoration activities	US Environmental Protection Agency (EPA) Office of Water Chief, Non-Point Source Control Branch (202) 566-1155 Mississippi Department of Environmental Quality (601) 961-5171

Program / Activity	Type of Assistance	Agency & Contact
Clean Water State Revolving Funds	Provides loans at actual or below-market interest rates to help build, repair, relocate, or replace wastewater treatment plants.	EPA Office of Water State Revolving Fund Branch (202) 260-7359 A list of Regional Offices is available upon request
Wetlands Protection - Development Grants	Provides grants to support the development and enhancement of State and tribal wetlands protection programs.	EPA National Wetlands Hotline (800) 832-7828 or EPA Region IV Chief, Wetlands Section (404) 562-9900 Mississippi Department of Environmental Quality. (601) 961-5171
Watershed Protection, Flood Prevention, and Soil and Water Conservation Program	Provides technical and financial assistance for installing works of improvement to protect, develop, and utilize land or water resources in watersheds under 250,000 acres.	US Department of Agriculture (USDA) - National Resources Conservation Service (NRCS) Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851
Watershed Surveys and Planning Small Watershed Protection Act (PL 566)	Provides surveys and planning studies for appraising water and related resources, and formulating alternative plans for conservation use and development. Provides grants and advisory counseling services to assist with planning and implementing improvement.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 965-5196
Emergency Watershed Protection Program	Provides technical and financial assistance for relief from imminent hazards in small watersheds, and to reduce vulnerability of life and property in small watershed areas damaged by natural hazard events.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 965-5196

Program / Activity	Type of Assistance	Agency & Contact
Wetlands Reserve Program	Provides financial and technical assistance to protect and restore wetlands through easements and restoration agreements.	USDA-NRCS Conservation Planning and Technical Assistance Division National NRCS Office (202) 720-8851 State NRCS Conservationist (601) 965-5196
Project Modifications for Improvement of the Environment	Provides for ecosystem restoration by modifying structures and/or operations or water resources projects constructed by the USACE, or restoring areas where a USACE project contributed to the degradation of an area	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (212) 264-7813
Aquatic Ecosystem Management and Restoration	Provides direct support for carrying out aquatic ecosystem restoration projects that will improve the quality of the environment.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) (212) 264-7813
Beneficial Uses of Dredged Materials	Provides direct assistance for projects that protect, restore, and create aquatic and ecologically-related habitats, including wetlands, in connection with dredging an authorized Federal navigation project.	DOD-USACE Chief of Planning @ appropriate USACE Regional Office (U.S. Army Corps of Engineers) (212) 264-7813
National Cooperative Soil Survey	Maintains soil surveys of counties or other areas to assist with farming, conservation, mitigation or related purposes.	USDA-NRCS Soil Survey Division (202) 720-4593
Land Acquisition	Acquires or purchases easements on high-quality lands and waters for inclusion into the National Wildlife Refuge System.	DOI-Fish and Wildlife Service (FWS) Southeast Region Division of Realty (404) 679-7199

Program / Activity	Type of Assistance	Agency & Contact
Transfers of Inventory Farm Properties to Federal and State Agencies for Conservation Purposes	Transfers title of certain inventory farm properties owned by FSA to Federal and State agencies for conservation purposes (including the restoration of wetlands and floodplain areas to reduce future flood potential)	US Dept. of Agriculture (USDA) - Farm Service Agency (FSA) Farm Loan Programs National Office (202) 720-3467 State Field Office (601) 965-4300
Federal Land Transfer / Federal Land to Parks Program	Identifies, assesses, and transfers available Federal real property for acquisition for State and local parks and recreation, such as open space.	DOI-National Parks Service (NPS) Federal Lands to Parks Office Southeast Region (404) 562-3175 Federal Lands to Parks Leader NPS National Office: (202) 354-6915
Partners for Fish and Wildlife	Provides financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats.	DOI - FWS Southeast Region Ecological Services (404) 679-7138 State Field Office (601) 965-4900
Forest Tree Seedlings	Produces and distributes quality seedlings to assure forest regeneration and to sustain Mississippi's forest resources.	Regeneration Forester Mississippi Forestry Commission (601) 359-2825
Mississippi Reforestation Tax Credit	Promotes reforestation on private, non-industrial lands. A Mississippi Tax Credit on up to 50% of the cost of approved hardwood and pine reforestation practices.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us
Forest Health	Assists timber owners in forest pest management by conducting forest pest surveys and evaluation. Recommendations on practices to salvage lumber, reduce and prevent damage from pests, will be provided to landowners upon request.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us

Program / Activity	Type of Assistance	Agency & Contact
Forest Land Enhancement Program	Promotes long-term sustainability of private, non-industrial forestlands. Cost-share assistance is available.	Contact your County Forester
Landowner Services	Offers a variety of forest management services to private non-industrial owners of relatively small acreages. Most technical assistance and forestry advice is free to the landowner. Direct services, such as plowing fire lanes, tree planting, and timber-marking are available for a fee.	Contact your County Forester
Forest Resource Development Program	Provides financial assistance to eligible landowners for establishing and improving a crop of trees. This program helps offset a landowner's expense by sharing the cost implementing one or more forestry practices.	Mississippi Forestry Commission Tel: (601) 359-1386 Fax: (601) 359-1349 www.mfc.state.ms.us/landownerassistance
Conservation Contracts	Assists debt reduction for delinquent and non-delinquent borrowers in exchange for conservation contracts placed on environmentally sensitive real property that secures FSA loans.	USDA-FSA Farm Loan Programs FSA National Office: (202) 720-3467 FSA State Office (601) 965-4300
Historic Preservation Fund Grants	Provides grants to assist communities in carrying out historic preservation activities.	DOI-National Park Service Mississippi Department of Archives and History (601) 576-6940
The Foundation Directory	Provides annual source of information about grants & loans from federal and private sources. Available for a fee.	The Foundation Center (800) 424-9836 www.foundationcenter.org
Federal and Foundation Assistance Monitor	Provides semi-monthly reports on federal and private grants. Available for a fee	CD Publications 8204 Fenton Street Silver Springs, MD 20910 Tel: (301) 588-6380 www.cdpublications.com

Program / Activity	Type of Assistance	Agency & Contact
Environmental Grantmaking Foundations	**Provides a comprehensive list of foundations that support environmental nonprofit activities and programs. Available for a fee.**	
Environmental Grantmaking Foundations ***"2007 Plan Update"***	Provides a comprehensive list of foundations that support environmental nonprofit activities and programs. Available for a fee.	Resources for Global Sustainability, Inc. Cary, North Carolina (800) 724-1857
Basic & Applied Research/ Development Grants, Loans & Assistance	**Research and Educational Assistance Information, Grants / Loans and Technical Assistance**	
Center for Integration of Natural Disaster Information	Develops and evaluates technology for information integration and dissemination	Department of Interior (DOI) US Geological Survey (USGS) (888) 275-8747 www.usgs.gov
Hazard Reduction Program	Provides funding for research and related educational activities on hazards.	National Science Foundation (NSF), Directorate for Engineering, Division of Civil and Mechanical Systems (703) 292-8360
Decision, Risk, and Management Science Program	Provides funding for research and related educational activities on risk, perception, communication, and management (primarily technological hazards)	NSF Directorate for Social, Behavioral and Economic Science, Division of Social Behavioral and Economic Research, Decision, Risk, and Management Science Program (DRMS) (703) 292-7263 www.nsf.gov/sbe.drms

Program / Activity	Type of Assistance	Agency & Contact
Societal Dimensions of Engineering, Science, and Technology Program	Provides funding for research and related educational activities on topics such as ethics, values, and the assessment, communication, management, and perception of risk	NSF Directorate for Social, Behavioral and Economic Science, Division of Social, Behavioral and Economic Research, Societal Dimensions of Engineering, Science and Technology Program (703) 292-7279
National Earthquake Hazard Reduction Program (NEHRP) in Earth Sciences	Research into basic and applied earth and building sciences	NSF Directorate for Geosciences Division of Earth Sciences (703) 292-8550
Other Planning Information, Including Demographics, Societal Data, Transportation, Agricultural, Industrial & Other Commercial Economic Statistics	**Low and/ or No Cost Information Helpful for Determining At-Risk Populations and Potential Economic Damages & Information to Help Determine Avoidance of Losses.**	

Program / Activity	Type of Assistance	Agency & Contact
Demographics, Societal Statistics and Economic Statistics	Provides free Planning Information Concerning Jobs, Business and Economic Statistics, Population and Housing Statistics, and Help with Census Products (i.e. statistics, maps, reports, etc.), State Government, etc. Note: For statistics regarding clean water, wetlands, conservation, disasters, natural resources, rivers, and other subjects covered separately in this document, use the contact information provided in those subject areas.	U.S. Census Bureau Washington DC 20233 General telephone inquiries (800) 923-8282 www.census.gov Bureau of Economic Analysis (BEA) 1441 L Street NW Washington DC 20230 Public Information Office 202-606-9900 BEA Order Desk 800- 704-0415 Bureau of Labor Statistics Division of Information Services 2 Massachusetts Avenue, N.E. Room 2860 Washington, D. C. 20212 800-877-8339 202-691-5200 www.bls.gov
University of Mississippi Center for Population Studies	Disseminates U S Census data, provides technical assistance in the collection and analysis of Census and other demographic and social data, and undertakes research on population issues	University of Mississippi College of Liberal Arts Center for Population Studies (662) 915-7288
University of Mississippi Geoinformatics Center	Provides satellite data and crop information	Geology and Geological Engineering Dr. Greg Easson, Director (662) 915-5995 Hal Robinson (662) 915-1074 Lance Yarborough (662) 915-7651

Program / Activity	Type of Assistance	Agency & Contact
University of Mississippi	Research Centers	www.olemiss.edu
National Climactic Data	Maintains the largest active archive of national weather data, produces numerous climate publications, and responds to data requests	U. S. Dept. of Commerce National Climactic Data Center (828) 271-4800
State Climactic Data	Provides current weather information and forecasts, maintains an active archive of weather data for the state, and responds to data requests.	Office of the Mississippi State Climatologist Dr. Charles L. Wax (662) 325-3915

5.0: Local Mitigation Planning

A key element of hazard mitigation planning is the strengthening of interactions between the state and local communities, particularly in coordination of implementation strategies. It is thought that most of the significant mitigation occurs at the local level. Thus, it is beneficial to all concerned to make sure that local plans are as effective as possible in identifying hazards and developing action plans.

By developing the State Hazard Mitigation Plan, MEMA is assisting communities in updating local mitigation strategies by initiating a number of activities designed to integrate objectives consistent at both the State and local levels. These activities include funding and technical support, as well as educational opportunities.

Summary of Changes - 2010 State Plan Update

Technical Support (Section 5.1) Planning Assistance for Local Governments were updated. Recipents, funding source and amounts changed. Technical Assistance for Local Governments were updated. Recipients, funding source and amounts changed. CAV's and CAC numbers were updated along with applicant briefings conducted between 2007-2010.

Methodology and Analysis of Local Plans (Section 5.2) Vulnerability Assessment Methodoogy by Planning and Development District (Table 5.2.1) Updates on the methodology of Golden Triangle and South Delta. Mississippi now has 340 approved hazard mitigation plans. All 82 counties now have approved plans.

5.1: Local Mitigation Planning Coordination

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section on the Coordination of Local Mitigation Planning that includes the following:

A description of the State process to support, through funding and technical assistance, the development of local mitigation plans.

Funding Support

The State has met it's goal to have an approved mitigation plan in every community in the state. All 82 counties has an approved hazard mitigation plan. The State will continue the process to support the development of local mitigation plans through funding and technical assistance is as follows:

Mississippi has a number of local communities that have the capability and need to develop and implement a local hazard mitigation plan. Many of these communities have existing mitigation plans that are being updated to ensure that the effective implementation of mitigation initiatives is realized. Also these plans are being updated to identify potential utilization of funds for projects in these communities.

Also there are a large number of small communities within the State that do not have the capability of developing and implementing a local hazard mitigation plan. These communities are served by one of the ten regional planning and development districts. These Districts have the capability and experience of developing regional plans and assisting the local communities in implementing those plans.

Planning & Development Districts	Counties	Point of Contact
Central Mississippi Planning & Development District	Copiah, Hinds, Madison, Rankin, Simpson, Warren & Yazoo	Mr. F. Clarke Holmes Executive Officer 1170 Lakeland Drive Post Office Box 4935 Jackson, Mississippi 39296-4935 601) 981-1511 (601) 981-1515-Fax
East Central Mississippi Planning & Development District	Clarke, Jasper, Kemper, Lauderdale, Leake, Neshoba, Newton, Scott & Smith	Mr. Bill Richardson Executive Officer 280 Commercial Drive Post Office Box 499 Newton, Mississippi 39345 (601) 683-2007 (601) 683-7873-Fax

Planning & Development Districts	Counties	Point of Contact
Golden Triangle Planning & Development District	Choctaw, Clay, Lowndes, Noxubee, Oktibbeha, Webster & Winston	Mr. Rupert L. Johnson Executive Director Post Office Box 828 Starkville, Mississippi 39760-0828 (662) 324-7860 (662) 324-7328-Fax
North Central Planning & Development District	Attala, Carroll, Grenada, Holmes, LeFlore, Montgomery & Yalobusha	Mr. Robert Berry, Jr. Executive Director 711B South Applegate Winona, Mississippi 38967 (662) 283-2675 (662) 283-5875-Fax
North Delta Planning & Development District	Coahoma, DeSoto, Panola, Quitman, Tallahatchie, Tate & Tunica	Mr. Glen Brown Executive Director 220 Power Drive Batesville, Mississippi 38606 (662) 561-4100 (662) 561-4112- Fax
Northeast Mississippi Planning & Development District	Alcorn, Benton, Marhsall, Prentiss, Tippah & Tishomingo	Ms. Sharon Gardner Executive Director Post Office Box 600 Booneville, Mississippi 38829 (662) 728-6248 (662) 728-2417-Fax
South Delta Planning & Development District	Bolivar, Humphreys, Issaquena, Sharkey, Sunflower & Washington	Mr. William B. Haney, Jr. Executive Director 124 South Broadway, Post Office Box 1776 Greenville, Mississippi 38702 (662) 378-3831 (662) 378-3834-Fax
Southern Mississippi Planning & Development District	Covington, Forrest, George, Greene, Hancock, Harrison, Jackson, Jefferson Davis, Jones, Lamar, Marion, Pearl River, Perry, Stone & Wayne Counties	Mr. Leslie Newcomb Executive Director 9229 U. S. Highway 49 Gulfport, Mississippi 39503 (228) 868-2311 (228) 868-2550-Fax
Southwest Mississippi Planning & Development District	Adams, Amite, Claiborne, Franklin, Jefferson, Lawrence, Lincoln, Pike, Walthall & Wilkinson	Mr. Wirt Peterson Executive Director 100 South Wall Street Natchez, Mississippi 39120 (601) 446-6044 (601) 446-6071-Fax

Planning & Development Districts	Counties	Point of Contact
Three Rivers Planning & Development District	Calhoun, Chickasaw, Itawamba, Lafayette, Lee, Monroe, Pontotoc & Union	Mr. Vernon R. Kelley III Executive Director 75 South Main Street, Post Office Drawer 690 Pontotoc, Mississippi 38863 (662) 489-2415 (662) 489-6815-Fax

Technical Support

Technical Support is provided to local jurisdictions and the Planning and Development Districts (PDD) in developing mitigation plans, identifying mitigation action strategies, and applying for assistance through various funding sources. This support is provided primarily by the MEMA Mitigation Bureau and FEMA Region IV.

The State has a Memorandum of Understanding (MOU) with the ten PDDs to develop local hazard mitigation plans. Under that MOU, the State provided technical assistance funded by FEMA's Technical Assistance Program. . The Hazard Mitigation Grant Program and Pre-Disaster Mitigation Program funding are currently being used to develop plans for the local jurisdictions. The State continues to use the FEMA Technical Assistance Program for funding the National Flood Insurance Program, Hazard Mitigation Grant Program, and Hazard Mitigation Planning training workshops for local governments as needed and requested.

MEMA has conducted 60 Applicants' Briefings in support of federally declared disasters since 2007 plan update. MEMA is also a member of Mississippi Civil Defence/Emergency Management Association (MCDEMA), Building Officials Association of Mississippi (BOAM), and an affiliate of the Mississippi Municipal League (MML) and the Mississippi Association of Supervisors (MAS). MEMA representatives attend the annual and semi-annual meetings of these organizations and provides updates on all mitigation activities taking place throughout the state.

MEMA's Floodplain Management Specialist conducted a total number of 196 CACs from 2007-2010 and 131 CAV's from 2007-2010.

Additional technical support opportunities provided are shown on the subsequent page.

Planning Assistance for Local Governments

Recipients	Funding Source	Amount ($)
City of Jackson County	PDM	40,500
City of Pass Christian	PDM	31,500
North Delta PDD	PDM	56,250
State of MS Plan Update	PDM	387,694
North East PDD	PDM	75,000
Central MS PDD	PDM	75,000
East Central PDD	PDM	75,000
MEMA	PDM	70,000
MS IHL DRU Planning	HMGP	491,807
Bolivar County Planning	HMGP	32,334
Golden Triangle PDD	HMGP	117,283
South Delta PDD	HMGP	56,250

Planning Assistance for Local Governments

Class	Recipient of Training
FPM 101 Workshop	AFMM Conference
L273 Workshop	All Hazards Conference
FPM 101 Workshop	Gulf Coast
RSDE/EC Workshop	State Farm Insurance Agents
Elevation Certificate	BOAM Conference
Planning Workshop	North East PDD
Planning Workshop	North Delta PDD
Planning Workshop	East Central PDD
Planning Workshop	Pearl River County
Planning Workshop	Pearl RIver County

5.2: Local Plan Integration

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section on the Coordination of Local Mitigation Planning that includes the following:

A description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.

Review and Approval of Local Plans

Federal mandate 44 CFR Sec. 201.4 requires that states and local jurisdictions must have an approved mitigation plan in order to receive grant funding. Once a local jurisdiction has applied for and received grant funding for a local hazard mitigation plan, they have one year in which to complete it. Applicants are not eligible to receive mitigation grant funds unless their plan has been approved. During plan development, technical assistance is provided by MEMA upon requested, in addition to any plans training already provided.

The Mitigation Planning Bureau of MEMA reviews all local hazard mitigation plans based on the FEMA local plan crosswalk. MEMA and FEMA planners developed a plan review methodology to expedite the plan review process. Instead of taking the usual four to six months, the time has been reduced by one to two months. As a result, the State now has over 340 jurisdictions with approved hazard mitigation plans. Prior to the joint review process, only 18 jurisdictions had approved hazard mitigation plans. Once MEMA receives a plan from a local jurisdiction, MEMA planners will review the plan within 30-45 days of receipt and either return the local plan for required revisions or forward the plan to FEMA for final review.

Plans that pass the state review are forwarded to the FEMA Region IV Mitigation Division for conditional approval. Once the local jurisdiction(s) adopts the plan, the State forwards the adoption resolution(s) to FEMA for final approval. FEMA encourages the adoption of local hazard mitigation plans within 90-days of the federal approval.

For local plans that do not pass State review and require additional work, MEMA's Mitigation Planning Bureau provides a crosswalk with explanations of the actions and or changes that must occur in order to bring the plan into compliance with FEMA planning guidance and the Code of Federal Regulations (CFR) 44. Furthermore, each jurisdiction is provided technical assistance through the Mitigation Planning Bureau Director and the four mitigation planners assigned to regions within the State. Eighteen months prior to plan expiration, local jurisdictions are notified to begin looking at the plan update process and made aware of any available funding sources. The local jurisdictions are again notified at twelve, six and three months before plan expiration.

The Mitigation Planning Bureau will continue to use this review and educational process to assist local jurisdiction leaders in developing and updating plans.

Methodology and Analysis of Local Plans

The plan developers analyzed the risk assessments of FEMA-approved local hazard mitigation plans in Mississippi to assess their consistency with the state plan's risk assessment and to determine if the ranking of the state's hazards should be revisited and if any additional hazards should be profiled in the state plan. All of Mississippi 82 counties have FEMA approved plans. There are 92 FEMA approved local plans that were reviewed to determine which hazards each county was vulnerable to and to what degree (city-level plans were examined for consistency with the county-level determinations, but information presented is summarized to the county level).

Among the plans, roughly eight different methodologies were used to assess vulnerability by county (see Table 5.2.1). These methodologies largely follow planning and development district (PDD) boundaries. To properly analyze and summarize the data, a common scale was required. All vulnerability information in the county plans was converted to a High, Medium, Low scale.

Table 5.2.1
Vulnerability Assessment Methodology by Planning and Development District

Planning and Development District	Methodology (information analyzed)
Central	Overall Vulnerability Level Table; High, Medium, Low Scale
East Central	Vulnerability Assessment: Overall Summary & Impact Table*
Golden Triangle	Vulnerability Assessment Level Table; High, Meduim, Low Scale
Northeast	Vulnerability Assessment: Overall Summary & Impact Table*
North Central	Hazard Rankings/Priority Vulnerable Areas/ Table; Scale of 0-11 (0-3=Low, 4-7=Medium, 8-11=High)
North Delta	Individual Vulnerabilities Table; High, Medium, Low Scale
South Delta	Overall Vulnerability Level Table; Very High, High, Midium High, Medium, Medium Low, Low, Very Low
Southern	Varied; All Converted to High, Medium, Low Scale
Southwest	Assessing Vulnerability—Overall Summary and Impact*
Three Rivers	Vulnerability Assessment: Overall Summary & Impact*

Note: *These assessments did not include rankings or ratings. Information provided about likelihood and expected impacts were assigned numeric values, added together, and converted to the High, Medium, Low scale.

Linking Local Plans to the State Plan

During the 2010 plan update process, the State gathered information from local plans to integrate this data into the State plan. The Hazard Mitigation Council reviewed and summarized information from the local plans on the following categories:

- Hazard identification and risk assessment
- Goals and objectives
- Local capabilities
- Mitigation actions

The process in 2010 involved reviewing all of the county-level plans and capturing the information related to the four categories above in spreadsheets for further review and comparison purposes. (For more details on this process, and how the information was collected and incorporated, see Section 3.0 Risk Assessment, Section 4.1 Hazard Mitigation Goals and Objectives, Section 4.3 Local Capability Assessment, and Section 4.4 Mitigation Actions.)

This information was used to inform the planning process and to reassess the plan for the following purposes:

- To improve the alignment of the state mitigation strategy with local goals, objectives, and actions;
- To update the statewide risk and vulnerability assessments;
- To identify and promote initiatives proven successful at the local level;
- To review state initiatives to determine if they meet the overall mitigation needs of the state and to change those that have not produced anticipated results; and
- To link local action with the state's mitigation strategy.

New and updated plans will be incorporated into the state plan during the three-year update cycle. Should state priorities change, these plans may be incorporated sooner.

The Mitigation Planning Bureau of MEMA makes a copy of the State plan and a summary of state prioritized strategies available to each local community. It was evident in the local plan review that some jurisdictions did incorporate information from the State plan's risk assessment and goals and objectives into their local plan. Upon approval of this plan update, the State would like to further promote the use of the updated risk assessment and mitigation strategy in local government mitigation planning by using the Planning and Development Districts. HAZUS flood models developed for each county, and hurricane and earthquake models developed for vulnerable counties, will also be distributed to counties through the Planning and Development Districts.

This 2010 update reflects the successful integration of the plans from all 82 counties in the state. MEMA has encouraged local governments to participate in multi-jurisdictional, county-level plans, to maximize the number of communities covered by mitigation plans and to help develop more coordinated, regional approaches to mitigation. Now that all the counties have a FEMA approved plan, MEMA's prioity is to ensure timely updates of the local jurisdictions plans. As local plans are updated, the local governments will be encouraged to develop more tailored actions to their specific community. MEMA's priority will be facilitating the completion of remaining local plans, followed by technical assistance on plan implementation and updates.

5.3: Prioritizing Local Technical Assistance

44 CFR 201.4(c)(4)(i) – To be effective, the plan must include the following elements:

A section on the Coordination of Local Mitigation Planning that includes the following:

Criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and 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.

Funding Priority

The state has established the following types of projects for funding priority:

- Hazard Mitigation Planning.
- Retrofit of critical facilities and critical infrastructure.
- Repetitive flood properties and severe repetitive flood loss areas.
- Projects that would result in a general improvement of regional or local mitigation capability.
- State Identified Mitigation Initiatives such as saferooms and storm shelters, severe weather warning systems for universities and colleges, and severe weather notification systems for local communities.
- Post-disaster identified mitigation needs.
- Other projects initiatives identified in the state and local mitigation plan.

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.

Prioritizing Alternatives

STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to select and prioritize the most appropriate mitigation alternatives for the plan. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on the state's capabilities. Appendix 7.5.3-A provides additional information regarding the review and selection criteria for alternatives.

Prioritization of Communities /Jurisdictions for Planning Grants

This section provides a description of the criteria by which the State will prioritize communities and local jurisdictions that would receive planning grants under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM), and other available funding programs.

Federal and State funding for mitigation planning will be limited and in some instances may not be available. There will always be more requests for mitigation planning funds than there will be available funds. Approval of funds for mitigation planning will be based on the availability of funds and the determination as to whether the requesting jurisdiction has demonstrated the desire and ability to complete the plan and follow through on the strategies identified in the plan. This desire to comply with the initiatives in the local mitigation plan should not be dependent on the availability of state or federal funds. Local jurisdictions should develop mitigation plans based on their unique capabilities and needs.

In an effort to allow some flexibility in the distribution of mitigation planning funds, the following general guidelines have been developed. These guidelines are not all inclusive and compliance with all of the issues listed below may not be required for approval of a planning grant.

- The community must meet the criteria for the specific source of funds referenced in Section 5.1 (Funding Support).
- MEMA will consider its past experience in dealing with the community on other grants (such as disaster grants, mitigation projects, etc.).
- MEMA may contact the Mississippi Development Authority (MDA) Community Development Block Grant (CDBG) program, other State agencies/departments, and/or the Planning & Development District (PDD) to check on their past experiences with the requesting community.
- The State and local risk assessment will be reviewed to determine the susceptibility of the community to natural and human caused disasters.
- MEMA will review previous presidential disaster declarations to determine the number of times the requesting community has been impacted by declared disasters and the magnitude of damages resulting from those disasters. This review would consider impact on community infrastructure, as well as families and businesses.
- MEMA will also consider the number of non-declared disasters that have impacted the community. This review would consider impact on community infrastructure, as well as families and businesses.
- MEMA will consider whether or not the community participates in the National Flood Insurance Program (NFIP).
- MEMA will consider the number of insured, repetitive loss structures in the community.
- MEMA will also consider the community's status as a small-impoverished community and communities with special developmental pressures, if applicable.
- The community has identified natural disaster hazards in areas under its jurisdiction.

Prioritization of Non-Planning Grants

This section provides a description of the criteria by which the State will prioritize communities and local jurisdictions that would receive non-planning grants under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation, and other available funding programs.

- The extent and nature of the hazards to be mitigated;
- The degree of commitment of the local government to reduce damages from future natural disasters;
- The degree of commitment of the local government to support the hazard mitigation measures to be carried out using the technical and financial assistance;
- The extent to which the hazard mitigation measures to be carried out using the technical and financial assistance contribute to established State/Local mitigation goals and priorities;
- The extent to which prioritized, cost-effective mitigation activities that produce meaningful and definable outcomes are clearly identified;
- If the local government has submitted a mitigation plan, the extent to which the activities identified under paragraph (5) above are consistent with the mitigation plan;
- The opportunity to fund activities that maximize net benefits to society;
- The extent to which assistance will fund activities in small impoverished communities;
- The extent of development pressure particularly in those areas experiencing unexpected growth as a result of the post-Katrina evacuation and relocations; Communities with the Highest risk and
- Small and Impoverished Community Provisions

As used in pre-disaster mitigation, a small-impoverished community means a community of 3,000 or fewer individuals that is economically disadvantaged, as determined by the State. Additional criteria may be determined by FEMA. The President may increase the federal cost share to 90% of the total cost of mitigation activities carried out by small impoverished communities; however, all other requirements will be the same as any other community participating in pre-disaster mitigation activities.

In order for a project to be considered for funding, it has to have a benefit cost ratio of a minimum of 1.0 that is technically feasible and cost-effective in accordance to FEMA requirements. Only projects that meet this criteria along with the other bulleted elements listed above are considered eligible, this ensures that the benefits are maximized from the projects. In accordance with the Hazard Mitigation Plan and the Administrative Plan, the Hazard Mitigation Council approves projects that meet the goals and objectives of the state plan and based also on the recommendations of the State Hazard Mitigation Officer. Mississippi Gulf Coast communities have received more grant funding than the other areas of the state because of the higher risks associated with the coastal area.

Mississippi is classified as a mostly rural state. Sixty-three percent of the state is classified as rural and thirty-four percent urban. At the time of this plan update, the Hazard Mitigation Council is unaware of any significant development pressures within the state's communities. None of the communities has identified any development pressures in their local plans and was not addressed in the state plan.

The State of Mississippi amended it's plan to participate in FEMA's Severe Repetitive Loss Program to take advantage of the 90/10 cost share to help mitigate RL properties. The state is committed to mitigating these properties as is shown in Table 5.3.1.

Evaluation of Prioritizing Planning and Non-Planning Grants

The Hazard Mitigation Bureau's Administrative Plan for the Hazard Mitigation Grant Program provides an evaluation process for approval of grant applications as stated in Section VI – Program Administration. In addition, this plan presents a process to ensure benefits are maximized according to a cost benefit review of proposed projects.

Repetitive and Severe Repetitive Loss

Section 3.4 provides details about hazard assessments in Mississippi and appropriate mitigation actions to increase safety and reduce losses. One of the most revealing facts is the repetitive and severe repetitive losses that occur to structures and infrastructures. Mitigation Actions have been identified to address these repetitive and severe repetitive losses and are listed in Table 4.4.1. These actions were developed from an historical, as well as a vulnerability, perspective.

Table 3.4.9 provides details about the National Flood Insurance Program. This information shows 5,970 repetitive loss properties with 15,373 claims and over $590 million repetitive losses paid. With 1,010 repetitive loss properties mitigated, the State of Mississippi has shown to place a high priority on assisting local communities in reducing future losses through defined mitigation actions. Our goal is to continue to increase the mitigation of repetitive and severe repetitive loss properties. The State of Mississippi is commited to mitigate its repetitive and severe repetitive loss properties, to that end we have previously amended the state plan to take advantage of the SRL Program with the 90/10 share cost. With that being said, The State of Mississippi does not adopt or enforce a statewide building code for all structures, nor does it mandate a code for residential construction. It is up to local jurisdictions to adopt and enforce building codes.

- We do encourage communities to restrict development in floodprone areas by implementing stricter building codes, zoning and ordinances.
- Placed and continue to place higher priority for applications inclusive of, but not limited to, developing a floodplain management program, restricting development in flood prone areas, acquiring flood prone properties, elevate structures that have been deemed repetitive loss and severe repetitive loss structures, and flood proofing businesses that meet the criteria of repetitive loss and severe repetitive loss structures.

Hurricane Katrina mitigated a large number of repetitive loss properties, the exact number is unknown at this time. The following table, Table 5.3.1 Repetitive Loss Mitigation Actions, details the mitigation actions/ projects the State has undertaken since the previous plan update.

Table 5.3.1 Repetitive Loss Mitigation Actions

Municipality	*Project Program*	*Type of project*	*Funding/ Structures*	*Status*
City of Grenada	*FMA-PJ-04-MS-2009-001*	*Acquisition*	*62,000/1*	*Complete*
City of Canton	*HMGP 1550-005*	*Acquisition*	*51,686/1*	*Complete*
Jackson County	*HMGP 1550-015*	*Acquisition*	*589,928/5*	*Complete*
Jackson County	*HMGP 1604-0204*	*Acquisition*	*6,000,000/55*	*Ongoing*
Tallahathcie Co.	*HMGP 1604-0176*	*Acquisition*	*700,000/8*	*Ongoing*
Tallahathcie Co.	*HMGP 1604-0289*	*Acquisition*	*300,071/3*	*Ongoing*
City of Pascagoula	*HMGP 1604-0185*	*Elevation*	*987,485/20*	*Ongoing*
City of Vicksburg	*HMGP 1764-001*	*Acquisition*	*1,020,984/20*	*Ongoing*
City of Ocean Springs	*HMGP 1604-0307*	*Acquisition*	*1,060,983/*	*Ongoing*
Desoto County	*HMGP 1604-0355*	*Acquisition*	*204,500/1*	*Ongoing*
City of South Haven	*HMGP 1604-0347*	*Drainage*	*2,100,000/100*	*Ongoing*

6.0: Plan Maintenance Process

A formal process is required to ensure that the Plan will remain an active and relevant document. This section, Plan Maintenance, includes a schedule for monitoring and evaluating the Plan annually, and for revising the Plan every three years. It describes how the Hazard Mitigation Council and individual member institutions will receive public input throughout the process. Finally, this section explains how institutions will transform the mitigation strategies outlined in this plan into existing planning mechanisms.

Summary of Changes-2010 Plain Maintenance

Plan Monitoring,Evaluating, and Updating (Section 6.1.1) Mitigation action appendix numbers updated

Plan Evaluation (Section 6.1.2) Quarterly meetings that involved periodic reports from other agencies.

The projects were worked on and narrowed down to 71 projects.

Staffing (Section 6.2.3) Updates were done on staff titles and duties.

6.1: Monitoring, Evaluating, and Updating the Plan

44 CFR 201.4(c)(5)(i)(ii) - The State mitigation strategy shall include the following elements:

A Plan Maintenance Process that includes:

An established method and schedule for monitoring, evaluating, and updating the plan.

A system for monitoring implementation of mitigation measures and project closeouts.

6.1.1 Plan Monitoring, Evaluating, and Updating

The Mississippi Hazard Mitigation Council participants will review the goals, objectives, and action items listed in the plan on a quarterly basis. They shall be responsible for communicating any desired or necessary changes to the Mississippi Emergency Management Agency and other stakeholders. The Hazard Mitigation Council will convene quarterly meetings to conduct the following activities:

- Review existing action items to determine appropriateness of funding;
- Identify issues that may not have been identified when the plan was developed;
- Prioritize potential mitigation projects using the methodology described in the plan; and
- Assist in development of funding proposals for priority action items.

The mitigation action worksheets included in Appendix 7.3.12 C will be used to evaluate project status and to update such items as time-line, funding source, and responsible entity. The Mississippi Emergency Management Agency Office of Mitigation will be responsible for updating the plan on a three-year cycle. A memorandum, describing needed changes and progress on implementation, will be provided annually to MEMA, FEMA Region IV, and the Hazard Mitigation Council.

The previously approved State of Mississippi Standard Mitigation Plan dated August of 2007, dealt with monitoring, evaluating, and updating the plan in section 6.1. This section called for review in three ways:

- Annual review of mitigation actions and identified projects,
- Review after each major disaster to determine the need for Plan refocus, and
- Review every three years before resubmission to FEMA for approval.

The State focused its priorities on sustaining those communities most affected by Hurricane Katrina, however; from this point forward in an effort to make the updated plan a living document that will be constantly reviewed and utilized to track projects, the new plan will be evaluated at each quarterly Hazard Mitigation Council Meeting. This change will provide an opportunity for effective utilization of the Plan and will involve stakeholders from State agencies with responsibility for mitigation actions and projects.

6.1.2 Plan Evaluation

In addition to quarterly reviews, the Hazard Mitigation Council and each participating agency will perform a more comprehensive review of the Plan every two years, or as deemed necessary by the Council and MEMA. The coordinating organizations responsible for the various action items will report on the status of their projects, the success of various implementation processes, difficulties encountered, and success of coordination efforts. They will then evaluate the content of the plan using the following questions:

- Are these programs effective?
- Have there been any changes in development that affect our mitigation priorities?
- Do our goals, objectives, and action items meet STAPLE/E criteria?
- Are our goals, objectives, and action items relevant, given any changes in our Agency?
- Are our goals, objectives, and action items relevant given any changes to State or Federal regulations and policy?
- Is there any new data that affects the risk assessment portion of the Plan?

The Hazard Mitigation Council meets quarterly. During our quarterly meetings, the following occured:

- Review updates of risk assessment data and findings, as well as new events and data
- Discuss methods of continued public and stakeholder participation, and
- Document successes and lessons learned based on actions that were accomplished during the past two years.

Any resulting updates or changes will be included in the Plan. Again, the Hazard Mitigation Council and the Mississippi Emergency Management Agency Office of Mitigation will be responsible for making any changes and will provide the updates via a memorandum, as described earlier, and will keep files of changes needed for the three-year re-submittal.

The 2007 Standard Mitigation Plan contained project profiles; these profiles are regularly updated and reviewed by all State agencies that have assigned projects using State's intrasite. During the quarterly Hazard Mitigation Council meetings, these projects were discussed and evaluated to make sure that projects remained relevent and viable.

The State began with a total of 110 projects assigned to different state agencies to monitor and implement. Based on evaluation and feedback of the mitigation actions/projects, the projects that were found to redundant or obsolete were combined or deleted. The State started out with 110 and narrowed it down to 71 actions to date.

The process for monitoring the mitigation actions has been modified. A tabular summary of all projects referenced to a profile will be available and will detail each mitigation action. The monitoring process will be organized in an information management system, which will be maintained and updated by MEMA. The new process will provide for efficient and effective updates of the mitigation actions. Since the Hazard Mitigation Council will now meet quarterly, review of the mitigation action will result in timely updates.

6.1.3 Plan Updates

The Hazard Mitigation Council is responsible for making updates to the Plan, and the Agency participants are responsible for the content of the updates. The council meets quarterly and continue to contribute input and periodically reporting on agency projects.The Agencies will provide institutional-level updates to the Plan when necessary. At the time of review, the following key questions will be addressed:

- Are the plan goals still applicable?
- Are there new partners or stakeholders who should be targeted for involvement?
- Do existing actions need to be re-evaluated or re-prioritized for implementation?
- Are the actions still appropriate given current resources?
- Have changes in construction and development influenced the effects of hazards?
- Are there new studies or data available that would enhance the risk assessment?
- Have the Agencies been affected by any disasters, and did the plan accurately address the impacts of the events?

The Plan will be submitted for review to MEMA and FEMA every three years.

6.1.4 Implementation through Existing Programs

The multi-institutional participants can use the Plan as a baseline of information on the natural hazards that impact their institutions.

6.1.5 Continued Public Involvement

The public, as well as State and Local communities, will be directly involved in reviewing and updating the Plan. The Hazard Mitigation Council and its representatives should solicit feedback from the public during monitoring, evaluating, and updating the Plan as described above. The State Plan is accessible on our MEMA website for the public to view and give feedback to the state plan.

An up-to-date copy of the plan will reside within the Mississippi Emergency Management Agency web site, on a home page devoted to Hazard Mitigation and Emergency Preparedness. Annual and biennial status memorandums will also be posted there.

A copy of the Plan will be publicized and available for review at the Mississippi Emergency Management Agency offices and additional copies of the plan will be catalogued and made available at pertinent State Agencies. The existence and locations of these copies will also be posted on the Mississippi Emergency Management Agency web site. The site will contain contact information for members of the Hazard Mitigation Council to which the public may direct comments and concerns. All public feedback will be forwarded to the appropriate institution for review.

In addition to these activities, many of the educational and outreach activities will support continued public involvement in the Plan implementation process.

6.2: Monitoring Progress of Mitigation Actions and Assessments of Mitigation Actions

44 CFR 201.4(c)(5)(iii) - The State mitigation strategy shall include the following elements:

A Plan Maintenance Process that includes:

A system for reviewing progress on achieving goals as well as activities and projects identified in the Mitigation Strategy.

The plan maintenance process should include:

- A system for monitoring implementation of mitigation measures and project closeouts.
- A system for reviewing progress on achieving goals as well as activities and projects in the Mitigation Strategy.

6.2.1 Monitoring Implementation of Mitigation Measures and Project Closeouts

Mississippi Emergency Management Agency (as grantee) recognizes the responsibilities laid out in 44 CFR 206.438(a): The State, serving as grantee, has primary responsibility for project management, accountability of funds as indicated in 44 CFR part 13, and is responsible for ensuring that subgrantees meet all program and administrative requirements.

The State Hazard Mitigation Grant Administrative Plan outlines the administrative procedures that the state employs for meeting these requirements.

6.2.2 Progress Review for Mitigation Goals and Objectives

In order for any program to remain effective, the goals and objectives of that program must be reviewed periodically. That review should address, as a minimum, the following issues:

- Are the established goals and objectives realistic? Take into consideration available funding, staffing, and state/local capabilities, and the overall State mitigation strategy.
- Has the State clearly explained the overall mitigation strategy to local governments?
- Are proposed mitigation projects evaluated based on how they help the State and/or local government meet overall mitigation goals and objectives?
- How have approved mitigation projects complemented existing State and/or local government mitigation goals and objectives?
- Have completed mitigation projects generated the anticipated cost avoidance or other disaster reduction result?

A thorough and realistic evaluation of the benefits of a mitigation project may be delayed until the area of the project is impacted by another disaster. The lack of realized benefits from a completed mitigation project may result in the disapproval or modification of similar projects in the future. At the same time, mitigation projects that have proven their worth may be repeated in other areas of the State.

Based on the results of the review/evaluation mentioned above, the State may need to adjust its goals and objectives to meet the current and future mitigation needs of the State and local governments. A quarterly mitigation status report will be prepared by the MEMA Mitigation Planning Bureau. This report will be provided to the MEMA Director and Deputy Director for review and distribution, as needed. The report will address, as a minimum, the following items:

- Mitigation goals, objectives and strategies
    - ◊ Brief description of the project
    - ◊ Linkage of the project with goals and objectives
    - ◊ Linkage of project with strategies.
    - ◊ Linkage of the project with funding priorities
- Completed mitigation projects
    - ◊ Affected jurisdiction
    - ◊ Brief description of the project
    - ◊ Source of funding
    - ◊ Brief summary of any problem areas, with proposed solution
    - ◊ Brief summary of effectiveness (cost-avoidance) of project, if available
- Mitigation projects in progress
    - ◊ Affected jurisdiction
    - ◊ Brief description of the project
    - ◊ Source of funding
    - ◊ Brief summary of project status
    - ◊ Anticipated completion date
- Pending (under review) mitigation projects
    - ◊ Affected jurisdiction
    - ◊ Brief description of the project
    - ◊ Source of funding

◊ Brief summary of project status

6.2.3 Staffing

The Mississippi Emergency Management Agency will implement the State Plan and administer the mitigation programs by utilizing the following positions:

Mitigation Office Director

The Mitigation Office Director has overall management responsibility for the program and is responsible for ensuring that the state properly carries out its Section 404 and Section 406 responsibilities subsequent to a Presidential Disaster Declaration. In this regard, the Mitigation Office DIrector will monitor the activities of the mitigation staff and the State Hazard Mitigation Team. Responsibilities include, but are not limited to:

◊ Ensuring the Administrative Plan is updated, outlining how the state will administer the Hazard Mitigation Grant Program and other applicable hazard grant programs.

◊ Ensuring that the State Hazard Mitigation Plan is active and identifies potential hazard mitigation projects, as well as establishes priorities among those projects.

◊ Ensuring that all potential applicants are notified of the program and receive the assistance to which they are entitled.

◊ Ensuring that a proper initial application and any necessary supplemental applications, including SF-424's, are submitted in a timely fashion to the FEMA Region IV Director.

◊ Ensuring that technical assistance is provided to potential applicants and/or eligible subgrantees.

◊ Ensuring that adequate procedures are developed for the distribution of financial assistance to eligible subgrantees by the technical assistance staff.

◊ Ensuring development of a system to monitor completion of approved projects in federally required time frames.

◊ Ensuring that a system exists to monitor subgrantee accounting systems and is in compliance with 44 CFR parts 13 and 14.

◊ Ensuring that appropriate state agencies are on the State Hazard Mitigation Team and are involved as necessary with the hazard mitigation process.

◊ Ensuring participation of the appropriate local agencies in the administration and implementation of the hazard mitigation process.

◊ Coordinating with the GAR on all policy/regulatory issues. Reviewing and making appropriate recommendation to the GAR regarding appeals, cost overruns/underruns and all other program issues is also included.

Mitigation Grants Bureau Director

The Mitigation Grants Bureau Director is responsible for the grants program coordination, implementation and administration. He/She will asure the necessary work required to deliver the Mitigation Grant Programs to eligible subgrantees. The individual filling this is usually appointed as the state hazard mitigation officer (SHMO) for Hazard Mitigation Grants Program funding. In addition to assisting the Office Director in all aspects of mitigation, the Mitigation Grants Bureau Director's responsibilities include, but are not limited to:

- Develop the Administrative Plan which outlines how the State will administer the Hazard Mitigation Grant Program and implement the plan in a Presidential Disaster Declaration.
- Develop and implement a process for identifying potential hazard mitigation projects and setting priorities among those projects.
- Maintain a management system for hazard mitigation activities and products.
- Notify potential applicants of the program and brief them, with appropriate handout material on elements of the program.
- Coordinate with Federal, State and local officials to ensure that they understand the involvement of the Hazard Mitigation effort in the Public Assistance program.
- Provide technical assistance to potential applicants and /or eligible subgrantees in developing and submitting applications and in completing projects.
- Implement departmental procedures to monitor the status of approved projects, for processing extention requests and appeals, and for closing out completed projects
- Coordinate with the Administrative and Finance Bureau staff in monitoring subgrantee accounting systems to meet requirements of Code of Federal Regulations (CFR) 44 Part 13 and Part 14.
- Help update the State Hazard Mitigation Plan.
- Conduct site visits to monitor progress and provide technical assistance.
- Assist the Mitigation Office Director in conducting mitigation conferences and or public meetings.

Grants Management Specialist

The Grants Management Specialist is responsible for program coordination, implementation and administration. The specialist will accomplish the necessary work required to deliver the Hazard Mitigation Grant Program to eligible subgrantees. In addition to assisting the SHMO in all aspects of mitigation, the Emergency Management's responsibilities include, but are not limited to:

◊ Developing the Administrative Plan, which outlines how the State will administer the Hazard Mitigation Grant Program, and implementing the plan in a Presidential Disaster Declaration.

- ◊ Developing and implementing a process for identifying potential hazard mitigation projects and for setting priorities among those projects.
- ◊ Maintaining a management system for hazard mitigation activities and products.
- ◊ Notifying potential applicants of the program and briefing them, with appropriate handout material, on elements of the program.
- ◊ Coordinating with Federal, State and local officials to ensure that they understand the involvement of the Hazard Mitigation effort in the Public Assistance program.
- ◊ Providing technical assistance to potential applicants and/or eligible subgrantees in developing and submitting applications and in completing projects.
- ◊ Implementing departmental procedures to monitor the status of approved projects, for processing extension requests and appeals, and for closing out completed projects.
- ◊ Coordinating with the Administrative & Finance Bureau staff in monitoring subgrantee accounting systems to meet requirements of Code of Federal Regulations (CFR) 44 Part 13 and Part 14.
- ◊ Helping update the State Hazard Mitigation Plan.
- ◊ Conducting site visits to monitor progress and provide technical assistance.
- ◊ Assisting the Mitigation Office Director in conducting mitigation conferences and or public meetings.

NFIP State Coordinator/ Floodplain Management Bureau Director

The National Flood Insurance Program (NFIP) State Coordinator is responsible for the direction, evaluation, oversight, planning, and promotion of the 312 + local floodplain management programs within the state of Mississippi. Work also invlolves advising MEMA staff of floodplain management requirements; as they pertain to emergency preparedness, response, and recovery actions. Successful oversight of the local communitites' floodplain management programs enables the MEMA hazard mitigation assistance, mitigation planning, public assistance, and individual assistance bureaus to effectively administer their programs.

The FPM Bureau is the only compliance/regulatory focused staff element within MEMA. Accordingly, its compliance and enforcement actions include frequent contacts/inspections with state and local officials, public

agencies; community and civic groups, etc. Other duties include, but are not limited tot he following:

- ◊ Planning and conducting the Agency's portion of the Flood Map Modernization Initiative and the follow-up Risk MAP initiative.
- ◊ Oversight of the 23 Community Rating System (CRS) communities within the state.
- ◊ Advising and assisting local officials on floodplain management and NFIP training, workshops, conferences, and emergency test exercises.

◊ Planning and participating in floodplain management and NFIP training, workshops, conferences, and emergency test exercises

◊ Making public appearances before civic and community groups to promote the floodplain management program.

◊ Corresponding with local officials, government agencies, federal floodplain management representatives, etc., and preparing reports as required.

◊ Assisting local communities throughout the state in preparation of flood damage prevention ordinances, pamphlets, training, and education documents.

◊ Traveling extensively throughout the state to conduct both Community Assistance Visits (CAV) and Community Assistance Contact (CAC) visits.

◊ Reviewing local regulations and FPM programs for compliance with federal regulations.

◊ Providing staff to the State Emergency Response and FPM programs for compliance with federal regulations.

◊ Providing staff to the State Emergency Response Team (SERT) and to the logistics element within the State Emergency Operations Center during times of state emergencies and activiations.

Floodplain Management Specialist

The duties of the Floodplain Management Specialist include providing regulatory and programmatic oversight, technical assistance, and floodplain management training to communities within an assigned district (of counties) that participate in the NFIP. All actions are based on the 44 CFR 60.1 – 60.3, Executive Order 11988, and other Federal/State regulations. Other duties include, but are not limited to the following:

◊ Providing technical assistance with local community governments.

◊ Conducting Community Assistance Visits (CAV) and Community Assistance Contact (CAC) actions per FEMA and MEMA guidelines.

◊ Responsible for inputting and tracking all floodplain managemnet actions through the use of the FEMA community Information System (CIS)

◊ Responsible for inputting and tracking all actions through the use of the FEMA CommunitInformation System (CIS).

◊ Assisting the State Coordinator in facilitating the scoping, delivery, review and adoption of new Digital Flood Insurance Rate Maps (DFRIMS).

◊ Notifying apprpriate officials of meetings through correspondence.

◊ Performing follow-up actions as required.

◊ Facilitating the DFIRMS adoption process by the community.

◊ Procuring training site locations.

Bureau Director, Mitigation Plans

The Bureau Director, Mitigation Plans, formulates, controls, and directs the Mitigation Planning Bureau's operations in regard and in compliance with mandates by the Federal Emergency Management Agency. These duties include the following:

◊ Supervising the activities of the Planning Bureau Staff in performing specific functions and duties.

◊ Performing a variety of administrative tasks consisting of fiscal management, strategic planning, legal compliance, and required reports.

◊ Serving as liaison to various government agencies, other public/private agencies, and/or the general public in matters related to hazard mitigation planning.

◊ Coordinating plans and budgets with other Bureau Directors to ensure that they meet the stated goals of the office and the agency.

◊ Coordinating with FEMA on any necessary training requirements and/or providing technical assistance for the local communities concerning mitigation planning.

◊ Submitting reports to the Office of Mitigation in reference to any accomplishments and/or any deviations from bureau-stated goals.

◊ Coordinating with the Director of the Office of Mitigation and the Bureau Director of Grants Management to establish a budget for the state hazard mitigation plan.

◊ Using FEMA mandated guidelines, develop the state hazard mitigation plan.

◊ Overseeing the development of the state hazard mitigation plan.

Mitigation Planner

The Mitigation Planner assists the Bureau Director in formulating and controlling the Mitigation Planning Bureau's operations in regard and in compliance with mandates by the Federal Emergency Management Agency. In addition, the Mitigation Planner's duties include the following tasks:

◊ Performing specific functions and duties including a variety of administrative tasks consisting of strategic planning, legal compliance, and required reports.

◊ Serving as liaison to various government agencies, other public/private agencies, and/or the general public in matters related to hazard mitigation planning.

◊ Reviewing plans and assisting local communities, consultants and other state agencies to ensure that developed plans meet or exceed FEMA standards.

◊ Reviewing and monitoring plan updates.

- ◊ Coordinating with FEMA on any necessary training requirements and/or providing technical assistance for local communities concerning mitigation planning.
- ◊ Submitting reports to the Office of Mitigation in reference to any accomplishments and/or any deviations from bureau-stated goals.
- ◊ Using FEMA mandated guidelines, assisting the Bureau Director with development and update of the state hazard mitigation plan.
- ◊ Overseeing and procuring training sites and venues.
- ◊ Facilitating mitigation planning training with local officials and state agencies. Coordinating administrative requirements for workshops and training seminars.
- ◊ Attending conferences to furnish various audiences with programmatic advice and assisting with planning matters.
- ◊ Enhancing public understanding of mitigation planning programs through presentations.

Administrative Assistant

The Administrative Assistant performs skilled clerical work and provides secretarial services for mitigation staff. This work involves making independent decisions concerning the procedure or process to be followed and the actions to be taken. Examples of tasks performed include, but are not limited to:

- ◊ Supervising and participating in the receipt and processing of correspondence; preparing, coding and typing of personnel, purchasing, supply, financial, and other documents; and the checking and posting of program transactions.
- ◊ Organizing work and coordinating workflow; establishing priorities, setting deadlines and reviewing work for adequacy, accuracy, timeliness, and conformance with instructions and standard practices.
- ◊ Receiving visitors and answering calls, ascertaining the purpose of calls and visits, and furnishing information from knowledge of agency policies, rules and procedures.
- ◊ Performing a variety of supportive secretarial duties for administrative staff.

7.0: Appendices

7.2: Planning Process

APPENDIX 7.2-A

"Roadmap" for 2007 to 2010 Update

1. **Introduction: State Characteristics; Plan Adoption; and Compliance with Federal Laws and Regulations**
    - Revisions in text from the 2007 Plan.
    - State Characteristics Update.
    - Minor changes in "Compliance with Federal Laws and Regulations".
2. **The Planning Process: Documenting the Planning Process; Coordination with Federal and State Agencies and Interested Groups in the Planning Process.**
    - Minor changes in this section with updates from 2007.
3. **Risk Assessment: Identifying Hazards; Risk Assessments for Hurricane, Tornado, Flood, Extreme Winter Weather, Earthquake, Dam/Levee, and Drought.**
    - Major revisions from the 2007 plan with new approaches to hazard identification, profiling and individual assessments.
4. **Comprehensive State Mitigation Program: Goals and Objectives; State Capabilities; Local Capability Assessment; Mitigation Measures; and Funding Sources.**
    - Reviewed Mitigation Mission, Goals, Objectives and Actions adopted by the Hazard Mitigation Council.
    - Review and assessment of local plans compared to state goals and objectives. Significant changes from 2007 with new and updated local plans.
    - Updates to State Capabilities with details given by pertinent State Agencies.
    - Local Capability Updates with Comparison Table showing changes from 2007.
    - Mitigation Actions sorted by type with project profiles and additional tables in Appendix 7.3.11.
    - Updated and enhanced funding source summaries.
5. **Local Mitigation Planning: Local Mitigation Planning Coordination; Local Plan Integration; and Prioritizing Local Technical Assistance.**
    - Summary of assistance given for Local Mitigation Planning.
    - Continued coordination through Planning & Development Districts with additional training.
    - Details about prioritization of Local assistance.
6. **Plan Maintenance Process: Monitoring, Evaluating and Updating the Plan; and Monitoring Progress of Mitigation Actions and Assessment of Mitigation Actions**
    - Minor updates with changes in the process and staffing.

7.3.0: Risk Assessment

Appendix A **Definition of Critical Facility**

Appendix B **Definition of Critial Infrastructure**

Appendix C **Critical Facilities Database**

Appendix D **Hazard Ranking Worksheet - Mississippi**

Appendix A Hazard Ranking Worksheet

Appendix 7.3.0-A

MEMA definition of critical facility

DEFINITION

A **critical facility** is defined as any structure that provides or houses critical services necessary to ensure the health and welfare of the population following a natural or man-made hazardous event, including any facilities designated by the local government in their Hazard Mitigation Plan.

COMPONENTS of definition	EXAMPLES
as designated by the local government in the local Hazard Mitigation Plan	
provides shelter and/or resources for displaced individuals	• churches • public buildings • animal shelters • schools • recreation center
provides safe and reliable production or treatment of essential services	• water • waste water • power • gas • solid waste • testing labs
provides essential communication between emergency personnel and the general public	• phone • television station • radio station • satellite systems • comunication tower
provides crucial public safety	• police • EOC • fire • Department of Defense • National Guard • correctional facilities • 1st responder agencies
central facility which houses officials providing leadership and guidance for essential community operations	• city hall • EOC • court house
provides primary health care	• hospital • nursing home • acute care • clinics • ambulance services • mental health
intermodal transportation providing evacuation and/or distribution of supplies	• highways • ports • airports • railroads

Appendix
7.3.0-B

MEMA definition of critical infrastructure

DEFINITION

Critical infrastructure is defined as systems so vital to the State of Mississippi that the incapacity or destruction of those systems would have a debilitating impact on security, economics, public health, safety, or any combination of those factors, including any infrastructure designated by the local government in their Hazard Mitigation Plan.

COMPONENTS of definition	EXAMPLES
as designated by the local government in the local Hazard Mitigation Plan	
provides general transportation	• highways • airports • shipping ports • railroads
provides telecommunications for the general public	• phones • radio stations • television stations • communication towers • underground communication lines
provides utilities to the end-user	• water • gas • waste water • solid waste • power
provides financial services	• banks
provides postal and shipping	• US Postal Service • commercial shipping services
provides for the provision of food for human use and consumption	• farms • food processing facilities
provides fuel to the end-user	• gas stations

7.3.2: Flood

Appendix A **FEMA Community Status Book Report**

Appendix B **HAZUS Stream Discharge Edits by County**

Appendix C **Mississippi HAZUS Flood Results**

Appendix D **FEMA NFIP Policy and Claims Report**

Appendix E **Repetitive Flood Loss Claims**

7.3.3: Hurricane

Appendix A **Hurricane Evacuation Routes**

Appendix B **Catagory 3 and Catagory 1 Hurricane Scenarios**

Appendix A Fire in the South

7.3.5: Tornado

Appendix A **Tornado Vulnerability Assessment**

Appendix B **History of Mississippi Tornadoes: 1950-2009**

APPENDIX 7.3.5-A
Extreme Winter Weather Summary by County

County	Winter Storm Events	Prior Event Rating	Total Property Valuation	Property Valuation Rating	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating	Vulnerability Rating
Adams	1	2	$1,223,950,965	2	460.26	33,537	72.87	3	**7**
Alcorn	8	16	$1,362,554,205	2	399.89	35,306	88.29	3	**21**
Amite	1	2	$551,676,039	1	729.6	14,234	19.51	1	**4**
Attala	5	10	$875,204,266	1	735.13	19,552	26.60	1	**12**
Benton	11	22	$429,258,506	1	406.79	7,852	19.30	1	**24**
Bolivar	9	18	$1,675,660,938	2	876.28	38,641	44.10	2	**22**
Calhoun	5	10	$478,379,959	1	586.54	14,652	24.98	1	**12**
Carroll	3	6	$477,384,315	1	627.73	10,397	16.56	1	**8**
Chickasaw	5	10	$595,864,907	1	501.56	19,184	38.25	2	**13**
Choctaw	5	10	$939,473,986	1	419.1	9,572	22.84	1	**12**
Claiborne	3	6	$333,948,991	1	486.77	12,325	25.32	1	**8**
Clarke	2	4	$656,566,293	1	691.27	19,228	27.82	1	**6**
Clay	4	8	$947,327,526	1	408.56	21,223	51.95	2	**11**
Coahoma	8	16	$1,114,166,221	1	554.15	29,002	52.34	2	**19**
Copiah	2	4	$1,022,577,563	1	776.6	31,505	40.57	2	**7**
Covington	0	0	$704,901,073	1	413.79	22,961	55.49	2	**3**
DeSoto	10	20	$9,546,160,485	10	477.86	139,399	291.72	9	**39**
Forrest	1	2	$3,166,540,912	3	466.58	79,600	170.60	6	**11**
Franklin	1	2	$303,736,260	1	564.6	8,981	15.91	1	**4**
George	1	2	$641,261,422	1	478.29	23,856	49.88	2	**5**

APPENDIX 7.3.5-A
Extreme Winter Weather Summary by County

County	Winter Storm Events	Prior Event Rating	Total Property Valuation	Property Valuation Rating	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating	Vulnerability Rating
Greene	2	4	$394,289,567	1	712.82	14,068	19.74	1	**6**
Grenada	4	8	$1,131,068,075	1	421.79	22,861	54.20	2	**11**
Hancock	1	2	$2,524,331,093	3	476.88	38,837	81.44	3	**8**
Harrison	1	2	$8,829,278,614	9	580.98	188,482	324.42	10	**21**
Hinds	4	8	$10,440,283,505	10	869.18	264,797	304.65	10	**28**
Holmes	4	8	$610,971,141	1	756	21,099	27.91	1	**10**
Humphreys	4	8	$319,451,074	1	418.09	10,527	25.18	1	**10**
Issaquena	3	6	$119,875,058	1	413.06	1,909	4.62	1	**8**
Itawamba	6	12	$795,321,474	1	532.31	23,359	43.88	2	**15**
Jackson	1	2	$6,799,517,252	7	726.9	130,668	179.76	6	**15**
Jasper	2	4	$625,751,546	1	676	19,840	29.35	1	**6**
Jefferson	1	2	$283,674,742	1	519.39	10,028	19.31	1	**4**
Jefferson Davis	0	0	$389,445,826	1	408.41	14,210	34.79	1	**2**
Jones	1	2	$2,599,492,762	3	693.82	72,390	104.34	4	**9**
Kemper	4	8	$308,960,519	1	766.13	10,716	13.99	1	**10**
Lafayette	6	12	$2,685,297,750	3	631.11	40,842	64.71	2	**17**
Lamar	1	2	$2,630,179,251	3	497.07	52,211	105.04	4	**9**
Lauderdale	4	8	$3,219,519,863	4	703.51	80,153	113.93	4	**16**
Lawrence	0	0	$754,612,482	1	430.63	15,757	36.59	1	**2**
Leake	5	10	$751,123,894	1	582.71	23,336	40.05	2	**13**
Lee	6	12	$5,139,786,847	5	449.59	78,793	175.26	6	**23**
Leflore	4	8	$1,381,981,866	2	591.93	36,431	61.55	2	**12**

APPENDIX 7.3.5-A
Extreme Winter Weather Summary by County

County	Winter Storm Events	Prior Event Rating	Total Property Valuation	Property Valuation Rating	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating	Vulnerability Rating
Lincoln	1	2	$1,452,506,260	2	585.71	36,392	62.13	2	**6**
Lowndes	5	10	$3,379,021,027	4	502.3	60,750	120.94	4	**18**
Madison	5	10	$8,320,664,510	8	717.11	87,287	121.72	4	**22**
Marion	1	2	$861,320,141	1	542.34	29,005	53.48	2	**5**
Marshall	9	18	$1,227,079,822	2	706.33	35,659	50.48	2	**22**
Monroe	5	10	$1,706,241,829	2	764.17	37,704	49.34	2	**14**
Montgomery	4	8	$354,810,564	1	406.85	11,829	29.07	1	**10**
Neshoba	4	8	$973,901,377	1	570	30,549	53.59	2	**11**
Newton	4	8	$674,626,409	1	578.03	23,742	41.07	2	**11**
Noxubee	5	10	$380,438,383	1	694.79	12,808	18.43	1	**12**
Oktibbeha	5	10	$1,960,374,583	2	457.71	41,247	90.12	3	**15**
Panola	7	14	$1,593,113,360	2	684.2	35,331	51.64	2	**18**
Pearl River	0	0	$1,984,356,116	2	811.33	59,202	72.97	3	**5**
Perry	2	4	$476,282,390	1	647.18	13,643	21.08	1	**6**
Pike	1	2	$1,481,225,270	2	408.89	44,679	109.27	4	**8**
Pontotoc	6	12	$1,099,569,352	1	497.35	28,208	56.72	2	**15**
Prentiss	7	14	$830,856,577	1	414.93	25,593	61.68	2	**17**
Quitman	6	12	$291,686,959	1	404.84	9,512	23.50	1	**14**
Rankin	4	8	$7,552,285,344	8	774.52	136,894	176.75	6	**22**
Scott	4	8	$975,674,147	1	609.08	29,850	49.01	2	**11**
Sharkey	3	6	$211,685,956	1	427.71	5,967	13.95	1	**8**
Simpson	1	2	$918,589,058	1	588.73	29,974	50.91	2	**5**

APPENDIX 7.3.5-A
Extreme Winter Weather Summary by County

County	Winter Storm Events	Prior Event Rating	Total Property Valuation	Property Valuation Rating	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating	Vulnerability Rating
Smith	1	2	$601,695,719	1	635.89	16,910	26.59	1	**4**
Stone	1	2	$578,964,353	1	445.37	16,633	37.35	2	**5**
Sunflower	8	16	$1,013,017,805	1	693.79	32,311	46.57	2	**19**
Tallahatchie	3	6	$476,867,814	1	643.92	14,191	22.04	1	**8**
Tate	10	20	$1,047,197,321	1	404.48	26,548	65.63	2	**23**
Tippah	8	16	$717,068,969	1	457.91	21,212	46.32	2	**19**
Tishomingo	7	14	$858,377,560	1	424.12	19,202	45.27	2	**17**
Tunica	10	20	$1,633,024,720	2	454.81	10,321	22.69	1	**23**
Union	8	16	$1,062,460,773	1	415.43	26,784	64.47	2	**19**
Walthall	1	2	$463,499,810	1	403.82	17,543	43.44	2	**5**
Warren	4	8	$3,168,378,449	3	586.61	50,515	86.11	3	**14**
Washington	6	12	$2,040,192,680	2	723.99	59,220	81.80	3	**17**
Wayne	3	6	$746,411,733	1	810.32	22,066	27.23	1	**8**
Webster	4	8	$415,710,109	1	422.49	10,092	23.89	1	**10**
Wilkinson	1	2	$356,478,926	1	676.7	11,072	16.36	1	**4**
Winston	6	12	$758,764,577	1	606.97	19,870	32.74	1	**14**
Yalabusha	4	8	$386,717,179	1	467.12	13,417	28.72	1	**10**
Yazoo	5	10	$951,279,601	1	919.48	29,192	31.75	1	**12**

* The population numbers highlighted were obtained from the Claritas January 20006 study. The population numbers not highlighted are Census Annual Population Estimates.

7.3.6: Earthquake

Appendix A Definition of Technical Terms

Appendix B Southwest Arm - New Madrid Fault Zone

- Potential Ground Velocity from a M7.7 Earthquake
- Spectral Acceleration at 0.3 Second Frequency
- Spectral Acceleration at 1 Second Frequency

Appendix C HAZUS-MH Earthquake Event Report

Appendix D New Madrid M7.7 HAZUS Scenarios - Probabilities of Exceeding Moderate Structural Damage:

- Bridges
- Schools
- Wastewater Facilities
- Essential Services

APPENDIX 7.3.6-A

Definition of Technical Terms

Epicenter - The epicenter is the geographic location directly above the hypocenter on the earth's surface. Ideally, the epicenter and the highest MMI values on the isoseismal map coincide; this relationship does not, however, always hold true.

Fault - Faults can be defined as a rupture in subsurface geological materials where there is relative movement on the opposing sides of the rupture. The origin of this movement is stress built up in the earth's crust from plate movement or other geological forces.

Fault Plane - The rupture along which the movement of the fault blocks takes place can be a sharp planar feature, referred to as a fault plane. In this case, the direction the fault blocks moved (up, down or sideways) can be fairly straightforward.

Fault Zone - Unfortunately, it is also common for the movement of fault blocks to take place across a zone consisting of a number of faults planes with small individual displacements. This zone of displacement is referred to as a fault zone and it can be only a few inches wide or it can consist of a series of large faults and may be measured in miles.

Hypocenter - The hypocenter is the location in the subsurface where the rupture actually took place.

HAZUS-MH - The acronym for Hazards U.S. computer code. HAZUS-MH is a standardized tool that uses a uniform approach to determining economic and social losses due to earthquake events. HAZUS-99 is the version released in 1999 and uses data derived from the 1990 census. HAZUS-MH is a multi-hazard version of the code and is scheduled to be released in 2004.

Isoseismal Map - Typically, site intensities are plotted on a map and like intensities are grouped. The groupings are separated by lines referred to as isoseismals and the map itself is referred to as an isoseismal map. Intensities are always denoted by roman numbers so as to distinguish them from magnitude values which are always in arabic numerals. The assigned intensity value for any particular earthquake represents the highest MMI value assigned in the felt area.

Liquefaction - Liquefaction is an earthquake-related hazard involving geological conditions that pose a potential hazard to structures. Liquefaction is a complex process resulting in soils losing their bearing strength (i.e. they act more like a liquid than a solid) due to seismic induced vibrations. The major concern is that during an earthquake the liquefaction soils become "liquid" and move laterally away from the foundation of buildings causing foundation failure or causing them to literally topple over.

Magnitude - There are several magnitude scales (see Stover and Coffman, 1993). All are different from intensity scales as they measure completely different aspects of the earthquake i.e. the strength of the earthquake source (Reiter, 1990). Reiter (1990, p. 34) also defines the difference between intensity and magnitude stating that "...magnitude is determined by quantitatively analyzing instrumental recordings utilizing specific, explicitly defined formulas ..." Magnitude scales were originally devised in 1934 for use in California. This scale came to be known as the Richter or Local Magnitude Scale. Although it is still used in California, it does not work very well in other parts of the country. A number of other magnitude scales were devised to make the idea more broadly applicable. Recently the trend is to standardize by using the Moment Magnitude Scale denoted as either the letter "M" or "Mw".

Modified Mercalli Intensity Scale - The size of an earthquake can be expressed in several ways, most commonly used are the various magnitude scales and the Modified Mercalli Intensity Scale (MMI). There are several intensity scales, but the MMI is most commonly used in this country. The intensity scales differ from magnitude scales in that they measure the effects of seismic waves as they are perceived by people in the "felt" area of the earthquake. The first question, for example, is usually "Did you feel the earthquake?" If the answer is "yes" then a set of questions are asked that will help the interviewer determine the level of intensity at that site (referred to as site intensity). Intensity levels vary from a MMI intensity level I, where the earthquake was not felt to a MMI value of XII which is described as total damage.

Normal Fault -. A normal or gravity fault is one where a fault block has moved downward as gravity moves a fault block down along an inclined fault plane.

Reverse Fault - A reverse fault is the opposite of a normal fault where a fault block has moved up an inclined fault plane, opposite of the movement that would be expected if gravity were the main force acting on the block.

Peak Ground Acceleration (PGA) - The maximum level of vertical or horizontal ground acceleration caused by an earthquake. The PGA is typically expressed as a percent of the acceleration due to gravity.

Spectral Response (SA or SD) - The response (acceleration or displacement) caused by an earthquake at a specific site at a specific frequency or period of vibration. The complete variation of response over all frequencies or periods is called the response spectrum. HAZUS-MH uses a standard form for the response spectrum for all situations. The SA is typically expressed as a percent of the acceleration due to gravity, and the SD is usually expressed in inches.

Strike Slip Fault - A strike-slip fault is one where the movement is largely horizontal and oriented in the same direction as the fault trends. Normal faults are the result of an extension of the earth's crust, reverse faults are a result of a shortening or compression of the earth's crust and strike-slip faults result from forces acting in a horizontal fashion.

7.3.7: Extreme Winter Weather

Appendix A Extreme Winter Weather by County

7.3.9: Dam/Levee

Appendix A State of Mississippi Dam Inventory

Appendix B High Hazard Dams with Census Tracts

Appendix C State of Mississippi Levee Inventory

7.3.11: Growth Trends

Appendix A **Demographic**

Appendix B **2010 Mitigation Actions**

Appendix C **2007 Mitigation Actions Update**

7.5.3: Prioritizing Local Technical Assessment

Appendix A STAPLE/E Review and Selection Criteria

Appendix B Project Profiles/Progress Reports

APPENDIX 7.5.3-A
Prioritizing Alternatives

The Mississippi Hazard Mitigation Council used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) criteria to select and prioritize the most appropriate mitigation alternatives for the plan. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on the state's capabilities.

The table below, provides information regarding the review and selection criteria for alternatives.

STAPLE/E Review and Selection Criteria
Social
• Is the proposed action socially acceptable to the state and its communities • Are there equity issues involved that would mean that one segment of the state or its communities are treated unfairly? • Will the action cause social disruption?
Technical
• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other state goals?
Administrative
• Can the state implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political
• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal
• Is the state authorized to implement the proposed action? • Are there legal side effects? Could the activity be construed as a taking? • Will the state be liable for action or lack of action? • Will the activity be challenged?
Economic
• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the state? • What burden will this action place on the state and/or local tax base? • What are the budget and revenue effects of this activity? • Does the action contribute to other state goals? • What benefits will the action provide?

STAPLE/E Review and Selection Criteria
Environmental
• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet federal, state and regulatory requirements? • Are endangered or threatened species likely to be affected?

In formulating a mitigation strategy, a wide range of activities were considered in order to help achieve the goals and to lessen the vulnerability of the State of Mississippi to the effects of natural hazards.

In addition, the anticipated level of cost effectiveness of each measure was a primary consideration when developing mitigation actions. Because mitigation is an investment to reduce future damages, it is important to select measures for which the reduced damages over the life of the measure are likely to be greater than the project cost. For structural measures, the level of cost effectiveness is primarily based on the likelihood of damages occurring in the future, the severity of the damages when they occur, and the level of effectiveness of the selected measure. Although detailed analysis was not conducted during the mitigation action development process, these factors were of primary concern when selecting measures. For those measures, that do not result in a quantifiable reduction of damages, such as public education an outreach, the relationship of the probable future benefits and the cost of each measure was considered when developing the mitigation actions.

Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to natural hazards. The SHMC and Technical Support Stakeholders developed strategies through subject matter expert breakout groups by hazard at Council meeting number three. Once projects were brainstormed, weighed against the criteria noted above and fully vetted, each subject expert breakout group presented its recommendations to the full Council and technical stakeholders.

Following the report outs, strategy descriptions were staged throughout the meeting room and the full Council and stakeholders used a multi-dot voting process to prioritize the mitigation strategies based on the criteria described above. Each participant was given a limited number of dots to assign to the comprehensive collection of strategies from all of the hazard break out groups, forcing participants to select the projects they saw as highest priority. Based on the number of dots assigned to projects, ranges were developed to prioritize into categories of High, Medium and Low.

Actions were given a ranking of high, medium or low, with the following general meanings:

- High - Activities for which funding sources are readily available or are vital to the state's reconstruction or recovery efforts.
- Medium - Assigned to activities that are identified as long-range in nature or for which funding is not presently available but may be in the relatively near future.
- Low - Assigned to activities for which there is no clear method of funding, or may not ever be funded, and are not critical to the state's reconstruction and recovery efforts.