Table of Contents

1. Introduction

    1.1 State Characteristics

    1.2 Plan Adoption

    1.3 Compliance with Federal Laws and Regulations

2. The Planning Process

    2.1 Documenting the Planning Process

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

    2.3 Integration with Other Planning Efforts, Programs and Initiatives

3. Risk Assessment

    3.1 Identifying Hazards

    3.2 Hurricane Risk Assessment

    3.3 Tornado Risk Assessment

    3.4 Flood Risk Assessment

    3.5 Extreme Winter Weather Risk Assessment

    3.6 Earthquake Risk Assessment

    3.7 Wildfire Risk Assessment

    3.8 Dam/Levee Risk Assessment

    3.9 Drought

    3.10 Growth and Trend Analysis

4. Comprehensive State Mitigation Program

    4.1 Goals and Objectives

    4.2 State Capabilities

    4.3 Local Capability Assessment

    4.4 Mitigation Measures

    4.5 Funding Sources

5. Local Mitigation Planning

5.1 Local Mitigation Planning Coordination

5.2 Local Plan Integration

5.3 Prioritizing Local Technical Assistance

6. Plan Maintenance Process

6.1 Monitoring, Evaluating and Updating the Plan

6.2 Monitoring Progress of Mitigation Actions and Assessment of Mitigation Actions

7. Appendices

7.2 The Planning Process
The Five Minute Survey

7.3 Risk Assessment

7.3.0 Risk Assessment
A - Definition of Critical Facility
B - Definition of Critical Infrastructure
C - Critical Facilities2 final
D - Hazard Ranking Worksheet

7.3.2 Hurricane
A - Evacuation Zones (Hancock, Harrison and Jackson Counties)
B - Hurricane Scenarios: Category 3 and Category 1

7.3.3 Tornado
A - Assessing Tornado Vulnerability by Jurisdiction
B - State Inventory
C - HAZUS Facility Summary

7.3.4 Flood

7.3.5 Extreme Winter Weather

7.3.6 Earthquake

7.3.8 Dam/Levee

7.4 Comprehensive State Mitigation Program

7.5 Local Mitigation Planning

7.6 Plan Maintenance

Introduction

The State of Mississippi is committed to saving lives and reducing future losses when confronted with natural hazards throughout the State. These natural hazards include:

- Hurricanes
- Flooding
- Tornados
- Dam and Levee Failures
- Winter Storms
- Earthquakes
- Wildfires

To establish a framework in which effective hazard mitigation initiatives can be implemented, the State of Mississippi has completed this "State of Mississippi Standard Mitigation Plan". This plan is an update of the Plan completed in 2004 by the Mississippi Emergency Management Agency Mitigation Bureau in cooperation with the Department of Homeland Security, FEMA Region IV. This Plan is completed in accordance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, enacted under the Disaster Mitigation Act of 2000.

In addition to the "Standard Mitigation Plan", the State of Mississippi is completing an upgrade of the Plan in the "State of Mississippi Enhanced Hazard Mitigation Plan". This additional initiative will establish an approach to hazard mitigation that will provide for even more effective strategies for saving lives and reducing future losses. The scheduled completion date for the Enhanced Plan is by the end of the year 2007.

Completion of these plans is an effort necessary to ensure effective hazard mitigation and is therefore an effort worthy of the full attention of the stakeholders involved. The completion of the "State of Mississippi Standard Mitigation Plan" is a pre-requisite for receiving some Federal disaster assistance; including public assistance and mitigation funds. This disaster assistance includes Hazard Mitigation Grant Program Funds that are available to the State of Mississippi, Tribes, Cities and Counties. These funds can be used to save lives and reduce future losses by planning for mitigation and implementation strategies.

To guide in the development of the Plan, Governor Haley Barbour established, by executive order, a State of Mississippi Hazard Mitigation Council. 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.

The Hazard Mitigation Council not only gave guidance in the development of the Plan but also provide for an integrated plan that is coordinated with pertinent State and Local agencies, departments, and focus groups. The Council enlisted the assistance of technical committees and technical representatives from Federal, State and Local agencies in the development of the Plan.

The “State of Mississippi Standard Mitigation Plan” includes a comprehensive approach to hazard mitigation. 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 “State of Mississippi Standard Mitigation Plan” has been completed with 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 will serve as a guide for hazard mitigation activities and provide 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, but at least every three years.

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 48,430.19 square miles. According to the 2005 Census, the state is 31st among other states with a population of 2,915,696. The name Mississippi means "Great River." This is derived from Objibwe, a Native American or Algonquian language. 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 of Mississippi 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, the state has much to offer.

Mississippi's flag was first adopted in an 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 differrent 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

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State Capitol

The Mississippi Sate 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 redition of a blind folded lady which represents "Blind Justice." The four paintend scense 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://www.ls.state.ms.us/htms/cap_info.htm 2007

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 Prairie: 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 some what 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 included 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 divided into 10 different climate zones. Figure 1.1.2 shows each climate division. The climate regions are as follows: 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. In general, the state is located in the humid subtropical climate region. This region is characterized by long, hot summers, temperate winters and rainfall that is evenly distributed throughout the year. 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 was set on January 30, 1966, in Corinth, Miss. The temperature reached minus 19 degrees.

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

Recreation

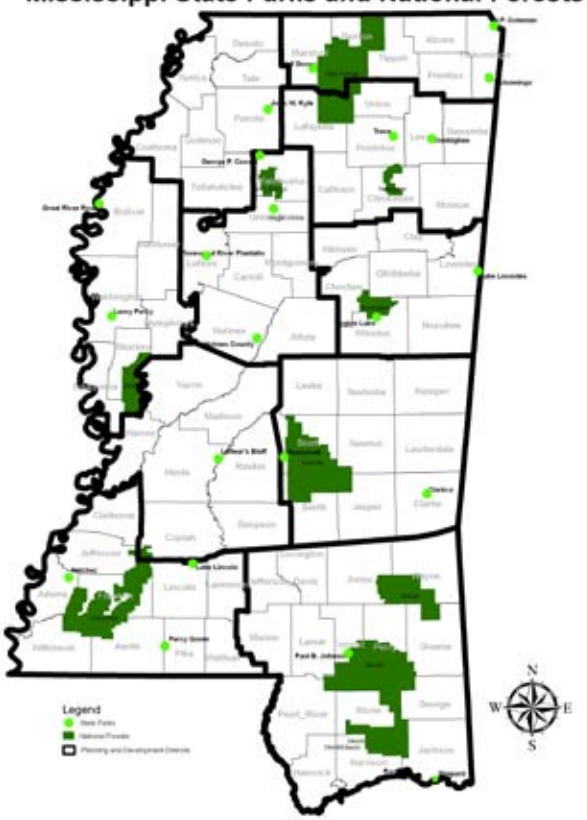
The State of Mississippi is home to over 20 state parks (Figure 1.1.3), which are easily accessible to the public. Each park offers a variety of recreational activities such as boating, wildlife watching, fishing, hiking, and swimming. It was estimated by a 2001 U.S. Fish and Wildlife Service Survey that approximately one million people participated in a wildlife-associated recreation activity. This indicates that approximately 35 percent of the population participates in wildlife related recreation in the State of Mississippi.

In a 2001 study by the U.S. Department of Commerce, almost $1 billion were contributed to the state economy as a result of recreational activites. 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 has 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

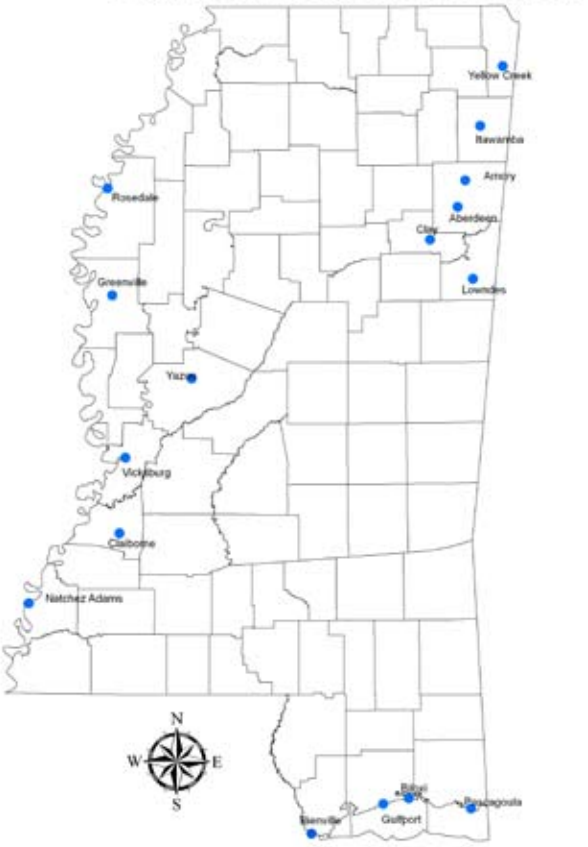
Mississippi's highway network includes approximately 73,500 miles and more than 16,000 bridges under the jurisdiction of federal, state, and local governments. The state's highway network characteristics (support the view of Mississippi as a rural state). The Mississippi Department of Transportation (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 he 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. Of this total, seven provide state residents with regularly scheduled airline service. A large amount of Mississippi's population is within one-hour drive. 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 2006 estimated population of Mississippi is 2,910,540. This number indicates a 2.1 percent increase from the 2000 figure of 2,848,753. 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 (286.0), Harrison (332.5) and Hinds (285.5).

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 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.
- 48.3 percent of the population is male.
- 51.7 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 Mississippi Development Authority, the populations of the top seven cities in Mississippi are:

- Jackson 180,455
- Gulfport* 70,978
- Biloxi* 51,184
- Hattiesburg 46,511
- Greenville 37,019
- Meridian 38,044
- Southaven 36,047

* Does not include Post- Hurricane Katrina figures.

In late August 2005, the worst natural disaster in United States history struck Mississisppi. This disaster was Hurricane Katrina. It affected (and to date is till 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 ha 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 2005 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

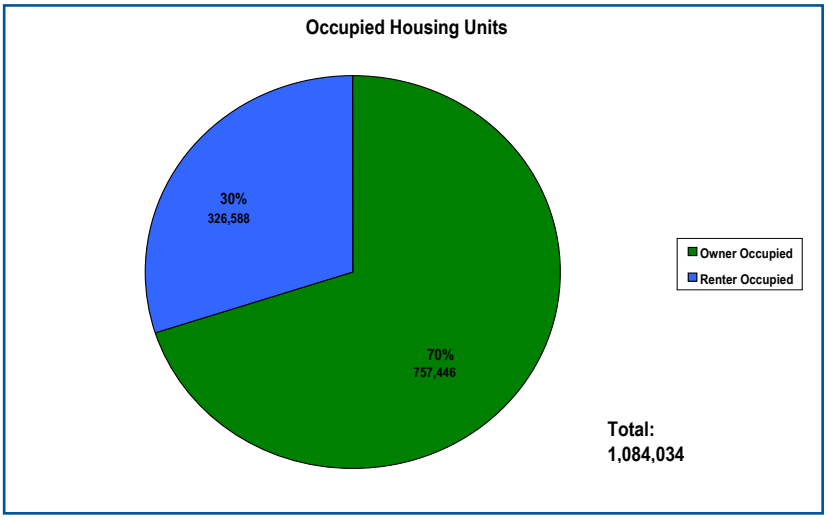
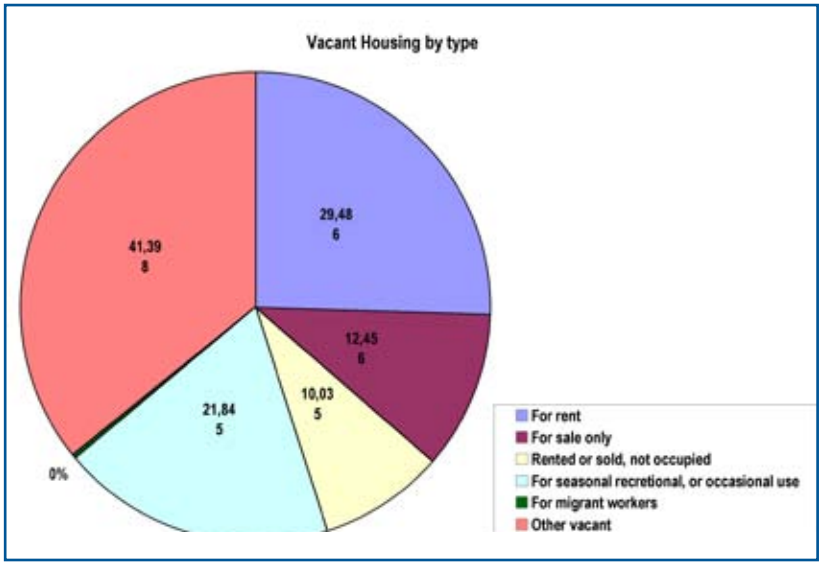


Figure 1.1.6



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

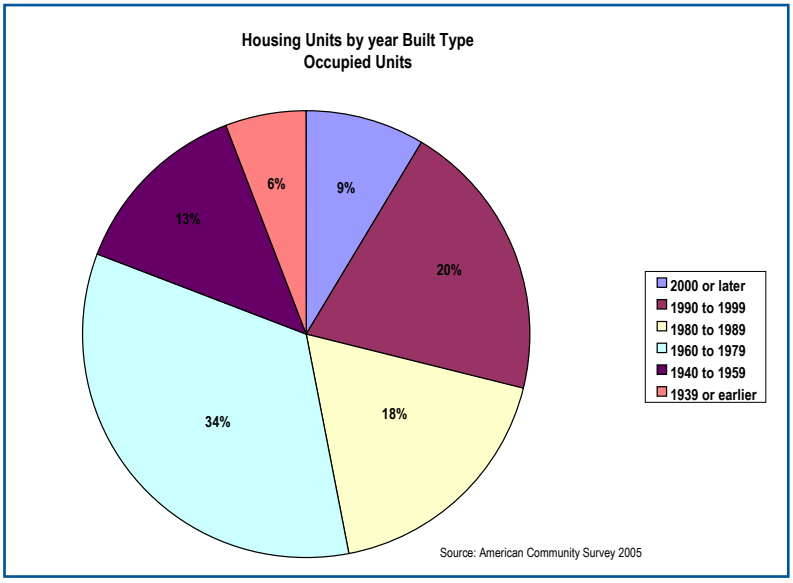
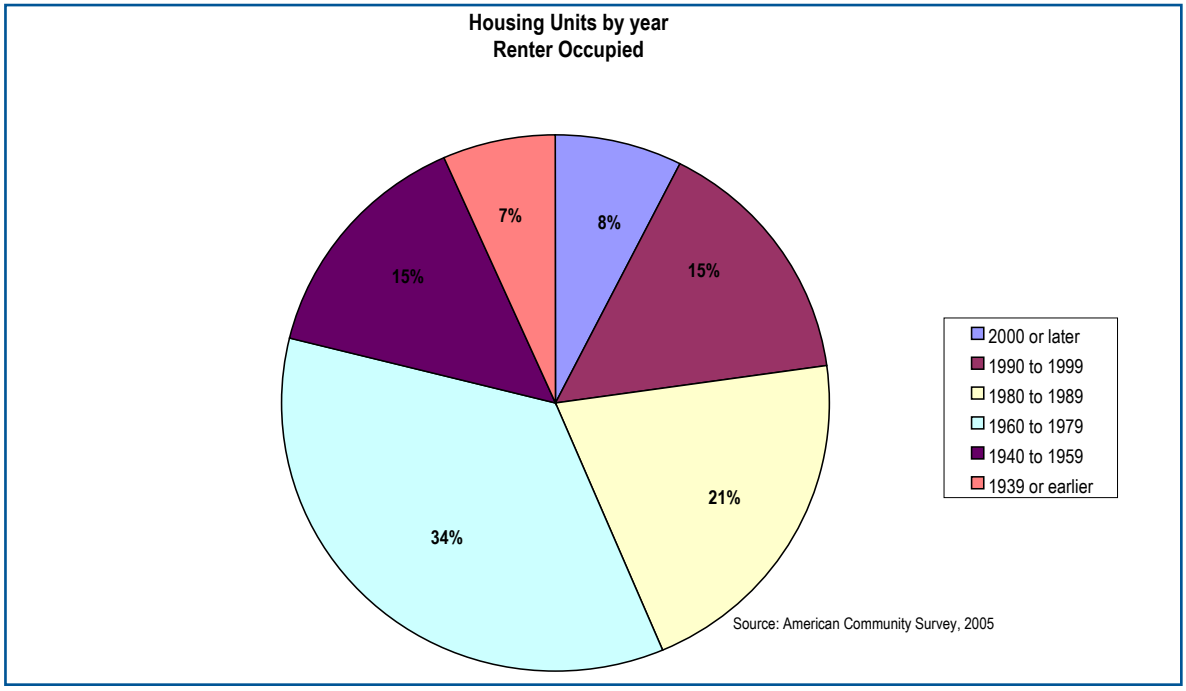
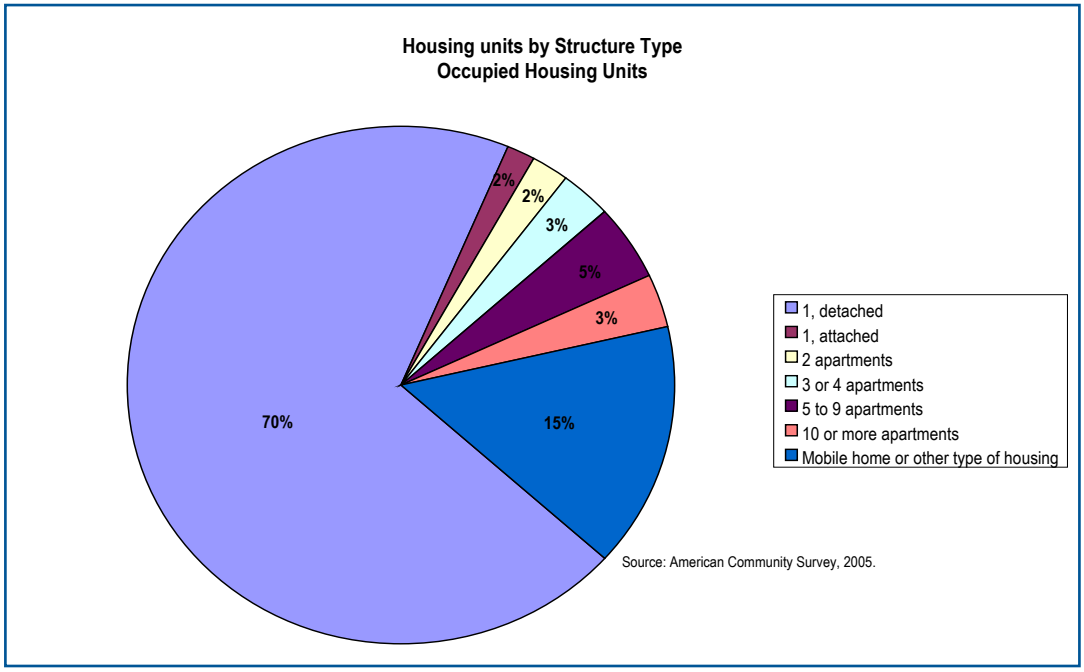


Figure 1.1.8



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 years1990 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



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 our 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 Gurumman 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). Production at the $1.3 billion plant is 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.

Companies do not choose to locate where there is no skilled workforce or those that are 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 relating to climate and physiography. These regions pose different levels of threats as it relates to hazards. 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 worse disasters in U.S. history occurred along the State's coastline in August 2005. This disaster, Hurricane Katrina, destroyed homes as well as entire communities. Many areas of the Delta lie near the Mississippi River which makes it ideal for flooding after large amounts of rain. As it relates to climate, the state is characterized by long, hot summers and temperate winters. 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 winters, 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 cultural 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 billion dollars are contributed to the economy based on these type activities. In the aftermath of Katrina, the tourism and transportation industries were greatly affected. There were a number of road and bridge closures, extensive damage to casinos, state parks being permanent closed and other devastating impacts. The population of the state increased from 2,848,753 to 2,910,540. This marked an increase of 2.1 percent. As the population continues to increase; the threat to loss of life and property damage grows as well. It is for this reason and the aforementioned, that this plan takes into account the efforts of local government and addresses all issues as it relates to hazards 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 will be submitted to the Governor's Authorized Representative (GAR) for review and recommendation. From here it is sent to Governor Haley Barbour for adoption by the State of Mississippi under the executive powers of the Governor.

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, Unifom 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.

2.1: 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 planning is a process for states and communities to identify policies, activities and tools for implementing mitigation actions. Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event. This process has four basic steps or phases as listed below:

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

Phase I: Organization of Resources

Identification and organization of available resources in order to meet today's challenges in the most efficient manner was one of the Mississippi Emergency Management Agency's (MEMA) top priorities in development of the 2007 Standard Hazard Mitigation Plan. While mitigation groups had existed within different pockets of government and volunteer organizations in the past, MEMA personnel felt that establishment of a formal, statewide hazard mitigation council would best serve the people of Mississippi by providing a platform from which an integrated statewide plan could be developed. This council, which was established through Executive Order 985 under the hand of Governor Haley Barbour and which is discussed in detail in the next section of this report, is the representation of Mississippi's single greatest resource: its people.

Both public and political understanding and support of the need for planning hazard mitigation actions are expected to be gained with the development of the Mississippi Hazard Mitigation Council. 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.

It is expected that the Council will remain intact indefinitely and that it will 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.

In addition to the Hazard Mitigation Council, MEMA also established a well-rounded team of state employees and consulting agencies to serve as plan developers for the 2007 Hazard Mitigation Plan. Through public involvement activities as well as workshops and meetings, the plan developers detected a higher level of community support for hazard mitigation planning than in years past. Many stakeholders and emergency response organizations and agencies with existing mitigation plans were found to have already begun improving their processes and were eager to participate in and contribute to a statewide hazard mitigation planning effort. This renewed interest and change in procedures for most state agencies, volunteer organizations, and a large segment of the general public can most likely be directly contributed to the physical, mental, economical, and environmental devastation that thousands of Mississippians are continuing to bear as a result of Hurricane Katrina. Although Katrina also created an urgency and interest in planning and preparedness efforts relating to hurricanes, the State Hazard Mitigation Plan developers were careful to continually broaden the planning scope and encourage participation from those who work to mitigate hazards that historically have had a much more narrow impact upon the state.

We learned much from Hurricane Katrina. More than ever our state's citizens feel a sense of commitment and the shared sense that some things need to change and some things can be improved. Lessons learned from Katrina spilled into arenas and disciplines as diverse as mental health needs and national insurance policies. The recognition of the need for more feasible financial assistance strategies, better planning and more training, and increased education for officials as well as the general public – locally and at the highest of levels – was duly noted. And thus, community support of a statewide hazard mitigation plan remains high.

Phase II: Assessment of Risks

Risks faced by the State of Mississippi are varied. 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 bases 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 Hazard 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 2007 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, understanding and shared goals. 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.

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. The majority was eager to participate and moved quickly to embrace MEMA's vision of a comprehensive state mitigation plan and program.

Team Approach

As specified in the Maintenance section of the 2004 Mississippi Hazard Mitigation Plan, the update process began approximately 12 months prior to submittal of the 2007 Plan to the Federal Emergency Management Agency. During the first months, MEMA worked to secure a joint-venture contract with three consulting firms: Neel-Schaffer, Inc., Dewberry & Davis, Inc., and AMEC, Earth and Environmental, Inc.

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. To guide actions necessary for achieving this goal, a work group of plan developers was formed and remained intact throughout the update process. The project was also clearly branded for quick and easy identification.

Mississippi's Enhanced Hazard Mitigation Plan

"Strategies for Saving Lives and Reducing Future Losses"

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, and the consulting firms of Neel-Schaffer, Inc., Dewberry & Davis, Inc., and AMEC, Earth and Environmental, Inc.

Throughout the process, the plan developers guided the process by setting agendas and goals; developing strategies for achieving targeted results; gathering and evaluating data for use in planning new mitigation strategies; facilitating effective participation and communication with mitigation specialists from all levels of government and the private sector; and producing the final draft of the 2007 Mississippi Hazard Mitigation Plan.

Development of the State's First Gubernatorial Mandated Hazard Mitigation Council

One of the first tasks undertaken by the plan developers was to seek support from Governor Haley Barbour in the development of a state Hazard Mitigation Council. By seeking an Executive Order, this action denoted a change from previous years' planning in that the Mitigation Council is now a formal, tightly structured, highly visible entity.

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 will bolster development, support on-going maintenance, and improve planning efforts.

The Hazard Mitigation Council was created through Executive Order # 985.

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
GOVERNOR

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

The Hazard Mitigation Council met three times during the updating of Mississippi's 2004 Hazard Mitigation Plan. Meetings one and two followed more traditional formats. Meeting number three served as a brainstorming/working session to engage not only the Mitigation Council, but also individuals with expertise and diverse backgrounds in a wide array of mitigation strategies. This workshop allowed for exploration of new ways of working together to address needs.

The first meeting provided an overview of the mitigation planning process, an explanation of how Council members could contribute to developing a stronger mitigation plan, and a call for members to provide updated listings of state capabilities. To assist the Hazard Mitigation Council members in attendance, the plan developers prepared educational materials – including a power point presentation – designed to quickly convey the purpose and need of various requests. Examples of these materials are available from MEMA in the Planning Development Process Notebook. The sign-in sheet and minutes of the meeting are also included there.

The Mississippi Hazard Mitigation Council members met for the first time on May 16, 2007.

The second meeting provided a status report of the risk assessment, the plan goals and objectives, and a review of the local and state capabilities assessment, as well as time for open discussion. Experts from various private, state and local entities statewide, as well as representatives from the Federal Emergency Management Agency (FEMA), were invited for the purpose of increasing integration with ongoing State hazard mitigation planning efforts.

Approximately one month later, the Hazard Mitigation Council and individuals with expertise in mitigation, met again. One task for the group of 32 individuals was to review local state capabilities assessments as provided during the first meeting.

During its third meeting, MEMA solicited participation from industry associations and volunteer agencies, as well as from mitigation planners and specialists representing all levels of governments and numerous specialized areas. A status report of 2004 mitigation actions and local mitigation action analysis was provided along with educational materials. Copies of these materials are included in the Planning Development Manual. Afterward, participants were divided into focus groups by hazard. The purpose was to stimulate open discussion for updating existing mitigation actions, identifing lead agencies that might take ownership of particular actions, prioritizing the actions, and then developing a draft strategy for maintaining identified actions. A copy of the third Council meeting agenda and a copy of the sign in sheet are included in the Planning Development Process Notebook.

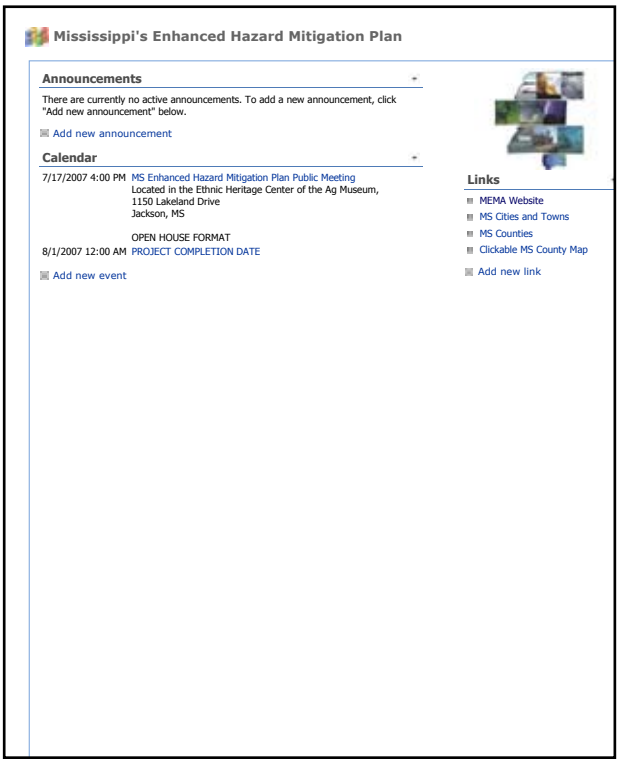
Meeting three of the Hazard Mitigation Council provided an open forum session in which participants worked together to begin laying the groundwork of a comprehensive Hazard Mitigation Plan for Mississippi.

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;
- development of Mississippi's State Mitigation Strategy, which includes development 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 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 Hazard 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 sight on the Internet.



This access allowed for transparency in the planning process by proving opportunites 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 members, the plan developers' contact information was also listed on the site. In all, the site received approximately 3,000 hits from March 2007 until August 2007.

A concerted outreach effort via the Internet was made to inform Mississippi businesses and industry associations, as well as professional associations and non-profit groups. From this outreach effort, new partners (such as the Mississippi Manufactures Association and Mississippi Psychological Association) were identified and added within the communication loop.

Public Participation Outreach Efforts

Associations

In an effort to engage hazard mitigation stakeholders, plan developers attended various Mississippi based conferences and provided information and accepted comments for use in the development of the 2007 Hazard Mitigation Plan. Conferences attended and objectives of each are listed here (Table 2.2.2):

Table 2.2.2
Conference Outreach
Public Participation

Conference	Date/Location 2007	Purpose
MS Association of Planning and Development Districts	April 24 – 26 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	May 1 – 3 Bay St. Louis, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and invite participation through MEMA booth
MS Chapter of the American Public Works Association	May 11 Choctaw, MS	Present purpose and need for updating MS's Hazard Mitigation Plan; MEMA is placed on conference agenda
MS Association of Supervisors	June 18 – 21 Biloxi, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and receive comments; MEMA is placed on conference agenda
Mississippi Municipal League	June 25 – 28 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 25 – 27 Biloxi, MS	Present purpose and need for updating MS's Hazard Mitigation Plan and receive comments; MEMA is allotted a position on conference agenda

MEMA participated in roundtable discussions during the Mississippi Municipal League's Annual conferece.

During the annual conference of the Mississippi Association of Planning and Development Districts, plan developers provided information and invited feedback on local capabilities, technical support needs, and existing mitigation strategies.

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. 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. This can be found in the Planning Development Notebook.

Input was also sought from state agencies that were not named to the Hazard Mitigation Council. These agencies were sent personalized letters from MEMA's executive director, Mike Womack, inviting them to participate in other ways. Documentation of the letter sent, as well as a listing of agencies contacted, can be found in the Planning Development Process Notebook.

Meeting with the Mississippi Band of Choctaw Indians

Plan developers met with representatives of the Mississippi Band of Choctaw Indians (the Tribe) in Choctaw, Miss., Tuesday, June 19, 2007. Historically, the Tribe's hazard mitigation planning efforts have been included within Neshoba County's plan.

Currently the Tribe has a statutory framework (known as Ordinance 50) that

- establishes the emergency management team of the Directors of the Fire Department, the Police Department, the Health Department, and Facilities;
- provides equipment for facility buildings in each community designated as emergency shelters (includes generators);
- significantly improves communications; and
- provides for a draft risk analysis.

Tribal mitigation activities resulting from review and evaluation of events during and after Hurricane Katrina are either in the works or completed. They include:

- increased training opportunities;
- increased purchases of emergency related equipment;
- improved 'on the ground' communications for effective contact of first responders;
- recent aquisition of communication equipment that has been installed in all faculty buildings (radios);
- evaluation of policies for addressing staff burnout, which will likely be implemented.

A personal invitation was extended to the Tribe to attend the Hazard Mitigation Planning public meetings June 28th and July 17th in Jackson, and printed materials indicating the time, location, purpose, and need for the meetings were provided.

Public Meetings

The general public (with emphasis placed on notification by email of business and industry association representatives) was invited to participate in two open forum public meetings. MEMA's first meeting was held Thursday, June 28, from 4 p.m. until 7 p.m. at the Mississippi Agriculture and Forestry Museum, which is centrally located in Jackson, Miss. This 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. Through face-to-face communication, several misconceptions about hazard mitigation were corrected as detailed explanations of how mitigation can save lives and reduce future losses were openly discussed. Although attendance at the meeting was very low with only eight individuals actually attending the meeting, those that participated were highly committed to the process and worked with plan developers to discussed mitigation issues in depth.

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 2007 Hazard Mitigation Plan.

In addition to feedback recieved during the meeting, over 100 individuals participated in the public involvement process via the internet. 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 Supervisors, thus providing easy access for large segments 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 for review. 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 action steps and to provide suggestions for new or amended action steps. Information received from approximately 110 completed forms is tallied on the subsequent page.

MEMA's second public meeting, held Tuesday, July 17, 2007 at the Mississippi Agriculture and Forestry Museum in Jackson, provided an opportunity for review and comment of the draft 2007 Hazard Mitigation Plan. Participants were invited to review the draft plan at thier leisure and provide feedback to the plan developers. A total of 24 individuals were present, includeing a camera crew from WJTV-Channel 12, a local TV news station. Visitors were invited to make suggestions or write questions on provided comment sheets or directly on the pages of the draft plan. This type of public participation allowed visitors to physically take part in the develpment process.

For both meetings, information concerning the times, dates and locations was sent by email 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, emails, meetings, and personal invitations. Documentation of these outreach efforts may be reviewed upon request from MEMA in the Public Involvement Process Notebook.

Mississippi's Enhanced Hazard 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			
• Objective 1.1 Protect critical facilities, infrastructure, and systems	96 %	1 %	3 %
• Objective 1.2 Reduce the number of at-risk and repetitive loss properties	82 %	15 %	3 %
• Objective 1.3 Reduce potential damage to future buildings and infrastructure	73 %	22 %	5 %
• Objective 1.4 Develop and maintain hazards-related research, modeling, data, and analysis to support program and project implementation	70 %	24 %	6 %
• Objective 1.5 Identify needs and appropriate projects from post-disaster damage assessments	80 %	17 %	3 %
• Objective 1.6 Preserve, create, and restore natural systems to serve natural mitigation functions	81 %	16 %	3 %
• Objective 1.7 Protect historic and cultural resources	65 %	28 %	7 %
Goal 2: Build and enhance local mitigation capabilities			
• Objective 2.1 Support and provide guidance for local hazard mitigation planning and projects	83 %	16 %	1 %
• Objective 2.2 Encourage the adoption, improvement, and enforcement of local codes, ordinances, and land use planning	81 %	14 %	5 %
• Objective 2.3 Provide and promote technical assistance and training to local governments	79 %	18 %	3 %
• Objective 2.4 Identify and provide financial incentives and funding opportunities	77 %	19 %	4 %
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	74 %	20 %	6 %
• Objective 3.2 Promote and utilize existing hazard and mitigation education programs from state, federal, and nonprofit sources	67 %	29%	4%
• 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	70 %	20 %	10 %
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	86 %	11 %	3 %
• Objective 4.2 Institutionalize hazard mitigation as integrated state policy	66 %	24 %	10 %
• Objective 4.3 Implement, monitor, and assess the effectiveness of the mitigation strategy and promote successes	72 %	21 %	7 %

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.

Integration with ongoing hazard mitigation planning efforts at the local, state and federal levels has increased since MEMA's development of the 2004 Hazard Mitigation Plan. In addition to oversight of the HMGP, FMA, PDM, floodplain management, Earthquake Program, and mitigation planning programs, MEMA considers 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. The Mississippi Development Authority partners with MEMA in joint funding of flood acquisition and drainage projects, and in stormshelter/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 a 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 of Transportation and Mississippi Department of Public Safey on emergency evaculation 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 conjuntion 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).

2.3.2 Integrating Planning Information with Other Mitigation Partners

MEMA's efforts to identify and engage mitigation partners continue to increase. New efforts include engaging traditional partners through unique public involvement outreach efforts. For example, to assist the newly formed Mississippi Hazard Mitigation Council, 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 below lists those agencies/associations invited to participate in the development of the 2007 Hazard Mitigation Plan.

Table 2.3.2.1

Name	Title	Organization
Stuart Williamson	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
Bob Durrin	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,
Brian Adam	Director	Hancock County Emergency Management Agency

Name	Title	Organization
Rupert Lacy	Deputy Director	Harrison County Emergency Management and Homeland Security Agency
Albert Loper	Director	Jackson County Civil Defense
Micheal Bograd	State Geologist, Office of Geology	Mississippi Department of Environmental Quality
Steve Champlin		Mississippi Department of Environmental Quality
Gaylan McGregor	State Dam Safety Coordinator	Mississippi Department of Environmental Quality
Charles Cupit	Hurricane Program Manager	Mississippi Emergency Management Agency
Al Goodman	State NFIP 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	Area Coordinator	Mississippi Emergency Management Agency
Jimmy Mordica	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. Beginning in 2006, MEMA and MCDEMA worked jointly with emergency management professionals in Alabama to organize the first Bi-State Hurricane Conference. The MS-AL Bi-State Hurricane Conference proved to be highly successful and is scheduled to continue with the second meeting set for Mobile, Ala., in May 2008. A copy of the MS-AL Bi-State Hurricane Conference agenda is included in the Planning Development Process Notebook.

Today, MEMA and MCDEMA enjoy close working relationships while expanding 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. This year, for the first time, 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. A copy of the MCDEMA Annual Conference agenda is also located in the Planning Development Process Notebook.

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

The 2007 Annual MCDEMA conference was attended by some 300 mitigation authorities representing most of the 82 counties within the state. In addition, various public and private organizations such as hospitals, faith based organizations, communication specialists, and voluntary responders, were also in attendance. Educational opportunities included (but were not limited to) sessions on the following:

- Statewide Hazard Mitigation Planning Initiative
- The Mississippi Levee System
- The Importance of Unified Legislative Efforts
- Catastrophic Planning Initiative
- Emergency Support Functions – How State and Local ESFs Work with the Federal ESFs in a Disaster
- Statewide Interoperability Communications Plan – What It Will Mean for Local Response

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.

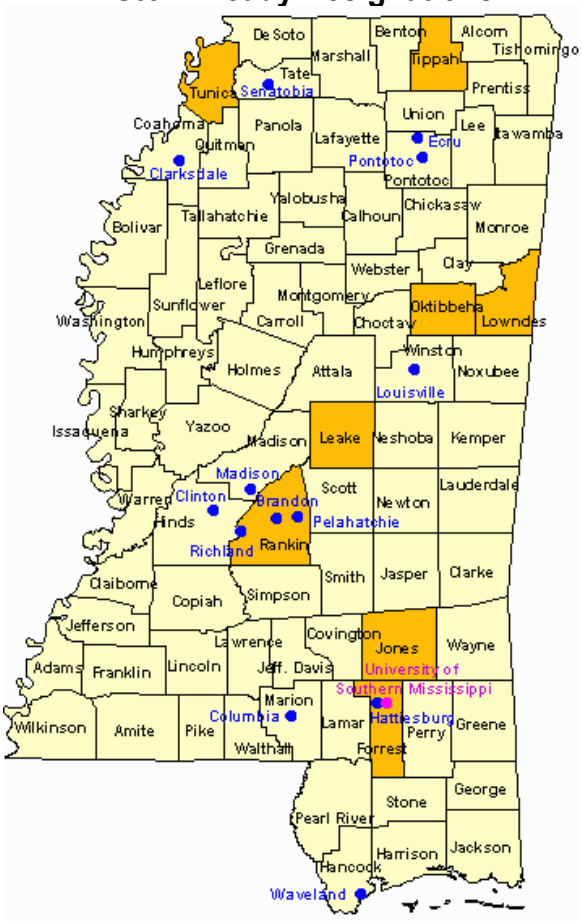
Some 276 Mississippi communities participate in the National Flood Insurance Program (NFIP) and 19 participate in the Community Rating System (CRS). The MEMA State NFIP Coordinator and the Floodplain Management Bureau conduct approximately 25 workshops and public meetings each year for the purpose of promoting the NFIP program. Additional workshops are conducted to promote the CRS program. The workshops have been instrumental in increasing the number of communities participating in both of these programs and in raising local floodplain development compliance standards. 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 in removing homes and businesses from the 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 8 counties, 13 communities and one university, as well as the many mitigation measures included in that program and its plans (Figure 2.3.2.1). Mema has also funded 3,000 storm shelters and safe rooms and 42 community shelters throught the Hazard Mitigation Grant Program (HMGP). MEMA has 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, Volunteer Organizations Active in Disaster (VOAD), about the importance of mitigation.

Figure 2.3.2.1
StormReady Designations



Gold Shading: Storm Ready County		Blue Dot: StormReady Community		
Forrest	Oktibbeha	Brandon	Hattiesburg	Pontotoc
Jones	Rankin	Clarksdale	Louisville	Richland
Leake	Tippah	Clinton	Madison	Senatobia
Lowndes	Tunica	Columbia	Pelahatchie	Waveland
		Ecru		
University				
Southern Mississippi				

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

2.3.3 Mitigation Programs and Measures

The following is a synopsis of the state, FEMA and other programs and initiatives that are integrated into the SHMP 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 statutues or regulations or (2) a material change in any State law, organization, policy, or State agency operations. The State will obtain approval for the ammendment 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 Sashington 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 intergrating 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 reciptant 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 the new flood zones as well as to upgrade the homes to the new International Building Codes. Also the funds will be used to buy-out property to possibly 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) 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, as well as all county plans, have been or are in the process of being updated utilizing post-Katrina lessons learned as well as incorporation of the guidelines contained in the National Response Plan.

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 consolidate 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 Services (MFS) has responsibilities for Firefighting (ESF4) duties during and following a disaster. MFS is in the process of developing the Disaster Hazard Mitigation and Preparedness Plan (DHMPP). This plan will 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 MFS 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 Hazard Mitigation Plan.

Hazard Mitigation Grant Program (HMGP)

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 retrofit of critical facilities identified in the 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 wthstand 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 form 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. Demolition-rebuild will be an extremely effective alternative under the Flood Reform Act of 2004, as the state has completed one demonstration demo-rebuild.

Public Alert and Warning System – A special initiative funded through 5 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 to identify and plan feasible mitigation projects, and incorporate those projects into their Local MitigationPlans (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 these 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.

Hazard Mitigation Technical Assistance Program

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 assistances 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 ad 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 Flood Mitigation Assistance Grant Program (FMA), the Increased Cost of Compliance Insurance Program (ICC), and the Flood Map Modernization Program, all of which serve as mitigation incentives for reducing the cost of flood losses.

Community Assistance Program (CAP) – 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 to manage the NFIP CAP program. The MEMA Executive Director, as the State NFIP Coordinator, designates the State NFIP Program Manager.

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

The 276 local communities currently participating in the plan. Mitigation capability assessments have been conducted in all of these communities to determine and address shortfalls. Funding assistance is provided to these communities to ensure that local administrators are trained to become Certified Floodplain Managers (CFM). Funding is also provided for flood mitigation planning and projects.

Participating communities with low to moderate flood risk receive compliance visits ever five years. The state has been successful in employing post-disaster recovery opportunities such as the Hazard Mitigation Technical Assistance Program to conduct wide-scale compliance visits of low risk communities. Over 150 of the low risk communities have been evaluated within the last three years. The majority of these communities have adopted the state model ordinance and community leaders/ administrators have attended regional workshops.

The State NFIP 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.

The Association of Floodplain Managers of Mississippi (AFMM) was established in 2001 as a state chapter of the Association of State Floodplain Managers. The state chapter currently has over 100 members and in 2004 hosted the annual international 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.

Over 7,500 insured and uninsured repetitive loss structures have been mitigated in the past 10 years through acquisition, elevation or flood protection projects.

Flood Mitigation Assistance (FMA) Program – The Flood Mitigation Assistance (FMA) program provides funding to assist states and communities to accomplish flood mitigation planning and to implement measures to reduce future flood damages to structures. This program is authorized under the 1994 Act. These funds can be used before disasters strike.

The FMA program provides annual funding based upon a risk formula. The funding is derived from policy premiums and other program income. Examples of eligible activities for planning grants include conduction local planning meetings to obtain citizen input; contracting for engineering or planning technical assistance; surveying structures at risk of flooding; and assessing repetitive losses. Only projects for mitigation activities specified in an approved Flood Mitigation Plan are eligible for project grants. For example, a community may determine in its plan that acquisition of structures would be the preferred alternative for floodway areas, while elevation may be a more appropriate solution in other areas of the floodplain.

The state has received on average $275,000 - $325,000 annually in FMA funds. Since the inception of the program, funds have been used to develop plans for CRS communities, to cover the cost of workshops and conferences, and to acquire repetitive flood loss properties. With the passage of the Flood Reform Act of 2004, the FMA program is authorized to increase funding through a direct grant program and a demonstration grant program for the acquisition of "high end" insured repetitive loss properties. Owners of the "high end" repetitive loss properties who decline the funding offer to mitigate will have their flood insurance policies re-rated to actual risk. This will provide the state with an additional opportunity to decrease flood risk structures.

Increased Cost of Compliance (ICC) – ICC coverage provides for the payment of a 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, thus triggering the requirement to comply with a community floodplain management ordinance, ICC will help pay for the cost to elevate, relocate, demolish, or flood proof (non-residential buildings only) 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 SFIP, 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 Program – Nationwide, approximately 75 percent of the FEMA flood maps are more than 10 years old. Because flood hazards are dynamic and usually increase over time as development occurs, old maps tend to understate existing flood hazards. Additionally, most of the maps were produced using antiquated manual cartographic techniques. The primary reason for the existing backlog of outdated maps has been inadequate program funding over the past 20 years.

As a result, in 1997, FEMA designed a plan to modernize the FEMA flood-mapping program. With funding and implementation of the modernization plan in 2003, the flood hazard information provided to communities will be more accurate and extensive, resulting in safer communities. The plan established a seven-year upgrade to the flood map inventory and an enhancement of products and services.

The State of Mississippi serves as a State Technical Partner (STP) with FEMA in the Map Modernization program. MEMA and the Mississippi department of Environmental Quality (MDEQ) are coordinating map modernization within the state through the State Remote Sensing and Geographic Information System Council. The digital flood insurance rate maps developed through this partnership will become a layer in the Mississippi Digital Earth Model (MDEM). The MDEM will serve as a statewide G.I.S. system that will serve as an efficient and effective source for planning, risk management and mitigation.

The state has submitted its initial Map Modernization Business Plan and has identified communities based on FEMA criteria for funding for Fiscal Year 2003 – Fiscal Year 2005, which will include communities representing 50 percent of the state's population. A contractor has been selected by the Council to assist the MEMA/DEQ STP with map modernizations.

Homeland Security Plan

Findings from this plan will be 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-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.

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 in order 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-Guides (How-to-Guides) identify 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, including information on previous occurances of hazard events, as well as the probablity of future hazard events, using maps where appropiate.

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 planning document and report literature review 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 occurances of hazard events, as well as the probablity of future hazard events, using maps where appropiate.

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 that 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 identificated 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 to show their locations and to determine their vulnerability to each hazard type, where practicable.

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. (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. (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 which houses officials providing leadership and guidance for essential community operations, provide primary health care, and/or accommodate inter-modal transportation providing evacuation and/or distribution of supplies.

For a complete list of the facilities collected and the agencies/departments that provided the information, refer to Appendix 7.3.0-C.

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 HMC, 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).

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.

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 few welds.
- **Moderate:** Some steel members have observable permanent rotations at connections; welded connections may exhibit major cracks through welds or 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 occurances 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.

3.1.1 List of Hazards

The Hazard Mitigation Council reviewed hazards from the existing plan and those listed in the How-to-Guide and determined the prevalence of each hazard in the State of Mississippi and evaluated and prioritized which hazards should be included in the Plan. All hazards identified by FEMA in the How-To-Guides were reviewed. They include: avalanche, coastal 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.

3.1.2 Hazard Identification Process

The Council worked with the consultant team to narrow the all-inclusive list of hazards to those most threatening to Mississippi. Consideration was also given as to which hazards could realistically be addressed at the State level in terms of mitigation during the screening process. Many hazards are best addressed by county and local plans. It should be noted that the lack of a profile in this plan does not mean that the state will not provide adequate support to local jurisdictions in mitigating the affects of those hazards. The Hazard Mitigation Council members and other Stakeholders, including representatives from state and federal government agencies and academia participated in and provided input to this screening effort. Surveys and meetings with the general public were held to gather input and to confirm that the decisions of the Council were inclusive of public sentiment regarding which hazards pose the most significant threat and/or were realistic to address within the scope of this plan.

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

Table 3.1.2.1 shows a summary of the hazard identification results for State of Mississippi.

Table 3.1.2.1
Summary of Hazard Identification Results

Hazard	Representative Data Collected for Hazard Identification	Reasons for Inclusion
Hurricane (wind, and surge)	• Historical Events Data • Post-Katrina Awareness Mapping • HAZUS wind data	• Hurricanes are common and devastating in Mississippi
Tornado	• NCDC • SHELDUS • Historical Tornado Damage and Disaster Declaration data	• Tornados are common disasters in MS In 2003 and 2004, MS ranked 8th and 13th, respectively, in the nation for number of tornadoes
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 MS , including both coastal and riverine
Extreme Winter Weather	• NCDC • SHELDUS • Historical Damage Data	• There have been more than 34 damaging events between 1993 and 2006 with a reported $24 million in property damages and $5 billion in crop damages

Hazard	Representative Data Collected for Hazard Identification	Reasons for Inclusion
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
Wildfire	• Southern Wildfire Risk Assessment • Past events from MS Forestry Commission • Wildland-Urban Interface • SILVIS Laboratory – University of WI • National Fire Protection Association Interviews • Historical fire records • FEMA Hazards website	• State of Mississippi experiences wildfires on a regular basis – history presented in the Plan
Dam/Levee Failure	• FEMA-HAZUS • MS Dept of Environmental Quality Dam Location Mapping • USACE levee locations • MS Levee Districts • Historical dam failure data • FEMA FIRM maps • FEMA Hazards website	• Inundation mapping and Emergency Action Plans • Presence of some downstream development

3.1.3 Hazard Identification Sources

In addition to the sources identified in the table above, 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
- Mississippi Dept of Environmental Quality
- Natural Resources Conservation Service
- United States Geological Survey (USGS)
- Federal Emergency Management Agency (FEMA) HAZUS
- FEMA Flood Insurance Rate Maps (FIRM)
- Mississippi Department of Health
- Mississippi Department of Education
- Mississippi Levee Board
- Building Officials Association of Mississippi
- Central United States Earthquake Consortium
- University of Mississippi
- Mississippi Department of Public Safety
- Mississippi Department of Finance and Administration
- Mississippi Automated Resource Information System
- Hancock, Jackson and Harrison Counties Emergency Management/Civil Defense
- US Army Corp of Engineers, Mobile and Vicksburg District
- Mississippi Development Authority
- Mississippi Department of Transportation
- Mississippi Department of Marine Resources
- Mississippi Forestry Commission
- Nations 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)
- National Climatologic Data Center (NCDC)
- Input from local jurisdictions, districts and agencies
- SILVIS Laboratory, University of Wisconsin
- National Fire Protection Association

3.1.4 Non-Profiled Hazards

During the initial evaluation the Hazard Mitigation Council determined that a number of hazards would not be included in the Plan. This decision was based on the belief that they were not prevalent hazards within the State of Mississippi as they were found to pose only minor or very minor threats to the State as compared to the other hazards. Additionally, these hazards were either generally linked to or covered by other selected hazards. In many cases it was determined that these hazards are best addressed by regional or local plans. In some cases hazards are being addressed by other planning initiatives. Table 3.1.4.1 gives a brief description of those hazards and the reason for their exclusion.

Table 3.1.4.1
Summary of Hazards Excluded from Hazard Profiling

Hazard	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 MS
Drought/water supply	Long periods without substantial rainfall	Droughts are not fully analyzed in this plan, however, approximately 45% of the existing local plans in the state list drought among their profiled hazards. The state recognizes drought as a hazard and will support mitigation activities, which it believes are best handled at the local and regional level.
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 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 35% of local mitigation plans identified extreme heat as a hazard to be profiled. While extreme heat can create emergencies in MS, mitigation or response are best addressed at the local level.
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.

Hazard	Description	Reason for Exclusion
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 hard. Presents a minor threat. No significant historical record of this hazard in the region.
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.
Windstorm	A storm with winds that have reached a constant speed of 74 miles per hour or more	Addresed extensively within Hurricanes and Tornado Sections
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. Undersea landslides can cause tsunamis. 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.

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.

3.1.5 Hazard Ranking

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

- probability that the hazard will affect the State; and,
- 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; and,
- 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 may 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 on the 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, as well as 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.

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. Table 3.1.5.1 below indicates the ranking established by the Council using the method described above.

Table 3.1.5.1
Hazard Ranking and Planning Consideration

Hazard Type and Ranking	Planning Consideration Based on Hazard Level
1. Hurricane (70)	Significant
2. Tornado (66)	Significant
3. Flooding (58)	Significant
4. Extreme Winter Weather (34)	Moderate
5. Earthquake (33)	Moderate
6. Wildfire (32)	Limited
7. Dam/Levee Failure (21)	Limited

The Hazard Identification and Ranking Worksheet is included as Appendix 7.3.1-A and contains all the calculations and formulas utilized. Section 3.1.6 and Section 5 address the handling of additional hazards identified in local plans.

3.1.6 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; drought in 45%, and excessive heat in 35% of the local plans. All other hazards were addressed by a smaller percentage (less than 35%) of the local plans. Thunderstorm mitigation is best addressed at the local level. The hazard “high winds” is addressed in this plan in the hurricane and tornado sections.

Drought can have statewide impacts, but is best mitigated by local practices. Since drought was the highest locally ranked hazard not selected for full inclusion in this plan, it is addressed in Section 3.9 of this Chapter in a qualitative manner. 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.

3.2 Hurricane Risk Assessment

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). Hurricanes are classified by intensity into one of five categories on the Saffir/Simpson Scale shown below. An examination of the Saffir/Simpson Scale ranges will show that as a hurricane goes up in scale number and category, so does wind speed, storm surge, and severity.

The Saffer/Simpson Scale is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf and the shape of the coastline, in the landfall region.

Saffir/Simpson Hurricane Scale [Simpson, R.H. (1974)]

Scale Number (Category)	Central Pressure		Wind Speed (MPH)	Storm Surge (Feet)	Potential Damage
	(Millibars)	(Inches)			
1	> 980	> 28.94	74 - 95	4 to 5	Minimal
2	965 - 979	28.50 - 28.91	96 - 110	6 to 8	Moderate
3	945 - 964	27.91 - 28.47	111 - 130	9 to 12	Extensive
4	920 - 944	27.17 - 27.88	131 - 155	13 to 18	Extreme
5	< 920	< 27.17	> 155	> 18	Catastrohpic

Source: Multihazard Identification and Risk Asssessment, FEMA, 1997

Category One Hurricane:

Winds 74-95 mph (64-82 kt or 119-153 km/hr). Storm surge generally 4-5 ft above normal. No real damage to building structures. Damage occurs primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs. Also, some coastal road flooding and minor pier damage may occur.

Category Two Hurricane:

Winds 96-110 mph (83-95 kt or 154-177 km/hr). Storm surge generally 6-8 feet above normal. Some roofing material, door, and window damage of buildings. May cause considerable damage to shrubbery and trees with some trees blown down as well as to mobile homes, poorly constructed signs, and piers. Coastal and low-lying escape routes flood 2-4 hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings.

Category Three Hurricane:

Winds 111-130 mph (96-113 kt or 178-209 km/hr). Storm surge generally 9-12 ft above normal. Some structural damage may occur to small residences and utility buildings with a minor amount of curtainwall failures. In addition, damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than 5 ft above mean sea level may be flooded inland 8 miles (13 km) or more. Evacuation of low-lying residences with several blocks of the shoreline may be required.

Category Four Hurricane:

Winds 131-155 mph (114-135 kt or 210-249 km/hr). Storm surge generally 13-18 ft above normal. More extensive curtainwall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shore. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as 6 miles (10 km).

Category Five Hurricane:

Winds greater than 155 mph (135 kt or 249 km/hr). Storm surge generally greater than 18 ft above normal. Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water 3-5 hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required. Hurricane Camille in 1969 made landfall in Mississippi as a Category 5 hurricane. It caused a 25-foot storm surge which inundated Pass Christian.

Source: National Hurricane Center

Hazard Profile

Location

The Gulf Coast of Mississippi is located in a high hazard area for hurricanes. According to the 2000 U.S. Census, over 363,988 residents reside in the coastal counties of Hancock, Harrison, and Jackson, and the upland counties of George, Pearl River, and Stone. 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 would occur if a Category 5 Hurricane were to strike one of Mississippi's Gulf Coast counties of Hancock, Harrison, and Jackson. 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 3.2.1 reflects the history of hurricanes and tropical storms/depressions from 1965 to 2005 in Mississippi as well as the counties involved.

Table 3.2.1
Mississippi Hurricane & Tropical Storm History

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
Tropical Depression Rita	9/25/2005	Coahoma and Tunica	0	0	$10,000
Hurricane Rita	9/24/2005	Adams, Bolivar, Carroll, Clairborne, Copiah, Franklin, Hinds, Holmes, Humphreys, Issaguena, 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

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
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	231		$80 billion
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	$26,000,000
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	$50,000
Tropical Storm Ivan	9/16/2004	Chickasaw, Itawamba, Lee and Monroe	1	0	$30,000

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
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
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			
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	0	0	$674,000,000

Incident Name	Event Date	County(s) Affected	Deaths	Injuries	Property Damage
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
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	143	No Details Available	
Hurricane Betsy	9/25/1965	No County Information	No Details Available		

Source; National Climatic Data Center

In 2005, the state of Mississippi was impacted by Hurricane Katrina. To help understand the total effects of this catastrophic event, a storm track/wind speed map and storm surge map are portrayed in this section as Figures 3.2.1 and 3.2.2.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 that 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 (Figure 3.2.3), 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, health care and government - were destroyed in Bay St. Louis, Waveland, Pass Christian and Long Beach. The challenges of rebuilding these communities who have experienced the total loss in their tax base and sales tax revenues continue today. Affordable housing and a total rebuilding of the infrastructure continue to strain the 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 3.2.1
Hurricane Katrina Storm Surge Map

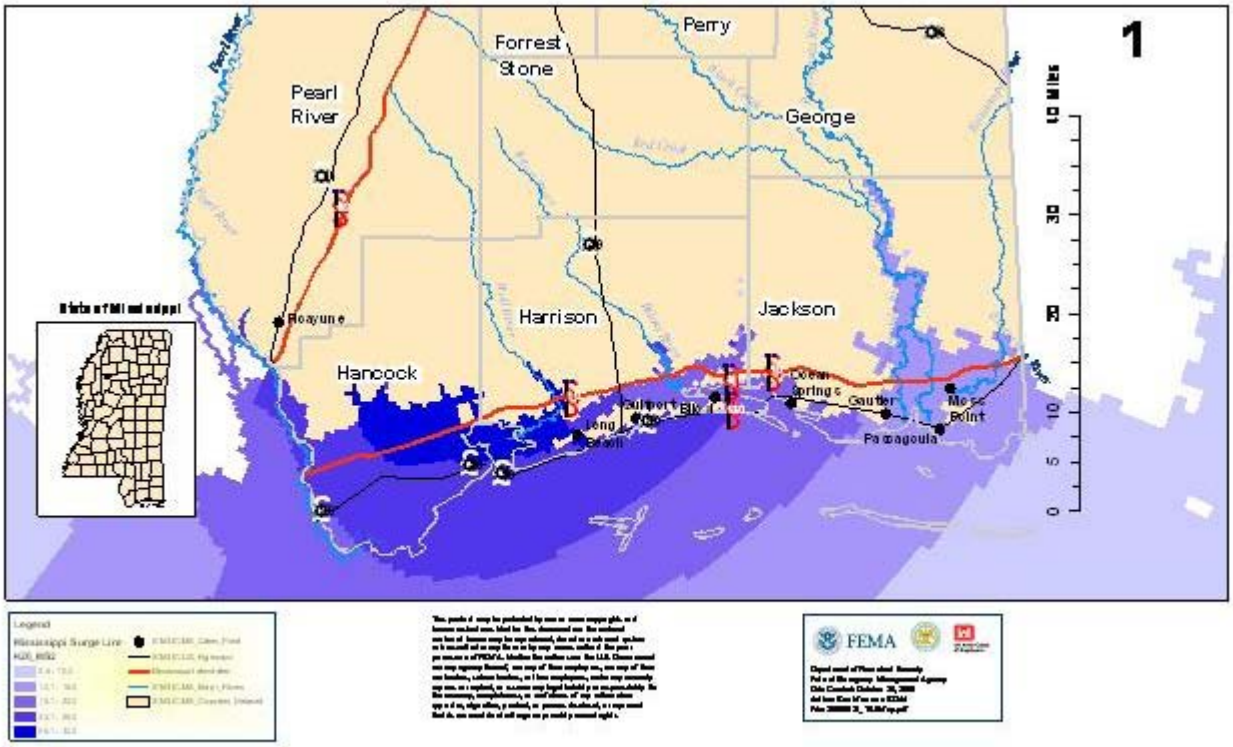


Figure 3.2.2
Hurricane Katrina Storm Track and Wind Map

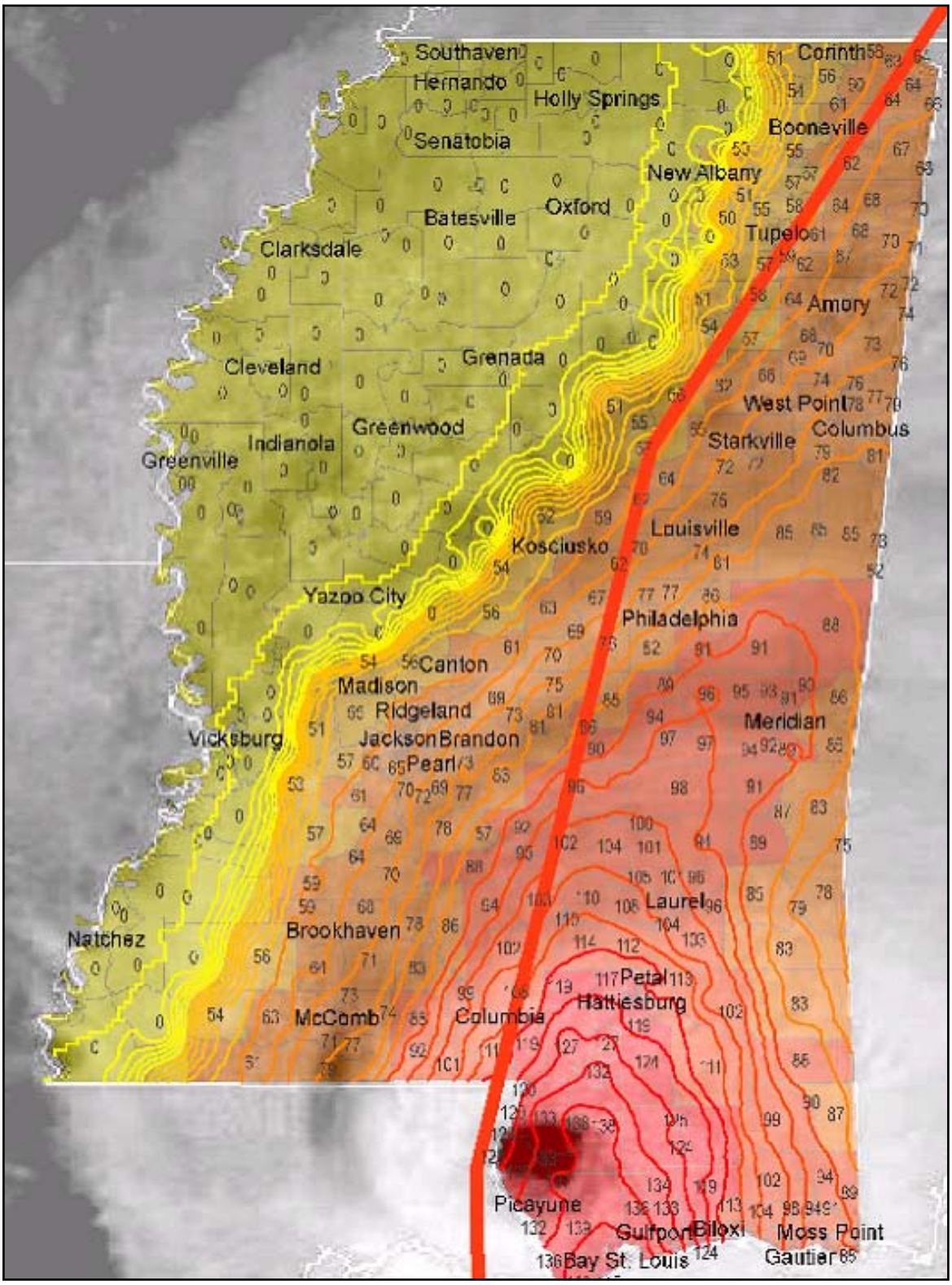
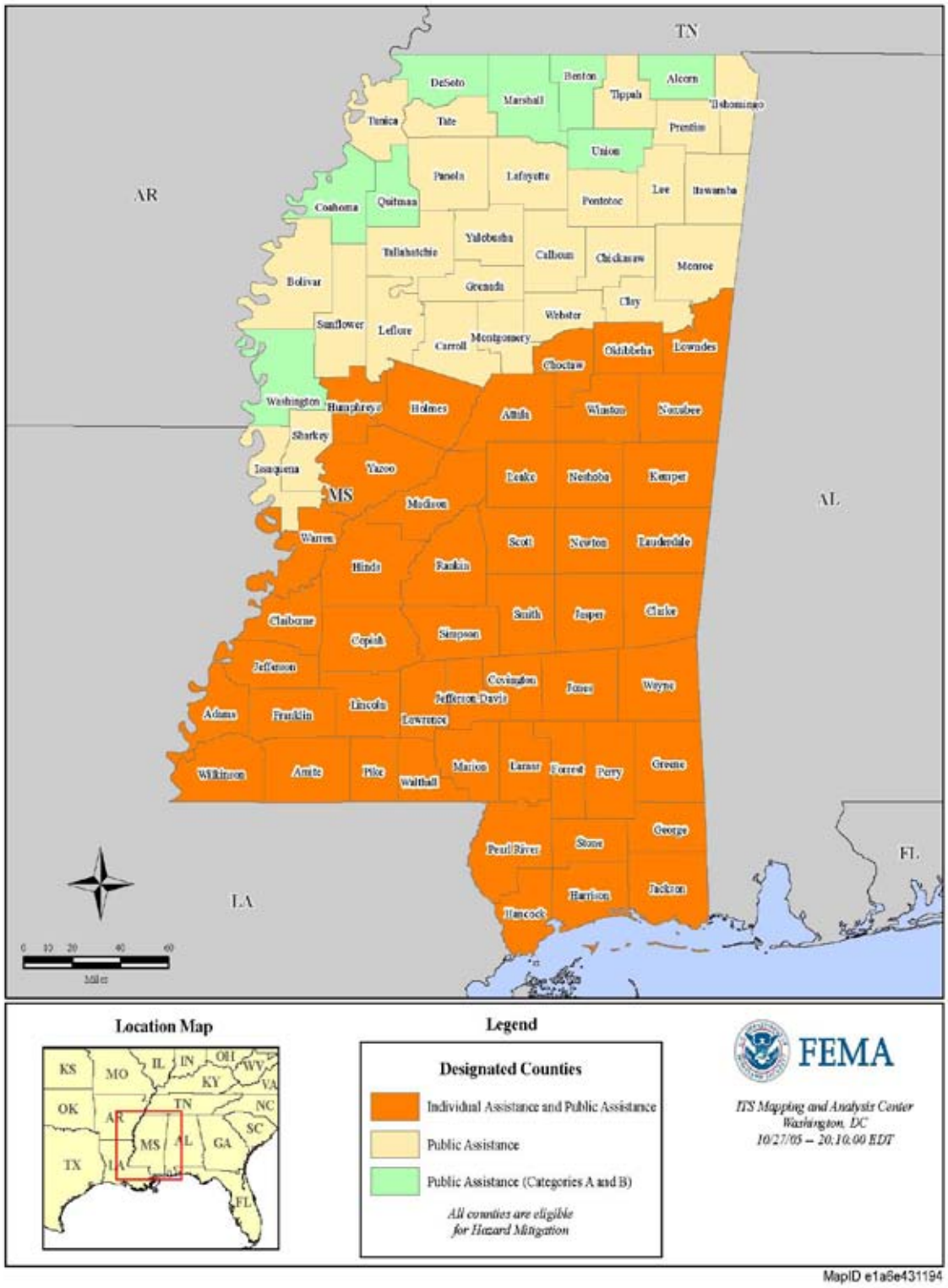


Figure 3.2.3
FEMA-1604-DR, Mississippi
Disaster Declaration as of 10/27/2005



Probability of Hurricane Future Events

In the Assessing Vulnerability section that follows counties are ranked by relative vulnerability due to the frequency of their inclusion in past disaster declarations. The coastal and first-tier counties are in high risk areas with an almost certain probability they will be impacted in the future. Second and third tier counties have also been declared in past events and may also be impacted though with less severity. The remaining counties within the state were declared following Hurricane Katrina which indicates there is a possibility a Category 3 or higher could impact the minimal risk counties again in the future.

Probability of Future Occurrence within 75 miles of the Gulf Coast

Intensity of Storm	Gulf Coast of Mississippi
Category 1	10 years
Category 2	21 years
Category 3	34 years
Category 4	68 years
Category 5	160 years

Source: Tropical Prediction Center National Hurricane Center 2006

The National Weather Service has predicted 75% chance that the Atlantic hurricane season will be above normal in 2007. A prediction of 13 to 17 named storms, with seven to ten becoming hurricanes, of which three to five could become major hurricanes of Category 3 or higher.

Assessing Vulnerability

In assessing Mississippi's vulnerability to damage and loss of life from hurricanes and tropical storms, at the top of lthe ist 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 and 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 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. 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. Table 3.2.2 compares 2000 and 2006 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 3.10 for more detail on the population shifts as a result of Katrina.

Mississippi Gulf Coast - Hurricane Katrina

Mississippi Gulf Coast - Hurricane Katrina

Table 3.2.2
Vulnerable Populations in High Risk Counties

County	City	2000 Population	2006 Estimated Population
Jackson	Pascagoula	26,200	23,719
	Moss Point	15,851	14,583
	Gautier	11,681	16,251
	Ocean Springs	17,255	17,140
Jackson County Totals		**131,420**	**130,577**
Harrison	Biloxi	50,644	44,342
	Gulfport	71,127	64,316
	Pass Christian	6,579	n/a*
	D'Iberville	7,608	7,064
	Long Beach	17,320	n/a*
Harrison County Totals		**189,601**	**171,875**
Hancock	Bay St. Louis	8,209	n/a*
	Waveland	6,674	n/a*
Hancock County Totals		**42,967**	**40,421**

*The U.S. Census Bureau was unable to obtain reliable data to estimate population change caused by Hurricane Katrina for Waveland, Bay St. Louis, Pass Christian, and Long Beach and therefore is not releasing 2006 estimates for these cities.
Based on 2000 U.S. Census Bureau figures and 2006 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 has developed routes to aid in a speedy and effective evacuation out of the coastal area and in to the interior of Mississippi or neighboring states. Utilizing these advanced evacuation techniques, the vulnerability of people can be minimized before and after the onset of a hurricane. Zoned evacuation maps by county for Hancock, Harrison, and Jackson may be found in Appendix 7.3.2-A .

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 428 persons. Two hundred and eighty-three died in Hurricane Katrina, 143 died in Hurricane Camille and two 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 when combined with timely evacuation from coastal areas inundated by storm surge, has 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 the 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.

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 eight declared hurricane/tropical storm disaster declarations. Table 3.2.3 provides information on the coastal and upland counties that have been declared in previous hurricanes as an established vulnerability to hurricane damage. In Camille, for example, central Mississippi counties as well as coastal counties received damage. These incidents cover the period 1969 to 2006, a 37-year period. The table was updated in 2007 to include risk based on declarations for Hurricanes Dennis and Katrina. The cut off between low- and medium-risk designation is three declarations. That moved Clarke, Jasper, Lauderdale, Rankin, Simpson, and Smith counties from 'low' to 'moderate' risk. Amite county shifted from 'moderate' to 'low.'

Table 3.2.3
COUNTIES DECLARED IN HURRICANE EVENTS BY RISK RATING
Very High Risk—High Risk—Medium Risk—Low Risk

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	DENNIS FEMA-1594-DR	KATRINA FEMA-1604-DR
VERY HIGH RISK								
Hancock	X	X	X	X	X	X	X	X
Harrison	X	X	X	X	X	X	X	X
Jackson	X	X	X	X	X	X	X	X
HIGH RISK								
George	X	X		X	X	X	X	X
Pearl River	X	X	X	X	X	X	X	X
Stone	X	X				X	X	X
MODERATE RISK								
Clarke		X					X	X
Covington	X	X					X	X
Forrest	X	X		X			X	X
Greene	X	X		X		X	X	X
Jasper	X						X	X
Jeff Davis				X			X	X
Jones	X	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	DENNIS FEMA-1594-DR	KATRINA FEMA-1604-DR
Lamar	X			X	X		X	X
Lauderdale	X						X	X
Marion	X			X				X
Perry	X	X		X			X	X
Pike					X	X		X
Rankin	X						X	X
Simpson	X						X	X
Smith	X						X	X
Walthall	X							X
Wayne	X	X		X			X	X
LOW RISK								
Adams								X
Alcorn								X
Amite						X		X
Attala							X	X
Benton								X
Bolivar								X
Calhoun							X	X
Carroll								X
Chickasaw							X	X
Choctaw							X	X
Claiborne								X
Clay							X	X
Coahoma								X
Copiah						X		X
Desoto								X
Franklin								X
Grenada								X
Hinds							X	X
Holmes								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	DENNIS FEMA-1594-DR	KATRINA FEMA-1604-DR
Humphreys								X
Itawamba							X	X
Issaquena								X
Jefferson								X
Kemper							X	X
Lafayette								X
Lawrence								X
Leake							X	X
Lee							X	X
Leflore								X
Lincoln								X
Lowndes							X	X
Madison							X	X
Marshall								X
Monroe							X	X
Montgomery								X
Neshoba							X	X
Newton							X	X
Noxubee							X	X
Oktibbeha							X	X
Panola								X
Pontotoc							X	X
Prentiss								X
Quitman								X
Scott							X	X
Sharkey								X
Sunflower								X
Tallahatchie								X
Tate								X
Tippah								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	DENNIS FEMA-1594-DR	KATRINA FEMA-1604-DR
Tishomingo								X
Tunica								X
Union								X
Warren								X
Washington								X
Webster							X	X
Wilkinson								X
Winston							X	X
Yalobusha								X
Yazoo								X

Assessing Vulnerability by Jurisdiction Methodology/HAZUS-MH Modeling

HAZUS-MH hurricane loss modeling capabilities were used to quantify expected losses to the state and differentiate vulnerability by county. HAZUS-MH 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.

During 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. This scenario was chosen over a deterministic analysis largely because the impacts from a severe hurricane are known due to Hurricane Katrina and because the HAZUS-MH inventory (developed prior to Katrina) is not a valid representation of post-Katrina conditions in the most at-risk counties.

Camille's storm track served as the pattern for the 2004 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 1, 3 and 5 storms.

HAZUS-MH 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-MH 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 into 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 was 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. 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-MH was the "best available data" and provided the basis for the scenarios.

According to operating instructions from HAZUS-MH 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). 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 3.2.4) and the results of the scenarios are in the pages that follow and in Appendix 7.3.2-B.

Table 3.2.4
DAMAGE STATES FOR RESIDENTIAL CONSTRUCTION CLASSES
(Similar criteria were applied to other building types by the HAZUS-MH 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 over, 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.
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 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.

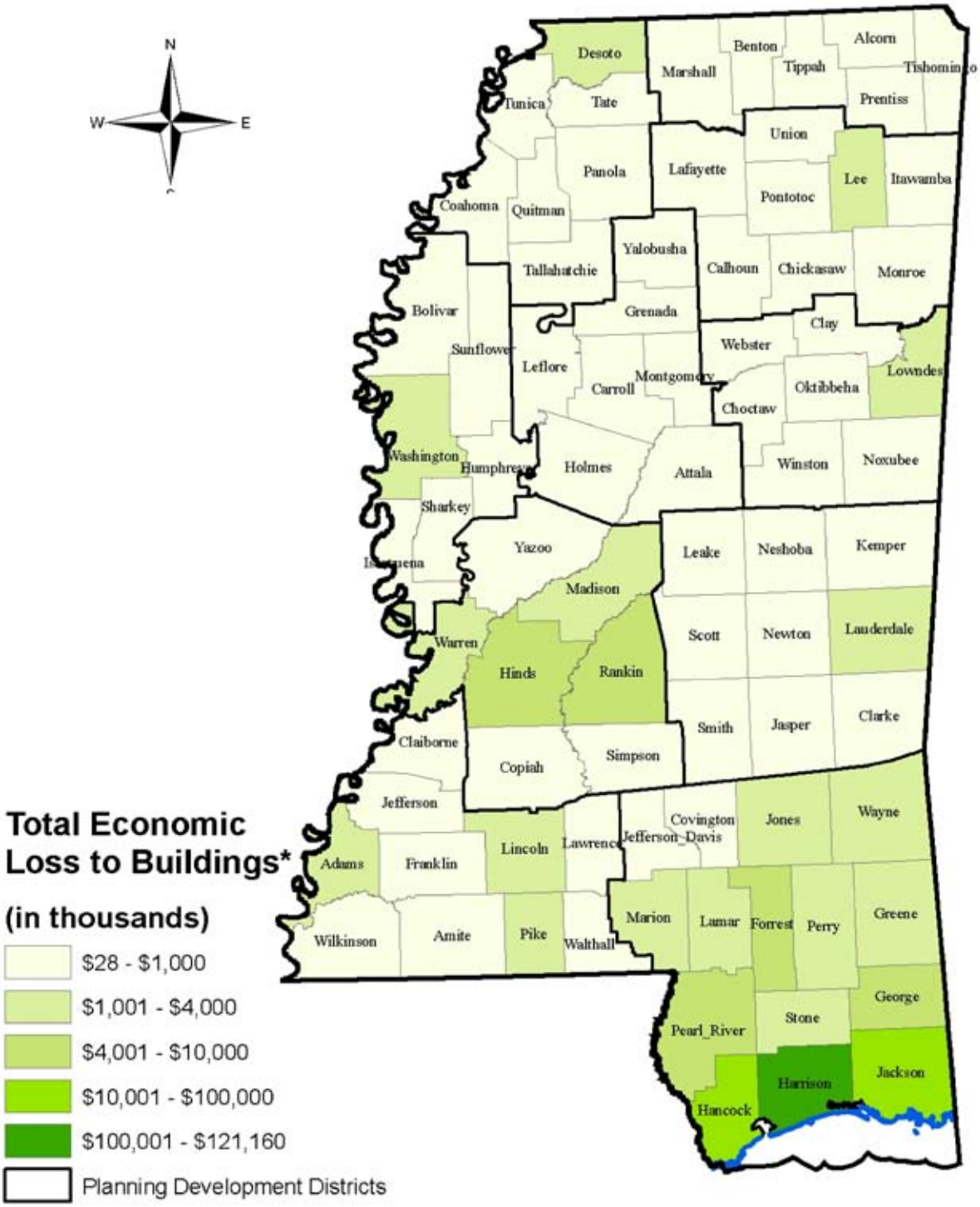
Hurricane Lili
2002

Hurricane Ivan
2004

The results of the annualized loss modeling are presented in the maps (Figures 3.2.4 and 3.2.5) and Table 3.2.5 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 10 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. Note that this is pre-Katrina inventory in the HAZUS-MH model.

Figure 3.2.4

HAZUS-MH Hurricane Loss Estimation: Annualized Loss Scenario Total Economic Loss

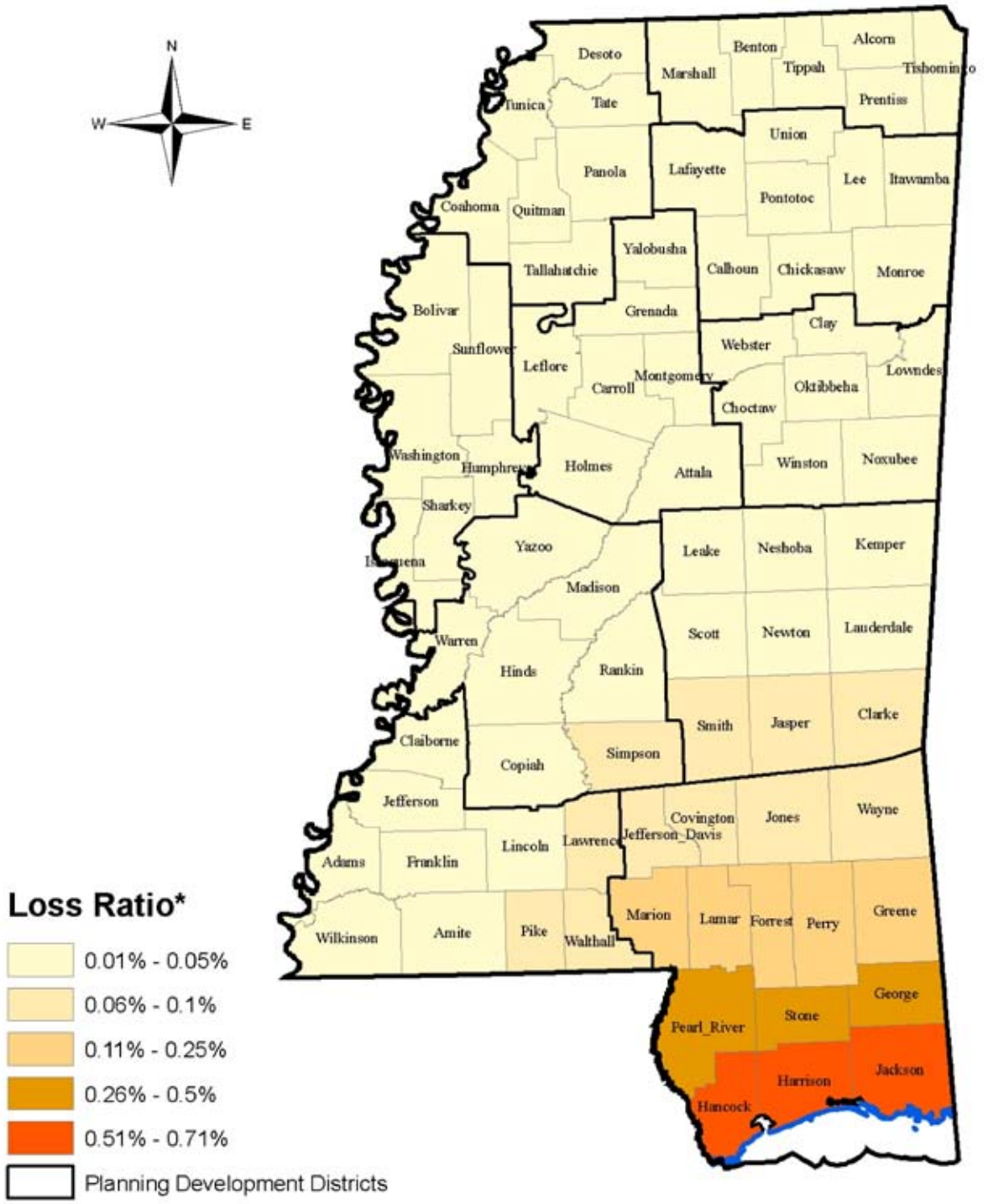


* Represents expected average annualized building losses from hurricanes in any given year. Includes property damage and business interruption losses.

Source: HAZUS-MH MR2

Figure 3.2.5

HAZUS-MH Hurricane Loss Estimation: Annualized Loss Scenario Loss Ratio



Source: HAZUS-MH MR2

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

Table 3.2.5
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
Harrison	69,242	0.63	32,805	19,113	121,160	2
Jackson	44,302	0.71	19,895	11,136	75,332	1
Hancock	12,028	0.52	5,274	2,980	20,283	3
Pearl River	5,616	0.27	2,353	1,387	9,356	6
Hinds	4,995	0.04	1,801	1,222	8,018	37
Forrest	4,393	0.13	1,728	1,180	7,301	9
George	2,862	0.36	1,206	686	4,754	4
Rankin	2,625	0.04	969	509	4,103	30
Jones	2,293	0.09	860	563	3,717	14
Lamar	2,141	0.12	827	602	3,570	10
Madison	2,077	0.05	754	417	3,248	27
Stone	1,742	0.33	795	443	2,979	5
Lauderdale	1,504	0.04	520	369	2,393	29
Lee	1,037	0.02	433	293	1,762	63
Pike	950	0.06	340	247	1,537	20
Desoto	999	0.01	335	184	1,519	79
Marion	875	0.10	345	235	1,455	11
Greene	727	0.18	271	180	1,178	7
Warren	711	0.03	274	152	1,137	50
Lincoln	681	0.05	242	160	1,083	24
Washington	653	0.02	241	168	1,062	58
Wayne	654	0.09	241	164	1,059	13
Adams	649	0.04	245	164	1,058	33
Lowndes	668	0.02	237	150	1,055	61
Perry	619	0.15	250	150	1,020	8
Simpson	597	0.06	215	139	952	21
Oktibbeha	519	0.02	223	167	909	64
Covington	533	0.08	188	141	862	15

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)	Loss Ratio Rank
Copiah	501	0.05	182	109	792	26
Walthall	427	0.09	156	114	697	12
Newton	428	0.05	157	97	681	25
Leflore	409	0.03	151	116	676	47
Neshoba	420	0.04	152	99	672	35
Scott	414	0.05	154	100	668	28
Bolivar	397	0.03	147	108	652	53
Clarke	362	0.06	126	81	569	19
Smith	350	0.06	129	72	550	22
Monroe	348	0.02	125	76	549	62
Jasper	338	0.06	121	87	545	18
Sunflower	317	0.03	118	93	528	43
Lafayette	298	0.01	142	75	515	81
Lawrence	317	0.06	120	73	510	17
Jefferson Davis	299	0.07	101	83	483	16
Yazoo	286	0.03	105	63	454	45
Leake	276	0.04	98	62	436	36
Amite	261	0.05	96	51	408	23
Coahoma	242	0.02	86	69	397	68
Alcorn	252	0.01	87	58	397	80
Winston	243	0.03	89	56	388	42
Panola	232	0.02	80	65	377	69
Union	225	0.02	88	61	374	67
Pontotoc	220	0.02	77	52	349	66
Clay	219	0.03	72	56	348	52
Attala	216	0.03	76	53	345	46
Grenada	193	0.02	69	49	311	72
Marshall	196	0.02	67	41	304	78
Chickasaw	183	0.03	69	49	301	56
Noxubee	173	0.04	67	46	286	31
Tate	175	0.02	59	44	278	73

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)	Loss Ratio Rank
Prentiss	168	0.02	56	42	266	74
Holmes	161	0.03	55	39	255	51
Itawamba	162	0.02	56	33	251	76
Calhoun	150	0.02	55	38	243	60
Tippah	153	0.02	57	33	242	75
Wilkinson	143	0.04	47	30	220	32
Humphreys	131	0.03	52	35	218	38
Claiborne	132	0.03	49	29	209	40
Franklin	131	0.04	48	28	207	34
Kemper	128	0.03	45	27	200	39
Tishomingo	128	0.01	45	24	197	82
Jefferson	106	0.03	43	28	177	48
Tallahatchie	101	0.03	36	30	167	55
Montgomery	103	0.02	34	26	163	65
Choctaw	96	0.03	35	21	152	54
Webster	92	0.02	32	23	147	59
Tunica	79	0.02	28	36	143	71
Carroll	91	0.02	31	19	141	57
Yalobusha	86	0.02	29	20	134	70
Sharkey	76	0.03	30	20	126	41
Quitman	76	0.03	25	23	124	49
Benton	46	0.02	17	9	72	77
Issaquena	18	0.03	6	4	28	44

Source: HAZUS-MH MR2

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 $300 million in any given year. The expected losses by hurricane return period are provided in the table that follows. Note that HAZUS-MH estimated total losses, even to a 1,000-year event ($29 billion), are less than the losses that resulted from Hurricane Katrina ($80 billion). One explanation for this is that HAZUS-MH models wind damage only and not flood damage. Another analysis limitation could be deficiencies in the default HAZUS-MH inventory, which may not include the casinos on the Gulf Coast. This annualized HAZUS-MH model, run in 2007, did not change the ranking of risk county by county but now estimates what the average annual hurricane losses could be statewide.

Table 3.2.6
Summary Impacts to State by Return Period

NUMBER OF RESIDENTIAL BUILDINGS DAMAGED					
Return Period	Minor	Moderate	Severe	Destruction	Total
10	4,003	162	1	0	4,167
20	25,203	4,811	320	184	30,518
50	53,820	24,671	6,459	3,830	88,780
100	54,973	43,162	17,699	10,915	126,749
200	24,054	15,065	12,034	44,835	95,988
500	107,317	74,264	49,041	48,210	278,831
1,000	105,674	94,689	61,968	65,051	327,381

NUMBER OF BUILDINGS DAMAGED					
Return Period	Minor	Moderate	Severe	Destruction	Total
10	4,055	165	1	0	4,222
20	25,428	4,891	331	184	30,833
50	54,255	25,008	6,613	3,834	89,710
100	55,331	43,682	18,166	10,930	128,109
200	24,279	15,258	12,385	45,087	97,008
500	108,014	75,025	50,197	48,303	281,538
1,000	106,473	95,753	63,445	65,168	330,839

SHELTER REQUIREMENTS		
Return Period	Displaced Households (No. of Households)	Short-term Shelter (No. of People)
10	3	0
20	931	253
50	10,623	2,871
100	30,602	8,253
200	60,749	15,603
500	109,056	29,709
1,000	138,330	37,994

ECONOMIC LOSS (X 1000)				
Return Period	**Residential**	**Total**	**Business Interruption**	**Total loss**
10	122,436	124,764	6,419	131,183
20	522,680	556,938	76,637	633,575
50	2,578,941	2,889,443	574,351	3,463,794
100	5,846,473	6,898,240	1,405,882	8,304,121
200	10,532,092	12,357,964	2,112,448	14,470,411
500	16,856,034	20,024,584	3,773,398	23,797,982
1,000	20,913,744	24,899,048	4,753,845	29,652,893
Annualized	**221,230**	**256,609**	**46,173**	**302,782**

Source: HAZUS-MH

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 -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-MH 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 the 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. The same $500,000 threshold and analysis process was applied to Category 3 and 1 storms.

Tables 3.2.7, 3.2.8 and 3.2.9 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 nine HAZUS-MH deterministic scenarios.

Table 3.2.7
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 damage in this scenario. Those counties were Attala, Carroll, Choctaw, Clarke, Copiah, Covington, Forrest, George, Granada, 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.

Number of Structures Damaged

TOTAL BUILDINGS DAMAGED ALL COUNTIES					
OCCUPANCY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
Total Residential	82,296	39,087	24,453	32,518	178,354
Total	758	522	68	58	1,946
TOTAL	**83,054**	**39,609**	**25,061**	**32,576**	**180,300**

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
SOUTHERN MISSISSIPPI PDD					
COVINGTON					
Total Res	2,241	998	193	120	3,552
Total Other*	11	10	5	0	26
Total	2,252	1,008	198	120	3,578
FORREST					

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
Total Res	5,213	1,546	277	49	7,085
Total Other*	62	34	6	0	2
Total	5,275	1,580	283	49	7,187
GEORGE					
Total Res	7	0	0	0	7
Total Other*	0	0	0	0	0
Total	7	0	0	0	7
HANCOCK					
Total Res	641	2,488	5,165	11,105	19,399
Total Other*	3	17	107	21	148
Total	644	2,505	5,272	11,126	19,547
HARRISON					
Total Res	14,891	13,468	9,924	10,906	49,189
Total Other*	145	206	352	24	727
Total	15,036	13,674	10,276	10,930	49,916
JACKSON					
Total Res	2,651	318	48	4	3,021
Total Other*	18	3	0	0	21
Total	2,669	321	48	4	3,042
JEFFERSON DAVIS					
Total Res	1,713	1,222	412	289	3,636
Total Other*	7	7	5	0	19
Total	1,720	1,229	417	289	3,655
JONES					
Total Res	759	69	8	1	837
Total Other*	3	0	0	0	3
Total	762	69	8	1	840
LAMAR					
Total Res	5,061	3,190	1,042	612	9,905
Total Other*	43	42	19	1	105
Total	5,104	3,232	1,061	613	10,010
MARION					

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
Total Res	2,513	2,690	1,389	1,015	7,607
Total Other*	10	19	24	1	46
Total	2,523	2,709	1,413	1,016	7,661
PEARL RIVER					
Total Res	1,519	3,981	5,339	7,838	18,677
Total Other*	4	18	72	10	104
Total	1,523	3,999	5,411	7,448	18,781
PERRY					
Total Res	49	2	0	0	51
Total Other*	0	0	0	0	0
Total	49	2	0	0	51
STONE					
Total Res	1,267	343	40	16	1,666
Total Other*	6	4	0	0	11
Total	1,273	347	40	16	1,677
SOUTHWESTERN MISSISSIPPI PDD					
LAWRENCE					
Total Res	1,437	437	66	41	1,981
Total Other*	9	5	1	0	15
Total	1,446	442	67	41	1,996
LINCOLN					
Total Res	175	11	2	0	189
Total Other*	1	0	0	0	1
Total	176	11	2	9	190
PIKE					
Total Res	93	5	1	0	99
Total Other*	1	0	0	0	1
Total	94	5	1	0	100
WATHALL					
Total Res	1,334	340	39	28	1,741
Total Other*	4	1	0	0	5
Total	1,338	341	39	2	1,746

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
CENTRAL MISSISSIPPI PDD					
COPIAH					
Total Res	747	72	2	2	823
Total Other*	2	0	0	0	0
Total	749	72	2	2	825
HINDS					
Total Res	16,506	2,940	100	77	19,623
Total Other*	252	85	6	0	290
Total	16,758	3,025	106	77	19,966
MADISON					
Total Res	6,508	1,319	69	79	7,975
Total Other*	47	20	2	0	69
Total	6,555	1,339	71	79	8,044
RANKIN					
Total Res	10,268	2,104	108	118	12,598
Total Other*	91	39	4	0	133
Total	10,359	2,142	112	118	12,731
SIMPSON					
Total Res	3,101	1,237	160	146	4,644
Total Other*	12	10	3	0	27
Total	3,113	1,247	163	146	4,669
WARREN					
Total Res	43	1	0	0	44
Total Other*	1	0	0	0	1
Total	0	0	0	0	0
YAZOO					
Total Res	488	30	1	0	519
Total Other*	2	0	0	0	2
Total	490	30	1	0	521

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
EAST CENTRAL MISSISSIPPI PDD					
LAUDERDALE					
Total Res	27	3	0	0	30
Total Other*	1	0	0	0	1
Total	28	3	0	0	31
LEAKE					
Total Res	393	23	0	0	416
Total Other*	2	0	0	0	2
Total	395	23	0	0	418
JASPER					
Total Res	35	2	0	0	37
Total Other*	0	0	0	0	0
Total	35	2	0	0	37
NESHOBA					
Total Res	66	2	0	0	68
Total Other*	72	0	0	0	72
Total	138	2	0	0	141
NEWTON					
Total Res	66	2	0	0	68
Total Other*	0	0	0	0	0
Total	66	2	0	0	68
SCOTT					
Total Res	837	82	2	2	923
Total Other*	3	0	0	0	3
Total	840	82	2	2	926
SMITH					
Total Res	695	88	6	3	792
Total Other*	1	0	0	0	1
Total	696	88	6	3	793

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
GOLDEN TRIANGLE PDD					
CHOCTAW					
Total Res	8	0	0	0	8
Total Other*		0	0	0	0
Total	8	0	0	0	0
WINSTON					
Total Res	16	0	0	0	16
Total Other*	0	0	0	0	0
Total	16	0	0	0	16
NORTH CENTRAL MISSISSIPPI PDD					
ATTALA					
Total Res	230	11	0	0	241
Total Other*	2	0	0	0	1
Total	231	11	0	0	242
CARROLL					
Total Res	41	1	0	0	42
Total Other*	0	0	0	0	0
Total	41	1	0	0	42
GRENADA					
Total Res	11	0	0	0	11
Total Other*	0	0	0	0	0
Total	11	0	0	0	11
HOLMES					
Total Res	293	19	0	0	312
Total Other*	1	0	0	0	1
Total	294	19	0	0	313
LEFLORE					
Total Res	138	4	0	0	142
Total Other*	1	0	0	0	1
Total	139	4	0	0	143

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
MONTGOMERY					
Total Res	27	1	0	0	28
Total Other*	0	0	0	0	0
Total	27	1	0	0	28
SOUTH DELTA PDD					
HUMPHREYS					
Total Res	83	3	0	0	86
Total Other*	0	0	0	0	0
Total	83	3	0	0	86
SUNFLOWER					
Total Res	39	1	0	0	40
Total Other*	0	0	0	0	0
Total	39	1	0	0	40
WASHINGTON					
Total Res	17	0	0	0	17
Total Other*	1	0	0	0	1
Total	1	0	0	0	16

*Other structures will include the following: Agriculture, Commercial, Education, Government, Industrial, and Religion

Table 3.2.8
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.

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 AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
SOUTHERN MISSISSIPPI PDD					
COVINGTON					
Total Res	2,427	1,486	405	273	4,591
Total Other*	12	12	6	0	30
Total	2,439	1,498	411	273	4,621
FORREST					
Total Res	6,469	6,817	3,554	2,109	18,949
Total Other*	53	92	107	4	256
Total	6,521	6,909	3,661	2,114	21,505
GEORGE					
Total Res	827	141	12	6	986
Total Other*	1	0	0	0	1
Total	828	141	12	6	987

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
GREENE					
Total Res	103	6	1	0	110
Total Other*	0	0	0	0	0
Total	103	6	1	0	110
HANCOCK					
Total Res	4,041	4,831	3,867	3,907	16,646
Total Other*	18	36	70	7	97
Total	4,059	4,867	3,937	3,915	16,743
HARRISON					
Total Res	2,294	8,657	18,439	35,364	64,743
Total Other*	18	94	87	137	224
Total	2,313	8,751	19,105	35,501	66,025
JACKSON					
Total Res	11,233	8,662	6,158	6,796	32,849
Total Other*	71	83	105	10	269
Total	11,304	8,745	6,262	6,806	33,118
JEFFERSON DAVIS					
Total Res	748	106	8	4	866
Total Other*	2	1	0	0	3
Total	750	107	8	4	869
JONES					
Total Res	7,035	2,935	618	342	10,931
Total Other*	41	29	9	0	70
Total	7,077	2,965	627	342	11,931
LAMAR					
Total Res	4,354	4,208	2,064	1,333	13,060
Total Other*	30	54	58	3	146
Total	4,324	4,262	2,123	1,336	13,206
MARION					
Total Res	1,164	177	16	6	1,467
Total Other*	8	2	0	0	10
Total	1,172	179	16	6	1,477
PEARL RIVER					
Total Res	4,234	1,843	738	640	7,455
Total Other*	18	11	7	0	36
Total	4,252	1,854	745	640	7,491

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
PERRY					
Total Res	25	1	0	0	25
Total Other*	0	0	0	0	0
Total	25	1	0	0	25
STONE					
Total Res	630	1,310	1,312	1,358	4,775
Total Other*	2	7	21	1	42
Total	633	1,317	1,333	1,360	4,808
WAYNE					
Total Res	54	3	0	0	57
Total Other*	0	0	0	0	0
Total	54	3	0	0	57
SOUTHWESTERN MISSISSIPPI PDD					
LAWRENCE					
Total Res	25	1	0	0	26
Total Other*	0	0	0	0	0
Total	25	1	0	0	26
WATHALL					
Total Res	8	0	0	0	8
Total Other*	0	0	0	0	0
Total	8	0	0	0	8
CENTRAL MISSISSIPPI PDD					
COPIAH					
Total Res	13	0	0	0	13
Total Other*	0	0	0	0	0
Total	13	0	0	0	13
HINDS					
Total Res	1,936	110	2	0	2,149
Total Other*	32	3	0	0	35
Total	1,968	113	2	0	2,184
MADISON					
Total Res	1,894	143	2	3	2,042
Total Other*	11	1	0	0	12
Total	1,,905	144	2	3	2,054

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
RANKIN					
Total Res	3,525	324	2	9	3,865
Total Other*	23	3	0	0	26
Total	3,548	327	2	9	3,891
SIMPSON					
Total Res	1,478	356	7	23	1,881
Total Other*	7	4	0	0	12
Total	1,486	360	7	23	1,894
YAZOO					
Total Res	62	0	24	0	64
Total Other*	0	0	1	0	0
Total	62	0	25	0	64
EAST CENTRAL MISSISSIPPI PDD					
CLARKE					
Total Res	22	1	0	0	23
Total Other*	0	0	0	0	0
Total	22	1	0	0	23
JASPER					
Total Res	845	154	14	7	1,020
Total Other*	9	4	0	0	13
Total	854	158	15	7	2,067
KEMPER					
Total Res	18	0	0	0	18
Total Other*	0	0	0	0	0
Total	18	0	0	0	18
LAUDERDALE					
Total Res	169	17	4	0	190
Total Other*	2	0	0	0	2
Total	171	17	4	0	192
LEAKE					
Total Res	842	83	2	2	929
Total Other*	3	1	0	0	4
Total	846	84	2	2	934

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
NESHOBA					
Total Res	533	32	0	0	565
Total Other*	3	0	0	0	3
Total	536	32	0	0	568
NEWTON					
Total Res	754	68	1	1	824
Total Other*	4	0	0	0	4
Total	758	68	1	1	828
SCOTT					
Total Res	1,771	306	12	17	2,106
Total Other*	10	2	0	0	12
Total	1,781	308	12	17	2,118
SMITH					
Total Res	1,851	554	71	46	2,522
Total Other*	7	4	0	0	11
Total	1,858	558	72	46	2,533
GOLDEN TRIANGLE PDD					
CHOCTAW					
Total Res	40	1	0	0	41
Total Other*	0	0	0	0	0
Total	40	1	0	0	41
LOWNDES					
Total Res	7	0	0	0	7
Total Other*	0	0	0	0	0
Total	7	0	0	0	7
NOXUBEE					
Total Res	8	0	0	0	8
Total Other*	0	0	0	0	0
Total	8	0	0	0	8
OKTIBBEHA					
Total Res	34	1	0	0	35
Total Other*	2	0	0	0	1
Total	36	1	0	0	37

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
WEBSTER					
Total Res	11	0	0	0	11
Total Other*	0	0	0	0	0
Total	11	0	0	0	11
WINSTON					
Total Res	131	4	0	0	135
Total Other*	1	0	0	0	1
Total	132	4	0	0	136
NORTH CENTRAL MISSISSIPPI PDD					
ATTALA					
Total Res	363	21	0	0	384
Total Other*	1	0	0	0	1
Total	364	21	0	0	385
CARROLL					
Total Res	24	1	0	0	25
Total Other*	0	0	0	0	0
Total	24	1	0	0	25
HOLMES					
Total Res	121	6	0	0	127
Total Other*	0	0	0	0	0
Total	121	6	0	0	137
LEFLORE					
Total Res	34	1	0	0	35
Total Other*	1	0	0	0	1
Total	35	1	0	0	36
MONTGOMERY					
Total Res	36	1	0	0	37
Total Other*	0	0	0	0	0
Total	36	1	0	0	37

*Other structures will include the following: Agriculture, Commercial, Education, Government, Industrial, and Religion

Table 3.2.9
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.

Number of Structures Damaged

TOTAL BUILDINGS DAMAGED ALL COUNTIES					
OCCUPANCY	**MINOR**	**MODERATE**	**SEVERE**	**DESTROYED**	**TOTAL**
Total Residential	49,667	33,753	25,004	35,741	141,165
Other*	412	360	555	76	1,403
TOTAL	**50,079**	**31,113**	**25,559**	**35,817**	**142,568**

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
SOUTHERN MISSISSIPPI PDD					
COVINGTON					
Total Res	159	10	1	0	169
Total Other*	1	0	0	0	1
Total	160	10	1	0	17
FORREST					
Total Res	5,369	1,595	300	103	7,367
Total Other*	51	21	3	0	75
Total	5,420	1,616	303	103	7,442
GEORGE					
Total Res	1,111	2,022	1,833	1,970	6,936
Total Other*	3	10	22	1	36
Total	1,114	2,032	1,855	1,971	6,972
GREENE					
Total Res	1,410	1,260	505	347	3,522
Total Other*	4	9	9	0	22
Total	1,414	1,269	514	347	3,544
HANCOCK					
Total Res	181	13	3	0	197
Total Other*	2	0	0	0	2
Total	183	13	3	0	199
HARRISON					
Total Res	14,400	10,373	7,153	7,226	39,152
Total Other*	173	194	226	23	616
Total	14,573	10,567	7,379	7,249	39,768
JACKSON					
Total Res	2,093	7,116	13,323	24,963	47,495
Total Other*	10	45	264	49	368
Total	2,103	7,161	13,587	25,012	47,863
JONES					
Total Res	7,735	3,636	822	449	12,642
Total Other*	44	39	17	0	100
Total	4,446	3,675	836	449	12,742

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
LAMAR					
Total Res	701	79	17	0	797
Total Other*	9	2	0	0	11
Total	710	81	17	0	808
PEARL RIVER					
Total Res	43	2	0	0	45
Total Other*	0	0	0	0	0
Total	43	2	0	0	45
PERRY					
Total Res	1,370	1,333	557	430	3,690
Total Other*	3	7	7	0	17
Total	1,373	1,340	564	430	3,707
STONE					
Total Res	1,673	832	178	90	2,773
Total Other*	9	8	4	0	21
Total	1,682	841	182	90	2,794
WAYNE					
Total Res	2,188	868	154	99	3,309
Total Other*	9	6	1	0	16
Total	2,197	874	155	99	3,325
CENTRAL MISSISSIPPI PDD					
HINDS					
Total Res	58	2	0	0	60
Total Other*	4	0	0	0	4
Total	62	2	0	0	64
MADISON					
Total Res	68	1	0	0	69
Total Other*	1	0	0	0	1
Total	69	1	0	0	70
RANKIN					
Total Res	84	2	0	0	86
Total Other*	2	0	0	0	2
Total	86	2	0	0	88

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
SIMPSON					
Total Res	22	1	0	0	23
Total Other*	0	0	0	0	0
Total	22	1	0	0	23
EAST CENTRAL MISSISSIPPI PDD					
CLARKE					
Total Res	951	149	12	6	1,118
Total Other*	5	2	0	0	7
Total	956	151	12	6	1,125
JASPER					
Total Res	1,762	475	55	33	2,325
Total Other*	12	6	2	0	20
Total	1,774	481	57	33	2,345
KEMPER					
Total Res	194	12	0	0	206
Total Other*	0	0	0	0	0
Total	194	12	0	0	205
LAUDERDALE					
Total Res	2,546	348	69	2	2,965
Total Other*	27	6	0	0	33
Total	2,573	354	70	2	2,998
LEAKE					
Total Res	425	26	0	0	451
Total Other*	2	0	0	0	2
Total	427	26	0	0	453
NESHOBA					
Total Res	1,242	132	3	4	1,381
Total Other*	9	1	0	0	10
Total	1,251	133	3	4	1,391
NEWTON					
Total Res	1,723	313	14	16	2,066
Total Other*	9	3	0	0	12
Total	1,732	317	14	16	2,078

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
SCOTT					
Total Res	752	73	2	2	829
Total Other*	4	1	0	0	5
Total	757	74	2	2	834
SMITH					
Total Res	433	40	2	1	476
Total Other*	2	0	0	0	2
Total	435	40	2	1	478
GOLDEN TRIANGLE PDD					
CHOCTAW					
Total Res	69	3	0	0	72
Total Other*	0	0	0	0	0
Total	69	3	0	0	72
CLAY					
Total Res	19	0	0	0	19
Total Other*	0	0	0	0	0
Total	19	0	0	0	19
LOWNDES					
Total Res	43	1	0	0	44
Total Other*	1	0	0	0	1
Total	44	0	0	0	45
NOXUBEE					
Total Res	96	4	0	0	100
Total Other*	0	0	0	0	0
Total	96	4	0	0	100
OKTIBBEHHA					
Total Res	165	7	0	0	172
Total Other*	4	0	0	0	4
Total	169	7	0	0	176
WEBSTER					
Total Res	15	0	0	0	15
Total Other*	0	0	0	0	0
Total	15	0	0	0	0

BUILDINGS DAMAGED BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	MINOR	MODERATE	SEVERE	DESTROYED	TOTAL
WINSTON					
Total Res	369	19	0	0	388
Total Other*	1	0	0	0	1
Total	370	19	0	0	389
NORTH CENTRAL MISSISSIPPI PDD					
ATTALA					
Total Res	138	5	0	0	143
Total Other*	0	0	0	0	0
Total	138	5	0	0	143
HOLMES					
Total Res	10	0	0	0	10
Total Other*	0	0	0	0	0
Total	10	0	0	0	10
MONTGOMERY					
Total Res	11	0	0	0	11
Total Other*	0	0	0	0	0
Total	11	0	0	0	11
THREE RIVERS PDD					
MONROE					
Total Res	4	0	0	0	4
Total Other*	0	0	0	0	0
Total	4	0	0	0	4

*Other structures will include the following: Agriculture, Commercial, Education, Government, Industrial, and Religion.

Category 3 and Category 1 Storm Vulnerability: Structures Damaged

Summaries of the results for the scenarios for Category 3 and Category 1 hurricanes are below. The details can be found in Appendix 7.3.2-B.

Category 3 Storm Vulnerability

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

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.

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-MH 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.

Ttables 3.2.10 and 3.2.11 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 3.2.10
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	6,780,840	14,749,842	9,420,176

DAMAGED BUILDINGS LOSSES BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO	TOTAL BUILDING VALUE	AVERAGE BUILDING LOSS RATIO (%)
SOUTHERN MISSISSIPPI PDD					
Covington	61,198	104,731	3,103	922,552	6.1
Forrest	121,543	1,013,206	120,022	4,391,947	9.52
George	655	13,241	464,437	994,097	16.04
Greene	94	2,177	110,910	561,139	6.61
Hancock	2,072	1,102,145	6,759	2,800,991	44.4
Harrison	3,566,246	8,859,219	2,498,055	12,579,386	39.54
Jackson	51,796	2,007,571	5,530,134	7,819,743	32.35
Jefferson Davis	98,507	8,573	191	618,923	5.78
Jones	13,856	202,167	254,810	3,388,274	4.63
Lamar	291,271	562,971	13,034	2,400,662	12.04
Marion	320,836	15,596	311	1,220,071	9.21
Pearl River	1,543,532	203,760	1,949	2,538,342	22.97
Perry	1,582	45,907	124,337	541,493	10.58

DAMAGED BUILDINGS LOSSES BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO	TOTAL BUILDING VALUE	AVERAGE BUILDING LOSS RATIO (%)
Stone	22,279	332,956	57,283	692,138	19.87
Wayne	124	1,939	52,455	964,031	1.72
SOUTHWEST MISSISSIPPI PDD					
Lawrence	28,457	1,063	0	693,128	1.42
Lincoln	4,222	140	0	1,728,054	.08
Pike	3,393	0	0	2,118,403	.05
Walthall	20,139	596	0	654,972	1.05
CENTRAL MISSISSIPPI PDD					
Copiah	9,187	938	33	1,347,882	.25
Hinds	219,182	39,457	4,213	16,531,670	39.51
Madison	105,970	29,194	4,284	5,341,001	.87
Rankin	154,998	50,752	6,156	7,424,137	.95
Simpson	75,091	24,317	1,117	1,323,509	2.53
Warren	2,838	383	0	3,081,651	.03
Yazoo	6,749	2,115	281	1,232,626	.25
EAST CENTRAL MISSISSIPPI PDD					
Clake	170	1,152	12,675	895,738	.52
Jasper	1,277	12,442	28,798	841,189	1.68
Kemper	165	752	2,844	514,994	.24
Lauderdale	1,284	6,321	40,310	4,737,294	.29
Leake	5,760	9,870	6,003	980,088	.25
Neshoba	2,577	8,078	14,673	1,460,361	.45
Newton	2,208	9,257	21,311	1,137,090	.96
Scott	10,494	21,830	9,757	1,217,972	1.15
Smith	9,019	33,495	6,066	773,884	2.09
GOLDEN TRIANGLE PDD					
Choctaw	526	1,284	1,651	502,477	.23
Clay	30	335	1,048	1,138,851	.04
Lowndes	65	606	2,663	3,751,354	.03
Noxubee	103	502	1,927	590,660	.14

DAMAGED BUILDINGS LOSSES BY COUNTY AND PLANNING AND DEVELOPMENT DISTRICT					
COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO	TOTAL BUILDING VALUE	AVERAGE BUILDING LOSS RATIO (%)
Oktibbeha	461	1,661	4,196	3,193,127	.06
Webster	265	583	717	553,056	.10
Winston	1,110	3,246	5,702	1,042,926	.32
NORTH CENTRAL MISSISSIPPI PDD					
Attala	4,143	5,402	3,196	1,035,094	.41
Carroll	1,345	986	283	503,426	.18
Grenada	802	769	358	1,418,843	.10
Holmes	4,281	2,542	648	842,135	.53
Leflore	3,206	1,380	271	1,948,895	.08
Montgomery	1,075	1,264	661	666,334	.06
SOUTH DELTA PDD					
Bolivar	416	0	0	1,992,788	0.0
Humphreys	1,483	408	12	519,632	.15
Sharkey	380	74	0	303,183	0
Sunflower	1,357	338	0	1,496,891	.04
Washington	1,004	60	0	3,369,282	.01
THREE RIVERS PDD					
Monroe	0	91	532	2,032,451	0
TOTAL	6,780,840	14,749,842	9,420,176	123,804,876	0

Source: HAZUS-MH

Table 3.2.11
Total Economic Losses to Mississippi Counties from Category 5 Hurricane (Expressed in Thousands of Dollars)

COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO
SOUTHERN MISSISSIPPI PPD			
Covington	96,889	170,754	3,852
Forrest	178,695	1,725,901	178,221
George	915	18,955	773,076
Greene	135	2,740	180,315

COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO
Hancock	3,501,268	1,850,706	9,153
Harrison	6,299,738	15,656,085	4,264,525
Jackson	71,960	3,320,089	9,341,932
Jefferson Davis	160,369	11,216	228
Jones	18,169	317,759	408,310
Lamar	475,426	954,922	16,989
Marion	535,923	21,652	416
Pearl River	2,598,367	327,144	2,649
Perry	2,119	73,469	205,796
Stone	34,115	568,571	93,721
Wayne	210	2,500	81,581
SOUTHWEST MISSISSIPPI PDD			
Lawrence	43,699	1,322	26
Lincoln	5,288	219	7
Pike	4,229	63	
Walthall	29,544	730	
CENTRAL MISSISSIPPI PDD			
Copiah	11,938	1,167	64
Hinds	297,223	46,335	4,968
Madison	148,937	36,147	5,012
Rankin	220,280	65,634	7,561
Simpson	117,802	35,303	1,360
Warren	3,568	518	
Yazoo	8,582	2,620	356
EAST CENTRAL MISSISSIPPI PDD			
Clarke	258	1,420	17,311
Jasper	1,584	17,689	43,222
Kemper	221	923	3,628
Lauderdale	1,700	7,855	53,244
Leake	7,455	13,057	7,834
Neshoba	3,208	10,390	19,529
Newton	2,882	12,226	30,162
Scott	13,942	30,839	12,986

COUNTY	HANCOCK SCENARIO	HARRISON SCENARIO	JACKSON SCENARIO
Smith	12,390	51,470	8,067
GOLDEN TRIANGLE PDD			
Choctaw	668	1,695	2,200
Clay	39	375	1,131
Lowndes	124	806	3,190
Noxubee	127	592	2,349
Oktibbeha	579	1,934	4,965
Webster	314	677	826
Winston	1,398	4,211	7,400
NORTH CENTRAL PDD			
Attala	5,300	7,005	4,014
Carroll	1,720	1,228	367
Grenada	1,001	953	463
Holmes	5,366	3,226	783
Leflore	3,507	1,451	292
Montgomery	1,275	1,526	784
SOUTH DELTA PDD			
Bolivar	416		
Humphreys	1,636	421	12
Sharkey	393	78	
Sunflower	1,380	347	
Washington	1,017	60	
THREE RIVERS PDD			
Monroe		148	696
TOTAL	14,935,537	25,385,210	15,805,573

Source: HAZUS-MH

Category 3 and Category 1 Storm Vulnerability: Damaged Buildings Losses and Total Economic Losses

Damaged buildings losses and total economic losses for Category 3 and Category 1 hurricanes can be found in Appendix 7.3.2-B.

Assessing Vulnerability of State Facilities/Estimating Potential Losses

Methodology for Assessing Vulnerability of State Facilities

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 3.2.13, 3.2.14 and 3.2.15 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 3.2.12). 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 3.2.12
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
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	

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
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
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	

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
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	
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 3.2.13
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, Granada, 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											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	6.63	27,358
Forrest	4	4,352	221	215,457	20	381,021	30	27,540	628,370	2.77	17,406
George	2	2,537	231	209,041	6	187,340	44	29,580	428,498	0.07	300
Hancock	14	14,772	103	375,077	4	57,707	34	30,685	478,241	73.98	353,803
Harrison	34	37,146	320	1,388,120	21	716,975	129	228,055	2,370,296	28.35	671,979
Jackson	48	50,154	487	3,215,788	42	1,179,460	113	74,120	4,519,522	0.66	29,829
Jefferson Davis	0	428	114	142,023	5	114,232	16	22,950	279,633	15.92	44,518
Jones	8	7,921	295	304,494	18	492,303	54	40,545	845,263	0.41	3,466
Lamar	2	2,672	109	104,806	8	235,365	30	28,220	371,063	12.13	45,010
Marion	1	1,507	179	192,342	9	228,548	15	14,790	437,187	26.30	114,980
Pearl River	12	12,364	251	497,115	7	226,695	42	39,355	775,529	60.81	471,599
Perry	0	148	119	129,452	5	170,842	16	14,960	315,402	0.29	915
Stone	0	515	108	85,747	11	114,827	7	4,590	205,679	3.22	6,623
SOUTHWEST MISSISSIPPI PPD											
Lawrence	0	879	113	91,188	6	227,452	6	11,220	330,739	4.11	13,593
Lincoln	2	2,195	322	156,945	3	56,780	21	16,745	232,665	0.24	558

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Pike	5	7,824	220	114,162	16	660,025	31	27,115	809,126	0.16	1,295
Walthall	3	3,037	131	118,710	5	58,633	10	8,840	189,220	3.07	5,809
CENTRAL MISSISSIPPI PPD											
Copiah	2	3278	292	194163	11	396610	25	19465	613,516	0.68	4,172
Hinds	80	93345	679	947782	58	1643458	191	186660	2,871,245	1.33	38,188
Madison	6	8655	361	510344	20	653378	51	33405	1,205,782	1.98	23,874
Rankin	12	13206	399	542425	21	568718	75	65705	1,190,054	2.09	24,872
Simpson	1	965	211	193031	5	226525	29	20485	441,006	5.67	25,005
Warren	11	11426	190	344205	14	292315	40	45645	693,591	0.09	624
Yazoo	6	6280	408	457300	17	662635	24	17340	1,143,555	0.55	6,290
EAST CENTRAL MISSISSIPPI PDD											
Jasper	2	1822	185	146458	12	266535	18	17000	431,815	0.15	648
Lauderdale	14	15738	495	498954	24	294848	60	87380	896,920	0.03	269
Leake	1	1480	138	140628	5	113475	17	14620	270,203	0.59	1,594
Neshoba	8	9336	198	233180	6	226610	24	27625	496,751	0.18	894
Newton	5	5228	198	129196	7	339745	23	22015	496,184	0.19	943
Scott	5	5481	167	72874	8	283305	16	14790	376,450	0.86	3,237

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	No. of Facilities	Value	Total Value	Loss Ratio	Total Est. Loss
Smith	5	5981	139	96732	2	113220	11	8670	224,603	1.17	2,628
GOLDEN TRIANGLE PPD											
Choctaw	2	1390	94	68778	8	357085	10	12155	439,408	0.10	439
Winston	3	2996	143	91650	7	227537	16	21505	343,688	0.11	378
NORTH CENTRAL MISSISSIPPI PPD											
Attala	1	2095	175	105508	9	265438	18	15725	388,766	0.40	1,555
Carroll	1	1788	196	198804	2	113220	8	6545	320,357	0.27	865
Grenada	2	2445	149	180194	5	170000			352,639	0.06	212
Holmes	3	3831	250	278225	12	397537	31	27540	707,133	0.51	3,606
Leflore	6	7535	134	145916	19	697170	29	29325	879,946	0.16	1,408
	2	2467	291	176037	9	283390	24	20740	482,634	0.16	772
SOUTH DELTA PPD											
Humphreys	0	1776	91	115676	6	170927	11	9690	298,069	0.29	864
Sunflower	13	12207	162	122245	19	567707	37	33575	735,734	0.09	662
Washington	6	11648	387	616403	20	437631	46	35870	1,101,552	0.03	330

Source: HAZUS-MH

Table 3.2.14
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											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	3278	292	194163	11	396610	25	19465	613,516	0.07	429
Hinds	80	93345	679	947782	58	1643458	191	186660	2,871,245	0.24	6,891
Madison	6	8655	361	510344	20	653378	51	33405	1,205,782	0.55	6,632
Rankin	12	13206	399	542425	21	568718	75	65705	1,190,054	0.68	8,092
Simpson	1	965	211	193031	5	226525	29	20485	441,006	1.84	8,115
Yazoo	6	6280	408	457300	17	662635	24	17340	1,143,555	0.17	1,944
EAST											
Ckarke	1	1209	189	144122	8	172779	19	15555	333,665	0.13	434
Jasper	2	1822	185	146458	12	266535	18	17000	431,815	1.48	6,391
Kemper	2	1797	155	123844	4	114232	8	5015	244,888	0.15	367
Lauderdale	14	15738	495	498954	24	294848	60	87380	896,920	0.13	1,166
Leake	1	1480	138	140628	5	113475	17	14620	270,203	1.01	2,729
Neshoba	8	9336	198	233180	6	226610	24	27625	496,751	0.55	2,732
Newton	5	5228	198	129196	7	339745	23	22015	496,184	0.81	4,019
Scott	5	5481	167	72874	8	283305	16	14790	376,450	1.79	6,738
Ssmith	5	5981	139	96732	2	113220	11	8670	224,603	4.33	9,725

TOTAL POTENTIAL DAMAGE TO STATE-OWNED OR OPERATED BUILDINGS, CRITICAL FACILITIES AND INFRASTRUCTURE											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	1390	94	68778	8	357085	10	12155	439,408	0.26	1,142
Lowndes	18	17922	196	416281	13	434512	47	42840	911,555	0.02	182
Noxubee	2	2357	169	254303	4	170757	10	12410	439,827	0.08	352
Oktibbeha	9	10278	178	131194	8	113730	26	19720	274,922	0.05	137
Webster	5	5465	166	105677	5	170000	12	14365	295,507	0.11	325
Wlinston	3	2996	143	91650	7	227537	16	21505	343,688	0.31	1,065
NORTH CENTRAL PDD											
Attala	1	2095	175	105508	9	265438	18	15725	388,766	0.52	2,022
Carroll	1	1788	196	198804	2	113220	8	6545	320,357	0.20	641
Holmes	3	3831	250	278225	12	397537	31	27540	707,133	0.30	2,121
Leflore	6	7535	134	145916	19	697170	29	29325	879,946	0.07	616
Montgomery	2	2467	291	176037	9	283390	24	20740	482,634	0.19	917

Source: HAZUS-MH

Table 3.2.15
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											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	3.196,206
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	93345	679	947,782	58	1,643,458	191	186,660	2,871,245	0.03	861
Madison	6	8655	361	510,344	20	653,378	51	33,405	1,205,782	0.08	965
Rankin	12	13206	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

COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	1209	189	144,122	8	172,779	19	15,555	333,665	1.41	4,705
Jasper	2	1822	185	146,458	12	266,535	18	17,000	431,815	3.42	14,768
Kemper	2	1797	155	123,844	4	114,232	8	5,015	244,888	0.55	1,347
Lauderdale	14	15738	495	498,954	24	294,848	60	87,380	896,920	0.85	7,624
Leake	1	1480	138	140,628	5	113,475	17	14,620	270,203	0.61	1,648
Neshoba	8	9336	198	233,180	6	226,610	24	27,625	496,751	1.00	4,968
Newton	5	5228	198	129,196	7	339,745	23	22,015	496,184	1.87	9,279
Scott	5	5481	167	72,874	8	283,305	16	14,790	376,450	0.80	3,012
Smith	5	5981	139	96,732	2	113,220	11	8,670	224,603	0.78	1,752
GOLDEN TRIANGLE PDD											
Choctaw	2	1390	94	68,778	8	357,085	10	12,155	439,408	0.33	1,450
Clay	0	1181	242	316,611	15	227,375	30	22,270	567,437	0.09	511
Lowndes	18	17922	196	416,281	13	434,512	47	42,840	911,555	0.07	638
Noxubee	2	2357	169	254,303	4	170,757	10	12,410	439,827	0.33	1,451
Oktibbeha	9	10278	178	131,194	8	113,730	26	19,720	274,922	0.13	357
Webster	5	5465	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											
COUNTY BY PDD	GOVERNMENT BUILDINGS		TRANSPORTATION LIFELINE SYSTEMS		LIFELINE UTILITY SYSTEMS		ESSENTIAL FACILITIES				
County	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	2996	143	91,650	7	227,537	16	21,505	343,688	0.55	1,890
NORTH CENTRAL PDD											
Attala	1	2095	175	105,508	9	265,438	18	15,725	388,766	0.31	1,205
Holmes	3	3831	250	278,225	12	397,537	31	27,540	707,133	0.08	566
Montgomery	2	2467	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

Source: HAZUS-MH

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 7.3.2-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.

3.3 Tornado Risk Assessment

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. 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

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 56 years:

Weak Tornados (FO – F1)

Represent 62% of prior tornado events in Mississippi and resulted in 3% of tornado-caused fatalities in Mississippi. This classification represents tornado with a duration between one and ten plus minutes with wind speeds less than 110 mph.

Strong Tornados (F2 – F3)

Represent 34% of prior tornado events in Mississippi and resulted in 25% of tornado caused fatalities in Mississippi. The life expectancy of this classification of tornado is 20 minutes or longer minutes with wind speeds from 110 to 205 mph.

Violent Tornados (F4 – F5)

Represent 4% 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 205 mph.

Listed below is the Fujita Scale (F-Scale) table that defines the ratings of tornadoes:

Fujita Tornado Damage Scale

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

Source:www.spc.noaa.gov/faq/tornado/f-scale

In February 2007, an Enhanced Fujita Scale, or EF-Scale, was approved by the National Weather Service. The EF-Scale follows the rating system (F0-F5) of the 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.

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 has been updated from the previous approved plan of 2004 to include current statistics regarding tornado activity and education programs conducted throughout the state.

Tornado activity remains relatively consistent in Mississippi. Over the past four years (2003 – 2006), Mississippi has ranked 8th, 13th and tied for 1st respectfully among other states in the highest number of tornado events recorded. During the years 1950 to 2006, Mississippi has had 1,787 tornadoes, accounting for 404 fatalities and 5,788 injuries. This averages to less than one fatality per tornado, but more than 3 injuries during each event.

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 respectfully. 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.

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, on February 21, 2007, a statewide test of the tornado warning system was conducted. The purpose of this test was to encourage schools, government agencies and businesses throughout the state to participate in an annual tornado drill. This test was in conjunction with Severe Weather Awareness Week held February 19 – 23, 2007.

Maximum Tornado Threat

A review of past tornado occurrences reveals that Hinds County had the most recorded tornados over the period 1950 – 2006. Jackson. the capitol city of Mississippi is located in Hinds County. Jackson is the site of hospitals, numerous public and private schools, public and private universities, in addition to the seat of county and state government. The number of fatalities could be more than 100 should a severe tornado strike during business hours in Hinds County.

Location / Past Occurrences

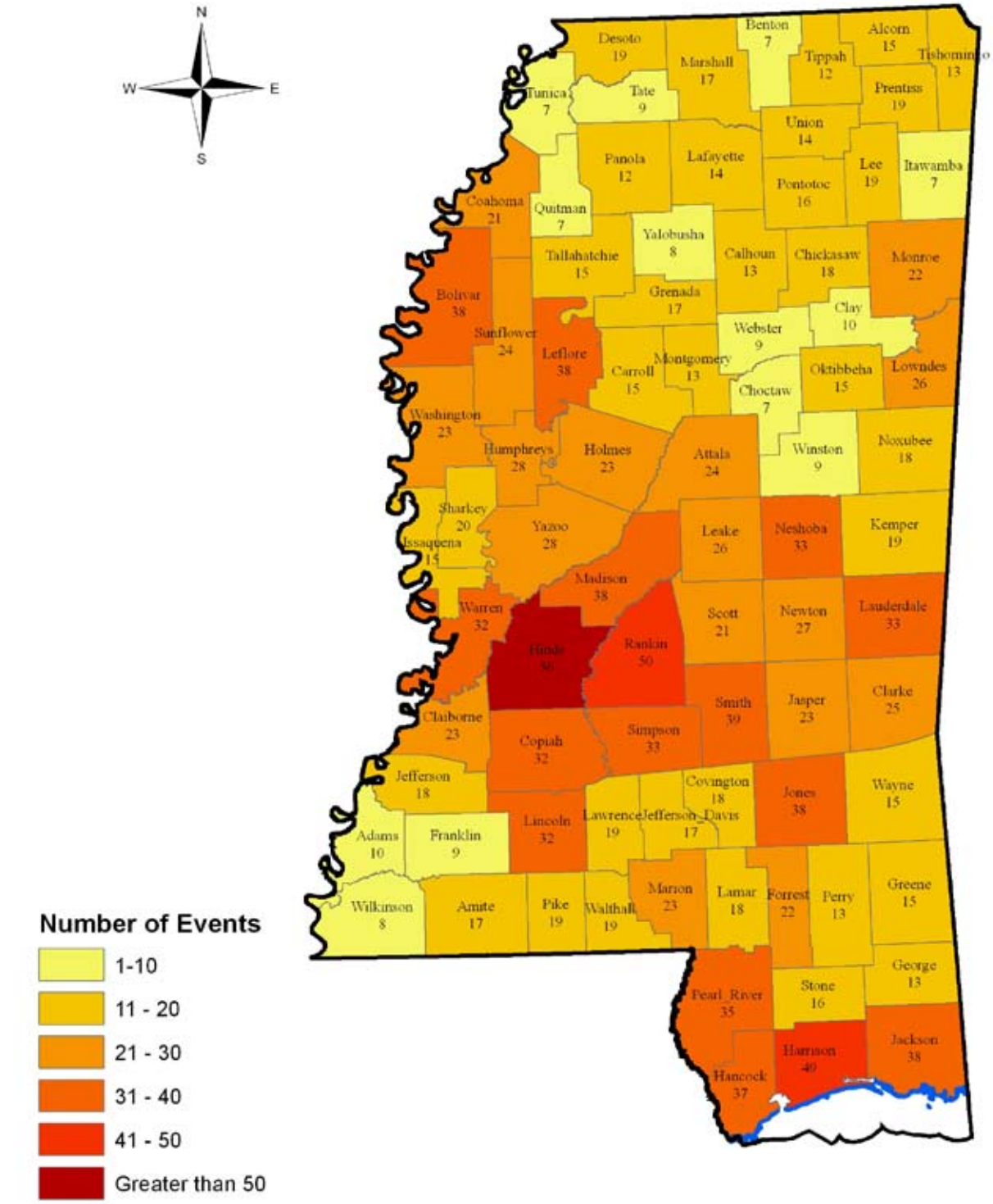
The maps on the subsequent pages (Figures 3.3.1 and 3.3.2) reflect the number of tornados in each county as well as their touch down points during the recorded period based on historical information gathered by the National Climatic Data Center. Densely populated counties such as Hinds, Rankin, and Harrison reported more tornados than less populated counties. This may be because visual confirmation is required by the National Weather Service for a tornado to be listed in their database.

The map shows a wide variance in the number of recorded tornados from one county to the next but every county has been struck. Hinds County has been struck with 56 tornados, while 5 counties (Benton, Choctaw, Itawamba, Quitman, and Tunica) had only seven tornados reported during the recorded period.

In addition to the map, the number of tornados is also listed in graphs by each of the ten Planning and Development District (PDD) and counties within each district. Though tornado risk is statewide, the data clearly shows the Southern Mississippi PDD with 367 tornados has been historically more at risk than the Northeast Mississippi PDD with only 83 past occurrences. Taken together the map and the tables, based on historical records, clearly show Mississippi is frequently and widely in the path of tornados.

Figure 3.3.1

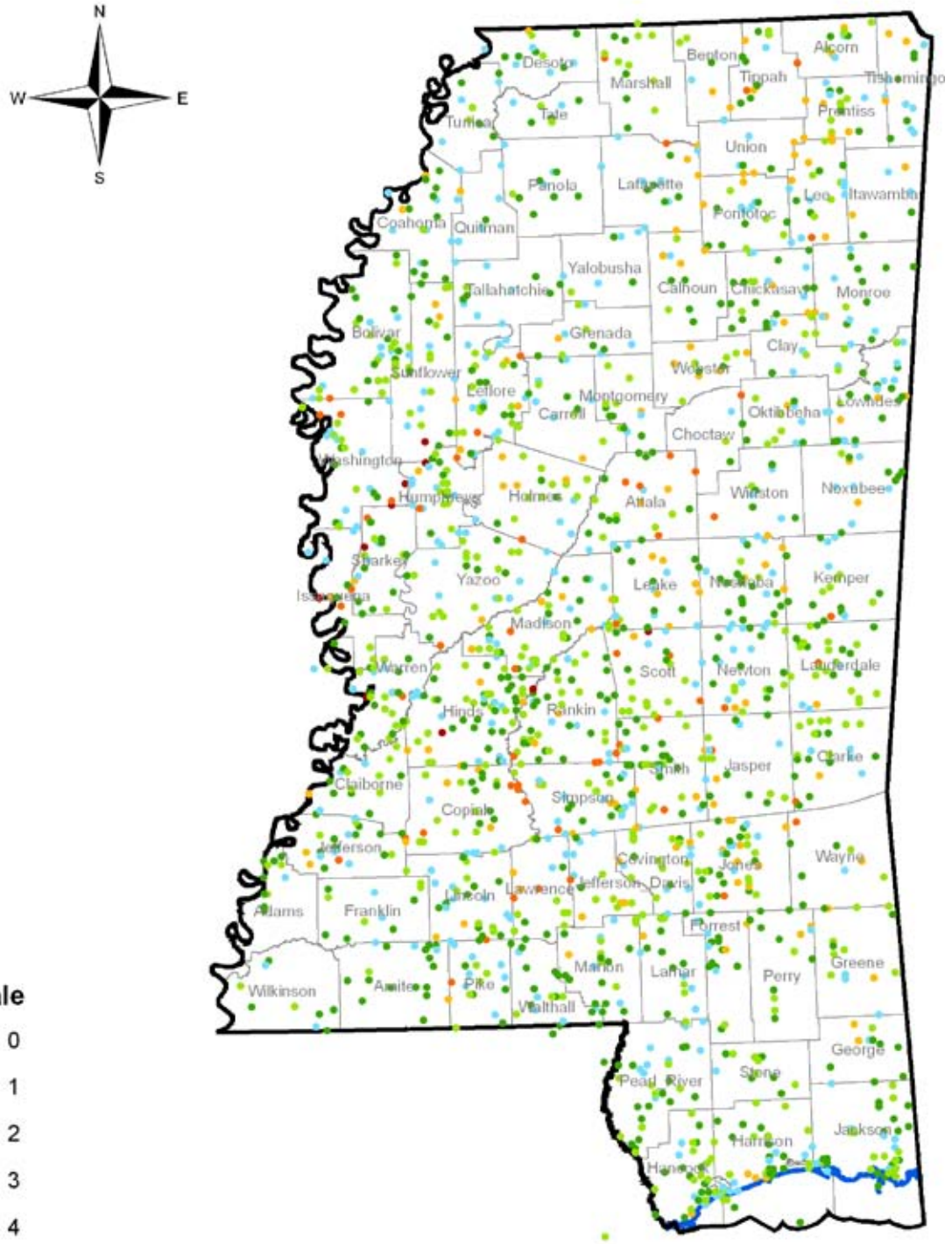
Mississippi Tornados 1950-2006



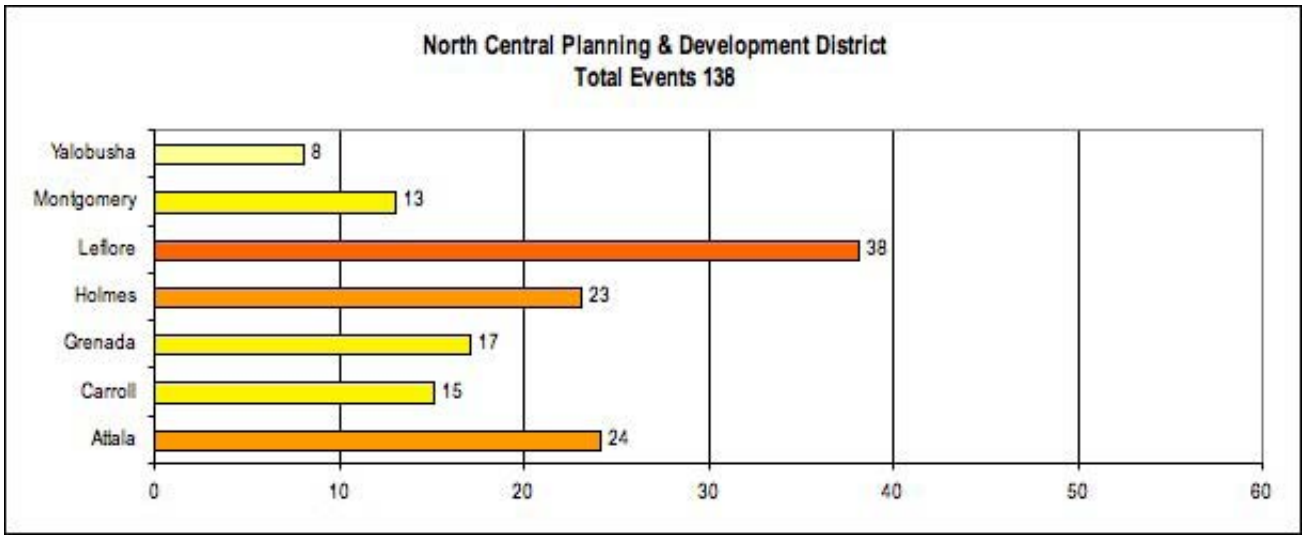
Source: National Climatic Data Center

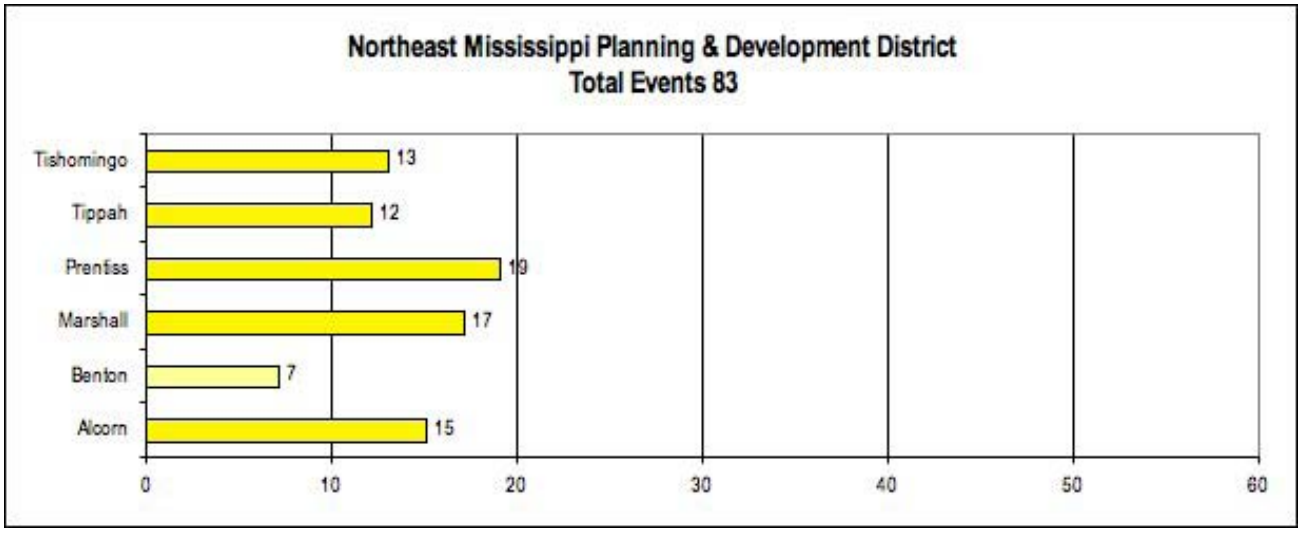
Figure 3.3.2

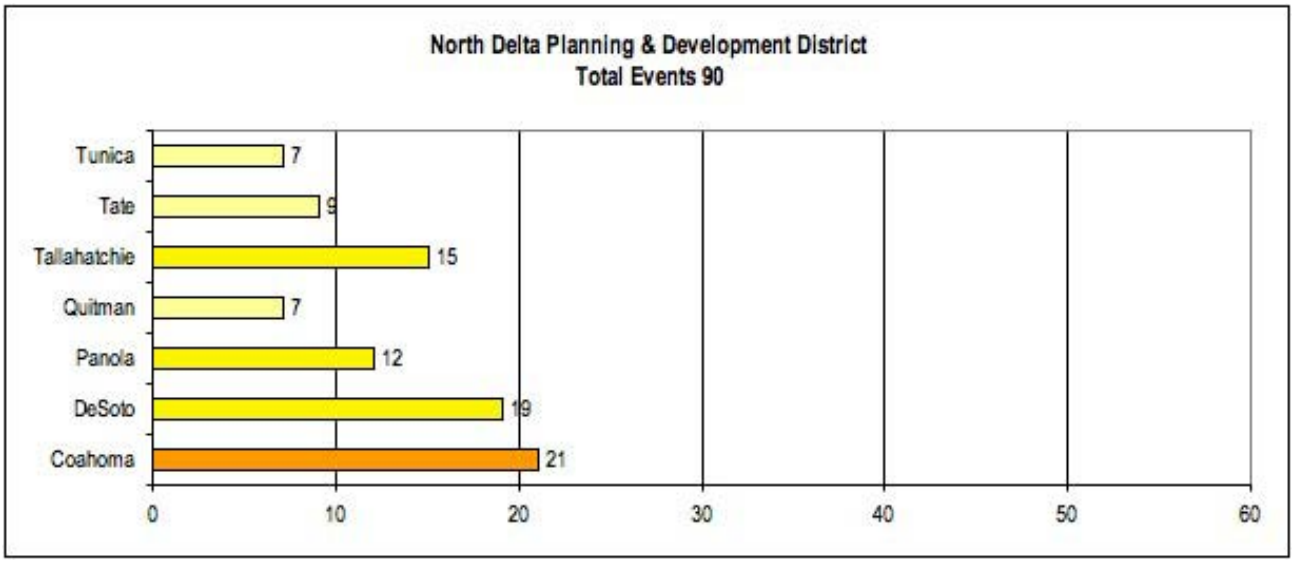
Mississippi Tornado Touch Down Points

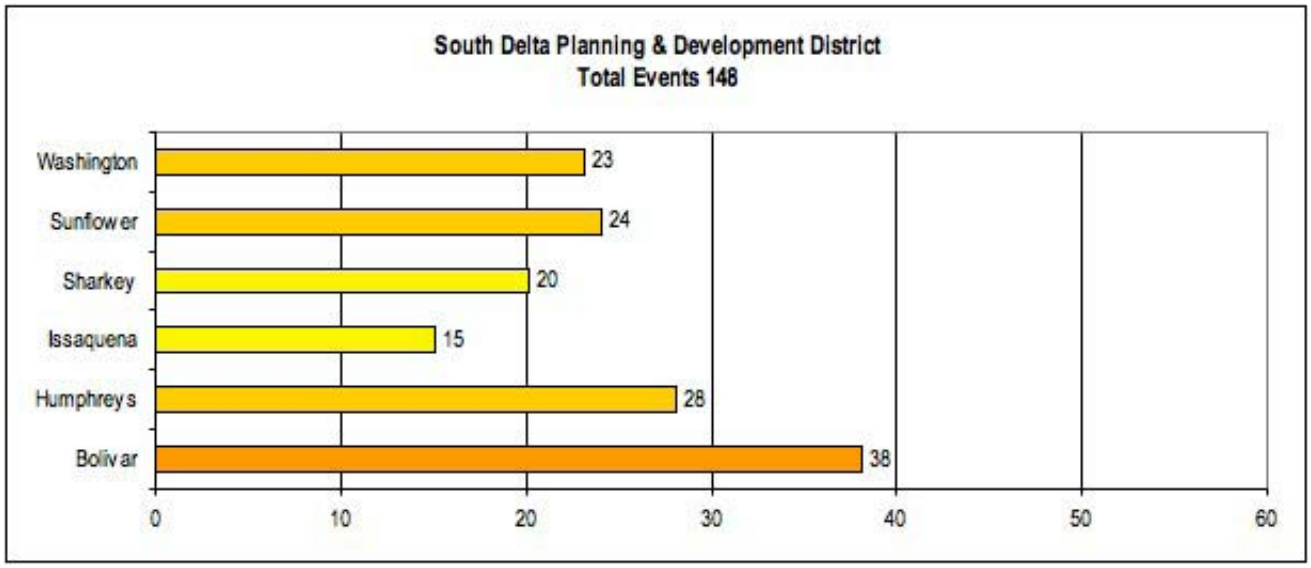


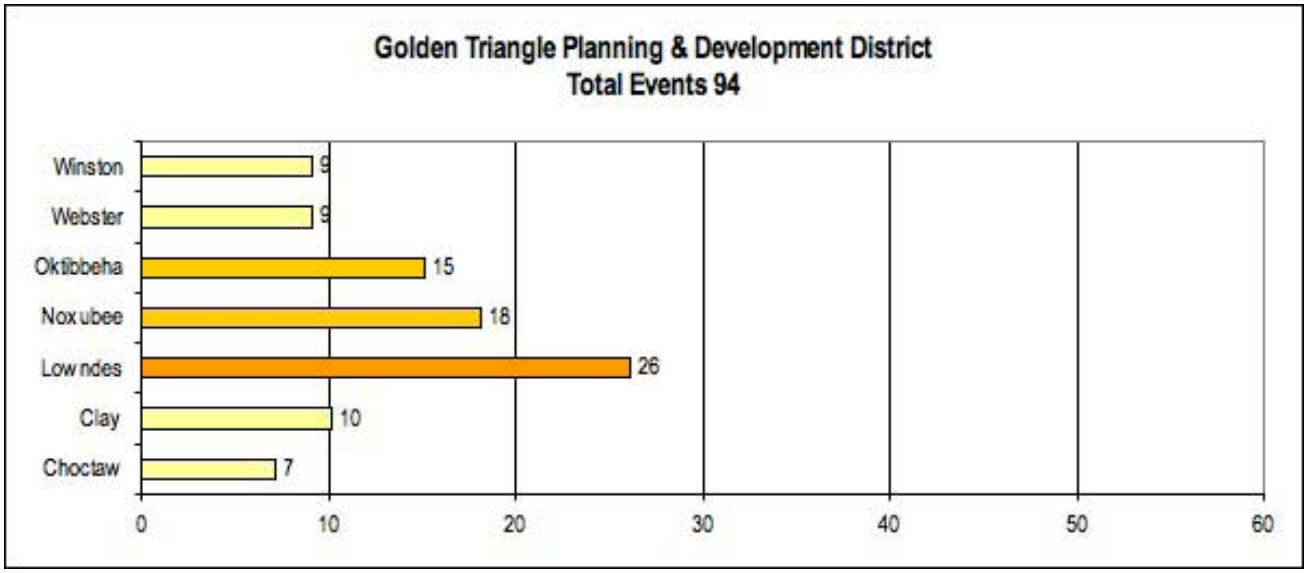
Source: National Climatic Data Center

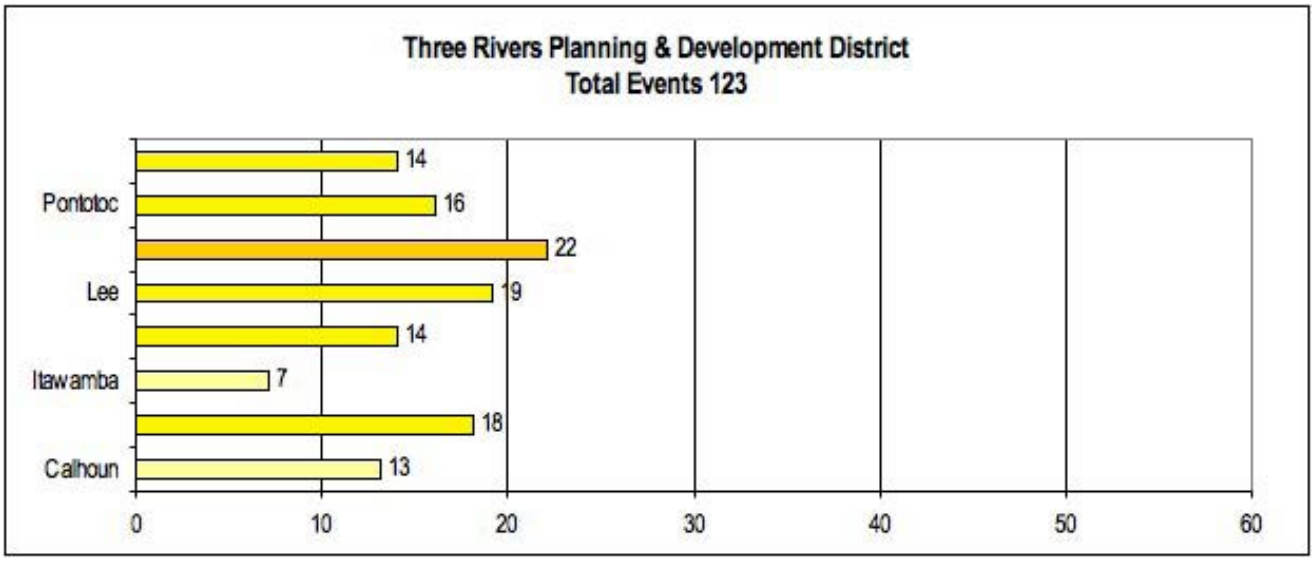

North Central Planning & Development District
Total Events 138
Yalobusha
8
Montgomery
13
Leflore
38
Holmes
23
Grenada
17
Carroll
15
Attala
24
0
10
20
30
40
50
60

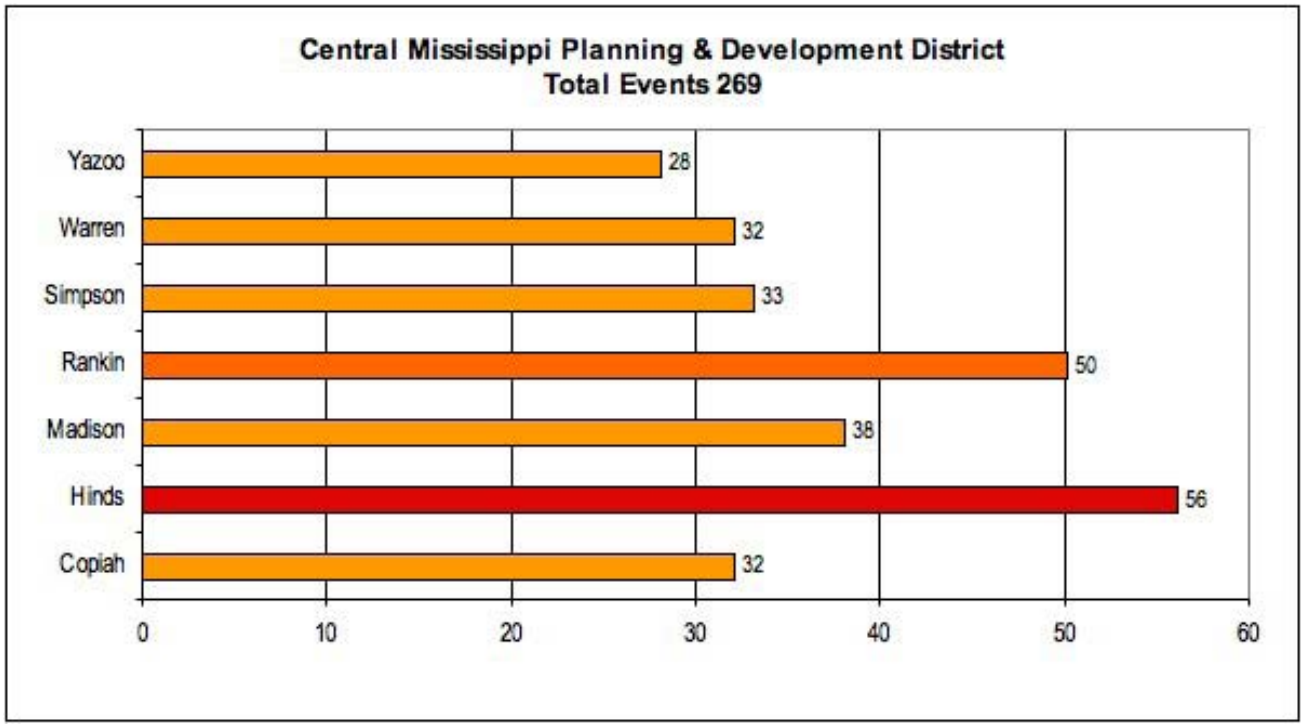

Northeast Mississippi Planning & Development District
Total Events 83
Tishomingo
13
Tippah
12
Prentiss
19
Marshall
17
Benton
7
Alcorn
15
0
10
20
30
40
50
60

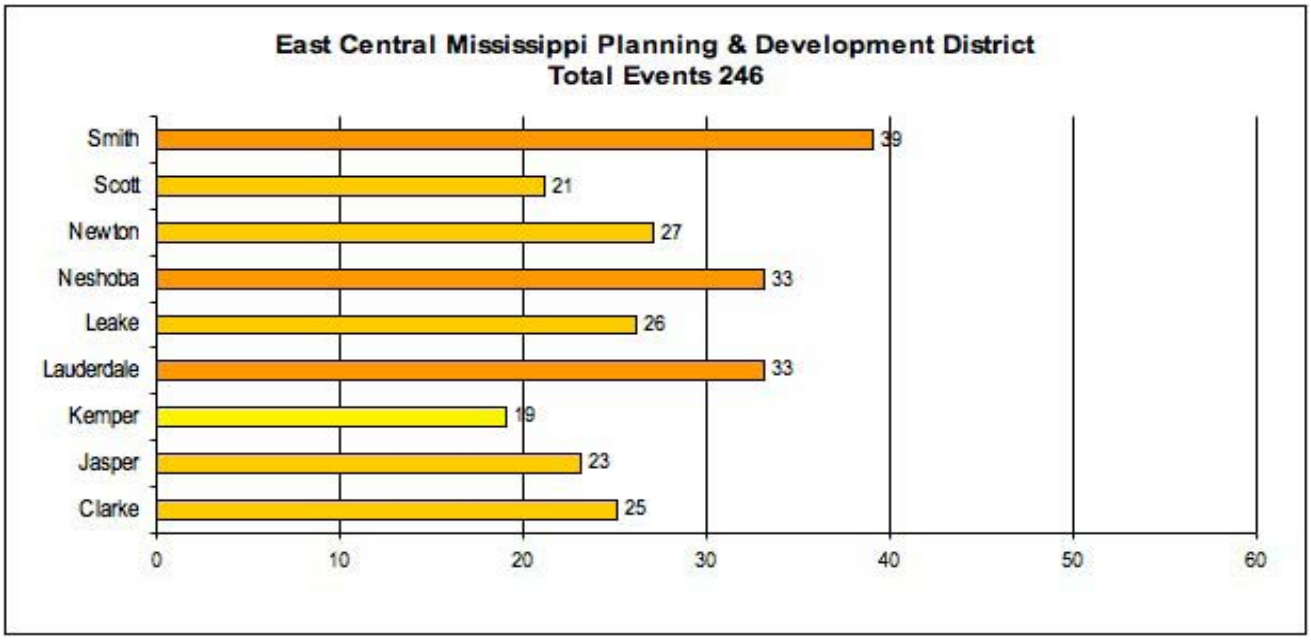

North Delta Planning & Development District
Total Events 90
Tunica
7
Tate
9
Tallahatchie
15
Quitman
7
Panola
12
DeSoto
19
Coahoma
21
0
10
20
30
40
50
60

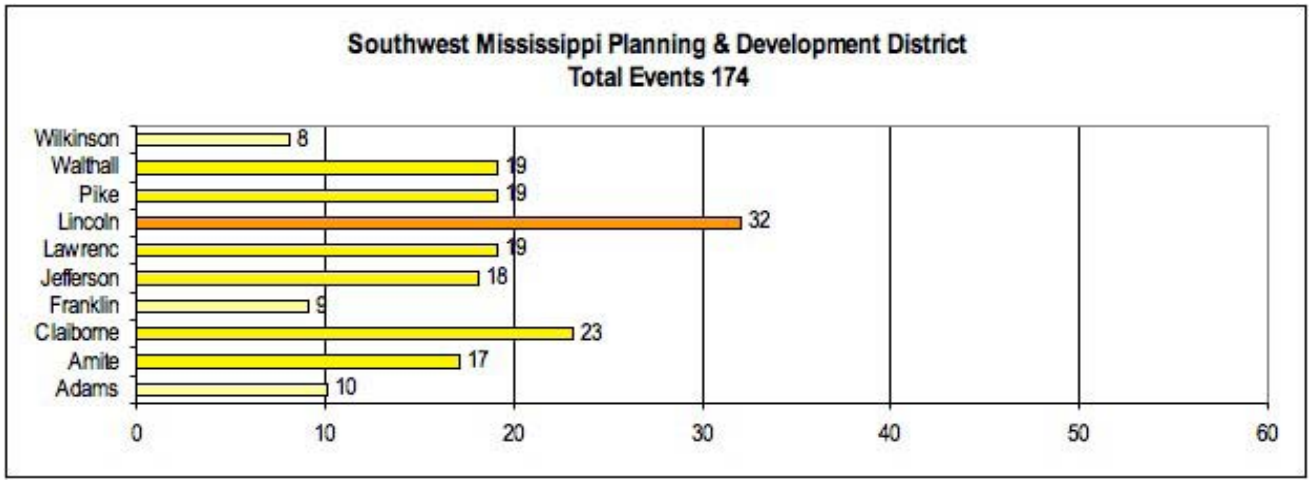

South Delta Planning & Development District
Total Events 148
Washington
Sunflower
Sharkey
Issaquena
Humphreys
Bolivar
23
24
20
15
28
38
0
10
20
30
40
50
60

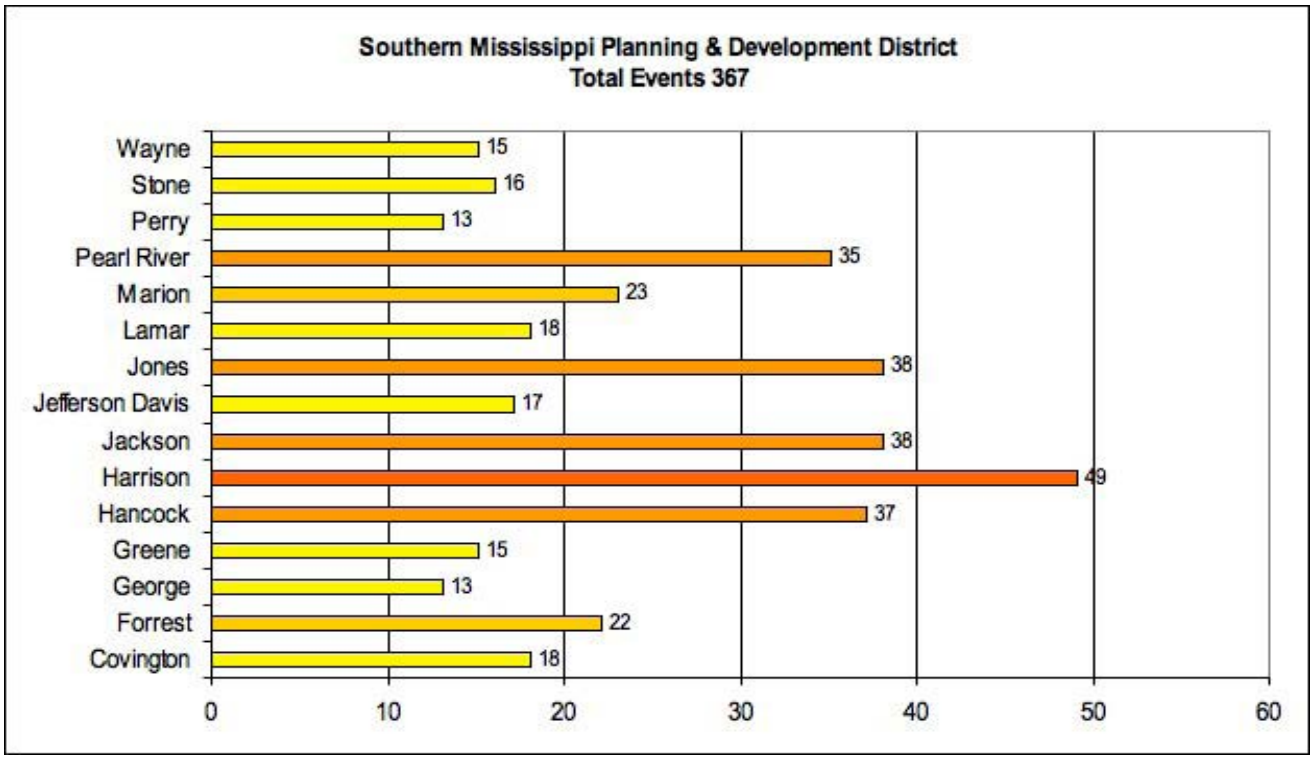

Golden Triangle Planning & Development District
Total Events 94
Winston
Webster
Oktibbeha
Noxubee
Lowndes
Clay
Choctaw
9
9
15
18
26
10
7
0
10
20
30
40
50
60


Three Rivers Planning & Development District
Total Events 123
Pontotoc
Lee
Itawamba
Calhoun
14
16
22
19
14
7
18
13
0
10
20
30
40
50
60


Central Mississippi Planning & Development District
Total Events 269
Yazoo
28
Warren
32
Simpson
33
Rankin
50
Madison
38
Hinds
56
Copiah
32
0
10
20
30
40
50
60


East Central Mississippi Planning & Development District
Total Events 246
Smith
39
Scott
21
Newton
27
Neshoba
33
Leake
26
Lauderdale
33
Kemper
19
Jasper
23
Clarke
25
0
10
20
30
40
50
60


Southwest Mississippi Planning & Development District
Total Events 174
Wilkinson 8
Walthall 19
Pike 19
Lincoln 32
Lawrenc 19
Jefferson 18
Franklin 9
Claiborne 23
Amite 17
Adams 10
0 10 20 30 40 50 60


Southern Mississippi Planning & Development District
Total Events 367
Wayne 15
Stone 16
Perry 13
Pearl River 35
Marion 23
Lamar 18
Jones 38
Jefferson Davis 17
Jackson 38
Harrison 49
Hancock 37
Greene 15
George 13
Forrest 22
Covington 18
0 10 20 30 40 50 60

Percentage of Tornados Encountered over 56 Years by Category

Category	Percent of Occurances
F-0	25
F-1	37
F-2	25
F-3	9
F-4	4
F-5	< 1

Probability of Future Tornado Events

According to the National Weather Service in Jackson, MS, tornado occurrence is too random to scientifically establish the probability of future events in any one county. Tornados have occurred and could reoccur in any of the Mississippi's 82 counties. The recorded period shows an average of 32 tornado events per year throughout the state of Mississippi.

Past occurrences indicate that more densely populated counties, such as Hinds, Hancock, Harrison, Rankin and Jackson have experienced a greater number of tornados. Based solely on historical data the counties with the greatest number of past occurrences are those with the greatest perceived risk of reoccurrence.

The following table 3.3.2 shows the annual probability of occurrence for each county based on the 56 year period of record. To develop this probability, the total number of events occurring in each county over the past 56 years was divided by 56. Since Hinds County has experienced 56 tornadoes over the past 56 years, the probability for occurrence in future years is 1. Seventeen counties in Mississippi have a greater than 50% chance of a tornado occurring in any given year.

Columbus, MS 11-10-2002

Table 3.3.2
Annual Probability of Occurrence by County over 56 Year Period

County	Probability of Occurrence	County	Probability of Occurrence	County	Probability of Occurrence
Hinds	1.00	Marion	0.41	Tallahatchie	0.27
Rankin	0.89	Holmes	0.41	Wayne	0.27
Harrison	0.88	Forrest	0.39	Carroll	0.27
Smith	0.70	Monroe	0.39	Greene	0.27
Madison	0.68	Coahoma	0.38	Issaquena	0.27
Jackson	0.68	Scott	0.38	Lafayette	0.25
Jones	0.68	Sharkey	0.36	Union	0.25
Leflore	0.68	DeSoto	0.34	George	0.23
Bolivar	0.68	Lee	0.34	Tishomingo	0.23
Hancock	0.66	Pike	0.34	Calhoun	0.23
Pearl River	0.63	Kemper	0.34	Montgomery	0.23
Lauderdale	0.59	Prentiss	0.34	Perry	0.23
Neshoba	0.59	Walthall	0.34	Panola	0.21
Simpson	0.59	Lawrence	0.34	Tippah	0.21
Warren	0.57	Wilkinson	0.34	Adams	0.18
Lincoln	0.57	Lamar	0.32	Clay	0.18
Copiah	0.57	Covington	0.32	Tate	0.16
Humphreys	0.50	Chickasaw	0.32	Franklin	0.16
Yazoo	0.50	Jefferson	0.32	Webster	0.16
Newton	0.48	Noxubee	0.32	Winston	0.16
Leake	0.46	Marshall	0.30	Yalabusha	0.14
Lowndes	0.46	Grenada	0.30	Quitman	0.13
Clarke	0.45	Amite	0.30	Choctaw	0.13
Attala	0.43	Jefferson Davis	0.30	Itawamba	0.13
Sunflower	0.43	Pontotoc	0.29	Tunica	0.13
Washington	0.41	Stone	0.29	Benton	0.13
Claiborne	0.41	Alcorn	0.27		
Jasper	0.41	Oktibbeha	0.27		

Assessing Vulnerability of People to Tornados

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 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 who 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 that they may cause a disruption in the 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 the event both contribute to the number of fatalities resulting from a given tornado event. Due often to mobility problems or an 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.

In the State of Mississippi, during the period 1950 to 2006, 5,788 injuries from tornados occurred with an average of 103 injuries per year. On average, 3.24 injuries occurred as a result of each recorded tornado incident.

Loss of Life from Tornados

Windborne glass, debris, signs, and shrubs are the major cause of injury and death during a tornado. 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 2006 recorded 404 deaths, 1,787 tornados and $3,520,736,573 (2007 value) in damage within the State of Mississippi. Annual averages equate to 7 deaths, 32 injuries, and $6,2870,295 in damages per year.

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 wild life 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 a tornado. Homes built below grade or underground are likely to remain the safest retreat from tornados.

Assessing Vulnerability by Jurisdiction Methodology

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. 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** — Though tornado touchdowns are unpredictable, the State of Mississippi considers past occurrences to be a legitimate indicator of vulnerability. The past event data was provided by the National Weather Service and covered the period of January 1, 1950 to December 31, 2006. The number of past tornado events per county during this time period were tallied and used to develop the Prior Event Rating.

The lowest amount of past tornado occurrences during the 56 year period was 7 and the highest number of past tornado occurrences was 56. To develop the Prior Event Rating, the total range of past occurrences (7 to 56) was divided into ten equal ranges as shown below. The ranges were numbered one through ten in ascending order, and this became the Prior Event Rating.

Prior Event Rating

Number of Past Occurrences	Rating
7 - 11.9	1
11.9 - 16.8	2
16.8 - 21.7	3
21.7 - 26.6	4
26.6 - 31.5	5
31.5 - 36.4	6
36.4 - 41.3	7
41.3 - 46.2	8
46.2 - 51.1	9
51.1 - 56	10

Summary of Prior Event Ratings:

Hinds County is the only county that received a Prior Event Rating of 10. However, all counties in Mississippi have had at least 7 tornado events, so although a county may have a low Prior Event Rating, they have still experienced at least 7 prior tornado events. All counties and the number of events are shown on the Mississippi Tornados 1950 – 2006 Figure 3.3.1.

A complete table with values used to derive the ratings is included as Appendix 7.3.3-A.

2. **Private Property Valuation Rating** — In order to relatively compare the amount of assets vulnerable to loss by tornado damage in each county, the State of Mississippi turned to assessment data from the Mississippi Tax Commission. The values obtained are from the fiscal year 2006 Ad Valorem Assessment of State of Mississippi provided by the Mississippi State Tax Commission.

The Annual Report provides private property assessments in two categories. These are “Real Property” and “Personal Property”. The “Real Property” assessment represents residential property including improvements. The “Personal Property” assessment represents commercial and business property. The “True Value” listed in each assessment is a total (by county) of the categories within the property assessment. 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 below. The ranges were numbered one through ten in ascending order, and this became the Property Valuation Rating.

Total Private Property Valuation Ranges		Private Property Valuation Rating
$119,875,058	$1,151,915,902	1
$1,151,915,903	$2,183,956,747	2
$2,183,956,748	$3,215,997,592	3
$3,215,997,593	$4,248,038,437	4
$4,248,038,437	$5,280,079,282	5
$5,280,079,283	$6,312,120,126	6
$6,312,120,127	$7,344,160,971	7
$7,344,160,972	$8,376,201,815	8
$8,376,201,816	$9,408,242,660	9
$9,408,242,661	$10,440,283,505	10

Summary of Private Property Valuations:

The Total Private Property Valuation ranged from $119,875,058 in Issaquena County to $10,440,283,505 in Hinds County. Only two counties (DeSoto and Hinds) received the highest Private Property Valuation Rating of 10, while more than half (53) of the counties in Mississippi received the lowest Private Property Valuation Rating of 1. The counties that received a Private Property Valuation Rating greater than 1 are shown in the table below.

County	Private Property Valuation Rating
Adams	2
Marshall	2
Alcorn	2
Leflore	2
Lincoln	2
Pike	2
Panola	2
Tunica	2
Bolivar	2
Monroe	2
Oktibbeha	2
Pearl River	2
Washington	2
Hancock	3

County	Private Property Valuation Rating
Jones	3
Lamar	3
Lafayette	3
Forrest	3
Warren	3
Lauderdale	4
Lowndes	4
Lee	5
Jackson	7
Rankin	8
Madison	8
Harrison	9
DeSoto	10
Hinds	10

A complete table with values used to derive the ratings is included as Appendix 7.3.3-A.

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. An updated population count for counties affected by Hurricane Katrina was developed by Claritas. For those counties not included in the Claritas study, the plan developers used the 2005 estimated population produced by the Population Division of the US Census Bureau released on March 16, 2006. The sources of the population data for each county are noted by the shading in Table Counties with High Population Density Ratings. The shaded population numbers reflect Claritas' January 2006 Population estimate incorporating the impact of Hurricane Katrina.

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.

Population Density Range (persons per square mile)		Population Density Rating
4.62	36.60	1
36.60	68.58	2
68.58	100.56	3
100.56	132.54	4
132.54	164.52	5
164.52	196.50	6
196.50	228.48	7
228.48	260.46	8
260.46	292.44	9
292.44	324.42	10

Summary of Population Density:

The lowest population density is found in Issaquena County with an estimated 4.62 people per square mile. Coincidentally, Issaquena is estimated to have the lowest overall population of 1,909 people over 413 square miles. The highest population density is found in Harrison County with an estimated 324.42 people per square mile. Hinds County is estimated to have the highest overall population with 264,797 people over 869 square miles. Harrison and Hinds County were the only two counties to receive the highest Population Density rating of 10. Those counties with Population Density Ratings of 6 and above are listed in Table 3.3.3 below. (Note: No counties received a Population Density Rating of 5.)

Table 3.3.3
Counties with High Population Density Ratings

County	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating
Lee	449.59	78,793	175.26	6
Forrest	466.58	79,600	170.60	6
Jackson	726.9	130,668	179.76	6
Rankin	774.52	136,894	176.75	6
DeSoto	477.86	139,399	291.72	9
Harrison	580.98	188,482	324.42	10
Hinds	869.18	264,797	304.65	10

*The shaded population numbers reflect Claritas' January 2006 Population estimate incorporating the impact of Hurricane Katrina. Population numbers in unshaded cells were obained from the U.S. Census estimates.

A complete table with values used to derive the ratings is included as Appendix 7.3.3-A.

4. **Tornado Damage Rating** — Total damages on past tornado damage 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 $3,520,736,573 (present day value) in tornado damages from 1950 to 2006. That is an average of $62,870,295.94 per year (present day value).

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.

Tornado Damage Ranges		Tornado Damage Rating
$514,760	$30,376,501	1
$30,376,501	$60,238,242	2
$60,238,242	$90,099,983	3
$90,099,983	$119,961,724	4
$119,961,724	$149,823,465	5
$149,823,465	$179,685,206	6
$179,685,206	$209,546,947	7
$209,546,947	$239,408,688	8
$239,408,688	$269,270,429	9
$269,270,429	$299,132,170	10

Summary of Tornado Damage:

During the 56-year period, Rankin County suffered the greatest loss with $299,132,170 worth of damages. The least amount of damage was in Tate County with $854,993 worth of damages. Rankin was the only county to receive a Tornado Damage Rating of 10. Harrison and Leake Counties received a Tornado Damage Rating of 9. Twenty-five counties received a Tornado Damage Rating between 2 and 4. Fourty-seven counties received a Tornado Damage Rating of 1. Those counties with Tornado Damage Ratings of 5 or higher are listed below.

County	Tornado Damage Rating
Rankin	10
Harrison	9
Leake	9
Hinds	7
Warren	7
Madison	5
Jones	5
Neshoba	5
Alcorn	5
Sharkey	5

A complete table with values used to derive the ratings is included as Appendix 7.3.3-A.

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 highest possible total vulnerability rating was 40. The total vulnerability ratings varied from a high of 37 for both Hinds County and Harrison County to a low of four for Benton, Franklin, Webster and Winston Counties. All 82 counties are listed in Table 3.3.4 as well as in Figure 3.3.3, with their four rating values, in the order of most vulnerable to least vulnerable to torndados.

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 below.

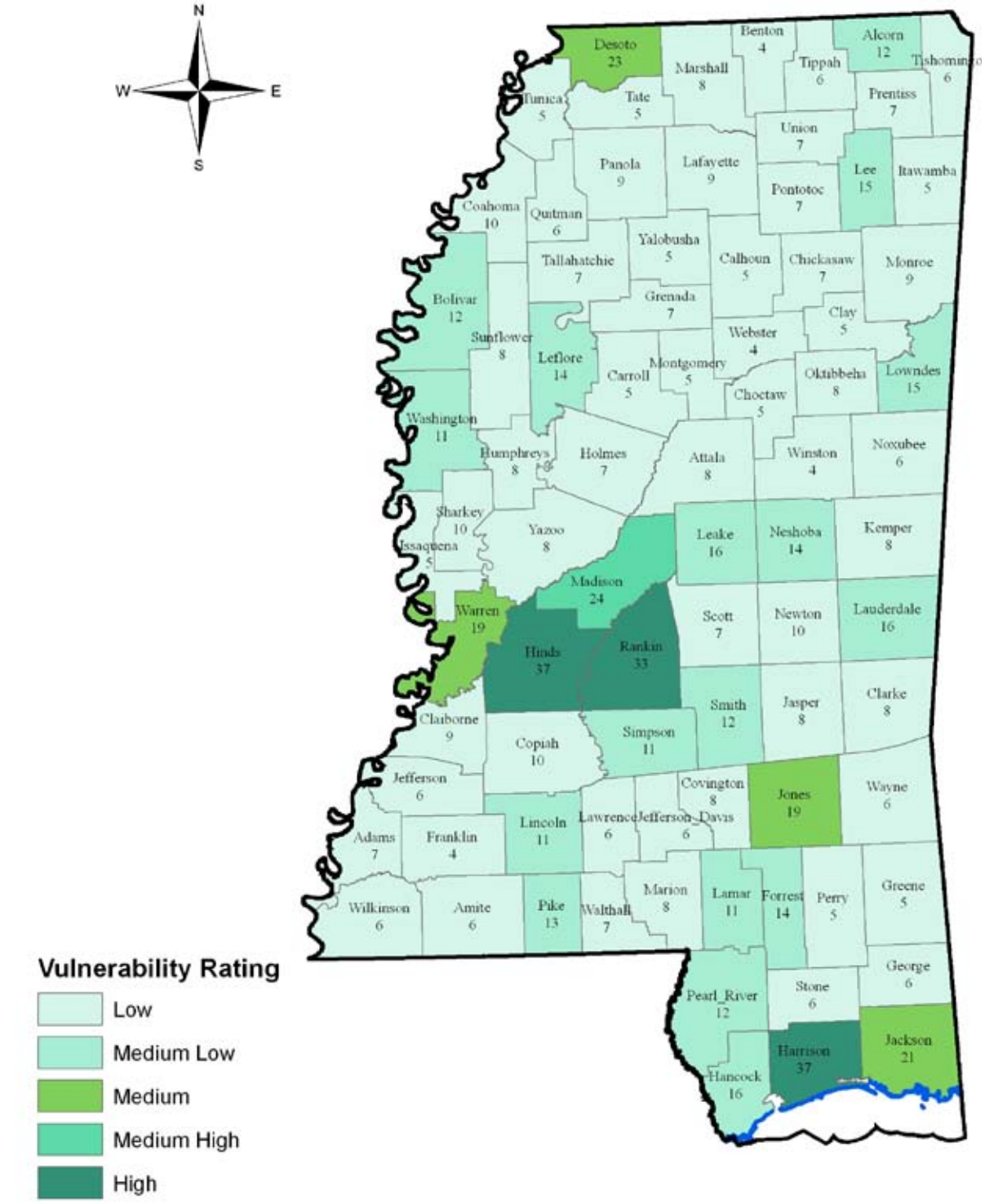
Vulnerability Rating Ranges		Tornado Vulnerability
4	10.6	low
10.6	17.2	medium low
17.2	23.8	medium
23.8	30.4	medium high
30.4	37	high

Harrison, Hinds, and Ranking Counties received a high Tornado Vulnerability. Madison County is the only county with a vulnerability rating within the range for medium high Tornado Vulnerability.

A complete table with values used to derive the ratings is included as Appendix 7.3.3-A.

Figure 3.3.3

Mississippi Tornado Vulnerability Rating



Note: Numbers on map represent the vulnerability rating for each county.

Table 3.3.4
Tornado Vulnerability Ratings for all 82 Mississippi Counties

County	Prior Event Rating	Private Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Harrison	9	9	10	9	37	High
Hinds	10	10	10	7	37	High
Rankin	9	8	6	10	33	High
Madison	7	8	4	5	24	Medium High
DeSoto	3	10	9	1	23	Medium
Jackson	7	7	6	1	21	Medium
Warren	6	3	3	7	19	Medium
Jones	7	3	4	5	19	Medium
Leake	4	1	2	9	16	Medium Low
Hancock	7	3	3	3	16	Medium Low
Lauderdale	6	4	4	2	16	Medium Low
Lowndes	4	4	4	3	15	Medium Low
Lee	3	5	6	1	15	Medium Low
Neshoba	6	1	2	5	14	Medium Low
Leflore	7	2	2	3	14	Medium Low
Forrest	4	3	6	1	14	Medium Low
Pike	3	2	4	4	13	Medium Low
Alcorn	2	2	3	5	12	Medium Low
Smith	7	1	1	3	12	Medium Low
Bolivar	7	2	2	1	12	Medium Low
Pearl River	6	2	3	1	12	Medium Low
Simpson	6	1	2	2	11	Medium Low
Washington	4	2	3	2	11	Medium Low
Lamar	3	3	4	1	11	Medium Low
Lincoln	6	2	2	1	11	Medium Low
Sharkey	3	1	1	5	10	Low
Coahoma	3	1	2	4	10	Low
Newton	5	1	2	2	10	Low
Copiah	6	1	2	1	10	Low
Claiborne	4	1	1	3	9	Low
Panola	2	2	2	3	9	Low
Lafayette	2	3	2	2	9	Low
Monroe	4	2	2	1	9	Low
Kemper	3	1	1	3	8	Low
Attala	4	1	1	2	8	Low

County	Prior Event Rating	Private Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Clarke	4	1	1	2	8	Low
Covington	3	1	2	2	8	Low
Jasper	4	1	1	2	8	Low
Humphreys	5	1	1	1	8	Low
Marion	4	1	2	1	8	Low
Marshall	3	2	2	1	8	Low
Oktibbeha	2	2	3	1	8	Low
Sunflower	4	1	2	1	8	Low
Yazoo	5	1	1	1	8	Low
Tallahatchie	2	1	1	3	7	Low
Pontotoc	2	1	2	2	7	Low
Union	2	1	2	2	7	Low
Adams	1	2	3	1	7	Low
Chickasaw	3	1	2	1	7	Low
Grenada	3	1	2	1	7	Low
Holmes	4	1	1	1	7	Low
Prentiss	3	1	2	1	7	Low
Scott	3	1	2	1	7	Low
Walthall	3	1	2	1	7	Low
Quitman	1	1	1	3	6	Low
Wayne	2	1	1	2	6	Low
Amite	3	1	1	1	6	Low
George	2	1	2	1	6	Low
Jefferson	3	1	1	1	6	Low
Jefferson Davis	3	1	1	1	6	Low
Lawrence	3	1	1	1	6	Low
Noxubee	3	1	1	1	6	Low
Stone	2	1	2	1	6	Low
Tippah	2	1	2	1	6	Low
Tishomingo	2	1	2	1	6	Low
Wilkinson	3	1	1	1	6	Low
Choctaw	1	1	1	2	5	Low
Yalabusha	1	1	1	2	5	Low
Calhoun	2	1	1	1	5	Low
Carroll	2	1	1	1	5	Low
Clay	1	1	2	1	5	Low
Greene	2	1	1	1	5	Low
Issaquena	2	1	1	1	5	Low

County	Prior Event Rating	Private Property Valuation Rating	Population Density Rating	Tornado Damage Rating	Overall Vulnerability Rating	Tornado Vulnerability
Itawamba	1	1	2	1	5	Low
Montgomery	2	1	1	1	5	Low
Perry	2	1	1	1	5	Low
Tate	1	1	2	1	5	Low
Tunica	1	2	1	1	5	Low
Benton	1	1	1	1	4	Low
Franklin	1	1	1	1	4	Low
Webster	1	1	1	1	4	Low
Winston	1	1	1	1	4	Low

Exposure Analyses

The following section consists of three exposure analyses, using three different sets of data. In the 2004 state mitigation plan, it was stated that the State of Mississippi did not have a comprehensive list of state-owned or operated buildings, critical facilities, and infrastructure sorted by county that could be used to determine exposure risk or loss estimations. Since that time, the State of Mississippi has identified the locations of many critical facilities as well as replacement values for state-owned facilities. These are both reviewed below in addition to the updated critical facilities and infrastructure provided in HAZUS-MH.

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.

Monterey Road, Brandon MS April 2005

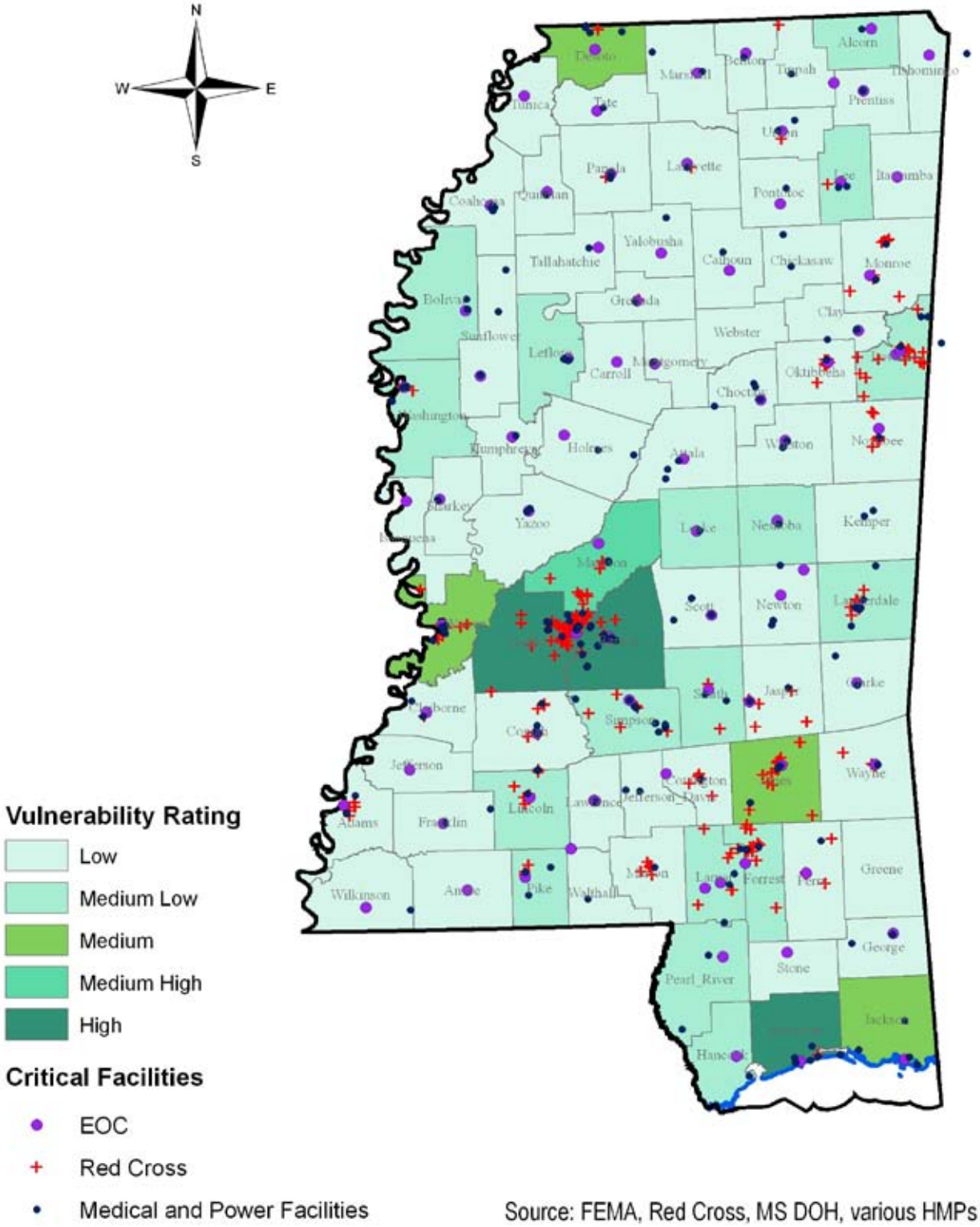
Exposure Analysis of Critical Facilities:

The State of Mississippi developed a definition for "critical facilities" 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 tornados.

The table below presents a summary of critical facilities within the counties of High and Medium High Tornado Vulnerability. These are Harrison, Hinds, Rankin, and Madison Counties. This analysis gives the State of Mississippi an understanding of which critical facilities are most likely to be exposed to tornado events. However, it should be noted that tornadoes may strike in any county.

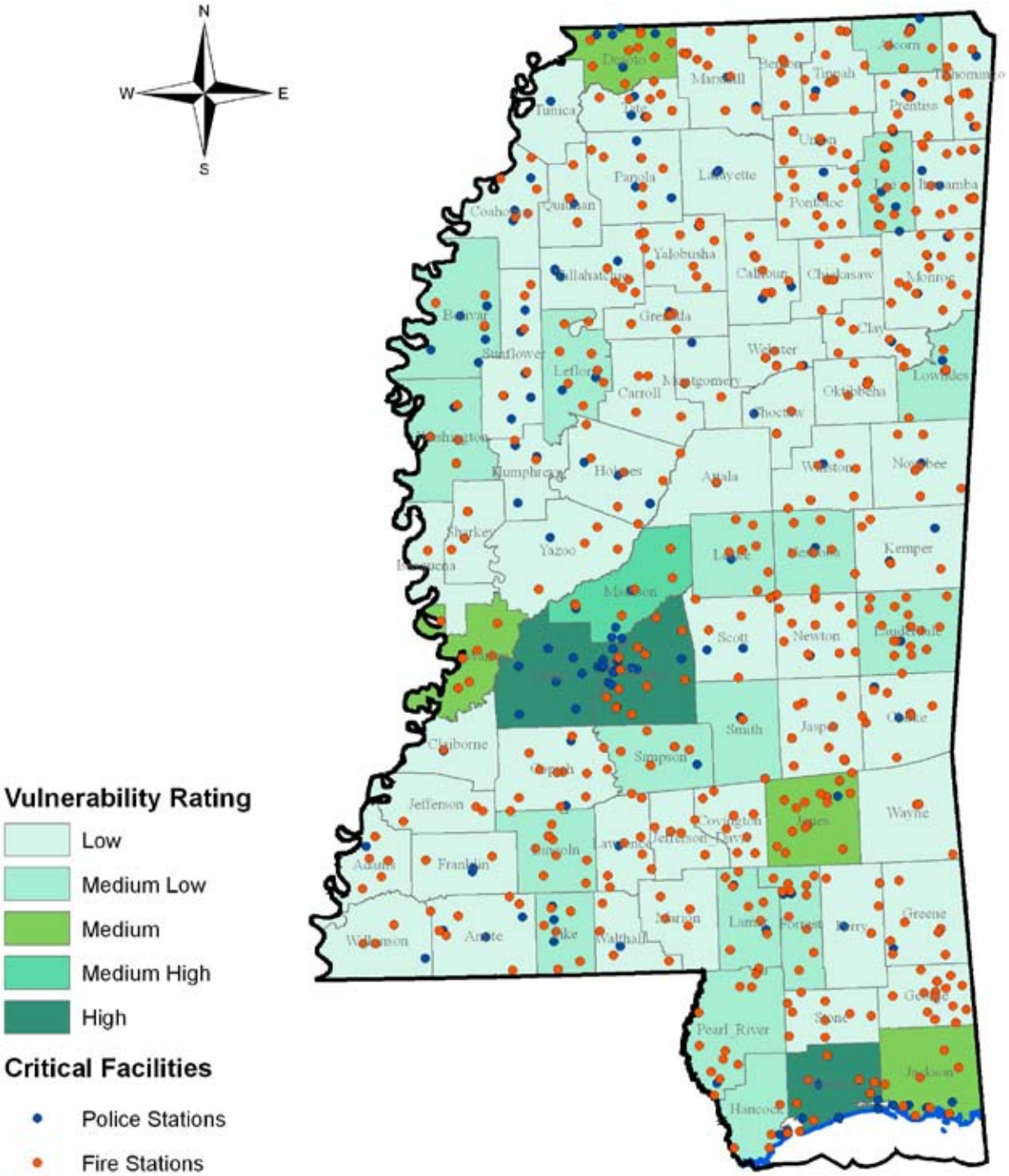
Critical Facility Categories	Number of Facilities in High Vulnerability Counties			Number of facilities in Medium High Vulnerability Counties	Total
	Harrison	Hinds	Rankin	Madison	
Airports	1	3	0	1	5
Animal Shelters	1	2	0	0	2
City Halls	5	8	7	4	24
Courthouses	2	2	1	1	6
Department of Corrections	0	0	1	0	1
Department of Defense	2	0	0	0	2
Emergency Operations Centers	1	1	1	1	4
Fire Stations	7	0	14	7	28
Intermodal Facilities	4	1	1	0	6
MDOT	0	2	0	0	2
Media	20	42	0	0	62
Medical and Power	9	14	20	5	48
Military	7	5	4	1	17
Police Stations	11	17	12	6	46
Red Cross	2	44	6	10	62
Testing Labs	1	5	2	0	8
Wastewater	75	59	38	16	188
Water	7	1	0	2	10
TOTAL FACILITIES	**155**	**206**	**107**	**54**	

Mississippi Tornado Vulnerability Rating and Critical Facilities



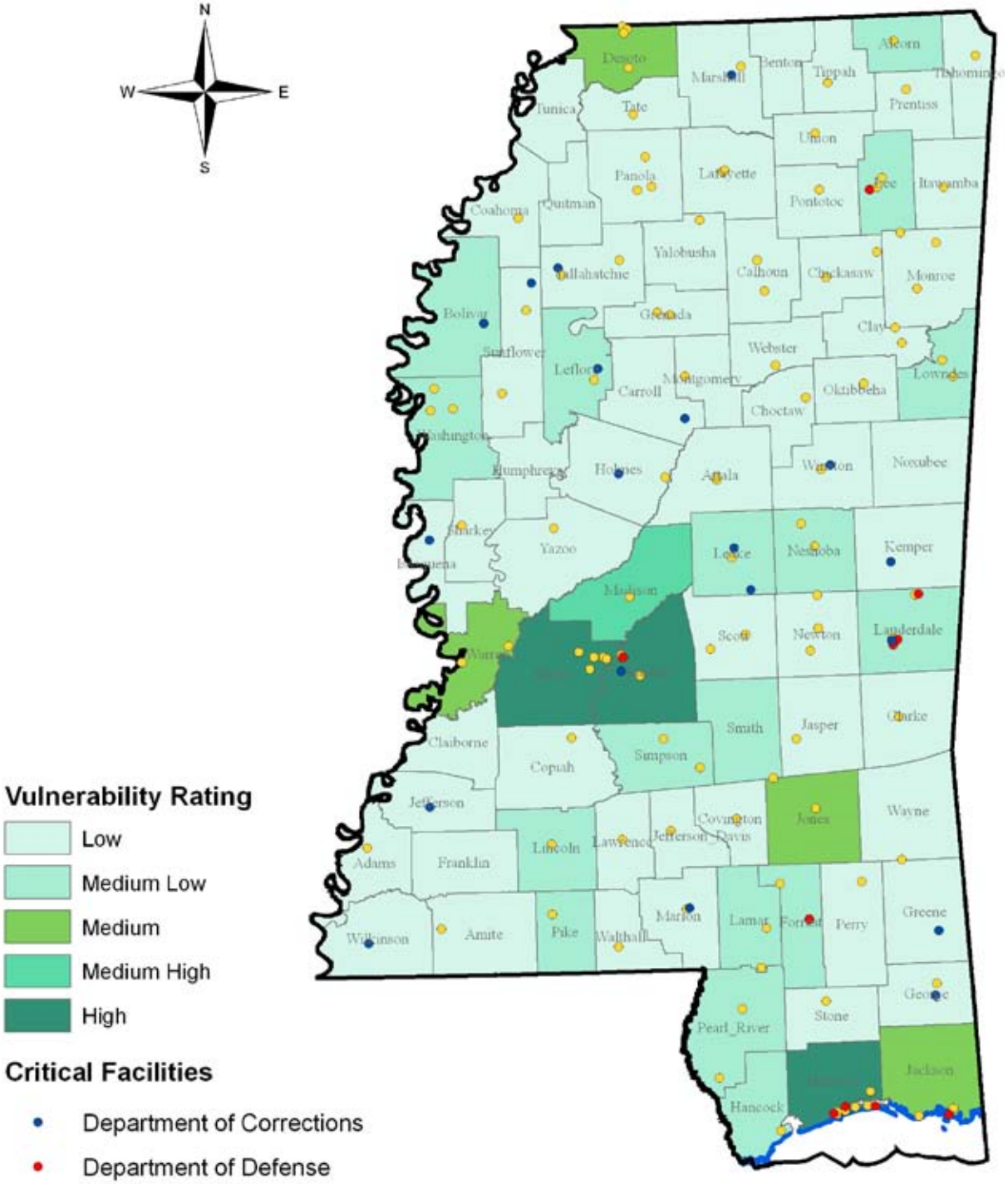
Source: FEMA, Red Cross, MS DOH, various HMPs

Mississippi Tornado Vulnerability Rating and Critical Facilities



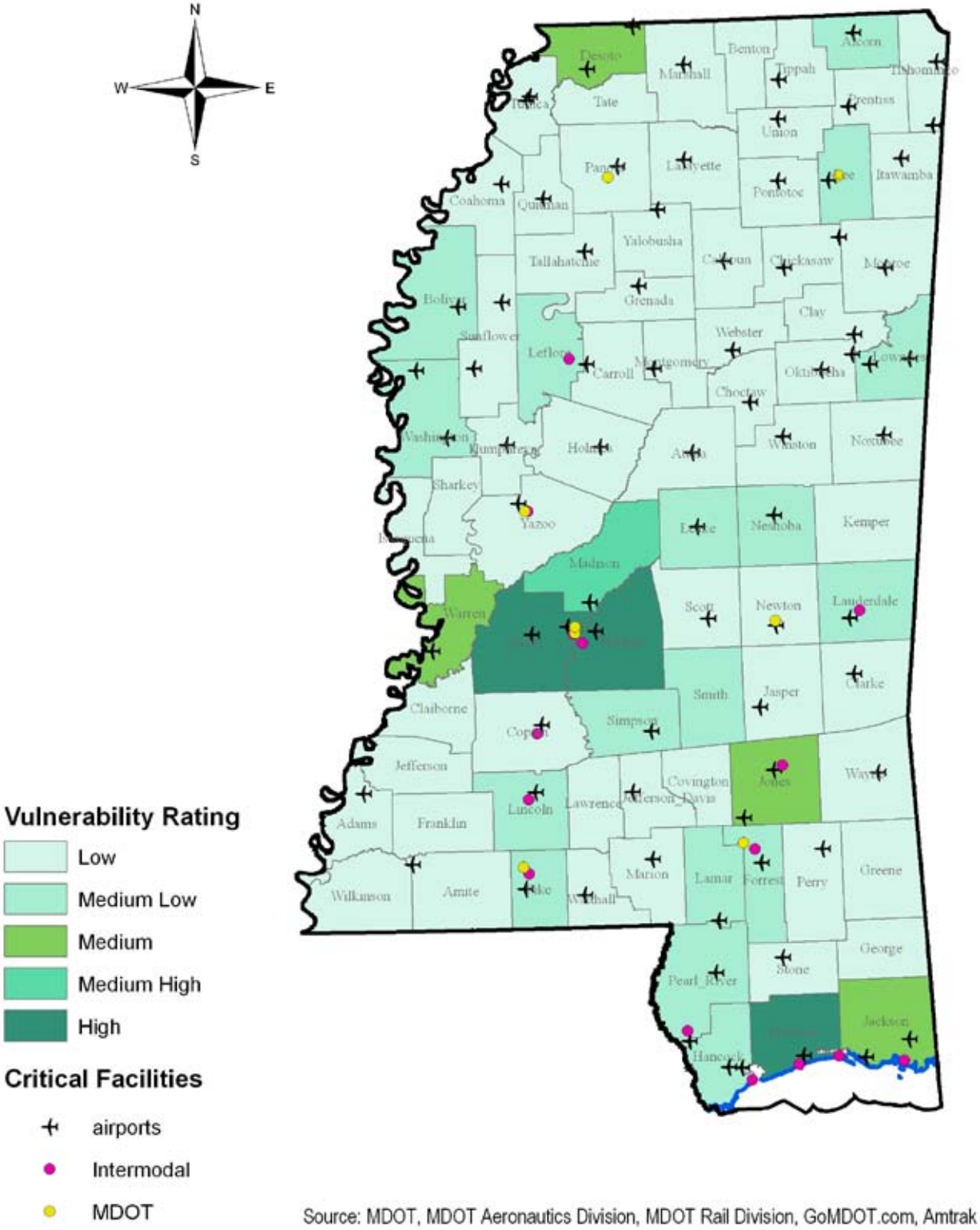
Source: MS Association of Chiefs of Police, State Fire Coordinator

Mississippi Tornado Vulnerability Rating and Critical Facilities



Source: Nassa-base locations, MS Department of Corrections, National Guard EOC

Mississippi Tornado Vulnerability Rating and Critical Facilities



Source: MDOT, MDOT Aeronautics Division, MDOT Rail Division, GoMDOT.com, Amtrak

Exposure Analysis of State-Owned Facilities:

A state inventory of facilities was compiled from 67 building inventory spreadsheets obtained from the Department of Finance Administration. Each spreadsheet contains building inventory information for a given state institution/agency. The State of Mississippi looked for the most useful and consistent information from these spreadsheets to develop the state inventory. The total number of buildings and total replacement value (as provided in the bottom line of each spreadsheet) was entered into the state inventory for use in this analysis. The spreadsheets indicate buildings that were destroyed by Hurricane Katrina by giving them a notation of "deleted". These buildings had no replacement value since they no longer exist. Buildings that have been constructed post-Hurricane Katrina were given a notation of "added" as well as a replacement value. These are included in the totals used in this analysis.

It should be noted that not all buildings included in the 67 spreadsheets were assigned a replacement value. These buildings are not included in the state inventory. Several buildings with replacement values were not accompanied with enough location data to determine the county they are located in. The following table summarizes the total replacement value of buildings owned by state agencies that were unable to be included in the state inventory.

State facilities excluded from the state inventory due to non-existent location information

Department Name	Number of Buildings with Available Replacement Values	Total Replacement Value (as available)
Mississippi Department of Corrections	803	$612,361,986
DFA - Capital Facilities	44	$936,455,566
Department of Transportation	8	$521,997
Wildlife, Fisheries, & Parks	840	$181,990,660
Total	**1695**	**$1,731,330,209**

Using the address and location data provided in the spreadsheets, the county in which each facility exists was identified. The total number of buildings in each county and the total replacement value of those buildings were tallied. Hinds County has the highest total replacement value of all counties for its 904 facilities (state-owned buildings). If all of these buildings needed to be replaced, the cost would amount to $2,260,042,306. Stone County resulted in the lowest tallied total replacement value. The two state-owned facilities in Stone County have a total replacement cost of $277,200.

The table below presents the results for those counties with high and medium high vulnerability to tornadoes.

EXPOSURE TO STATE FACILITIES IN COUNTIES WITH HIGH AND MEDIUM HIGH VULNERABILITY TO TORNADOES

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	Vulnerability Rating
Harrison	70	$186,747,529	High
Hinds	904	$2,260,042,306	High
Rankin	181	$407,397,838	High
Madison	13	$21,106,017	Medium High

The list of all counties in Mississippi and their total replacement values for state-owned facilities is presented as Appendix 7.3.3-B

Exposure Analysis of HAZUS-Identified Critical Facilities and Infrastructure:

The State of Mississippi reviewed three categories of facilities provided in FEMA's HAZUS-MH inventory. This review updates the prior review in the 2004 state plan by utilizing HAZUS-MH MR2 (a more recent version of the software). In the previous version of HAZUS there were government buildings not contained in other categories. These have been incorporated into the three remaining categories shown below (essential facilities, lifeline utility systems, and transportation lifeline systems). 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.

The number of facilities and value of each of the three types of systems for the counties with High and Medium High vulnerability to tornadoes are displayed in the following table. It is generally accepted that tornadoes may strike anytime anywhere in Mississippi with any severity. Thus, for the purposes of this plan, all assets listed within each county are vulnerable to exposure to a tornado.

County Name	Essential Facilities		Lifeline Utility Systems		Transportation Lifeline Systems		Total Value/ Potential Loss
	$ Values	# Facilities	$ Values	# Facilities	$ Values	# Facilities	$ Values
Harrison	$126,735	98	$660,365	20	$786,521	296	$1,573,621
Hinds	$162,775	162	$1,360,068	49	$801,670	572	$2,324,513
Rankin	$61,285	63	$455,413	18	$425,942	291	$942,640
Madison	$30,005	44	$538,305	16	$391,686	223	$959,996

A complete listing of all 82 counties and the HAZUS facility summaries may be found in Appendix 7.3.3-C.

Potential Losses

To estimate annual losses due to tornado damage, the State of Mississippi looked at the historical damage amounts as presented in the Tornado Damage Rating section of the Vulnerability Assessment above. The total damage amounts (dollars) for each county were averaged over the 56 year recorded time period to estimate annual damages. Specifically, the total tornado damage values for each county over the past 56 years (as shown in the vulnerability assessment and inflated to present day values) was divided by 56. For example, the total tornado damage for Harrison County in present day values for the past 56 years amounts to $246,243,767. This total value divided by 56 results in an estimated annual damage value of $4,599,204. Using this methodology, the following table presents the estimated annual losses for the counties with High and Medium High vulnerability to tornadoes.

County	Tornado Vulnerability	Estimated Annual Losses**
Harrison	High	$4,397,210.12
Hinds	High	$3,545,594.37
Rankin	High	$5,341,645.89
Madison	Medium High	$2,204,119.48

A complete listing of estimated annual losses for each county in Mississippi may be found in Appendix 7.3.3-A.

Pontotoc, MS
February 24, 2001

3.4: Flood Risk Assessment

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 genera 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 ten river basins in Mississippi.

Flash Flooding (Rapid):

Flash floods are a result of heavy, localized rainfall, possibly from slow-moving intense thunderstorms 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. These floods often become raging torrents of water that rip through riverbeds, streambeds, city streets, coastal sections, and narrow valleys, sweeping everything in their path. Rapid or flash flooding occurs in all ten river basins in Mississippi.

Coastal (Tidal) Flooding:

All lands bordering the Mississippi Sound, such as various bays and estuaries, or lakes are prone to tidal affects/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 accompany 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: the Pearl River, the Coast and the Pascagoula.

Drainage:

Drainage flood 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.

Hazard Profile

Flood season in Mississippi is considered to primarily occur between the months of November through June, 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. Mean annual rainfll percentages range from about 50 inches in the northwest (Clarksdale) to 61 inches in the south (Biloxi) , with an overall average rainfall of 55 inches.

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. The known major flood events recorded for 5 of the 10 river basis are depicted in the following chart.

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. Due to the large amounts of rain, river flooding quickly became a major problem. The Pelahatchie Creek experienced a 100-year flood event. The Chunky River at Chunky, MS 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, MS also set a record. In addition to all

the flash flooding, the 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. Overall, this storm dropped between 5 to 8 inches of rain over a 6 to 10 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 a small section washed out or nearly washed out due to their locations in low lying areas near creeks and creek-bottoms.

Location/Past Occurrences

Seven of the more severe flooding events of the past century are:

- 1892 Tombigee 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

Overall these floods impacted approximately 90% of the states counties.

Table 3.4.1
Major Flood Events for the Pearl, Pascagoula, Tombigbee, Yazoo and Mississippi River Basins

Pearl	Pascagoula	Tombigbee	Yazoo	Mississippi
1900, 1902, 1935, 1938, 1946, 1947 1950, 1961, 1962, 1971, 1972, 1973 1974, 1977, 1979, 1982, 1983, 1984	1900, 1916, 1920, 1961, 1972, 1974, 1979, 1983, 1998	1892, 1927, 1944, 1948, 1951, 1955, 1961, 1973, 1979, 1982, 1995	1882, 1927, 1932, 1933, 1946, 1973, 1974, 1982, 1991	1913, 1916, 1922, 1927, 1929, 1937, 1945, 1950, 1973, 1974, 1975, 1979, 1983, 1984

Source: United States Geological Survey, 2002

Table 3.4.1 is used to illustrate the extent of the flood hazard due to riverine, flash flooding, coastal flooding and drainage issues since 1971. Each depicted event contained a combination of the four types of flooding.

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), 20 floods have resulted in federally declared “Major Disasters.”

Table 3.4.2
Federal Disaster Declarations Due to or Including Flooding

Date	Description	Designation	Funds Extended
January 1971	Southwest	OEP-318	$594,000
March 1973	Delta	OEP-368	$5,684,364
April 1974	Spring Floods	FDAA-430	$2,063,497
April 1979	Easter Flood	FEMA-577	$16,411,359
September 1979	Hurricane Frederic	FEMA-599	$19,471,559
April 1980	April Floods	FEMA-618	$1,379,143
April 1983	April Floods	FEMA-678	$2,335,180
May 1983	West Central	FEMA-683	$460,447
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 & Hurricane Lili	FEMA-1436	$9,700,101
April 2003	Severe Storms	FEMA-1459	$6,470,877
May 2003	Severe Storms	FEMA-1470	Not Available
September 2004	Hurricane Ivan	FEMA-1550	$15,599,059
July 2005	Hurricane Dennis	FEMA-1594	$1,691,481
August 2005	Hurricane Katrina	FEMA-1604	$2,032,150,345

Source: Mississippi Emergency Management Agency – Public Assistance Programs. (Insert date when new information is received)

Mississippi has 309 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. They are also known as the "100-Year Floodplain" 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.

Of these 309 mapped communities, 276 are members of the National Flood Insurance Program (NFIP). A total of four communities (Belmont, Pontotoc, Rienzi and Wiggins) are in the emergency plan. Additionally, 19 of these communities also participate in the Community Rating System (CRS).

The identified counties from each federal declaration (and the single SBA flood declarations) are listed in the following table. 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 3.4.2.

Table 3.4.3
Declaration Instances by County
Mississippi Flood History 1993 - October, 31 2006

County	Number of Events	County	Number of Events	County	Number of Events
Adams	20	Issaquena	7	Pearl River	15
Alcorn	18	Itawamba	6	Perry	10
Amite	5	Jackson	16	Pike	8
Attala	12	Jasper	14	Pontotoc	7
Benton	3	Jefferson	8	Prentiss	8
Bolivar	24	Jefferson Davis	14	Quitman	4
Calhoun	7	Jones	24	Rankin	39
Carroll	7	Kemper	5	Scott	10
Chickasaw	4	Lafayette	7	Sharkey	5
Choctaw	7	Lamar	29	Simpson	11
Claiborne	9	Lauderdale	23	Smith	11
Clarke	14	Lawrence	12	Stone	16
Clay	5	Leake	11	Sunflower	12
Coahoma	11	Lee	21	Tallahatchie	6
Copiah	11	Leflore	19	Tate	10
Covington	15	Lincoln	20	Tippah	4
DeSoto	23	Lowndes	11	Tishomingo	8
Forrest	29	Madison	29	Tunica	3
Franklin	8	Marion	29	Union	11
George	12	Marshall	7	Walthall	7
Greene	11	Monroe	8	Warren	22
Grenada	22	Montgomery	4	Washington	16
Hancock	12	Neshoba	14	Wayne	8
Harrison	22	Newton	16	Webster	3
Hinds	51	Noxubee	6	Wilkinson	5
Holmes	11	Oktibbeha	4	Winston	6
Humphreys	9	Panola	8	Yalobusha	2
				Yazoo	12

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 reoccurance 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 Map (FIRM) provide a means to identify the probability of future flood events. Through the 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 10-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 ten federally declared disasters in Mississippi since 1998 and four Small Business Administration (SBA) flood declaration. Each event contained some measure of the four types of flooding identified in the flood hazard description of this plan. This statistics places the state of Mississippi within the top tier of disaster prone states. The 14 events are listed in Table 3.4.4.

Table 3.4.4
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
FEMA 1470	May 2003	9
SBA (Flooding)	August 2003	7
SBA (Flooding)	August 2004	2
SBA (Flooding)	April 2005	18

Source: Mississippi Emergency Management Agency, Public Assistance Program, 2007

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, fifty 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 2007 plan update, the state used the most recent release of FEMA's loss estimation software, HAZUS-MH MR2 (May 2006), to model flood loss for every Mississippi county. HAZUS-MH 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-MH to develop computer-generated floodplain boundaries for the flood elevation that has a 1-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-MH 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-MH flood analysis was a significant undertaking for the state. Producing a HAZUS-MH flood run is very computer resource intensive. Processing a single county takes an average of 12 hours from start to finish, depending on the size of the county, density of the stream network, and density of census blocks. A single machine dedicated to running HAZUS-MH was used continually over a period of three months. Three additional computers ran HAZUS-MH overnight in order to produce the needed results.

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 10 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-MH.
- HAZUS-MH building inventory defaults summarized to the census-block level with 2005 building valuations.
- Post-Katrina Advisory Base Flood Elevations (ABFE) developed by the Federal Emergency Management Agency (FEMA) were used to model base flood still water elevations in the three coastal counties where riverine and coastal flooding was modeled.

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

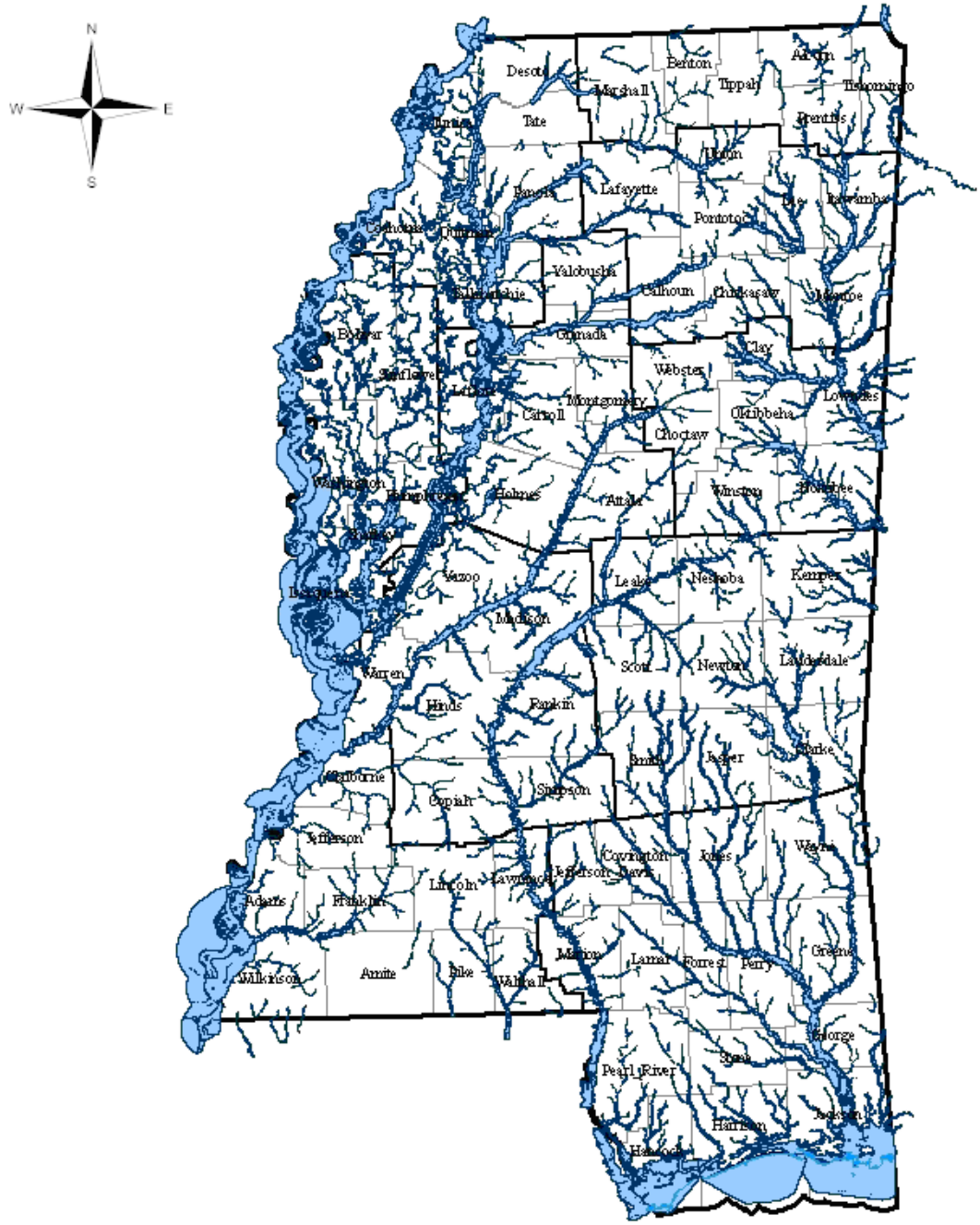
available for use in GIS and could be valuable to communities that have not been mapped by the National Flood Insurance Program. A statewide digital flood hazard layer was created by appending floodplain boundaries created in each county run.

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-MH takes into account flood depth when modeling damage (based on FEMA's depth-damage functions). The HAZUS-MH reports capture damage by occupancy class (in terms of square footage impacted) by damage percent classes. Occupancy classes in HAZUS-MH include agriculture, commercial, education, government, industrial, religion, and residential. Damage percent classes are grouped by 10 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, in the Town of Marks, HAZUS-MH predicts 104 buildings will be substantially damaged in a base flood.

The HAZUS-MH 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-MH using a methodology based on the building damage estimates.

Figure 3.4.1

HAZUS-MH Countywide Base-Flood Scenarios: Modeled Floodplain Boundaries



100 year floodplain boundary

Source: HAZUS-MH MR2

Map Compilation: AMEC 6/12/07

Data Limitations

Default HAZUS-MH data was used to develop the loss estimates. Thus, the potential losses derived from HAZUS-MH, the best available data, may contain some inaccuracies. One obvious limitation is that the building inventory with HAZUS-MH MR2 is based on 2002 counts with valuations adjusted to 2005 dollars. In the case of the coastal counties (Jackson, Harrison and Hancock), this inventory has changed dramatically as a result of Hurricane Katrina. The flood vulnerability in these counties is likely overestimated by HAZUS-MH. Losses and affected populations in other counties in northern and central Mississippi that have grown since 2002 (DeSoto, Tunica, Tate, Madison, Rankin) may be underestimated.

The damaged building counts generated by HAZUS-MH 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-MH "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-MH model. In several counties, the HAZUS-MH 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-MH 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.

HAZUS-MH may or may not account for levee protection, depending on if the levees are detected on the 30m resolution digital elevation model (DEM). In some counties, notably Coahoma County, HAZUS-MH 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-MH 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-MH is modeling damage from the worst-case scenario, which is essentially no levee protection.

HAZUS-MH 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.

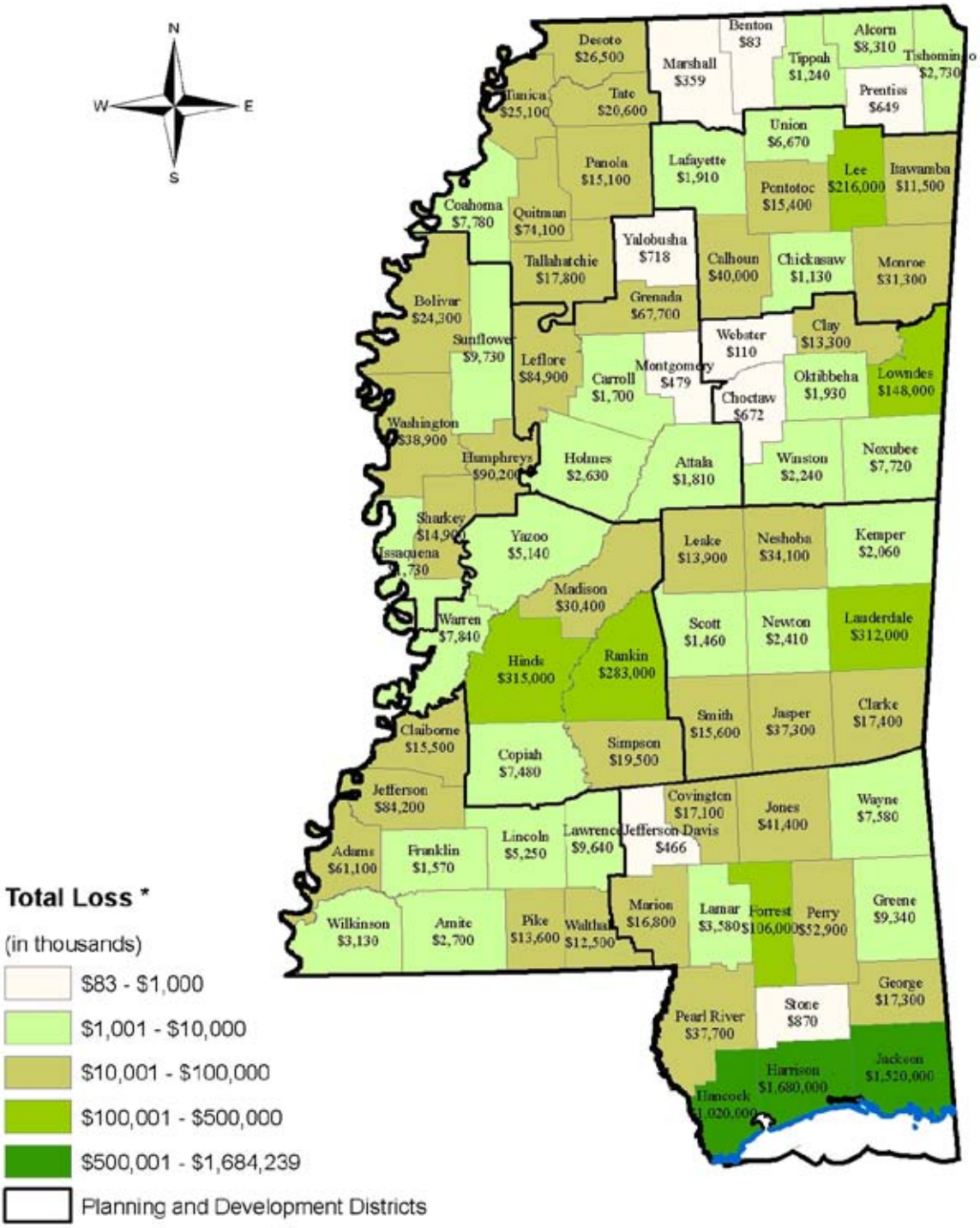
HAZUS-MH impact analyses were run for direct economic losses for buildings and societal impacts (displaced people and shelter needs) to see which counties ranked the highest on these risk indicators (these losses and impacts are illustrated in the maps and tables that follow). Using GIS, HAZUS-MH flood 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[1], 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, 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-MH model, and that the model may represent little or no levee protection. (Figures 3.4.2 and 3.4.3 and Table 3.4.5.)

Figure 3.4.2

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

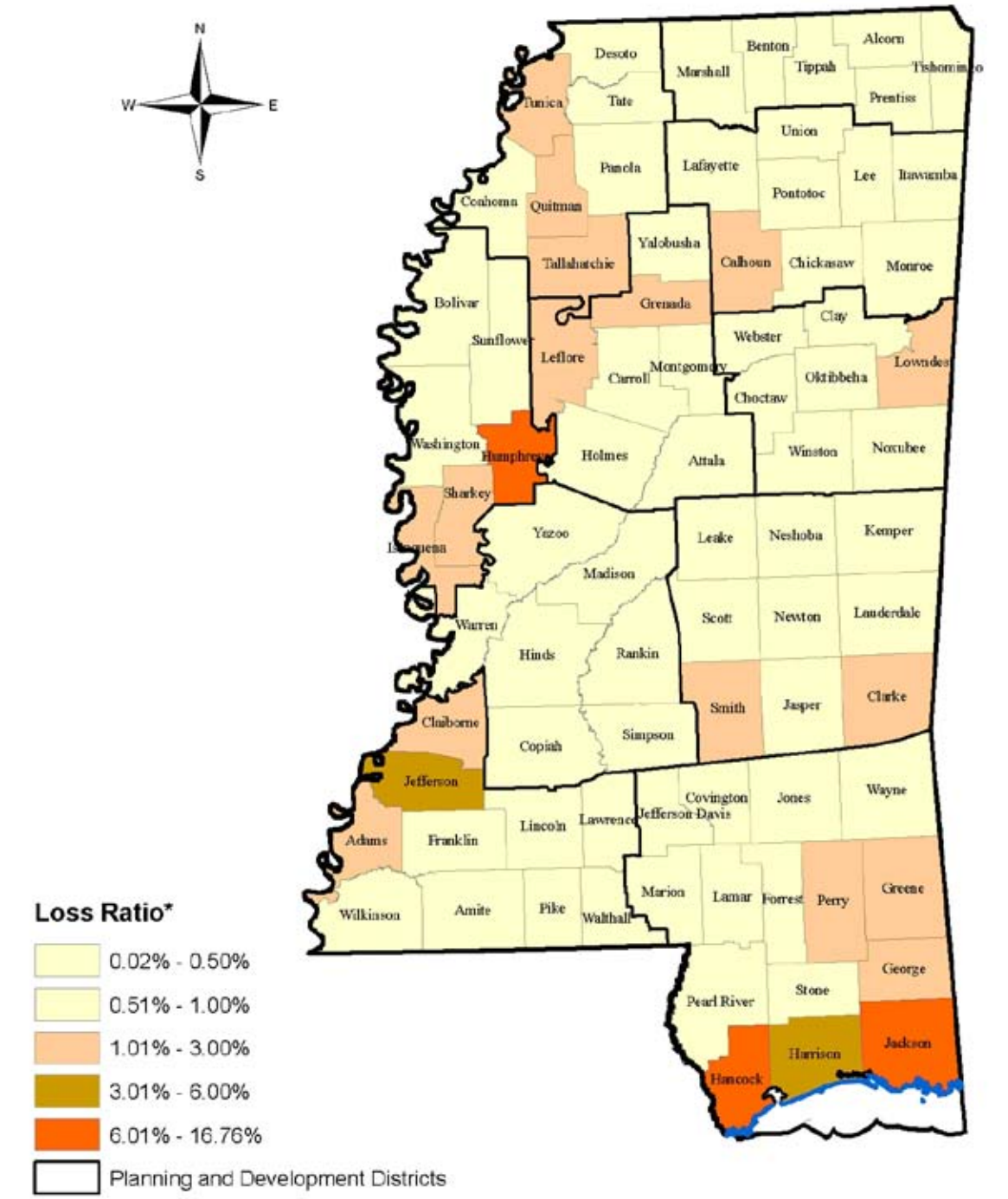


Source: HAZUS-MH MR2

* Includes property damage and business interruption losses.

Map Compilation: AMEC 6/28/07

Figure 3.4.3
HAZUS-MH Countywide 100-Year Flood Scenarios: Loss Ratio



Source: HAZUS-MH MR2

*Loss Ratio is the percentage of the total value of structures in the county that could be damaged by a 100 year flood.

Map Compilation: AMEC 6/28/07

Table 3.4.5
HAZUS-MH 100-Year Flood Loss Estimation
Results: Building Impacts by County, Ranked by Highest Total Building Losses

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)
Harrison	548,357,000	4.97%	510,996,000	624,886,000	1,684,239,000
Jackson	487,482,000	6.88%	431,955,000	602,927,000	1,522,364,000
Hancock	391,267,000	16.76%	319,840,000	313,149,000	1,024,256,000
Hinds	51,044,000	0.37%	75,821,000	188,624,000	315,489,000
Lauderdale	27,727,000	0.77%	68,162,000	216,540,000	312,429,000
Rankin	60,439,000	0.94%	94,547,000	127,649,000	282,635,000
Lee	28,234,000	0.61%	72,045,000	115,715,000	215,994,000
Lowndes	36,128,000	1.25%	68,567,000	43,012,000	147,707,000
Forrest	30,367,000	0.90%	49,126,000	26,864,000	106,357,000
Humphreys	24,216,000	6.41%	23,345,000	42,628,000	90,189,000
Leflore	16,119,000	1.12%	21,795,000	47,006,000	84,920,000
Jefferson	20,487,000	5.33%	41,496,000	22,168,000	84,151,000
Quitman	18,565,000	1.01%	21,373,000	34,169,000	74,107,000
Grenada	14,191,000	1.36%	21,538,000	31,962,000	67,691,000
Adams	25,820,000	1.53%	21,317,000	13,951,000	61,088,000
Perry	11,622,000	2.84%	17,138,000	24,118,000	52,878,000
Jones	7,431,000	0.29%	9,403,000	24,547,000	41,381,000
Calhoun	10,650,000	1.66%	16,683,000	12,702,000	40,035,000
Washington	6,463,000	0.24%	8,300,000	24,170,000	38,933,000
Pearl River	18,704,000	0.90%	13,896,000	5,080,000	37,680,000
Jasper	3,757,000	0.64%	10,241,000	23,323,000	37,321,000
Neshoba	4,675,000	0.42%	9,261,000	20,208,000	34,144,000
Monroe	7,867,000	0.51%	12,674,000	10,723,000	31,264,000
Madison	7,119,000	0.16%	9,636,000	13,618,000	30,373,000
Desoto	8,098,000	0.12%	7,918,000	10,456,000	26,472,000
Tunica	8,124,000	1.99%	8,648,000	8,288,000	25,060,000
Bolivar	5,106,000	0.34%	6,533,000	12,667,000	24,306,000
Tate	3,793,000	0.37%	7,838,000	8,950,000	20,581,000
Simpson	7,767,000	0.73%	6,813,000	4,917,000	19,497,000

County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)
Tallahatchie	5,011,000	1.28%	4,644,000	8,182,000	17,837,000
Clarke	7,795,000	1.22%	5,478,000	4,079,000	17,352,000
George	10,263,000	1.28%	6,130,000	867,000	17,260,000
Covington	4,092,000	0.59%	4,734,000	8,313,000	17,139,000
Marion	4,206,000	0.49%	4,923,000	7,709,000	16,838,000
Smith	8,055,000	1.29%	4,879,000	2,680,000	15,614,000
Claiborne	5,097,000	1.28%	5,527,000	4,917,000	15,541,000
Pontotoc	5,829,000	0.57%	5,020,000	4,532,000	15,381,000
Panola	8,886,000	0.76%	5,417,000	834,000	15,137,000
Sharkey	3,431,000	1.47%	4,508,000	6,979,000	14,918,000
Leake	5,669,000	0.76%	5,512,000	2,737,000	13,918,000
Pike	1,802,000	0.11%	3,655,000	8,156,000	13,613,000
Clay	7,727,000	0.93%	4,749,000	804,000	13,280,000
Walthall	3,178,000	0.70%	2,796,000	6,504,000	12,478,000
Itawamba	4,231,000	0.41%	4,636,000	2,612,000	11,479,000
Sunflower	2,217,000	0.21%	2,836,000	4,677,000	9,730,000
Lawrence	3,975,000	0.73%	3,125,000	2,538,000	9,638,000
Greene	5,014,000	1.21%	3,352,000	976,000	9,342,000
Alcorn	1,521,000	0.09%	2,283,000	4,503,000	8,307,000
Warren	3,150,000	0.12%	2,803,000	1,883,000	7,836,000
Coahoma	3,592,000	0.31%	2,825,000	1,367,000	7,784,000
Noxubee	3,192,000	0.75%	2,695,000	1,834,000	7,721,000
Wayne	4,038,000	0.57%	2,509,000	1,035,000	7,582,000
Copiah	2,556,000	0.23%	2,263,000	2,665,000	7,484,000
Union	1,406,000	0.13%	1,563,000	3,702,000	6,671,000
Lincoln	516,000	0.04%	637,000	4,095,000	5,248,000
Yazoo	2,212,000	0.22%	2,560,000	366,000	5,138,000
Lamar	867,000	0.05%	1,112,000	1,597,000	3,576,000
Wilkinson	1,912,000	0.54%	1,144,000	77,000	3,133,000
Tishomingo	1,231,000	0.12%	715,000	784,000	2,730,000
Amite	1,508,000	0.29%	970,000	217,000	2,695,000
Holmes	1,311,000	0.22%	911,000	407,000	2,629,000

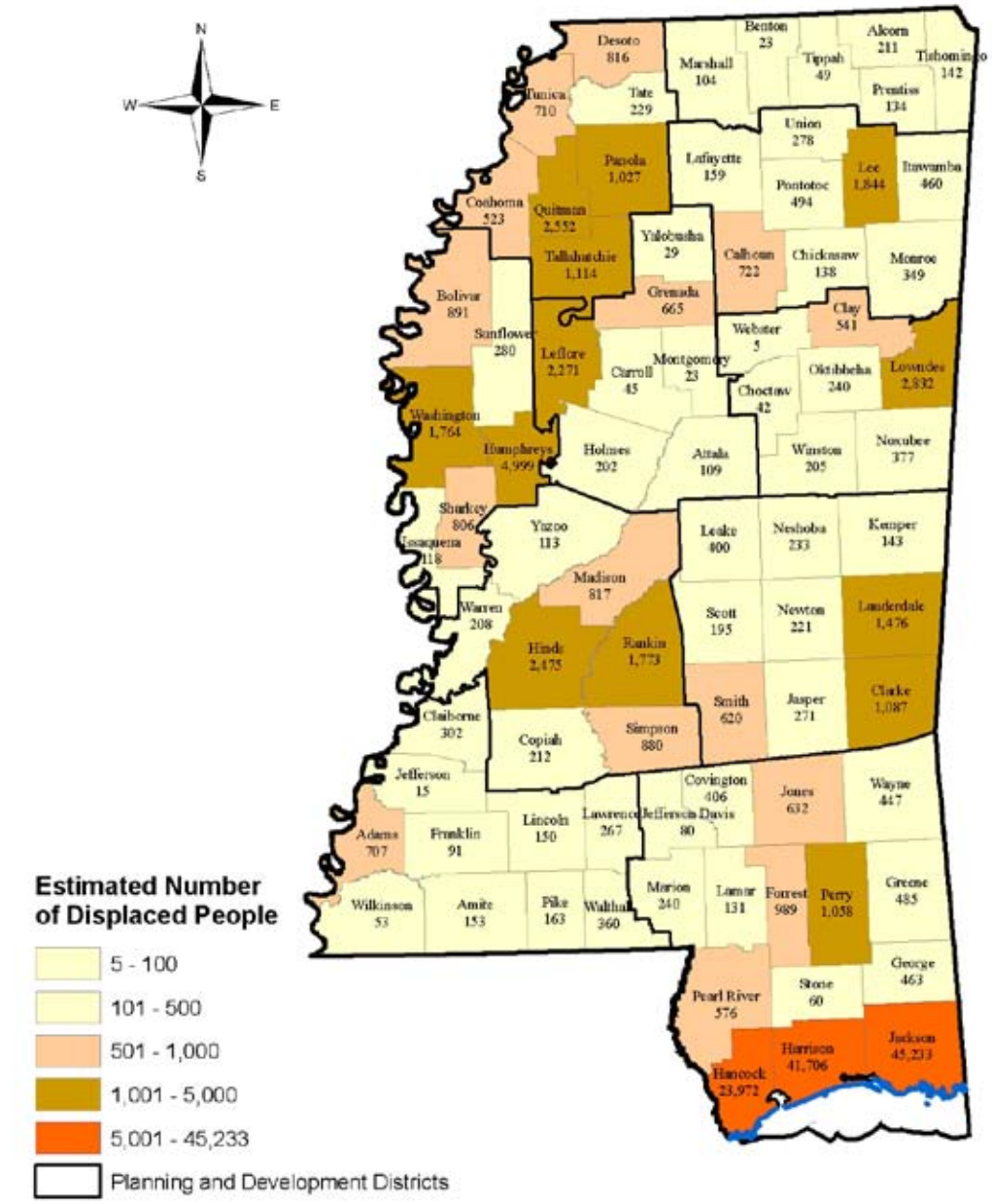
County	Building Damage ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)**	Total Building Loss ($)
Newton	1,271,000	0.14%	847,000	287,000	2,405,000
Winston	882,000	0.12%	497,000	862,000	2,241,000
Kemper	1,193,000	0.31%	704,000	161,000	2,058,000
Oktibbeha	507,000	0.02%	345,000	1,079,000	1,931,000
Lafayette	1,201,000	0.05%	672,000	38,000	1,911,000
Attala	742,000	0.10%	414,000	650,000	1,806,000
Issaquena	1,078,000	1.78%	623,000	32,000	1,733,000
Carroll	499,000	0.14%	421,000	779,000	1,699,000
Franklin	757,000	0.22%	489,000	319,000	1,565,000
Scott	255,000	0.03%	156,000	1,047,000	1,458,000
Tippah	173,000	0.02%	150,000	912,000	1,235,000
Chickasaw	213,000	0.03%	189,000	731,000	1,133,000
Stone	415,000	0.08%	250,000	205,000	870,000
Yalobusha	171,000	0.04%	180,000	367,000	718,000
Choctaw	113,000	0.03%	80,000	479,000	672,000
Prentiss	163,000	0.02%	102,000	384,000	649,000
Montgomery	203,000	0.04%	108,000	168,000	479,000
Jefferson-Davis	219,000	0.05%	116,000	131,000	466,000
Marshall	204,000	0.02%	100,000	55,000	359,000
Webster	70,000	0.02%	32,000	8,000	110,000
Benton	57,000	0.02%	19,000	7,000	83,000

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-MH Users Manual). HAZUS-MH 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 3.4.6 and map (Figure 3.4.4) compare the potential impacts of flood on Mississippi citizens, county by county.

Table 3.4.6
Flooding Impacts on Populations
(Ranked by Displaced People)

County	Displaced People	People Needing Shelter	County	Displaced People	People Needing Shelter
Jackson	45,233	39,264	Claiborne	302	168
Harrison	41,706	36,925	Sunflower	280	45
Hancock	23,972	18,009	Union	278	116
Humphreys	4,999	4,459	Jasper	271	67
Lowndes	2,832	2,009	Lawrence	267	71
Quitman	2,552	1,831	Marion	240	62
Hinds	2,475	2,017	Oktibbeha	240	135
Leflore	2,271	1,599	Neshoba	233	38
Lee	1,844	962	Tate	229	59
Rankin	1,773	1,256	Newton	221	36
Washington	1,764	1,288	Copiah	212	108
Lauderdale	1,476	835	Alcorn	211	36
Tallahatchie	1,114	639	Warren	208	92
Clarke	1,087	561	Winston	205	31
Perry	1,058	543	Holmes	202	125
Panola	1,027	558	Scott	195	14
Forrest	989	583	Pike	163	13
Bolivar	891	606	Lafayette	159	53
Simpson	880	442	Amite	153	16
Madison	817	469	Lincoln	150	16
Desoto	816	540	Kemper	143	17
Sharkey	806	434	Tishomingo	142	13
Calhoun	722	274	Chickasaw	138	17
Tunica	710	403	Prentiss	134	4
Adams	707	541	Lamar	131	18
Grenada	665	383	Issaquena	118	36
Jones	632	224	Yazoo	113	21
Smith	620	184	Attala	109	45
Pearl River	576	247	Marshall	104	8
Clay	541	177	Franklin	91	57
Coahoma	523	307	Jefferson Davis	80	3
Pontotoc	494	190	Stone	60	4
Greene	485	133	Wilkinson	53	20
George	463	192	Tippah	49	0
Itawamba	460	168	Carroll	45	3
Wayne	447	241	Choctaw	42	2
Covington	406	92	Yalobusha	29	2
Leake	400	186	Benton	23	0
Noxubee	377	228	Montgomery	23	1
Walthall	360	59	Jefferson	15	0
Monroe	349	79	Webster	5	0

Figure 3.4.4
HAZUS-MH Countywide Base-Flood Scenarios: Displaced People



Source: HAZUS-MH MR2

Map Compilation: AMEC 6/28/07

Local Critical Facility Floodplain Analysis

During the 2007 update, local critical facilities were inventoried and geolocated where possible. Information regarding the facility type and location were available, but valuations were not. The statewide HAZUS-MH-derived base-flood layer was overlayed, 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 3.4.7. 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. More detail on the hazards of facilities by county is provided in this section beginning on Tables 3.3.12 where vulnerabilities are summarized by Planning and Development District.

Table 3.4.7
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	3	Itawamba	3	Perry	3
Alcorn	1	Jackson	47	Pike	3
Bolivar	3	Jasper	1	Pontotoc	1
Calhoun	6	Jefferson Davis	2	Quitman	14
Carroll	2	Jones	9	Rankin	5
Choctaw	1	Kemper	1	Scott	1
Claiborne	1	Lafayette	2	Sharkey	2
Clarke	4	Lauderdale	9	Simpson	5
Clay	1	Lawrence	4	Smith	2
Coahoma	4	Leake	2	Stone	1
Copiah	3	Lee	6	Sunflower	1
Covington	7	Leflore	9	Tallahatchie	8
Forrest	2	Lincoln	1	Tate	1
Franklin	1	Lowndes	7	Tishomingo	2
Greene	4	Madison	5	Walthall	1
Grenada	5	Marion	4	Warren	4
Hancock	30	Marshall	1	Washington	10
Harrison	46	Montgomery	2	Wayne	1
Hinds	12	Newton	2	Wilkinson	2
Holmes	2	Noxubee	3	Yalobusha	1
Humphreys	14	Panola	2	Yazoo	1
Issaquena	5	Pearl River	3		

Flood Insurance Claims Analysis

In addition to the HAZUS-MH 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 March 31, 2007).

There are several limitations to this data, including:

- only 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.

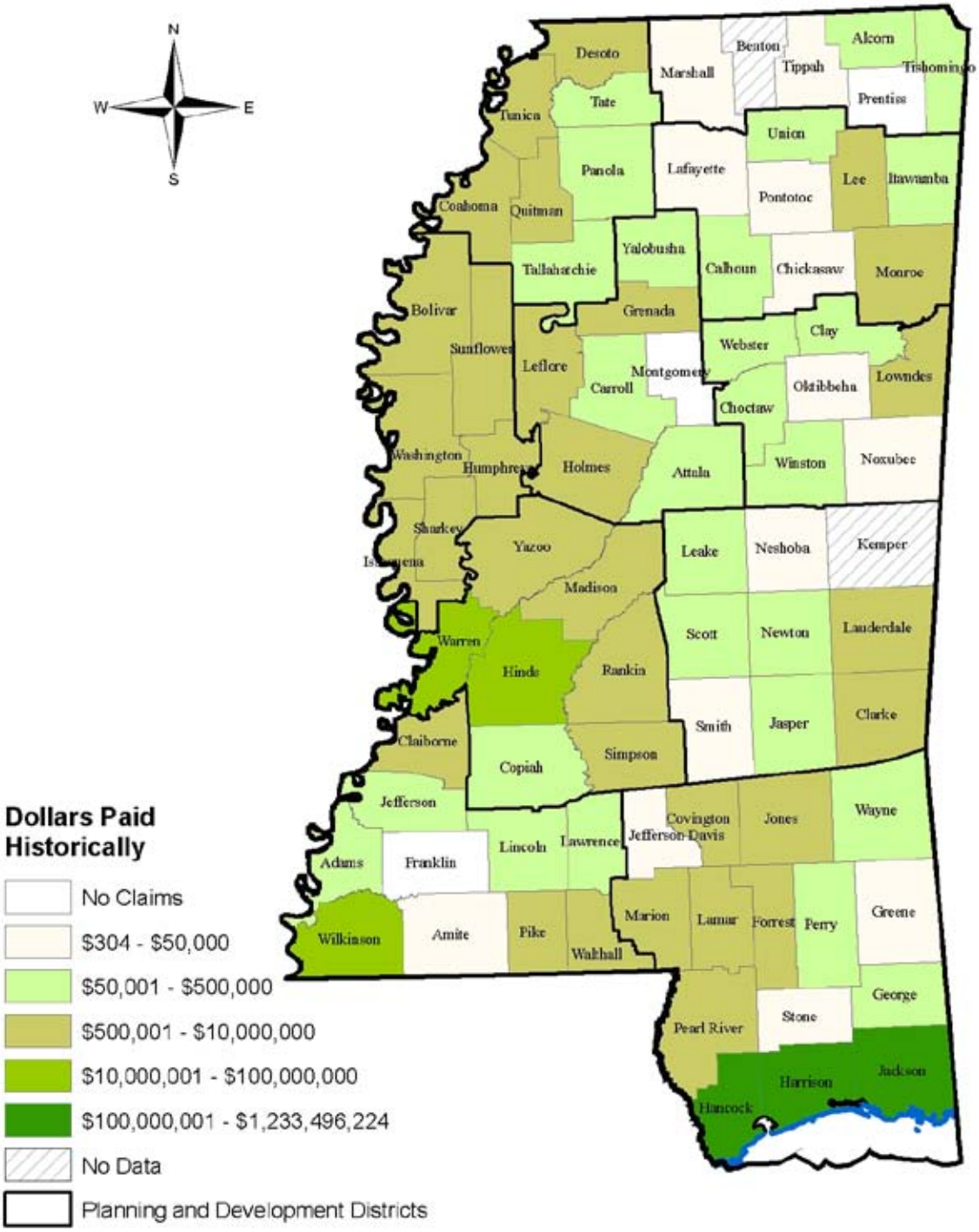
Despite these limitations, the data depict a pattern of historical flood losses in the state. The greatest losses have been in the counties along the Gulf Coast: Harrison, Hancock, and Jackson. Table 3.4.8 shows the details of the 10 Mississippi counties with the greatest historical dollar losses. Figures 3.4.5 and 3.4.6 that follow show the geographic distribution of flood payouts and claims by county across the entire state.

Table 3.4.8
Top 10 Counties for Flood Insurance Dollars Paid (Historical), 1978-2007

County	Dollars Paid ($ Historical)	Flood Claims	Current Policies	Coverage in Thousands ($)
Harrison	1,233,496,224	13,651	22,130	4,259,371
Hancock	702,858,075	8,284	9,241	1,729,141
Jackson	660,238,954	8,866	20,560	4,005,658
Hinds	51,641,166	3,775	5,520	804,077
Warren	23,130,105	2,495	413	41,981
Wilkinson	12,824,375	1,659	73	5,854
Washington	8,835,333	1,042	2,334	249,318
Forrest	7,691,136	1,578	991	108,903
Rankin	6,760,408	599	1,739	348,727
Pearl River	6,503,862	520	1,098	182,975

Source: FEMA, "Policy and Loss Data by Community with County and State Data," March 31, 2007

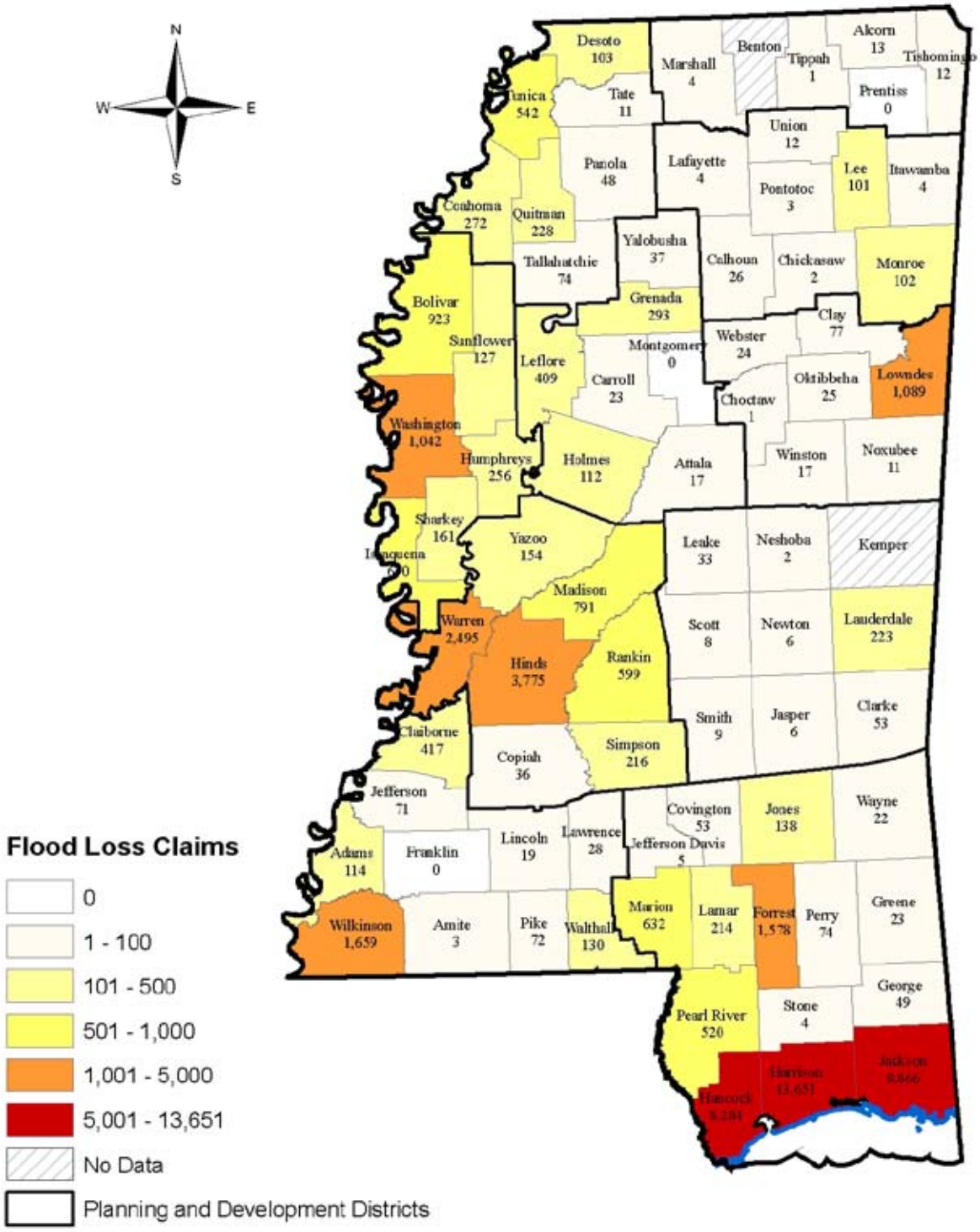
Figure 3.4.5
Map of Dollars Paid Historically for Flood Insurance Losses in Mississippi by County, 1978-2007



Source: National Flood Insurance Program (NFIP)

Map Compilation: AMEC 6/7/07

Figure 3.4.6
Map of Flood Loss Claims in Mississippi by County, 1978-2007



Source: National Flood Insurance Program (NFIP)

Map Compilation: AMEC 6/7/07

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 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 10-year period, since 1978. At least two of the claims must be more than 10-days apart." Table 3.4.9 and Figure 3.4.7 illustrate the number and location (county) of Mississippi's repetitive loss properties. The table ranks counties by repetitive loss dollars paid between 1978 and February 2006.

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 is done to revised base-flood elevations.

Table 3.4.9
Mississippi's NFIP Policies and Repetitive Loss Summary by County
(Ranked by Total Repetitive Loss Dollars Paid)

County	Total Current Policies	Total Flood Claims	Total Dollars Paid ($ Historical)	No. of Repetitive Loss Properties*	No. of Repetitive Loss Mitigated Properties	Repetitive Loss Flood Claims	Repetitive Loss Dollars Paid ($ Historical)
Harrison	22,130	13,651	1,233,496,224	1,088	143	3,247	141,386,237
Jackson	20,560	8,866	660,238,954	960	28	2,311	126,963,895
Hancock	9,241	8,284	702,858,075	695	56	1,712	73,061,051
Hinds	5,520	3,775	51,641,166	401	17	988	21,275,972
Warren	413	2,495	23,130,105	383	183	1,314	17,377,214
Wilkinson	73	1,659	12,824,375	204	0	708	8,694,661
Washington	2,334	1,042	8,835,333	152	2	467	6,182,376
Bolivar	439	923	6,173,244	157	1	474	4,651,722
Pearl River	1,098	520	6,503,862	67	0	198	4,091,948
Forrest	991	1,578	7,691,136	194	128	506	3,373,226
Marion	416	632	5,022,019	85	8	257	3,134,707

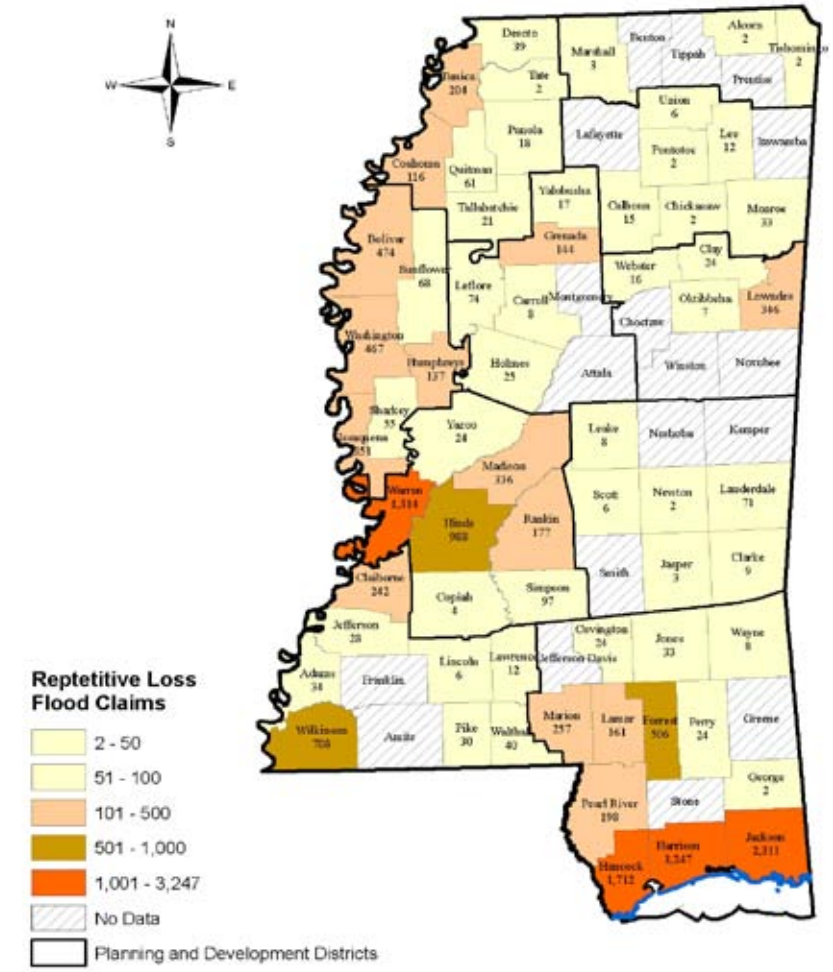
County	Total Current Policies	Total Flood Claims	Total Dollars Paid ($ Historical)	No. of Repetitive Loss Properties*	No. of Repetitive Loss Mitigated Properties	Repetitive Loss Flood Claims	Repetitive Loss Dollars Paid ($ Historical)
Madison	928	791	4,819,546	70	31	336	2,811,379
Rankin	1,739	599	6,760,408	67	21	177	2,758,866
Lowndes	1,480	1,089	5,622,826	120	0	346	2,691,903
Issaquena	106	670	3,836,380	126	0	351	2,640,342
Grenada	309	293	3,581,001	61	6	144	2,551,772
Lamar	227	214	2,841,116	36	1	161	2,530,162
Claiborne	47	417	2,533,291	79	0	242	1,829,015
Lauderdale	637	223	2,763,031	26	2	71	1,696,734
Tunica	90	542	2,163,452	77	0	204	1,357,163
Humphreys	196	256	1,702,896	40	0	137	1,282,961
Simpson	126	216	1,614,807	29	3	97	1,088,553
Coahoma	177	272	1,517,375	46	10	116	829,471
Quitman	155	228	1,763,454	21	0	61	780,710
Leflore	1,404	409	2,225,762	29	0	74	686,521
Walthall	89	130	1,086,580	19	0	40	651,337
Sunflower	188	127	690,779	19	3	68	613,171
Sharkey	128	161	963,806	20	0	55	508,796
Monroe	303	102	634,818	11	0	33	477,105
Pike	101	72	1,592,724	10	0	30	415,648
DeSoto	797	103	824,576	14	0	39	355,038
Covington	67	53	511,043	10	0	24	354,693
Holmes	107	112	1,159,144	11	0	25	340,373
Adams	45	114	458,276	14	2	34	288,330
Lawrence	45	28	295,111	3	0	12	240,943
Clarke	173	53	616,644	4	1	9	232,608
Jones	385	138	523,610	12	0	33	223,086
Jefferson	12	71	307,842	9	0	28	217,904
Panola	123	48	420,396	7	0	18	194,123
Tallahatchie	86	74	313,646	9	0	21	177,976
Clay	251	77	298,939	8	0	24	157,332

County	Total Current Policies	Total Flood Claims	Total Dollars Paid ($ Historical)	No. of Repetitive Loss Properties*	No. of Repetitive Loss Mitigated Properties	Repetitive Loss Flood Claims	Repetitive Loss Dollars Paid ($ Historical)
Yazoo	462	154	727,171	9	0	24	154,788
Calhoun	75	26	204,031	5	0	15	153,778
Yalobusha	36	37	270,885	8	0	17	151,285
Union	11	12	203,376	3	0	6	146,019
Lee	553	101	812,852	5	2	12	130,796
Perry	146	74	175,576	10	5	24	109,235
Wayne	69	22	142,858	2	0	8	104,187
Webster	7	24	108,564	5	0	16	96,334
Scott	13	8	67,173	3	0	6	65,840
Jasper	30	6	90,121	1	0	3	58,475
Carroll	22	23	181,834	4	0	8	57,956
Leake	64	33	278,396	4	0	8	56,800
George	150	49	317,575	1	0	2	37,000
Lincoln	50	19	50,446	3	0	6	28,314
Oktibbeha	234	25	48,405	2	0	7	27,729
Marshall	27	4	27,670	1	0	3	27,670
Copiah	40	36	143,978	2	0	4	25,084
Newton	30	6	52,455	1	0	2	24,850
Alcorn	84	13	406,791	1	0	2	23,158
Tate	41	11	114,544	1	0	2	13,871
Tishomingo	35	12	79,075	1	0	2	11,166
Chickasaw	11	2	8,170	1	0	2	8,170
Pontotoc	11	3	8,914	1	0	2	6,814
Total	75,937	51,807	2,777,378,632	5,467	653	15,373	442,696,340

Sources: National Flood Insurance Program, February 28, 2006 (1978–February 28,2006, repetitive loss information) and March 31, 2007 (1978–March 31,2007, general policy information: "Policy and Loss Data by Community with County and State Data")

Note: *Includes insured and no longer insured properties

Figure 3.4.7
Map of Mississippi's Repetitive Loss Flood Claims by County 1978- February 2006



Source: HAZUS-MH MR2

Map Compilation: AMEC 6/12/07

Severe Repetitive Loss Property Analysis

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss. Severe repetitive loss 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 3.4.10 illustrates severe repetitive loss properties by county. It ranks counties by total payments but also includes 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 are the coastal counties of Harrison, Hancock, and Jackson. It is not known how many of these structures may have been destroyed by Hurricane Katrina.

Table 3.4.10
Mississippi's Severe Repetitive Loss Summary by County
(Ranked by Total Payment)

County	Properties	Losses	Building Payments ($)	Contents Payments ($)	Total Payment ($)	Total Property Value ($)	Loss Ratio**
Harrison*[1]	72	389	7,901,250	3,140,268	11,041,518	10,597,684	1.04
Hancock	28	140	3,384,676	996,173	4,380,849	4,973,987	0.88
Jackson*[3]	23	135	2,063,449	577,302	2,640,750	2,780,275	0.95
Hinds	39	109	2,139,743	440,691	2,580,434	3,173,670	0.81
Wilkinson	17	123	1,735,284	467,033	2,202,316	960,426	2.29
Lamar	11	75	1,174,663	79,348	1,254,010	1,004,320	1.25
Washington	16	83	913,274	207,029	1,120,303	1,654,407	0.68
Bolivar	15	74	895,897	151,614	1,047,511	1,003,945	1.04
Warren	16	92	868,466	100,310	968,776	1,213,174	0.80
Forrest	8	49	445,930	237,915	683,846	1,696,712	0.40
Pearl River*[1]	4	23	500,520	95,818	596,338	383,620	1.55
Simpson	4	30	223,827	128,042	351,869	337,974	1.04
Claiborne	7	36	294,090	42,517	336,607	2,068,865	0.16
Calhoun	2	17	211,662	89,769	301,431	258,438	1.17
Issaquena	9	36	265,956	34,693	300,649	239,334	1.26
Marion	7	26	109,805	122,222	232,027	778,290	0.30
Madison*[1]	4	16	96,894	107,211	204,105	163,958	1.24
Lowndes	3	23	152,018	48,225	200,243	205,801	0.97
Humphreys	3	11	118,439	45,988	164,427	181,400	0.91
Coahoma	4	17	136,782	24,953	161,735	335,545	0.48
Monroe	1	4	105,344	45,118	150,462	122,850	1.22
Adams*[4]	4	4	85,499	255	85,754	n/a	n/a
Jefferson	1	6	66,766	14,703	81,469	39,200	2.08
Sharkey	2	12	53,955	13,321	67,276	124,800	0.54
Tunica*[1]	1	4	56,142	3,951	60,093	n/a	n/a
Clay	1	4	55,138	2,704	57,842	150,000	0.39
DeSoto	2	11	49,498	6,939	56,436	255,310	0.22
Sunflower	1	5	31,339	15,653	46,991	60,247	0.78
Leflore	1	4	16,143	21,311	37,454	25,000	1.50
Lauderdale	1	5	29,234	2,885	32,118	45,000	0.71
Walthall	1	2	16,643	5,400	22,043	13,328	1.65
Total*[11]	308	1,565	24,142,183	7,265,408	31,407,591	34,847,560	0.90

Source: National Flood Insurance Program, February 28, 2006 (1978–February 28,2006)
Notes: *Property value not available (number following * indicates number of properties value not available for)
**Loss ratio = total payment divided by total property value

During the 2004 planning process, the State established a 'Top 50 At Risk' list (Table 3.4.11), in order to focus its limited resources on a manageable number of communities. These fifty communities constitute 92% of all flood loss claims within the state and contain 96% of all insured repetitive loss properties. These communities are the jurisdictions in the state most vulnerable to flooding based on insured losses. There are 22 counties in the top 50.

Table 3.4.11
Top 50 'At Risk' Communities
Insured Repetitive Loss (RL) Properties

Community Name	Total Policy Count	Number of Claims	Amount Paid	Number of Insured RL
Jackson	4,632	3,340	40,175,791	203
Gulfport	2,011	1,495	15,564,027	142
Hancock Co.	3,079	2,338	11,919,931	142
Harrison Co.	2,288	1,691	20,111,893	90
Jackson Co.	2,439	1,157	13,517,450	71
Biloxi	2,193	865	6,455,196	37
Pascagoula	1,534	1,135	16,725,370	37
Long Beach	1,394	677	6,999,035	37
Pass Christian	2,098	593	3,274,940	27
Lamar Co.	131	111	1,041,658	24
Warren Co.	286	1,804	13,434,167	23
Bay St. Louis	904	338	2,110,509	21
Bolivar Co.	245	721	4,674,589	17
Pearl River Co.	377	209	2,840,864	17
Columbia	205	304	2,639,766	15
Greenville	1,188	315	2,244,195	14
Petal	189	292	1,209,225	14
Vicksburg	115	633	7,673,485	13
Washington Co.	1,045	658	6,196,724	12
Lowndes Co.	386	537	2,779,861	12
Wilkinson Co.	72	1,646	12,550,218	11
Columbus	1,080	504	2,246,966	11
Moss Point	325	303	2,149,044	10
Hattiesburg	586	1,033	4,840,499	9

Community Name	Total Policy Count	Number of Claims	Amount Paid	Number of Insured RL
Issaquena Co.	121	646	3,690,762	9
Claiborne Co.	48	372	2,308,796	9
Gautier	497	199	2,059,307	9
Humphreys Co.	163	180	1,045,422	8
Waveland	1,182	213	514,809	8
Ocean Springs	859	330	1,275,739	7
Mendenhall	40	112	932,662	7
Canton	120	443	2,007,442	6
Picayune	206	137	1,118,641	6
Walthall Co.	66	71	647,670	6
Marion Co.	147	284	2,091,355	5
Coahoma Co.	90	223	1,292,709	5
Tunica Co.	73	518	2,110,321	4
Madison Co.	147	175	1,255,458	4
Belzoni	58	73	622,664	4
Grenada Co.	104	145	1,845,942	3
Beulah	5	43	244,617	3
Foxwood	398	145	1,391,021	2
Sharkey Co.	62	152	897,177	2
Pearl	377	145	414,220	2
Laurel	230	76	251,541	2
Grenada	161	134	1,587,016	1
Forrest Co.	129	139	710,909	1
Tylertown	34	45	381,816	1
Jefferson Co.	8	70	283,112	1
Terry	4	19	131,612	1
Top 50 Totals	34,131	28,148	234,488,143	1,129
Statewide Totals	42,072	30,773	252,488,267	1,187
Percent in Top 50	82%	92%	93%	96%

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

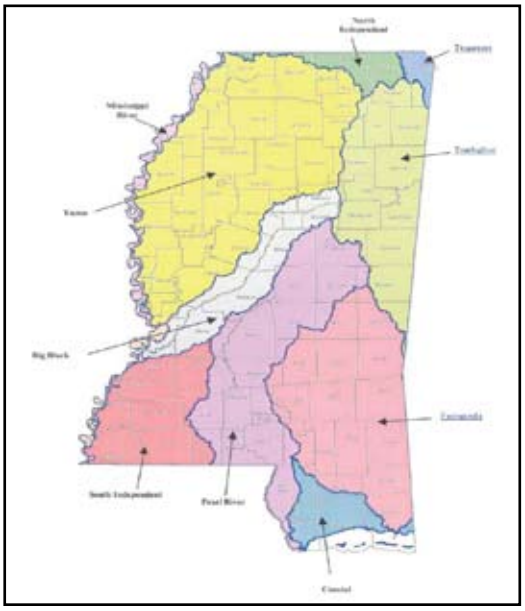
river basin and counties within each basin. Vulnerability is then summarized by planning and development district, providing additional insight into the jurisdictional vulnerability.

The number of one-family structures found within Mississippi's Special Flood Hazard Area (SFHA) is 106,386. The sum of all other structures within the SFHA is 13,384, for a total of 119,770. There have been 60,170 insured losses since 1978, with 4,568 of the total being 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. This floodplain is divided into ten (10) primary river basins: the Mississippi, North Independent, Tennessee, Yazoo, Tombigbee, Big Black, Pearl, South Independent, Pascagoula and Coastal. In order to visualize the state of Mississippi's floodplain, it is first necessary to examine and understand its ten (10) distinct river basins.

The State of Mississippi is located within the Gulf of Mexico drainage area. The 10 primary river basins within the state are categorized (from north to south) as the:

- Mississippi River Basin
- 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 Basin



The state is primarily concerned with the risk associated with the floodplains found within the ten 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.

The state's watersheds or river basins can be identified or depicted as ten distinct basins. In terms of floodplain management, it is necessary to identify the eighty-two counties in conjunction with their basin. The identified basins and their member counties are listed below. The assignment 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.

Mississippi County/River Basin Assignment for the Mississippi River Basin, North Independent River Basin, and Tennessee River Basin

MISSISSIPPI[1]	NORTH INDEPENDENT	TENNESSEE
Adams, Bolivar,	Alcorn, Tippah	Tishomingo
Claiborne, Coahoma,		
Desoto, Issaquena,		
Jefferson, Tunica,		
Warren, Washington,		
Wilkinson		

[1] The Mississippi River Basin is not considered in the state totals, due to its dual listing of counties within other basins. This basin consists only of a small slice of the western portions of the eleven counties

Mississippi County/River Basin Assignment for the Yazoo River Basin, Tombigbee River Basin, Big Black River Basin and Pearl River Basin

YAZOO	TOMBIGBEE	BIG BLACK	PEARL
Benton, Bolivar,	Chickasaw, Clay,	Attala, Choctaw,	Jefferson Davis, Lawrence,
Calhoun, Carroll,	Itawamba, Kemper,	Hinds, Madison,	Leake, Lincoln,
Coahoma, DeSoto,	Lee, Lowndes,	Montgomery, Warren,	Marion, Neshoba,
Grenada, Holmes	Monroe, Noxubee,	Webster	Pearl River, Rankin,
Humphreys, Issaquena,	Oktibbeha, Prentiss		Scott, Sharkey,
Lafayette, Leflore,			Simpson, Walthall,
Marshall, Panola.			Winston
Pontotoc, Quitman,			
Sunflower, Tallahatchie,			
Tate, Tunica,			
Union, Washington,			
Yalobusha, Yazoo			

Mississippi County/River Basin Assignment for the South Independent River Basin, Pascagoula River Basin, and Coastal River Basin

SOUTH INDEPENDENT	PASCAGOULA	COASTAL
Adams, Amite,	Clarke, Covington,	Hancock, Harrison
Claiborne, Copiah,	Forrest, George,	
Franklin, Jefferson,	Greene, Jackson,	
Pike, Wilkinson	Jasper, Jones,	
	Lamar, Lauderdale,	
	Newton, Perry,	
	Smith, Stone,	
	Wayne	

Mississippi County/River Basin

The Mississippi River Basin encompasses small portions of the above listed eleven counties. These counties have forty-two NFIP member communities within their borders. 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.

Mississippi River Basin

County	Total Area in Square Miles
Adams	486.4
Bolivar	905.7
Claiborne	501.4
Coahoma	583.0
DeSoto	496.6
Issaquena	441.4
Jefferson	527.2
Tunica	480.7
Warren	618.7
Washington	761.2
Wilkinson	687.8
Totals	6,490.1

North Independent River Basin

The North Independent Basin encompasses portions of the above listed two counties. These counties have five 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.

The five NFIP communities have reported, through the means of their respective Biennial Reports, a total of 191 structures within the floodplain. There are no state-owned buildings within this basin. There have been a total of 13 flood insurance claims since 1978. Of this number, 2 have been repetitive loss claims.

North Independent River Basins

County	Total Area in Square Miles
Alcorn	401.3
Tippah	459.9
Totals	861.2

Tennessee River Basin

The Tennessee River Basin encompasses portions of the above listed 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.

The four NFIP communities have reported, through the means of their respective Biennial Reports, a total of 101 structures within the floodplain. There are no state-owned buildings within this basin. There have been a total of 12 flood insurance claims since 1978. Of this number, two have been repetitive loss claims.

Tennessee River Basin

County	Total Area in Square Miles
Tishomingo	444.6
Totals	444.6

Yazoo River Basin

The Yazoo River Basin encompasses portions of the above listed twenty-five counties. These counties have 106 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.

The 106 NFIP communities have reported, through the means of their respective Biennial Reports, a total of 37,499 structures within the floodplain. There are 21 state-owned buildings within this basin. There have been a total of 5,369 flood insurance claims since 1978. Of this number, 2,276 have been repetitive loss claims.

Yazoo River Basin

County	Total Area in Square Miles
Benton	408.5
Bolivar	905.7
Calhoun	587.8
Carroll	634.3
Coahoma	583.0
DeSoto	496.6
Grenada	449.2
Holmes	764.0
Humphreys	431.1
Issaquena	441.4
Lafayette	679.1
LeFlore	606.2
Marshall	709.6
Panola	704.9
Pontotoc	500.9
Quitman	406.4
Sharkey	434.8
Sunflower	707.1
Tallahatchie	651.9
Tate	410.8
Tunica	480,7
Union	416.8
Washington	761.2
Yalobusha	494.8
Yazoo	933.9
Totals	14,600.7

Big Black River Basin

The Big Black River Basin encompasses portions of the above listed seven counties. These counties have 23 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.

The 23 NFIP communities have reported, through the means of their respective biennial reports, a total of 16,239 structures within the floodplain. There are 16 state-owned buildings within this basin. There have been a total of 7,085 flood insurance claims since 1978. Of this number, 2,654 have been repetitive loss claims.

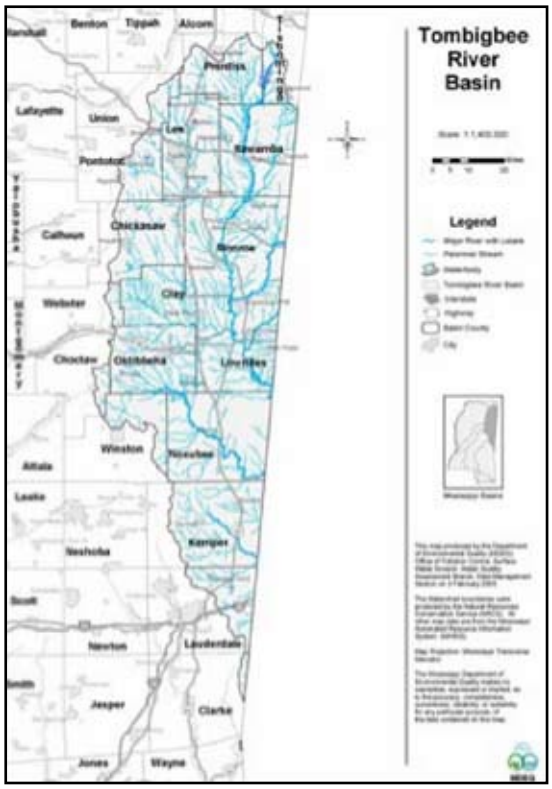
Big Black River Basin

County	Total Area in Square Miles
Attala	736.9
Choctaw	419.7
Hinds	877.1
Madison	741.7
Montgomery	407.1
Warren	618.7
Webster	423.2
Totals	4,224.4

Tombigbee River Basin

The Tombigbee River Basin encompasses portions of the above listed ten counties. These counties have 24 NFIP member communities within their collective borders. Flood losses associated with this basin are due primarily to the Tombigbee, Luxupalila, ant the Buttahatchee Rivers, the Bull Mountain, Mattubby and Yellow Creeks and their associated tributaries.

The 24 NFIP communities have reported, through the means of their respective Biennial Reports, a total of 13,225 structures within the floodplain. There are no state-owned buildings within this basin. There have been a total of 1,396 flood insurance claims since 1978. Of this number, 424 have been repetitive loss claims.



Tombigbee River Basin

County	Total Area in Square Miles
Chickasaw	504.2
Clay	416.0
Itawamba	540.5
Kemper	767.01
Lee	453.1
Lowndes	516.5
Monroe	772.1
Noxubee	700.0
Oktibbeha	461.8
Prentiss	418.2
Totals	5,549.4

Pearl River Basin

The Pearl River Basin encompasses portions of the above listed twelve counties and the Pearl River Valley Water Supply District. These twelve counties have 37 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 Walya and Big Slough Creeks and their associated tributaries.

The 37 NFIP communities have reported, through the means of their respective Biennial Reports, a total of 10,278 structures within the floodplain. There are 16 state-owned buildings within this basin. There have been a total of 2,346 flood insurance claims since 1978. Of this number, 856 have been repetitive loss claims.

Pearl River Basin

County	Total Area in Square Miles
Jefferson Davis	409.0
Lawrence	435.6
Leake	585.2
Lincoln	588.0
Marion	548.4
Neshoba	571.5
Pearl River	818.7
Rankin	805.9
Scott	610.2
Simpson	590.3
Walthall	404.3
Winston	610.0
Totals	6,977.1

South Independent River Basin

The South Independent Basin encompasses portions of the above listed eight counties. These eight counties have 18 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.

The 18 NFIP communities have reported, through the means of their respective biennial reports, a total of 3,030 structures within the floodplain. There is one state-owned buildings within this basin. There have been a total of 2,369 flood insurance claims since 1978. Of this number, 1,046 have been repetitive loss claims.

South Independent River Basin

County	Total Area in Square Miles
Adams	486.4
Amite	731.6
Claiborne	501.4
Copiah	779.2
Frankin	566.7
Jefferson	527.2
Pike	410.7
Wilkinson	687.8
Totals	4,691.0

Pascagoula River Basin

The Pascagoula River Basin encompasses portions of the above listed fifteen counties. These fifteen 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.

The 50 NFIP communities have reported, through the means of their respective biennial reports, a total of 28,405 structures within the floodplain. There are 10 state-owned buildings within this basin. There have been a total of 11,282 flood insurance claims since 1978. Of this number, 3,154 have been repetitive loss claims.

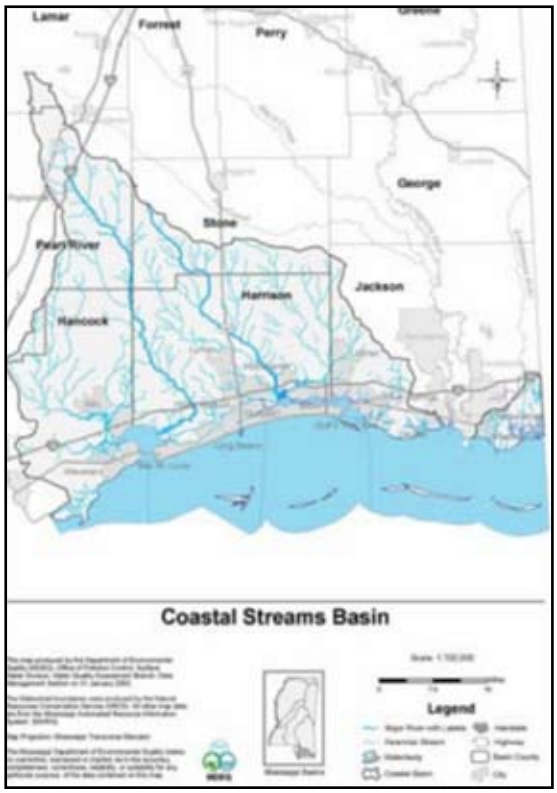
Pascagoula River Basin

County	Total Area in Square Miles
Clarke	693.4
Covington	414.8
Forrest	470.0
George	483.6
Greene	718.7
Jackson	1,043.3
Jasper	677.3
Jones	699.6
Lamar	500.3
Lauderdale	715.2
Newton	579.4
Perry	650.1
Smith	637.1
Stone	448.0
Wayne	813.4
Totals	9,544.2

Coastal River Basin

The Coastal River Basin encompasses portions of the above listed two counties. These two counties have nine 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.

The nine NFIP communities have reported, through the means of their respective biennial reports, a total of 16,947 structures within the floodplain. There are 16 state-owned buildings within this basin. There have been a total of 21,935 flood insurance claims since 1978. Of this number, 4,959 have been repetitive loss claims.



Coastal River Basin

County	Total Area in Square Miles
Hancock	552.4
Harrison	975.9
Totals	1,528.3

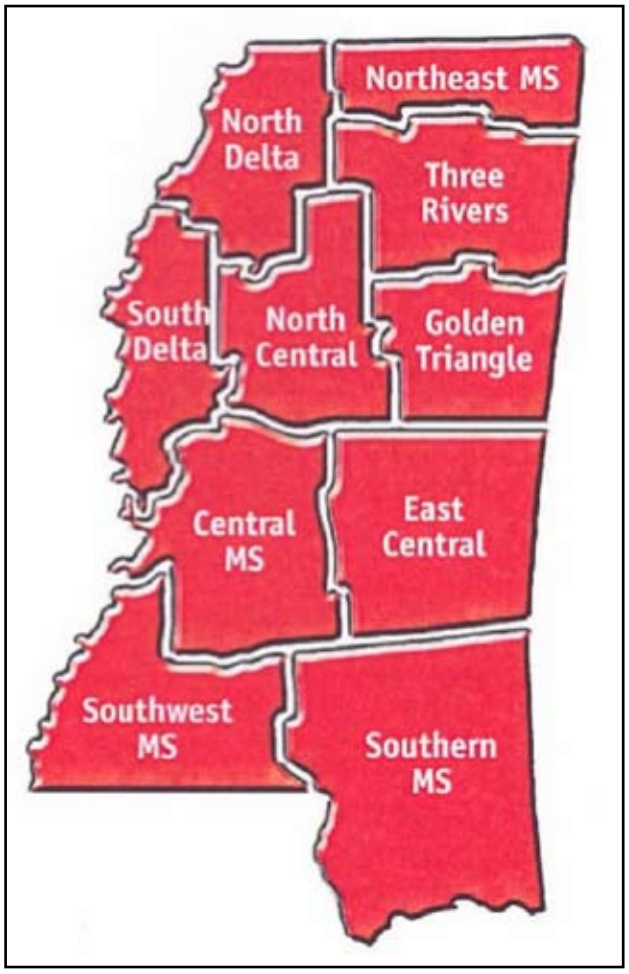
State Flood Summary	
Total Area in Sq. Miles:	48,420.9
Structures in SFHA:	125,875
State-Owned Buildings in SFHA:	178

Flood Hazard and Repetitive Loss Risk Properties by Planning and Development District

Planning and Development Districts in Mississippi

District	PDD	City
1	Northeast Mississippi	Booneville
2	North Delta	Batesville
3	Three Rivers	Pontotoc
4	North Central	Winona
5	South Delta	Greenville
6	Golden Triangle	Starkville

District	PDD	City
7	Central Mississippi	Jackson
8	East Central	Newton
9	Southwest Mississippi	Natchez
10	Southern Mississippi	Gulfport



The following tables (3.4.12 - 3.4.21) summarize vulnerabilities to flood by Planning and Development District. Added to this section in 2007 were revised repetitive loss claim numbers, total building losses estimated by HAZUS-MH, and an update to the state facilities located in the floodplain. Changes in the state facilities numbers are noted. Based on the HAZUS-MH flood losses, the Southern Mississippi, East Central Mississippi, and Central Mississippi Planning and Development Districts are most at risk. Based on the number of repetitive loss claims, the Southern Mississippi, Central Mississippi, and South Delta Planning and Development Districts are most at risk.

Potential losses to state facilities listed in the 2004 plan have been moved to the Assessing Vulnerabilities of State Facilities section.

Table 3.4.12
NORTHEAST MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Alcorn	25	0	1	2	2	0	$8,307,000
Benton	106	8	0	0	0	0	$83,000
Marshall	62	3	1	3	3	0	$359,000
Prentiss	100	0	0	0	0	0	$649,000
Tippah	90	76	0	0	0	0	$1,235,000
Tishomingo	80	21	2	0	2	0	$2,730,000
TOTALS	463	108	4	5	7	0	$13,363,000

Table 3.4.13
NORTH DELTA PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Coahoma	157	45	4	106	116	0	$7,784,000
Desoto	536	72	0	38	39	0	$26,472,000
Panola	118	13	2	15	18	0*	$15,137,000
Quitman	1,619	0	14	45	61	0*	$74,107,000
Tallahatchie	1,717	215	8	19	21	0	$17,837,000
Tate	12	0	1	2	2	1	$20,581,000
Tunica	615	20	0	204	204	0	$25,060,000
TOTALS	4,474	365	29	429	461	1	$186,978,000

* Panola County State Buildings in the Floodplain changed from 2 to 0; Quitman County from 1 to 0.

Table 3.4.14
THREE RIVERS PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Calhoun	663	19	6	15	15	0	$40,035,000
Chickasaw	233	31	0	2	2	0	$1,133,000
Itawamba	3	0	3	0	0	1	$11,479,000
Lafayette	15	10	2	0	0	0	$1,911,000
Lee	662	47	6	8	12	0	$215,994,000
Monroe	767	1	0	30	33	0	$31,264,000
Pontotoc	72	0	1	0	2	0	$15,381,000
Union	0	10	0	0	6	0	$6,671,000
TOTALS	2,415	118	18	55	70	1	$323,868,000

Table 3.4.15
NORTH CENTRAL PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Attala	55	25	0	0	0	0	$1,806,000
Carroll	90	0	2	8	8	0	$1,699,000
Grenada	854	90	5	129	144	0*	$67,691,000
Holmes	821	4	2	25	25	0*	$2,629,000
Leflore	1,653	120	9	73	74	1*	$84,920,000
Montgomery	147	6	2	0	0	0	$479,000
Yalobusha	94	5	1	17	17	0	$718,000
TOTALS	3,714	250	21	252	268	1	$159,942,000

*Grenada County State Buildings in the Floodplain changed from 1 to 9; Holmes County from 1 to 0; Leflore County from 2 to 1.

Table 3.4.16
SOUTH DELTA PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Bolivar	1,301	38	3	461	474	14*	$24,306,000
Humphreys	441	85	14	135	137	3**	$90,189,000
Issaquena	819	0	5	341	351	0	$1,733,000
Sharkey	1,429	50	2	55	55	0	$14,918,000
Sunflower	948	27	1	68	68	0	$9,730,000
Washington	17,412	365	10	447	467	0*	$38,933,000
TOTALS	22,350	565	35	1,507	1552	17	$179,809,000

*Bolivar County State Buildings in the Floodplain changed from 19 to 14; Humphreys County from 2 to 3; Washington County from 14 to 0.

Table 3.4.17
GOLDEN TRIANGLE PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Choctaw	6	8	1	0	0	0	$672,000
Clay	187	0	1	22	24	0	$13,280,000
Lowndes	7,931	2,756	6	321	346	0	$147,707,000
Noxubee	123	9	3	0	0	0	$7,721,000
Oktibbeha	275	100	0	7	7	0*	$1,931,000
Webster	122	122	0	16	16	0	$110,000
Winston	208	65	0	0	0	0*	$2,241,000
TOTALS	8,852	3,060	11	366	393	0	$173,617,000

*Oktibehha County State Buildings in the Floodplain changed from 3 to 0; Winston County from 7 to 0.

Table 3.4.18
CENTRAL MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Copiah	557	142	3	4	4	1	$7,484,000
Hinds	5,238	1,580	12	897	988	33*	$315,489,000
Madison	579	100	5	317	336	0	$30,373,000
Rankin	829	363	5	148	177	0	$282,635,000
Simpson	5,220	22	5	90	97	0	$19,497,000
Warren	2,977	368	4	1,263	1314	0	$7,836,000
Yazoo	4,706	1,710	1	23	24	0	$5,138,000
TOTALS	20,106	4,285	35	27,42	2940	34	$668,452,000

*Hinds County State Buildings in the Floodplain changed from 44 to 33.

Table 3.4.19
EAST CENTRAL MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Clarke	323	30	4	0	9	0	$17,352,000
Jasper	108	9	1	2	3	0	$37,321,000
Kemper	0	0	1	0	0	0	$2,058,000
Lauderdale	2,252	250	9	24	71	0*	$312,429,000
Leake	95	67	2	8	8	0	$13,918,000
Neshoba	100	0	0	0	0	0	$34,144,000
Newton	45	0	2	0	2	0	$2,405,000
Scott	146	4	1	6	6	0	$1,458,000
Smith	433	50	2	0	0	0	$15,614,000
TOTALS	3,502	410	22	40	99	0	$436,699,000

*Lauderdale County State Buildings in the Floodplain changed from 4 to 0.

Table 3.4.20
SOUTHWEST MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Adams	101	5	3	34	34	0	$61,088,000
Amite	109	0	0	0	0	0	$2,695,000
Claiborne	371	17	1	224	242	1	$15,541,000
Franklin	16	0	1	0	0	0	$1,565,000
Jefferson	75	0	0	26	28	0	$84,151,000
Lawrence	30	0	4	8	12	1	$9,638,000
Lincoln	12	0	1	6	6	0	$5,248,000
Pike	575	1,084	3	28	30	0	$13,613,000
Walthall	309	0	1	35	40	1	$12,478,000
Wilkinson	75	45	2	698	708	0	$3,133,000
TOTALS	1,673	1,151	16	1,059	1100	3	$209,150,000

Table 3.4.21
SOUTHERN MISSISSIPPI PLANNING & DEVELOPMENT DISTRICT

County	One-Family Structures	All Otther Structures	Critical Facilities	Rep. Loss Claim 2004	Rep. Loss Claim 2007	State Buildings in the Floodplain	HAZUS-MH Flood Building Losses
Covington	242	62	7	20	24	0	$17,139,000
Forrest	4,181	675	2	504	506	0	$106,357,000
George	225	50	0	2	2	0	$17,260,000
Greene	152	5	4	0	0	0	$9,342,000
Hancock	257	276	29	435	1712	0*	$1,024,256,000
Harrison	15,274	1,140	44	1,765	3247	15*	$1,684,239,000
Jackson	16,870	444	46	503	2311	0*	$1,522,364,000
Jeff Davis	159	0	2	0	0	0	$466,000
Jones	784	69	9	28	33	0	$41,381,000
Lamar	124	9	0	100	161	0	$3,576,000
Marion	757	148	4	251	257	0	$16,838,000
Pearl River	2,150	0	3	133	198	0	$37,680,000
Perry	261	55	3	24	24	0	$52,878,000
Stone	97	89	1	0	0	0	$870,000
Wayne	506	50	1	8	8	2**	$7,582,000
TOTALS	42,039	3,072	155	3,773	8483	72	$4,542,228,000

*Hancock County State Buildings in the Floodplain changed from 13 to 0; Harrison County from 50 to 15; Jackson County from 9 to 0; Wayne County from 0 to 2.

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 udpate, 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 3.4.22 serves as a summary of the potential losses to state-owned structures within the state of Mississippi.

Table 3.4.22
Summary of Potential Losses to State-Owned Facilities (update 2007)

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 3.4.23 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.

Table 3.4.23
Exposure and Flood Vulnerability of State Bridges by County
(Values in thousands of dollars)

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
Perry	36	64,396.78	3	Tippah	26	25,323.31	2
Pike	54	58,800.65	3	Tishomingo	33	78,274.19	3

County	Bridge Count	Value	Scour Critical	County	Bridge Count	Value	Scour Critical
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**	**6,579,643.64**	**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

3.5: Extreme Winter Weather Risk Assessment

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 iinch 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 2004 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 of the inability of manufacturers and product brokers 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 has a cascading effect on the domestic economy and the manufacturing economy.

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 when 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 the loss of heating, lighting, water and sewer systems. Finally, frozen and broken water lines in homes are not only costly to repair, but create additional hazards from electrocution.

Other secondary effects include flooding from melting ice and snow, including 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.

Location / Past Occurrences

The following summary of winter storm events from 1993 to 2006 reveals that 34 winter-related events occurred. Total property damage reported for this thirteen year period was $24,168,000 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 3.5.1

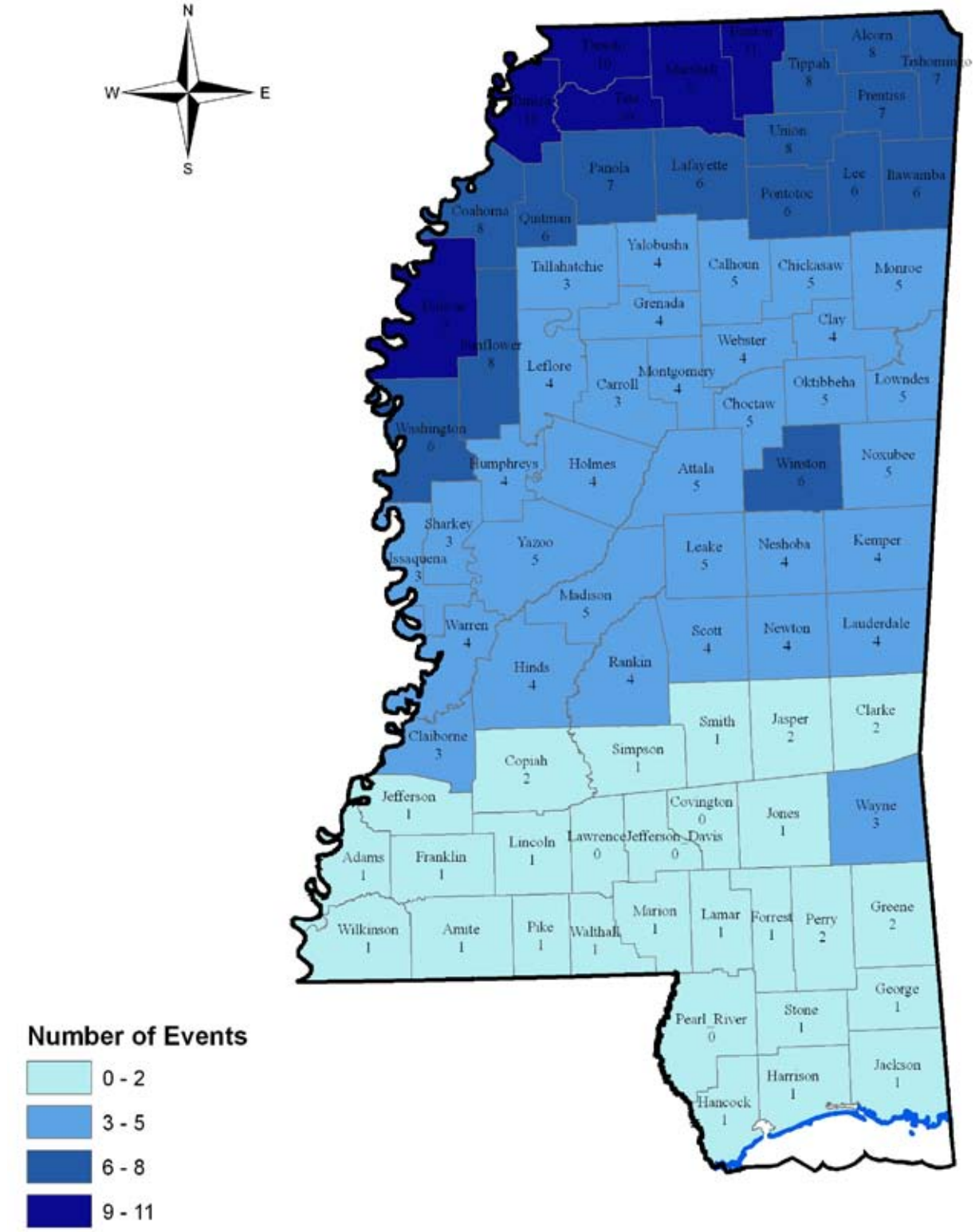
Table 3.5.1
Damage Costs for Mississippi Winter Storm Events 1993 - 2006

Year	Incident Type			Total Property Damage	Total Crop Damage
	Heavy Snow	Ice Storm	Winter Storm		
1993		1		$0	$0
1994		1		$500,000	$5,000,000,000
1996		1	2	$3,500,000	$0
1997	1			$50,000	$0
1998		2	1	$16,699,000	$0
2000	3	4	2	$1,450,000	$0
2001			1	$0	$0
2002	1		3	$30,000	$0
2003	1	2		$148,000	$0
2004	1	1	2	$409,000	$0
2005	None to report				
2006	0	2	2	$1,382,000	$0
Totals	**7**	**14**	**13**	**$24,168,000**	**$5,000,000,000**

Source: National Weather Service website: http://www4ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~Storms. Best Available Data limited to the period of 1993 to 2006.

The following map, Mississippi Winter Storms 1993 – 2006, indicates which counties were impacted by winter storms in table 3.5.1 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.

ississippi Winter Storm Events 1993-2006



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.

Winter Storm Events prior to 1993

The National Weather Service, via NCDC, has created a consistent database of winter events since 1993. However, there have been many severe storms prior to this time period. The table 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.

Winter Storm Events 1994 – 2006

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.

Event: Ice Storm	Date of Event: February 9 - 10, 1994
Property Damage: $500,000	**Crop Damage: $5,000,000,000**
Number of Deaths: 0	**Impacted Mississippi Counties:** Benton, Desoto
Description: During the early morning hours on the 9th, freezing rain began falling over North Mississippi and continued through mid-day on the 10th. Ice accumulations of three to six inches were common over the affected area. Due to the weight of the ice, power lines, trees and tree limbs were downed. Many trees fell on houses and automobiles. The ice storm caused significant damage to approximately 3.7 million acres of commercial forestland. The value of damaged timber was estimated to be $27 million. Twenty-five percent of the states pecan crop will be lost for the next five to ten years at an estimated cost of $5.5 million per year. Nearly 750,000 customers were without power in the affected area. Customers were without power for up to a month. Over eight thousand utility poles were pulled down by the weight of the ice. Over 4,700 miles of power lines were down. Four-hundred-ninety-one water systems were affected with around 741,000 customers without water. Estimates of damage to utilities will run nearly $500 million. This is the worst ice storm to strike Mississippi since a severe ice storm struck the state in January 1951.	

Event: Ice Storm	Date: February 1 - 2, 1996
Property Damage: $3,000,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** 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
Description: Freezing rain occurred over all the above counties causing widespread damage to trees and power lines. Accumulations of one-half to one inch of ice were common over this area. Over one hundred thousand customers were without power during the event. Most roads and bridges were impassable and some of the roads had to be closed.	

Event: Winter Storm	Date of Event: January 15, 1998
Property Damage: $10,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Calhoun, Chickasaw, Itawamba, Lee, Lowndes, Monroe, Pontotoc, Prentiss, Tishomingo, and Union
Description: A mixture of sleet and freezing rain fell over the northeast part of Mississippi.	

Event: Ice Storm	Date of Event: December 22-23, 1998
Property Damage: $99,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Alcorn, Benton, Calhoun, Chickasaw, Coahoma, DeSoto, Itawamba, Lafayette, Lee, Marshall, Monroe, Panola, Pontotoc, Prentiss, Quitman, Tallahatchie, Tate, Tippah, Tishomingo, Tunica, Union, and Yalobusha
Description: Much of north Mississippi was hit with an ice storm. Most counties reported between ¼ to ½ inches of ice on their roads with some locations in the southern part of the region reporting as much as 3 inches of ice. The ice caused numerous power outages and brought down many trees and power lines. Thousands of people in north Mississippi were without power, some for as long as one week.	

Event: Ice Storm	Date: December 22 - 25, 1998
Property Damage: $16,600,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Attala, Bolivar, Carroll, Choctaw, Claiborne, Clay, Grenada, Hinds, Holmes, Humphreys, Issaquena, Kemper, Lauderdale, Leake, Leflore, Lowndes, Madison, Montgomery, Neshoba, Newton, Noxubee, Oktibbeha, Rankin, Scott, Sharkey, Sunflower, Warren, Washington, Webster, Winston, and Yazoo
Description: A crippling ice storm struck the three state region of Arkansas, Louisiana, and Mississippi at one of the worst times, just before Christmas. Much of the fall and early winter season of late 1998 had been very mild for southerners. But on Tuesday, December 22nd, a strong surge of shallow Arctic air drove southward and spelled a quick end to the unseasonable warmth and helped set the stage for one of winter's nasty tricks. A moist southwest flow above the cold air brought several upper level disturbances. This combination of cold air and moisture held together for several days and brought periods of freezing rain and sleet to the three state region beginning Tuesday night and not ending until Christmas morning. Up to 2 inches of ice accumulated on power lines and much of the area experienced long power outages, nearly seven days in some cases. Hardest hit was an area from northeast Louisiana to north central Mississippi where tree and power line damage was moderate to severe. The prior warmth had left most trees with a little more foliage than usual and greater potential for ice accumulation. The extra weight was more than many trees could handle and quite a few large oaks and maples split in half. Christmas travel was severely hampered for several days with motorists stranded at airports, bus stations, and truck stops. Travel did not return to normal until after Christmas in some locations. Total estimated cost of damage in the region covering southeast Arkansas, northeast Louisiana, and central Mississippi is around 23 million dollars, with most of the damage attributable to downed power lines and trees. Many counties were declared federal disaster areas. The inconvenience endured by holiday travelers and their loved ones was uncountable.	

Event: Heavy Snow	Date of Event: January 27 - 28, 2000
Property Damage: $1,100,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Attala, Bolivar, Carroll, Choctaw, Clay Grenada, Holmes, Humphreys, Leflore, Lowndes, Montgomery, Noxubee, Oktibbeha, Sunflower, Washington, Webster, and Winston
Description: A winter storm brought a swath of heavy snow across north central Mississippi. The snow began falling over western portions of the area during the early morning of the 27th and spread eastward during the day. The snow was heavy at time and died not end until the morning of the 28th. Snowfall amounts generally ranged from 4 to 10 inches. The heaviest amounts fell along the Highway 82 corridor from Greenville to Starkville where isolated snow depths of 12 inches were reported. Damage from the heavy snow was relatively minimal with reports limited to a few collapsed roofs and downed trees. Power outages were sporadic, but traveling was more than just an inconvenience as numerous reports of vehicles run off the road were received.	

Event: Ice Storm	Date of Event: January 27 - 28, 2000
Property Damage: $285,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Hinds, Issaquena, Kemper, Lauderdale, Leake, Madison, Neshoba, Newton, Rankin, Scott, Sharkey, Warren, and Yazoo
Description: A winter storm brought a mixture of sleet, freezing rain, and snow to much of central Mississippi on the 27th and 28th. The wintry mixture began early on the 27th across western portions of the area and spread eastward during the day. The precipitation did not end until the morning hours of the 28th. In some places, the precipitation changed to rain before ending and this helped to keep damage and inconvenience to a minimum. Overall, ice damage was rather light as much of the precipitation fell in the form of sleet. Total ice accumulations of one to two inches were common. Damage reports consisted primarily of downed trees and power lines.	

Event: Ice Storm	Date of Event: December 13, 2000
Property Damage: $13,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Bolivar, Sunflower, and Washington
Description: Ice accumulations of one eighth to one fourth of an inch were reported in portions of northwest Mississippi; mainly in extreme southern Sunflower county, northern and western Bolivar county, and northwestern Washington county. Throughout the event, temperatures remained close to the freezing mark. Also initial precipitation was very light. Therefore, although freeing rain occurred much of the day, damage to trees and power lines was relatively minor.	

Event: Ice Storm	Date of Event: December 13, 2000
Property Damage: $30,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Coahoma, DeSoto, and Tunica.
Description: Freezing rain fell across the northwest corner of Mississippi. Numerous tree limbs fell due to the ice with some homes losing power for a short period of time.	

Event: Ice Storm	Date of Event: December 21, 2000
Property Damage: $12,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Choctaw, Clay, Grenada, Lowndes, Montgomery, Noxubee, Oktibbeha, Webster, and Winston
Description: A brief freezing rain event occurred across portions of north central and northeast Mississippi. Since temperatures were close to the freezing mark during the entire event, the primary problem caused was icing bridges and other elevated road surfaces.	

Event: Heavy Snow	Date of Event: January 1 - 2, 2002
Property Damage: $30,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Clarke, Forrest, Jasper, Jones, Lamar, and Marion
Description: A winter storm produced heavy snow across portions of southeast Mississippi. The heavy snow began falling over Marion and Lamar counties during the late evening of the 1st, then spread east-northeast into southeast Jasper and Clarke counties the early morning hours of the 2nd. The heaviest snow fell between Foxworth and Oloh, where four to four and one half inches of snow was recorded. Farther east, two to three inches of snow fell in Forrest, Jones, Jasper, and Clarke counties along an axis from Hattiesburg and Petal, to Laurel, to Shubuta. Icy bridges made traveling across the region very treacherous. As a result several accidents occurred with three fatalities. One fatality was in Lamar County in Interstate 59 at mile marker 44. The other two fatalities were on High 537 near Sharon and on Highway 590 in Jones County.	

Event: Heavy Snow	Date of Event: February 6, 2003
Property Damage: $3,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Alcorn, Benton, and Tippah
Description: Heavy snow fell across northern sections of Alcorn, Benton and Tippah counties in north Mississippi. Between 2 and 4 inches of snow fell over this area.	

Event: Heavy Snow	Date of Event: February 25, 2003
Property Damage: $130,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Bolivar and Washington
Description: Freezing rain caused ¼ to ½ inch of ice to cover trees and power lines. This ice accumulation caused numerous trees and power lines to be knocked down.	

Event: Ice Storm	Date of Event: February 26, 2003
Property Damage: $15,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Bolivar and Sunflower
Description: Additional ice accumulation, the second night, caused a few more trees and power lines to be knocked down.	

Event: Heavy Snow	Date of Event: February 15, 2004
Property Damage: $700	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Alcorn, Benton, Marshall, Tate, Tippah, Tishomingo, and Union
Description: A brief heavy snowstorm produced between 3 and 6 inches of snow over sections of north Mississippi. Much of the snow melted several hours after the event.	

Event: Ice Storm	Date of Event: December 22 - 23, 2004
Property Damage: $400,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Bolivar and Sunflower
Description: None Reported	

Event: Winter Storm	Date of Event: December 22 - 23, 2004
Property Damage: $8,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Benton, Coahoma, DeSoto, Marshall, Panola, Tate, Tippah and Tunica
Description: A winter storm brought a mix of sleet and snow to North Mississippi. Most of the precipitation fell as sleet with accumulations ranging from ½ inch to 2 inches.	

Event: Winter Storm	Date of Event: February 10, 2006
Property Damage: $5,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Benton, DeSoto, Marshall, Tate and Tunica
Description: The combination of a surface low moving across the northern Gulf coast and a southward moving arctic front produced significant winter weather over northwest Mississippi. Between 2 and 4 inches of snow over this area.	

Event: Winter Storm	Date of Event: February 18, 2006
Property Damage: $17,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Alcorn, Benton, Coahoma, DeSoto, Itawamba, Lafayette, Lee, Marshall, Panola, Pontotoc, Prentiss, Quitman, Tate, Tippah, Tishomingo, Tunica and Union
Description: A mix of snow, sleet and freezing rain fell on much of North Mississippi. Over extreme northwest portions of the state, about 1 inch of a mix of snow and sleet fell along with ¼ inch of ice accumulation. Across the remainder of North Mississippi about ½ inch to 1 inch of sleet fell along with ¼ inch of ice accumulation.	

Event: Ice Storm	Date of Event: February 18, 2006
Property Damage: $60,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Bolivar and Sunflower
Description: Freezing rain began falling during the morning hours of the 18th and light icing occurred for several hours across a portion of the Mississippi Delta region. By late morning and around noon, ice accumulations reached ¼ inch across northern portions of Bolivar county and extreme northern portions of Sunflower county. May bridges in this area were iced over along with icing on trees and power lines. The ice accumulations ended before much damage occurred and at its greatest was generally around ¼ inch before evaporating and melting some during the evening.	

Event: Ice Storm	Date of Event: February 20, 2006
Property Damage: $1,300,000	**Crop Damage: $0.0**
Number of Deaths: 0	**Impacted Mississippi Counties:** Attala, Choctaw, Holmes, Leake, Madison, Okibbeha, Winston and Yazoo
Description: During the early morning hours of February 20th, and lasting through early afternoon, portions of the region saw periods of freezing rain. The amount of accumulation varied with only a narrow corridor from Northeast Louisiana to portions of Northeast Mississippi receiving ¼ to ½ of an inch of ice accumulation. A large portion of the region did see freezing rain, but for the most part, accumulations of ice stayed below ¼ of an inch. Across Northeast Louisiana, the core of the heaviest freezing rain occurred from Southwest Richland parish across Northern Franklin parish into the west half of Madison parish. Here ¼ to 0.4 inches of ice occurred and caused bridges and overpasses to freeze over and ice to weigh down trees and power lines. Across Central and Northeast Mississippi, the core of freezing rain was a bit larger and extended from eastern Yazoo to northeast Winston county. Here ¼ to 0.6 inches of ice accumulation occurred. Many bridges and overpasses were iced over along with ice on trees and power lines. For the most part, damage remained minimal as the corridor that was affected was rather narrow. Additionally, this ice event occurred during the morning and mid-day hours of a federal holiday, President's Day. Due to the holiday, schools were off and many businesses were closed resulting in much less road traffic than usual.	

Probability of future winter storm events

The area most likely to receive an ice storm, heavy snow, or winter storm activity would be 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. Since 1993 thirty-four winter storm events have struck the state. No events impacted the state in 1995, 1999 and 2005. In 2000, the state was struck, with varying severity, by nine events. Winter storms have an average probability of striking the state about three times each year.

Assessing Vulnerability

An assessment of Mississippi's vulnerability to winter storms reveals that while warning is public, advance warnings are often not heeded. Preparedness for a winter storm is paramount. As is the case with other natural hazards, very young, elderly, persons with special needs, and handicapped people are vulnerable to winter storms. There is also a suggestion that the 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 electric poles. These can all be weighed down by ice and freezing rain. During the 1994 ice storm, eight thousand 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

People who are isolated in their homes due to illness or an inability to get around, the aged and the very young, as well as people with special needs are particularly vulnerable to winter storms.

The public warning systems in place to warn of an impending storm are existing media outlets, the national weather service and a NOAA weather radio. The oxygen-dependent and the insulin-dependent special needs people who are home bound due to age or medical condition are especially vulnerable and can only rely on their neighbors or relatives for contact and assistance in the event of a power failure. Often, roads are blocked to local traffic by fallen trees and home health care occasionally needs help from emergency forces to meet with their intended patients.

This disruption of citizens without needed insulin, oxygen, or needed medical care leaves this special needs, and children for that matter, particularly vulnerable to winter storm and the power failure that it brings with it. Previous incidents have left remote areas of the state without power for up to a month. Drivers and walkers both experience accidents due to icy conditions.

Loss of Life from Extreme Cold in Mississippi

Although cold-related deaths were not recorded by the National Weather Service during winter storm events, the following information was collected by the Mississippi Department of Health, Bureau of Health Statistics and is displayed to provide an understanding of recorded deaths in Mississippi due to cold. Table 3.5.2 below summarizes cold-related deaths over a 19-year period from the year 1984 to the year 2002 . During that time, a total of 223 deaths occurred, an average of 12 deaths per year. Information on the location of the deaths, however, was not available.

Table 3.5.2
Cold-Related Deaths
ICD9 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
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

Source: Mississippi Department of Health, Bureau of Health Statistics June 29, 2004.

*The tables above reflect the use of the International Class of Diseases (ICD) as used by the Mississippi Health Department. ICD codes have consolidated previous classifications relating to death due to cold into one category.

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 $27,000,000. The State's pecan crop was reduced by 25% over the next five to ten years at an estimated cost of $5,500,000 per year.

The fallen timber and tree limbs during winter storms provide a possibility of wildfires later in the year. Forestry Commission officials and private land-owners 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, roofs of businesses and homes only occasionally 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 wires, microwave, and cellular telephone repeater towers have been disrupted if not downed in the past. The failure of 9 fiber optic lines, 26 local telephone exchanges and several cellular telephone repeater towers are all vulnerable 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 were summed to determine an overall vulnerability rating for each county relative to the other counties.

The three ratings were:

I. **Prior Event Rating** (based on the number of past winter storm events)

II. **Private Property Valuation Rating** (based on the total valuation of private property in the county)

III. **Population Density Rating** (based on the population density of the county)

As with the tornado risk assessment, 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.

1. 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[1] covering the period of 3/12/93 until 2/20/06. Some information was gathered on winter weather events prior

1 http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

to 1993 but it is not consistent enough to use as a vulnerability indicator. Since, NWS data prior to March 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 2006 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 11 events since 1993. Only four counties in southern Mississippi had no winter storm events during the recorded time period. The counties with a Prior Event Rating of 10 and greater (or having 5 or more winter storm events) are listed in the table below.

County	Prior Event Rating	County	Prior Event Rating
Calhoun	10	Panola	14
Chickasaw	10	Tippah	16
Winston	10	Sunflower	16
Monroe	10	Union	16
Lowndes	10	Coahoma	16
Quitman	12	Alcorn	16
Itawamba	12	Marshall	18
Pontotoc	12	Bolivar	18
Washington	12	Tate	20
Lafayette	12	Tunica	20
Lee	12	DeSoto	20
Prentiss	14	Benton	22
Tishomingo	14		

[1] Source: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

A complete table with values used to derive the ratings is included as Appendix 7.3.5-A

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 obtained are from the fiscal year 2006 Ad Valorem Assessment of State of Mississippi provided by the Mississippi State Tax Commission[2].

The Annual Report provides private property assessments in two categories. These are "Real Property" and "Personal Property". The "Real Property" assessment represents residential property including improvements. The "Personal Property" assessment represents commercial and business property. The "True Value" listed in each assessment is a total (by county) of the categories within the property assessment. 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 below. The ranges were numbered one through ten in ascending order, and this became the Property Valuation Rating.

Total Valuation of Property Ranges		Property Valuation Rating
$119,875,058	$1,151,915,902	1
$1,151,915,903	$2,183,956,747	2
$2,183,956,748	$3,215,997,592	3
$3,215,997,593	$4,248,038,437	4
$4,248,038,437	$5,280,079,282	5
$5,280,079,283	$6,312,120,126	6
$6,312,120,127	$7,344,160,971	7
$7,344,160,972	$8,376,201,815	8
$8,376,201,816	$9,408,242,660	9
$9,408,242,661	$10,440,283,505	10

Summary of Property Valuations:

The Total Property Valuation ranged from $119,875,058 in Issaquena County to $10,440,283,505 in Hinds County. Only two counties (DeSoto and Hinds) 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. The counties that received a Property Valuation Rating greater than 1 are shown below.

[2] http://www.mstc.state.ms.us/info/annualreport/fy2006/AnnualReportFY06.pdf

County	Property Valuation Rating	County	Property Valuation Rating	County	Property Valuation Rating
Adams	2	Monroe	2	Lauderdale	4
Marshall	2	Oktibbeha	2	Lowndes	4
Alcorn	2	Pearl River	2	Lee	5
Leflore	2	Washington	2	Jackson	7
Lincoln	2	Jones	3	Rankin	8
Pike	2	Lamar	3	Madison	8
Panola	2	Lafayette	3	Harrison	9
Tunica	2	Forrest	3	DeSoto	10
Bolivar	2	Warren	3	Hinds	10

A complete table with values used to derive the ratings is included as Appendix 7.3.5-A

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 Census3. An updated population count for counties affected by Hurricane Katrina was developed by Claritas4. For those counties not included in the Claritas study, the plan developers used the 2005 estimated population produced by the Population Division of the US Census Bureau released on March 16, 20065. The sources of the population data for each county are noted by the shading in table 3.5.3. Counties with High Population Density Ratings. The shaded population numbers reflect Claritas' January 2006 Population estimate incorporating the impact of Hurricane Katrina.

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.

Population Density Range		Rating	Population Density Range		Rating
4.62	36.60	1	164.52	196.50	6
36.60	68.58	2	196.50	228.48	7
68.58	100.56	3	228.48	260.46	8
100.56	132.54	4	260.46	292.44	9
132.54	164.52	5	292.44	324.42	10

http://quickfacts.census.gov/qfd/states/28000lk.htm; www.claritas.com/katrina

[3] http://quickfacts.census.gov/qfd/states/28000lk.html
[4] www.claritas.com/katrina
[5] Table 1: Annual Estimates of the Population for Counties of Mississippi: April 1, 2000 to July 1, 2005.

Summary of Population Density:

The lowest population density is found in Issaquena County with an estimated 4.62 people per square mile. Coincidentally, Issaquena is estimated to have the lowest overall population of 1,909 people over 413 square miles. The highest population density is found in Harrison County with an estimated 324.42 people per square mile. Hinds County is estimated to have the highest overall population with 264,797 people over 869 square miles. Harrison and Hinds County were the only two counties to receive the highest Population Density rating of 10. Those counties with Population Density Ratings of 6 and above are listed in table XX below. (Note: No counties received a Population Density Rating of 5.

Table 3.5.3

County	Land Area in square miles obtained from 2000 Census	January 2006 Population with Katrina Impact*	Population Density	Population Density Rating
Lee	449.59	78,793	175.26	6
Forrest	466.58	79,600	170.60	6
Jackson	726.9	130,668	179.76	6
Rankin	774.52	136,894	176.75	6
DeSoto	477.86	139,399	291.72	9
Harrison	580.98	188,482	324.42	10
Hinds	869.18	264,797	304.65	10

*The shaded population numbers reflect Claritas' January 2006 Population estimate incorporating the impact of Hurricane Katrina. Population numbers in unshaded cells were obtained from the U.S. Census estimates.

A complete table with values used to derive the ratings is included as Appendix 7.3.5-A

Vulnerability Rating:

After rating each county in each of the above mentioned 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 forty-two. The total vulnerability ratings varied from a high of 39 for DeSoto County to a low of 2 for Jefferson Davis and Lawrence Counties. 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.

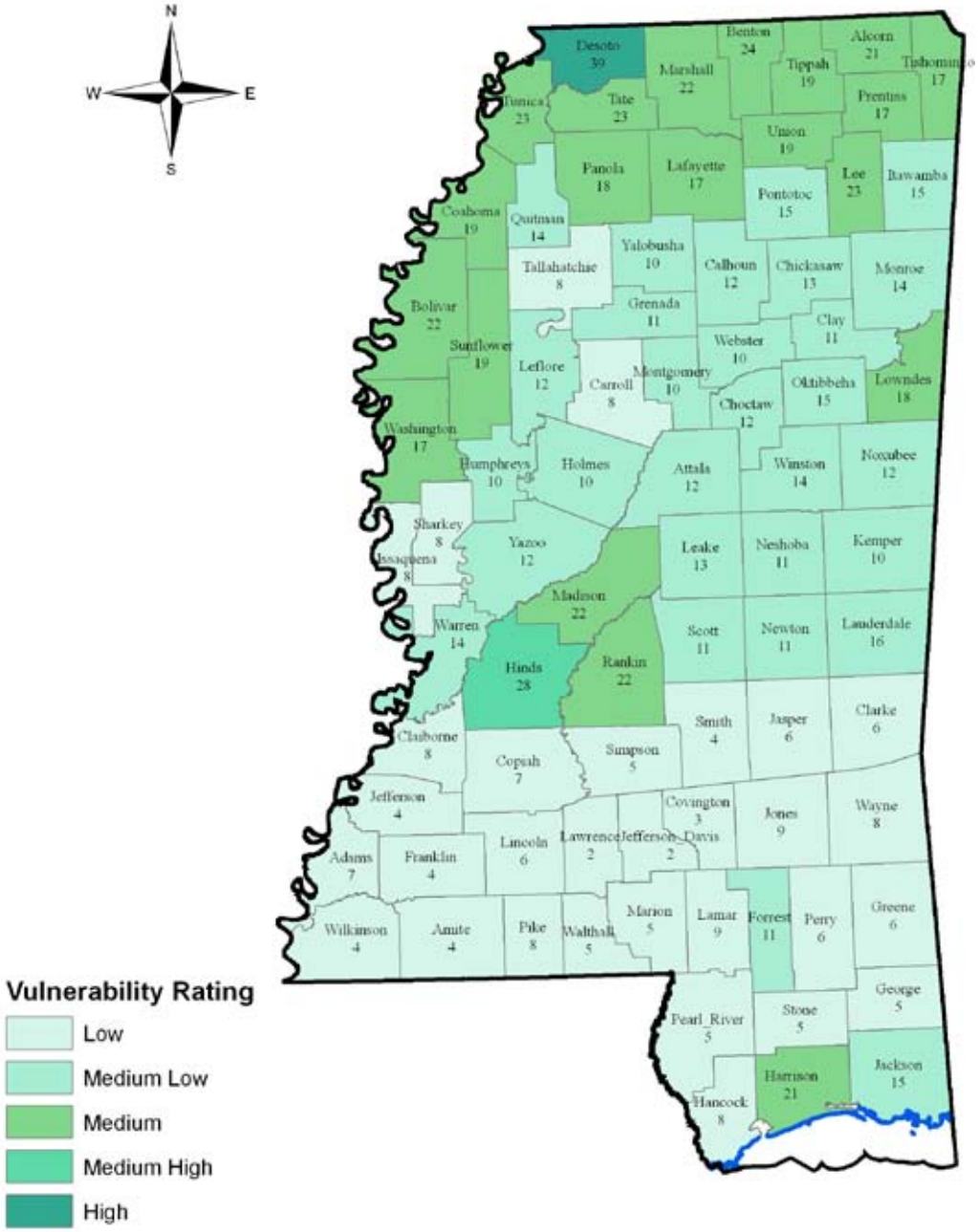
The range of overall vulnerability rating values was divided into five equal ranges to determine each county's Winter Storm Vulnerability. These ranges and corresponding levels of vulnerability are shown below.

Vulnerability Rating Ranges		Winter Storm Vulnerability
2	9	low
10	17	medium low
18	24	medium
25	32	medium high
33	39	high

DeSoto County is the only county to receive a high Winter Storm Vulnerability. Hinds County received a vulnerability rating within the range for medium high Winter Storm Vulnerability. Sixteen counties received medium Winter Storm Vulnerability.

A complete table with values used to derive the ratings is included as Appendix 7.3.5-A

Mississippi Winter Weather Vulnerability Rating



Note: Numbers on map represent the vulnerability rating for each county.

Table 3.5.4
Winter Storm Vulnerability Ratings for all 82 Mississippi Counties

County	Prior Event Rating	Property Valuation Rating	Population Density Rating	Vulnerability Rating	Winter Storm Vulnerability
DeSoto	20	10	9	39	High
Hinds	8	10	10	28	Medium High
Benton	22	1	1	24	Medium
Lee	12	5	6	23	Medium
Tate	20	1	2	23	Medium
Tunica	20	2	1	23	Medium
Rankin	8	8	6	22	Medium
Madison	10	8	4	22	Medium
Bolivar	18	2	2	22	Medium
Marshall	18	2	2	22	Medium
Harrison	2	9	10	21	Medium
Alcorn	16	2	3	21	Medium
Coahoma	16	1	2	19	Medium
Sunflower	16	1	2	19	Medium
Tippah	16	1	2	19	Medium
Union	16	1	2	19	Medium
Lowndes	10	4	4	18	Medium
Panola	14	2	2	18	Medium
Lafayette	12	3	2	17	Medium Low
Washington	12	2	3	17	Medium Low
Prentiss	14	1	2	17	Medium Low
Tishomingo	14	1	2	17	Medium Low
Lauderdale	8	4	4	16	Medium Low
Jackson	2	7	6	15	Medium Low
Oktibbeha	10	2	3	15	Medium Low
Itawamba	12	1	2	15	Medium Low
Pontotoc	12	1	2	15	Medium Low
Warren	8	3	3	14	Medium Low
Monroe	10	2	2	14	Medium Low
Quitman	12	1	1	14	Medium Low
Winston	12	1	1	14	Medium Low
Chickasaw	10	1	2	13	Medium Low
Leake	10	1	2	13	Medium Low
Leflore	8	2	2	12	Medium Low
Attala	10	1	1	12	Medium Low
Calhoun	10	1	1	12	Medium Low
Choctaw	10	1	1	12	Medium Low
Noxubee	10	1	1	12	Medium Low
Yazoo	10	1	1	12	Medium Low
Forrest	2	3	6	11	Medium Low

County	Prior Event Rating	Property Valuation Rating	Population Density Rating	Vulnerability Rating	Winter Storm Vulnerability
Clay	8	1	2	11	Medium Low
Grenada	8	1	2	11	Medium Low
Neshoba	8	1	2	11	Medium Low
Newton	8	1	2	11	Medium Low
Scott	8	1	2	11	Medium Low
Holmes	8	1	1	10	Medium Low
Humphreys	8	1	1	10	Medium Low
Kemper	8	1	1	10	Medium Low
Montgomery	8	1	1	10	Medium Low
Webster	8	1	1	10	Medium Low
Yalabusha	8	1	1	10	Medium Low
Jones	2	3	4	9	Low
Lamar	2	3	4	9	Low
Hancock	2	3	3	8	Low
Pike	2	2	4	8	Low
Carroll	6	1	1	8	Low
Claiborne	6	1	1	8	Low
Issaquena	6	1	1	8	Low
Sharkey	6	1	1	8	Low
Tallahatchie	6	1	1	8	Low
Wayne	6	1	1	8	Low
Adams	2	2	3	7	Low
Copiah	4	1	2	7	Low
Lincoln	2	2	2	6	Low
Clarke	4	1	1	6	Low
Greene	4	1	1	6	Low
Jasper	4	1	1	6	Low
Perry	4	1	1	6	Low
Pearl River	0	2	3	5	Low
George	2	1	2	5	Low
Marion	2	1	2	5	Low
Simpson	2	1	2	5	Low
Stone	2	1	2	5	Low
Walthall	2	1	2	5	Low
Amite	2	1	1	4	Low
Franklin	2	1	1	4	Low
Jefferson	2	1	1	4	Low
Smith	2	1	1	4	Low
Wilkinson	2	1	1	4	Low
Covington	0	1	2	3	Low
Jefferson Davis	0	1	1	2	Low
Lawrence	0	1	1	2	Low

Exposure Analyses

The following section consists of three exposure analyses, using three different sets of data. In the 2004 state mitigation plan, it was stated that the State of Mississippi did not have a comprehensive list of state-owned or operated buildings, critical facilities, and infrastructure sorted by county that could be used to determine exposure risk or loss estimations. Since that time, the State of Mississippi has identified the locations of many critical facilities as well as replacement values for state-owned facilities. These are both reviewed below in addition to the updated critical facilities and infrastructure provided in HAZUS-MH.

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.

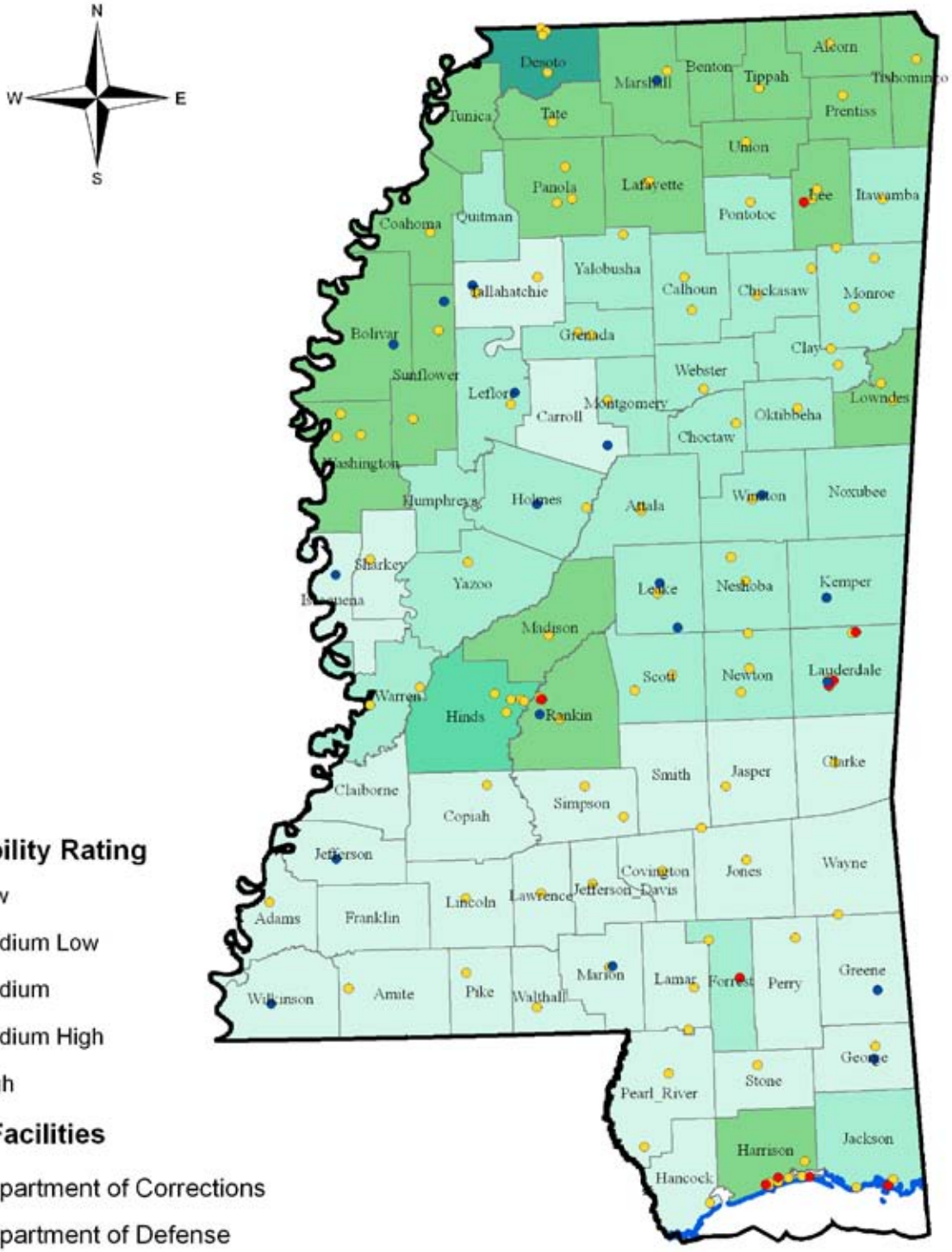
Exposure Analysis of Critical Facilities:

The State of Mississippi developed a definition for "critical facilities" 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 table below presents a summary of critical facilities within the counties of High and Medium High Winter Storm Vulnerability. These are Desoto and Hinds Counties. This analysis gives the State of Mississippi an understanding of which critical facilities are most likely to be exposed to winter storm events. However, it should be noted that winter storms may impact any county.

Critical Facility Categories	Number of facilities in High Vulnerability Counties	Number of facilities in Medium High Vulnerability Counties	Total
	DeSoto	Hinds	
Airports	2	3	5
Animal Shelters	2	2	4
City Halls	5	8	13
Courthouses	1	2	3
Department of Corrections	0	0	0
Department of Defense	0	0	0
Emergency Operations Centers	1	1	2
Fire Stations	8	0	8
Intermodal Facilities	0	1	1
MDOT	0	2	2
Media	2	42	44
Medical and Power	4	14	18
Military	4	5	9
Police Stations	6	17	23
Red Cross	2	44	46
Testing Labs	0	5	5
Wastewater	47	59	106
Water	1	1	2
TOTAL FACILITIES	**85**	**206**	

Mississippi Winter Weather Vulnerability Rating and Critical Facilities



Vulnerability Rating

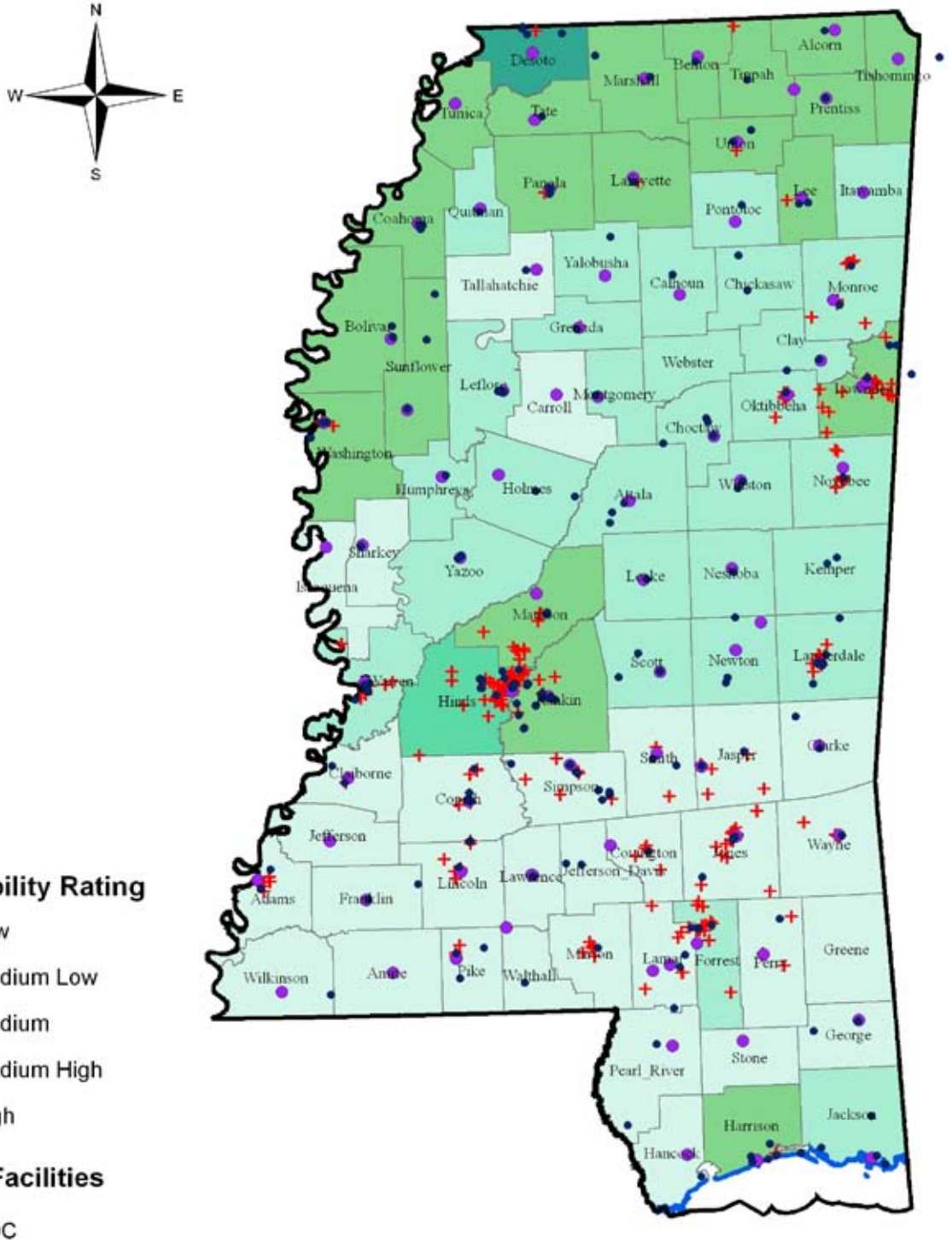
- Low
- Medium Low
- Medium
- Medium High
- High

Critical Facilities

- Department of Corrections
- Department of Defense
- Military Sites

Source: Nassa-base locations, MS Department of Corrections, National Guard EOC

Mississippi Winter Weather Vulnerability Rating and Critical Facilities



Vulnerability Rating

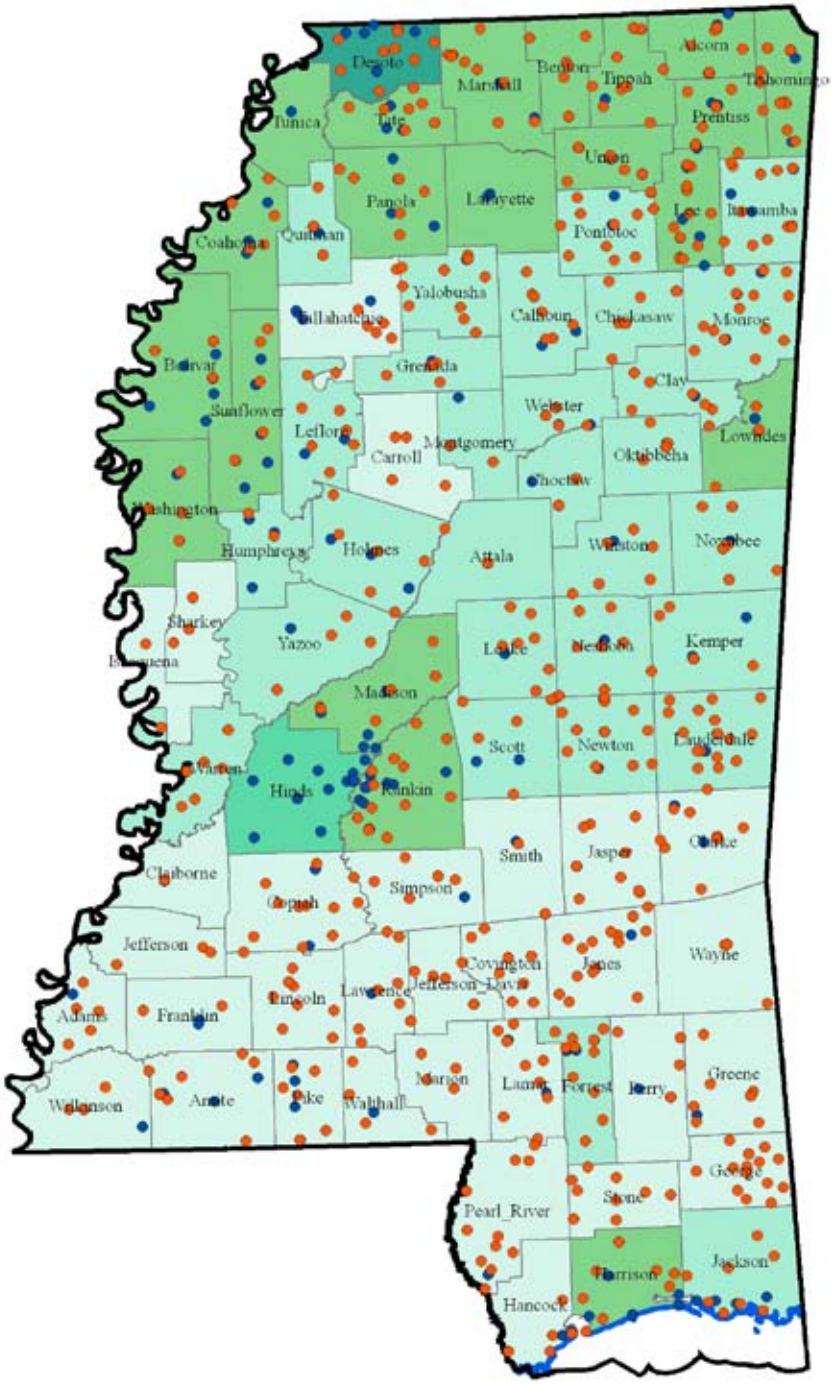
- Low
- Medium Low
- Medium
- Medium High
- High

Critical Facilities

- EOC
- Red Cross
- Medical and Power Facilities

Source: FEMA, Red Cross, MS DOH, various HMPs

Mississippi Winter Weather Vulnerability Rating and Critical Facilities



Vulnerability Rating

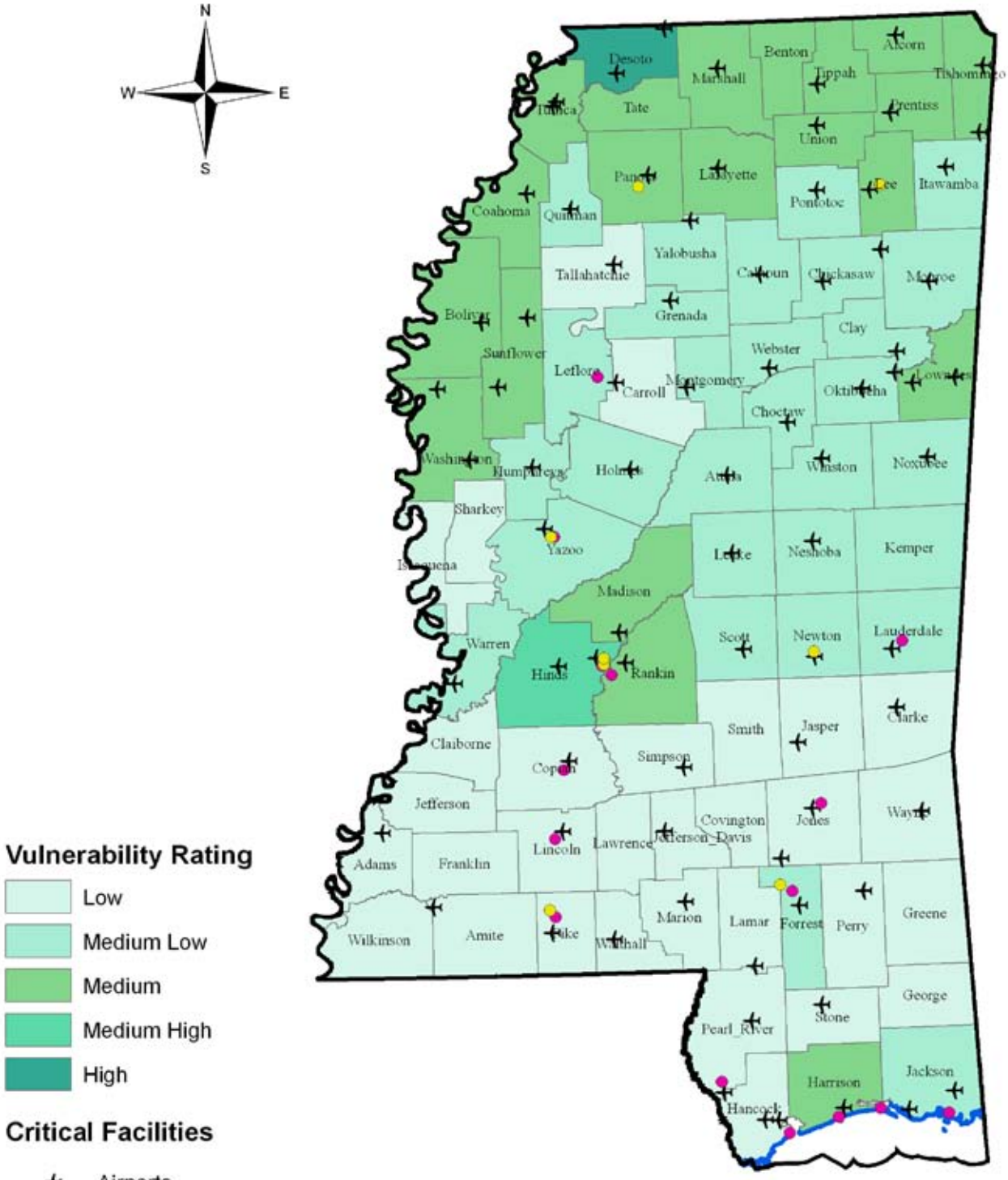
- Low
- Medium Low
- Medium
- Medium High
- High

Critical Facilities

- Fire Stations
- Police Stations

Source: MS Association of Chiefs of Police, State Fire Coordinator

Mississippi Winter Weather Vulnerability Rating and Critical Facilities



Source: MDOT, MDOT Aeronautics Division, MDOT Rail Division, GoMDOT.com, Amtrak

Exposure Analysis of State-Owned Facilities:

A state inventory of facilities was compiled from 67 building inventory spreadsheets obtained from the Department of Finance Administration. Each spreadsheet contains building inventory information for a given state institution/agency. The State of Mississippi looked for the most useful and consistent information from these spreadsheets to develop the state inventory. The total number of buildings and total replacement value (as provided in the bottom line of each spreadsheet) was entered into the state inventory for use in this analysis. The spreadsheets indicate buildings that were destroyed by Hurricane Katrina by giving them a notation of "deleted". These buildings had no replacement value since they no longer exist. Buildings that have been constructed post-Hurricane Katrina were given a notation of "added" as well as a replacement value. These are included in the totals used in this analysis.

It should be noted that not all buildings included in the 67 spreadsheets were assigned a replacement value. These buildings are not included in the state inventory. Several buildings with replacement values were not accompanied with enough location data to determine the county they are located in. Table 3.5.5 summarizes the total replacement value of buildings owned by state agencies that were unable to be included in the state inventory.

Table 3.5.5
State facilities excluded from the state inventory due to non-existent location information

Department Name	Number of Buildings with Available Replacement Values	Total Replacement Value (as available)
Mississippi Department of Corrections	803	$612,361,986
DFA - Capitol Facilities	44	$936,455,566
Department of Transportation	8	$521,997
Wildlife, Fisheries, & Parks	840	$181,990,660
TOTAL	1695	$1,731,330,209

Using the address and location data provided in the spreadsheets, the county in which each facility exists was identified. The total number of buildings in each county and the total replacement value of those buildings were tallied. Hinds County has the highest total replacement value of all counties for its 904 facilities (state-owned buildings). If all of these buildings needed to be replaced, the cost would amount to $2,260,042,306. Stone County resulted in the lowest tallied total replacement value. The two state-owned facilities in Stone County have a total replacement cost of $277,200.

Table 3.5.6 presents the results for those counties with High and Medium High Vulnerability to winter storm events.

Table 3.5.6
Exposure to state facilities in counties with High and Medium High vulnerability to winter storm events

County	Number of Buildings with available Replacement Values	Total Replacement Value (as available)	Vulnerability Rating
DeSoto	14	$4,433,574	High
Hinds	904	$2,260,042,306	Medium High

The list of all counties in Mississippi and their total replacement values for state-owned facilities is presented as Appendix 7.3.3-B.

Exposure Analysis of HAZUS-Identified Critical Facilities and Infrastructure:

The State of Mississippi reviewed three categories of facilities provided in FEMA's HAZUS-MH inventory. This review updates the prior review in the 2004 state plan by utilizing HAZUS-MH MR2 (a more recent version of the software). In the previous version of HAZUS there were government buildings not contained in other categories. These have been incorporated into the three remaining categories shown below (essential facilities, lifeline utility systems, and transportation lifeline systems). 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.

The number of facilities and value of each of the three types of systems for the counties with High and Medium High vulnerability to winter weather are displayed in the following table.

County	Essential Facilities		Lifeline Utility Systems		Transportation Lifeline Systems		Total Value/ Potential Loss
	$ Values	# Facilities	$ Values	# Facilities	$ Values	# Facilities	$ Values
Desoto	$45,815	50	$433,585	12	$328,940	132	$808,340
Hinds	$162,775	162	$1,360,068	49	$801,670	572	$2,324,513

A complete listing of all 82 counties and the HAZUS facility summaries may be found in Appendix 7.3.3-C.

Potential Losses

As discussed above, damage amounts (in dollars) due to prior winter storm events was not available on a county-by-county basis at the time of writing this plan. Therefore, the State of Mississippi is unable to develop potential loss estimates to winter storm damage. The hazard profile section demonstrates that ice storms cause more property damage than heavy snow events. In 1996 an ice storm caused $3 million worth of damage across 30 counties. In 1998 an ice storm caused $16.6 million worth of damage across 31 counties. In 2000, a heavy snow event caused $1.1 million worth of damage across seventeen counties. This shows that damages and losses due to winter storms may be significant in any given county.

Often times, secondary impacts, such as being forced to close businesses or major thoroughfares result in significant losses. These are difficult to quantify, but important to consider. A discussion of secondary impacts is included in the hazard profile section above.

Mississippi Delta Farm lands
1994

Mississippi Delta
1994

3.6: Earthquake Risk Assessment

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 or 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 the building, infrastructure or critical facility.

Seismic waves may also create other earthquake-related hazards such as liquefaction and slope failure. Liquefaction may occur where loose sand and silt, that is saturated with water, and 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 within the state were evaluated based on their location within the aforementioned floodplains and seismic zone. The liquefaction potential listed in the chart references the HAZUS scenario for liquefaction potential in each county. (Liquefaction Potential Map created by the plan developers).

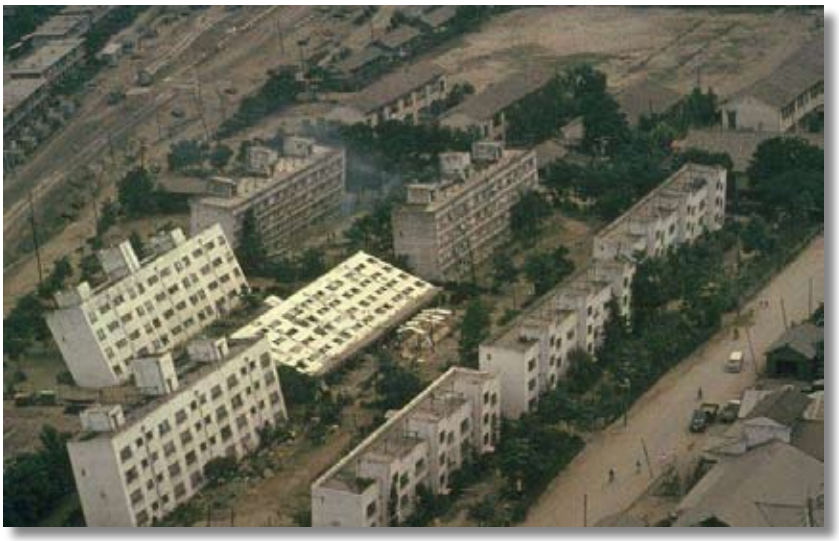


Table 3.6.1

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

[1]NMSZ = New Madrid Seismic Zone
WRFZ = White River Fault Zone
[2]MRFP = Mississippi River Floodplain
CRFP = Coldwater River Floodplain
TRFP = Tallahatchie River Floodplain
YRFP = Yocona River Floodplain
WoRFP = Wolf River Floodplain (Major River orginating 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 below.

Magnitude	Modified 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

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.

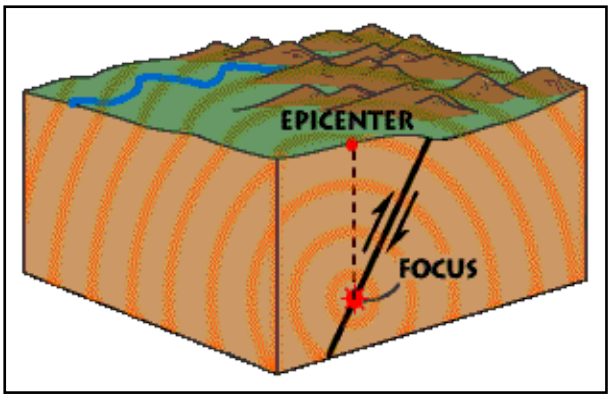
IX. Damage considerable in specially-designed structures; well–designed, frame structures thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off foundations.

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.

Hazard Profile

History of Mississippi Earthquakes

Historically, not many earthquakes are centered within Mississippi. As seen in Table 3.6.2, most earthquakes that originate in Mississippi have 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.

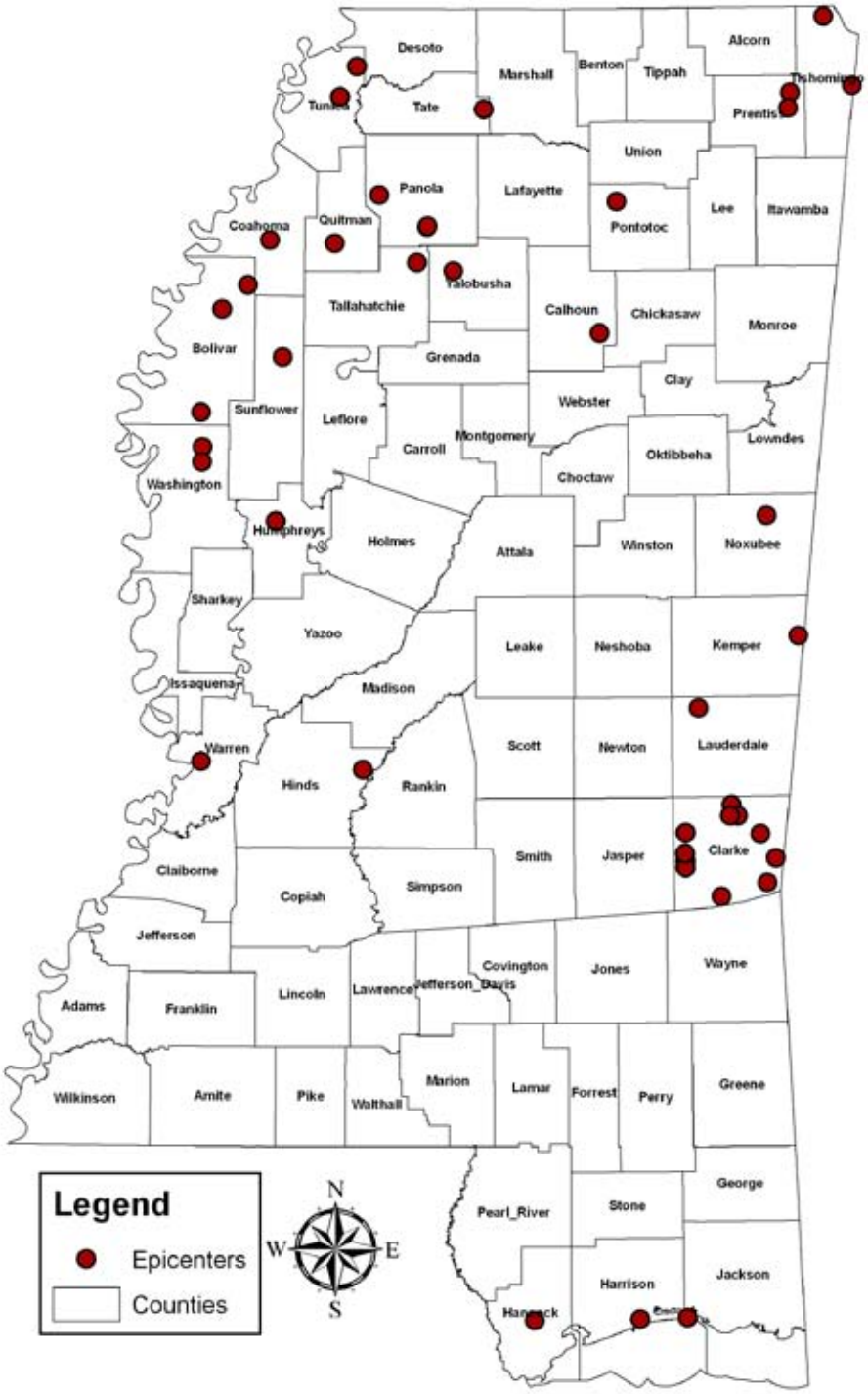
Table 3.6.2
Mississippi Earthquakes

Date	Origin	Magnitude	Maximum Intensity
March 27, 1923			IV
November 13, 1927		3.5	IV
December 16,1931	Charleston, MS		VII
June 28, 1941			IV
September 11, 1853			
February 1, 1955	30-mile coastline		VII
June 4, 1967	18 miles North of Greenville, MS	3.8	VI
June 29, 1967	near Greenville, MS	3.4	
January 8, 1973	Sunflower Co.	3.5	
May 25, 1973	Bolivar Co.		
September 9, 1975	along the Gulf Coast	2.9	IV
October 23, 1976	Clarke Co.	3.0	
May 3, 1977	Clarke Co.	3.6	V
November 4, 1977	Calhoun Co.	3.4	V
January 8, 1978		3.0	
June 9, 1978	Clarke Co.	3.3	
December 10, 1978	Clarke Co.	3.5	V
October 12, 1980		2.1	
February 15, 1981		2.4	
January 29, 1983		3.0	
February 5, 1983	Prentiss Co.	2.9	V
March 23, 1984		2.0	
April 25, 1983		1.6	
May 30, 1983		2.4	
September 24, 1984		2.5	
May 11, 1986		1.6	
August 1, 1988			
November 26, 1989			
February 11, 1991		2.7	
December 11, 1992		2.4	
March 25, 1996	Clarke Co.	3.5	

Date	Origin	Magnitude	Maximum Intensity
May 13, 1996		2.7	
August 11, 1996	Bolivar Co.	3.5	
February 24, 1999	Yalobusha Co.	2.9	VI
January 28, 2000		2.7	
October 10, 2000		2.3	
October 26, 2002	Bolivar Co.	3.1	
January 6, 2002		2.2	
August 11, 2002		2.8	
February 26, 2003			
March 10, 2006	3.2 miles ENE of Corinth, MS	2.7	VI

Source: USGS and MDEQ Office of Geology

Mississippi Earthquake Epicenters



For planning purposes only.

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.

Table 3.6.3
Earthquakes Effecting Mississippi

Date	Origin	Magnitude	Maximum Intensity	Intensities Reported in MS	MS Counties Affected
1811-1812	New Madrid Seismic Zone	7.8 - 8.1	XI		Affected counties as far as the Gulf Coast
March 29, 1972	New Madrid Seismic Zone		IV	I, II, III, IV	Bolivar, DeSoto, and Panola
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, AK	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, AK	4.1	IV	I, II, III	Bolivar, Tate and Tunica

Date	Origin	Magnitude	Maximum Intensity	Intensities Reported in MS	MS Counties Affected
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

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 1923. 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.

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 dollars in total economic loss) compared to other scenarios that have epicenters located within Mississippi.

Probability of Future Events

The Central U.S. does not have as high a frequency of 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%.

Assessing Vulnerability

Vulnerability Assessment Methodology/HAZUS-MH Modeling

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 forty 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 there 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." Color contour maps showing the HAZUS-MH simulated ground shaking distributions associated with the scenarios are provided in Figure 5 (maximum threat case) and Figure 6 (additional cases).

   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 3.6.4 has been prepared to summarize their composition and as a legend for the PDD numbers used in Figure 3.6.8. .

Table 3.6.4
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.

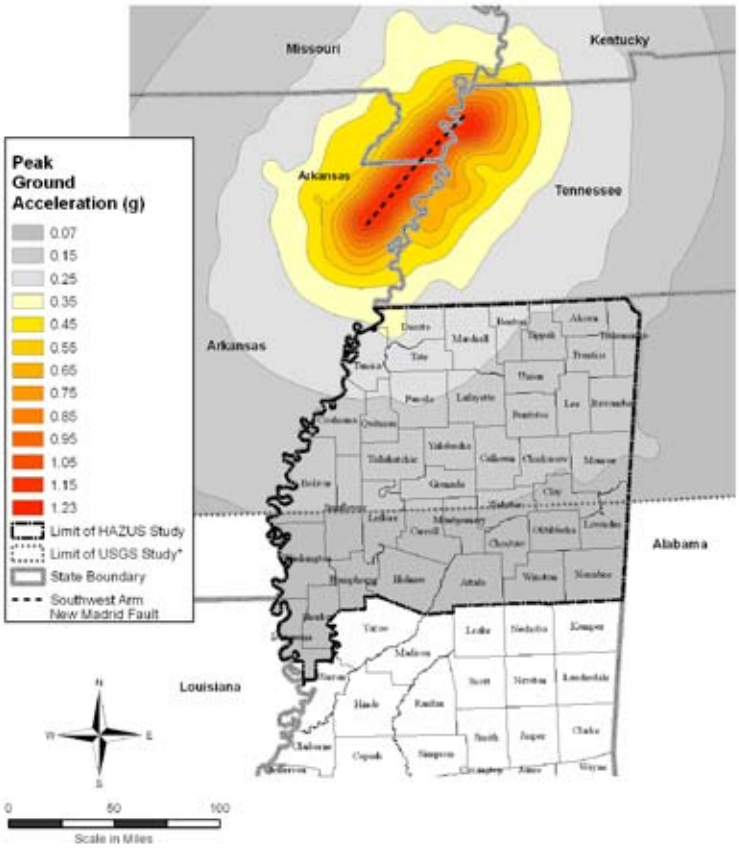
The following user-supplied data inputs were used in this analysis:

- 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 frequency
- 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 Peark Ground Acceleration (PGA) values and study region limit are show in Figure 3.6.1. Where data did not exist in this region, the outermost ground motion value was extrapolated to fill the gap. Other maps of HAZUS-MH user supplied data ground motion inputs can be found in Appendix 7.3.6

Figure 3.6.1
Ground Shaking Input for New Madrid Magnitude 7.7 Scenario

Peak Ground Acceleration from a M7.7 Earthquake
Southwest Arm - New Madrid Fault Zone



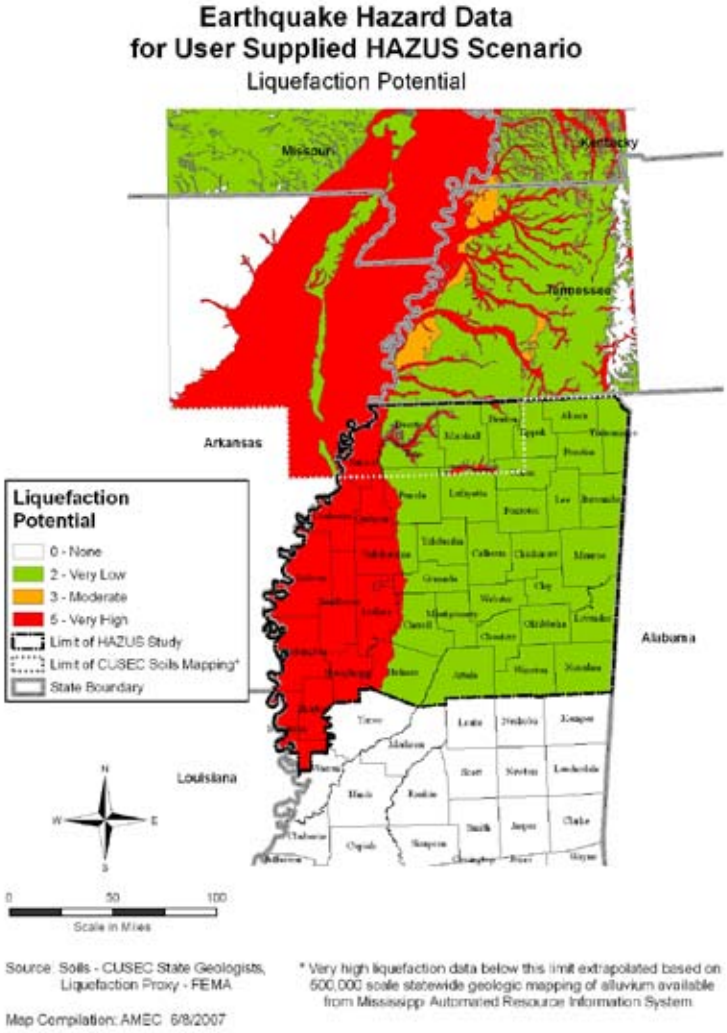
Source: USGS

* Values below this line extrapolated for purposes of HAZUS run.

Map Compilation: AMEC 7/23/2007

The liquefaction susceptibility map (Figure 3.6.2) 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 3.5.2). 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.

Figure 3.6.2
Liquefaction Hazard Input for New Madrid Magnitude 7.7 Scenario



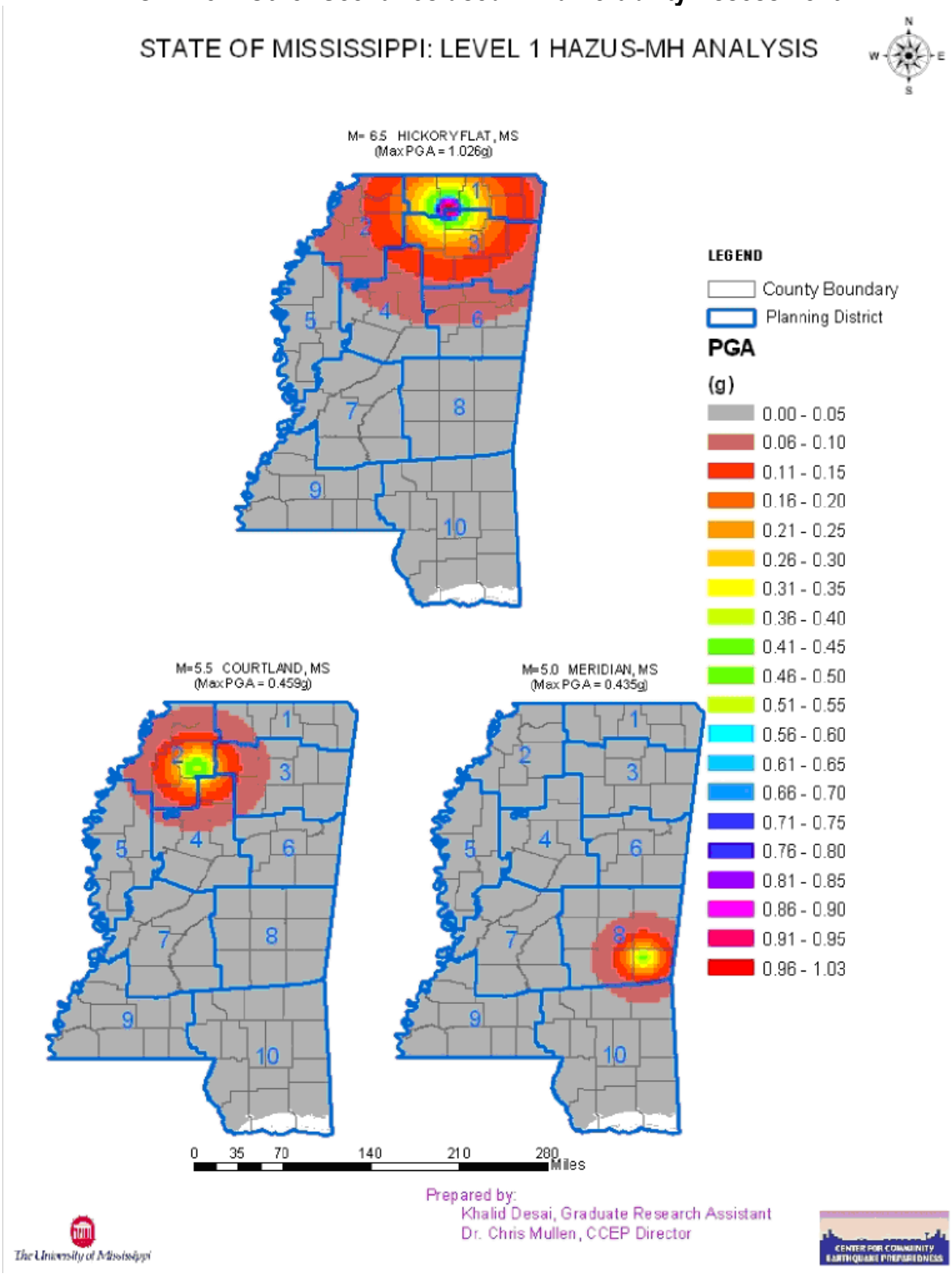
The Hickory Flat earthquake scenario (Benton County) is named for a small town in Benton County. This scenario is based on the recent work by Hough and Martin (2002), which suggested one of the larger earthquakes (magnitude 6.5) was associated with the 1811-1812 New Madrid Seismic Zone events and occurred 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 3.6.3).

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 magnitue 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 3.6.3).

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 3.6.3
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 3.6.5 summarizes the results from the HAZUS-MH run for the entire state (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 depicts the ratio of the building structure and nonstructural 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 3.6.5) depicts building losses, which include structural and nonstructural damage, content and inventory loss, and wage and income loss. Table 3.6.6 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.

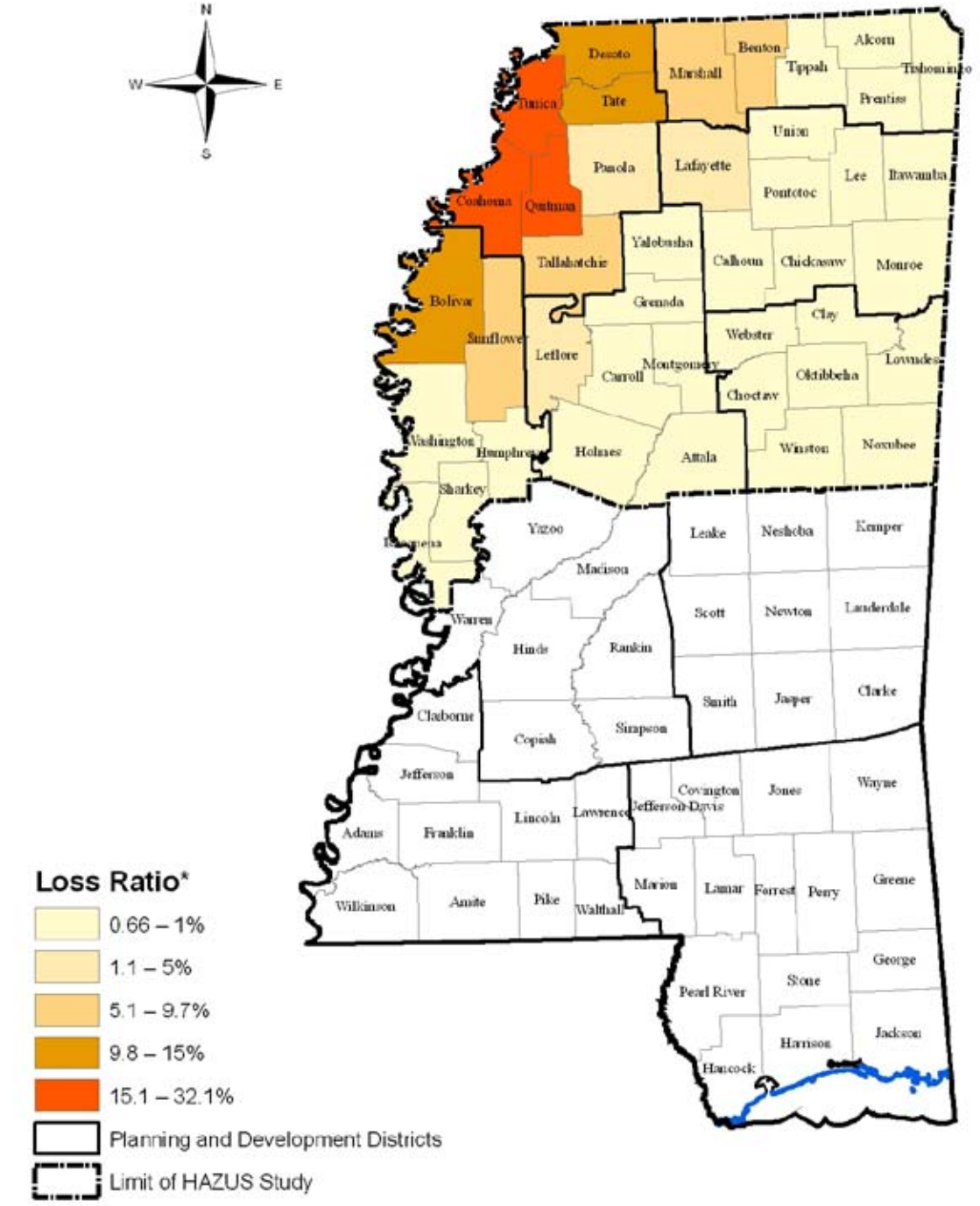
Table 3.6.5
HAZUS-MH Earthquake Loss Estimation: New Madrid Southwest Arm M7.7 Scenario Results Summary of Overall Impacts

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

Type of Impact	Impacts to Region
Casualties (based on 2 a.m. time of occurrence)	Without requiring hospitalization: 2,350 Requiring hospitalization: 566 Life threatening: 52 Fatalities: 94
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 3.6.4
Map of New Madrid M7.7 Scenario Results: Loss Ratio

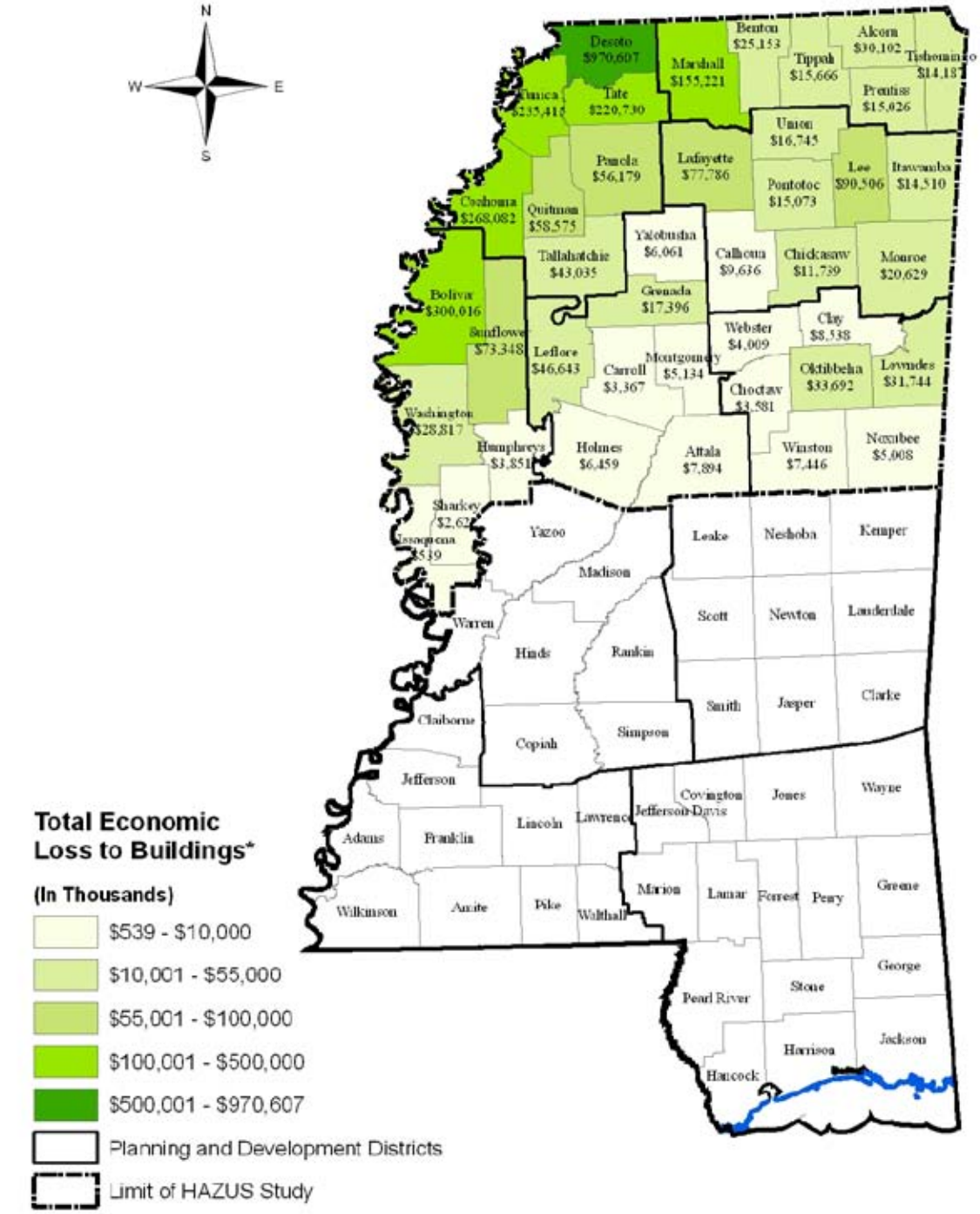


Source: HAZUS - MH

* 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 3.6.5
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 3.6.6
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
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

County	Structural Damage ($)	Non Structural Damage ($)	Total Direct Loss ($)	Loss Ratio*	Contents Damage and Inventory Loss ($)	Income Loss ($)	Total Building Loss ($)**	Loss Ratio Rank
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.

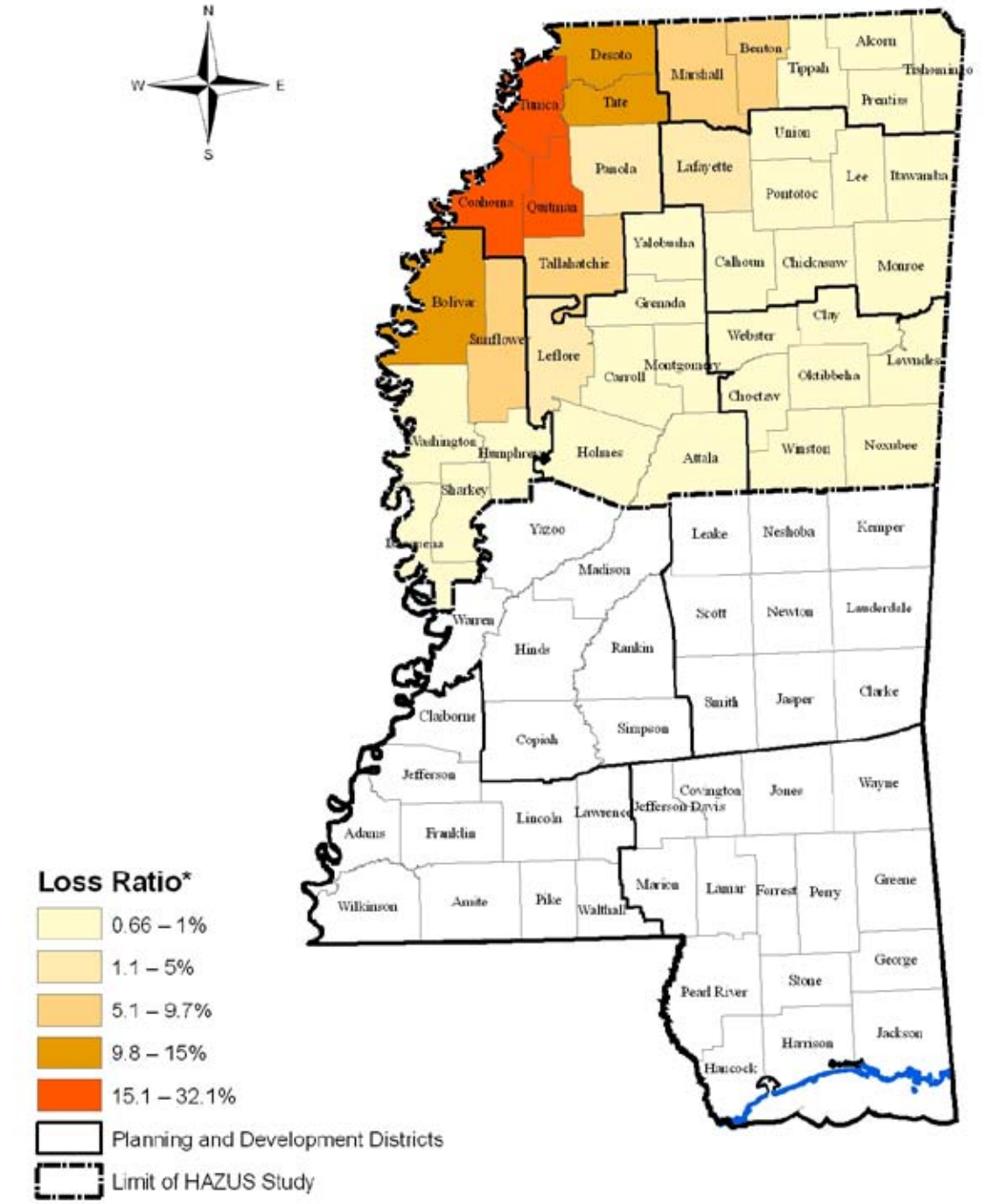
There are limits to the HAZUS-MH inventory, which is mostly based on 2002 building inventories. DeSoto County is rapidly growing as a bedroom community to Memphis. Tate and Tunica counties have grown in population between 2000 and 2006. More residential, commercial, and school buildings have been added 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 shows loss ratio, which is the ratio of the average annualized losses divided by the entire building inventory by county. The second map (Figure 3.6.7) 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 3.6.6
Annualized Loss Scenario Results: Loss Ratio

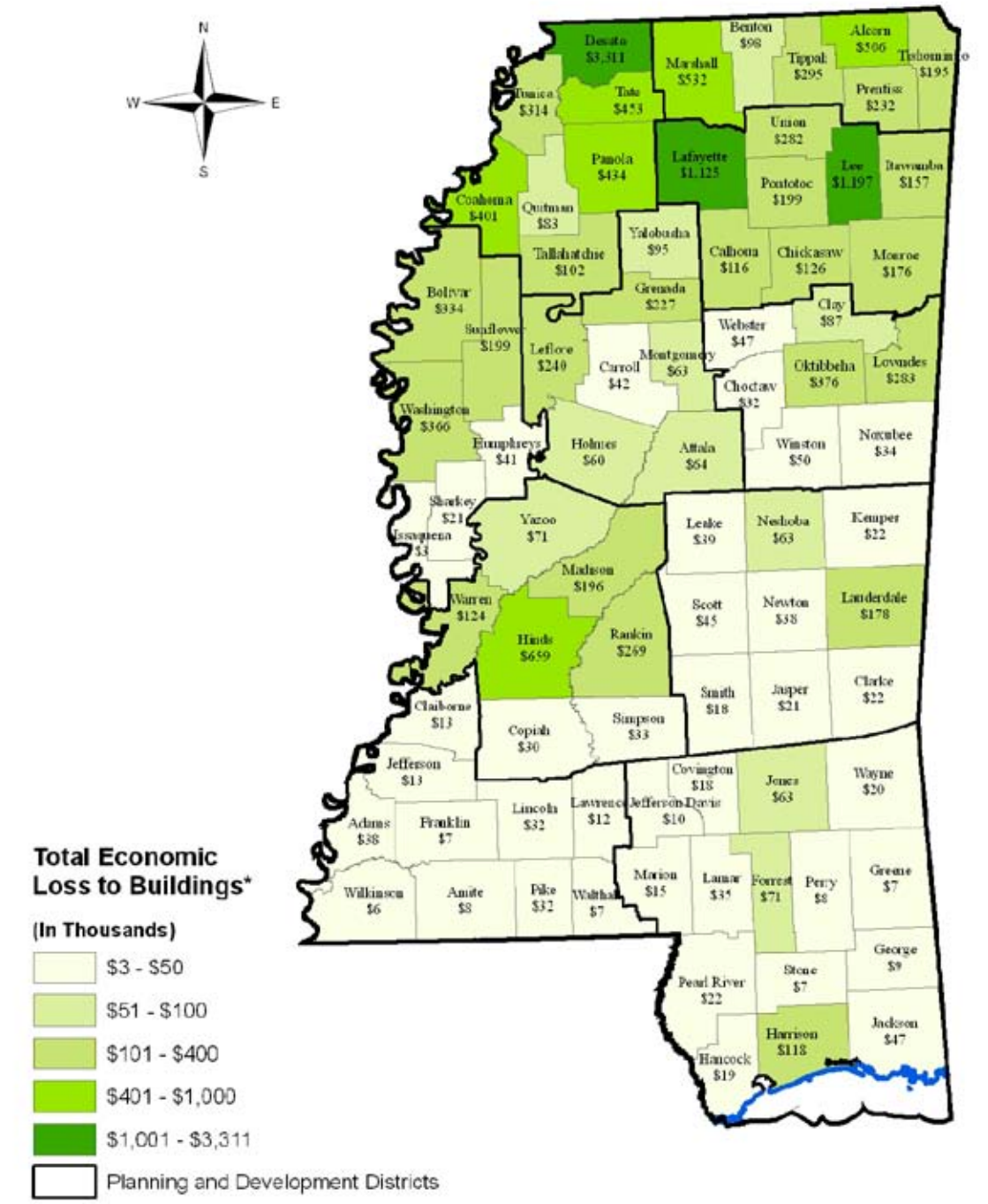


Source: HAZUS - MH

* 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 3.6.7
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-MS modeling suggests that most of the State's vulnerabilities are within three PDDs: North Delta, Three Rivers, and Northeast Mississippi. These PPDs 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 3.6.7 below. Scenario names reflect the different HAZUS-MH scenarios.

Table 3.6.7
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 3.6.10 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 Co. 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 nonstructural, 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, say 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 the 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 Figure 3.6.8 and Table 3.6.8, 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

I. DeSoto County*

II. Bolivar County**

III. Coahoma County**

IV. Tate County*

V. Tunica County*

VI. Marshall County

VII. Lee County*

VIII. Quitman County**

IX. Lafayette County*

X. Union County*

XI. 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 3.6.8
Vulnerability and Loss by Jurisdiction Detail
(ranked by total direct losses –NMSZ scenario)

	Exposure		Scenario								
	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		Vulnerability Rank
	Population [1]	GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
County		($M)	($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
Tallahatchi e	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

County	Exposure		Scenario								Vulnerability Rank
	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
	Population [1]	GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
		($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M, L**
Itawamba	22,770	1,297	9.3	0.9	12.6	1	-	-	-	-	M
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

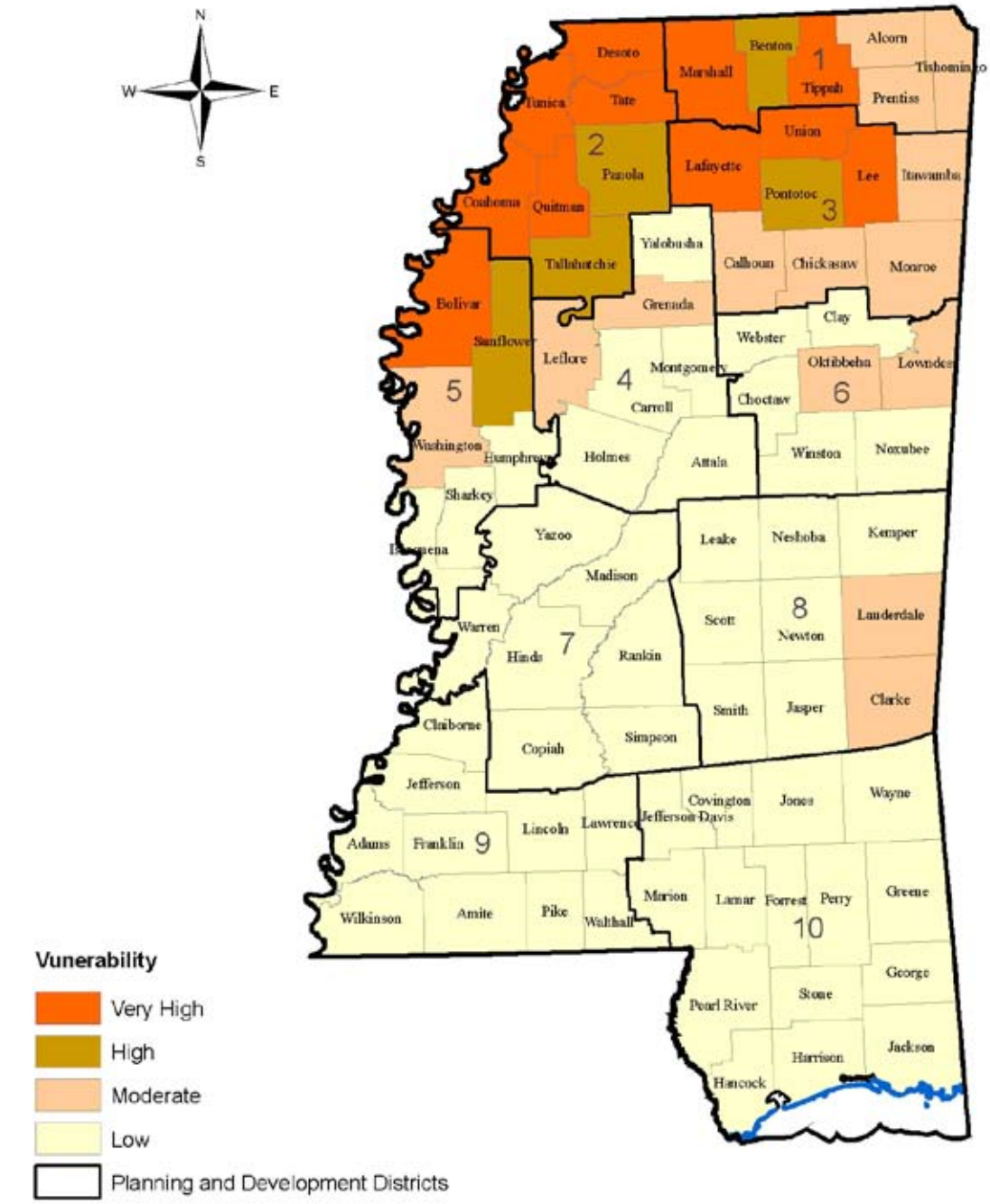
The PDDs can be ranked in a similar manner. The listing below contains the three PDDs that are the most vulnerable. They are listed in order of decreasing vulnerability. Any data base omissions will, of course, be reflected in the PDD ranking as well as the counties.

I. North Delta Planning & Development District

II. Three Rivers Planning & Development District

III. Northeast Mississippi Planning & Development Districtt

Figure 3.6.8
Earthquake Vulnerability Summary by County and Planning Development District



Source: HAZUS - MH

Map Compilation: AMEC 6/28/2007

Vulnerability and Loss by Planning Development District Detail

Jurisdiction		Exposure		Scenario								Vulnerability Rank
Regional	Local	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
		Population[1]	GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
PDD	County		($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M,
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	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**			**-**	**-**	

Jurisdiction		Exposure		Scenario								Vulnerability Rank
Regional	Local	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
		Population[1]	GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
PDD	County		($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M,
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**			**-**	**-**	
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
Regional	Local	People	Buildings	7.7 NMSZ*		Hickory Flat		Courtland		Clarke		
		Population[1]	GBS[2]	TDL[3]	LR[4]	TDL	LR	TDL	LR	TDL	LR	
PDD	County		($M)	($M)	(%)	($M)	(%)	($M)	(%)	($M)	(%)	VH, H, M,
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**					
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**									

[1]Population = 2000 Census data aggregated by county
[2]GBS = Replacement value estimate for General Building Stock ONLY!
3TDL = 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*

I. Benton County

II. DeSoto County

III. Marshall County

IV. Coahoma County

V. Lee County

VI. Pontotoc County

VII. Tippah County

VIII. Lafayette County

IX. 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 3.6.9 for the counties analyzed in the New Madrid scenario.

Table 3.6.9
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 Tables 3.6.11.

For reference, the government building exposure by county from the default HAZUS-MH inventory database is shown in Figure 3.6.9, and the educational buildings exposure is shown in Figure 3.6.10.

Data Limitations

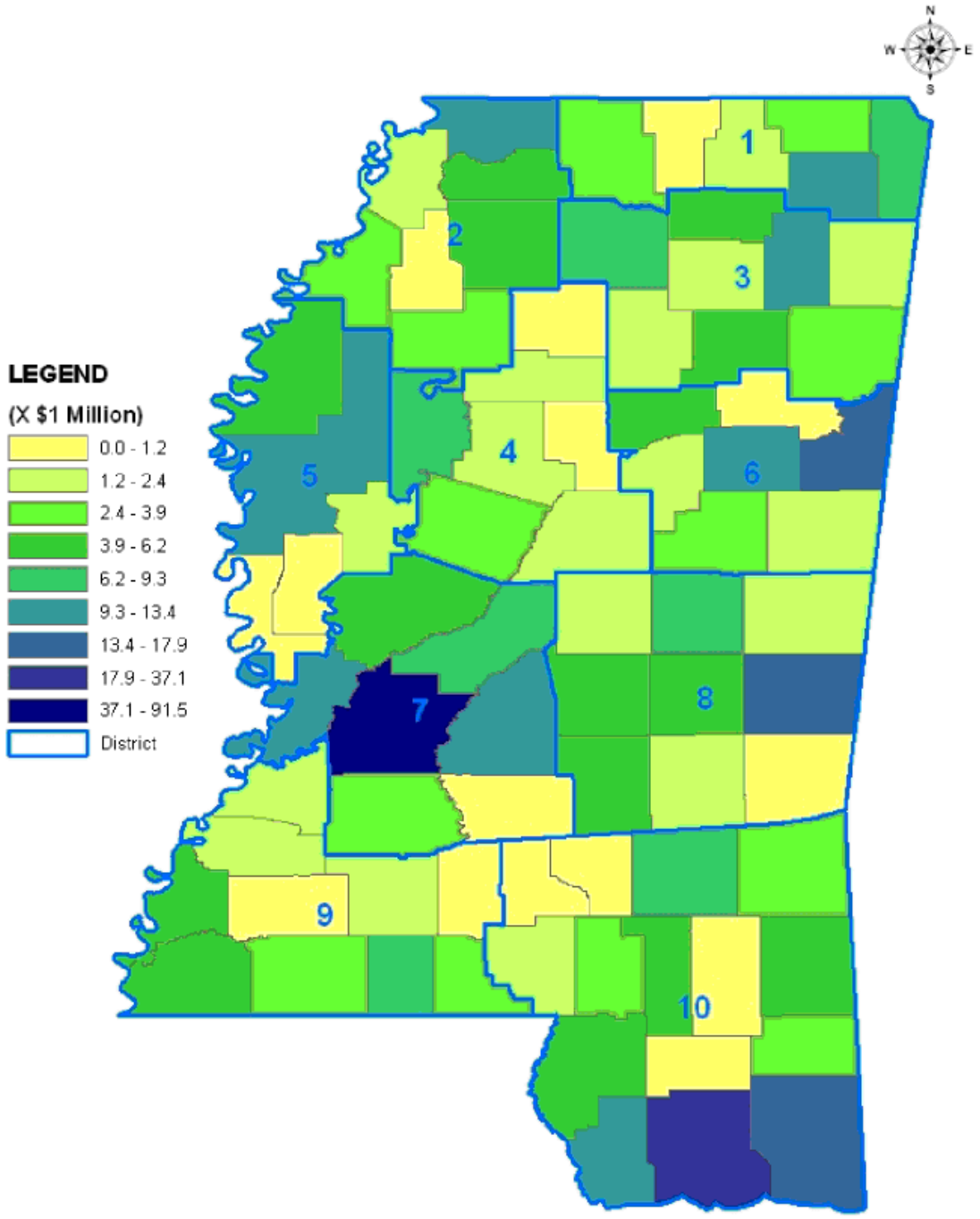
For all categories of facilities used in the assessment HAZUS-MH does not distinguish between federal, state or local ownership or building operation. Therefore all facilities regardless of ownership are included in the assessment.

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 3.6.8
Total dollar exposure of government buildings



The University of Mississippi

Prepared by:
Khalid Desai, Graduate Research Assistant
Dr. Chris Mullen, CCEP Director

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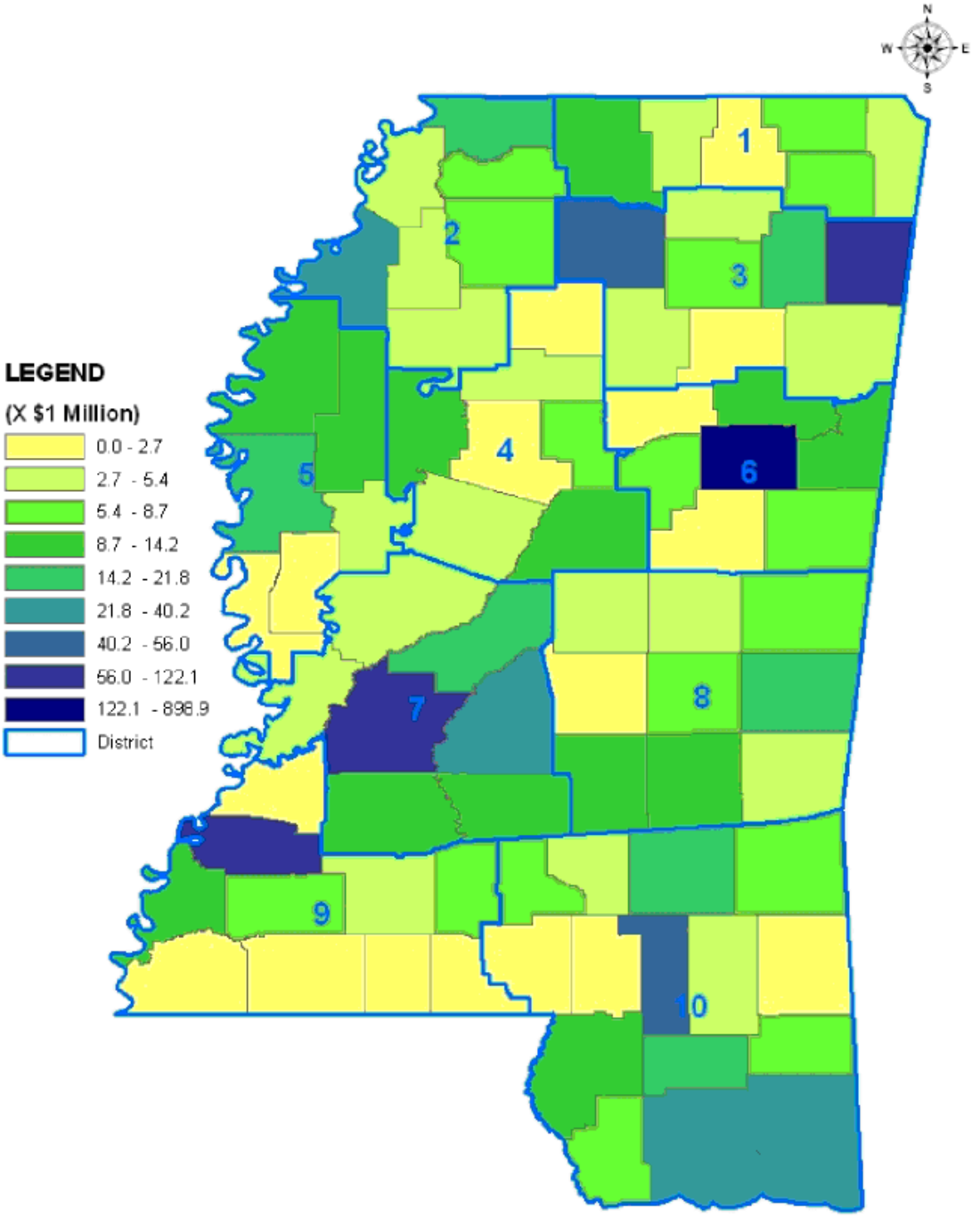
Figure 3.6.9
Total dollar exposure of education buildings



The University of Mississippi

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CENTER FOR COMMUNITY EARTHQUAKE PREPAREDNESS

From Figure 3.6.15, 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 3.6.16.

Table 3.6.10 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 3.6.11 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 3.6.11 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 3.6.10
State Building Exposure / Loss ($1000)

Jurisdiction	Government		Medical	Educational		Total		
	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 3.6.11
State Facility Exposure / Loss ($1000)

Jurisdiction	State Buildings		Transportation		Utility		Total Value	Total Loss	Total LR (%)
	Value	Loss	Value	Loss	Value	Loss			
3 RIVERS									
LEE	929417	26024	1,234,793	2444	546,975	29557	2,711,185	58025	2.1%
LAFAYETTE	235476	17425	714,678	2144	170,255	18789	1,120,409	38358	3.4%
MONROE	32700	4774	1,110,601	1172	171,182	1780	1,314,483	7726	0.6%
UNION	56603	10358	814,679	8766	57,792	16191	929,074	35315	3.8%
PONTOTOC	27130	1275	836,982	2783	396,610	45203	1,260,722	49261	3.9%
ITAWAMBA	215786	2158	909,199	1454	311,525	6549	1,436,510	10161	0.7%
CHICKASAW	25715	309	772,247	1800	226,695	7215	1,024,657	9324	0.9%
CALHOUN	21187	254	657,715	1107	226,525	5401	905,427	6762	0.7%
N DELTA									
DESOTO	238219	23345	1,070,801	11397	433,585	56442	1,742,605	91184	5.2%
PANOLA	70717	2333	980,693	2923	379,755	17660	1,431,165	22916	1.6%
COAHOMA	143286	22925	763,432	3911	791,257	34299	1,697,975	61135	3.6%
TATE	61555	8864	498,206	4203	171,938	15515	731,699	28582	3.9%
TUNICA	14961	4802	432,096	3618	113,220	13130	560,277	21550	3.8%
QUITMAN	8426	1331	384,097	2327	283,135	15175	675,658	18833	2.8%
TALLAHATCHIE	36469	2881	683,963	1837	227,452	5322	947,884	10040	1.1%
NORTHEAST									
ALCORN	177645	2665	757,773	1991	199,572	8958	1,134,990	13614	1.2%
MARSHALL	48773	4048	1,257,417	8096	226,950	74977	1,533,140	87121	5.7%
PRENTISS	50182	1054	684,551	797	113,475	4446	848,208	6297	0.7%
TISHOMINGO	60650	485	738,740	1383	367,965	5557	1,167,355	7425	0.6%
TIPPAH	60294	5487	496,707	2537	170,255	39475	727,256	47499	6.5%

Jurisdiction	State Buildings		Transportation		Utility		Total Value	Total Loss	Total LR (%)
	Value	Loss	Value	Loss	Value	Loss			
BENTON	24106	3833	572,801	4228	264,257	88800	861,164	96861	11.2%
N CENTRAL									
LEFLORE	86264	1897	790,607	83	697,170	979	1,574,041	2959	0.2%
GRENADA	78562	707	827,272	434	170,000	1365	1,075,834	2506	0.2%
MONTGOMERY	40531	284	807,496	109	113,390	332	961,417	725	0.1%
YALOBUSHA	3292	40	733,305	1931	113,220	3322	849,817	5293	0.6%
CARROLL	8350	58	1,027,715	142	113,220	234	1,149,285	434	0.0%
GOLDEN T									
LOWNDES	131498	920	1,153,456	595	462,817	1114	1,747,771	2629	0.2%
OKTIBBEHA	2375229	19002	442,303	283	113,730	568	2,931,262	19853	0.7%
CLAY	33022	231	540,834	296	57,035	316	630,891	843	0.1%
WEBSTER	28632	200	510,151	171	169,915	1221	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. Plots of moderate damage exceedance probabilities for some of the specific local facility data are provided in Appendix 7.3.6. These include essential facilities (hospitals, schools, police, fire stations, wastewater facilities and bridges). improved local critical f acilities 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: Wildfire Risk Assessment

Hazard Description

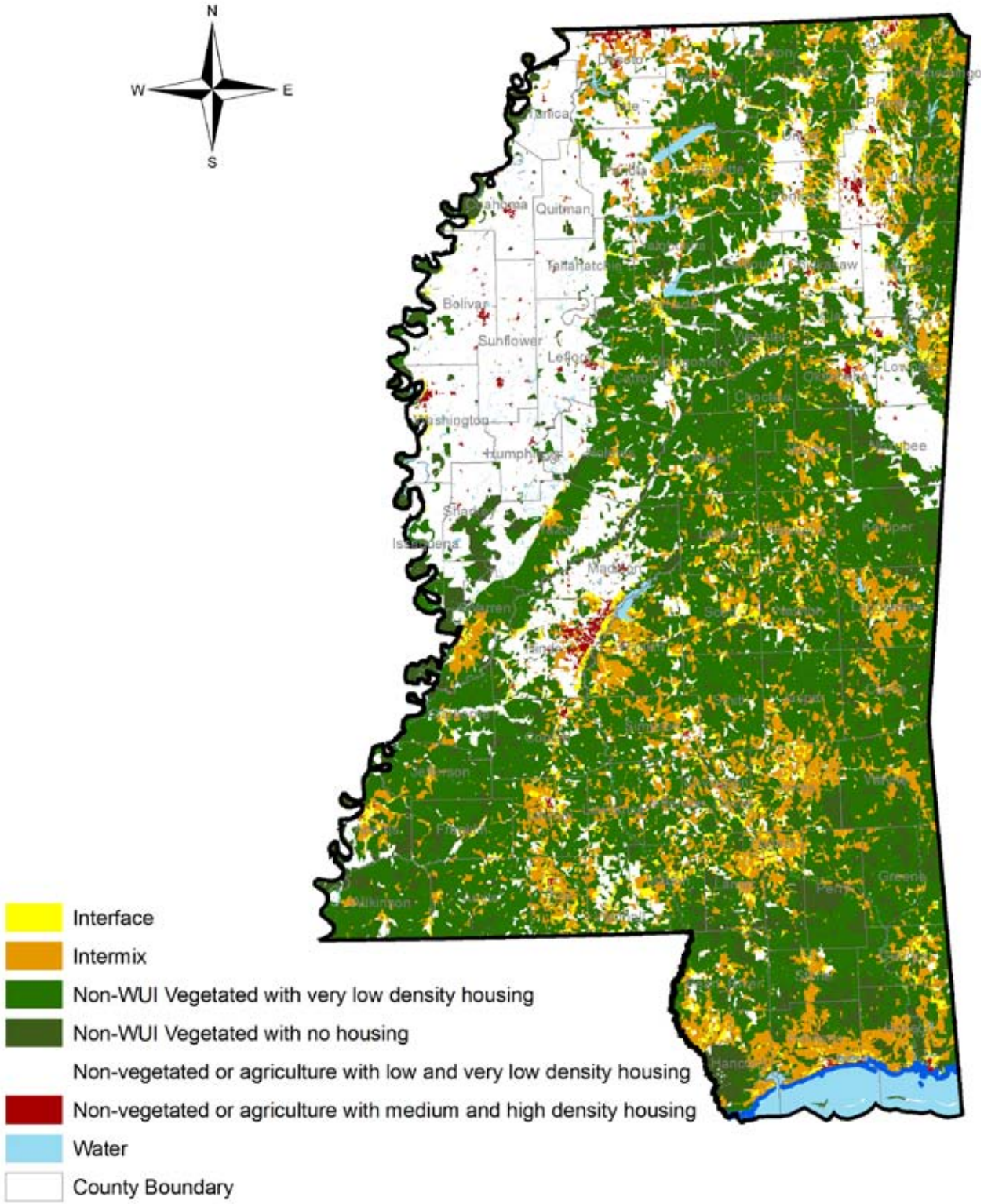
A wildfire is any fire that burns uncontrollably in a natural setting (such as, grasslands, forest, and brush land). Prescribed burnings are the only exception to a wildfire. Wildfires can be either man-made or natural. The typical cause of natural wildfires is lightning.

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.

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. This trend of development increases wildfires in urban areas and threatens human life, structures and wildland resources. As shown in the map, 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.

Mississippi Wildland Urban Interface 2000



Source: Wildland Urban Interface Mapping from SILVIS

Potential Damages from Wildfires

Mississippi is an agriculture-based state with 30% of the state employed directly or indirectly in the agriculture industry. 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 3.7.1 presents Mississippi's top ten agriculture crops are ranked and listed with their respective revenue for 2005.

Table 3.7.1
Mississippi's Top 10 Agricultural Crops

Rank	Agricultural Crop	2005 Revenue
1	Poultry/Eggs	$1.98 billion
2	Forestry	$1.27 billion
3	Cotton	$697 million
4	Soybeans	$315 million
5	Catfish	$272 million
6	Cattle & Calves	$250 million
7	Rice	$134 million
8	Corn	$102 million
9	Hay	$88 million
10	Horticulture	$79 million

Source: U.S. Department of Agriculture

Mississippi is comprised of over 19 million acres of timber and uncultivated lands. In 2003, the economic impact of the forestry industry on the state was approximately $14 billion. This industry provided more than 52,000 jobs and 1.6 billion dollars in wages in 2003. (See jobs and wages table 3.7.2) 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.

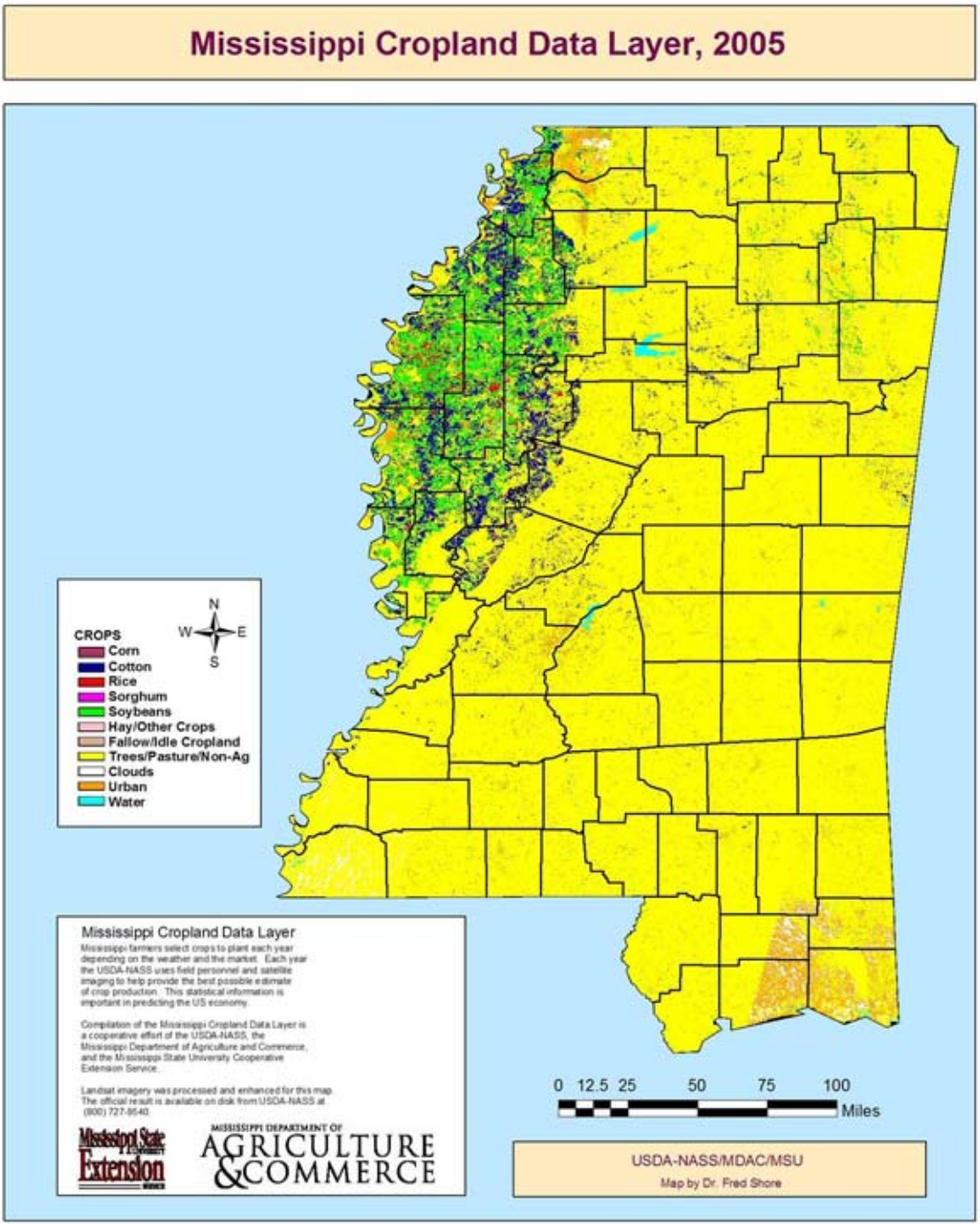
Table 3.7.2
Mississippi's Jobs and Wages

Forest Industry Sector	Wages Paid (in Millions)	Jobs
Forest Services & Logging	$143.9	5,790
Lumber & Wood Products	$403.0	13,146
Furniture & Fixtures	$741.6	27,429
Paper & Allied Products	$339.1	6,215
Totals	$1,627.6	52,580

Source: Mississippi Forestry Association, 2003

Mississippi's six main row crops are cotton, corn, rice, soybean, wheat and grain sorghum. All of these crops have a significant impact of the state's economy. In 2003, these row crops along with other green crops (i.e. pecans, flowers, etc.) have a 1.3 billion dollar impact on Mississippi's economy. As shown in by the map in Figure 3.7.1, agriculture makes a significant impact in all of Mississippi's 82 counties.

Figure 3.7.1



Location/Past Occurrences

As seen in Figure 3.2.2 on the subsequent page, wildfires have affected every county in the state since 1990. The region with the most wildfires appears to be the Southern Planning and Development District. Typically the fires are started by man-made causes, such as arson, campfires, and equipment. As shown in Table3.7.3, few fires are ignited by lightning when compared to the overall total of fires each year. On average, less than 300 wildfires are ignited by lightning out of the more than 49,000 wildfires ignited annually

Table 3.7.3
Mississippi Wildfires by Cause
2001 - 2006

Year	Number of Fires	Cause of Fire	Number of Acres Burned
2006	2,651	Arson	78,804
	2,144	Debris	33,916
	56	Lightning	1,148
	462	Other	8,402
	7	Campfire	34
	31	Smoking	311
	100	Equipment	1,241
	28	Railroads	327
	28	Children	818
	268	Misc.	5,671
2005	1,768	Arson	30,306
	1,299	Debris	12,145
	8	Lightning	50
	291	Other	3,074
	4	Campfire	19
	14	Smoking	211
	73	Equipment	919
	5	Railroads	29
	18	Children	71
	177	Misc.	1,825
2003	912	Arson	12,991
	574	Debris	5,716

Year	Number of Fires	Cause of Fire	Number of Acres Burned
	3	Lightning	17
	158	Other	1,505
	1	Campfire	1
	6	Smoking	45
	24	Equipment	193
	13	Railroads	119
	8	Children	50
	106	Misc.	1,097
2002	1,138	Arson	19,967
	900	Debris	8,446
	10	Lightning	126
	263	Other	3,437
	5	Campfire	21
	21	Smoking	181
	46	Equipment	384
	4	Railroads	9
	17	Children	65
	52	Reignition	429
	118	Misc.	2,348
2001	1,134	Arson	16,339
	868	Debris	8,164
	13	Lightning	89
	301	Other	2,293
	18	Smoking	148
	48	Equipment	240
	11	Railroads	82
	24	Children	151
	200	Misc.	1,672

Source: MS Forestry Commission 2007

Education and Outreach

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

Arson Awareness Week **May 6 – 12. 2007**

The theme for the 2007 Arson Awareness Week was "Vehicle Arson: Who Pays for This Crime?" The U.S. Fire Administration hopes to draw the attention of citizens to statistics of vehicle arson in the U.S. in an effort to expand the resources and support necessary to reduce this crime.

National Burn Awareness Week **February 4 – 10, 2007**

Burn awareness week is observed the first full week in February to provide an opportunity for fire, burn and life safety educators to unite and share the common message of burn awareness with local communities.

National Fire Prevention Week October 7 – 13, 2007

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. In 2007, the National Fire Protection Association (NFPA) will encourage Americans to not only plan an escape route for potential fire hazards, but also to practice the plan.

Firewise Awareness Field Day October 17, 2007

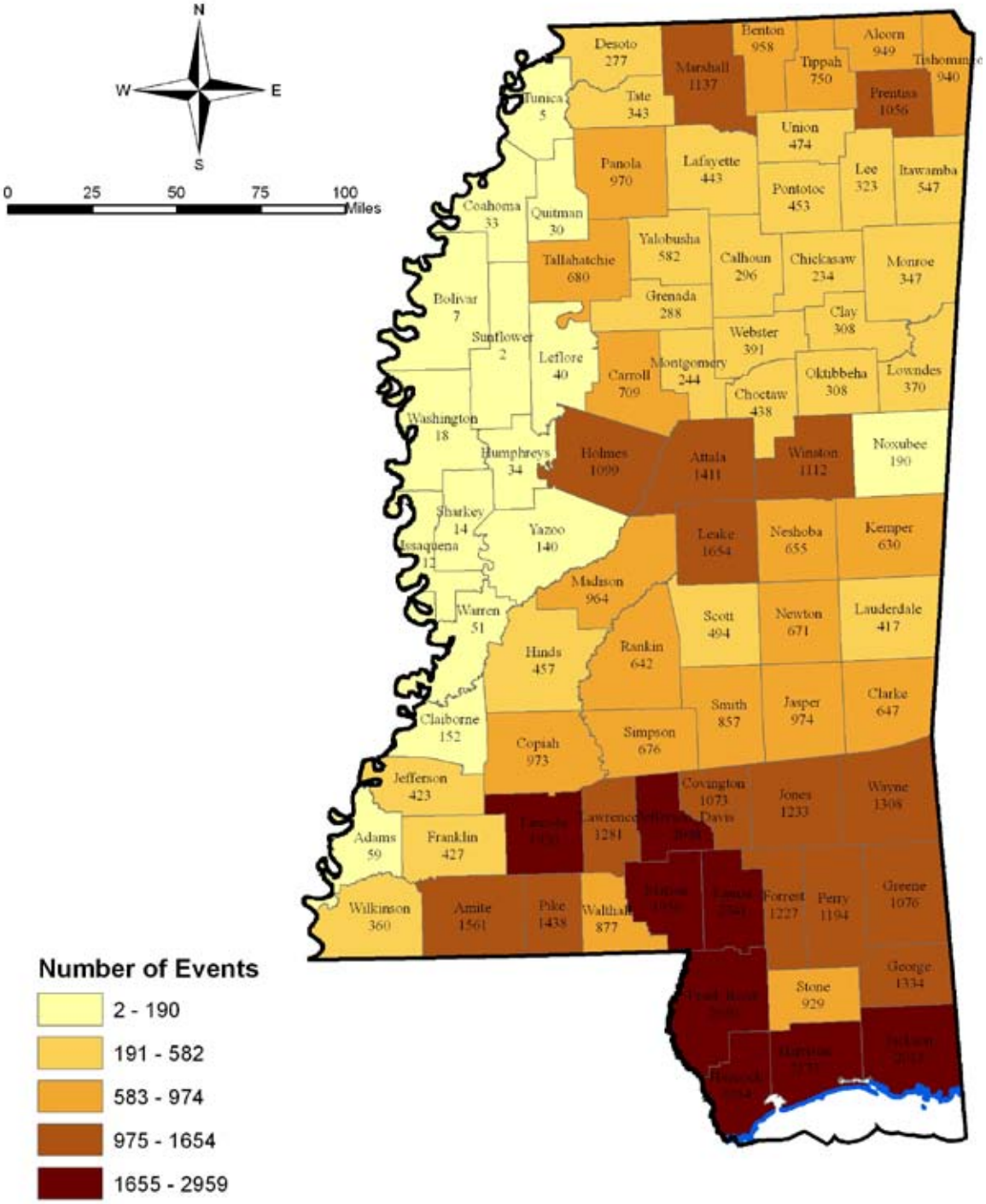
Firewise is a program to educate homeowners and community leaders on how to design, construct, landscape and maintain a home or community to withstand wildfire without the aid of firefighting resources.

The Mississippi Forestry Commission (MFC) is currently funded under a National Fire Plan grant to establish three Firewise communities.

By educating the public on fire specific topics as noted above, the state hopes to deter wildfires as well as urban fires.

Figure 3.7.2

Mississippi Wildfire Events 1990-2006



Source: MS Forestry Commission

Maximum Threat

Types of Fires

Causing an average of 29,000 fires each year, arson is Mississippi's biggest fire threat. Arson has been the number one source of fire related hazards since 2001 (note: no data was available for 2004).

The second most likely cause of wildfires in Mississippi is debris. Averaging more than 13,000 fires a year, debris fires more than doubled in 2006. Although the number of fires in the Southern Mississippi Planning District did not increase substantially from 2005 to 2006, the number of acres burned did increase. 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 4,000 fires annually, about 7.5% of annual fires.

Lightning strikes typically make up a small percentage of wildfires in Mississippi. Contributing to less than 1,500 fires statewide since 2001, lightning-ignited wildfires are not considered a serious hazard to the region.

Location of Fires

Averaging more than 1,500 fires annually since 1990, the Southern Planning and Development District maintains the highest history of wildfires within the State of Mississipi. The areas with minimal amounts of previous wildfire events are along the Mississippi River.

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 this assessment. 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 will continue to pose a threat toward future wildfires in the next few years. Since Katrina, communities have worked with local emergency management agencies to remove debris and dead standing trees.

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 structures are built within wildland intermix and wildland interface areas, increasing the risk of wildfire to life and property.

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 man-power 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 or built within wildland areas. The best available data for assessing wildfire threat to Mississippi is the results of the Southern Wildfire Risk Assessment (SWRA). The State of Mississippi is currently using funding received after Hurricane Katrina to prepare community wildfire prevention plans (CWPPs) for the 15 lower counties in Mississippi. These are expected to be completed 1 year from the completion of this plan update. Continuing into the future, the State intends to allocate some of the annual forest service budget each year to completing CWPPs for all Mississippi counties. Therefore, future plan updates will benefit from more detailed wildfire risk assessments performed at the county level. For this plan update, the SWRA data was determined to be the most complete and uniform across the state.

Southern Wildfire Risk Assessment

In 2002, the State of Mississippi participated in the Southern Wildfire Risk Assessment conducted by the Texas Forest Service, Sanborn, and the SWRA Steering Committee consisting of representatives from the 13 southern states. The Mississippi Forestry Commission confirmed that the data developed during this study is the most accurate and best available data for assessing wildfire risk in the State of Mississippi. The complete SWRA report may be downloaded from: http://dev.sanborn.com/swra/content/reports/finalrpt.htm

The purpose of the SWRA was to identify the potential for serious fires within 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 situation.

The SWRA was a complicated assessment. This plan focused on the major output from the assessment, the Level of Concern data set. The SWRA developed two major indexes to determine the ultimate Level of Concern across the southern states. These indexes are the Wildland Fire Susceptibility Index (WFSI) and the Fire Effects Index (FEI). The WFSI represents the probability of an acre burning. The FEI represents a measurement of the area's values at risk and/or cost to suppress.

As cited in the complete SWRA final report, the WFSI is a value between 0 and 1. It was developed consistent with the mathematical calculation process for determining the probability of an acre burning. The WFSI integrates the probability of an acre igniting and the expected final fire size based on the rate of spread in four weather percentile categories into a single measure of wildland fire susceptibility. Due to some necessary assumptions, mainly fuel homogeneity, it is not the true probability. But since all areas of the State have this value determined consistently, it allows for comparison and ordination of areas of the state as to the likelihood of an acre burning.

The FEI is comprised of two inputs: Value Impacted Rating and Suppression Difficulty Rating. The Values Impacted Rating reflects those areas that have important values at risk to wildland fire. This rating is based on three elements: transportation and infrastructure areas, wildland urban interface, and plantations. The wildland urban interface data referred to here is presented above in the profile section and again below in the vulnerability of residential and non-residential structures. Ratings were assigned by state fire managers using a matrix process to combine individual ratings for each element into one overall rating for each burnable cell. Each burnable cell was also assigned a Suppression Difficulty Rating (suppco). This suppression rating is based on three elements: fuel type, topography, and the presence or absence of organic (peat/muck) soils. The higher the rating, the increased difficulty of suppression and corresponding increase in suppression costs.

The Level of Concern (LOC) is a value between 0 and 100. It is calculated as the Wildland Fire Susceptibilty Index (WFSI) times the Fire Effects Index (FEI). It is a measure of wildfire risk. The LOC can be used to: identify areas where mitigation options may be of value; allow agencies to work together and better define priorities; develop a refined analysis of a complex landscape and fire situations using GIS; and increase communication with local residents to address community priorities and needs.

Exposure Analysis of Critical Facilities

The State of Mississippi developed a definition for “critical facilities” 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.

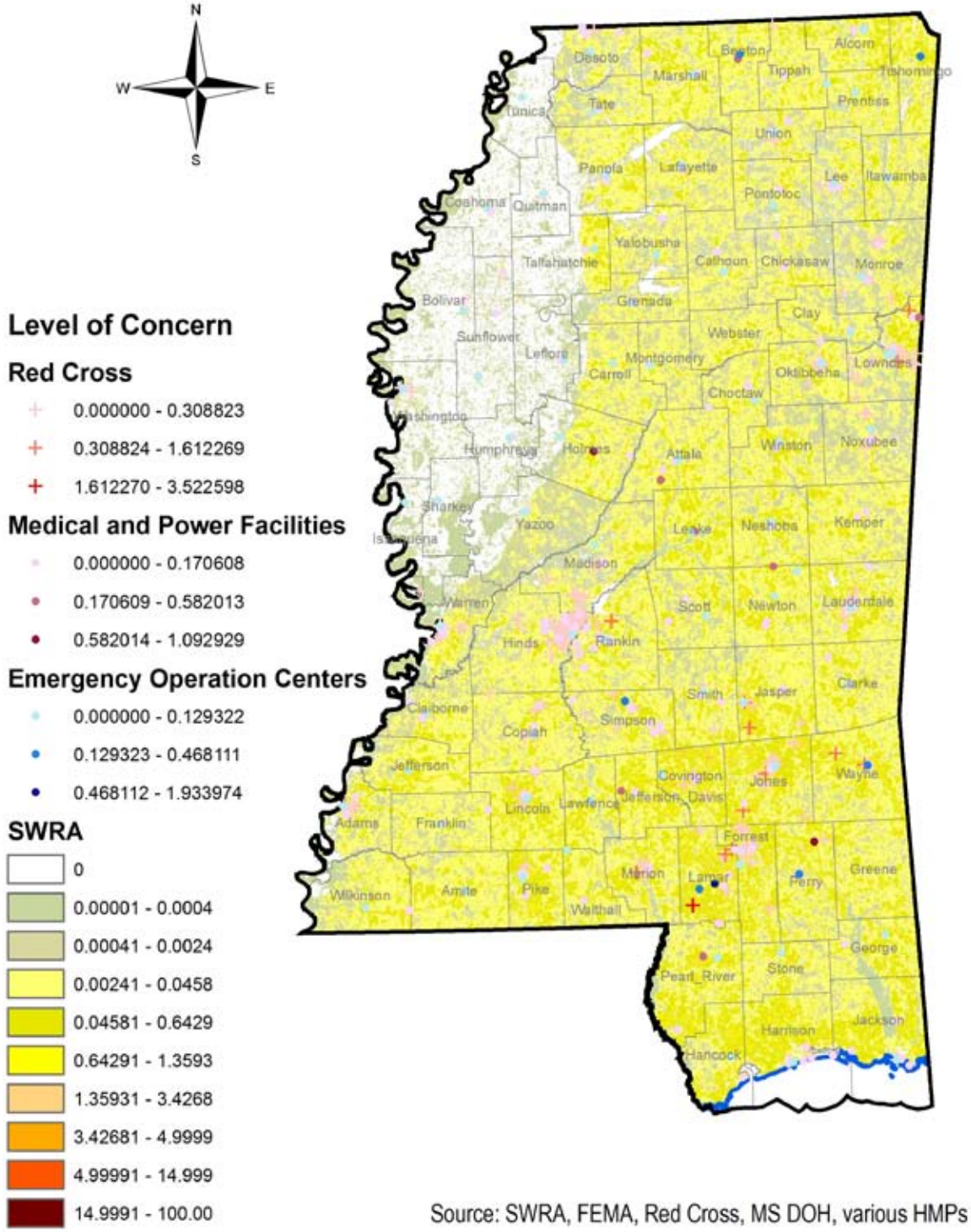
The critical facility categories deemed most pertinent to wildfire risk are: Emergency Operation Centers, Fire Stations, Police Stations, Medical and Power Facilities, and Red Cross shelters and facilities.

These facilities were overlaid (using GIS) with the Level of Concern data from the Southern Wildfire Risk Assessment to assess the Level of Concern for each of the critical facilities. These are shown in the maps found on the subsequent pages (Figures 3.7.3 and 3.7.4).

The Level of Concern data ranges in value between 0 and 100. Very limited areas in Mississippi have a value greater than 3.5. The areas of “high” level of concern are so small they cannot be seen on the statewide map. They may be found and analyzed more closely using GIS.

Figure 3.7.3

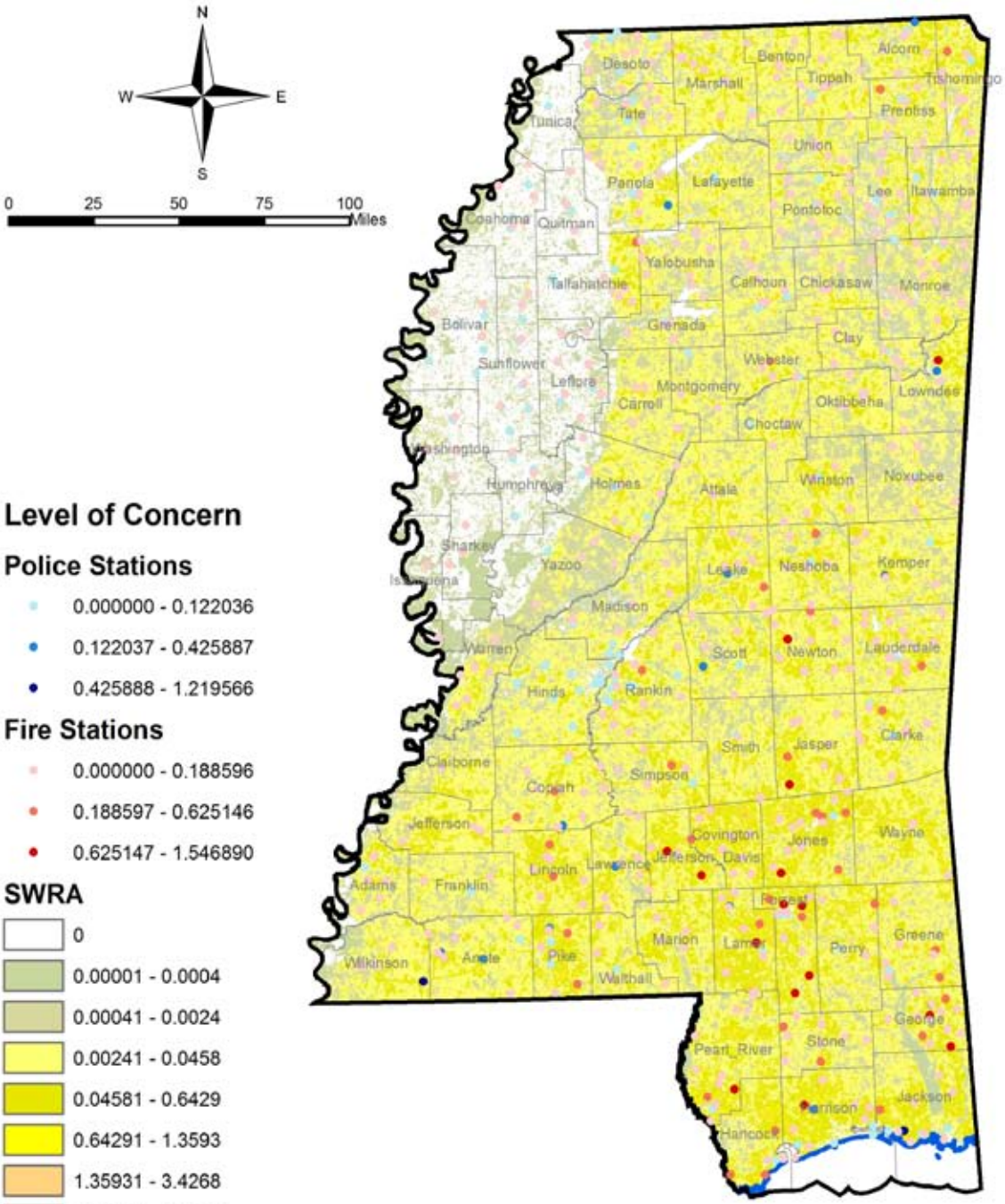
Mississippi Wildfire Risk: Level of Concern and Critical Facilities



Source: SWRA, FEMA, Red Cross, MS DOH, various HMPs

Figure 3.7.4

Mississippi Wildfire Risk: Level of Concern and Critical Facilities



Source: SWRA, MS Association of Chiefs of Police, State Fire Coordinator

Summary of Critical Facilities and their Level of Concern

Two police stations are located in areas with a Level of Concern greater than 1. These are Bassfield Police Department in Jefferson Davis County and Petal Police Department in Forrest County with Level of Concerns of 1.2 and 1.1 respectively. The other police stations have a Level of Concern are below one or zero.

Five fire stations are located in areas with a Level of Concern greater than 1. The highest Level of Concern (1.5) is in Harrison County at the Lizana VFD. The table below shows the five fire stations with Levels of Concern greater than 1 and their values. The other fire stations have a Level of Concern below one or zero.

County	Facility Name	Address	City / Town	Level of Concern
Harrison	Lizana Vfd	16445 Lizana School Rd	Gulfport	1.55
Jefferson Davis	Bassfield Vfd	Po Box 100	Bassfield	1.22
George	Twin Creek Vfd	163 Camellia Rd	Lucedale	1.21
Forrest	Petal Fire Department	1187 Hwy42 Station #3	Petal	1.13

Four Red Cross shelters are located in areas with a Level of Concern greater than 1. The highest Level of Concern (3.5) is in Lamar County at the Baxterville Attendance Center. The table below shows the four Red Cross shelters located in areas with Levels of Concern greater than 1 and their values. The other Red Cross shelters are located in areas of Level of Concern below one or zero.

County	Facility Name	Address	City / Town	Level of Concern
Lamar	Baxterville Attendance Center	5459 Hwy 13	Lumberton	3.52
Harrison	West Marion High School	2 West Marion Street	Foxworth	1.61
Forrest	Immanuel Baptist Church	510 Weathersby Road	Hattiesburg	1.33
Lafayette	New Liberty Methodist Church	858 CR 10	Stringer	1.13

Only one Medical Center from the medical and power facilities category of critical facilities located in a Level of Concern greater than 1. The Perry County General Hospital in Perry County has a Level of Concern of 1.1. The other medical and power facilities are in areas where the Level of Concern is less than 1 or zero.

Only one Emergency Operation Center in Mississippi located in area of a Level of Concern greater than 1. The Lamar County EMA in Purvis has a Level of Concern of 1.9. The other Emergency Operation Centers have a Level of Concern less than .5 or zero.

Overall, the Level of Concern, as calculated in the Southern Wildfire Risk Assessment, is very low and the critical facilities are not in areas of high risk.

Data Limitations:

Several critical facility points when displayed in GIS were not located within the area of the Level of Concern data. These included one Emergency Operations Center, four fire stations, 3 medical or power facilities, and 2 police stations.

3.8: Dam/Levee Failure Risk Assessment

Hazard Description

A dam is any artificial barrier, including appurtenant works, constructed to impound or divert water, wastewater, 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 countyside; however, they also confine the flow of the river resulting in higher and faster waterflow.

Dam Categories

The Surface Water Division, Licensing and Dam Safety Division and the Office of Land and Water Resources, develops regulations on Dam Safety for the Mississippi Department of Environmental Quality (MDEQ). Dams are categorized according to what lies downstream, as well as the expected impact of a 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 shall be classified as high hazard dams, unless otherwise classified by the Commission on a case-by-case business. For example, those 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, rather the potential for one death, or exposure to property damage downstream. 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 which meet the statutory thresholds for regulation that are proposed for construction in established or proposed residential, commercial, or industrial areas 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 may cause significant damage to main roads, minor roads, or cause interruption of use 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 has been updated from the previous approved plan of 2004 to include levee failure and current statistics regarding dam/levee failures as well as safety regulations that have been adopted by the State.

Location

Currently, Mississippi has 3,696 dams in its inventory. Of this total, 258 dams have been determined to be of high hazard classification and 94 as significant hazard classification by the MDEQ. Dam Safety Regulation adopted by the Mississippi Commission on Environmental Quality in 2004 requires all owners of High Hazard and Significant Hazard Dams to have their dams inspected by a registered professional engineer before March 2006. All High Hazard dam owners were required to submit an Emergency Action Plan (EAP) to MDEQ by the March 2006 deadline. Significant Hazard dams that may interrupt some road or pubic utility services may be required to have Emergency Action Plans in place, when needed.

The MDEQ, Office of Land and Water Resources, Division of Dam Safety list of dams can be found in Appendix __. This list includes those dams consisting of at least 50 acres of surface drainage area. Any size dam can be determined to be “High Hazard”.

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.

In 1978, the Mississippi Legislature enacted dam safety legislation authorizing the Board of Water Commissioners to administer the dam safety program under Section 51-3-39 of the Mississippi Code of 1972. Later revisions transferred authority to the Commission on Environmental Quality. The Dam Safety Division currently administers the program. Section 551-3-39 of the Mississippi Code of 1972 charges dam owners with responsibility for maintaining and operating their dams in a safe condition.

On June 24, 2004, the MDEQ adopted new regulations that require the owners of high hazard and significant hazard dams to have an additional inspection by March 2006. A licensed professional engineer must conduct these inspections. Additionally, the same owners must prepare an Emergency Action Plan (EAP) for submission to MDEQ.

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.

The dam safety program should ensure the safety of public and private dams arising from the extraordinary public safety risks posed by unsafe dams, the often-false sense of security that arises from the presence of an upstream dam (no matter its function), and the tendency of localities and private landowners to want to develop the area that seems protected but in reality could be inundated if the dam fails or is breached.

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 1-percent annual chance flood protection, also known as 100-year protection, and levees that meet provisional accreditation requirements will be depicted on the community maps. levees.

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 Engineer's Arkabutla, Sardis, Grenada, or Enid reservoirs. Simultaneous failure of these structures could occur due to an earthquake in the New Madrid Seismic Zone.

Information on Arkabutla Lake and Dam indicates that water from a dam failure originating in DeSoto County and ending in Leflore County will take 45 days to travel to the Sunflower River and will involve untold damages to private and public properties. Because the movement of water will be slowed in its journey to the Sunflower, there will be ample warning to people downstream to enable evacuation, but deaths are estimated to be in the hundreds because of the length of time that water will remain to block roads and access. The disruption to business and the costs of recovery would range in the billions of dollars.

Past Occurrences

Dam Failures:

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 Table3.8.1. 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 the repairs.

Big LakeBay Dam

Table 3.8.1
Dam Failures 1982 - 2005

APPROXIMATE 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

APPROXIMATE 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

Source: Mississippi Department of Environmental Quality-Dam Safety Division 2007

Levee Failures

During 1927, there were numerous breaks along the levee system up and down the Mississippi River. In total, a billion dollars of property damages were estimated throughout the entire Mississippi River. At least 246 people died, 325,000 people displaced, 162,000 homes inundated, 16.6 million acres flooded.

The last failure was April 21, 1927 at Mounds Landing, approximately 15 miles north of Greenville.

Source: Mississippi Levee Board

Emergency Action Plans

The Mississippi Department of Environmental Quality (MDEQ), Office of Land and Water Resources, Surface Water Division is responsible for the administration of the dam safety program within the State of Mississippi. Regulations adopted by that agency in June 2004, required that owners of high hazard dams develop an Emergency Action Plan (EAP). Dam owners were requested to follow a model EAP. Inundation maps identifying areas and structures at risk are a component of the model EAP.

These plans are to be submitted to MDEQ for approval. There is no timeline or suspense date established for the accomplishment of this requirement. At the time of this plan update 41 high hazard dams had approved EAPs. These are listed in Table 3.8.2.

As the Emergency Action Plans are developed, reviewed, and accepted by MDEQ, a database will be developed which addresses potential losses in vulnerable jurisdictions and to state-owned or operated facilities, due to dam failure. These costs will be captured through extrapolation of the values of structures found within the inundation areas of the dams. Also, with global information system technologies, it will be possible to plot the exact location of structures within the inundation areas. As this is accomplished, the state plan will be updated to capture this data.

Table 3.8.2
Mississippi High Hazard Dams
with Approved Emergency Action Plans

County	National ID	Dam Name	Latitude DD MM SS	Longitude DD MM SS	Hazard Potential Class
Adams	MS02948	Natchez State Park Dam	31 35 24	91 12 24	H
Bolivar	MS00053	Delta Steam Electric Station Dam	33 47 54	90 42 18	H
Choctaw	MS02800	Upper Yockanookany Number 4 Dam	33 17 59	89 9 56	H
Choctaw	MS02798	Upper Yockanookany Number 2 Dam	33 19 02	89 9 45	H
Choctaw	MS02797	Upper Yockanookany Number 1 Dam	33 19 26	89 10 04	H
Copial	MS00499	Lindsey Lake Dam	31 56 48	90 16 48	H
Desoto	MS01575	Lake Of The Hills Dam	34 48 31	90 11 02	H
Desoto	MS01512	Maywood Lake Subdivision Shahkoka Dam	34 58 04	89 51 02	H
Desoto	MS01513	Maywood Subdivision Sylvan Lake Dam	34 54 57	89 51 02	H
Desoto	MS01514	Maywood Subdivision Woodland Lake Dam	35 00 00	90 00 00	H
Desoto	MS01573	Woodland Lake Dam	34 49 24	90 11 35	H
Desoto	MS01585	Buena Vista Lakes Dam	34 43 42	90 0 30	H
Desoto	MS01587	Buena Vista Lakes Dam	34 43 54	89 59 48	H
Desoto	MS03407	Apple Creek North Dam	34 56 09	90 01 56	H

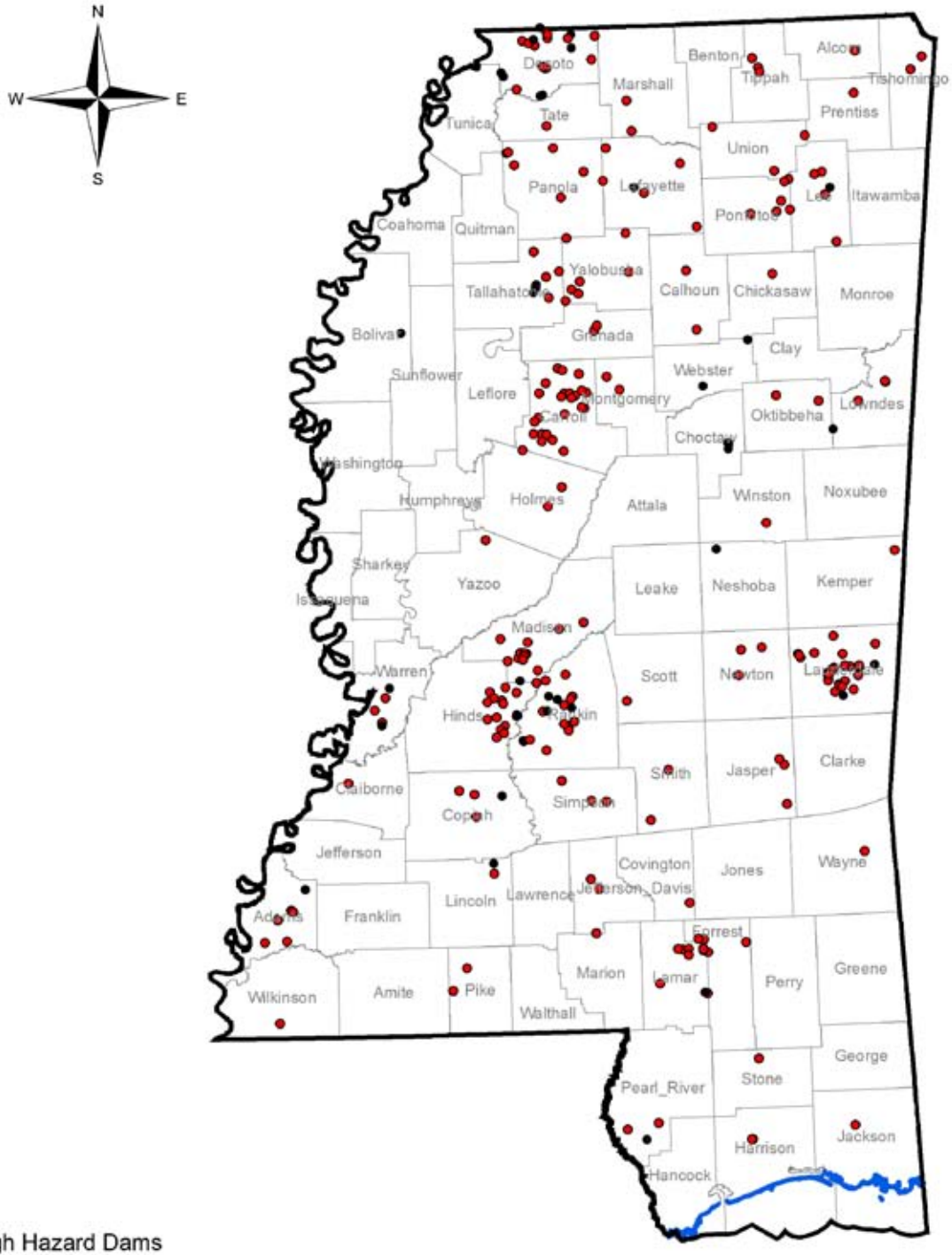
County	National ID	Dam Name	Latitude DD MM SS	Longitude DD MM SS	Hazard Potential Class
Hinds	MS01770	Engelhard Corporation Pond 4 Dam	32 15 48	90 12 12	H
Hinds	MS01771	Engelhard Corporation Pond 5 Dam	32 15 54	90 11 54	H
Hinds	MS03617	Engelhard Corporation Pond 3 Dam	32 16 09	90 12 09	H
Lafayette	MS03301	Royal Oaks Dam	34 21 10	89 34 21	H
Lamar	MS02732	Laird's Lake Dam	31 19 00	89 22 00	H
Lamar	MS00707	Fox Lake Dam	31 08 29	89 21 44	H
Lauderdale	MS02633	Lake Tom Bailey	32 25 14	88 31 01	H
Lauderdale	MS02697	Crescent Lake Dam	32 18 09	88 40 09	H
Lauderdale	MS02660	Bonita Lake Dam Number 1	33 21 46	88 39 57	H
Lee	MS02515	Lake Piomingo Dam	34 19 20	88 37 58	H
Lincoln	MS02758	Lake Lincoln Dam	31 40 42	90 19 36	H
Madison	MS02310	Costas Lake Dam	32 24 06	90 10 54	H
Neshoba	MS03227	Joyce Caracci Dam	32 54 15	89 14 26	H
Pearl River	MS00637	Hide-a-way Lake Dam	30 33 48	89 39 12	H
Rankin	MS01280	Cleary Lake Dam	32 09 54	90 10 30	H
Rankin	MS01286	Hoover Lake Dam	32 09 42	90 10 18	H

County	National ID	Dam Name	Latitude DD MM SS	Longitude DD MM SS	Hazard Potential Class
Rankin	MS03042	John Mcgowan Pond Dam	32 19 28	90 00 34	H
Rankin	MS03049	Oak Lake Dam	32 16 49	90 03 28	H
Rankin	MS03592	Mikell Lake Dam	32 17 25	89 56 32	H
Rankin	MS03549	Acacia Woods Lake Dam	32 20 20	90 03 01	H
Tallahatchie	MS00891	Ascalmore Y-17a-72 Lake Dam	33 56 48	90 04 09	H
Tallahatchie	MS01037	Ascalmore Y-17a-74 Lake Dam	33 58 35	90 03 12	H
Tallahatchie	MS01036	Ascalmore Y-17a-73 Lake Dam	33 58 02	90 03 16	H
Warren	MS03568	Camelot Lake Dam	32 14 15	90 50 00	H
Warren	MS02788	Lake Forest Dam	32 23 08	90 47 48	H
Webster	MS03277	Whites Creek Number 1 Dam	33 33 13	89 16 32	H
Webster	MS01857	Mantee Lake Dam	33 43 50	89 03 20	H

* Shaded rows represent state-owned dams.

The map (Figure 3.8.1) on the following page presents all 258 High Hazard dams and identifies the ones listed above with approved EAPs.

Map 3.8.1
High Hazard Dams



- High Hazard Dams
- High Hazard Dams with Approved EAP

Source: MDEQ

Probability of Future Dam Failure Events

The probability of dam failure is considered high due to the diminished inspection capabilities within the state government. While the structural weakness of a dam is apparent from an outside observation, a sunny day event, without warning, can turn an earthen dam into 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 a periodic inspection period require a five-year inspection period 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. The recent series of dam failures would indicate a period of frequent failures could be expected.

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 formally 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. Indirect death has 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 mitigation plan determined the most vulnerable areas to inundation by dam failure as those counties with the most high hazard dams. In this update, the State of Mississippi assessed the number of high hazard dams in census tract areas. Without inundation mapping for existing dams and levees there is no accurate way to determine the vulnerable lives and built structures. The flow of water in the event of a dam or levee failure is not restricted by political boundaries (county, census block, etc). 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. Although census tract areas are a political boundary and not reflective of water flow, they are smaller than county boundaries and give a more clear picture of the development and population within close proximity to each dam.

Census Tracts with the Most High Hazard Dams

There are 605 census tracts in Mississippi. Eighty-six tracts have only one high hazard dam within the boundary. Thirty-two tracts have two high hazard dams within the boundary. There are only two census tracts with more than ten high hazard dams located in them. These are both in Carroll County. One tract has 11 and the other has 12 high hazard dams. The following table indicates density of high hazard dams by demonstrating the frequency of multiple high hazard dams in a given census tract.

Column A: Number of Dams per Census Tract	Number of Census Tracts with the corresponding number of dams in column A
1	86
2	32
3	8
4	5
5	4
6	2
8	1
11	1
12	1

High Hazard Dams and Demographics

The table below 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 MR2 software. The highlighted census tract in Lamar County contains the most households (4,497) of all the census tracts containing high hazard dams. The highlighted census tract in Rankin County contains the most residential structures (5,086) of all the census tracts containing high hazard dams. Census tract number 28071950400 in Lafayette County contains the most non-residential structures (350) of all the census tracts containing high hazard dams.

Table 3.8.3

County Name	Census Tract	Number of High Hazard Dams	Population	Number of Households	Number of Residential Structures	Number of Non-Residential Structures
Pearl River	28109950500	2	11892	4412	4889	8
Lafayette	28071950500	3	11294	4306	4044	3
Lamar	28073020300	3	11260	4497	3609	93
Rankin	28121020201	1	11179	4463	5086	11
Stone	28131020200	1	10060	3457	3640	10
Lafayette	28071950400	1	8802	3426	3989	350

High Hazard Dams and Demographics by County

The Table 3.8.3 demonstrates 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 7.3.8

County Name	Number of Census Tracts with HH Dams	Number of High Hazard Dams	Population*	Number of Households*	Number of Residential Structures*	Number of Non-Residential Structures*
Adams	2	6	9,827	3,852	3,692	18
Alcorn	1	1	6,498	2,796	2,208	81
Bolivar	1	1	5,352	1,993	1.596	11
Calhoun	2	2	7,007	2,795	3,199	18
Carroll	2	23	10,769	4,071	4,485	11
Chickasaw	1	1	3,808	1,404	1,488	7
Choctaw	2	3	6,649	2,473	2,338	17
Claiborne	1	1	3,775	1,398	1,455	5

County Name	Number of Census Tracts with HH Dams	Number of High Hazard Dams	Population*	Number of Households*	Number of Residential Structures*	Number of Non-Residential Structures*
Copiah	3	4	14,218	5,070	4,956	24
Covington	1	1	6,979	2,613	2,766	4
Desoto	14	21	55,237	19,769	22,034	240
Forrest	3	4	21,034	7,764	7,723	79
Grenada	1	2	5,798	2,141	2,472	35
Harrison	1	2	7,272	2,555	2,675	0
Hinds	12	17	59,641	21,630	21,592	554
Holmes	3	7	18,060	6,085	5,668	31
Jackson	1	1	6,684	2,243	2,537	6
Jasper	2	3	10,596	3,924	3,935	12
Jefferson Dav	3	3	19,809	7,372	7,137	30
Kemper	1	1	5,465	1,973	1,873	12
Lafayette	3	5	24,123	9,265	9,664	358
Lamar	5	10	35,792	13,165	13,037	160
Lauderdale	10	30	52,111	19,817	20,058	173
Lee	4	8	27,525	10,487	10,814	67
Lincoln	1	2	4,004	1,492	1,581	5
Lowndes	1	2	7,495	2,934	3,383	28
Madison	8	14	35,528	12,189	14,296	62
Montgomery	1	2	3,105	1,203	1,292	1
Neshoba	1	1	3,005	1,168	1,325	4
Newton	3	3	13,049	4,830	5,101	23
Noxubee	1	1	4,211	1,595	1,602	0
Oktibbeha	2	2	10,681	3,844	3,570	16
Panola	2	3	11,889	4,456	4,527	94
Pearl River	2	3	18,329	6,762	7,571	10
Pike	2	2	9,807	4,032	3,570	104
Pontotoc	2	6	13,726	5,266	4,983	76
Prentiss	1	1	5,843	2,243	2,277	16
Rankin	10	19	65,076	25,112	25,390	172
Scott	1	1	4,944	1,872	2,037	0
Simpson	2	2	9,024	3,272	3,339	11
Smith	1	2	5,953	2,240	2,308	3
Stone	1	1	10,060	3,457	3,640	10
Tallahatchie	2	13	9,563	3,696	3,878	6
Tate	1	1	8,500	2,988	3,164	33
Tippah	2	3	10,881	4,253	4,359	32
Tishomingo	2	2	9,280	3,787	4,611	10
Union	2	2	9,342	3,559	3,855	2

County Name	Number of Census Tracts with HH Dams	Number of High Hazard Dams	Population*	Number of Households*	Number of Residential Structures*	Number of Non-Residential Structures*
Walthall	1	1	6,027	1,952	2,662	9
Warren	3	5	18,850	7,018	7,097	44
Wayne	1	1	5,437	1,957	2,049	0
Webster	2	2	8,385	3,187	3,317	9
Yalobusha	2	2	8,107	3,266	3,231	10
Yazoo	1	1	6,431	1,562	1,584	3

*The demographics numbers reflect only the census tracts containing high hazard dams. They do not reflect demographics for the entire county.

The following maps (Figures 3.8.2, 3.8.3 and 3.8.4) demonstrate the Census Tracts containing high hazard dams:

Summary by County: High Hazard Dams

DeSoto County has the largest number of Census tracts (14) with high hazard dams. Lauderdale County has the largest number of high hazard dams (30). Rankin County has the largest population (65,076), the largest number of households (25,112), and the largest number of residential structures (25,390) within census tracts containing high hazard dams. Hinds County has the largest number of non-residential structures (554) 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. The reason for this being that 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 Carroll Counties with the highest number of High Hazard Dams with 29 and 23 respectively. Lauderdale has the highest number of all dams with 184 in total, most of them classified as Low Hazard Dams. Hinds County follows closely behind with 181 total dams, 17 of them classified as High Hazard. Table 3.8.4 and map (Figure 3.8.5) presents a breakdown, by county, of the number of dams in each classification.

Table 3.8.4
Dam Inventory by County and Classification

County Name	Total Number of Dams	Number of High Hazard Dams	Number of Significant Hazard Dams	Number of Low Hazard Dams
Adams	46	6		40
Alcorn	38	1		37
Amite	20			20
Attala	54			54
Benton	83			83

County Name	Total Number of Dams	Number of High Hazard Dams	Number of Significant Hazard Dams	Number of Low Hazard Dams
Bolivar	26	1		25
Calhoun	54	2	1	51
Carroll	104	23	9	72
Chickasaw	39	1	3	35
Choctaw	26	3	3	20
Claiborne	24	1		23
Clarke	24			24
Clay	26		1	25
Coahoma	6			6
Copiah	34	4		30
Covington	22	1		21
Desoto	119	22	4	93
Forrest	50	4		46
Franklin	20		1	19
George	20			20
Greene	26		1	25
Grenada	22	2		20
Hancock	23			23
Harrison	44	2		42
Hinds	181	17	5	159
Holmes	59	4	2	53
Humphreys	63			63
Itawamba	43			43
Jackson	5	1		4
Jasper	47	3	1	43
Jefferson	21	3		21
Jefferson Davis	31			28
Jones	74		3	71
Kemper	30	1	1	28
Lafayette	82	5	4	73
Lamar	57	10		47
Lauderdale	184	29	2	153
Lawrence	13			13
Leake	29		5	24
Lee	72	7	2	63
Leflore	10		1	9
Lincoln	23	2	1	20
Lowndes	52	3	1	48
Madison	152	14	5	132
Marion	24			24

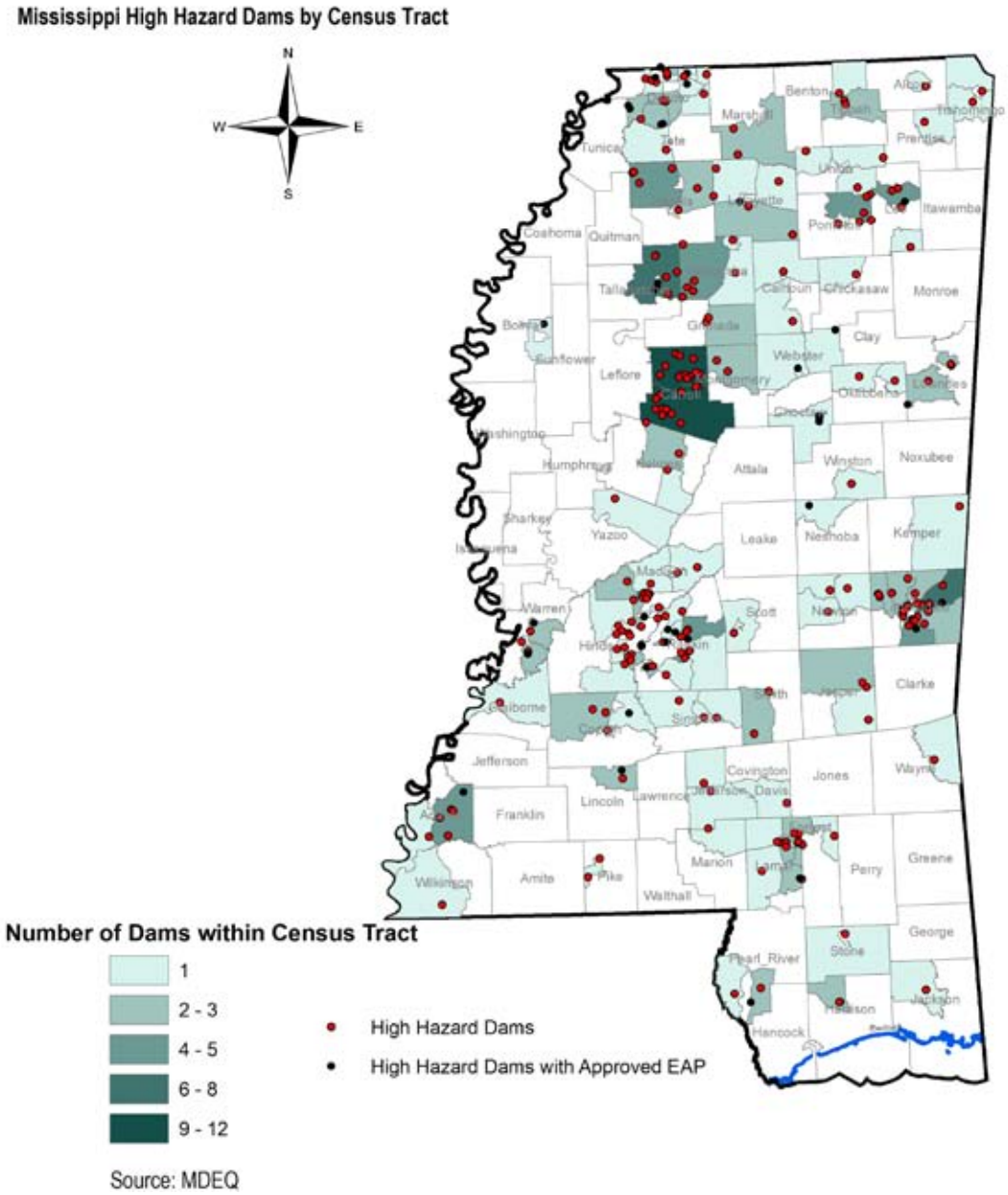
County Name	Total Number of Dams	Number of High Hazard Dams	Number of Significant Hazard Dams	Number of Low Hazard Dams
Marshall	54	1	1	51
Monroe	46			46
Montgomery	33	2	2	29
Neshoba	56	1	4	51
Newton	42	3		39
Noxubee	65	1		64
Oktibbeha	81	2	3	76
Panola	65	6	3	56
Pearl River	62	3	3	56
Perry	21			21
Pike	32	2		30
Pontotoc	40	6		34
Prentiss	28	1		27
Quitman	2			2
Rankin	94	19	3	72
Scott	55	1		54
Sharkey	7			7
Simpson	36	2		34
Smith	31	2	2	27
Stone	50	1		49
Sunflower	29			29
Tallahatchie	46	9	4	33
Tate	46	1	1	44
Tippah	57	3	2	52
Tishomingo	7	2	1	4
Tunica	13			13
Union	52	2	2	48
Walthall	10	1		9
Warren	51	5	1	45
Washington	31			31
Wayne	31	1		30
Webster	28	2		26
Wilkinson	19			19
Winston	36		1	35
Yalobusha	47	6	4	37
Yazoo	91	1	1	89

Source: Mississippi Department of Environmental Quality-Dam Safety Division

Limitations in this Vulnerability Assessment to Dam Failure

Inundation mapping was not available at the time of this update. 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. Census Block data would give a more accurate estimate of the population in very close proximity to the high hazard dams. It was not used in this assessment because when imported into GIS approximately half of the dam point coordinates fell within water body areas that are not part of a Census Block. Therefore demographic data could not be assembled for the dams using census blocks. During the next plan update, the State of Mississippi should be able to use inundation mapping as required in the EAPs for the high hazard dams.

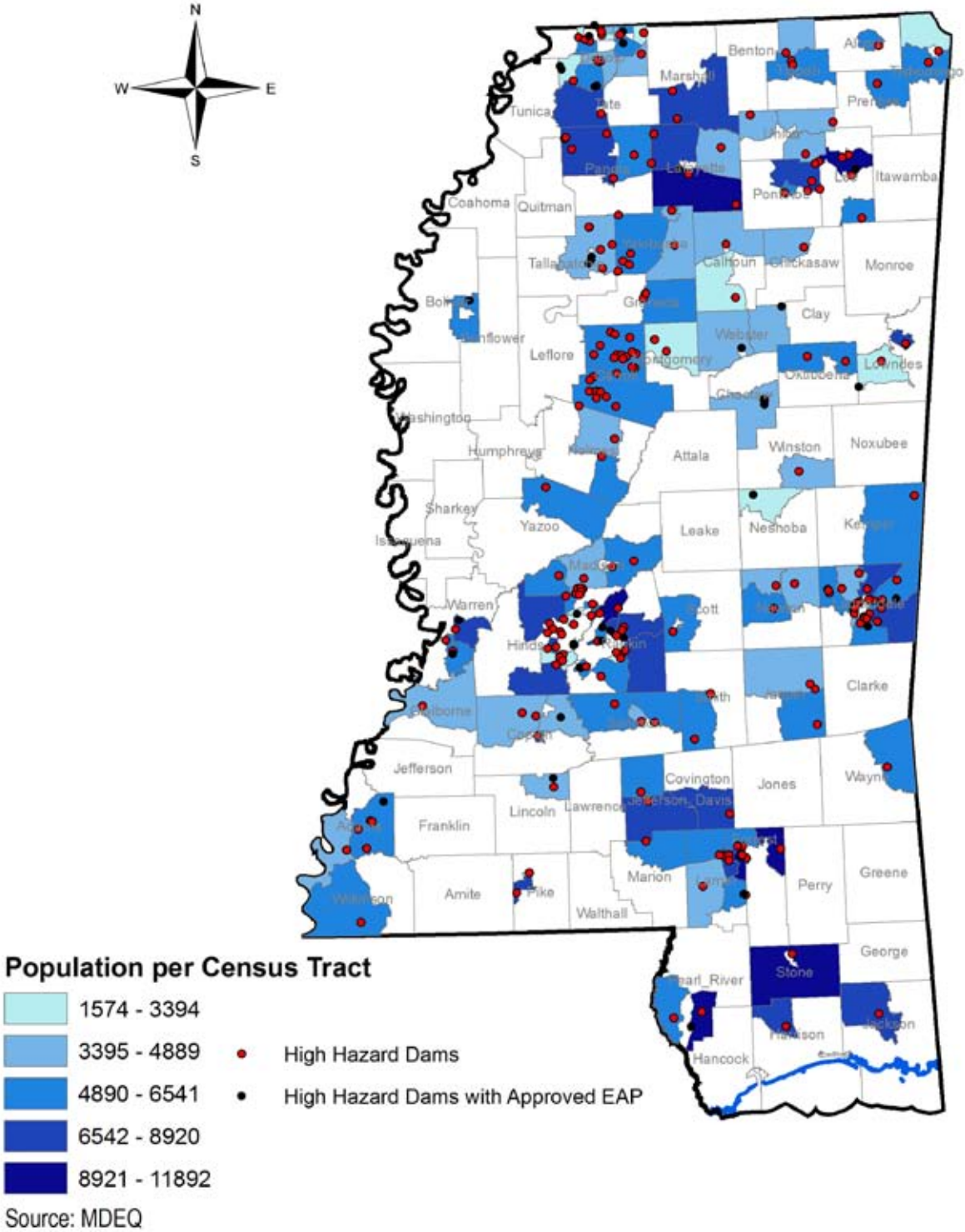
Figure 3.8.2



Source: MDEQ

Figure 3.8.3

Mississippi High Hazard Dams by Census Tract



Source: MDEQ

Figure 3.8.4

Mississippi High Hazard Dams by Census Tract

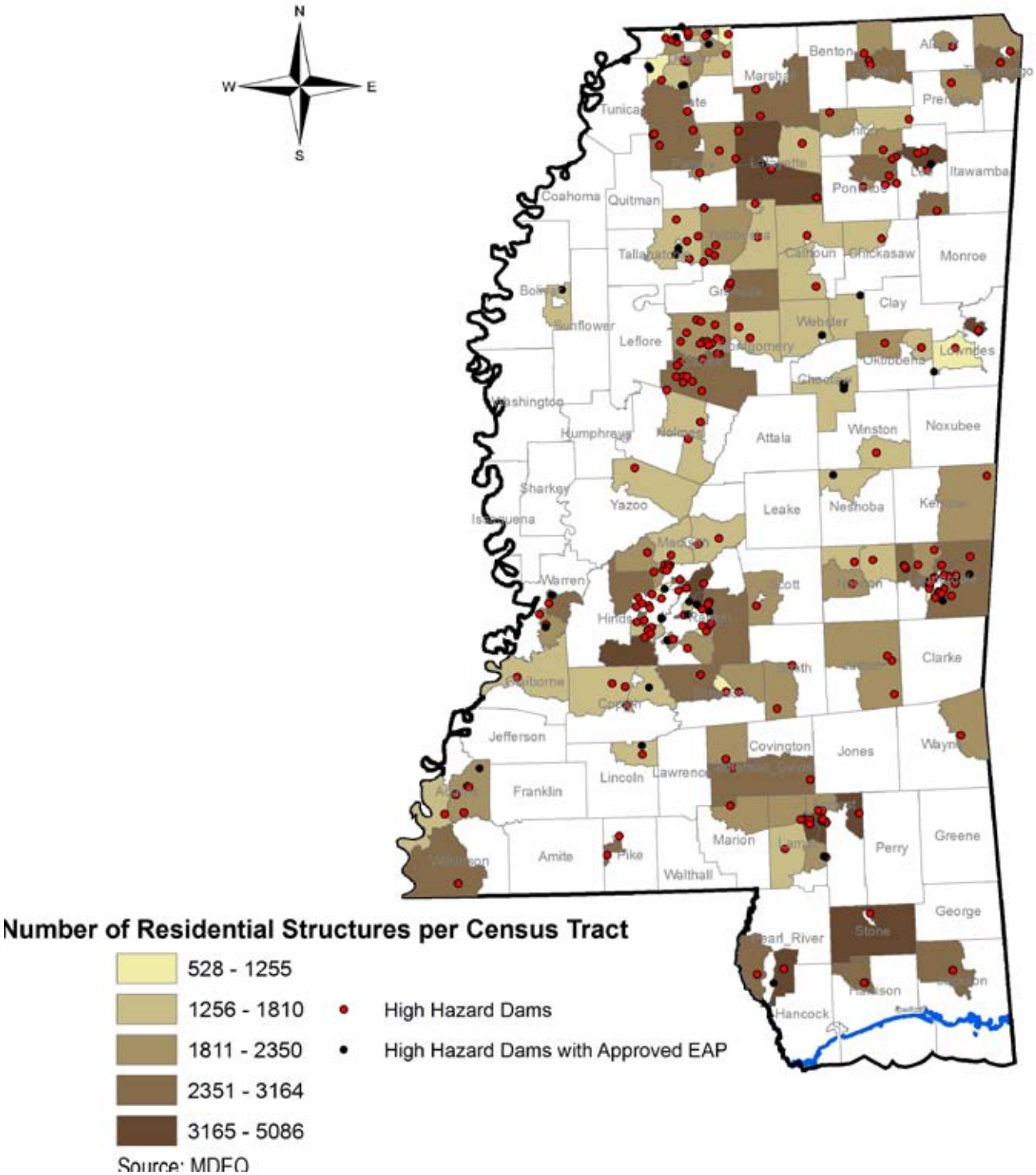
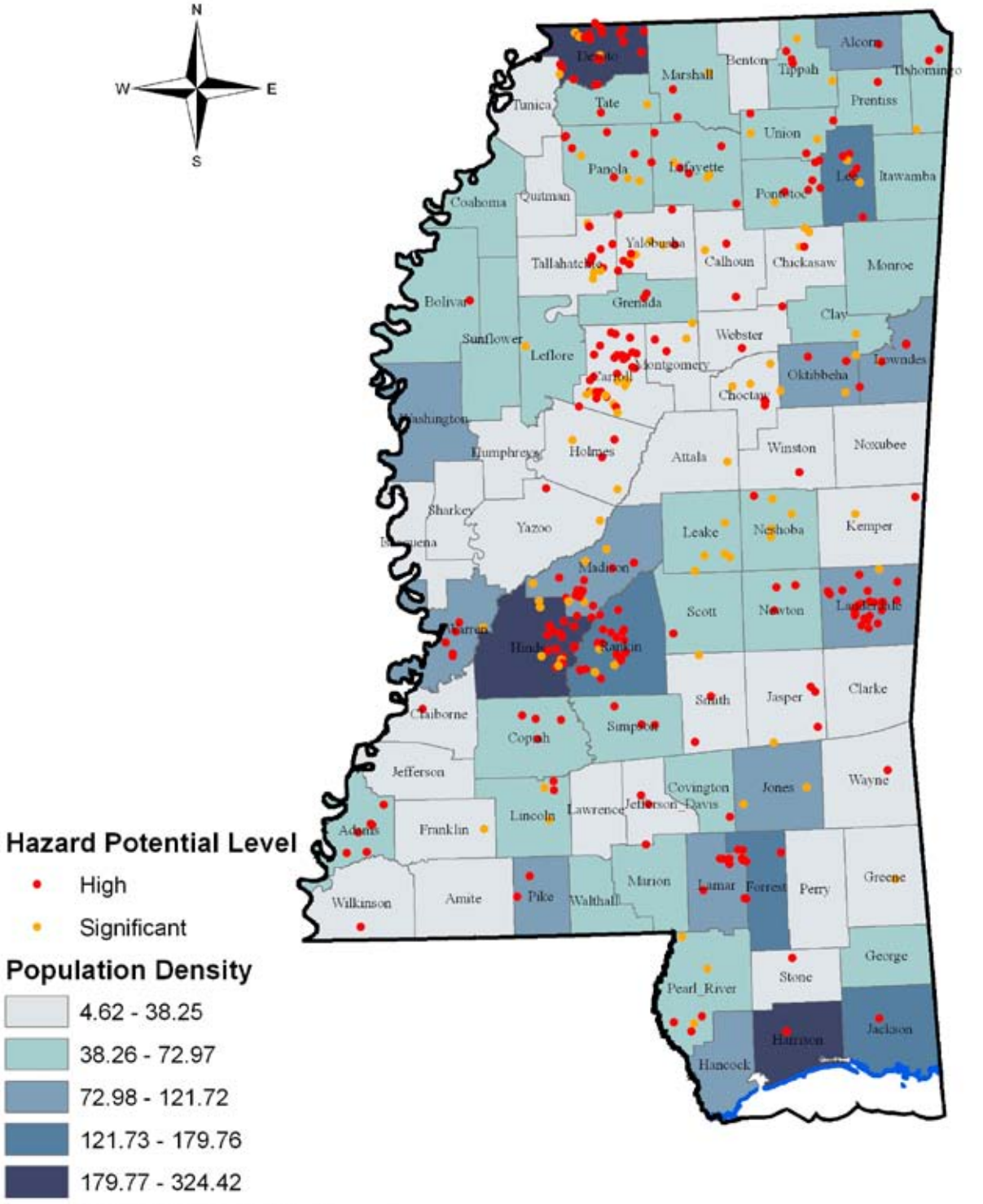


Figure 3.8.5

Mississippi High and Significant Level Dams



Hazard Potential Level

- High
- Significant

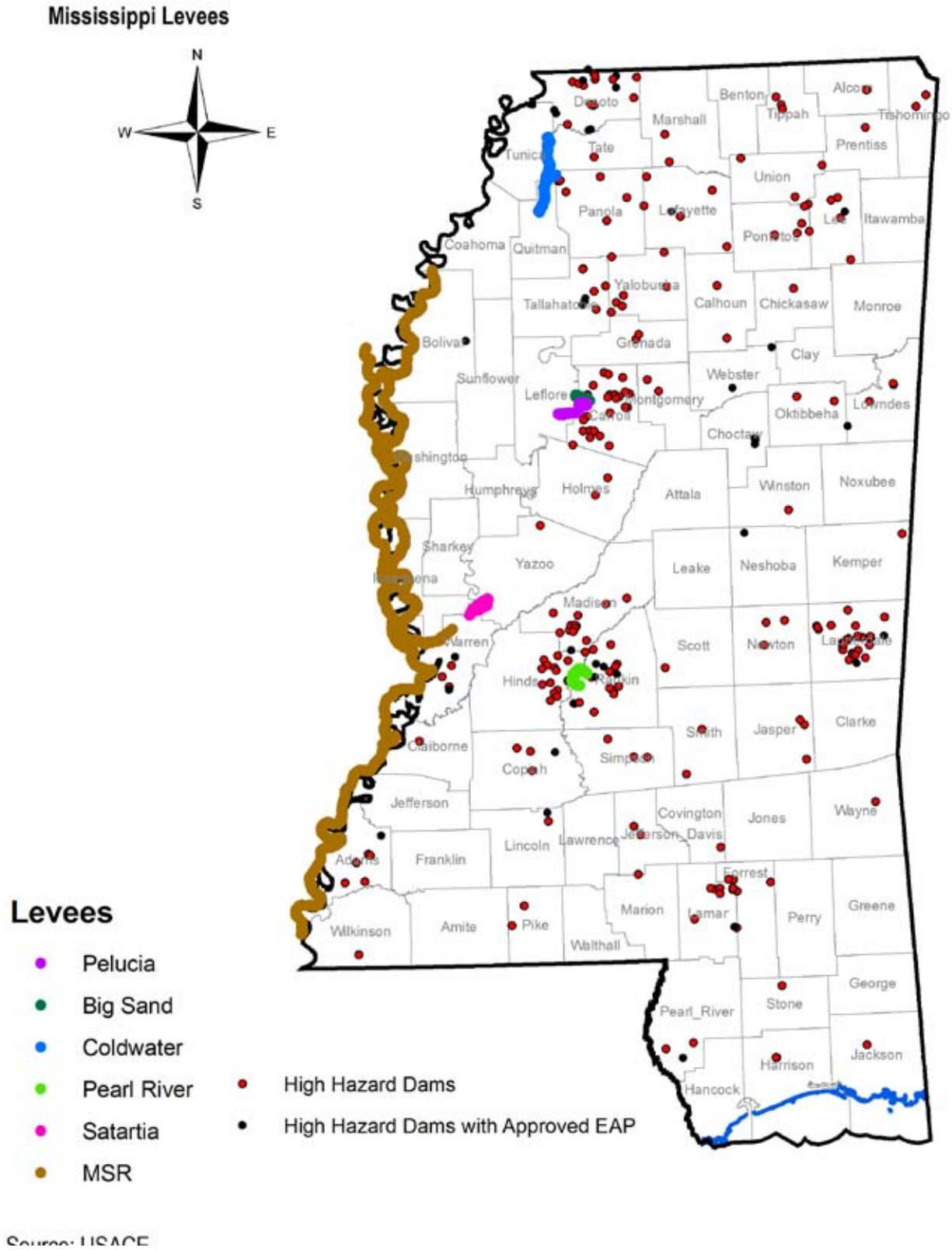
Population Density

- 4.62 - 38.25
- 38.26 - 72.97
- 72.98 - 121.72
- 121.73 - 179.76
- 179.77 - 324.42

Source: MDEQ, CLARITAS, U.S. Census Bureau

Note: Population Density is the number of people per square mile

Figure 3.8.6



Source: USACE

Assessing Vulnerability to Levee Failure

Inventory of Levees

The U.S. Army Corps of Engineers, Vicksburg District provided an inventory of all the levees in Mississippi that the Vicksburg District has responsibility for. The information in this inventory was used to develop a risk rating for each levee in the following section. The U.S. Army Corps of Engineers is currently developing a GIS data for all 100 year protection levees in the Corps nationwide. The location map (Figure 3.8.6) shows the available surveyed control points for levees in the Vicksburg District available at the time of this plan update. The GIS for the Vicksburg District is expected to be completed in early 2008 and will be available for use in the next plan update. There are no levees owned or constructed by the USACE in the Mississippi portions of the Mobile District.

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 table 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		
		75 - 100 square miles	5.0		
		Greater than 100 square miles	6.0		

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 7.3.8

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 table below demonstrates the Total Risk Rating by County.

Risk Rating by County	
Leflore	37
Quitman	23
Washington	22
Yazoo	21
Humphreys	15
Warren	14
Holmes	10
Sharkey	9
Tallahatchie	8
Rankin	7
Carroll	7
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.

Estimating Potential Losses

As high hazard dam owners complete EAPs, future state mitigation plan updates will provide additional assessments of the vulnerability and potential losses from high hazard dam failure. It is possible to provide information on two EAPs that are on file with state planners. These two examples were derived from completed action plans submitted by a professional engineer. The loss estimates, based on total structure loss, were provided by plan developers and not derived from the EAPs themselves.

State of Mississippi Dam Inventory as of June 2007

See Appendix 7.3.8 for the Mississippi Dam Inventory List.

3.9: Non-Profiled Hazards Discussion

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 50% of all local plans identified and ranked the hazards selected for the state plan. More than 75% of all local plans included flood, tornado, earthquake, winter weather, and wildfire sections.

Thunderstorm (hail, lightning, high wind) was identified and addressed by 80% of the local plans; drought in 45%, and excessive heat in 35% of the local plans. All other hazards were addressed by a smaller percentage (less then 35%) of the local plans as illustrated in the table below:

Hazard	Number of Plans	Percent of Plans
Thunderstorm (includes hail, lightning, high wind)	48	80%
Drought	27	45%
Excessive Heat (heat wave)	21	35%
Expansive Soils	20	33%
Land Subsidence	14	23%
Radiological (nuclear power plant)	10	17%
Terrorism	7	12%
Hazardous Materials Incident	7	12%
Bomb Threat	7	12%
Erosion	6	10%
Gas/Oil Line Disturbance (pipeline)	5	8%

Thunderstorm mitigation is best addressed at the local level. The hazard “high winds” is addressed in this plan in the hurricane and tornado sections. Excessive heat, although a statewide threat is also best addressed by local mitigation and as such not addressed in this plan. As noted earlier in the chapter, hazards identified and addressed in local plans which are not included in this plan will receive the support of the state mitigation program.

Drought can have statewide impacts, but is best mitigated by local practices. Since drought was the highest locally ranked hazard not selected for full inclusion in this plan, it is addressed here in a qualitative manner.

Drought Hazard Description

“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

A full disaster history search was not completed for drought, but limited information available from the National Climatologic Data Center database included one drought in 2006 which reportedly caused $60.7 million dollars in crop damage. The University of South Carolina Hazards Research Laboratory SHELDUS database listed an additional drought in the summer of 1988 that reportedly caused $82 million dollars (inflated to 2005 value) in crop damages. As recently as June of this year, portions of Mississippi were experiencing agricultural and hydrological drought conditions

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.

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. For that reason, this plan defers to local vulnerability assessments.

The most obvious primary impact from droughts 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 through 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.

3.10: 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, changes and trends in growth and development were analyzed and reviewed in the context of the Mississippi's hazard-prone areas and how the changing trends in growth and development affect loss estimates and vulnerability. When the population in a hazard area increases, so does the vulnerability associated with these hazards. The converse is also true that when the population in a hazard area decreases, vulnerability also decreases. Also factored into this analysis are the changes and shifts in population pre and post-Katrina and projected trends for the future.

Also reviewed were notable and important trends identified in the review of the local hazard mitigation plans. Particular attention was given to areas which experienced significant shifts in population numbers, both increases and decreases.

Population

In 2006, Mississippi ranked 31st among the 50 states in population, 38th in rate of growth, 31st in land area and 32nd in population density (assuming land area in 2006 was the same as it was in 2000 which was 46,914 square miles). In 2005, Mississippi had an estimated population of 2,915,696. Decennial census findings from the last few decades illustrate Mississippi's growth (see Table 3.10.1).

Table 3.10.1
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%

US Census Bureau estimates place Mississippi's 2006 population at 2,910,540. This reflects an increase of 2.3 percent between 2000 and 2006 and a decrease of .0018 in the year following Hurricane Katrina (5,156 people). County estimates for 2006 were released in July of 2006 and include post-Katrina figures and are included as available in this analysis. For the bulk of all other analysis 2005 US Census Bureau figures were used. It must be noted that these figures are pre-Katrina numbers and as such though they constitute best available data, do not reflect changes as a result of Katrina. Figure 3.10.1 illustrates Mississippi's 2006 population by county.

Total Estimated 2006 Population: 2,910,540 Persons

Data Source: Mississippi Development Authority/US Census 2007

Figure 3.10.1

Counties by Population (Estimated), 2006

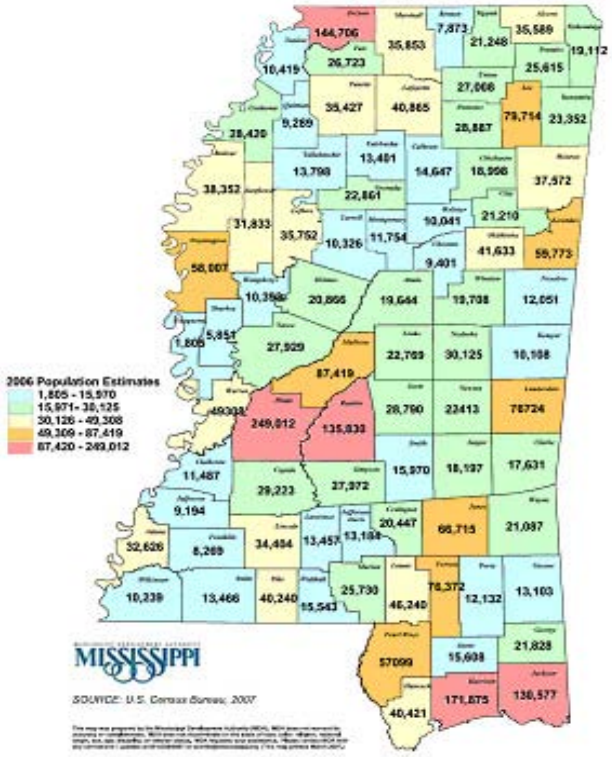


Table 3.10.2
Mississippi Quick Facts

Mississippi Population	2,910,540
Area Square Miles (2000)[1]	46,906.96
Persons per Square Mile[1]	60.6
Number of Incorporated Cities, Towns and Villages	296
Number of Counties	82
Urban/Rural Population[1]	36.9%/63.1%
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	4 (DeSota, Harrison, Rankin & Jackson)
Counties with a Population of 49,309 to 87,419	8
Counties with a Population of 30,126 to 49,308	15
Counties with a Population of 15,971 to 30,125	27
Counties with a Population of 10,000 to 15,971	20
Counties with a Population of 1 to 10,000	7

[1]Note: 2000 data is used when no more recent information is available from the U.S. Census Bureau

Sources: Us Census Bureau 2000, 2006 and the Mississippi Development Authority

Between 2000 and 2005, 32 counties gained population, 17 of which (18 percent of all counties) gained more than 5 percent. This growth was concentrated primarily in three areas of the state (south central, central and north central).

The three Mississippi counties Katrina impacted the worst were Jackson, Harrison and Hancock. Within these three counties, approximately 375,000 people were impacted by Hurricane Katrina. According to the US Census Bureau in 2005 approximately thirteen (13) percent of Mississippi's total population lived in these three counties prior to Katrina. Harrison had the second largest population (193,890) and Jackson County had the fourth largest population (135,940); Hancock County ranked 15th among Mississippi's 82 counties. Pre-Katrina, the three coastal counties all experienced population increases ranging from 2.22 percent (Harrison) and 8.71 percent (Hancock). Hancock County had the eighth largest percentage population gain among Mississippi's counties during the period 2000 – 2005.

Table 3.10.3 lists Mississippi's 10 most populous counties and Table 3.10.4 the 10 smallest counties. Tables 3.10.5 and 3.10.6 list the counties that have grown and declined by the greatest number of people and percent respectively. Figures 3.10.2 and 3.10.3 illustrate population changes statewide.

Table 3.10.3
Top Counties Ranked by Population (Estimated), 2006

County	2006 Population
Hinds County	249,012
Harrison County	171,875
DeSoto County	144,706
Rankin County	135,830
Jackson County	130,577
Madison County	87,419
Lee County	79,714
Lauderdale County	76,724
Forrest County	76,372
Jones County	66,715

Source: Mississippi Development Authority/US Census Bureau

Table 3.10.4
Ten Smallest Counties Ranked by Population (Estimated), 2006

County	2006 Population
Issaquena	1,805
Sharkey	5,851
Benton	7,873
Franklin	8,269
Jefferson	9,194
Quitman	9,289
Choctaw	9,401
Webster	10,041
Kemper	10,108
Wilkinson	10,239

Source: Mississippi Development Authority/US Census Bureau

Table 3.10.5
Counties with the Greatest Population Losses and Gains (Numerical) 2000 – 2006

County	Population Loss 2000 - 2006	County	Population Gain 2000 - 2006
Harrison	-17726	DeSoto	37507
Washington	-4970	Rankin	20503
Hancock	-2546	Madison	12745
Sunflower	-2536	Pearl River	8478
Bolivar	-2281	Lamar	7170
Coahoma	-2202	Lee	3959
Leflore	-2195	Forrest	3768
Lowndes	-1813	George	2684
Hinds	-1788	Pontotoc	2161
Adams	-1714	Lafayette	2121

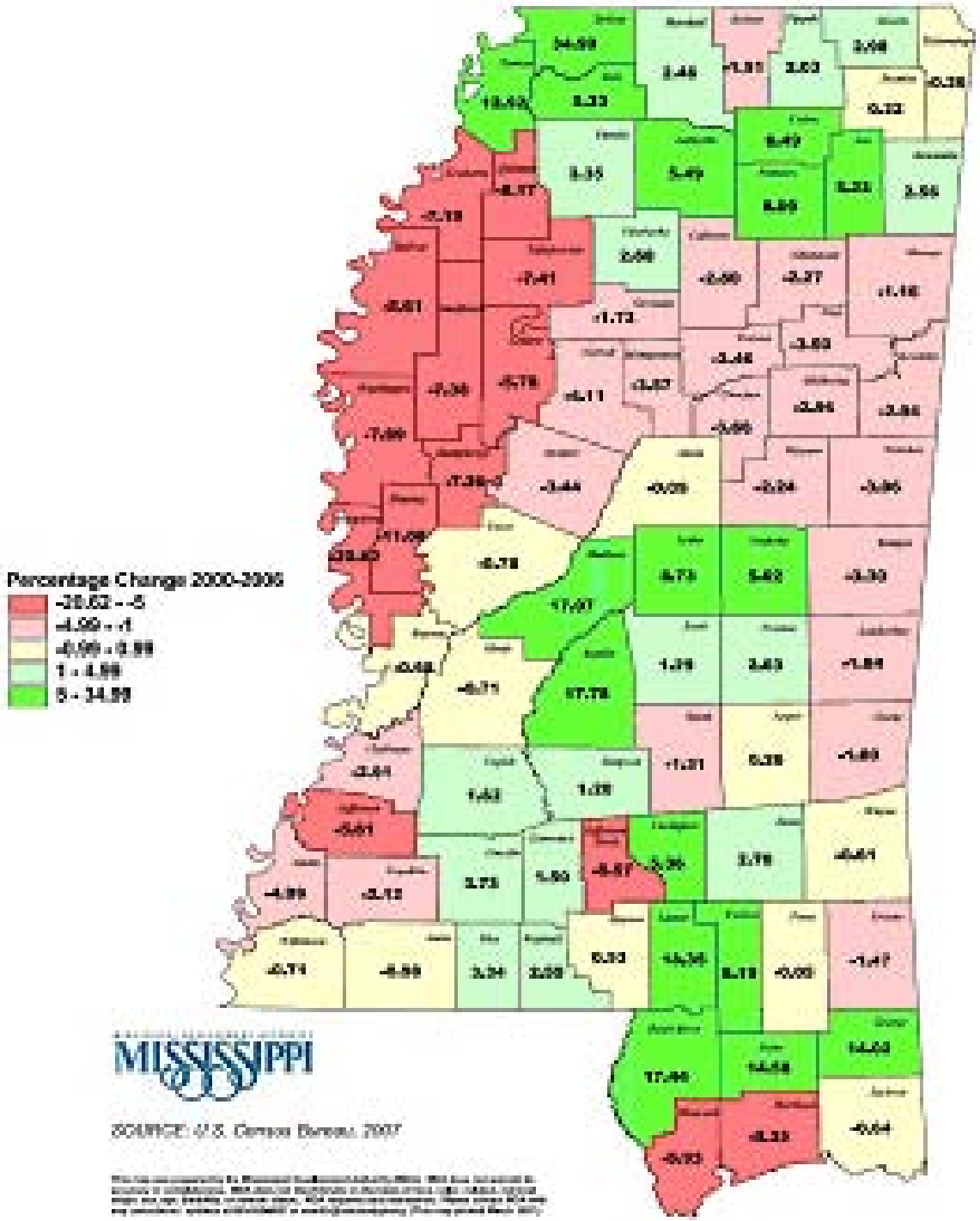
Source: Mississippi Development Authority/US Census Bureau

Table 3.10.6
Counties with the Greatest Population Loss and Gain (Percent) 2000 – 2006

County	% Change	County	% Change
Issaquena	-20.62%	DeSoto	34.99%
Sharkey	-11.08%	Lamar	18.35%
Harrison	-9.35%	Rankin	17.78%
Quitman	-8.17%	Pearl River	17.44%
Washington	-7.89%	Madison	17.07%
Tallahatchie	-7.41%	Stone	14.58%
Sunflower	-7.38%	George	14.02%
Humphreys	-7.26 %	Tunica	12.92%
Coahoma	-7.19 %	Leake	8.73%
Hancock	-5.93%	Pontotoc	8.09%

Source: Mississippi Development Authority / US Census

Figure 3.10.2
Estimated Change in Population by County, 2000 – 2006



Not all of Mississippi's counties experienced growth during the period 2005 – 2006. Fourty-nine of the State's 82 counties experienced a decline during this period with two of the counties experiencing double digit decline. The area of the State most affected by declining populations is northwestern Mississippi from mid-state to the northwest corner of the State. The Counties which experienced double digit decline are Issaquena and Sharkey. Issaquena County is located in Central Mississippi just east of the Mississippi River. Sharkey County is located just to the east of Issaquena County. Both these counties are quite small with current populations estimated at 1,805 and 5,851 respectively.

The counties experiencing the greatest numeric decline in population are Harrison, Washington and Hancock. Both Harrison and Hancock are located on the Gulf Coast. Jackson County, the third Mississippi coastal county but also the furthest east, saw only a slight decline in population over the same period (-0.64%). The catastrophic events of August 29, 2005 had a significant long-term effect on the Mississippi Gulf Coast. Population that was located in the highest risk areas along the Gulf may never rebound.

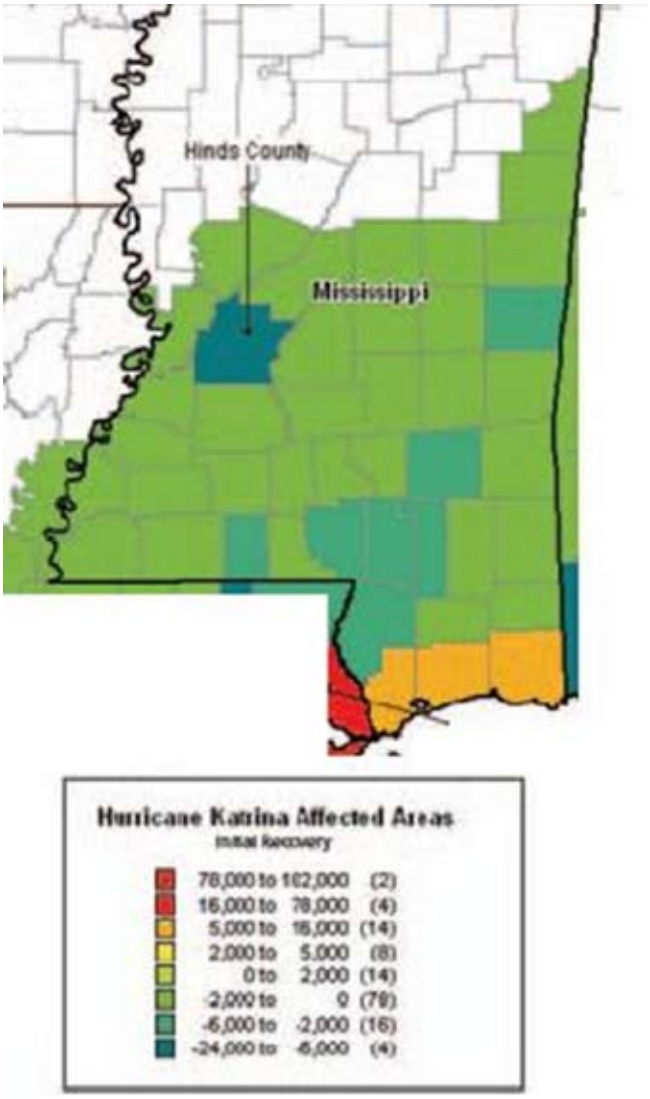
Mississippi Counties have experienced dramatic fluctuations in their populations post-Katrina. Significant population shifts were seen as an immediate response to Hurricane Katrina and the damage it inflicted on the residents of Mississippi. Post-Katrina, the population changes and shifts have continued with the population returning to the Mississippi Gulf Coast. Per the John C. Stennis Institute of Government's July 2006 report, although some former residents of coastal Mississippi have relocated and may never return to their former hometown areas, 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.

The Stennis Institute has additionally reported that there has been a significant influx of construction and temporary labor. It is believed that a large number of these construction laborers may transition to permanent residency as reconstruction is anticipated to take three to five years. The Institute also reports that this predicted transition from temporary to permanent resident is also in part due to the exceptionally high quality of life in coastal Mississippi. Finally, Katrina-related population loss at the county level generally declines as you move eastward from Katrina's point of impact. It has generally been found that the closer to the Gulf, the greater the devastation and resulting initial population decline.

The following Figure 3.10.2 identifies the Mississippi Counties which experienced the most significant population shifts as a result of Hurricane Katrina making landfall in Mississippi in August 2005.

Figure 3.10.3

Hurricane Katrina Affected Areas/ Population – Initial Response Recovery

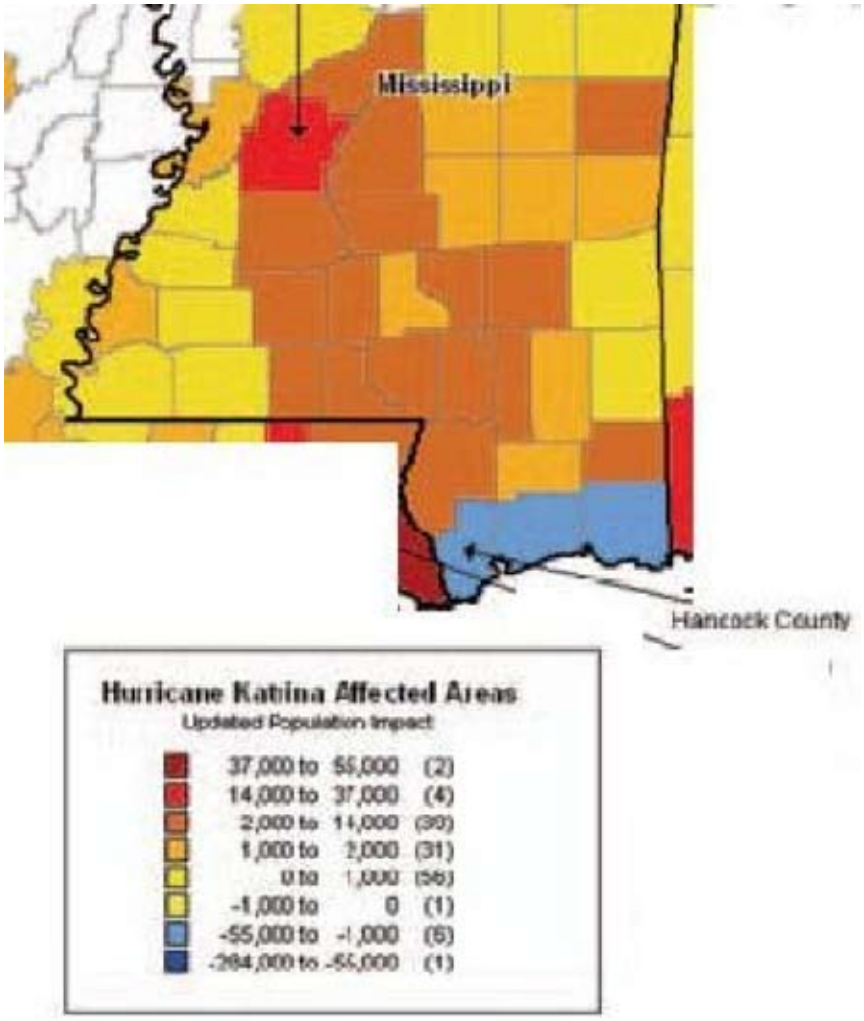


Source: Claritas 2007

In the months following the event, the recovery and repopulation has advanced. Recent data compiled by Claritas (2007) provides a glimpse at the population shifts that have occurred statewide following the initial evacuation and relocation in response to Hurricane Katrina.

Figure 3.10.4

Hurricane Katrina Affected Areas/ Population – Updated Population Impact (2007)



Source: Claritas 2007

The US Census Bureau has released interim population projections using interim 2005 population numbers and revised numbers for 2006 through 2030. The following Table summarizes those projections. Mississippi is projected to experience a slower than historic rate of growth in the foreseeable future.

Table 3.10.7
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

Another indicator of growth is number of housing units. According to the US Census Bureau, the number of estimated housing units in Mississippi increased 6.0 percent (73,544) between 2000 and 2005. Mississippi ranked 32nd among the 50 states in number of housing units. DeSoto County topped the list for the greatest growth in the state in terms of housing units between 2000 and 2005 with an increase of 29.87% during the five year period32nd.

Tables 3.10.8 and 3.10.9 list the counties that have grown the most in terms of housing units by number and percent respectively. Figures 3.10.5 and 3.10.6 illustrates these results statewide.

Table 3.10.8
Counties with the Greatest Estimated Housing Gains (2000 – 2005)

County	2000	2005	Housing Unit Gain 2000 - 2005
DeSoto	40,795	52,979	12,184
Harrison	79,636	88,138	8,502
Rankin	45,070	51,411	6,341
Madison	28,781	34,109	5,328
Jackson	51,678	56,732	5,054
Hinds	100,287	104,535	4,248
Hancock	21,072	23,531	2,459
Pearl River	20,610	22,521	1,911
Forrest	29,913	31,703	1,790
Oktibbeha	17,344	18,972	1,628

Table 3.10.9
Counties with the Greatest Estimated Housing Unit Gains (Percent) 2000 – 2005

County	2000	2005	% Change
DeSoto	40,795	52,979	29.87%
Madison	28,781	34,109	18.51%
Tunica	3,705	4,377	18.14%
Rankin	45,070	51,411	14.07%
Hancock	21,072	23,531	11.67%
Harrison	79,636	88,138	10.68%
Tate	9,354	10,320	10.33%
Jackson	51,678	56,732	9.78%
Oktibbeha	17,344	18,972	9.39%
Lafayette	16,587	18,125	9.27%

Figure 3.10.5
Estimated Numeric Change in Housing Units by County , 2000 - 2005

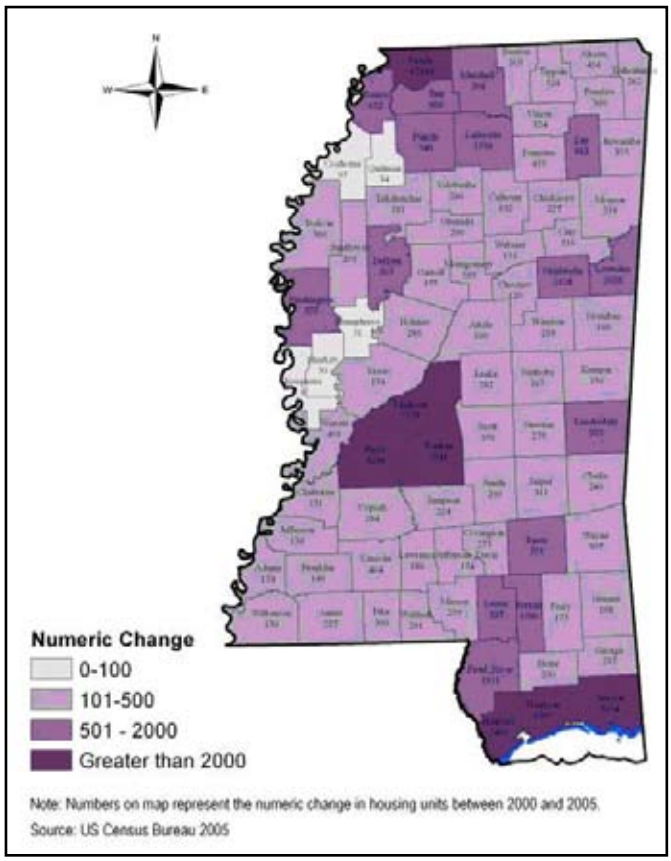
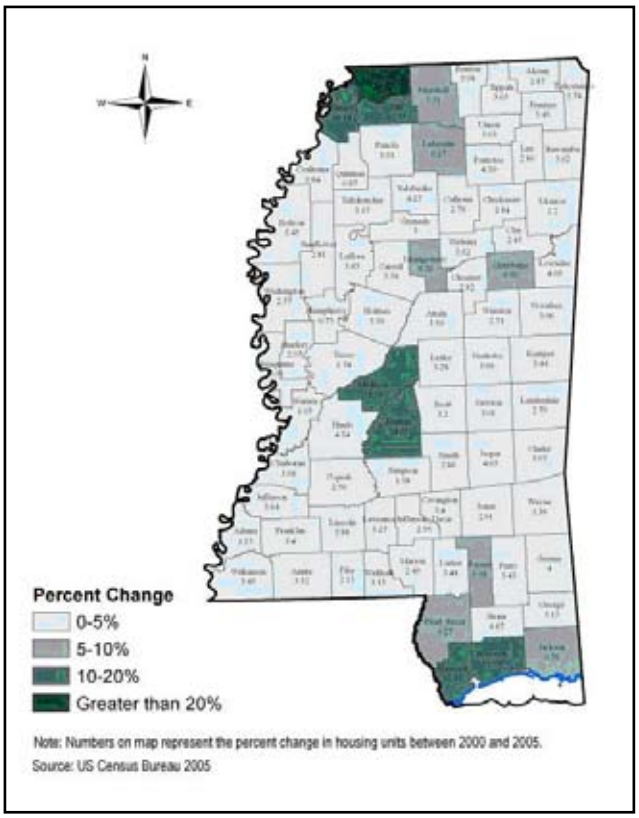


Figure 3.10.6
Estimated Percent Change in Housing Units by County , 2000 - 2005



As illustrated in Table 3.10.9, the seven of the 10 most populous counties (Table 3.10.10) also have the most housing units. Housing growth also similarly tracks with population growth though not exactly.

Table 3.10.10
Top 10 Counties Ranked by Number of Housing Units (Estimated), 2005

County	2005	County	2005
Hinds	104,535	Madison	34,109
Harrison	58,168	Jackson	33,482
DeSoto	52,979	Lee	32,800
Rankin	51,411	Forrest	31,703
Lauderdale	34,351	Jones	27,624

February 12, 2006, FEMA reported total damage to Mississippi housing as 220,384 units with damage of varying extent. This computes to 21 percent of Mississippi's total housing stock (Census 2000 and FEMA 2/12/06 data). Seventy two percent of the 220,384 damaged units were owner occupied. Approximately 18 percent of these owner occupied housing units were due to flood damage while approximately twenty eight percent of damaged renter occupied units received flood damage. The Stennis Institute reported that approximately twice as many housing units (owner and renter occupied) with flood damage were outside the FEMA 100 year flood plain (vs. inside).

Table 3.10.11
Mississippi Total Housing Unit Damage (Estimates 2-12-06)

Damage Category	Owner-Occupied Homes		Renter-Occupied Homes		Total Housing Units	
	Number	% of Total Damaged (line 4)	Number	% of Total Damaged (line 4)	Number	% of Total Damaged (line 4)
(1) Minor Damage	117,407	74%	41,591	67%	158,998	72%
(2) Major Damage	30,889	20%	14,887	24%	45,776	21%
(3) Severe/Destroyed	9,618	6%	5,992	10%	15,610	7%
(4) Total Damaged	157,914	100%	62,470	100%	220,384	100%

Source: Mississippi Review and Economic Outlook, June 2006; U.S. Department of Housing and Urban Development, Office of Policy Development and Research. "Current Housing Unit Damage Estimates: Hurricanes Katrina, Rita and Wilma", 2/12/06 based on FEMA and SBA data

Density

Mississippi has a surface land area of 46,906.96 square miles (2000 census) and a population of 2,910,540 (2006 estimate). Based on the 2005 census estimates, Mississippi ranked 32nd in population density and 33rd in housing density in the 50 states. The same eleven counties ranked at the top in terms of both population and housing density (see Table 3.10.12). Ten of these counties (excluding Hancock) also ranked among Mississippi's top most populous counties. Figure 3.10.7 illustrates density by county statewide.

Table 3.10.12
Top 10 Counties Ranked by Population/Housing Density, 2005

Geographic area	2005 Housing Units Density Per Square Mile
Mississippi	26.3
COUNTY	
Harrison	151.7
Hinds	120.3
DeSoto	110.9
Jackson	78.0
Lee	73.0
Forrest	67.9
Rankin	66.4
Lowndes	52.0
Hancock	49.3
Lauderdale	48.8
Madison	47.6

Geographic area	2005 Population Density Per Square Mile
Mississippi	62.0
COUNTY	
Harrison	332.5
DeSoto	286.0
Hinds	285.5
Jackson	186.5
Lee	174.6
Rankin	169.8
Forrest	160.6
Lowndes	118.9
Madison	117.4
Lauderdale	109.4
Hancock	97.6

The fastest growing counties are typically also seeing their density increase more rapidly than other counties (see Table 3.10.13 and Figure 3.10.8).

Figure 3.10.7
Housing Density by County, 2000 – 2005

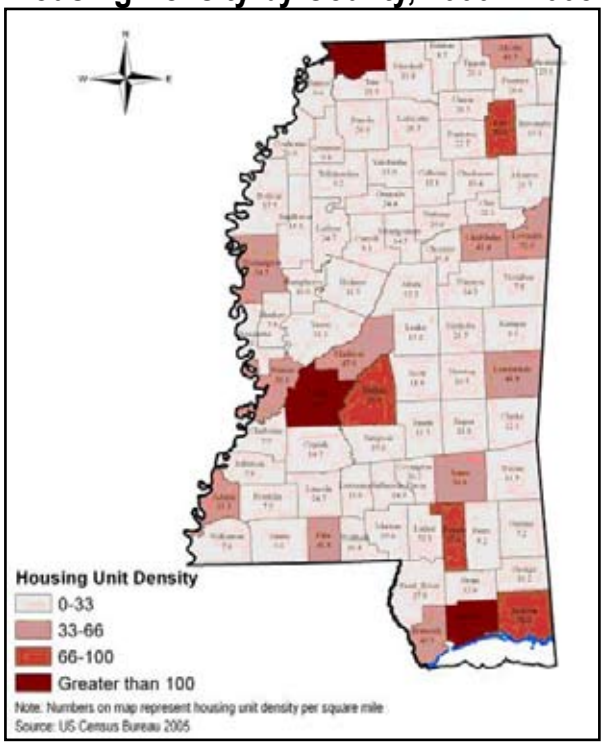


Figure 3.10.8
Population Density by County, 2000 – 2005

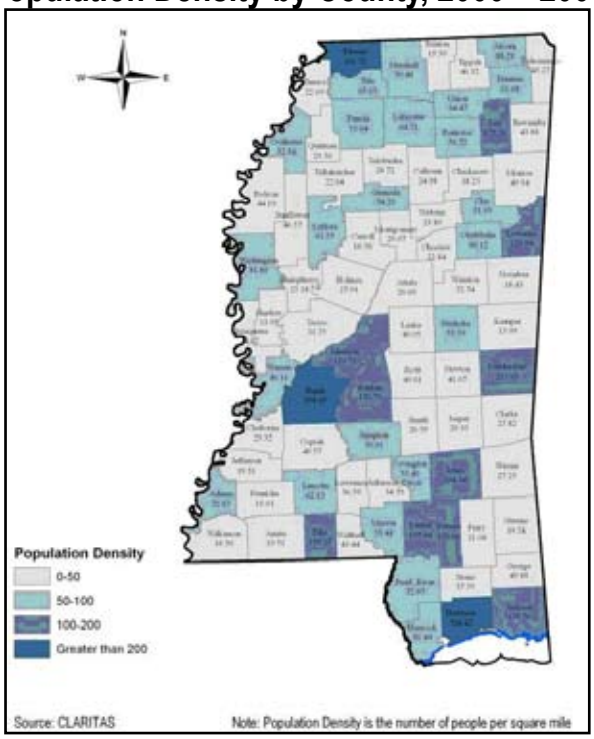


Table 3.10.13
Counties with Greatest Estimated Population Density Gains 2000 - 2005

Geographic area	Population Density per square mile of land area		
	2000	2005	% Change
Mississippi	60.6	62.0	1.4%
DeSoto County	224.3	286.0	61.7%
Rankin County	148.9	169.8	20.9%
Madison County	104.1	117.4	13.3%
Lamar County	78.6	89.4	10.8%
Hancock County	90.1	97.6	7.5%
Harrison County	326.3	332.5	6.2%
Lee County	168.5	174.6	6.1%
Jackson County	180.8	186.5	5.7%
Forrest County	155.6	160.6	5.0%
Pearl River County	59.9	64.7	4.8%

Social Vulnerability

The University of South Carolina 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 3.10.9 displays Mississippi's geographic variation in social vulnerability. According to the index, the following twenty Mississippi counties are the most vulnerable counties in the State.

Figure 3.10.9
Mississippi's Geographic Variation in Social Vulnerability

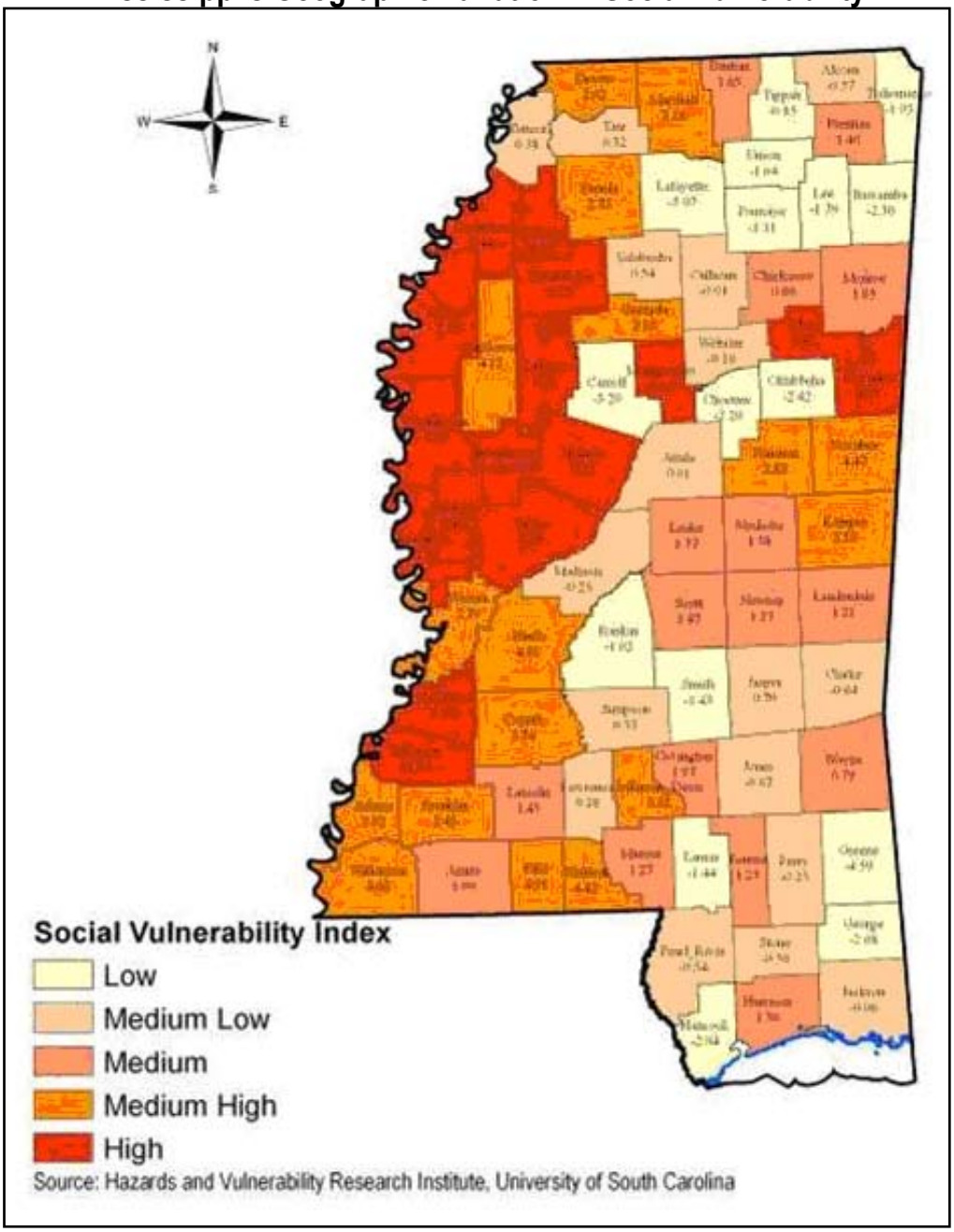


Table 3.10.14
Top Twenty Counties based on Social Vulnerability to Environmental Hazards, County Comparison within the State, 2000

County	SOVI 2000	National Percentile Ranking
Issaquena	12.7	99.4
Jefferson	10.54	98.8
Coahoma	9.44	98.3
Sharkey	9.4	98.3
Holmes	9.21	98.2
Humphreys	8.89	97.9
Quitman	8.02	97.4
Bolivar	7.98	97.3
Washington	7.78	97.1
Leflore	7.28	96.7
Montgomery	6.86	96.2
Claiborne	6.57	95.7
Clay	5.42	93.1
Tallahatchie	5.32	92.8
Yazoo	5.28	92.8
Lowndes	4.93	91.2
Pike	4.91	91.1
Wilkinson	4.66	90.3
Hinds	4.61	90.1
Noxubee	4.47	89.5

4.0: Comprehensive State Hazard Mitigation Program

Introduction

It is essential that State and local mitigation policy be directed to minimize 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 take full advantage of public-private partnerships.

Development of a sound mitigation strategy provides a focus that assists State and local governments to identify priorities and channel their limited resources towards critical mitigation projects. This process helps government at all levels make the most effective use of available resources.

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 of the State of Mississippi. The State will also vigorously pursue methods to augment existing state and local programs by involving other opportunities, such as public-private partnerships.

The State will provide education and training on the benefits of a comprehensive statewide hazard mitigation program for state agencies, local governments, private enterprises, and the citizens of the State of Mississippi will remain a priority.

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 2007 update planning process. The state has updated the framework of its mitigation strategy to improve its capabilities to track progress toward accomplishing the plan goals and to improve 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 2007 update process, the Hazard Mitigatin Council developed a mission statement and updated the goals and objectives from the previously approved plan. The updated 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 postdisaster damage assessments

Objective 1.6 Preserve, create, and restore natural systems to serve natural mitigation functions

Objective 1.7 Protect historic and cultural resources

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 to determine if they still addressed current and anticipated future conditions. The review 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 2004 plan;
- Types and status of mitigation actions from the 2004 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, a mission statement and updated goals and objectives were drafted and presented to the MHMC for review and approval at the second MHMC planning meeting and then revised to reflect their input.

The key issues identified in the statewide risk assessment and the analysis of local risk assessments can be found in Chapter 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 2007 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 7.5 Effective Use of Available Mitigation Funding.

Review of Local Goals and Objectives

The MHMC 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 84 plans) that have a similar goal or objective to each of the goals and objectives in the 2004 Mississippi State Hazard Mitigation Plan. 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

2004 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 2007 Updated Goals and Objectives
G1 Fund applied research projects to learn more about and mitigate natural hazards	0%	0%	0%	Objective 1.4
G2.1 Add to the overall public awareness of hazards in the state	63%	31%	94%	Goal 3
G2.2 Reduce deaths and injuries	80%	0%	80%	Goal 1
G2.3 Reduce damage and loss of property, infrastructure, and economic costs	63%	0%	63%	Goal 1

2004 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 2007 Updated Goals and Objectives
G3 Reduce destruction of natural and cultural resources	17%	20%	37%	Objectives 1.6 and 1.7
G4 Foster cooperation among all levels of governments and the private sector	80%	8%	88%	Objective 4.1
O1 Identify hazards, assess risk, and present mitigation strategies	8%	50%	58%	Goals 1 and 4
O2 Provide guidance to state and local mitigation teams for projects and funding opportunities through local mitigation planning	0%	48%	48%	Goal 2
O3.1 Encourage local governments to adopt zoning/ subdivision regulations	0%	32%	32%	Objective 2.2
O3.2 Encourage local governments to adopt comprehensive land use plans	1%	21%	23%	Objective 2.2
O3.3 Encourage local governments to adopt floodplain management ordinances	0%	42%	42%	Objective 2.2
O3.4 Encourage local governments to adopt building/ safety codes, including fire prevention codes	2%	42%	44%	Objective 2.2
O3.5 Encourage local governments to develop adequate enforcement capability	2%	43%	45%	Objective 2.2
O4 Develop partnerships to enhance private sector involvement	2%	67%	69%	Objective 4.1

The state goals most represented in local plans are Goal 2 and Goal 4. State Goal 2 is to identify strategies to include funding of three types of projects, each of which was compared to local goals and objectives. Ninety-four percent of local plans had a goal or objective to improve public awareness of hazards, 80 percent to reduce deaths and injuries, and 63 percent to reduce damage to property, infrastructure, and the economy. Several local plans discussed specific types of public outreach programs and intended audiences. For example, several identified the need to target visitors or tourists to Mississippi.

Eighty percent of local plans have a goal similar to State Goal 4: Foster cooperation among all levels of governments and the private sector. In addition, the state objective to enhance partnerships with the private sector was the one with the highest percentage of similar objectives in local plans. Interestingly, out of the five capabilities specified in Objective 3, the one with the highest percentage of similar objectives in local plans was the development of an adequate enforcement capability (45 percent).

The MHMC also analyzed other goals and objectives that occur commonly in local plans, but that 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. Those that were common to less than 5 percent of plans are not included. 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	73%
Promote local hazard mitigation plans	62%
Improve emergency response operations	60%
Increase local capacity for mitigation and emergency management	57%
Involve and/or educate public officials in natural hazards mitigation	54%
Enhance public warning and information systems	52%
Monitor effectiveness of measures and initiatives	40%
Identify and address repetitive loss properties	31%
Reduce damage to future buildings and infrastructure	20%
Increase property acquisitions	20%
Integrate mitigation in land use planning	20%
Promote the National Flood Insurance Program	20%
Encourage jurisdictions to implement and share GIS system	15%
Improve and retrofit public buildings	15%
Protect business continuity and economic vitality	15%

Common Goals and Objectives in Local Plans	Percentage of Local Plans with Goal or Objective
Improve sheltering capabilities	15%
Plan for continuity of local government operations	14%
Plan for vulnerable populations	14%
Develop or improve stormwater/drainage programs	14%
Improve communications systems	14%
Support State identified initiatives	12%
Improve evacuation capabilities	10%
Seek funding for mitigation	10%

The protection or retrofitting of critical facilities was the issue most common in local plans that is not specifically addressed in state goals, though it is part of the intent of Goal 2. Promoting local hazard mitigation plans was another common issue and usually occurred in county plans in reference to local municipalities. Improving emergency operations response was a frequent goal or objective in local plans (60 percent), as were other response-related items, such as warning systems, evacuations, and sheltering. More than half of plans also seek to increase local capacity for emergency management, specifically related to mitigation, and to involve and educate public officials in natural hazards mitigation.

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 mangement 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, demolition, acquisition, and relocation costs,
- Small Business Administration funds, and
- Federal Home Administration loan funds.

Each state agency from the 2004 plan was afforded the opportunity to review their mitigation capabilities from the existing standard plan and provide updates to their current agency capabilities. Agencies who did not have changes or provided updates are noted as *no change from the 2004 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, CAX, environmental, project application review, HAZUS and NEMIS Entry.

The Mitigation Grants Management Branch 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 Branch has developed a website, www.MitigationMS.org that allows local governments/eligible applicants to submit applications online.

Currently, over $45,000,000 in hazard mitigation grants has been provided to local governments. These grants include the acquisition of over 500 flood-prone homes at a cost of $15,000,000, flood protection and drainage grants of over $10,000.,000, grants for the installation of 3,000 Saferooms and storm and storm shelters for $7,000,000, and planning grants to regional and local governments for the development of hazard mitigation plans. Due to Hurricane Katrina, the State was allocated $433,000,000 in mitigation funds. Using these funds the State will continue to fund flood mitigation and protection of critical facilities along with several ongoing initiatives that include the generator, saferoom and siren initiatives.

The generator initiative has been funded at $31,000,000 and will be instituted is three phases. Phase I of the initiative was to purchase 16 trailer mounted generators, Seven of the generators stayed with MEMA and the other nine went to the six coastal counties and to Forrest and Jones County for emergency use. Phase II of the initiative is to fund each of the Six Coastal Counties and also Forrest and Jones County generators for nine critical facilities, totaling eighty one generators. Phase III of the initiative is to go statewide offering each County $100,000 for the first 10,000 residents and an additional $3 per resident over 10,000. Special Needs Shelters identified by the Department of Health are also being retrofitted with generators.

General population shelters are another ongoing project for the state. Currently shelter needs in the six coastal counties is being evaluated and funding provided for retrofitting to improve the existing sites by upgrading them to FEMA 361 standards and funding new construction of stand alone shelters. Three to Five new sites for shelters per county have been identified based on that particular county's need. Codes and Standards project is a post-Katrina project that allows a community to adopt or upgrade building codes, hire building inspectors, train and certify staff, buy equipment and supplies.

The Saferooms and Storm Shelters initiative began in 2001 and is an ongoing program. Since program inception, 3,000 shelters have been installed at a cost of $7,000,000. The amount of funding allocated for saferooms/storm shelters is $30,000,000. The Siren Initiative is an ongoing program that began 2004. The program initially was for the installation of sirens on college campuses but has now been expanded to include municipalities.

The Floodplain Management Branch manages the National Flood Insurance Program's Community Assistance Program for the 276 participating communities. Branch staff provides compliance visits, workshops, and technical assistance to local communities. The Map Modernization Program is a joint Federal-State effort to provide funding and technical assistance to local communities seeking updated flood maps in order to better plan and regulate development in identified special flood hazard areas. National Flood Insurance policies have increased in Mississippi from 41,000 to 71,000 since 2005.

The planning branch develops the State of Mississippi Standard Mitigation Plan, which documents statewide hazard risk and the capability to mitigate the risk. The planning branch 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, and administer Federal 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 meteorology 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

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 working with MEMA to develop GIS data system in order to have that data (what is in place/existing) prior to a disaster. This is under review by MEMA and not approved as of the 2007 plan update.

Department Of Audit

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

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

Marketing and Communications Division

Authority for mitigation: Miss. Code 1972, Annotated 33-15-2 and 33-15-3 (2005)

imely communication during and after a disaster to prevent loss of life and to mitigate public danager 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 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

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. DEQ 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.

DEQ 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, DEQ 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

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

Authority for mitigation: Miss. Code 1972, Annotated. 45-1-1 ET. Seq.

This agency 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 houses the Office of Homeland Security.

Department Of Wildlife, Fisheries, And Parks

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

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

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 website.
- 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 CBDG 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

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.
- Encourages and supports libraries to:
- 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. There is public trust in the library as a public institution. The library is not perceived as “the government.” The public is comfortable in a public library environment. The library has staff trained to assist the public; multiple point-of-access to high speed connectivity to facilitate communication; and, many times, the facilities to accommodate larger groups of people. All of these factors make libraries ideal as early responders to emergencies.

Mississippi Automated Resource Information Systems (MARIS)

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 manmade hazards.
4. In-house emergency coordination staff increased from four in 2005 to 12 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-sufficiently 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 deployed.
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 Educational Television

Authority for mitigation: Miss. Code 1972, Annotated. 37-63-1 Et. Seq.

This agency administers and supervises Educational Television and Radio. It can aid mitigation through its educational and public service programming.

Mississippi State Forestry Commission

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

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

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

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 all for-hire transportation, 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. Helps identify threats to public utilities by natural hazards.

Soil And Water Conservation Commission

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

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

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

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

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

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.

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 24-26, 2007, the annual conference of the Association of Floodplain Managers of Mississippi, May 1-3, the Mississippi Association of Supervisors annual conference June 18–21, the Mississippi Municipal League June 25–28, and the Mississippi Civil Defense Emergency Management Association June 2-27.

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: Miss Code 1972, 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.

Each county in Mississippi has a full or part-time emergency management program. As of September 15, 2003, 59 of Mississippi's 82 counties have Emergency Management designated full-time emergency management or civil defense directors. Twenty-three counties have part-time directors. Eighty-two counties have completed comprehensive emergency management plans 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.

***Auth*ority: 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: Miss. Code 1972, Annotated 43-41-11.

The National Flood Insurance Program (NFIP) has identified flood hazards in Mississippi communities. Presently, 71 counties, one water supply district (Pearl River Valley), and 205 municipalities participate in the NFIP, for a total of 276 "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 2004 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

When the original table in the 2004 plan was created, few jurisdictions had completed their local mitigation plans. Information collected from the 84 approved local hazard mitigation plans in Mississippi was used to update the table and provide additional information on capabilities. During the 2007 update process, 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 x: Local Mitigation Capabilities Assessment.

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	34	44%	128	38%
Building Code	29	52%	102	64%
Building Official	21	29%	72	49%
Zoning Ordinance	36	36%	124	55%
Subdivision Ordinance	33	39%	124	44%
Floodplain Ordinance*	82	87%	291	72%

*Adoption of floodplain ordinance is assumed based on participation in the NFIP, as calculated from the NFIP Community Status Book Report, June 7, 2007.

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 (87 percent) and cities (70 percent) have in place. In approved local plans that identified whether building codes had been adopted or not, 52 percent of counties and 64 percent of cities had adopted building codes. Of these codes, 40 percent are IBC, 57 percent are SBCCI Southern Standard Code, and 3 percent reported other codes.

Out of 82 counties, all 82 have adopted comprehensive emergency management plans and 58 have adopted FEMA-approved local hazard mitigation plans. It may be the case that the jurisdictions with greater population and capabilities are more likely to have completed their hazard mitigation plans and are also more likely to have adopted comprehensive plans and land use ordinances. Therefore, if accounting for all Mississippi local governments, and not just those with approved mitigation plans, the percentage with each local capability may be lower.

Table 4.3.2 shows the changes in local participation in the NFIP, CRS, and BCEGS from 2004 to 2007. There have not been significant changes, though four communities with identified hazard areas have joined the flood insurance program.

Table: 4.3.2
Change in Select Capabilities since the 2004 Plan

Capability	2004	2007
NFIP Participation Total	273	276
NFIP Participation Suspended	4	4
NFIP Not in Program with Hazard Area Identified	37	33
CRS Participation	19	19, 0 rescinded
BCEGS Rating	14**	37 cities and counties

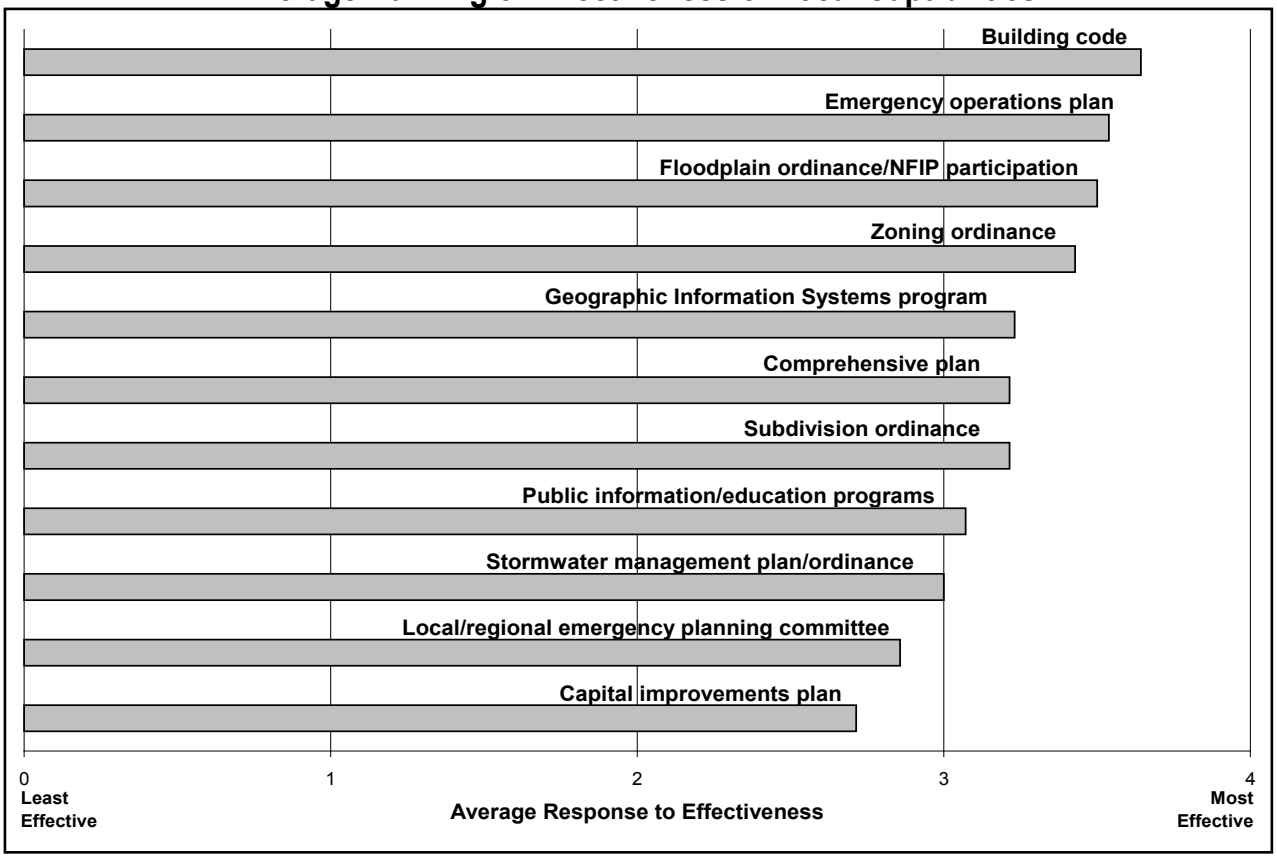
*NFIP Community Status Book Report is current as of June 7, 2007; CRS report current as of October 1, 2006
**According to Table 4.3.1 in 2004 Plan

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. Fourteen completed surveys were evaluated—seven from the Planning and Development District conference and seven from the Association of Floodplain Managers conference. 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 (79 percent) was building codes. This was followed by zoning ordinance (71 percent), floodplain ordinance /NFIP participation (57 percent), and geographic information systems (57 percent). The capability that the most number of respondents (21 percent) ranked as least effective for mitigation was capital improvements 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 the limited knowledge about hazard mitigation in local communities. The lack of county codes, ordinances, and staff; lack of enforcement of existing codes and ordinances; and new development in hazard areas were also cited by more than one respondent as challenges. Other challenges or weaknesses identified were the need for updated flood maps, local match funding, cooperation between counties and municipalities, public understanding about the need for codes and ordinances, and leadership in developing local plans.

Local adoption and enforcement of regulations, codes, and comprehensive plans was the opportunity most identified by respondents, followed by improved technology and GIS capabilities and additional training. Other opportunities for improving mitigation capabilities identified by respondents included joining the Community Rating System, assistance with buyout and grant applications, updated digital flood maps, disaster response and preparedness, improved coordination, and statewide adoption of regulations and codes.

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. Trainings 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 building codes, half or fewer 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 still 33 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 capabilties.
- 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.

**The local capabilities table referenced in the section will be included in the plan as an Appendix 7.4.

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:

- Multi-Hazard
- Hurricane
- Tornado
- Earthquake
- Flood
- Winter Storm
- Dam Safety
- Wildfire

These measures are classified in the following strategies:

- Prevention
- Property Protection
- Public Education and Awareness
- Technical Assistance
- Natural Resource Protection
- Emergency Services
- Structural Projects

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.

Completion – The year of completion has been identified. Some measures are completed on an annual basis.

Priority – Each measure has been ranked as high, medium or low priority.

This table is not intended to capture all the pertinent data regarding the mitigation action. Project profiles are given in the appendix which gives additional data. These project profiles 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.

Additionally, this table is sorted by additional categories in the appendix to present the information in a format that is easily interpreted. The tables and project profiles will be used interchangeably to assist with implementation of the projects

Local Mitigation Actions

As part of the 2007 plan update process, 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.

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
4	Dam Safety	Prevention	Development of Owner Emergency Action Plans	MDEQ	500,000	Private	2012	H
5	Dam Safety	Structural	Repair and Rehabilitation Federally Constructed Dams	MDEQ	10,000,000	Gramts	2017	H
6	Dam Safety	Structural	Establish Revolving Loan Program to Fund Dam Rehabilitation	MDEQ	20,000	Budget	Annual	H
7	Dam Safety	Prevention	Enforce Implementation of 2006 dam safety legislation	MDEQ	20,000	Budget	Annual	H
8	Dam Safety	Outreach and Education	Educate Dam Owners about 2006 Dam Safety Regulation	MDEQ	60,000	Budget	Annual	H
9	Dam Safety	Technical Assistance	Information Management for Inundation Area and Assess Vunerabilities	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
4	Earthquake	Outreach and Education	Yearly Information Meetings for Medical Community	MEMA	10,000	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
7	Earthquake	Technical Assistance	Informatation Management System with Site Specific Information	MEMA	100,000	HMGP	2010	H
8	Earthquake	Outreach and Education	Partnership Programs for Utilizing CCP Data	MEMA	10,000	Budget	Annual	H
9	Earthquake	Technical Assistance	Information Management System for Critical Facilities	MEMA	10,000	HMGP	2010	H

PROJECT No.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
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
12	Earthquake	Technical Assistance	Complete Local Building Vulnerability Analysis	MEMA	200,000	HMGP	2010	H
1	Flood	Prevention	Map Modernization: New Firm Adoption by Communities	MEMA	20,000	CAP, MMS	2010	H
2	Flood	Prevention	Map Modernization: Early FIRM Adoption by Communities	MEMA	20,000	CAP, MMS	2010	H
3	Flood	Technical Assistance	Map Modernization: Program Implementation	MEMA	7,000	CAP, MMS	Annual	H
4	Flood	Technical Assistance	Community Rating System: Program Implementation	MEMA	7,000	CAP	Annual	M
5	Flood	Property Protection	Repetitive Loss Structures: Target Group Mitigation	MEMA	10,000,000	HMGP, SRC, RLC, PDM-c, 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 Assoc.	MEMA	7,000	CAP	Annual	M
10	Flood	Technical Assistance	NFIP Implementation: Higher Regulatory Standard Adoption	MEMA	7,000	CAP	Annual	H
11	Flood	Technical Assistance	NFIP Implementation: Community Assistance Contact and Visit	MEMA	20,000	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	HMGP, FMA	2010	H
15	Flood	Technical Assistance	Information Management System for Critical Infrastruction	MEMA	100,000	HMGP, FMA	2010	H
16	Flood	Structural	Community Assistance for Flood Warning Systems	MEMA	1,000,000	FMA	2017	H
17	Flood	Technical Assistance	Support Reconstruction Pilot Program	MEMA	7,000	HMGP	Annual	H
18	Flood	Technical Assistance	Support Global Match Initiative	MEMA	7,000	HMGP	Annual	H

PROJECT No.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
19	Flood	Property Protection	Support Implementation of local RL Acquisition Program	MEMA	10,000,000	HMGP, FMA, PDM-c	2017	H
20	Flood	Property Protection	Support Implementation of local Elevation, and Floodproofing Programs	MEMA	10,000,000	HMGP, FMA, PDM-c	2017	H
21	Flood	Property Protection	Conitinue to Support floodproofing and hardening of water/wastewater systems	MDEQ	100,000,000	CDBG	2017	H
22	Flood	Emergency Service	Support acquisition of generators at existing WWTPs	MEMA	10,000,000	HMGP, CDBG	2017	H
23	Flood	Technical Assistance	Support updating of of stormwater ordinances to address future development	MEMA, MDEQ	7,000	Budget	2010	H
24	Flood	Technical Assistance	Support Llocal Capital Improvement Infrastructure Planning	MDEQ	7,000	Budget	2010	H
25	Flood	Technical Assistance	Develop a statewide floodplain management standard	MEMA	50,000	CAP-SSSE	2010	H
26	Flood	Technical Assistance	GIS Inventory of Hazardous Waste/ Materials Storage Facilities	MDEQ	150,000	HMGP, EPA	2010	H
28	Flood	Technical Assistance	Sheltering needs assessment	MEMA	50,000	HMGP	2010	H
32	Flood	Technical Assistance	Provide HAZUS flood runs to each county	MEMA	7,000	Budget	2008	H
33	Flood	Technical Assistance	Use HAZUS/HIRA flood data to update or confirm top 50 communities list	MEMA	2,500	FMA, CAP	2008	H
27	Flood	Technical Assistance	Develop a comprehensive GIS based inventory of levees	MDEQ	50,000	Map Mod, CTP, PDM	2010	H
1	Hurricane	Structural	Wind Resistant and Flood Resistant Critical Facilities	MEMA	10,000,000	HMGP	2017	H
2	Hurricane	Outreach and Education	Public Information Forums and Fairs Statewide	MEMA	7,000	Budget	Annual	H
3	Hurricane	Outreach and Education	Building Product Demonstrations	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
8	Hurricane	Property Protection	Develop Acquisition Relocation Projects	MEMA	10,000,000	USACOE	2017	H

PROJECT No.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
9	Hurricane	Technical Assistance	Encourage Local Adoption of Minimum Building Codes	MEMA	7,000	Budget	Annual	H
10	Hurricane	Structural	Encourage Use of Non-Hazardous Materails in Critical Facilities	MDEQ	7,000	Budget	Annual	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
13	Hurricane	Outreach and Education	Outreach to Local Coastal Officials on Preparedness for HIRA Findings	MEMA	7,000	HMGP	Annual	H
1	Multi-Hazard	Technical Assistance	Inventory of State Buildings, Critical Facilities and Infrastructure	MEMA	200,000	HMGP	2010	H
2	Multi-Hazard	Outreach and Education	Pre-disaster Mitigation Grant Applicantion Training	MEMA	25,000	Budget, HMTPA	Annual	H
3	Multi-Hazard	Outreach and Education	Mitigation Grant Education	MEMA	7,000	HMTAP	Annual	H
4	Multi-Hazard	Outreach and Education	"Storm Ready" Community Education	MEMA	7,000	Budget	Annual	H
5	Multi-Hazard	Property Protection	Adoption and Enforcement of Building Codes	MEMA	7,000	Budget	2010	H
6	Multi-Hazard	Technical Assistance	Develop Local Hazard Mitigation Planning	MEMA	20,000	PDM, HMGP	Annual	H
7	Multi-Hazard	Outreach and Education	Workshops for Evaluating Wind and Flood Damaged Buildings	MEMA	20,000	HMGP	Annual	H
8	Multi-Hazard	Outreach and Education	Develop, Train and Implement Strategies for State Owned Bldgs.	MDFA	40,000	HMGP	2010	H
9	Multi-Hazard	Emergency Services	Privide Auxilary Power Source for All Critical Facilities	MEMA	10,000,000	HMGP, Homeland Security Grants	2017	H
10	Multi-Hazard	Technical Assistance	Utilize NEMIS to Update Historical Data for Disasters	MEMA	10,000	HMGP, EMGP	Annual	H
11	Multi-Hazard	Technical Assistance	Coordinated Emergency Action Plans for Health Care Facilities	MEMA	10,000	HMGP, EMGP	Annual	H
12	Multi-Hazard	Technical Assistance	Develop Methodology for Future Development Trends for Vulnerability Analysis	MEMA	10,000	Budget	2010	H
13	Multi-Hazard	Natural Resources Protection	Wet Debris Management for Access, Water Quality and Environmental	MDMR	10,000,000	USACOE	2017	H

PROJECT No.	TYPE	STRATEGY	PROJECT NAME	AGENCY	PROJECT COST ($)	FUNDING STRATEGY	COMPLETION	PRIORITY
13	Multi-Hazard	Technical Assistance	Debris Management Plans	MEMA	1,000,000	HMGP, EMGP, Homeland Security Grants	2010	H
14	Multi-Hazard	Technical Assistance	Complete/enhance inventory of state owned/operated facilities	MDFA	300,000	HMGP	2010	H
1	Tornado	Technical Assistance	Update of Economic Risks	MEMA	7,000	Budget	Annual	M
2	Tornado	Structural	Public Access to Community Storm Shelters	MEMA	5,836,320	HMGP	2017	H
3	Tornado	Prevention	Warning System on College Campuses	MEMA	196,836	HMGP	2010	H
4	Tornado	Prevention	Warning System for Communities	MEMA	1,000,000	HMGP	2017	H
5	Tornado	Outreach and Education	Public Education and Outreach through "A Safe Place to Go"	MEMA	7,000	Budget	Annual	H
6	Tornado	Prevention	Partnership Programs for Purchasing Weater Radios for Individuals	MEMA	500,000	HMGP	2017	H
7	Tornado	Outreach and Education	Public Outreach and Education for Homebuilders and Developers	MEMA	7,000	Budget	Annual	H
8	Tornado	Structural	Indiviual Assistance for "Safe Room" Program	MEMA	500,000	HMGP	2017	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
1	Winter Storm	Structural	Placement of Auxillary Power Sources at Critical Facilities	MEMA	$ 31,968,000	HMGP	2017	H
2	Winter Storm	Outreach and Education	Public Education and Outreach	MEMA	$ 7,000	Budget	Annual	H
TOTAL PROJECT COSTS					**$708,766,656**			

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.

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

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 Mississippi Emergency Management Agency (MEMA) Tel: (601) 933-6362 Fax: (601) 933-6815 bboteler@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 (Technical Assistance Only): Tel: (601) 933-6362 Fax: (601) 933-6815 bboteler@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 Tel: (601) 933-6362 Fax: (601) 933-6815 bboteler@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 Tel: (601) 933-6362 Fax: (601) 933-6815 mcarter@msmema.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) www.doc.gov/eda N. Mississippi (404) 730-3020 S. Mississippi (859) 224-7426
Economic Development Program	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	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	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	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	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	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 Evironmental Quality Tel: (601) 961-5171
Homeowner Assistance Program (Phases I and II)	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	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	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	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 Unemployement Assistance	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	Provides temporary housing for storm victims	FEMA (800) 621-3362 www.fema.gov
Small Business Disaster Bridge Loan Program	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)	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	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 Eonomic Development (800) 998-9999
Brownfields Economic Development Initiative (BEDI) Program	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 Eonomic Development (800) 998-9999

Program / Activity	Type of Assistance	Agency & Contact
Rural Business Opportunity Grants (RBOG)	Provides technical assistance, business development, and planning in rural communities with exceptional need	U.S. Department of Agriculture (USDA) State Office (601) 965-4316
Rural Impact Fund Grant Program	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	Provides grants to promote economic growth by improving public infrastructure.	Mississippi Development Authority Tel: (601) 359-3179
Development Infrastructure Program (DIP)	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	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	Makes loans to counties or municipalities to construct or improve public infrastructure.	Mississippi Development Authority Tel: (601) 359-3179
Mississippi Economic Redevelopment Program	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	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	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	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	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	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	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	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	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	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	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 Tel: (601) 933-6362 Fax: (601) 933-6815 lbowman@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815
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 Tel: (601) 933-6362 Fax: (601) 933-6815
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

Program / Activity	Type of Assistance	Agency & Contact
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
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

Program / Activity	Type of Assistance	Agency & Contact
Self-Help Homeownership Opportunity Program (SHOP)	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	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
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

Program / Activity	Type of Assistance	Agency & Contact
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 Tel: (601) 933-6362 Fax: (601) 933-6815 agoodman@msmema.org
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 Tel: (601) 933-6362 Fax: (601) 933-6815 bboteler@msmema.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

Program / Activity	Type of Assistance	Agency & Contact
Non-Structural Altematives to Structural Rehabilitation of Damaged Flood Control Works	Provides direct planning and construction grants for non-structural altematives 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
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 Tel: (601) 933-6362 Fax: (601) 933-6815 bboteler@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 agoodman@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 jcartright@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 jcartright@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 agoodman@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 agoodman@msmema.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 G.I.S. (601) 961-5506 MEMA Tel: (601) 933-6362 Fax: (601) 933-6815 agoodman@msmema.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 Tel: (601) 933-6362 Fax: (601) 933-6815 jcartright@msmema.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 Brownfield 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 of 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 j 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

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.**	**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
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

Program / Activity	Type of Assistance	Agency & Contact
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.**	
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

Program / Activity	Type of Assistance	Agency & Contact
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
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

5.1: 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.

It is the goal of the state to have an approved mitigation plan in every community in the state. The State 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 on of the ten regional planning and development districts. These District 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
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
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

5.2: Local Plan Integration

44 CFR 201.4(c)(4)(ii) - The State mitigation strategy shall include the following elements:

A section on the Coordination of Location 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

The Mitigation Section of MEMA reviews all local hazard mitigation plans based on the FEMA local plan crosswalk. Plan review by the State is completed within 45 days of the receipt of the plan. Plans that pass the state review are forwarded on 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. The Mitigation Section will continue to use this review process for new plans and updates to local plans.

For local plans that do not pass State review and require additional work, the Mitigation Planning Section provides a crosswalk with explanations of the actions and or changes that must occur in order to bring the jurisdiction's 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 five mitigation planners assigned to regions within the State.

It is encouraged by FEMA that local hazard mitigation plans that have been approved should complete the plan adoption process within 90-days of FEMA approval.

Linking Local Plans to the State Plan

During the 2007 plan update process, the State gathered information from local plans to integrate this data into the State plan. The MHMC 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 2007 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 3.3 Assessing Vulnerability and Estimating Potential Losses by Jurisdiction, 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 Section 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 2007 update reflects the successful integration of the plans from about three-fourths of the 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. One challenge in this approach was the repetition in mitigation strategies identified among the local governments. 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.

One constraint in linking the local plans is the different types of information provided in the plans. The local risk assessments used different methods and interpretations to determine vulnerability and different measures to assess risk. Therefore, it was challenging to compare the counties to see where one might be more vulnerable to a particular hazard than another. In addition, not all counties developed a local capability assessment, and those that did included different types of information. This information was also difficult to summarize and compare. Consistency in plan quality and methods will be improved through future mitigation planning workshops that will emphasize FEMA's new guidance on local plan updates.

5.3: Prioritizing Local Technical Assisstance

44 CFR 201.4(c)(4)(iii) - The State mitigation strategy shall include the following elements:

A section on the Coordination of Location 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 high risk 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.

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, 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.
- The community has demonstrated the ability to form effective public-private natural disaster hazard mitigation partnerships.
- The community has identified a higher level of development pressure.

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; and
- The extent to which assistance will fund activities in small impoverished communities.
- The extent of development pressure.
- 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.

While the State does not maintain a list of communities specifically designated as small and impoverished, it does have communities that have been designated as distressed and targeted. MEMA has received assistance from the Mississippi Development Authority Community Development Block Grant program in determining those communities that meet the criteria. These communities appear to meet the intent of the Disaster Mitigation Act of 2000's definition of small and impoverished.

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.

6.0: Plan Maintenance Process

44 CFR 201.4(c)(5)(i) - 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 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 Mississippi 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.

The Mississippi Hazard Mitigation Council is responsible for maintaining the Mississippi Standard Hazard Mitigation Plan.

6.1: Monitoring, Evaluating and Updating the Plan

44 CFR 201.4(c)(5)(ii) - The State mitigation strategy shall include the following elements:

A Plan Maintenance Process that includes:

A system for monitoring implementation of mitigation measures and project closeouts.

6.1.1 Plan Monitoring

The Mississippi Hazard Mitigation Council participants will review the goals, objectives, and action items listed in the plan on a yearly basis. They shall be responsible for communicating any desired or necessary changes to the Mississippi Emergency Management Agency and other stakeholders. The Mississippi 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 the Appendices 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 Mitigation Branch will be responsible for updating the plan accordingly, on a five year cycle, described below. A memorandum, describing needed changes, and progress on implementation will be provided annually MEMA, FEMA Region I and the Mississippi Hazard Mitigation Council.

6.1.2 Plan Evaluation

The Mississippi Hazard Mitigation Council and each participating agency will perform a more comprehensive review of the Plan every two years. 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?

In addition to answering these questions, the Mississippi Hazard Mitigation Council will use the two year meeting as an opportunity to:

- Review updates of Risk Assessment data and findings, including new events and data
- Discuss methods of continued public and stakeholder participation
- Document successes and lessons learned based on actions that were accomplished during past two years

Any resulting updates or changes will be included in the Plan. Again, the Mississippi Hazard Mitigation Council and the Mississippi Emergency Management Agency Mitigation Branch will be responsible for making the changes and will provide the updates via a memorandum as described above and will keep files of changes needed for the five year re-submittal.

6.1.3 Plan Updates

The Mississippi Hazard Mitigation Council is responsible for making updates to the Plan, but the Agency participants are responsible for the content of the updates. The Agencies will provide institutional-level updates to the Plan when necessary as described above. At the time of this 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 five 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 and State and Local community should be directly involved in reviewing and updating the Plan. The Mississippi Hazard Mitigation Council and their representatives should solicit feedback from the public during monitoring, evaluating, and updating the Plan as described above.

A maintained copy of the plan will reside on the Mississippi Emergency Management Agency website, on a homepage devoted to Hazard Mitigation and Emergency Preparedness. Then annual and biennial status memorandums will also be posted on the site.

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 location of these copies will also be posted on the Mississippi Emergency Management Agency website. The site will contain contact information for members of the MAC to which the public can direct their comments and concerns. All public feedback will be forwarded to the appropriate institution for review

In addition to these activities, many of the education and outreach activities will contribute to 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 their 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 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

Mississippi Emergency Management Agency will implement the State Plan and administer the mitigation programs utilizing the following positions:

State Hazard Mitigation Officer (SHMO)

The Governor's Authorized Representative (GAR) designates the SHMO. The SHMO has overall management responsibility for the program and is the state official who is ultimately responsible for ensuring that the state properly carries out its Section 404 and Section 409 responsibilities subsequent to a Presidential Disaster Declaration. In this regard, the SHMO will monitor the activities of the mitigation staff and the State Hazard Mitigation Team. Responsibilities include, but are not limited to:

- Ensure the Administrative Plan is updated, outlining how the state will administer the Hazard Mitigation Grant Program and other applicable hazard grant programs.
- Ensure that the State Hazard Mitigation Plan is active and identifies potential hazard mitigation projects, as well as establish priorities among those projects.
- Ensure that all potential applicants are notified of the program and receive the assistance to which they are entitled.
- Ensure that a proper initial application and any necessary supplemental applications, including SF-424's, are submitted in a timely fashion to the FEMA Regional Director.
- Ensure that technical assistance is provided to potential applicants and/or eligible subgrantees.
- Ensure that adequate procedures are developed for the distribution of financial assistance to eligible subgrantees by the technical assistance staff.
- Ensure development of a system to monitor completion of approved projects in federally required time frames.
- Ensure that a system exists to monitor subgrantee accounting systems and compliance with 44 CFR parts 13 and 14.
- Ensure that appropriate state agencies are on the State Hazard Mitigation Team and are involved as necessary with the hazard mitigation process.
- Ensure participation of the appropriate local agencies in the administration and implementation of the hazard mitigation process.
- Coordinate with the GAR on all policy/regulatory issues. Review and make appropriate recommendation to GAR regarding appeals, cost overruns/underruns and all other program issues.

Special Projects Officer/Grants Manager

The Special Projects Officer/Project Manager is responsible for program coordination, implementation and administration. The manager 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 project manager'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 for 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 extension requests and appeals, and for closing out completed projects.
- Coordinate 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.
- Help update the State Hazard Mitigation Plan.
- Conduct site visits to monitor progress and provide technical assistance.
- Assist the SHMO in conducting mitigation conferences and or public meetings.

Special Projects Officer/Floodplain Manager

The Floodplain Manager is responsible for the planning, promotion, direction and evaluation of floodplain management issues. Work involves advising and assisting the Director and SHMO in a statewide program and normally involves frequent contacts with state and local officials, public agencies, community and civic groups etc. Duties also include conducting special studies and surveys and planning and participating in workshops, conferences and exercises. Other duties include, but are not limited to:

- Supervise, plan and conduct special studies and surveys necessary for the organization, planning and evaluation of floodplain management activities including hazard mitigation.

- Advise and assist local officials on floodplain management matters; interpret and explain federal requirements and procedures; maintain liaison with federal representatives on floodplain management matters.
- Plan and participate in floodplain management training, workshops, conferences and test exercises, particularly in those program areas in which responsibility is delegated.
- Make public appearances before civic and community groups to promote the floodplain management program.
- Correspond with local officials, government agencies; federal floodplain management representatives, etc. prepare reports as required.
- Assist local communities throughout the state in preparation of ordinances, pamphlets, training and education documents and various planning reports.
- Travel extensively throughout the state to conduct community assistance visits and make community assessments.
- Review ordinances for compliance with federal and state regulations.

Technical Support

A technical support staff member is responsible for assisting the SHMO, Project Manager, and Floodplain Manager in all aspects of administration of the mitigation program. Examples of work performed in addition to assisting both the SHMO, project manager and floodplain manager include, but are not limited to:

- Conduct on-site reviews of subgrantee program operations and activities and financial records and report significant findings.
- Review and examine vendor uses to determine adequacy of services and compliance with state and federal rules, regulations and procedures.
- Perform budget reviews to determine cost/service appropriateness of each item and proper cost of each budget category.
- Examine documents to determine that expenditures are charged against correct appropriation accounts and that expenditures fall within the intent of the appropriation, the law, and are in the form in which the account was established.
- Gather, reconcile and prepare financial and program data pertaining to budgetary control, state and federal cost reports, personnel services and non-appropriated funds.
- Examine expenditures for propriety and reasonableness.
- Compose correspondence as necessary for areas of responsibility.
- Review current federal and state regulations concerning mitigation programs so as to maintain currency of knowledge and standards that are necessary to the performance of subgrantee review.

- Provide technical assistance to subgrantees through site visits, written correspondence and telephonic means.
- Explain to subgrantees the purpose of and the procedures and obligations involved in a review.

Administrative Assistant

The Administrative Assistant performs skilled clerical work and provides secretarial services for mitigation staff. 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:

- Supervise and participate in the receipt and processing of correspondence; the preparation, coding and typing of personnel, purchasing, supply, financial and other documents; and the checking and posting of program transactions.
- Organize work and coordinate workflow; establish priorities, set deadlines and review work for adequacy, accuracy, timeliness and conformance with instructions and standard practice.
- Receive visitors and answer calls, ascertain the purpose of calls and visits, and furnish information from knowledge of agency policies, rules and procedures.

Perform a variety of supportive secretarial duties for administrative staff.