



City of Bay St. Louis Local Hazard Mitigation Plan

September 2011



The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Bay St. Louis developed this Local Hazard Mitigation Plan (LHMP) update to make the City and its residents less vulnerable to future hazard events. Similar to the 2005 LHMP, this plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 so that Bay St. Louis would be eligible for the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation and Hazard Mitigation Grant programs as well as lower flood insurance premiums (in jurisdictions that participate in the National Flood Insurance Program's Community Rating System).

The City followed a planning process prescribed by FEMA, which began with the formation of a hazard mitigation planning committee (HMPC) comprised of key county, city, and district representatives and other stakeholders. The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to Bay St. Louis, assessed vulnerability to these hazards, and examined the capabilities in place to mitigate them. Bay St. Louis is vulnerable to many hazards that are identified, profiled, and analyzed in this plan. Hurricanes, floods, severe weather, tornadoes and wildfires are among the hazards that can have a significant impact on the City

Based on the risk assessment review and goal setting process, the HMPC identified the following goals and objectives, which provide the direction for reducing future hazard-related losses within the Bay St. Louis Planning Area.

Goal 1: Protect the lives and property of the residents in Bay St. Louis from natural hazards.

Objective 1.1: Use the best approaches and technology to protect buildings including relocation, acquisition and elevation, if feasible.

Objective 1.2: Implement innovative capital programs to address infrastructure issues.

Objective 1.3: Continue to enforce existing regulatory measures that ensure that new development will not increase threats to existing properties or to new development.

Goal 2: Through education, maintain a flood and hurricane alert and aware resident population.

Objective 2.1: Establish educational libraries and programs in conjunction with partners to bring new information to the residents and businesses located in Bay St. Louis.

Objective 2.2: Provide outreach efforts on mitigation and the threat of flooding to residents and businesses located in areas that are specifically threatened by flooding.

Objective 2.3: Where possible provide model projects.

Goal 3: *Increase the number of households that voluntarily adopt measures that protect their homes and property.*

Objective 3.1: Provide information about existing mitigation technologies, options and programs to assist with mitigation of structures against hazards to residents and businesses in hazard areas.

Objective 3.2: Seek model projects.

Goal 4: *Ensure the continuity of emergency services during storms and high water situations.*

Objective 4.1: Make structural improvements to city and school district buildings to ensure the continuity of emergency services during major hazard events.

Objective 4.2: Provide for general purpose shelter within the City.

Objective 4.3: Establish emergency routes or retrofit existing roadways to insure continued use during hazardous situations.

Objective 4.4: Ensure that dispatchers are prepared for emergency situations.

Goal 5: *Increase the capacity of the Public Works Department to serve the residents of the City of Bay St. Louis*

Objective 5.1: Implement innovative capital programs to address infrastructure issues.

Objective 5.2: Continue existing programs to ensure existing drainage ways are unimpeded.

Objective 6.3: Improve evacuation routes.

Goal 6: *Participate actively with Hancock County to provide the best possible emergency services to the residents of Bay St. Louis.*

Objective 6.1: Participate in the development of the Update of the County's Hazard Mitigation Plan.

Goal 7: *Develop a partnership with the Hancock County Board of Supervisors and the City of Waveland to find effective solution to flooding problems in Bay St. Louis*

Objective 7.1: Participate in the County's Hazard Mitigation Plan.

Objective 7.2: Coordinate with county programs that provide additional data to the City.

Objective 7.3: Participate with county programs that provide additional data to the City.

To meet identified goals and objectives, the plan recommends 30 mitigation actions, which are summarized in the table that follows. This plan has been formally adopted by the City of Bay St. Louis and will be updated every five years at a minimum.

Table 1 Bay St. Louis Mitigation Actions

Action Item	Priority	New Action/ 2011
New 2011 Actions		
2011-01. Apply to ISO to Further Lower CRS Rating	High	Yes
2011-02 Develop a Repetitive Loss Plan for the Annexed Area of the City	High	Yes
2011-03 Require that New Development in Annexed Area Include Neighborhood green Space for Absorption of Runoff and Wildfire Control.	High	Yes
2005 Actions		
2005-40 Establish a Program to Offer CEUs to Real Estate and Insurance Professionals on Hazard Mitigation.	High	No
2005-43 The Building Office Should Continue to offer Site Specific Information to Property Owners and Update the Data Available as it is Made Available by the Tax Assessor, FEMA and MEMA.	High	Yes (modified from 2005)
2005.46 Seek Funding to Assist Homeowners Located in Special Flood Hazard areas to Mitigate Their Homes from Flooding through Elevation and Acquisition.	High	No
2005.47 Market the Hazard Mitigation Loan Program to Home and Businesses	Low	No
2005-48 Participate in the Development of the County Hazard Mitigation Plan	High	No
2000 Actions		
2001-01 Continue to Maintain FEMA Elevation Certificates on Buildings in Bay St. Louis	High	No
2000-02 Continue to Enforce Ordinance No. 400 Requiring One Foot of Freeboard.	Omitted	No
2000-03a Continue to Enforce City Ordinance No. 285 to Protect Natural Drainage from Development.	High	No
2000-03b Continue to Enforce City Ordinance No. 285 to Include Erosion, Coastal Erosion, and Sediment Control BMPs as Required by NPDES Phase II program.	High	No
2000-04 Continue to Enforce the City's Subdivision Regulations to Require that Streets in Subdivisions are Located Above Flood Elevation to Prevent Isolation.	High	No
2000-5 Continue to Mail Out a City-Developed Brochure to Owners of Property	High	No
2000-6 Continue to Implement the City's Substantial Drainage Rule.	High	No
2000-7 Continue to Implement Drainage Standard Operating Procedure.	High	No
2000-8 Continue to Enforce the Stream Dumping Ordinance to Prohibit Depositing of Debris in the Drainage System.	High	No
2000-9 Continue to Enforce Standards for Hurricane Resistant Construction and the International Building Code.	High	No
2000-10 Post Awareness Posters in City Offices	High	No
2000-13 Continue to Enforce the City's Tree Ordinance.	High	No
2000-15 Digitize Property maps to include BFE and Flood Hazard Information	High	No

Action Item	Priority	New Action/ 2011
2000-16 Continue an Internet Website to Make Hazard Mitigation Information and Programs and Requirements in Bay St. Louis Available to the Public.	High	No
2000-17 Participate in Hurricane Awareness Week by Adopting a Proclamation.	High	No
2000-18 Participate in the Annual Mississippi Homebuilders Association Fair and Exposition, Providing Hazard Mitigation Information and Related City Programs and Regulations.	High	No
2000.20 Continue Hurricane and Storm Safety Curriculum in Bay-Waveland High School	High	No
2000-21 Implement Flood Awareness/Storm Surge Markers in Special Flood Hazard Areas.	High	No
2000-22 Partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information for All Hazards	Moderate	No
2000.23 Develop a five-Year Capital Improvement Program and Continue to Upgrade Drainage Facilities throughout the City to Protect Public and Private Properties.	High	No
2000-35 Continue to Update Floodproofing, Retrofitting, and Construction Technology Resources in the Hancock County Library-Bay St. Louis Branch and in the Building Office of the City of Bay St. Louis	High	No
2000.36 Coordinate with Adjacent Communities to Assure that Actions Taken in one Community will not Contribute to Greater Impact by Hazards in the Shared Floodplain.	High	No

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1.1 Purpose

The City of Bay St. Louis prepared this Local Hazard Mitigation Plan (LHMP) update to the 2005 Federal Emergency Management Agency (FEMA) approved Bay St. Louis Multi-Hazard Mitigation Plan. The purpose of this plan update is to guide hazard mitigation planning to better protect the people and property of the City from the effects of hazard events. This plan demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision-makers direct mitigation activities and resources. This plan was also developed, among other reasons, to ensure Bay St. Louis' continued eligibility for certain federal disaster assistance: specifically, the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA). Completion also earns points for the National Flood Insurance Program's Community Rating System (CRS) which can lower flood insurance premiums for home and business owners in participating CRS communities.

1.2 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses incurred by insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of \$4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents Bay St. Louis' hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the City will use to decrease vulnerability and increase resiliency and sustainability.

The Bay St. Louis LHMP update is a single-jurisdiction plan that geographically covers the entire area within Bay St. Louis' jurisdictional boundaries (hereinafter referred to as the planning area).

This plan update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the *Federal Register* on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA or DMA 2000.)) While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to hazards related to its waterfront location, access to these funding streams is vital.

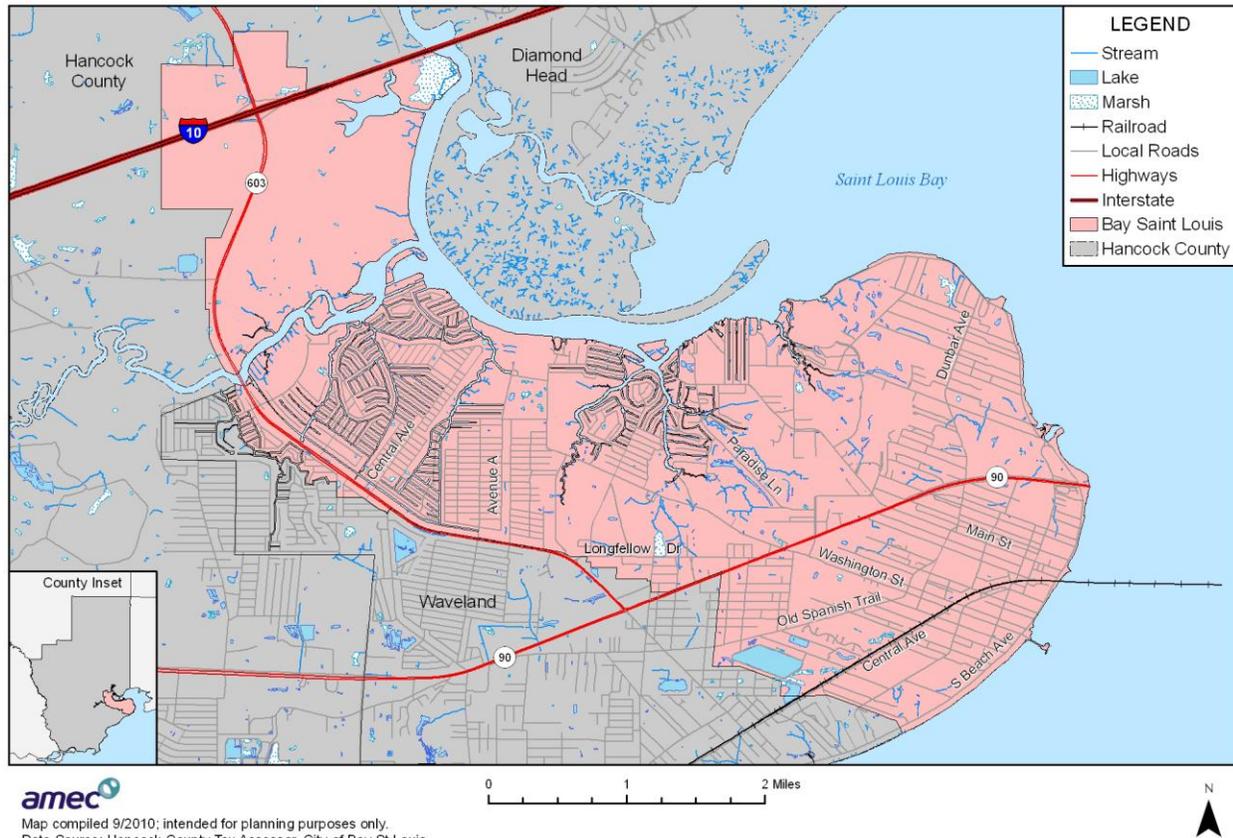
Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The planning area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and maintaining eligibility for mitigation-related federal funding.

1.3 Community Profile

1.3.1 Overview of the Community

Bay St. Louis is the larger of the two incorporated cities located in Hancock County on the Mississippi Gulf Coast. It the seat of government for Hancock County and shares boundaries with the City of Waveland on the west, with the Mississippi Sound of the Gulf of Mexico on the south, the Bay of St. Louis and Harrison County on the east and unincorporated Hancock County on the west and north. Bay St. Louis is located approximately 145 miles south of Jackson, Mississippi, 58 miles east of New Orleans, Louisiana, and 93 miles west of Mobile, Alabama. State Highway 603 runs north and south along the western boundary of Bay St. Louis. U.S. Highway 90 runs east and west from the eastern City Limits through the City. Both highways intersect with Interstate Highway 10 allowing easy commuting to New Orleans and other communities to the east and west and access to other major north-south highways. The City of Bay St. Louis is shown in Figure 1.1.

Figure 1.1. Bay St. Louis



Map compiled 9/2010; intended for planning purposes only.
Data Source: Hancock County Tax Assessor, City of Bay St. Louis, GRPC

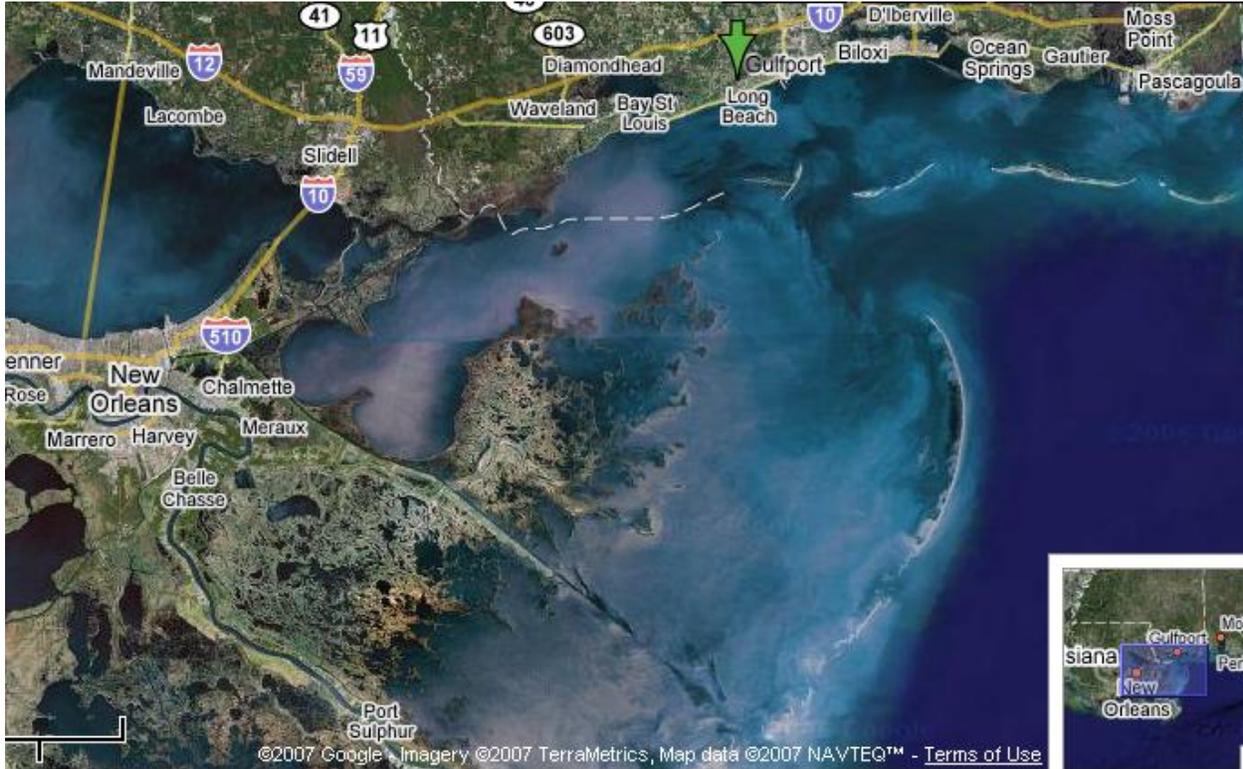
Source: FEMA 549/July 2006, Mitigation Assessment Team Report Hurricane Katrina on in the Gulf Coast

1.3.2 Topography and Climate

Bay St. Louis’s topography is characterized by a coastal, sandy beach along the south, east and northern shore of the Bay of St. Louis. A ridge reaching an altitude of approximately 21 National Geodetic Vertical Datum (NGVD) runs east and west through the central part of the city stretching from south of the railroad northward to just south of U.S. Highway 90. The elevation of the ridge drops to below 10 feet near Watts Bayou and Joe’s Bayou. In 2006, the City annexed lands lying to the northwest to just west of Mississippi Highway 603 and to the intersection of Highway 603 with Interstate 10. Elevations in Bay St. Louis now vary from 21 feet NGVD along the bluff running along the mouth of the Bay to a low only a foot or two near Bayou La Croix and Jourdan River in the annexed area along Highway 603.

Bay St. Louis’ southern boundary is found in the waters of the Mississippi Sound. The Mississippi Sound is a relatively shallow body of water with the average depth of 2.97 meters and is separated from the Gulf of Mexico by a series of barrier islands. South of Bay St. Louis lie the low, marshy islands of the Louisiana Marshes. Lake Bourgne, a wide saltwater bay, is situated to the southwest and the mouth of the Mississippi River and is almost due south of Bay St. Louis. These features can be seen in Figure 1.2.

Figure 1.2. Topography of the Gulf of Mexico



Source: Mitigation Assessment Team Report, Hurricane Katrina in the Gulf Coast (FEMA 549/July 2006)

Based upon information in the 2005 Hazard Mitigation Plan, the climate is mild with mean annual temperatures in the upper sixties. Average winter temperatures range from 50 to 60 degrees Fahrenheit. Rainfall averages approximately 57 inches annually with the majority of the accumulation between July and September. Winds in the area generally vary from southeasterly to southwesterly with wind speeds usually remaining under 10 miles per hour. Wind speeds increase during periodic coastal storms. Thunderstorms occur between 70 and 80 days a year; many of these storms are accompanied by strong to severe winds

1.3.3 History

French explorer, Pierre Le Moyne Bienville explored the Bay in 1699, naming it St. Louis in honor of the feast day of St. Louis. In December 1699 a fort was built on Bay St. Louis and populated with fifteen soldiers and five families, establishing the third French settlement on the Mississippi Gulf Coast. Over the next twenty years, the capital of the French coastal colony was moved from Biloxi to Mobile, then to New Orleans in 1722. Over the next century, the area was transferred from France to England and then to Spain that recognized the property rights of settlers living there. The area later was incorporated into the Louisiana Territory in 1810.

The City of Bay St. Louis and the neighboring city of Waveland were originally combined and known as Shieldsboro. In January of 1811 the area became a possession of the United States

with raising the flag on the shores of Bay Saint Louis and in 1817 Mississippi was admitted to the Union as a state. The arrival of a Post Office in 1819 put Shieldsboro on the national map.

Shieldsboro was incorporated on April 21, 1818 and became the seat of county government for Hancock County in 1869. The area was a favorite resort for Mississippi Delta planters and New Orleans professionals and aristocrats who reached the Mississippi Gulf Coast area by coastal steam boats via the Mississippi River and the Mississippi Sound. The completion of the New Orleans, Mobile, and Chattanooga Railroad in 1869 played an important role in the development of the town as a summer resort. Due to popular demand, the name of the town was changed from Shieldsboro to Bay St. Louis and was incorporated by the Mississippi Legislature on February 24, 1882. Known locally as “The Bay,” the City’s old town charm, mild climate, historical homes, and picturesque scenery continue to attract regional and national visitors.

1.4 Economy

1.4.1 Early Economic Development

Coastal Hancock County, where Bay St. Louis is located, is steeped in unique history of traditions that set the coastal region apart from the rest of Mississippi. The unique history was created by an influx of different adventurers looking for riches, power, and a new world. These adventurers settled an area offering vast scenic and natural resources. This historic industries of the area relied upon the resources found there. Timber-related activities, fishing, and tourism sustained the area well into the twentieth century.

The establishment of a NASA rocket testing facility in northwestern Hancock County brought a new economic dimension to the area, and development of the test site in the 1960s marked the start of double-digit population growth in Hancock County and its communities. The name of the test facility was later changed to the John C. Stennis Space Center in honor of long time supporter and U.S. Senator John C. Stennis, and the facility remains the premier rocket testing and technology facility in the United States. The John C. Stennis Space Center has brought with it a population of technical and scientific personnel who have relocated to the area including Bay St. Louis and numerous nationally known contractors supporting the center.

1.4.2 Current Economic Opportunities

Bay St. Louis and surrounding Hancock County and coastal Mississippi has a healthy and diverse economy ranging from tourism, focused mainly along the coastal communities, to technology and scientific endeavors that are centered at NASA’s John C. Stennis Space Center that covers approximately one half of the land area of Hancock County. Stennis Space Center is the premier national site for testing rocket engines and world class research center that has been an economic magnet for more than 40 years. Approximately 35 commercial interests have set up operations in and around the center and range from such technology giants as Boeing, Digital Media, and Lockheed Martin. The center is known as a world-wide leader in the geospatial remote sensing technology field. The site is located in northwestern Hancock County on the

Pearl River. Parts of the facility were flooded by storm surge from Katrina, but most of the facility was operational soon afterward.

Table 1.1 shows the employment and unemployment rates along with industry employment by major classification for Hancock County, including Bay St. Louis.

Table 1.1. 2000 Employment Occupations Classifications

Occupation Classification	Percent Employed
Management, Professional, and Related Occupations	27.9
Service Occupations	23.5
Sales and Office Occupations	24.9
Farming, Fishing, and Forestry Occupations	0.0
Construction, Extraction, Maintenance Occupations	10.3
Production, Transportation, and Material Moving Occupations	13.4

Source: U. S. Census Bureau, American Fact Finder; Profile of Selected Economic Characteristics; 2010 American Community Survey – 1 Year Estimates

According to 2000 Census data, household income in Bay St. Louis was derived primarily from private wages and salaries (75.7 percent); the next highest category for wages was government at 15.5 percent. The 1999 median household income for the area was \$35,202, and the per capita income was \$17,748. Annual median family income was reported to be \$40,307. Median full-time income for male wage earners was reported to be significantly higher (\$32,999) than that of female wage earners (\$22,066). The 2010 Census is in process but not yet available.

There are no designated industrial parks in Bay St. Louis, but the Port Bienville Industrial Park, Stennis Space Center, and Stennis International Airpark, all in Hancock County, are located within a few miles of Bay St. Louis. Among tenants operating at Port Bienville are Calgon Carbon Corporation, Con-Tech Power Systems, General Electric Plastics Company, and Wellman of Mississippi, Inc., all major manufacturers. There are also several metal fabrication plants, producers of polymers and chemicals located in the park. As its name suggests, Port Bienville is a waterfront industrial park. Most of the facilities at Port Bienville were damaged by Katrina’s storm surge; however, in the 5 years since the storm, most are back in operation.

Stennis International Airpark is located immediately north of Interstate 10 on State Highway 603 and is home to several light industries and airport dependent industries. The largest is Memphis International that employed 40 persons pre-Katrina, followed by Koenig Stainless, Inc. with 29 employees. The airpark was flooded by storm surge from Hurricane Katrina but the runways and most facilities were soon back in operation.

The airport has full air traffic control capabilities and handles flights bringing tourists from distant locations to the casinos in Hancock County. The airport was used as a staging site for aircraft supporting response to the British Petroleum oil well disaster in the Gulf of Mexico that occurred in April 2010.

1.4.3 Impacts of Natural Hazards

According to the State Hazard Mitigation Plan, Hancock County has a significant hazard level for hurricanes, tornadoes, and flooding. The worst of those disasters the County must deal with is hurricanes. Two of the most deadly and intense hurricanes to strike the U.S, Hurricane Camille in 1969 and Hurricane Katrina in 2005, made landfall in Hancock County. The impact of Hurricane Katrina upon Bay St. Louis and coastal Mississippi can be graphically demonstrated by post Katrina statistics created by damage assessments.

In Bay St. Louis a total of 743 housing units were 100% damaged and/or destroyed displacing the occupants. An additional 628 housing units received damages exceeding 50% and considered not safe for habitation, displacing the occupants. The remaining housing units (918) sustained 50% or less damage, leaving them repairable but in many cases water damaged and temporary uninhabitable, temporarily displacing the occupants.

Prior to Hurricane Katrina, there were 3,771 utility accounts for occupied buildings and structures in Bay St. Louis. Post Katrina as of February 15, 2006, there were only 1,978 occupied structures with utility hookups, 773 prior utility customers with structures totally destroyed and utilities disconnected; 456 damaged and standing structures with owners residing in temporary mobile homes furnished by FEMA. There were seven properties with no permanent structures standing and the occupants living in FEMA furnished mobile homes and 557 abandoned damaged structures still standing with no owners present.

The bluff on the west side of the Bay of St. Louis was eaten away by storm surge and wave action destroying a section of South Beach Boulevard. Nearly all the retail establishments were lost and those not completely destroyed were heavily damaged. Some of the businesses have temporarily relocated to other areas along U.S. Highway 90, and most have expressed an intention of rebuilding in the old downtown area. Some of the businesses have temporarily relocated to other areas and most have expressed an intention of rebuilding along South Beach Boulevard. South Beach Boulevard has been reconstructed and a seawall is under construction through this area that will allow restoration of land eroded away by Katrina's surge. When completed, this project will increase land area for new business development with long term positive impact to the downtown area of Bay St. Louis and its restoration and growth. The seawall is also a major hazard mitigation action that will protect downtown Bay St. Louis from future hurricane storm surge.

Bay St. Louis city government temporarily relocated to the historic Depot building and a series of mobile structures located nearby. In 2006, Bay St. Louis was successful in acquiring existing buildings and facilities located at Highway 90 and Main Street that formerly housed Coast Electric Power Association and were spared extensive damage from Katrina. Most city offices and personnel were relocated to that permanent location.

Nearly all of the businesses and retail establishments in the City sustained heavy damage in Katrina and while some have managed to repair or rebuild and reopen, many have yet to reopen for business. During the first six months after the storm, the only grocery supermarket in Hancock County was located in the Diamondhead shopping center north of Interstate 10 approximately 10 miles from Bay St. Louis. For major retail purchases, residents had to travel to neighboring Harrison County or further.

1.4.4 Population Growth

Over the past several decades, the population of Bay St. Louis has experienced a steady increase. In 1970, the Census Bureau placed the population of Bay St. Louis at 6,752 persons, an increase of 33.6% over the 1960 Census. Between 1970 and 2000, the population continued to grow at a somewhat slower pace to 8,209, an increase of 21%. The Census estimates published in July 2005 indicated an increase to 8,317 (1.0%) a slight increase. Hurricane Katrina in August 2005 displaced much of the population of Bay St. Louis and Census 2008 population estimates placed the population at 8,053, nearly 2% lower than the July 2005 estimates. The 2010 Census indicates a significant increase to 9,250 (12.8%) over the 2000 Census.

Pre-Katrina Bay St. Louis was approaching “built out” status, the primary reason the City filed for the annexation of areas to the north and west. According to calculations in the Bay St. Louis Comprehensive Plan in the weeks prior to Katrina, the population including the area proposed for annexation was 11,884 persons. In July 2006 a year after Katrina, the Bay St. Louis pre-annexation population reflected a loss of 1,818 persons or about 22.2% of the 2000 population.

The 2010 population of Bay St. Louis shows a significant rebound to 9,260, over the 2000 Census for an increase of 12.8%. It is anticipated that this growth trend will continue into the future. Table 1.2 shows a breakdown of population changes and growth over the past 40 years in Bay St. Louis compared with the population growth of neighboring Waveland and Hancock County

Table 1.2. Population in Waveland, Bay St. Louis, and Hancock County, 1970–2010

Year	Bay St. Louis	Waveland	Hancock County
2010 Population	9,250	5,182	43,929
% Change 2000–2010	12.80%	<3.58%	2.24%
2000 Population	8,209	6,674	42,967
% Change 1990–2000	1.8%	24.3%	35.3%
1990 Population	8,063	5,369	31,760
% Change 1980–1990	2.2%	28.3%	29.7%
1980 Population	7891	4,186	24,496
% Change 1970–1980	16.9%	34.7%	34.7%
1970 Population	6,752	3,108	17,387
% Change 1960–1970	33.6%	108.5%	23.8%

Source: U. S. Bureau of the Census, Census 2010, 1990, 1980, 1970

Populations for Hancock County, Bay St. Louis and Waveland by the year 2030 are projected to be 78,269, 18,896 and 11,333 respectively. This projection indicates that the population of the two incorporated cities will be about 38% of the County's total population. The Gulf Regional Planning Commission (GRPC) is projecting an 82.2% population growth within the next twenty five years. This projection is based upon potential projects identified by County planners after Hurricane Katrina and developed through GRPC's transportation model. It also estimates that the City of Bay St. Louis population will increase by 64% by 2030.

The population of Bay St. Louis, including the newly annexed area tends to be older than that for the County, the region or the State. The City tends to have a slightly higher percentage of the population over 45 than percentages for other communities across the Gulf Coast. Within the City of Bay St. Louis including the annexed area, about 13.8% of the population was over 65 compared to 12.5% of the State and 10.8% for Harrison County and 9.4% for Jackson County. About 23% of the population in Bay St. Louis is under the age of 18. Population diversity in the City of Bay St. Louis including the annexed area is shown on Table 1.3.

Table 1.3. Population Diversity in Bay St. Louis

Ethnicity	Population
White	7,656
African American	1,175
Native American	30
Asian	108
Hawaiian/Pacific Islander	5
Other Races	87
Two or More Races	199
	9,260

Source: US Census Bureau 2010 Profile of General Population 2010

1.5 Plan Organization

The Bay St. Louis Local Hazard Mitigation Plan update is organized as follows:

- Chapter 2: What's New
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption
- Chapter 7: Plan Implementation and Maintenance
- Appendices

Requirements §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

In 2005 and 2006, the population of Bay St. Louis was affected by two significant events. On August 29, 2005, the City was impacted by Hurricane Katrina and on June 30, 2006, a Chancery Court Judge awarded the City of Bay St. Louis a 10.7 square mile area that was part of an annexation court case. The proceedings had begun in 2004 between Bay St. Louis and Waveland and on June 30, 2006, the judge ruled that the Bay St. Louis would receive the 10.7 square mile area located north of Highway 603 except for an area of Highway 603 south of the intersection of Highway 603 and Longfellow Road. According to 2000 Census data, Bay St. Louis would have received a population increase of approximately 3,282 people through the annexation.

Prior to the award of the newly annexed area into Bay St. Louis however, the soon to be annexed area was struck by Hurricane Katrina, inundating all of the annexed area. In the aftermath of the storm as many as 60% of homes, including most of those in the annexed area in Bay St. Louis were deemed to be uninhabitable and residents within these areas were forced to temporarily and in some cases, permanently relocate.

The 2005 Bay St. Louis Multi-Hazard Mitigation Plan contained a risk assessment of identified hazards for the Bay St. Louis planning area and a mitigation strategy to address the risk and vulnerability from these hazards. Over the past five years, Bay St. Louis and the entire central Gulf Coast have struggled to recover from the impacts of Katrina. The annexation nearly doubled the land area of the City and included a large number of known repetitive loss properties and high hazard areas. This section of the plan provides an overview of the approach to updating the plan, and identifies new analysis and information included in the plan update

2.1 What's New in the Plan Update

This LHMP update involved a comprehensive review and update of each section of the 2005 plan and includes an assessment of the success of the participating communities in evaluating, monitoring, and implementing the mitigation strategy outlined in the initial plan. Also to be noted, Section 7.0 Implementation and Maintenance of this plan update identifies key requirements for updating future plans:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;

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- Incorporate new data or studies on hazards and risks;
 - Incorporate new capabilities or changes in capabilities;
 - Incorporate growth and development-related changes to inventories; and
 - Incorporate new action recommendations or changes in action prioritization.

These requirements and others as detailed throughout this plan were also addressed during this plan update process.

As part of its 2005 Mitigation Strategy, Bay St. Louis and recognized that certain data, if available, would enhance the analyses presented in the risk assessment and utilized in the development of the mitigation strategy. New information and analyses contained in this plan update includes the following:

- A new assessment of hazards affecting Bay St. Louis was completed resulting in the addition of extreme heat and wildfire as a potential hazard.
- An entire rework of the risk assessment for each identified hazard. This included reworking the hazard profile and adding new hazard event occurrences; recreating the entire vulnerability analysis to add items identified below and updating the vulnerability assessment based on more recent hazard data as well as using the most current parcel and assessor data for the existing built environment. GIS maps were produced using information provided by various sources such as the National Weather Service, DFIRMs, and other sources, creating a digital base to which new events can be added as they occur.
- An expansion of the flood hazard analysis to include an analysis of the 500-year flood and an analysis of the localized/stormwater flooding problems affecting the planning area. Also, included in this section is new storm surge mapping produced by the Corps of Engineers and released in early 2010 and mapping of Repetitive Loss Properties overlaid on FIRMs produced by FEMA since completion of the 2005 plan update.
- An enhanced vulnerability assessment which added an inventory of critical facilities.
- An enhanced vulnerability assessment which added an analysis of populations vulnerable to flood from stormwater and flood from storm surge.
- Also, as required by the 2008 planning guidance, an analysis of ongoing and continued compliance with the NFIP, and where applicable, the CRS program.

2.2 2005 LHMP Mitigation Strategy Status and Successes

Bay St. Louis has been successful in implementing actions identified in the 2005 LHMP Strategy as follows:

- Protect the lives and property of residents in Bay St, Louis from natural hazards.
- Through education, maintain a flood and hurricane alert and aware resident population.
- Increase the number of households and voluntarily adopt measures that protect their homes and property.

- Insure the continuity of emergency services during storms and high water situations Increase the capacity of the Public Works Department to serve the residents of the City of Bay St. Louis.
- Participate actively with Hancock County to provide the best possible emergency services to the residents of Bay St. Louis.
- Develop partnerships with the Hancock County Board of Supervisors and the City of Waveland to find effective solutions to flooding problems in Bay St. Louis.
- Where possible, Bay St. Louis has used existing plans and programs to implement the 2005 mitigation strategy. Examples include extending building code enforcement and enforcement of NFIP requirements immediately after annexation in the large area north and west of the 2005 City Limits in 2006.

The 2005 mitigation strategy contained 7 goals and 26 separate mitigation actions. Of these 26 actions, 23 have been completed or are ongoing. 3 have not yet been started due to a variety of reasons such as changes in priorities, lack of funding, or changes to the projects themselves. The status of these mitigation actions are shown in Table 2.1 and the descriptions that follow.

Table 2.1 2005 Bay St. Louis Goals, Actions and Status Summary

	Complete	Ongoing	Not yet Started	Project in 2010 LHMP Update
2005 Actions				
2005-40. Establish a Program to Offer CEUs to Real Estate and Insurance Professionals on Hazard Mitigation.		X		Y
2005-41. Request Funding to Provide Shutters, Structural Improvements and Upgrades to Second Street Elementary School to Insure That it Will Meet Red Cross Shelter Structural Requirements.			X	N
2005-42. Request Funding to Strengthen Emergency Operations Centers and Buildings Throughout the City by Adding Shutters, Generators, and Safe Rooms.	X			N
2005-43. Equip The Building Office With Software And Printer To Allow The Building Official To Print Hazard Threat Maps For Customers.	X	X		Y
2005-44. Find an Alternative Route around Dunbar Avenue.	X			N
2005-45. Increase the Size of the Culvert under Beach Boulevard at the Yacht Club.	X			N
2005-46. Seek funding to assist homeowners located in special flood hazard areas to mitigate their homes from flooding through elevation and acquisition.		X		Y
2005-47. Market the Mitigation Loan Program to home and businesses		X		Y
2005-48. Participate in the Development of the County Hazard Mitigation Plan		X		Y

	Complete	Ongoing	Not yet Started	Project in 2010 LHMP Update
Ongoing Actions from 2000				
2001-01. Continue to maintain FEMA Elevation Certificates on each building in Bay St. Louis		X		Y
2000-02. Continue to Enforce Ordinance No. 400 Requiring One Foot of Freeboard.	X			N
2000-03a. Continue to enforce City Ordinance No. 285 to Protect Natural Drainage from Development.		X		Y
2000-5. Continue to Mail Out a City-Developed Brochure to Owners of Property		X		Y
2000-6. Continue to Implement the City's Substantial Drainage Rule.		X		Y
2000-7. Continue to Implement Drainage Standard Operating Procedure.		X		Y
2000-08. Continue to Enforce the Stream Dumping Ordinance to Prohibit Depositing of Debris in the Drainage System.		X		Y
2000-09. Continue to Enforce Standards for Hurricane Resistant Construction.		X		Y
2000.10 Post awareness posters in City Offices		X		Y
2000-13. Continue to enforce the City's Tree Ordinance.		X		Y
2000-15 Digitize property maps to include BFE and Flood Hazard Information		X		Y
2000-16. Continue an Internet Website to make hazard Mitigation Information and Programs and Requirements in Bay St. Louis Available to the Public.		X		Y
2000-17. Participate in Hurricane Awareness Week by Adopting a Proclamation.		X		Y
2000-18. Participate in the Annual Mississippi Homebuilders Association Fair and Exposition, Providing Hazard Mitigation Information and Related City Programs and Regulations.		X		Y
2000-21. Implement Flood Awareness/Storm Surge Markers in Special Flood Hazard Areas.		X		Y
2000-35. Continue to Update Flood proofing, Retrofitting, and Construction Technology Resources in the Hancock County Library-Bay St. Louis Branch and in the Building Office of the City of Bay St. Louis.		X		Y
2000 Plan Actions Accomplished and Considered Ongoing				
2000-03b. Continue to Enforce City Ordinance No. 285 to Include Erosion and Sediment Control BMPs as Required by NPDES Phase II program.		X		Y
2000-04. Continue to enforce the City's Subdivision Regulations to Require that Streets in Subdivisions are Located Above Flood Elevation to Prevent Isolation.		X		Y
2000 Plan Actions Not Accomplished as of 2005 Plan				
2000-15. Digitize Property Maps to Include Base Flood Elevations and Flood hazard Information.		X		Y

	Complete	Ongoing	Not yet Started	Project in 2010 LHMP Update
2000-22. Partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information.		X		Y

Source: 2005 Hazard Mitigation Plan

Bay St. Louis 2005 Actions

Action Item #1: 2005-40. Establish a Program to Offer CEUs to Real Estate and Insurance Professionals on Hazard Mitigation.

Progress to date: Requesting FEMA/MEMA to assist with establishment of program.

Were any significant barriers or problems encountered? Hurricane Katrina occurred in August 2005 shortly after the plan was complete, causing catastrophic damage to the community; the City has concentrated rebuilding the community over the past five years.

What aspects made the action effective or successful? No impact

Should the task be changed or revised? No

What further actions are planned (if any)? Carry over to 2011 update

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? Yes. No change

Additional comments or information: None

Action Item #2: 2005-41. Request Funding to Provide Shutters, Structural Improvements and Upgrades to Second Street Elementary School to Insure That it Will meet Red Cross Shelter Structural Requirements.

Progress to date: None

Were any significant barriers or problems encountered? The school was closed after Hurricane Katrina and has not reopened. It was determined that no public shelters should be located in Bay St. Louis due to new DFIRM. The only shelters remaining within the boundaries of Bay St. Louis are first responder shelters.

What aspects made the action effective or successful? Action will be omitted from the 2011 Plan update

Should the task be changed or revised? Action will be omitted from the 2011 Plan update

What further actions are planned (if any)? None

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? No

Additional comments or information: The damage from Hurricane Katrina indicates that no public shelters should be considered within the boundaries of Bay St. Louis.

Action Item #3: 2005-42. Request Funding to Strengthen Emergency Operations Centers and Buildings throughout the City by Adding Shutters, Generators, and Safe Rooms.

Progress to date: Post Katrina, all municipal office buildings were moved to the corner of Main Street and U. S. Highway 90 one of the highest elevations in the City. Shortly after Katrina the City purchased the former Coast Electric Power Company complex located on either side of Main Street at the intersection of Main and U.S. Highway 90.

The City Hall was relocated to the two-story building on the site and is in the process of being retrofitted by adding shutters. The Police Department was relocated to another building on the site which is being retrofitted. Public Works occupies the area on the west side of Main Street across from City Hall. All are equipped with standby generators that can be put into use in the event of power failures.

A new Fire Station No. 1 was constructed on the site behind the City Hall to conform with FEMA 361 Shelter Standards and will serve as the Center for Emergency Operations in Bay St. Louis during future events. This building is fully equipped with a standby generator, water and sewer storage facilities. A new Fire Station No. 2 has been constructed on Highway 603.

The Bay St. Louis, Waveland, Hancock County Civil Defense Agency building was flooded by Katrina storm surge and temporarily relocated to an old school building in the Kiln Community post Katrina. A new building is being constructed to FEMA 361 Shelter Standards at a site near the intersections of State Highways 603 and 43, far from any source of flooding.

Were any significant barriers or problems encountered? There were many delays in accessing Federal grant funds to pay for upgrading and construction of these facilities.

What aspects made the action effective or successful? Hurricane Katrina severely damaged or destroyed every public facility including emergency operations and first responder's buildings in Bay St. Louis. The City was fortunate to be able to acquire the Coast Electric Power Company site because it is located in an area of the City that does not flood except in the most severe circumstances. This action allowed all critical government agencies to relocate from sites near the beach to a safer location at a lower cost than would have been involved in retrofitting the pre-Katrina facilities or rebuilding them.

Being able to access the already existing, sound facility allowed quicker restoration of government and critical public safety services than most other coastal communities affected by Katrina. Consolidation of government services to one general area allows easier access by the public. An added bonus was that the site was large enough to accommodate construction of the new Fire Station and first responder's shelter, sparing the cost of acquiring a site for the new facility.

Should the task be changed or revised? Since construction is still in progress on several of the projects, this task should remain in the updated plan pending reevaluation in the 2011 plan update.

What further actions are planned (if any)? At this time, no further action is planned.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? For the reason stated above, this action should be included in the 2011 update of the plan. No improvement is needed.

Additional comments or information: None

Action Item #4: 2005-43. Equip the Building Office with Software and Printer to Allow the Building Official to Print Hazard Threat Maps for Customers.

Progress to date: The building office is now equipped with software and printer to allow the building official to print Hazard Threat Maps for customers. The FIRM was updated with the new DFIRM and adopted by the City in 2009

Were any significant barriers or problems encountered? The most significant problem was inaccuracies on the DFIRM maps that were originally produced by FEMA. The City challenged the DFIRM, requiring minor revisions but delaying adoption by a year or so.

What aspects made the action effective or successful? The City has upgraded its digital capabilities considerably since the completion of the 2005 plan.

Should the task be changed or revised? No, however as new technology emerges, the City should consider upgrades to the system.

What further actions are planned (if any)? None

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? The action has been substantially completed; however it is ongoing and should be upgraded from time to time as new technology emerges.

Additional comments or information: None

Action Item #5: 2005-44. Find an Alternative Route Around Dunbar Avenue.

Progress to date: The City, with a contribution from the Hancock County Board of Supervisors is in the process of elevating the roadway at the site on Dunbar Avenue. This action should be omitted from the plan.

Were any significant barriers or problems encountered? No other viable alternative route could be found. The City attempted to gain access to HMGP funds to assist with the road elevation but the project could not meet BCA requirements and that idea was abandoned. Since then, the City of Bay St. Louis has committed local funding and combined with the County's contribution, is able to raise the roadway on Dunbar Avenue and eliminate the problem without HMGP assistance.

What aspects made the action effective or successful? In December 2009, the County Board of Supervisors committed funds to elevate the roadway, however, the amount committed by the County was not enough to complete the task. The City's commitment of dollar for dollar matching funds made the project viable without a federal funds contribution.

Should the task be changed or revised? What further actions are planned (if any)? No further action is necessary as the elevation project is already under way.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? No

Additional comments or information: None

Action Item #6: 2005-45. Increase the Size of the Culvert under Beach Boulevard at the Yacht Club.

Progress to date: The City has had its engineering company analyze the rate of flow and found that the existing culvert is adequately sized to meet the needs of this location.

Were any significant barriers or problems encountered? No significant barriers or problems were encountered.

What aspects made the action effective or successful? The engineering study

Should the task be changed or revised? If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This task should be omitted from the plan.

Additional comments or information: None

Action Item #7: 2005-48. Participate in the Development of the County Hazard Mitigation Plan

Progress to date: Hancock County updated its Hazard Mitigation Plan in 2005, and adopted it shortly after being struck by Hurricane Katrina. Bay St. Louis should participate in the development of all future updates of the County's plan. The County's plan is scheduled to be updated in 2011 – 2012.

Were any significant barriers or problems encountered? What aspects made the action effective or successful? Should the task be changed or revised? No

What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This action should be included in the updated plan

Additional comments or information: None

Ongoing Actions from 2000

Action Item #8: 2001-01. Continue to Maintain FEMA Elevation Certificates on Each Building in Bay St. Louis

Progress to date: Bay St. Louis Building Department maintains FEMA Elevation Certificated on all buildings in Bay St. Louis

Were any significant barriers or problems encountered? None

What aspects made the action effective or successful? This is an ongoing activity for CRS credit,

Should the task be changed or revised? What further actions are planned (if any)? The City is working on digital storage of Elevation Certificates

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? Yes. This is an ongoing activity.

Additional comments or information:

Action Item #9: 2000-02. Continue to Enforce Ordinance No. 400 Requiring One Foot of Freeboard.

Progress to date: The DFIRM requires that elevations be significantly higher than were required in the old FIRM. The City no longer requires elevation above the DFIRM requirement and has eliminated the “one foot rule” from its ordinance.

Were any significant barriers or problems encountered? The most significant barrier was caused by release of the “Advisory Base Flood Elevations” shortly after Katrina, then release of the DFIRM in 2008. During those three years, a number of buildings were reconstructed with no authority to require elevations above that of the FIRM that was in effect prior to Katrina. Ultimately, the DFIRM was corrected and adopted by the City and is being enforced.

What aspects made the action effective or successful? The new DFIRM requirements are more stringent than the old “one foot rule.”

Should the task be changed or revised? What further actions are planned (if any)? This task should be omitted from the plan

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This action should no longer be included in the plan.

Additional comments or information:

Action Item #10: 2000-03a. Continue to Enforce City Ordinance No. 285 to Protect Natural Drainage from Development.

Progress to date: The City continues to enforce Ordinance No. 285 to protect Natural Drainage from Development.

Were any significant barriers or problems encountered? No.

What aspects made the action effective or successful? Yes, however this should be an ongoing action in all future plan updates.

Should the task be changed or revised? What further actions are planned (if any)? No.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? Present requirements are adequate into the foreseeable future

Additional comments or information: None

Action Item #11: 2000-5. Continue to Mail Out a City-Developed Brochure to Owners of Property

Progress to date: The City continues to mail out a City Developed Brochure twice annually, once to all addresses in the City and again to properties located in recognized flood hazard areas.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This action is required for CRS participation.

Should the task be changed or revised? What further actions are planned (if any)? The only change would be to publish the brochure on the City's web site.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing action for CRS credit and should be continued.

Additional comments or information:

Action Item #12: 2000-6. Continue to Implement the City's Substantial Damage Rule.

Progress to date: As required for CRS participation, the City strictly enforces the substantial damage rule.

Were any significant barriers or problems encountered? The most significant problem encountered was after Hurricane Katrina, when so many persons were displaced from their homes when they were damaged. This situation made it difficult to accurately track cumulative substantial damage.

What aspects made the action effective or successful? The City's Building Department is working on digitizing tracking of substantial damages in the near future.

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing action

Additional comments or information: None

Action Item #13: 2000-7. Continue to Implement Drainage Standard Operating Procedure.

Progress to date: This is an ongoing activity. Hurricane Katrina made it necessary to replace and clear nearly the entire drainage system of the City.

Were any significant barriers or problems encountered? Debris from Hurricane Katrina made this task more difficult than it would have otherwise been. The City continues to clear Katrina deadfall and debris from drainage way.

What aspects made the action effective or successful? The City has succeeded in clearing all Katrina debris from the drainage ways in the community.

Should the task be changed or revised? What further actions are planned (if any)? No changes necessary, this is an ongoing task.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved?

Additional comments or information:

Action Item #14: 2000-08. Continue to Enforce the Stream Dumping Ordinance to Prohibit Depositing of Debris in the Drainage System.

Progress to date: The Public Works Department actively enforces this ordinance.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? Yes

Should the task be changed or revised? What further actions are planned (if any)? No, this is an ongoing activity for which the community receives CRS credit.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? Yes, this is an ongoing activity

Additional comments or information: None

Action Item #15: 2000-09. Continue to Enforce Standards for Hurricane Resistant Construction.

Progress to date: The City enforces the 2006 IBC which includes hurricane resistant measures requiring all construction to be constructed to withstand 130 MPH hurricane wind

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? The City adopts all updates of the IBC.

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity

Additional comments or information: None

Action Item #16: 2000-13. Continue to Enforce the City's Tree Ordinance.

Progress to date: The City's tree ordinance protects all live oak and magnolia trees and encourages planting of trees and preservation of all trees.

Were any significant barriers or problems encountered? The most significant problem encountered was the damage to the City's tree canopy by Hurricane Katrina. Many trees were substantially damaged and/or destroyed

What aspects made the action effective or successful? The City's tree ordinance encourages protection of important species and all trees.

Should the task be changed or revised? What further actions are planned (if any)? No, it should be ongoing.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity that should be continued.

Additional comments or information: None

Action Item #17: 2000-16. Continue an Internet Website to make Hazard Mitigation Information and Programs and Requirements in Bay St. Louis available to the public.

Progress to date: The website remains available to any who wish to access it.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? Updating the site is an ongoing situation

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This action is ongoing and should be continued.

Additional comments or information: None

Action Item #18: 2000-17. Participate in Hurricane Awareness Week by Adopting a Proclamation.

Progress to date: Each year at the beginning of Hurricane Season, the City participates in a Hurricane Awareness Week with other communities along the coast.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This is an ongoing action by coastal communities.

Should the task be changed or revised? What further actions are planned (if any)? No changes are necessary and the action will be continued.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing action

Additional comments or information: None

Action Item #19: 2000-18. Participate in the Annual Mississippi Homebuilders Association Fair and Exposition, Providing Hazard Mitigation Information and Related City Programs and Regulations.

Progress to date: Bay St. Louis participates in the Annual Mississippi Homebuilders Association Fair and Exposition at the Mississippi Coast Coliseum in Biloxi along with other communities.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This action is effective through participation with other local communities along the coast.

Should the task be changed or revised? What further actions are planned (if any)? No significant changes are anticipated.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an annual CRS outreach project and should continue to be included in the plan.

Additional comments or information: None

Action Item #20: 2000-21. Implement Flood Awareness/ Storm Surge Markers in Special Flood Hazard Areas.

Progress to date: Hurricane Katrina destroyed many markers and even the roadway along the beachfront. Establishment of new markers is ongoing as beachfront infrastructure is reconstructed

Were any significant barriers or problems encountered? The devastation of Hurricane Katrina was a significant barrier to maintenance of markers. New markers were established when the DFIRM was prepared.

What aspects made the action effective or successful? This is an ongoing activity.

Should the task be changed or revised? What further actions are planned (if any)? No change is necessary.

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? Yes, this is an ongoing activity

Additional comments or information: None

Action Item #21: 2000-35. Continue to update floodproofing, retrofitting, and construction technology resources in the Hancock County Library-Bay St. Louis Branch and in the Building Office of the City of Bay St. Louis.

Progress to date: As new resources become available they are cataloged into the Library System. Supplies of brochures, etc. are checked from time to time and replaced as necessary.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This is an ongoing activity.

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity and should continue

Additional comments or information: None

Action Item #22: 2000-03b. Continue to Enforce City Ordinance No. 285 to Include Erosion and Sediment Control BMPs as Required by NPDES Phase II Program.

Progress to date: This activity is ongoing

Were any significant barriers or problems encountered? The most significant barrier encountered was the damage caused by Hurricane Katrina. No

What aspects made the action effective or successful? This is an ongoing activity

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity that should continue to be included in the plan.

Additional comments or information: None

Action Item #23: 2000-04. Continue to Enforce the City's Subdivision Regulations to Require That Streets in Subdivisions are Located above Flood Elevation to Prevent Isolation.

Progress to date: This activity is ongoing.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This is an ongoing activity that is considered any time new subdivision plats are reviewed.

Should the task be changed or revised? What further actions are planned (if any)? No, Ongoing

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity that should continue to be included in the plan.

Additional comments or information: None

Action Item #24: 2000-15. Digitize Property Maps to Include Base Flood Elevations and Flood Hazard Information.

Progress to date: The City is in the process of digitizing all property maps to include BFE and Flood Hazard information.

Were any significant barriers or problems encountered? The situation that could be considered a barrier is the new DFIRM that significantly changes the location of flood hazard areas. The DFIRM should actually make this task more doable than it was before.

What aspects made the action effective or successful? Completion of the DFIRM by FEMA in the past five years.

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity that should be continued.

Additional comments or information: None

Action Item #25: 2000-22. Partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information.

Progress to date: NASA's cutting edge activity in remote sensing continues to make new additional map based information available.

Were any significant barriers or problems encountered? No

What aspects made the action effective or successful? This activity is ongoing

Should the task be changed or revised? What further actions are planned (if any)? No

If the action has not been completed, should it be included in the updated plan? If yes, how could it be improved? This is an ongoing activity that should not be changed

Additional comments or information: None

Action Items Not Included in the 2011 Plan Update

Action items included in the 2005 Plan that have been omitted from the 2011 Plan and the rationale for elimination follows:

2005.41: Request funding to provide shutters, structural improvements and upgrades to Second Street Elementary School that will meet Red Cross Standards.

This item is being dropped from the plan. Second Street Elementary was badly damaged and flooded in hurricane Katrina. The building is no longer being used as a school and the city is undecided what if anything will be done with this property. Storm Surge from Hurricane Katrina made it clear that using this facility for a shelter would not be a good idea. This item is no longer applicable.

2005-42: Request funding to strengthen Emergency Operation Centers and buildings throughout the City by adding shutters, generators and safe rooms.

Virtually all public buildings in Bay St. Louis sustained flood damage in Hurricane Katrina. The City was able to purchase buildings and land on Highway 90 and Main Street to which all administrative offices, public works, Police Department and other activities located throughout the City to one primary location. The old City Hall is being restored as a museum and will no longer be used for day to day government services. The City Hall Annex is being offered for sale. A new central fire station has been constructed with a second station on Highway 603; both are constructed to withstand flooding and high winds. The Hancock County EOC formerly located in Bay St. Louis has been moved to a new location in the central part of the County away from the danger of flooding and is being constructed to FEMA 361 shelter standards. New evacuation shelters are also being constructed throughout the northern part of the County to house evacuees from Bay St. Louis and other coastal areas in the event of a major storm. This item is complete.

2005-42: Equip the Building Office with software and printer to allow the Building Official to print Hazard Threat Maps for customers.

The Building Department is fully equipped to print information concerning threats, DFIRM, Elevation Certificates and parcel based information for the public. This action item should be considered complete.

2005.44: Find an Alternative Route around Dunbar Avenue.

In a cooperative effort with Hancock County Board of Supervisors, the problem area on Dunbar Avenue is in the process of being remedied by raising the roadway and replacing the bridge across the roadway so there is no need for an alternative route for Dunbar Ave. Construction on this item is in process.

2005-45: Increase the size of the Culvert under Beach Boulevard at the Yacht Club.

Bay St. Louis had a study of this perceived problem performed resulting in the finding that the existing culvert is adequately sized for this area. This item is complete.

2000-02: Continue to enforce Ordinance No. 400 requiring one foot of freeboard.

Elevations established by the DFIRM are higher than the 2 foot freeboard requirement in Ordinance No. 400. The new ordinance adopted to comply with the DFIRM does not contain freeboard language because it is felt to be unnecessary since DFIRM elevations are considerably higher than the old FIRM. This item is no longer applicable.

2000-15: Digitize Property Maps to include base flood elevations and flood hazard information. The DFIRM is full digitized and all information is available. This item is complete.

3 PLANNING PROCESS

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

- 1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;**
- 2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and**
- 3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.**

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Bay St. Louis recognized the need and importance of the update process for their local hazard mitigation plan and initiated its development. After receiving a grant from the Federal Emergency Management Agency (FEMA), which served as the primary funding source for this plan, the County contracted with AMEC Earth and Environmental (AMEC) to facilitate and develop the plan.

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA);
- Meet the DMA requirements as established by federal regulations and follow FEMA's planning guidance;
- Support objectives under the National Flood Insurance Program's Community Rating System and the Flood Mitigation Assistance program;
- Facilitate the entire planning process;
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data,
- Assist in facilitating the public input process;
- Produce the draft and final plan documents; and
- Coordinate with the Mississippi Emergency Management Agency (MEMA) and FEMA Region IV plan reviews.

3.1 Local Government Participation

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Detail where within the planning area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For the Bay St. Louis Planning Area’s HMPC, “participation” meant the following:

- Providing facilities for meetings;
- Attending and participating in the HMPC meetings;
- Completing and returning the AMEC Data Collection Guide;
- Collecting and providing other requested data (as available);
- Managing administrative details;
- Making decisions on plan process and content;
- Identifying mitigation actions for the plan;
- Reviewing and providing comments on plan drafts; including annexes
- Informing the public, local officials, and other interested parties about the planning process and providing opportunity for them to comment on the plan;
- Coordinating, and participating in the public input process; and
- Coordinating the formal adoption of the plan by the governing boards.

The City’s participation in the plan and seeking FEMA approval met all of these participation requirements. Representatives from the City of Bay St. Louis included the Building Department, Community Development, and Grants Administration assisted as did the Hancock County GIS Department, Road Department, and Civil Defense Agency. Lifeline services was represented by the Administrator of the Hancock Medical Center. Neighboring Waveland was represented by its CRS Coordinator and Fire Department. Appendix A provides additional information and documentation of the planning process.

3.2 The 10-Step Planning Process

AMEC established the planning process for updating the Bay St. Louis Local Hazard Mitigation Plan (LHMP) using the DMA planning requirements and FEMA’s associated guidance. This guidance is structured around a four-phase process:

- 1) Organize Resources;
- 2) Assess Risks;
- 3) Develop the Mitigation Plan; and

4) Implement the Plan and Monitor Progress.

Into this process, AMEC integrated a more detailed 10-step planning process used for FEMA’s Community Rating System (CRS) and Flood Mitigation Assistance programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA’s Hazard Mitigation Grant Program; Pre-Disaster Mitigation program; Community Rating System; Flood Mitigation Assistance Program; Severe Repetitive Loss program; and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 3.1 shows how the modified 10-step process fits into FEMA’s four-phase process. The sections that follow describe each planning step in more detail.

Table 3.1 Mitigation Planning Processes Used to Develop the Bay St. Louis Local Hazard Mitigation Plan

DMA Process	Modified CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

This LHMP update involved a comprehensive review and update of each section of the 2005 plan and includes an assessment of monitoring and implementing the mitigation strategy outlined in the initial plan. The process followed to update the plan is detailed in the above table and the sections that follow and is the same process that was used to prepare the 2005 plan. As part of this plan update, all sections of the plan were reviewed and updated to reflect new data, processes, participating jurisdictions, and resulting mitigation strategies.

3.2.1 Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With Bay St. Louis' commitment to participate in the DMA planning process and the Community Rating System (CRS), AMEC worked with a Floodplain Manager (CFM) in the City's Building Department and other City officials to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational aspects of this plan update process.

The initial kick-off meeting held on April 13, 2010. A notice was posted in the local newspaper, The Seacoast Echo, inviting members of the public to attend. Invitations to this kickoff meeting were extended to City officials, as well as to other federal, state, and local stakeholders that might have an interest in participating in the planning process. The list of initial invitees is included in Appendix A. The HMPC was established as a result of the kickoff meeting and meeting participants suggested additional persons who would be of value as members.

Bay St. Louis

- Fire Department
- Public Works Department
- Police Department
- City GIS Contractor
- City Engineer
- Bay St. Louis Historic Preservation
- Hancock County Civil Defense

Neighboring Communities

- City of Waveland
- Hancock County

Other Government and Stakeholder Representatives:

- Hancock County Wastewater District
- Mississippi Highway Patrol
- Soil and Water Conservation District
- National Weather Service
- Department of Marine Resources
- U.S. Army Corps of Engineers
- Mississippi Department of Environmental Quality
- Mississippi Development Authority
- Southern Mississippi Planning and Development District
- Gulf Regional Planning Commission

A list of participating HMPC representatives for is included in Appendix A. This list details all HMPC members that attended one or more HMPC meetings detailed in Table 3.2. Planners also utilized the support of many other support staff in order to collect and provide requested data and to conduct timely reviews of the draft documents. Note that the above list of HMPC members also includes several other government and stakeholder representatives that contributed to the planning process. Specific participants from these other agencies are also identified in Appendix A.

The planning process officially began with kick-off meeting held April 13, 2010 held in the Bay St. Louis Conference Center located at 598 Main Street in Bay St. Louis. The meeting covered the scope of work and an introduction to the DMA requirements. Participants were provided with a Data Collection Guide, which included worksheets to facilitate the collection of information necessary to support development of the plan. Using FEMA guidance, AMEC designed these worksheets to capture information on past hazard events, identify hazards of concern to the City, quantify values at risk to identified hazards, inventory existing capabilities, and record possible mitigation actions. A copy of AMEC’s Data Collection Guide for this project is included in Appendix A. Because this is a plan update, another worksheet was developed, the Mitigation Action Status Summary Worksheet, to capture information on the current status of mitigation action items included in the 2005 plan. This worksheet is also included in Appendix A.

During the planning process, the HMPC communicated through face-to-face meetings, email, telephone conversations, and a file transfer protocol (ftp) website. Draft documents were posted on this website so that the HMPC members could easily access and review them.

Table 3.2 HMPC Meetings

Meeting Type	Meeting Topic	Meeting Date(s)	Meeting Location(s)
HMPC #1 Kick-off Meeting	1) Introduction to DMA and the planning process 2) Overview of current LHMP; 3) Organize Resources: the role of the HMPC, planning for public involvement, coordinating with other agencies/stakeholders 4) Introduction to Hazard Identification	April 13, 2010	Bay St. Louis
HMPC #2	Present the Risk Analysis to the LHMP	Jan. 12, 2011	Bay St. Louis
HMPC #3	Review existing Action Items and determine applicability and determine new Action Items	Jan. 26, 2011	Bay St. Louis
HMPC #4	Present final draft to LHMP; request that public hearings be set.	May 31, 2011	Bay St. Louis
HMPC #5	Public Hearing No. 1 – 9 AM	June 12, 2011	Bay St. Louis
HMPC #6	Public Hearing No. 2 – 2 PM	June 13, 2011	Bay St. Louis

Planning Step 2: Involve the Public

Early discussions with Bay St. Louis personnel established the initial plan for public involvement. Public outreach for this plan update began during the plan development process with an informational press release, shown in Figure 3.1, to inform the public of the purpose of the DMA and the hazard mitigation planning process for Bay St. Louis. At the kick-off meeting, the HMPC discussed additional options for public involvement and agreed to an approach using established public information mechanisms and resources within the community.

Public involvement activities for this plan update included press releases, stakeholder and public meetings, and the collection of public and stakeholder comments on the draft plan. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2005 plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for the plan update.

The draft of the plan was presented to the LHMP on May 31, 2011. Two public hearings were conducted on June 15 and 16, 2011. The public hearings were advertised in the Sea Coast Echo news paper and notices posted at City Hall and the Public Library. Additionally hard copies of the draft of the plan were made available to interested parties at the Library and City Hall and a copy of the draft plan was posted on the City of Bay St. Louis web site. Public hearing notices included where the hard copies of the draft of the plan would be available for review and the City's website address.

In addition to advertisement for public participation, notices of meetings were sent directly to all persons on the Hazard Mitigation Planning Committee Contact List. The majority of these people reside in Bay St. Louis or in surrounding communities. Notices of meetings were also posted on bulletin boards in the City Hall and at the Library in Bay St. Louis.

Figure 3.1 Notice to the Public of Plan Update

March 30, 2010

RE: City of Bay St. Louis – Update of Local Hazard Mitigation Plan

To: All Interested Parties, Agencies and Persons

The City of Bay St. Louis has received FEMA Hazard Mitigation Grant funding to develop an update of its Local Hazard Mitigation Plan (LHMP). The purpose of this plan is to reduce or eliminate long-term risk to the people and property of the City of Bay St. Louis from the effects of natural hazard events. The Disaster Mitigation Act of 2000 requires all local governments to assess their risks to natural hazards and identify actions that can be taken in advance to reduce future losses. The law requires all local governments and districts to have an approved Local Hazard Mitigation Plan after November 1, 2004 and update those plans every five (5) years to be eligible for certain federal disaster assistance and hazard mitigation funding programs. Bay St. Louis' Hazard Mitigation Plan was prepared and adopted in 2005 prior to Hurricane Katrina and the Annexation.

The City of Bay St. Louis' Flood Plain Manager and Building Official have taken the lead in developing this plan and the City has hired a consultant, AMEC Earth and Environmental, Inc. to manage and facilitate the planning process, collect the necessary data, and perform other technical services, including preparing the risk assessment and plan document. However, the City and AMEC will need your help to successfully complete this project.

The hazard mitigation planning process is heavily dependent on the participation of representatives from local government agencies and departments, residents and members of the public, and other stakeholder groups. A Hazard Mitigation Planning Committee is being formed to support this project and will include representatives from City, County, other Communities, special districts, and other local, state, and federal agencies in or that serve the City of Bay St. Louis. Members of the Public at Large are also cordially invited to attend, and participate in the planning process, the Kickoff Meeting and subsequent planning meetings and participate as members of the Planning Committee and Council.

Your participation on the Planning Committee and Council is requested due to your ability to contribute needed information, technical knowledge, or other valuable experience to the plan. Please designate a representative to serve on the committee and attend the kickoff meeting, which will discuss the benefits of developing a hazard mitigation plan, the project schedule, and the hazards that affect the City of Bay St. Louis, such as hurricanes and tropical storms, floods, wind storms, and more.

City of Bay St. Louis Local Hazard Mitigation Plan Kickoff Meeting

Tuesday April 13, 2010

9:30 AM to 12:00 PM

Bay St. Louis Conference Center

Figure 3.2 Public Hearing Notice

The City of Bay St. Louis, Mississippi has completed a draft of its 2011 Hazard Mitigation Plan. Public Hearings are being conducted to present the plan and receive comments concerning the plan, prior to adoption by the City Council. The hearings will be conducted on the dates, at the times and places indicated below:

Wednesday June 15, 2011 at 9:00 AM. CDT at the Bay St. Louis Conference Center located at 598 Main Street, Bay St. Louis, MS

Thursday, June 16, 2011 at 2:00 PM, CDT at the Bay St. Louis Conference Center located at 598 Main Street, Bay St. Louis, MS.

Members of the public and interested parties, groups, agencies and persons are cordially invited to attend the public hearing and comment on the draft of the 2011 Hazard Mitigation Plan. Copies of the draft of the Plan are on file and available for review and copying at the following locations: Hancock County, Bay - Waveland Public Library, 312 Highway 90, Bay St. Louis, MS. or at City Hall located at 388 Highway 90 Bay St. Louis, MS. during business hours.

Draft copies are also available for viewing and printing at the following internet websites: <http://www.baystlouis-ms.gov/documents>. Also at the following ftp site: <ftp://BaySt.Louis:BSLLHMP@amftp.amec.com/>. (Username - BaySt.Louis Password – BSLLHMP)

Written comments concerning the plan can be delivered or mailed to the following address: Floodplain Manager, 388 Highway 90, Bay St. Louis, MS 39520. All comments will be considered for inclusion in the plan. Written comments should be received no later than 4:00 P.M. CDT on Friday, June 17, 2011.

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in City, and/or their interest as a neighboring jurisdiction, representatives from the following agencies were invited to participate on the HMPC:

- Federal Emergency Management Agency
- Mississippi Emergency Management Agency
- Department of Marine Resources
- Mississippi Development Authority
- Mississippi Flood Plain Management
- U.S. Forest Service
- National Weather Service
- Public Safety Services (Fire and Police) City of Waveland and Hancock County
- County Watershed/Coastal Resources District Conservation Officer
- Southern Mississippi Planning and Development District

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- Gulf Regional Planning Commission
 - American Red Cross
 - Health Care, Hancock General Hospital
 - Senior Services
 - Public Works (City and County)
 - Hancock County Board of Supervisors
 - Historic Preservation

Figure 3.3 Sample Notice to Interested Agencies

May 11, 2011

RE: City of Bay St. Louis – Update of Local Hazard Mitigation Plan

To: All Interested Parties, Agencies and Persons

The City of Bay St. Louis received a FEMA Hazard Mitigation Grant funding in 2010 to develop an update its Local Hazard Mitigation Plan (LHMP). The purpose of this plan is to reduce or eliminate long-term risk to the people and property of the City of Bay St. Louis from the effects of natural hazard events. The Disaster Mitigation Act of 2000 requires all local governments to assess their risks to natural hazards and identify actions that can be taken in advance to reduce future losses. The law requires all local governments and districts to have an approved Local Hazard Mitigation Plan after November 1, 2004 and update those plans every five (5) years to be eligible for certain federal disaster assistance and hazard mitigation funding programs. Bay St. Louis' Hazard Mitigation Plan was prepared and adopted in 2005 prior to Hurricane Katrina and the Annexation.

The City of Bay St. Louis' Flood Plain Manager and Building Official have taken the lead in developing this plan and the City hired a consultant, AMEC Earth and Environmental, Inc. to manage and facilitate the planning process, collect the necessary data, and perform other technical services, including preparing the risk assessment and plan document. Work on the update of the plan nears completion and a draft of the plan is ready for review by interested agencies, organizations and persons.

A copy of the draft plan is available at the following web site for review: <http://www.baystlouis-ms.gov/documents.ftp://BaySt.Louis:BSLLHMP@amftp.amec.com/>. (Username - BaySt.Louis Password – BSLLHMP).

Copies of the plan are also available for review at the following locations: Building Office at City Hall and Hancock County Public Library in Bay St. Louis. Please address written comments as follows: Bay St. Louis Building Department, Attention: Josh Hayes, 688 Highway 90, Bay St. Louis, Mississippi 39520. Written comments will be received until close of business, Wednesday, June 17, 2011

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. Bay St. Louis uses a variety of comprehensive planning mechanisms, such as general plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies

into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

- Bay St. Louis and Hancock County Flood Insurance Studies
- Bay St. Louis Comprehensive Plan 2008
- Bay St. Louis Multi-Hazard Mitigation Plan, 2005
- Hancock County Comprehensive Emergency Management Plan 2010
- State of Mississippi Standard Mitigation Plan, 2010
- Mississippi Coastal Improvements Program Plan

Other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment.

Each chapter and section of the 2005 Hazard Mitigation Plan was reviewed and changes made to update data. Population and economic data was updated to reflect current conditions. Significant changes to the community as result of the 2006 annexation and Hurricane Katrina in 2005 were discussed and were noted as appropriate.

Most significantly, maps and graphics were reworked to reflect the new geographic area of the City of Bay St. Louis and land uses. Storm surge data from Mississippi Emergency Management Agency indicates a much larger area at risk than was shown in the 2005 Plan and the 2009 DFIRM indicate a community at risk from flooding, especially tidal and storm surge than was previously thought.

3.2.2 Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

AMEC led the HMPC in an effort to identify, document, and profile all the hazards that have, or could have, an impact the planning area. Data collection worksheets were developed and used in this effort to aid in determining hazards and vulnerabilities and where the risk varies across the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities.

The HMPC also conducted a capability assessment to review and document the planning area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Chapter 4 Risk Assessment.

3.2.3 Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

AMEC facilitated brainstorming and discussion sessions with the HMPC that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Chapter 5 Mitigation Strategy. Additional documentation on the process the HMPC used to develop the goals and strategy is in Appendix C.

Planning Step 8: Draft an Action Plan

At a meeting of the LHMP held on January 12, 2011, the 26 action items from the 2005 plan were reviewed. Of these 26 actions, 23 have been completed or are ongoing and 3 have not yet been started due to a variety of reasons such as changes in priorities, lack of funding, or changes to the projects themselves. The HMPC agreed that the goals in the 2005 plan should remain the same.

3.2.4 Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 7 Plan Implementation and Maintenance.

Implementation and Maintenance Process: 2005

The 2005 Multi-Hazard Mitigation Plan included a process for implementation and maintenance. This process as set forth in the 2005 plan was generally followed, with some variation. Shortly after the plan was completed in 2005, Hurricane Katrina affected every facet of the City. After assessing the damage the City prepared a short amendment to the plan to recognize the damages and changes to the city resulting from Katrina. Among others, the following findings were included in the amendment:

- 743 housing units were completely destroyed; damages to 628 housing units exceeded 50% of value and were unsafe for occupation; 918 had less than 50% damage with damages primarily from flooding and temporarily uninhabitable.

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- Pre-Katrina, Bay St. Louis had 3,771 active utility accounts; six months post-Katrina there were only 1,978 active utility accounts.
 - The bluff on the west side of the Bay of St. Louis was eaten away, destroying a several block wide section of Beach Boulevard and many structures in the downtown area of the City.
 - Every government building was seriously damaged and government services had to be relocated; nearly every city-owned vehicles and nearly all rolling equipment was damaged or destroyed.
 - Public infrastructure including streets, drainage, water, sewer and gas distribution was completely destroyed in some areas of the City and damaged in most other areas. Both the railroad bridge and the U.S. Highway 90 bridge across the Bay of St. Louis were destroyed and had to be reconstructed, isolating Bay St. Louis from the remainder of the Mississippi Gulf Coast.

Post-Katrina reconstruction resulted in implementation of many activities in the 2005 plan. Following are some of the activities:

- The center for City government was moved to an area away from the waterfront that is less likely to sustain flood damage from storm surge in the future. The buildings are part of a complex previously occupied as headquarters for a large utility, consolidating all city government functions into one location.
- One school that was recommended for public sheltering in the 2005 plan was severely damaged by Katrina and has been closed with students absorbed into the remaining schools.
- Two new fire department buildings have been constructed to FEMA 361 standards, providing a safe haven for first responders. The police station was moved to the same location as the City Hall.
- A solution has been found to a major drainage problem in Dunbar Avenue that was cited in the 2005 plan and work is underway on that project. An engineering study of culvert capacity on North Beach cited in the 2005 plan has revealed that the work on Dunbar Avenue should solve the problem and no action is necessary at that site.
- Funding became available to build a seawall that will prevent future damage to the downtown area of the City along the Bay of St. Louis and the Mississippi Sound. The seawall will prevent much of the coastal erosion the City was experiencing when the 2005 plan was completed.
- The bridge across the Bay of St. Louis was rebuilt at a much higher elevation and reopened in 2007. The CSX railroad bridge was reconstructed but not elevated.

The City continues to review the plan on an at least an annual basis as part of its CRS program recertification and revisits it whenever any problem occurs. One major change reported in the 2011 plan is the increase in Repetitive Loss (RL) properties resulting from the 2006 annexation. When the 2005 Plan was completed, the City had only 12 RL properties. Bay St. Louis now has over 400 repetitive loss properties and through the planning process has mapped all of those properties. As structures are rebuilt, owners must conform to the 2006 International Building

Codes which requires additional construction measures to strengthen against high winds and just as importantly, conform to the October 2009 DFIRM in flood hazard areas.

Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. “It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.”

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a jurisdiction’s potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

- 1) Identify Hazards;
- 2) Profile Hazard Events;
- 3) Inventory Assets; and
- 4) Estimate Losses.

Data collected through this process has been incorporated into the following sections of this chapter:

- **Section 4.1: Hazard Identification: Natural Hazards** identifies the natural hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.
- **Section 4.2: Hazard Profiles** discusses the threat to the planning area and describes previous occurrences of hazard events and the likelihood of future occurrences.
- **Section 4.3: Vulnerability Assessment** assesses the planning areas’ exposure to natural hazards; considering assets at risk, critical facilities, and future development trends.
- **Section 4.4: Capability Assessment** inventories existing mitigation activities and policies, regulations, and plans that pertain to mitigation and can affect net vulnerability.

This risk assessment covers the entire geographical extent of Bay St. Louis. The other jurisdictions, Hancock County and the City of Waveland both have their own plans but because they share boundaries with Bay St. Louis and share common problems, representatives of those jurisdictions were invited to be members of the planning committee and have participated in the

planning process. The Hazard Mitigation Planning Committee (HMPC) is required to evaluate how to define the hazards and risks faced by the community. This is a single jurisdiction plan but hazards and risks affecting the entire area or extending from one jurisdiction to another are noted in this Chapter. Risks crossing jurisdictional boundaries are noted and additional information may be included in an annex.

This Local Hazard Mitigation Plan (LHMP) update involved a comprehensive review and update of each section of the risk assessment. As part of the risk assessment update, new data was used, where available, and new analyses were conducted. Refinements, changes, and new methodologies used in the development of this risk assessment update are summarized in Chapter 2.0 What's New and detailed in this Risk Assessment portion of the plan.

As discussed in Chapter 2.0 What's New, one of the most significant additions to the risk assessment is the analysis of critical facilities present in the Bay St. Louis planning area and those falling within mapped hazard areas such as flood and surge zones.

4.1 Hazard Identification: Natural Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.

The City Bay St. Louis HMPC conducted a hazard identification study to determine the hazards that threaten the planning area.

4.1.1 Results and Methodology

Using existing natural hazards data and input gained through planning meetings, the HMPC agreed upon a list of natural hazards that could affect Bay St. Louis. Hazards data from the Mississippi Emergency Management Agency (MEMA) *State of Mississippi Standard Mitigation Plan*, FEMA, the National Oceanic and Atmospheric Administration (NOAA), the National Hurricane Center (NHC), National Climatic Data Center (NCDC) and many other sources were examined to assess the significance of these hazards to the planning area. Significance was measured in general terms and focused on key criteria such as frequency and resulting damage, which includes deaths and injuries, as well as property and economic damage. The natural hazards evaluated as part of this plan include those that have occurred historically or have the potential to cause significant human and/or monetary losses in the future. The natural hazards identified and investigated for the Bay St. Louis Local Hazard Mitigation Plan include:

- Tropical Storms/Hurricanes/Storm Surge
- Flood 100/500-year
- Thunderstorms, high winds, and hail
- Tornado
- Coastal Erosion

-
- Earthquake
 - Extreme Heat
 - Winter Weather/Freeze
 - Wildfires

All of the above, with the exception of extreme heat and wildfire, were profiled in the 2005 Bay St. Louis Hazard Mitigation Plan. In the 2005 plan, winter weather/freeze was title winter weather. Extreme heat and wildfire are new hazards profiled in this plan update.

During the evaluation the HMPC determined that a number of hazards would not be included in the plan. This decision was based upon the belief that they were not prevalent hazards within Bay St. Louis or the local area. Following is a brief description of those hazards and the reason for their exclusion:

- **Avalanche** – Avalanche is a mass of snow moving down a slope. Two basic elements are necessary to create a slide, a steep, snow covered slope and a trigger. There is no avalanche history in the State of Mississippi.
- **Dam Failure** - Dam failure is not considered a threat to the community. A review of the Mississippi Department of Environmental Quality (MDEQ) database of permitted dams within the state revealed that there are no dams in Bay St. Louis or the surrounding area.
- **Drought** – Located in sub-tropical South Mississippi, Bay St. Louis has an annual average rainfall of 62 inches. The National Climatic Data Center (NCDC) does not indicate any occurrences of problematic drought in this area. The State Plan recognizes drought as a hazard and will support mitigation activities handled by local governments.
- **Expansive Soils** – Expansive soils shrink when dry and swell when wet and can exert enough pressure to crack sidewalks, driveways, basement floors, pipelines and foundations. According to the U.S. Geological Survey (USGS), there are no expansive located in the Bay St. Louis area.
- **Land Subsidence** – Land subsidence occurs when large amounts of ground water have been withdrawn from certain types of rocks such as fine grained sediments causing the rock to compact. The soils in Bay St. Louis are predominately sandy ranging from a gray to black sandy silt with running veins of coarser sand that are not subject to land subsidence.
- **Landslide** – An abrupt movement of soil and bedrock down hill in response to gravity, landslides can be triggered by an earthquake or other natural cause. The City’s major geologic formation is a bluff that rises from the Bay of St. Louis, beginning gradually from the south, reaching its highest point in the general area of downtown and dropping off as the coastline continues to the north. At its highest point, the bluff is only about 21 feet National Geodetic Vertical Datum (NGVD).
- **Tsunamis** – Defined as a long-term (generally 15 to 60 minutes) wave caused by a large scale movement of the sea floor due to volcanic eruption, marine earthquake or landslide. Barely noticeable at sea, the wave velocity may be as high as 400 knots so that it travels great distances and in shoal water reaches heights up to 15 meters. The National Oceanic and

Atmospheric Association (NOAA) indicates that the risk of a tsunami in the area is low due to the relatively shallow depth of the Gulf of Mexico and the absence of geologic formation and activity on the sea floor.

- Volcano – A volcano is a mountain that is built by accumulation of lava, ash flows and air born ash and dust. When pressure from gases and the molten rock within the volcano become strong enough to cause an explosion, eruption occurs. There are no active volcanoes in Bay St. Louis or the State of Mississippi and no historical record of this hazard.

Table 4.1. Hazard Summary for the City of Bay St. Louis

Hazard	Tropical Storm/ Hurricane/ Storm Surge	Flood 100/500 Year	Thunderstorms/ Wind/Hail	Tornado	Coastal Erosion	Earthquake	Extreme Heat	Wildfire	Winter Weather/ Freeze
Frequency of Occurrence	Likely	Highly Likely	Highly Likely	Likely	Highly Likely	Unlikely	Limited	Unlikely	Occasional
Potential Magnitude	Catastrophic	Catastrophic	High	Critical	Limited	Limited	Limited	Limited	Limited
Spatial Extent	Extensive	Extensive	Extensive	Limited	Limited	Limited	Extensive	Limited	Limited
Significance	High	High	High	Medium	Low	Low	Low	Low	Low
Worst Case Scenario	Likely	Likely	Likely	Unlikely	Occasional	Unlikely	Occasional	Occasional	Occasional
Expected Scenario	Likely	Likely	Likely	Unlikely	Occasional	Unlikely	Occasional	Occasional	Occasional
Location	Extensive	Extensive	Extensive	Limited	Limited	Limited	Extensive	Limited	Limited
Worst Case Human Impact	Catastrophic	Catastrophic	High	Critical	Negligible	Negligible	Limited	Limited	Limited
Expected Human Impact	Catastrophic	Catastrophic	High	Critical	Negligible	Negligible	Limited	Limited	Limited
Worst Case Structural Impact	Catastrophic	Catastrophic	High	Critical	Negligible	Negligible	Limited	Limited	Limited
Expected Structural Impact	Catastrophic	Catastrophic	High	Critical	Negligible	Negligible	Limited	Limited	Limited
Additional Potential Impacts	Catastrophic	Catastrophic	High	Critical	Negligible	Negligible	Limited	Limited	Limited
Guidelines: Frequency of Occurrence: Highly Likely: Nearly 100% probability in the next year. Likely: Between 10 and 100% probability in the next year Occasional: Between 1 and 10% probability in the next year Unlikely: Less than 1% probability in the next year Potential Magnitude: Catastrophic: More than 50% of the area affected Critical: 25 to 50% of the area affected Limited: 10 to 25% of the area affected Negligible: Less than 10% of the area affected					Spatial Extent: Limited: Less than 10% of planning area Significant: 10-50% of planning area Extensive: 50-100% of planning Area Significance: Low Medium High				

Source: City of Bay St. Louis Data Collection Guide

4.1.2 Disaster Declaration History

One method the HMPC used to identify hazards was the researching of past events that triggered federal and/or state emergency or disaster declarations in the planning area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments’ capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

Based on the disaster declaration history provided in Table 4.2, Bay St. Louis and Hancock County is among the many areas in Mississippi susceptible to disaster. Details on federal and state disaster declarations were obtained by the HMPC from FEMA, and MEMA and compiled in chronological order in Table 4.2. A review of state and federal declared disasters indicates that Hancock County received 12 federal disaster declarations between 1965 and 2010. Ten of the declarations were associated with hurricanes and tropical storm occurring during hurricane season (June 1 – November 30). The remaining two were associated with spring storms that caused flooding and tornado activity in the month of May prior to the onset of hurricane season.

This disaster history (combined FEMA and State declared) suggests that Bay St. Louis and Hancock County are major event worthy of a disaster declaration every 3.75 years. Every declaration resulted directly or indirectly from severe weather. Similarly, most disaster-related injuries to people and damage to property resulted from severe weather conditions. Wind and flood damage from storm surge associated with hurricanes accounts for the majority of damage followed by heavy rainfall associated with hurricanes and tropical storms.

Table 4.2. Bay St. Louis/Hancock County State and Federal Disasters Declaration, 1965-2010

Hazard Type	Disaster #	Year	Federal Declaration	Location	Damage*
Hurricane Betsy	210	1965	09/24/1065	MS/LA Coasts	
Hurricane Camille	271	1969	08/18/1969	State of MS/TN/VA	
Hurricane Frederic	599	1979	09/13/1979	MS/AL Coasts	\$19,471,559
Hurricane Elena	741	1985	09/04/1985	MS/AL/FL Coasts	

Hazard Type	Disaster #	Year	Federal Declaration	Location	Damage*
Severe Storm, tornado, flooding	1051	1995	05/12/1995	Hancock Co. and 6 other counties	\$996,257
Hurricane Georges	1251	1998	10/01/1998	Hancock County and 6 other counties	\$32,124,060
TS Allison	1382	2001	06/21/2001	Hancock County and 4 other counties	\$2,356,352
TS Isidore	1436	2002	10/01/2002	Hancock County and 10 other counties	\$9,700,101
Hurricane Ivan	1550	2004	09/2004	MS/AL/FL Coasts	\$15,559,059
Hurricane Dennis	1594	2005	09/10/2005	Hancock and 2 other counties	\$1,691,481
Hurricane Katrina	1604	2005	08/29/2005	Hancock County and 40 other MS counties	\$2,032,150,345
Hurricane Gustav	1794	2008	09/29/2008	Hancock County and 4 other counties	
Severe storms, flooding, tornadoes	1837	2009	05/12/2009	Hancock and 3 other counties	

Source: FEMA, MEMA

4.2 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The hazards identified in Section 4.1 Hazard Identification Natural Hazards, are profiled individually in this section. In general, information provided by planning team members is integrated into this section with information from other data sources. These profiles set the stage for Section 4.3 Vulnerability Assessment, where the vulnerability is quantified for each of the priority hazards.

Each hazard is profiled in the following format:

Hazard/Problem Description

This section gives a description of the hazard and associated issues followed by details on the hazard specific to the Bay St. Louis Planning Area. Where known, this includes information on the hazard extent, seasonal patterns, speed of onset/duration, and magnitude and/or any secondary effects.

Past Occurrences

This section contains information on historical incidents, including impacts where known. The extent or location of the hazard within or near the Bay St. Louis Planning Area is also included here. Historical incident worksheets were used to capture information from participating jurisdictions on past occurrences.

Frequency/Likelihood of Future Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. It was determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percent chance of the event happening in any given year (e.g., three hurricanes or tropical storms over a 30-year period equates to a 10 percent chance of experiencing a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:

- **Highly Likely**—Near 100 percent chance of occurrence in next year or happens every year
- **Likely**—Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less
- **Occasional**—Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years
- **Unlikely**—Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Section 4.2.10 Natural Hazards Summary provides an initial assessment of the profiles and assigns a level of significance or priority to each hazard. Those hazards determined to be of high significance were characterized as priority hazards that required further evaluation in Section 4.3 Vulnerability Assessment. Those hazards that occur infrequently or have little or no impact on the planning area were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency and resulting damage, including deaths/injuries and property, crop, and economic damage. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the planning area, enabling the County to focus resources where they are most needed.

The following sections provide profiles of the natural hazards that the HMPC identified in Section 4.1 Hazard Identification. High and medium significance hazards (as identified in Table 4.1) are profiled first in order of risk to the planning area; followed by profiles of low significance hazards presented alphabetically, after the general severe weather profile for the City in Section 4.2.1.

4.2.1 Severe Weather: General

Severe weather is generally any destructive weather event, but usually occurs in the Bay St. Louis Area as localized storms that bring heavy rain, hail, lightning, and strong winds.

The National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) has been tracking severe weather since 1950. Their Storm Events Database contains data on the following: all weather events from 1993 to current (except from 6/1993-7/1993); and additional data from the National Hurricane Center. This database contains 219 severe weather events that occurred in the Bay St. Louis area between January 1, 1950 and February 10, 2010. Table 4.3 summarizes these events.

Table 4.3. NCDC Severe Weather Reports for Bay St. Louis 1995-2010*

Type	# of Events	Property Loss	Deaths	Injuries
Hurricanes/Tropical Storms)	20	\$8,019,000,000	0	0
Coastal Storms (Subtropical	5	\$500,000	0	0
Flood	19	\$41,620,000	0	0
Hail	47	\$0	0	0
Heavy Rain	2	\$0	0	0
Thunderstorm/Wind	77	\$219,000	0	4
Lightning, Hail	8	\$281,000	2	0
Tornado F0	16	\$74,000	0	0
Tornado F1	16	\$878,000	0	3
Tornado: F2	7	\$1,075,000	0	3
Tornado: F3	1	\$25,000,000	0	8
Totals	219	\$8,048,880,000	2	19

Source: National Climatic Data Center Storm Events Database, www4.ncdc.noaa.gov/cgi-win/wwcgl.dll?wwEvent~Storms

*Note: Losses reflect totals for all impacted areas of Hancock County.

The HMPC supplemented NCDC data with data from SHELDUS (Spatial Hazard Events and Losses Database for the United States). SHELDUS is a county-level data set for the United States that tracks 18 types of natural hazard events along with associated property and crop losses, injuries, and fatalities for the period 1960-2005. Produced by the Hazards Research Lab at the University of South Carolina, this database combines information from several sources (including the NCDC). From 1960 to 1995, only those events that generated more than \$50,000 in damage were included in the database. For events that covered multiple counties, the dollar losses, deaths, and injuries were equally divided among the affected counties (e.g., if four counties were affected, then a quarter of the dollar losses, injuries, and deaths were attributed to each county). From 1995 to 2005 all events that were reported by the NCDC with a specific dollar amount are included in SHELDUS.

SHELDUS contains information on 67 severe weather events that occurred in Hancock County between 1960 and 2005. Table 4.4 summarizes these events.

Table 4.4. SHELDUS Severe Weather Reports for Hancock County, 1960-2005*

Type	# of Events	Property Loss (\$)	Crop Loss (\$)	Deaths	Injuries
Hurricane/Tropical Storm	10	1,111,969,360	880,514	1.87	68.10
Tornado	10	5,481,750	250	0	11.5
Coastal Storm	9	3,769,058,333	0	0	0
Flooding	10	35,100,629	6,984,019	.14	.14
Hail	0	2,380	0	0	0
Lightning	10	380,800	0	3	3
Thunderstorm – Wind	10	307,696	1,638	0	4.58
Winter weather	8	89,482	61,585	1	6

Source: SHELDUS, Hazards Research Lab, University of South Carolina, www.sheldus.org/

*Events may have occurred over multiple counties, so damage may represent only a fraction of the total event damage and may be not specific to Hancock County

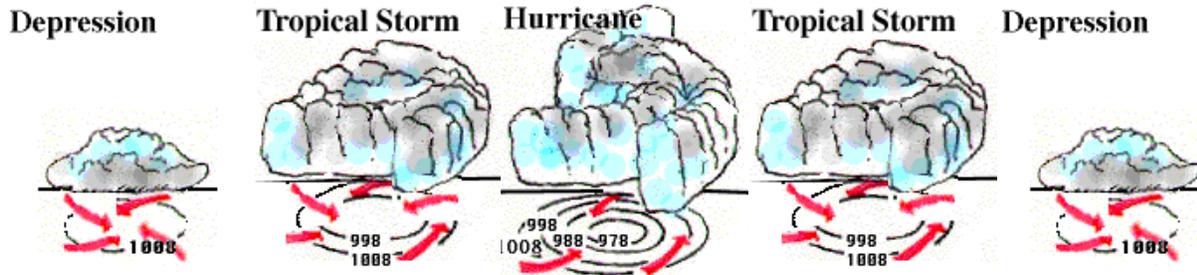
The NCDC and SHELDUS tables above summarize severe weather events that occurred in Hancock County. Only a few of the events actually resulted in state and federal disaster declarations. It is further interesting to note that different data sources capture different events during the same time period, and often display different information specific to the same events. While the HMPC recognizes these inconsistencies, they see the value this data provides in depicting the County’s overall hazard environment. As previously mentioned, most all of Bay St. Louis and South Mississippi’s state and federal disaster declarations have been a result of severe weather.

4.2.2 Tropical Storm/Hurricanes/Coastal Storm Surge

Hazard/Problem Description

Hurricanes evolve through a life cycle of stages from birth to death. A hurricane begins as a tropical depression. A tropical depression in time can grow to a tropical storm by attaining sustained 34 mph wind speeds. At this point, the tropical storm is named. Tropical storms, in turn, organize and intensify and can continue to grow to become hurricanes. Once a hurricane matures and begins to dissipate (either over the ocean or after the hurricane has made landfall), it is downgraded to a tropical storm, and finally to a tropical depression before dying out completely. The progression of tropical disturbances can be seen in Figure 4.1.

Figure 4.1. Life Cycle of a Hurricane



Source: Department of Atmospheric Sciences at the University of Illinois at Urbana-Champaign

This section of the plan profiles tropical storms, hurricanes, and coastal storm surge.

Tropical Storm

Tropical storms and tropical depressions affect the City of Bay St. Louis. Both are categorized by the National Weather Service as a tropical cyclone. The differentiation between these two is wind speed and organization:

- **Tropical Depression** - a tropical cyclone in which the maximum 1-minute sustained surface wind is 33 knots (38 mph) or less. When viewed from a satellite, tropical depressions appear to have little organization. However, the slightest amount of rotation can usually be perceived when looking at a series of satellite images. Instead of a round appearance similar to hurricanes, tropical depressions look like individual thunderstorms that are grouped together.
- **Tropical Storm** - a tropical cyclone in which the maximum 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph) inclusive. As the storm transitions from tropical depression to tropical storm, the storm itself becomes more organized and begins to become more circular in shape - resembling a hurricane.

Each are warm-core, non-frontal, synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and a closed surface wind circulation above a well-defined center. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere. Tropical storms can cause problems even without becoming a hurricane. However, most of the problems a tropical storm cause stem from heavy rainfall. Table 4.6 shows the tropical storms that have made landfall in Bay St. Louis and their affects on the City. Tropical storms, while a hazard on their own, often bookend hurricanes, as seen in Figure 4.1.

Hurricane

A hurricane is a 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. The

Saffir/Simpson Scale, shown in Table 4.5, is used to give an estimate of the potential property damage and flooding expected along the coast from hurricane landfall.

Table 4.5. Saffir/Simpson Hurricane Wind Scale 2010*

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

Source: National Hurricane Center

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

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. The following describes the characteristics of each category storm:

Category 1 Hurricane - Winds 74 – 95 mph

Very dangerous winds will produce some damage.

People, livestock, and pets struck by flying or falling debris could be injured or killed. Older (mainly pre-1994 construction) mobile homes could be destroyed, especially if they are not anchored properly as they tend to shift or roll off their foundations. Newer mobile homes that are anchored properly can sustain damage involving the removal of shingle or metal roof coverings, and loss of vinyl siding, as well as damage to carports, sunrooms, or lanais. Some poorly constructed frame homes can experience major damage, involving loss of the roof covering and damage to gable ends as well as the removal of porch coverings and awnings. Unprotected windows may break if struck by flying debris. Masonry chimneys can be toppled. Well-constructed frame homes could have damage to roof shingles, vinyl siding, soffit panels, and gutters. Failure of aluminum, screened-in, swimming pool enclosures can occur. Some apartment building and shopping center roof coverings could be partially removed. Industrial buildings can lose roofing and siding especially from windward corners, rakes, and eaves. Failures to overhead doors and unprotected windows will be common. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. There will be occasional damage to commercial signage, fences, and canopies. Large branches of trees will snap and shallow rooted trees can be toppled. Extensive damage to power lines and poles will likely result in power outages that could last a few to several days. Hurricane Dolly (2008) is an example of a hurricane that brought Category 1 winds and impacts to South Padre Island, Texas.

Category 2 Hurricane - Winds 96-110 mph

Extremely dangerous winds will cause extensive damage.

There is a substantial risk of injury or death to people, livestock, and pets due to flying and falling debris. Older (mainly pre-1994 construction) mobile homes have a very high chance of being destroyed and the flying debris generated can shred nearby mobile homes. Newer mobile homes can also be destroyed. Poorly constructed frame homes have a high chance of having their roof structures removed especially if they are not anchored properly. Unprotected windows will have a high probability of being broken by flying debris. Well-constructed frame homes could sustain major roof and siding damage. Failure of aluminum, screened-in, swimming pool enclosures will be common. There will be a substantial percentage of roof and siding damage to apartment buildings and industrial buildings. Unreinforced masonry walls can collapse. Windows in high-rise buildings can be broken by flying debris. Falling and broken glass will pose a significant danger even after the storm. Commercial signage, fences, and canopies will be damaged and often destroyed. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks. Potable water could become scarce as filtration systems begin to fail. Hurricane Frances (2004) is an example of a hurricane that brought Category 2 winds and impacts to coastal portions of Port St. Lucie, Florida with Category 1 conditions experienced elsewhere in the city.

Category 3 Hurricane - Winds 111-130 mph

Devastating damage will occur.

There is a high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. Most newer mobile homes will sustain severe damage with potential for complete roof failure and wall collapse. Poorly constructed frame homes can be destroyed by the removal of the roof and exterior walls. Unprotected windows will be broken by flying debris. Well-built frame homes can experience major damage involving the removal of roof decking and gable ends. There will be a high percentage of roof covering and siding damage to apartment buildings and industrial buildings. Isolated structural damage to wood or steel framing can occur. Complete failure of older metal buildings is possible, and older unreinforced masonry buildings can collapse. Numerous windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Most commercial signage, fences, and canopies will be destroyed. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to a few weeks after the storm passes. Hurricane Ivan (2004) is an example of a hurricane that brought Category 3 winds and impacts to coastal portions of Gulf Shores, Alabama with Category 2 conditions experienced elsewhere in this city.

Category 4 Hurricane - Winds 131 to 155 mph

Catastrophic damage will occur.

There is a very high risk of injury or death to people, livestock, and pets due to flying and falling debris. Nearly all older (pre-1994) mobile homes will be destroyed. A high percentage of newer mobile homes also will be destroyed. Poorly constructed homes can sustain complete collapse of all walls as well as the loss of the roof structure. Well-built homes also can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Extensive damage to roof coverings, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will break most unprotected windows and penetrate some protected windows. There will be a high percentage of structural damage to the top floors of apartment buildings. Steel frames in older industrial buildings can collapse. There will be a high percentage of collapse to older unreinforced masonry buildings. Most windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months. Hurricane Charley (2004) is an example of a hurricane that brought Category 4 winds and impacts to coastal portions of Punta Gorda, Florida with Category 3 conditions experienced elsewhere in the city.

Category 5 Hurricane - Winds greater than 155 mph

Catastrophic damage will occur.

People, livestock, and pets are at very high risk of injury or death from flying or falling debris, even if indoors in mobile homes or framed homes. Almost complete destruction of all mobile homes will occur, regardless of age or construction. A high percentage of frame homes will be destroyed, with total roof failure and wall collapse. Extensive damage to roof covers, windows, and doors will occur. Large amounts of windborne debris will be lofted into the air. Windborne debris damage will occur to nearly all unprotected windows and many protected windows. Significant damage to wood roof commercial buildings will occur due to loss of roof sheathing. Complete collapse of many older metal buildings can occur. Most unreinforced masonry walls will fail which can lead to the collapse of the buildings. A high percentage of industrial buildings and low-rise apartment buildings will be destroyed. Nearly all windows will be blown out of high-rise buildings resulting in falling glass, which will pose a threat for days to weeks after the storm. Nearly all commercial signage, fences, and canopies will be destroyed. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Long-term water shortages will increase human suffering. Most of the area will be uninhabitable for weeks or months. Hurricane Andrew (1992) is an example of a hurricane that brought Category 5 winds

and impacts to coastal portions of Cutler Ridge, Florida with Category 4 conditions experienced elsewhere in south Miami-Dade County.

All categories of storms feature property damaging high winds, storm surge flooding, and pounding surf that results in land subsidence and infrastructure damage. They produce torrential rainfall that can cause fresh water flooding many miles inland from the point of landfall. Depending upon the size of the storm, communities located within 100 or more miles inland from of the point of landfall may sustain measurable damage from the wind, tide, or rainfall associated with a hurricane. Since the impact of hurricanes is so widespread, and damage can result from any or all of the aforementioned, an attempt is made to identify the impacts of each of the hazards within the hazard identified as hurricanes and tropical storms.

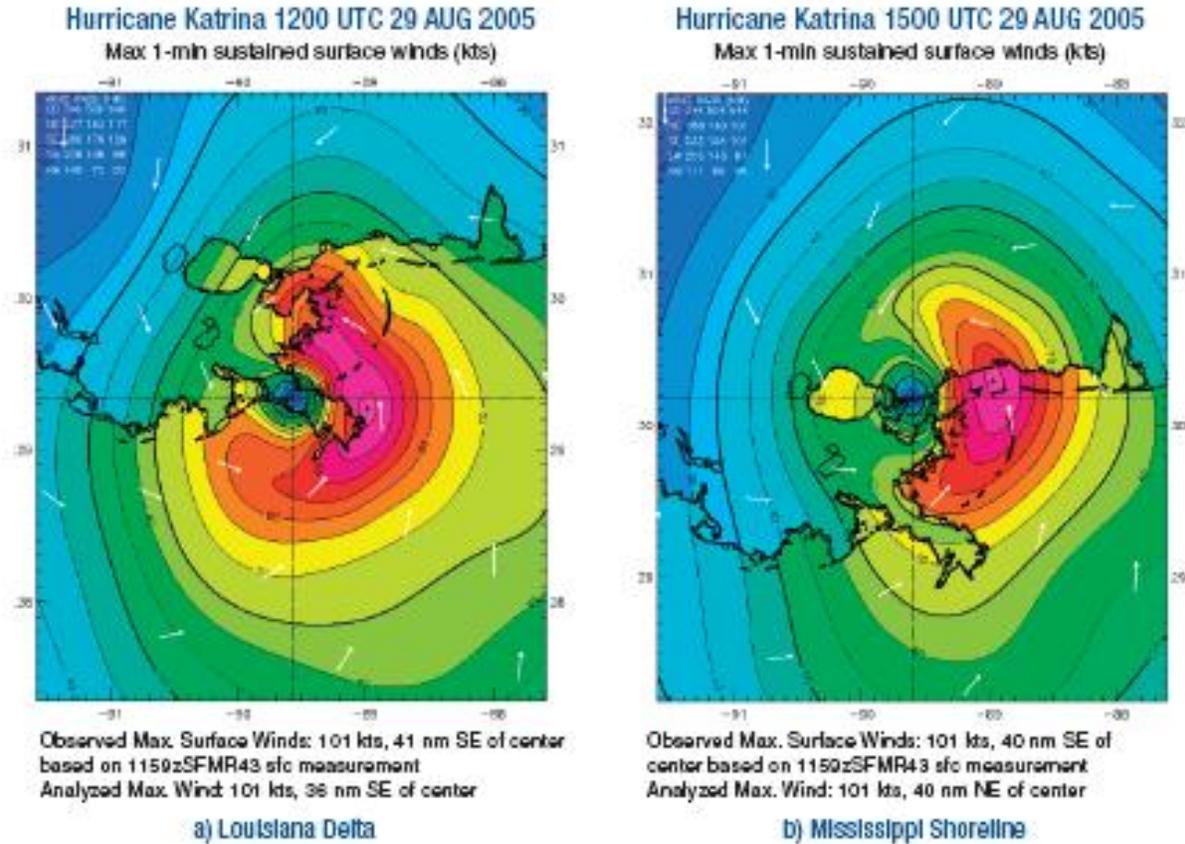
The greatest threat to life and property in Hancock County would occur if a Category 5 hurricane directly struck the coastline of Hancock County. The potential damages to public and private property was modeled by the State of Mississippi in its Hazard Mitigation Plan using HAZUS-MH and revealed that the greatest loss would occur across the Mississippi Gulf Coast and adjoining northern counties if the point of impact were Harrison County, immediately to the east of Hancock County.

Hurricane Katrina was the most damaging storm to strike Bay St. Louis and Hancock County in the past century. According to the Mitigation Assessment Team Report, Hurricane Katrina in the Gulf Coast, Building Performance Observations, Recommendations, and Technical Guidance (FEMA 549/July 2006), Hurricane Katrina was very large storm with hurricane force wind speeds covering approximately 200 miles in diameter as it neared shore and landfall. Within one hour of landfall and within 100 miles of the coastline, Katrina's wind speeds and central pressure were that of a Category 5 hurricane.

According to the National Weather Service (NWS) post-Katrina report issued on December 20, 2005, when the hurricane made its second landfall at Buras, Louisiana, it packed an estimated one-minute sustained wind speed of 110 knots (127 mph) with approximately 150 mph three-second gusts. After landfall in Louisiana, Katrina traveled over the Mississippi River Delta and Breton Sound before reaching the Mississippi coast, its third landfall (one in Florida, one in Louisiana, and one in Mississippi). The NWS estimated one-minute sustained surface winds of 105 knots (120 mph) or approximately 145 mph three-second gusts at landfall in Mississippi.

The NWS estimates were higher than any recorded by land-based instruments. The highest land-based wind speed was recorded at 117 mph by a Texas Tech University tower located at Stennis International Airport approximately 8 miles inland, north of Bay St. Louis, and more than 10 miles east of the actual landfall. Most other land-based anemometers either failed before they recorded maximum winds or were located great distances from the storm's path. As result, no wind speed instruments likely recorded the maximum winds produced by Katrina. Figure 4.2 depicts maximum sustained winds the Bay St. Louis and the surrounding area.

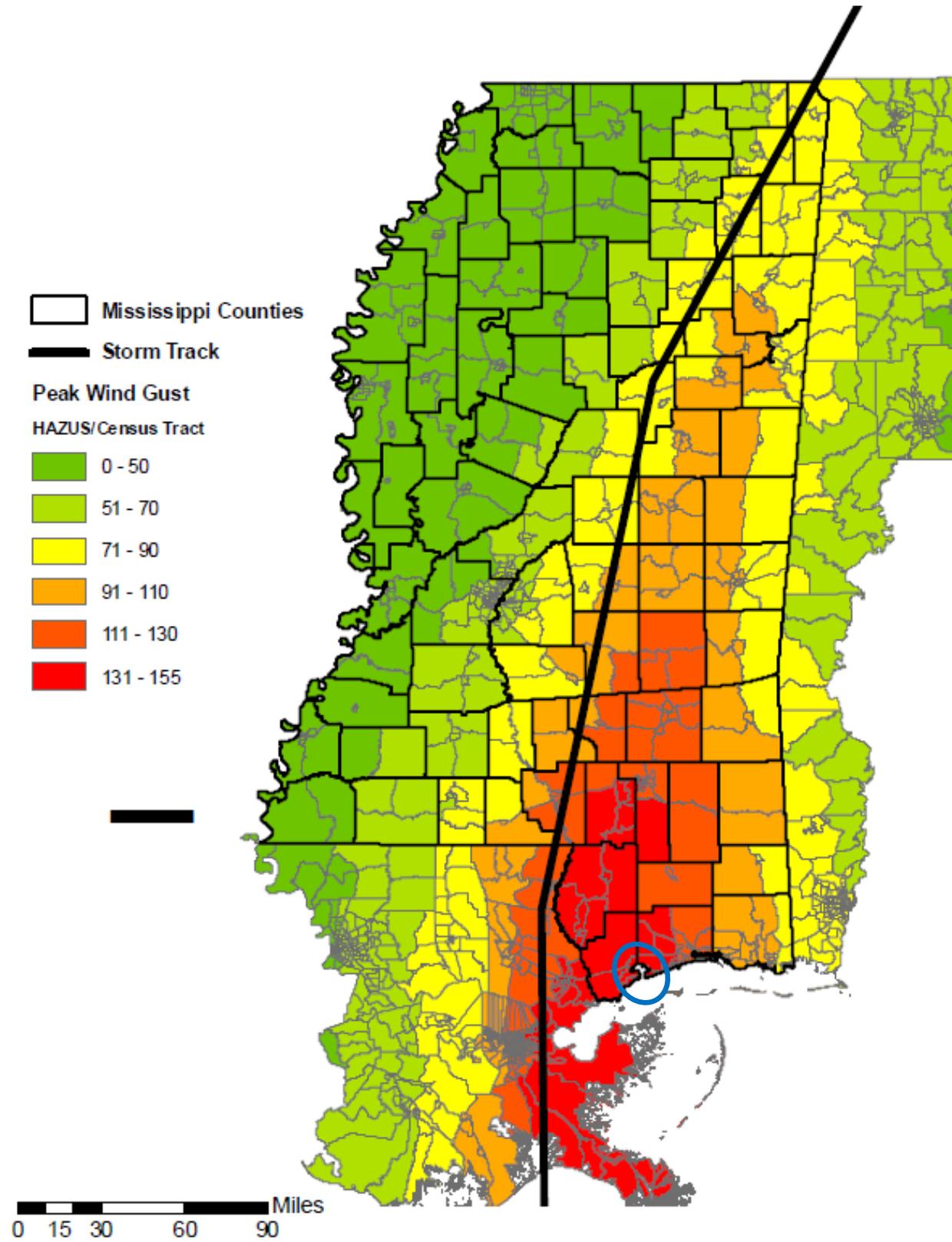
Figure 4.2. High Winds in the Bay St. Louis Area during Hurricane Katrina



Source: FEMA, Mitigation Assessment Team Report: Hurricane Katrina in the Gulf Coast

Winds of up to 100 mph were experienced in Hattiesburg, Jackson, and Laurel, Mississippi with hurricane force winds as far north as Amory, MS (see Figure 4.3). When the storm exited the northeast corner of Mississippi into Tennessee, wind speeds were recorded between 60 and 70 mph. Hundreds of thousands of acres of forest was damaged, and downed trees caused power outages lasting for up to several weeks in some areas. Property damaging F1 and F2 tornadoes spawned by Katrina were confirmed in Forrest County in the Hattiesburg area and in Newton, Lauderdale, Kemper, and Leake Counties as Katrina blew through the east-central area of the state. According to the assessment report, the anemometer was blown down at Laurel-Jones County Airport, and wind speed recording ceased in Jackson and Hattiesburg when power was lost, disabling wind measuring instruments at the height of the storm.

Figure 4.3. Peak Gusts of Hurricane Katrina



Source: State of Mississippi Hazard Mitigation Plan

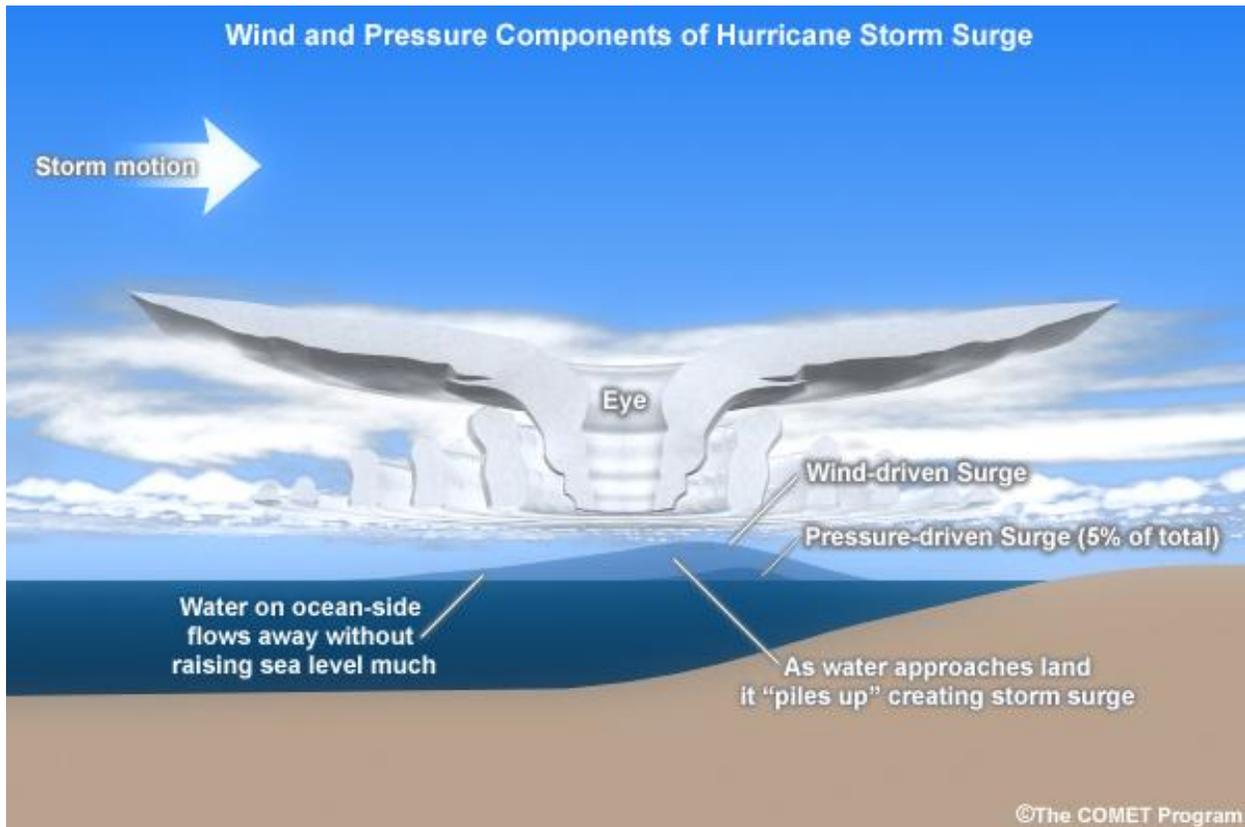
Coastal Storm Surge

According to the NOAA National Hurricane Center, along the coast, storm surge is often the greatest threat to life and property from a hurricane. In the past, large death tolls have resulted from the rise of the ocean associated with many of the major hurricanes that have made landfall. Hurricane Katrina (2005) is a prime example of the damage and devastation that can be caused by surge. At least 1,500 persons lost their lives during Katrina and many of those deaths occurred directly, or indirectly, as a result of storm surge.

Storm surge is an abnormal rise of water generated by a storm, over and above the predicted astronomical tides. This rise in water level can cause extreme flooding in coastal areas particularly when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more in some cases.

Storm surge is produced by water being pushed toward the shore by the force of the winds moving cyclonically around the storm (see Figure 4.4). The impact on surge of the low pressure associated with intense storms is minimal in comparison to the water being forced toward the shore by the wind. The maximum potential storm surge for a particular location depends on a number of different factors. Storm surge is a very complex phenomenon because it is sensitive to the slightest changes in storm intensity, forward speed, size, angle of approach to the coast, central pressure, and the shape and characteristics of coastal features such as bays and estuaries. Other factors which can impact storm surge are the width and slope of the continental shelf. A shallow slope will potentially produce a greater storm surge than a steep shelf.

Figure 4.4. How Storm Surge is Created



Source: NOAA

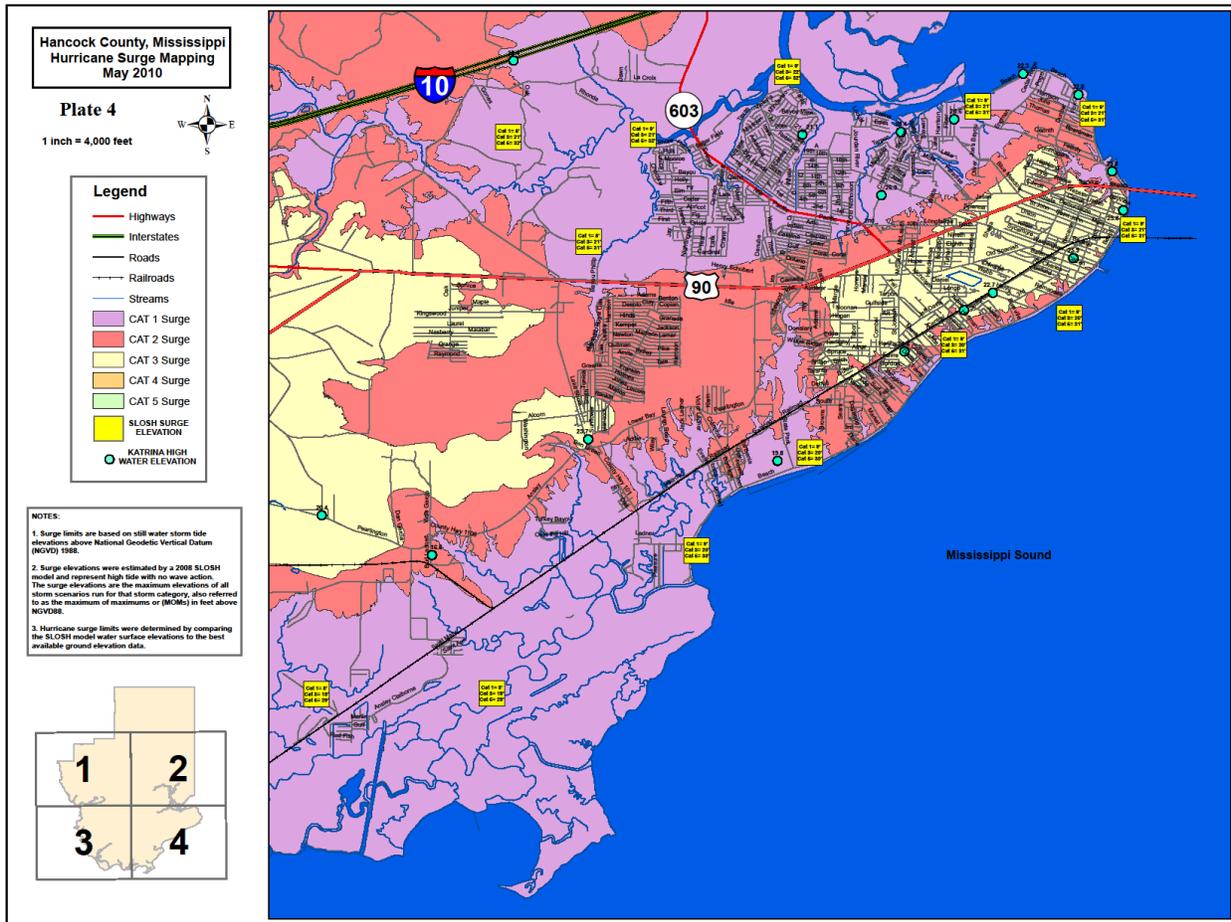
Adding to the destructive power of surge, battering waves may increase damage to buildings directly along the coast. Extended pounding by frequent waves can demolish any structure not specifically designed to withstand such forces. Additionally, currents created by tides combine with the waves to severely erode beaches and coastal highways. Buildings that survive hurricane winds can be damaged if their foundations are undermined and weakened by erosion.

In confined harbors, like in Bay St. Louis, the combination of storm tides, waves, and currents can also severely damage marinas and boats. In estuaries and bayous, salt water intrusion endangers the public health, kills vegetation, and can send animals, such as snakes and alligators, fleeing from flooded areas.

Storm Surge Mapping

In May 2010, MEMA published anticipated storm surge maps indicating expected storm surge from Category 1 through Category 5 hurricanes. In addition, the high water marks (HWM) and the depth of flooding at those locations established using Hurricane Katrina surge data are indicated. Anticipated Sea, Lake, and Overland Surges from Hurricane (SLOSH) surge elevations for Category 1, 3 and 5 hurricanes are also shown Figure 4.5 on the map at various locations across the City.

Figure 4.5. SLOSH Model for Bay St. Louis



Source: Mississippi Emergency Management Agency; U.S. Army Corps of Engineers, Mobile District.

Storm surge from Katrina caused severe damage to residential, commercial, and public buildings and infrastructure in Bay St. Louis. To assist in the long-term recovery and mitigation effort, FEMA performed a coastal high water marks (HWMs) study to investigate the high water conditions throughout the areas impacted by Katrina. The HWMs were surveyed by FEMA and the U.S. Geological Survey and results were classified as one of three basic types: surge only, surge and waves, or wave run up.

The HWM data demonstrates that Hurricane Katrina’s coastal storm surge and wave-related high water conditions reached historical proportions and covered significant portions of the Mississippi study area. Surge elevations along the open coast of Hancock County generally exceeded 23 feet with the highest surge HWMs in Hancock and Harrison Counties along either side of the opening to the Bay of St. Louis.

With elevations in the city averaging between 5 and 21 feet NGVD, nearly the entire land area of Bay St. Louis was inundated by the storm surge and/or wave action of Katrina. According to the HWM for the Bay St. Louis area, the high water mark resulting from surge was 25.9 feet along

Washington Avenue over a block from the beachfront. The HWM data was used by FEMA in calculating the flood hazard area boundaries and base flood elevations for the new DFIRMs. As such, the updated risk is reflected in the DFIRM that Bay St. Louis adopted October 16, 2009. Figure 4.5 illustrates worst-case storm surges for Category 1, 3, 5 storms along the Gulf Coast and the estimated maximum storm surge limits along the coast resulting from Hurricane Katrina storm surge and wave action. It is worthy to note that projected storm surges for Category 1, 3, and 5 hurricanes in Bay St. Louis are among the largest in the Gulf of Mexico.

Figure 4.6. SLOSH Data for Storm Surge in the Gulf of Mexico

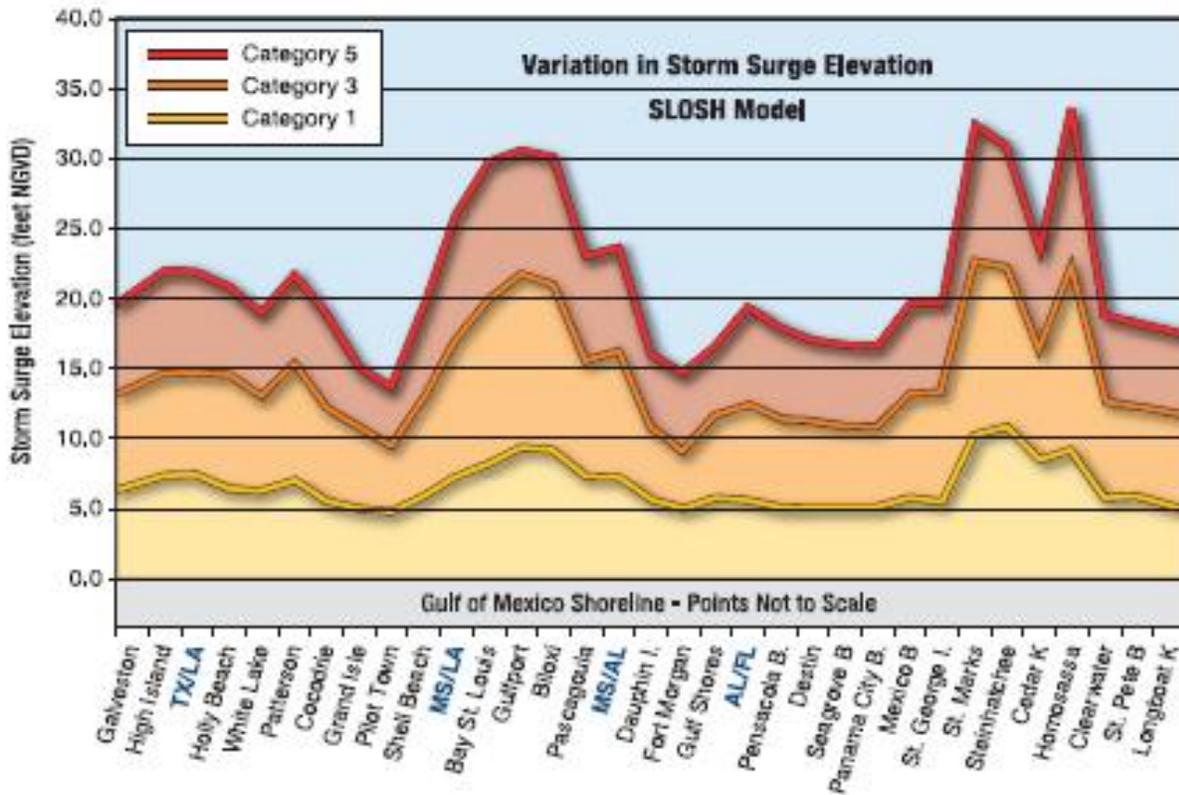


Figure 1-9. Maximum SLOSH storm surge predictions for open coast, developed shorelines

SOURCE: SLOSH DISPLAY CD-ROM/JANUARY 5, 2006/NOAA

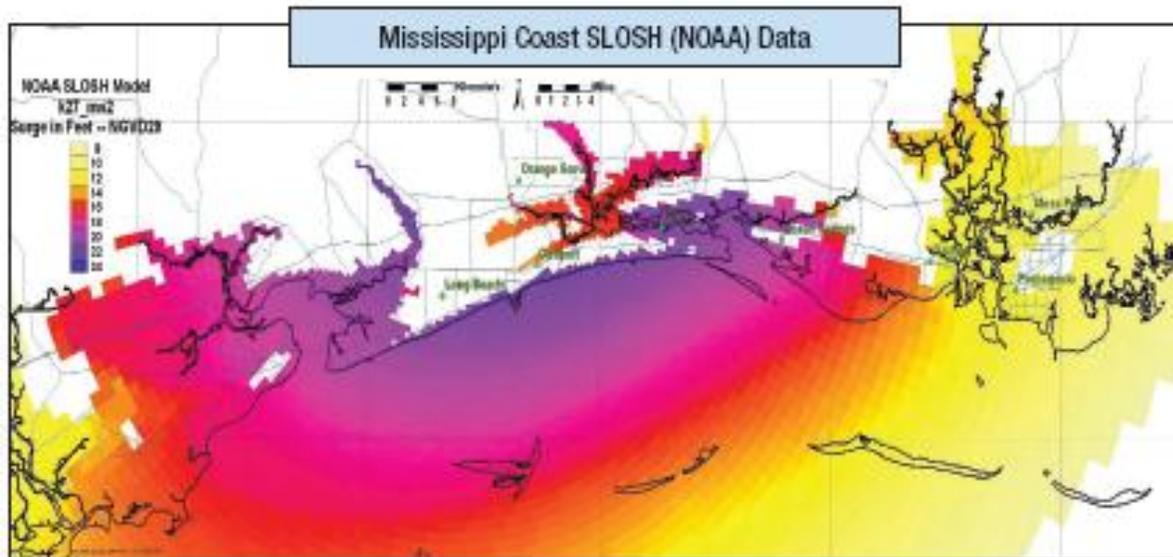


Figure 1-10. The SLOSH model of high water elevations for Hurricane Katrina

SOURCE: NOAA

Source: FEMA, Mitigation Assessment Team Report: Hurricane Katrina in the Gulf Coast

Past Occurrences

Hurricane

Since 1909, the Mississippi Coast and Hancock County has felt the effects of 19 hurricanes and 11 tropical storms. Table 4.6 reflects the history of hurricanes and tropical storms from 1909 to 2009.

Table 4.6. Hurricane & Tropical Storm History from 1909 to 2009

Name	Date	Category	Affected Area	Death	Injuries	Damage
Tropical Storm	11/9/2009	n/a	Hancock & Coastal MS	0	0	\$0
Tropical Storm	9/11/2008	n/a	Hancock & Coastal MS	0	0	\$0
Hurricane Ike	9/01/2008	3	Hancock, Coastal MS, LA, TX	0	0	\$10,700,000
Tropical Dep.	8/24/2008	n/a	Hancock County & coastal MS	0	0	\$0
Hurricane Katrina	8/29/2005	3	Hancock & 48 other counties	231	N/A	\$80,000,000,000
Hurricane Dennis	7/10/2005	2	Hancock & 40 other counties	0	0	\$26,000,000
Hurricane Cindy	7/5/2005	1	Hancock & 3 other counties	0	0	\$9,000,000
TS Arlene	6/10/2005	n/a	Hancock & 9 other counties	0	0	\$445,000
TS Matthew	10/9/2004	n/a	Hancock & 2 other counties	0	0	\$50,000
Hurricane Ivan	9/15/2004	4	Hancock & 43 other counties	1	0	\$200,000,000
TS Bill	6/30/2003	n/a	Hancock & 16 other counties	0	0	\$1,200,000
Hurricane Lili	10/3/2002	1	Hancock & 22 other counties	0	0	\$13,900,000
TS Isidore	9/25/2002	n/a	Hancock & 23 other counties	1	0	\$25,500,000
TS Hanna	9/14/2002	N/A	Hancock & no other details available	3	N/A	\$20,000,000
TS Bertha	8/5/2002	N/A	Hancock & no other details available	1	N/A	\$200,000
TS Allison	6/21/2001	n/a	Hancock & 4 other counties	0	0	\$50,000
Hurricane Georges	10/1/1998	2	Hancock & 15 other counties	0	0	\$674,000,000
TS Hermine	9/19/1998	n/a	Hancock & 3 other counties	0	0	\$85,000
Hurricane Danny	7/18/1997	1	Hancock & 2 other counties	4	N/S	100,000,000

Name	Date	Category	Affected Area	Death	Injuries	Damage
Hurricane Opal	10/4/1995	3	Hancock & 2 other counties	0	0	\$75,000
TS Dean	7/31/1995	N/A	Hancock & no other details available	1	N/A	\$500,000
Hurricane Florence	9/9/1988	1	Hancock & no other details available	1	N/A	\$2,900,000
Hurricane Juan	10/29/1985	1	Hancock & no other details available	24	N/A	\$1,750,000
Hurricane Elena	9/4/1985	3	Hancock & 3 other counties			No details available
Hurricane Frederic	9/13/1979	3	Hancock & 13 other counties	5	N/A	No details available
Hurricane Bob	7/10/1979	1	Hancock & no other details available	1	3	\$20,000,000
Hurricane Camille	8/18/1969	5	Hancock & 18 other counties	12 (in Hancock County)	143	No details available
Hurricane Betsy	9/25/1965	3	Hancock & no details available	N/A	N/A	No details available
1947 Hurricane	9/19/1947	3	Hancock County & no other details available	51	Unknown	\$100,000,000
1915 Hurricane	9/29/1915	4	Hancock County & no other details available	275	Unknown	No details available
1909 Hurricane	9/20-9/21/1909	4	Hancock County & no other details available	350	Unknown	No details available

Source: National Hurricane Center/Hurricane History; NOAA National Climatic Data Center – Extreme Events

In addition to these hurricanes, the Flood Insurance Study for the City of Bay St. Louis indicated that there were several significant storms during the 1800s which caused loss of life and damage to properties along the Mississippi Gulf Coast. These include hurricanes in 1819, 1821, 1852, 1855, 1860, and 1893. These hurricanes, although not in Table 4.6, are shown on Figure 4.7.

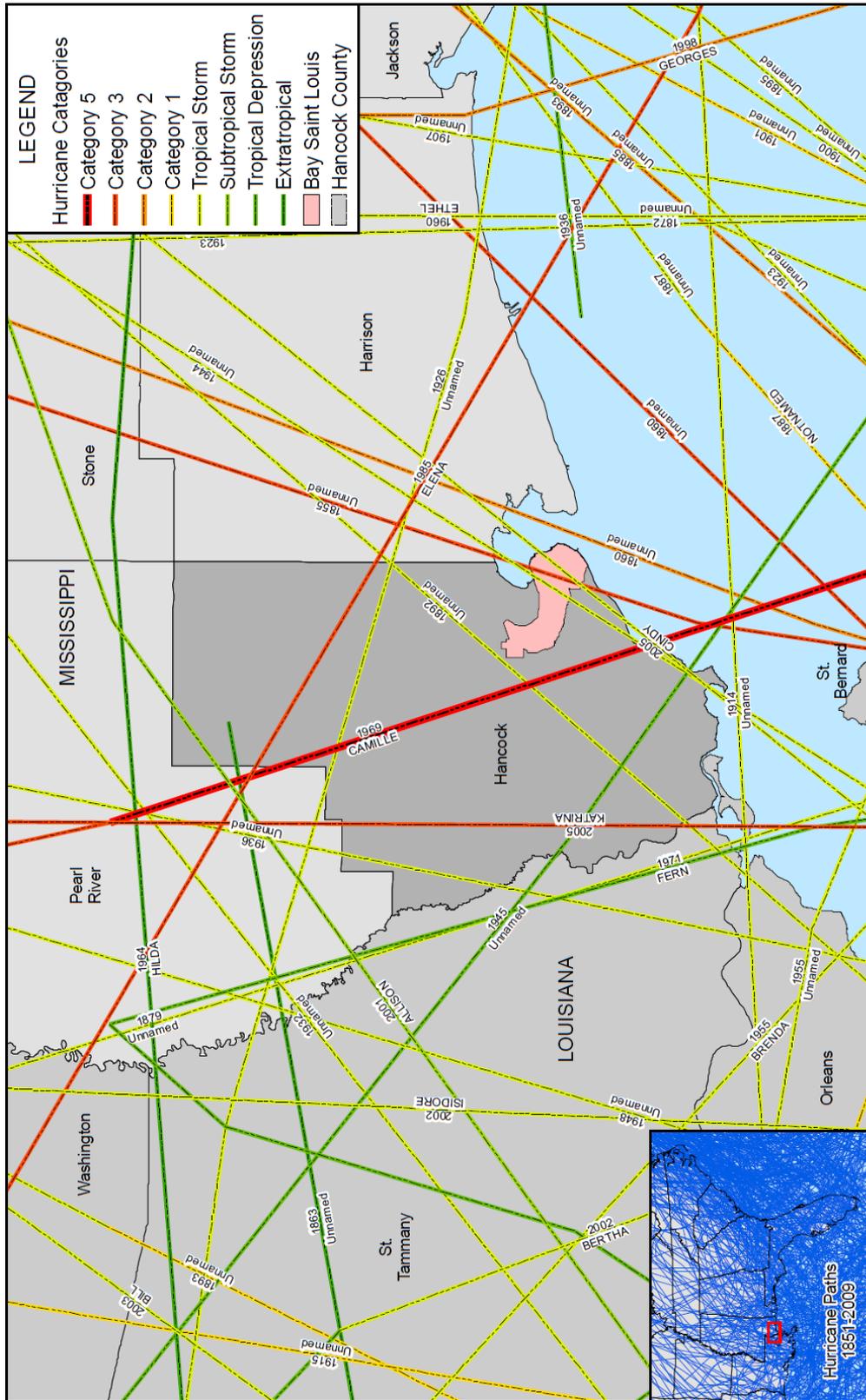
Coastal Mississippi, including Bay St. Louis, has felt the effects of direct strikes from many hurricanes during the last century, six of which were considered major (Category 3 or higher) with wind speeds exceeding 130 mph. Hancock County and Bay St. Louis sustained a direct hit from Hurricane Camille in 1969, one of only a few Category 5 storms to ever make landfall in the U.S. Hurricane Katrina was a Category 5 storm until only a few hours prior to landfall when its winds dropped to Category 3. The tide and storm surge experienced along the coastline actually exceeded that to be expected from a Category 5 storm.

The NOAA National Hurricane Center describes Katrina as an extraordinarily powerful and deadly hurricane that carved a wide swath of catastrophic damage and inflicted a large loss of life. Hurricane force winds extended 90 miles from the eye of the hurricane with tropical storm force winds extending 200 miles, making Katrina not only extremely intense but also exceptionally large. The impact of Katrina was felt from the Texas-Louisiana line to the Florida

Panhandle. Hurricane force winds were felt as far north as Jackson and Meridian in Mississippi with major wind damage, including widespread power failure, structural damage, and tree damage. For the first time in its history, the entire grid of the Mississippi Power Company was out of service, leaving more than 250,000 customers throughout South Mississippi without electricity, some for nearly two weeks.

Figure 4.7 indicates the historic paths of hurricanes over the past 150 years.

Figure 4.7. Hurricanes in Bay St. Louis



amec
 Map compiled 6/2010; intended for planning purposes only.
 Data Source: Hancock County Tax Assessor, City of Bay St. Louis,
 GRPC, National Hurricane Center

Coastal Storm Surge

Since 1995 (the date the NCDC began collecting data), the NCDC reports that the Mississippi Coast and Hancock County has felt the effects of 17 coastal storm surges. Table 4.6 reflects the history of hurricanes and tropical storms from 1995 to 2009.

Table 4.7. Coastal Storm Surge Events in Bay St. Louis

Type	Date	Affected Area	Death	Injuries	Damage
Coastal Flood	7/29/1995	Hancock, Harrison, and Jackson Counties	0	0	\$0
Storm Surge	2/15/1998	Hancock County	0	0	\$500,000
Storm Surge (TS Bill)	6/3/2003	Hancock, Harrison, and Jackson Counties	0	0	\$1,000,000
Storm Surge (TS Ivan)	9/16/2004	Hancock, Harrison, and Jackson Counties	0	0	\$2,000,000
Storm Surge (TS Matthew)	10/10/2004	Hancock and Harrison Counties	0	0	\$30,000
Storm Surge (TS Cindy)	7/5/2005	Hancock, Harrison, and Jackson Counties	0	0	\$1,000,000
Storm Surge (Hurricane Katrina)	8/29/2005	Hancock, Harrison, and Jackson Counties	0	0	\$11,300,000,000
Coastal Flood	10/16/2006	Hancock County	0	0	\$0
Coastal Flood	4/10/2008	Hancock County	0	0	\$0
Storm Surge (Hurricane Gustav)	9/1/2008	Amite, Hancock, Pearl River, Pike, Walthall, Wilkinson Counties	0	0	\$1,300,000
Storm Surge (Hurricane Ike)	9/11/2008	Hancock, Harrison, and Jackson Counties	0	0	\$0
Coastal Flood	3/27/2009	Hancock County	0	0	\$0
Coastal Flood	12/1/2009	Hancock County	0	0	\$0
Coastal Flood	2/4/2010	Hancock County	0	0	\$0
Coastal Flood	5/1/2010	Hancock County	0	0	\$0
Coastal Flood	5/2/2010	Hancock County	0	0	\$0
Coastal Flood	6/30/2010	Hancock County	0	0	\$0

Source: NCDC

Frequency/Likelihood of Future Occurrence

Hurricane

Likely—According to the *State of Mississippi Standard Mitigation Plan*, the three coastal and three first tier counties in the state are in high risk areas with an almost certain probability they will be impacted by hurricanes in the future. The plan places the probability of future occurrence within 75 miles of the Gulf Coast including Hancock County as follows:

Table 4.8. Probability of Future Hurricane Occurrence in Bay St. Louis

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

According to a release on August 5, 2010 by the National Oceanic and Atmosphere Administration, (NOAA), predicts a very active hurricane season. With the development of a La Nina current in the tropical Pacific Ocean, conditions favor lower wind shear over the Atlantic Basin allowing storm clouds to grow and organize into hurricanes. Other indicators include warmer than average water temperatures in the tropical Atlantic Ocean and Caribbean Sea.

Average annual predictions are for 11 named storms with wind speeds 39 or more mph, 6 forming into hurricanes and 2 into major hurricanes (Cat. 3, 4 or 5). For the 2010 season, 14 to 20 named storms with wind speeds 39 mph or higher are predicted. Of those 8 to 12 are predicted to strengthen into hurricanes with winds in excess of 74 mph and 4 to 6 of those are predicted to be major Category 3, 4 or 5 storms with wind speeds exceeding 111 mph.

Coastal Storm Surge

Highly Likely—Given the 17 storm surge occurrences over a period of 16 years (1995-2010), 1.06 coastal storm surge events affect Bay St. Louis each year.

4.2.3 Flood 100/500-Year

Hazard Profile

According to the *State of Mississippi Standard Mitigation Plan*, flooding causes 90% of all natural disaster damages. Most of the 288 deaths in Hurricane Katrina were flood related. Flooding can also cause extensive property damage, contributing to significant structural damage and in some cases structural failure from velocity associated with moving water and from saturation from flood waters. In nearly all cases of structural flooding unless personal property is relocated above the anticipated flood stage, it is also at risk.

Flooding is a natural and inevitable occurrence. Floods occur seasonally with torrential rains associated with tropical storms that later drain into river basins exceeding the natural capacity of the stream. Rivers and other bodies have always overflowed their normal beds to inundate nearby land. The low lands lying adjacent to these bodies of water are referred to as the floodplain.

Floodplains are made when floodwaters exceed the capacity of the main channel or escape the channel by eroding its banks. When this occurs, sediments (including rocks and debris) are deposited that gradually build up over time to create the floor of the floodplain. Floodplains generally contain unconsolidated sediments, often extending below the bed of the stream.

In Bay St. Louis, all flooding can be defined as coastal, drainage or flash flooding. Most drainage related flooding results from intrusion of tide water into drainage outlets that prevent drainage structures from operating as efficiently as they are designed to do during heavy rainfall.

Coastal (Tidal) Flooding: All lands bordering the Mississippi Sound, bays, estuaries or lakes are prone to tidal affects/flooding. Coastal land 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 flood plains provide a buffer zone along rivers and 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 tides, tropical storms and hurricanes. (see Section 4.2.2 for more details)

Flash or Rapid Flooding: Flash flooding is the result of heavy, localized rainfall, possibly from slow-moving intense thunderstorms that cause small streams to overflow. In Bay St. Louis, flash floods are most common when rain fall on built-up areas where impervious surfaces, gutters and storm sewers speed up the flow of run-off. These floods can become raging torrents of water that rip through streambeds, streets, and coastal section, sweeping everything in their path.

Drainage: Drainage flooding occurs primarily in urban or developed areas when the volume of runoff exceeds the capacity of the drainage system. Flooding of this nature can be the result of increased development, inadequate drainage structures, riverine flooding, coastal flooding or a combination of these causes.

Flooding can occur in coastal Bay St. Louis year-around but is most frequent in late spring, summer, and winter. The summer months often bring persistent thunderstorms and late summer the heavy rains associated with tropical storms and hurricanes moving ashore from the Gulf of Mexico are more prevalent. Winter storms originating in the Gulf also account for flooding events. Mean annual rainfall is 61 inches along the Mississippi Coast.

The City of Bay St. Louis defines flooding through its Ordinance No. 521 as “a general or temporary condition of partial or complete inundation of normally dry land from:

- The overflow of inland or tidal waters.
- The usual and rapid accumulation or runoff of surface waters from any source.

Bay St. Louis has sustained flood events severe enough to warrant federal disaster declarations. Table 4.9 shows the date, cause, designation, and funds extended as result of the declaration.

Table 4.9. Federal Disaster Declarations Due To or Including Flooding in Hancock County, Mississippi

Date	Description	Designation	Funds Extended
September 1979	Hurricane Frederic	FEMA – 599	\$ 19,471,559
May 1995	Flooding	FEMA -1051	\$996,257
September 1998	Hurricane Georges	FEMA - 1251	\$32,124,060
June 2001	TS Allison	FEMA – 1382	\$2,356,352
October 2002	TS Isidore/Hurricane Lili	FEMA – 1436	\$9,700,101
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
September 2009	Hurricane Gustave	FEMA – 1794	\$20,236,338
May 2009	Severe rain storms	FEMA - 1837	N/A

Source: Mississippi Emergency Management Agency – Public Assistance Program, State of Mississippi Standard Hazard Mitigation Plan, FEMA

Flood prone areas are identified within the City of Bay St. Louis from the Flood Insurance Study (FIS) and associated DFIRM Maps developed by the FEMA and the NFIP and adopted by ordinance on October 16, 2009. The DFIRM and Ordinance assist the City to manage activity within the floodplain and reduce loss of life and property damage from flooding.

The following Flood Insurance zones are identified by the DFIRM and defined in the ordinance:

- **VE Zone:** A Special Flood Hazard Area, extending from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action from storms.
- **AE Zone:** An area of 100-year or 1% annual chance of shallow flooding where depths are between one and three feet (sheet flow on sloping terrain or shallow ponding) with Base Flood Elevation shown or an area of 100-year shallow flooding where depths are between one and three feet with flood depths shown.
- **X 500 Zones (shaded):** Areas of 500 year or 0.2% annual chance of flooding with contributing drainage area of less than one square mile and areas protected by certified levees from the base flood.
- **X Zones (un-shaded):** Areas determined to be outside the 500 year floodplain.

The National Flood Insurance Program (NFIP) utilizes the 100-year flood as a basis for floodplain management. The Flood Insurance Study (FIS) defines the probability of flooding as flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 100 year period (recurrence intervals). Or considered another way, properties within a 100 year flood zone have a one percent probability of being equaled or exceeded during any given year.

Elevations in Bay St. Louis average between 5 and 21 feet National Geodetic Vertical Datum (NGVD). Elevations drop to below 10 feet NGVD in the northern and northwestern area of the city and average about 5 feet NGVD along the seawall on South Beach Boulevard. Elevations in the annexed area average between 4 and 8 feet. The entire city is vulnerable to inundation from storm surge flooding during major hurricanes. For this reason, the entire City of Bay St. Louis should be considered at risk for flooding and identified as a flood hazard area.

Mortgage lenders require that owners of properties with federally-backed mortgages located in Special Flood Hazard Areas (SFHA) purchase and maintain flood insurance policies on their properties. Consequently, newer and recently purchased properties in the community are insured against flooding. Due to the risk of flooding from hurricanes, the City of Bay St. Louis has encouraged all owners of property located in the City, even if the property is not located in a SFHA, to purchase and maintain flood insurance policies.

Bay St. Louis has achieved a Class 7 flood insurance rating through participation in the Community Rating System. The present Class 7 rating rewards all National Flood Insurance Program policyholders in Bay St. Louis with a 15 percent reduction in their flood insurance premiums. Bay St. Louis annually participates in an outreach program involving mailing a brochure to every address in the city. The brochure addresses flood related subjects including flood safety, flood warning, flood hazard areas, drainage system maintenance/stream ordinance, property protection measures, flood protection assistance, floodplain development regulations, substantial improvements/damage requirements, the National Flood Insurance Program, the natural and beneficial functions of wetlands, and flood zone descriptions.

A Hurricane Evacuation Zone Map and a Hurricane Tracking Map with instructions concerning hurricane safety are included in the mailing. The instructions address sheltering, helpful survival hints, family disaster planning, flood hazards in Bay St. Louis due to hurricane storm surge, and definitions of terms used by forecasters.

Impact on Existing and Future Development

Prior to the terrible impact of Hurricane Katrina in 2005 it was expected that growth and development in Bay St. Louis would increase significantly due to the anticipated annexation of areas to the northwest of the city to Interstate 10. Instead, the storm surge and flooding from Katrina significantly decreased the number of structures and population. When the annexation was approved in 2006, Bay St. Louis found itself responsible for a new area, largely devoid of structures and population without the increase in tax revenues it expected to gain.

The positive impact is that in the months following Katrina FEMA responded with temporary Advisory Base Flood Elevation (ABFE) maps to guide recovery and initial reconstruction and within three years, completed new DFIRM for Bay St. Louis and Coastal Mississippi. These tools gave Bay St. Louis and other coastal communities authority to require higher elevation of new structures and require better construction techniques. The entire coastal community, including Bay St. Louis is being rebuilt safer and stronger and more able to withstand future

flooding and storm surge because mitigation methods are designed into building plans. With expansion of VE Zones into areas previous A Zones came building and development requirements mandating higher elevations and stronger foundations than were previously required in most waterfront areas. The end result will be far more sustainable structures than the ones destroyed by Katrina.

With the annexation also came the need to revise the city’s land use ordinance. Without existing development, an opportunity was available to look at land use and other development tools in a different way than would have been possible without the widespread destruction of development that existed when the annexation petition was filed in 2004. While it is expected that waterfront property will continue to be the most preferred property in the community it is also expected that future development will be stronger and far more sustainable than in the past.

Past Occurrences

Table 4.10 shows the flood events from causes other than hurricanes reported by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) since 1995:

Table 4.10. Flooding in Bay St. Louis – January 1995 to February 2010

Location	Date	Cause	Type	Injuries/ Deaths	Damages
Citywide	5/8-5/9/95	Spring Storm	Flash Flood	0	0
Coastal Area	7/29/95	Tropical Storm	Coastal Flood	0	0
Citywide	5/19/97	Spring Storm	Flash Flood	0	100,000
Citywide	1/7/98	Winter Storm	Flash Flood	0	10,000
Citywide	3/7/98	Winter Storm	Flash Flood	0	0
Countywide	6/11/01	Heavy Rainfall	Urban/Small Stream Flood	0	0
Citywide	9/26/02	Heavy Rainfall	Flash Flood	0	0
Citywide	6/30/03	Tropical Storm	Flash Flood	0	500,000
Citywide	7/1/03	Tropical Storm	Flood	0	1,000,000
Countywide	7/5/03	Heavy Rainfall	Flash Flood	0	0
Coastal Area	5/29/05	Heavy Rainfall	Flash Flood	0	0
Coastal Area	10/16/06	Tropical storm	Coastal Flood	0	0
Citywide	12/21/06	Heavy Rainfall	Flash Flood	0	0
Citywide	10/22/07	Heavy Rainfall	Flash Flood	0	0
Coastal Area	4/10/08	Spring Storm	Coastal Flood	0	0
Coastal Area	3/27/09	Spring Storm	Coastal Flood	0	0
Citywide	3/28/09	Spring Storm	Flash Flood	0	0
Coastal Area	12/01/09	Winter Storm	Coastal Flood	0	0

Location	Date	Cause	Type	Injuries/ Deaths	Damages
Citywide	12/12/2009	Heavy Rainfall	Flash Flood	0	0
Coastal Area	2/4/10	Winter Storm	Coastal Flood	0	0

Source: NOAA National Climatic Data Center – Extreme Events

The following chart indicates flood losses by property classification in Bay St. Louis and flood damage payments to owners from the NFIP.

Table 4.11. Flood Damage Costs in Bay St. Louis

Occupancy	Content Payments	Building Payments	Total Payments
Single Family	\$11,731,910	\$38,722,880	\$735,146
2-4 Family	\$47,121	\$688,025	\$1,326,677
Condos	\$488,861	\$837,817	\$1,663,908
Other Residential	\$5,300	\$65,500	\$70,800
Non Residential	\$352,277	\$1,311,631	\$50,454,790
Total	\$12,625,469	\$41,625,853	\$54,251,321

Source: NFIP

Frequency/Likelihood of Future Occurrence

Highly Likely—The City of Bay St. Louis has a 1 percent chance of a 100-year or significant flood being equaled or exceeded in any given year. Tidal flooding from tropical storms and depressions can be expected to occur every other year. Due to the low elevations, flat terrain and tidal influence on drainage unusually heavy rainstorms and any tropical storm, hurricane or other storm-tide producing event will flood unmitigated properties in Bay St. Louis. Due to its location on the shores of the Mississippi Sound, the area’s susceptibility to hurricanes and other tropical disturbances originating in the Gulf of Mexico, and the high rate of annual rainfall, there is a 100 percent chance that flooding will continue to occur from time to time.

4.2.4 Severe Thunderstorms, High Wind, Hail

Hazard Profile

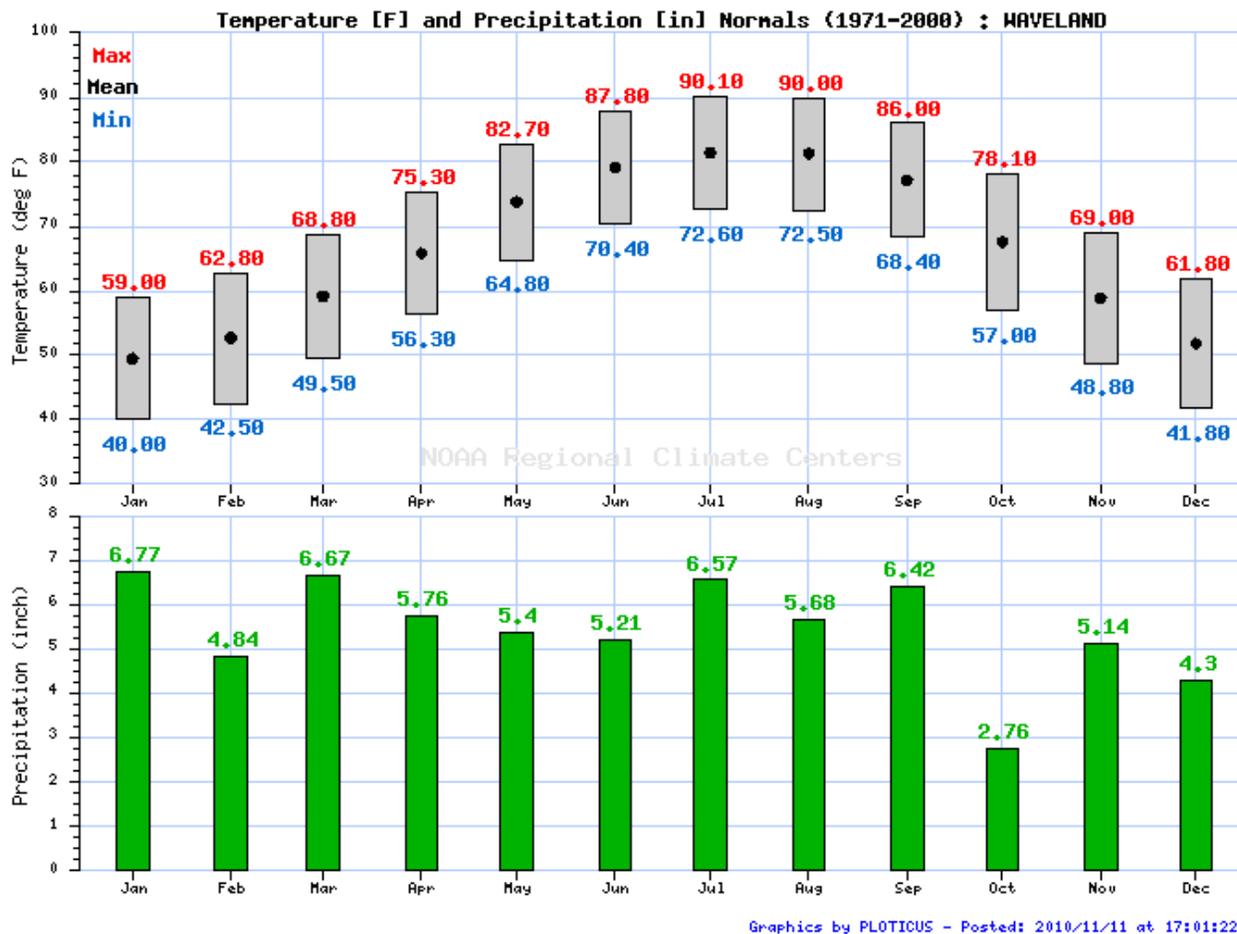
On the Mississippi Gulf Coast severe thunderstorms can occur at almost any time of the year. According to the National Weather Service, thunderstorms occur in this area 70 to 80 days each year. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is 1 inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado (profiled in Section 4.2.2).

Information from the National Weather Service Observation Site at Waveland is summarized in the discussion below and in Figure 4.8.

Waveland Weather Station (Period of Record 2008 to 2010)

Information from the closest weather station with the most comprehensive data, the Waveland weather station (30° 29' by -89° 38', 8 ft above mean sea level (MSL)), is summarized below in Figure 4.8. Average annual precipitation in Bay St. Louis is 65.1 inches per year. Precipitation averages are relatively consistent month to month, with the exception of October, which sees less rain.

Figure 4.8. Waveland/Bay St. Louis Average Monthly Temperatures and Precipitation

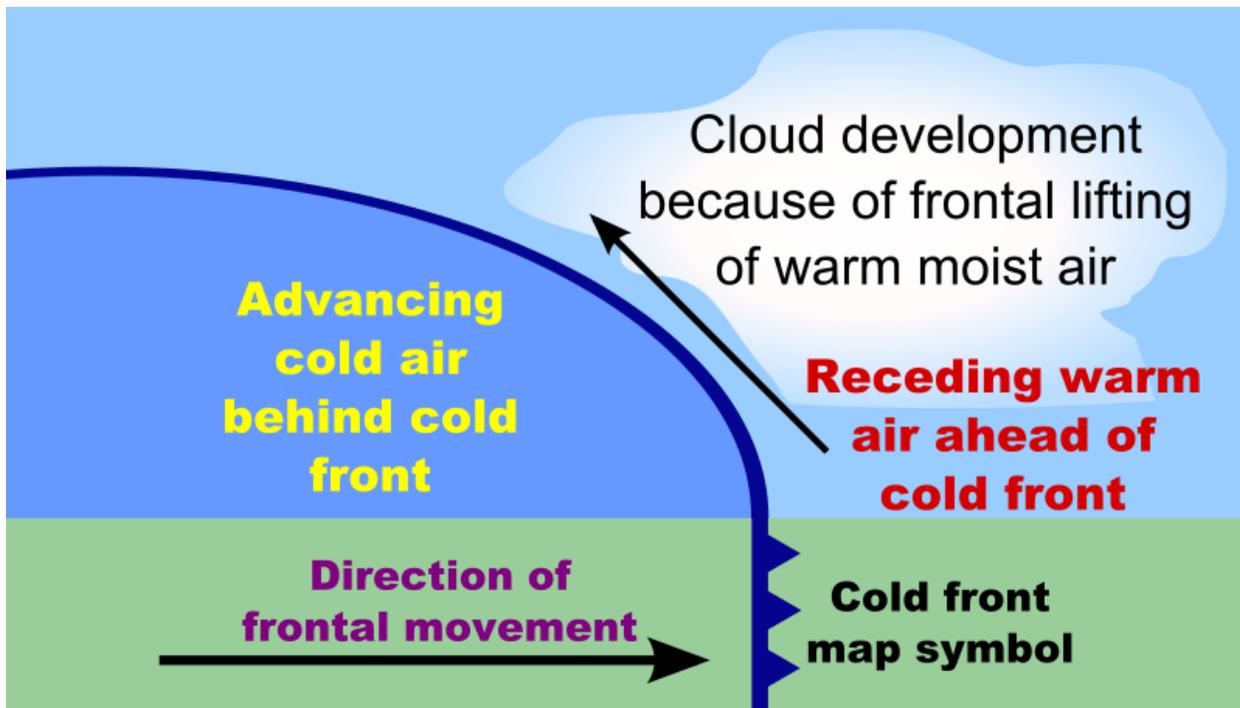


Severe Thunderstorms

Thunderstorms result from the rapid upward movement of warm, moist air (see Figure 4.9). They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other

droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

Figure 4.9. Formation of a Thunderstorm



Source: NASA. http://rst.gsfc.nasa.gov/Sect14/Sect14_1c.html

There are four ways in which thunderstorms can organize: single cell, multicell cluster, multicell lines (squall lines), and supercells. Even though supercell thunderstorms are most frequently associated with severe weather phenomena, thunderstorms most frequently organize into clusters or lines. Warm, humid conditions are favorable for the development of thunderstorms. The average single cell thunderstorm is approximately 15 miles in diameter and lasts less than 30 minutes at a single location. However, thunderstorms, especially when organized into clusters or lines, can travel intact for distances exceeding 600 miles.

Thunderstorms are responsible for the development and formation of many severe weather phenomena, posing great hazards to the population and landscape. Damage that results from thunderstorms is mainly inflicted by downburst winds, large hailstones, and flash flooding caused by heavy precipitation. Stronger thunderstorms are capable of producing tornadoes and waterspouts.

The National Weather Service issues two types of alerts for severe thunderstorms:

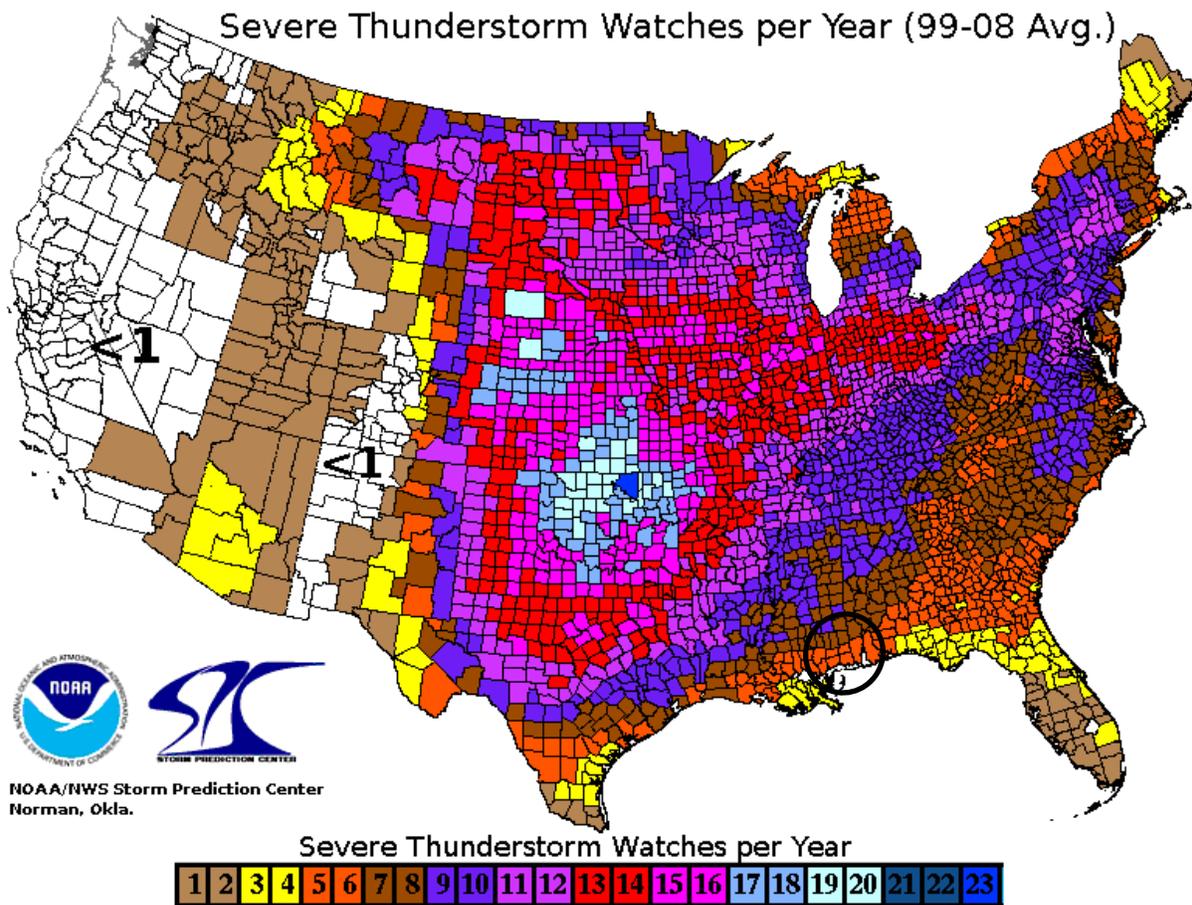
- A Severe Thunderstorm Watch indicates when and where severe thunderstorms are likely to occur. Citizens are urged to watch the sky and stay tuned to NOAA Weather Radio, commercial radio, or television for information. Severe Thunderstorm Watches are issued by

the Storm Prediction Center in Norman, OK.

- A Severe Thunderstorm Warning is issued when severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property to those in the path of the storm. Severe Thunderstorm Warnings are issued by the National Weather Service in Jackson.

The City sees 5-6 severe thunderstorm watches per year. This can be seen in Figure 4.10.

Figure 4.10. Severe Thunderstorm Watches per Year in the Planning Area



Source: NOAA/NWS Storm Prediction Center

Flash floods often result from the heavy rainfall of thunderstorm systems and nationally are considered the number one thunderstorm-related killer because they often occur at night and people in affected areas may not be able to see the extent of the rapidly rising water before it is too late to escape. Drivers attempting to cross flood-covered sections of roadways can be swept into deeper water and perish. During daylight hours, children playing in flooded drainage canals and ditches are particularly vulnerable to drowning in flash floods. Flash flooding and flooding from accumulations of rainwater from thunderstorms are addressed in depth in Section 4.2.8.

Lightning

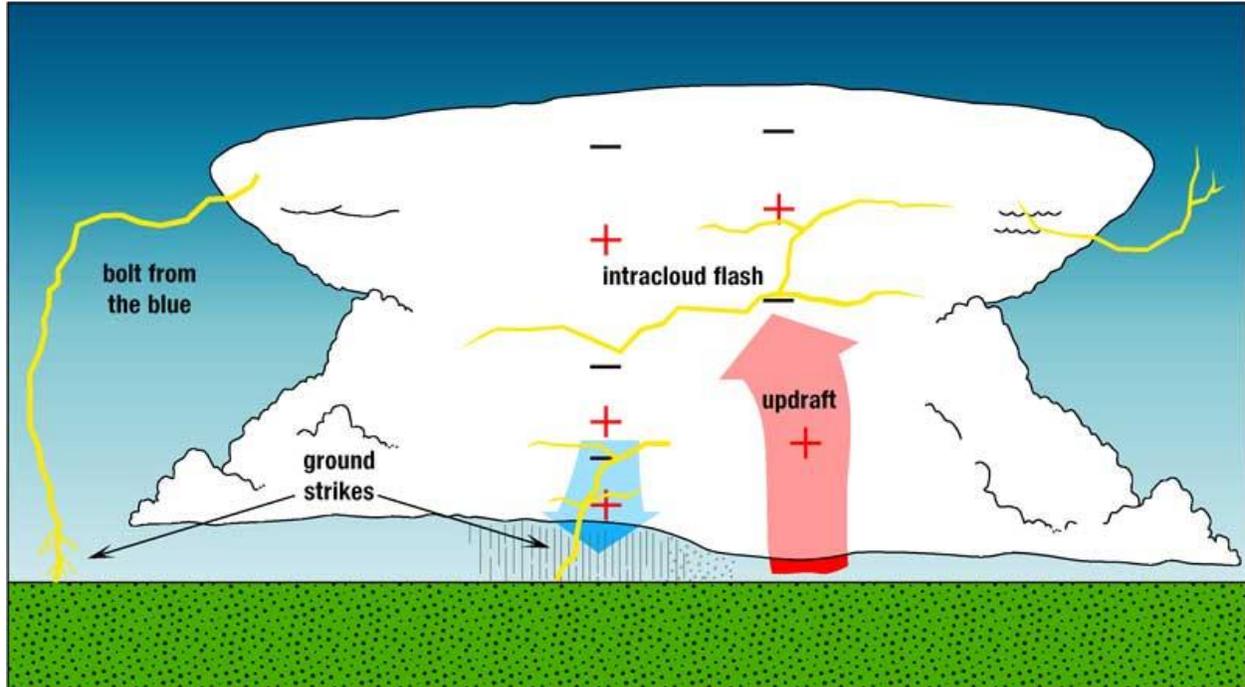
Lightning is an electrical discharge between positive and negative regions of a thunderstorm. A lightning flash is composed of a series of strokes with an average of about four. The length and duration of each lightning stroke vary, but typically average about 30 microseconds.

Lightning is one of the more dangerous weather hazards in the United States and in Mississippi. Each year, lightning is responsible for deaths, injuries, and millions of dollars in property damage, including damage to buildings, communications systems, power lines, and electrical systems. Lightning also causes forest and brush fires, and deaths and injuries to livestock and other animals. According to the National Lightning Safety Institute, lightning causes more than 26,000 fires in the United States each year. The institute estimates property damage, increased operating costs, production delays, and lost revenue from lightning and secondary effects to be in excess of \$6 billion per year. Impacts can be direct or indirect. People or objects can be directly struck, or damage can occur indirectly when the current passes through or near it.

Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat (see Figure 4.11). Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage.

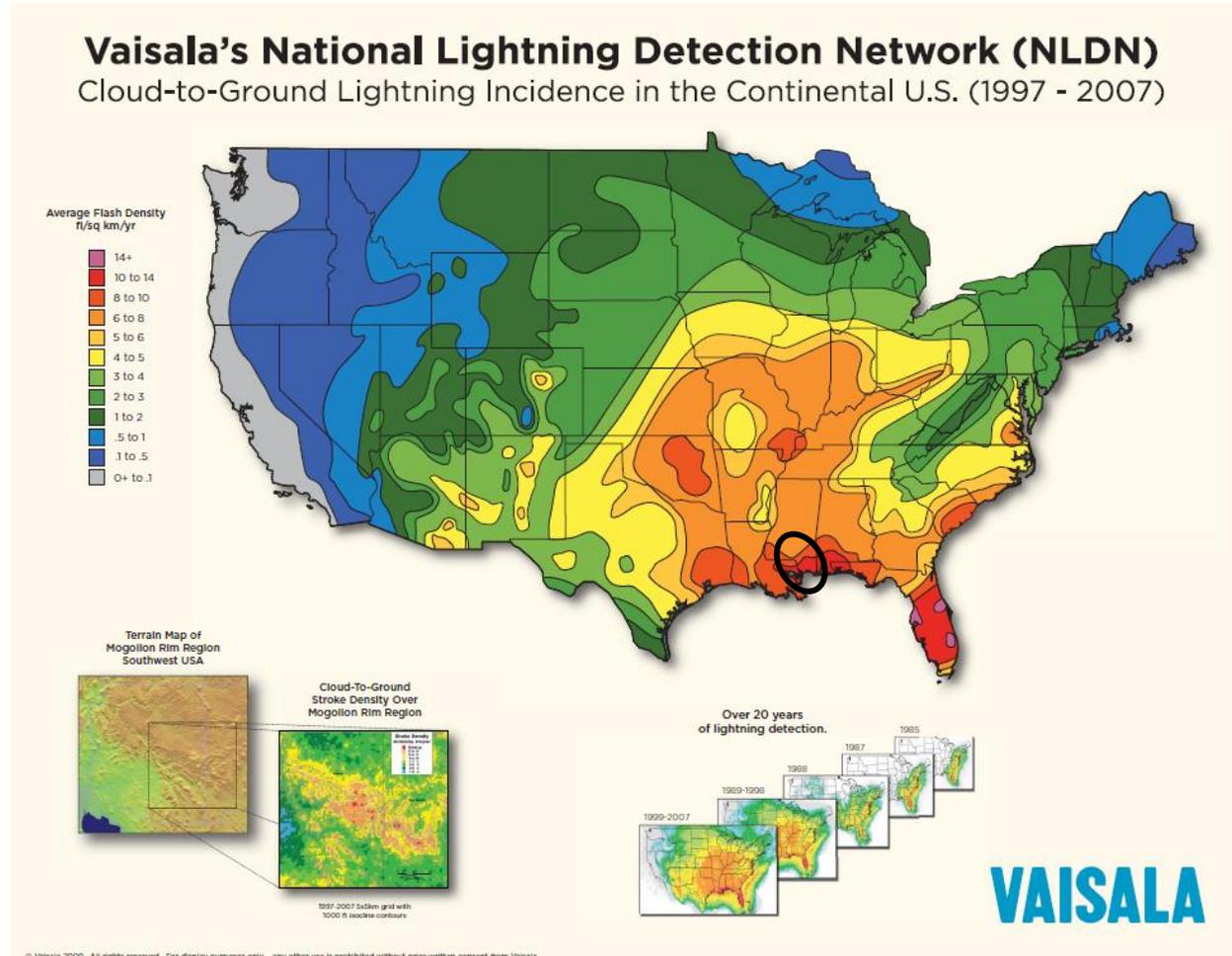
Figure 4.11. Cloud to Ground Lightning



Source: National Weather Service

The ratio of cloud-to-ground and intra-cloud lightning can vary significantly from storm to storm. Depending upon cloud height above ground and changes in electric field strength between cloud and earth, the discharge stays within the cloud or makes direct contact with the earth. If the field strength is highest in the lower regions of the cloud, a downward flash may occur from cloud to earth. Using a network of lightning detection systems, the United States monitors an average of 25 million strokes of lightning from the cloud-to-ground every year. Figure 4.12 depicts cloud-to-ground lightning strikes in the United States and the planning area (circled in black).

Figure 4.12. Lightning Flash Density Map



No deaths have been attributed to lightning in Bay St. Louis during the report period.

High Winds

High winds, often accompanying severe thunderstorms, can cause significant property damage threaten public safety, and have adverse economic impacts from business closures and power loss. Windstorms in Bay St. Louis can be straight-line winds, but most often are tornadic or hurricane related in the City. Straight-line winds are generally any thunderstorm wind that is not associated with rotation (i.e., not tornadic). These winds can overturn mobile homes, tear roofs off of houses, topple trees, snap power lines, shatter windows, and sandblast paint from cars. Other associated hazards include utility outages, arcing power lines, debris blocking streets, dust storms, and an occasional structure fire. Strong winds, when combined with saturated ground conditions, can down very mature trees. Figure 4.13 illustrates the wind zones in the United States.

Figure 4.13. United States Wind Zones

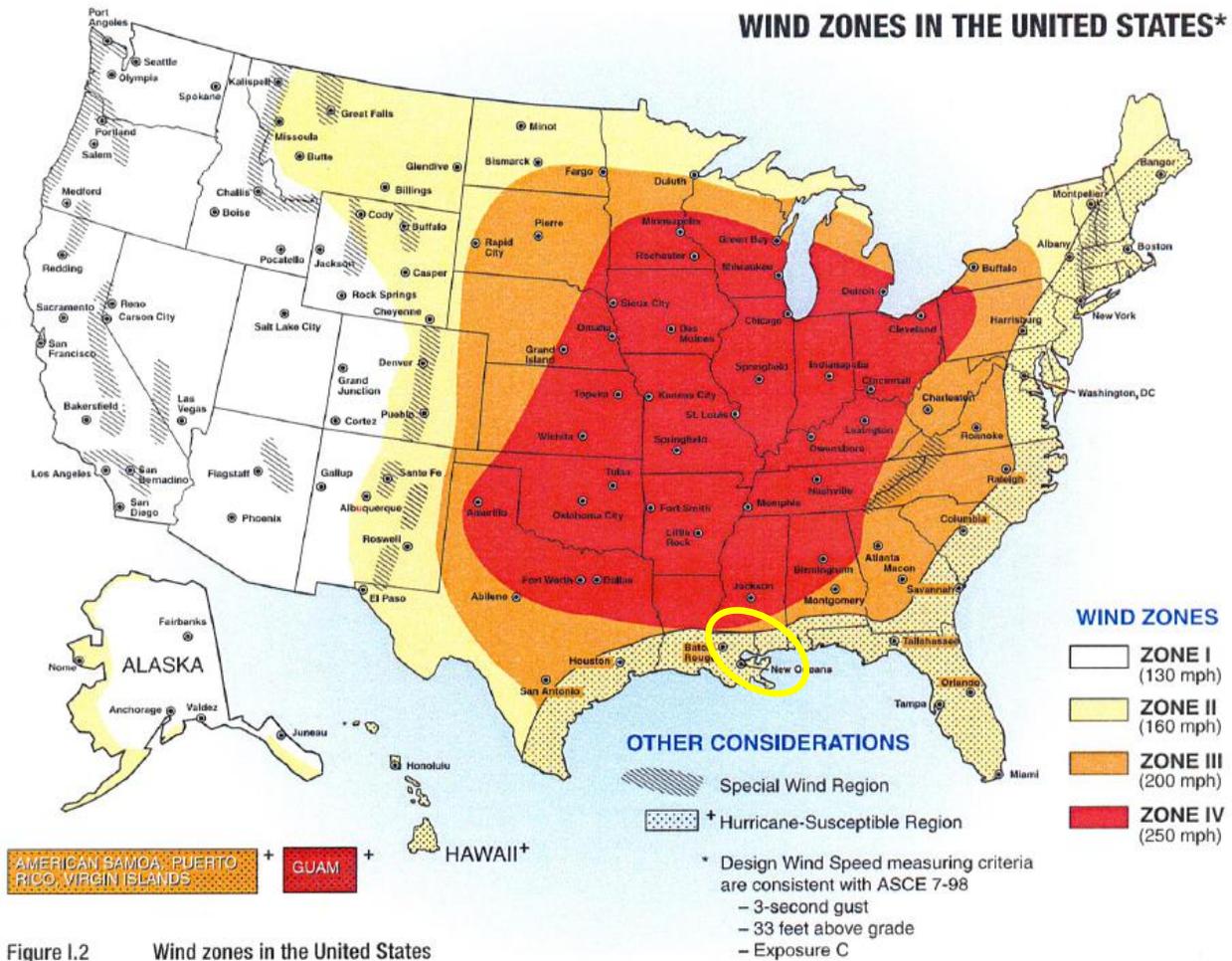


Figure I.2 Wind zones in the United States

Source: FEMA

Hail

Hail is associated with thunderstorms that can also bring high winds and tornados. It forms when updrafts carry raindrops into extremely cold areas of the atmosphere where they freeze into ice. Hail falls when it becomes heavy enough to overcome the strength of the updraft and is pulled by gravity towards the earth. Hailstorms occur throughout the spring, summer, and fall in the region, but are more frequent in late spring and early summer. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 mph. Hail causes nearly \$1 billion in damage to crops and property each year in the United States. Hail is also one of the requirements which the National Weather Service uses to classify thunderstorms as ‘severe.’ If hail more than 3/4 of an inch is produced in a thunderstorm, it qualifies as severe.

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4.12 indicates the hailstone measurements utilized by the National Weather Service.

Table 4.12. Hailstone Measurements

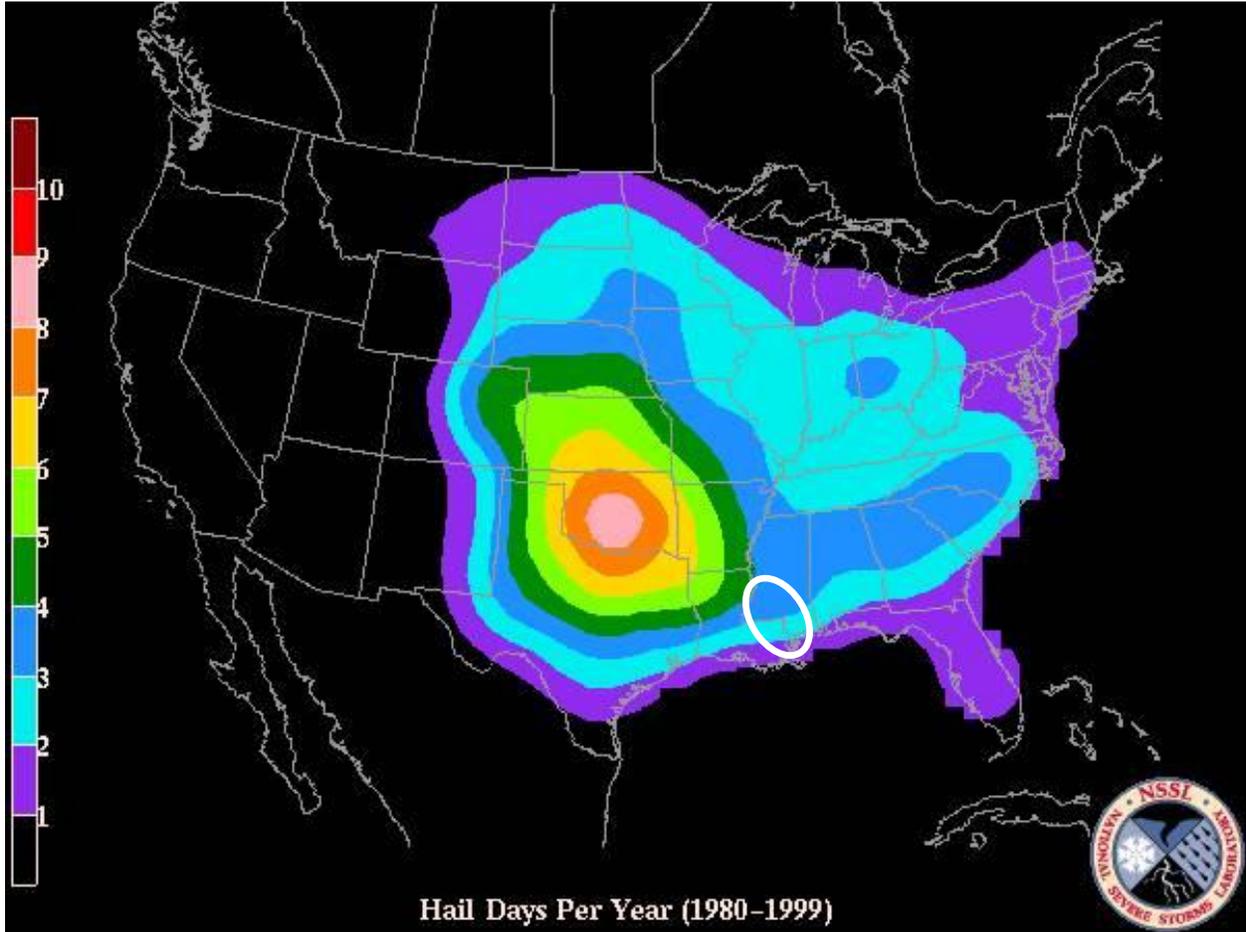
Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

There is no clear distinction between storms that do and do not produce hailstones. Nearly all severe thunderstorms probably produce hail aloft, though it may melt before reaching the ground. Multi-cell thunderstorms produce many hailstones, but not usually the largest hailstones. In the life cycle of the multi-cell thunderstorm, the mature stage is relatively short so there is not much time for growth of the hailstone. Supercell thunderstorms have sustained updrafts that support large hail formation by repeatedly lifting the hailstones into the very cold air at the top of the thunderstorm cloud. In general, hail 2 inches (5 cm) or larger in diameter is associated with supercells (a little larger than golf ball size which the NWS considers to be 1.75 inch.). Non-supercell storms are capable of producing golf ball size hail.

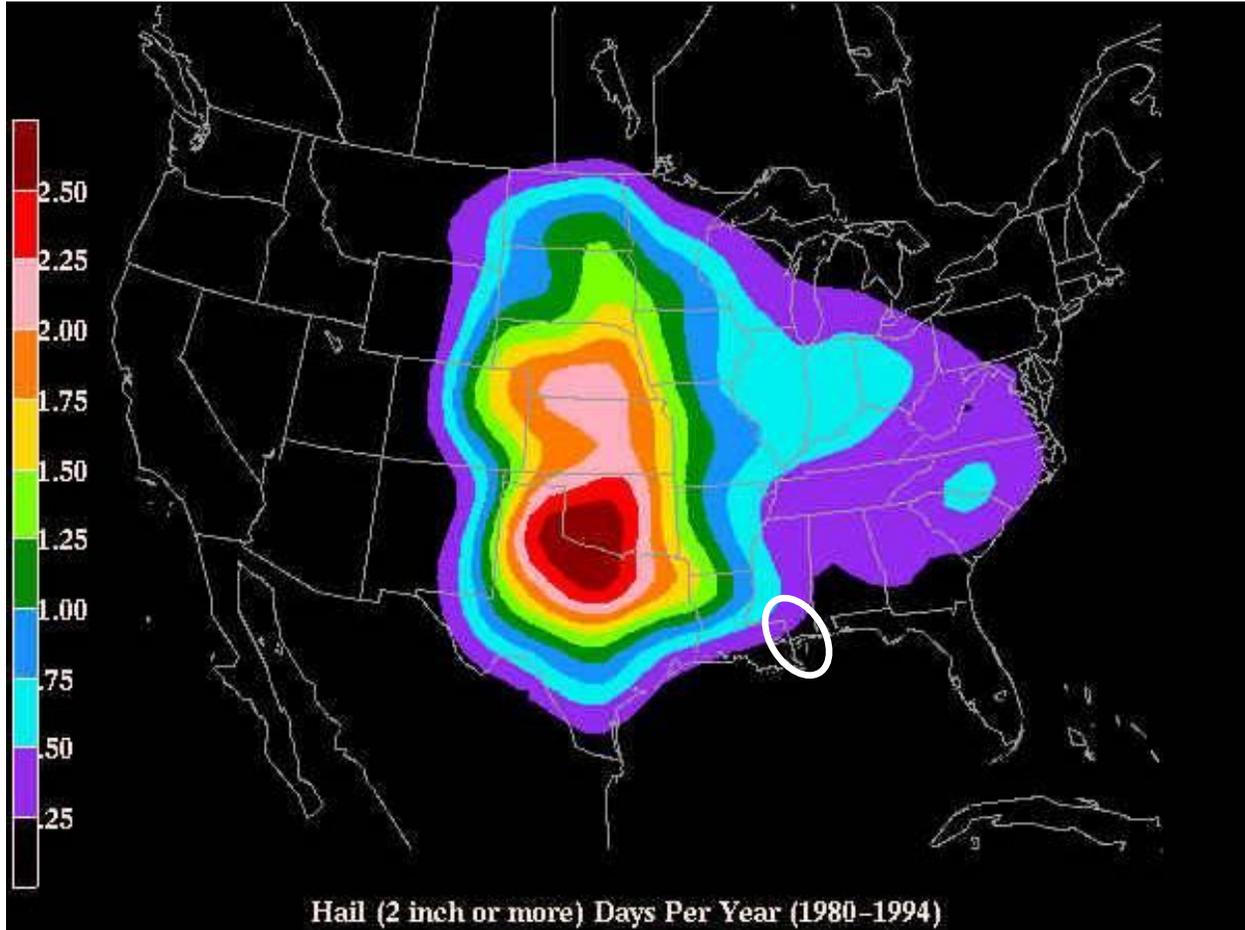
In all cases, the hail falls when the thunderstorm's updraft can no longer support the weight of the ice. The stronger the updraft the larger the hailstone can grow. When viewed from the air, it is evident that hail falls in paths known as hail swaths. They can range in size from a few acres to an area 10 miles wide and 100 miles long. Figure 4.14 shows the average number of days of hail per year in the United States, with the planning area outlined in a white oval. Figure 4.15 shows the average number of days of severe hail (over two inches in diameter) per year in the United States, with the planning area outlined in a white oval.

Figure 4.14. Average Number of Days of Hail per Year



Source: NOAA National Severe Weather Laboratory

Figure 4.15. Average Days of Large Hail in the Planning Area



Source: NOAA National Severe Weather Laboratory

Past Occurrences

Thunderstorm

According to the National Weather Service, winds with speeds of 58 miles per hour (50 knots) or higher is one of the defining indicators of a severe thunderstorm. The most significant thunderstorm wind damage is caused by straight-line winds that can exceed 100 miles per hour in severe thunderstorms. Straight-line winds known as downbursts can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. Table 4.13 shows the dates, wind speeds (if available), and the cost of damages for thunderstorms with high winds between September 1994 and December 31, 2006.

Table 4.13. Thunderstorms with High Wind between 1994 and 2010

Date	Wind Speed/Magnitude	Cost of Wind Damages (\$)*
September 9, 1994	Not Available	5,000

Date	Wind Speed/Magnitude	Cost of Wind Damages (\$)*
July 26, 1999	Not Available	1,000
September 29, 1999	Not Available	-0-
July 16, 2000	Not Available	2,000**
August 10, 2000	Not Available	1,000
March 14, 2001	Not Available	1,000
June 11, 2001	Not Available	15,000
August 2, 2002	Not Available	1,000
April 7, 2003	52 knots	50,000**
July 17, 2003	50 knots	10,000
November 18, 2003	50 knots	5,000
June 24, 2004	50 knots	1,000
April 11, 2005	50 knots	1,000
March 26, 2006	50 knots	1,000
July 2, 2009	50 knots	2,000

*Costs are unadjusted for inflation

**Countywide totals

Source: National Climatic Data Center Extreme Events Data, www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

Hail

Table 4.14 reflects the number of reported hail occurrences for each Bay St. Louis, as recorded in the NCDC database.

Table 4.14. Hail Events in Bay St. Louis between 1955 and 2010

Date	Hail Size (inches)	Cost of Damages (\$)
6/26/1971*	1.75	0
11/19/1974*	1.75	0
5/24/1976*	1.75	0
7/7/1980*	1.75	0
4/18/1988*	0.75	0
5/24/1988*	1.75	0
6/14/1989*	0.75	0
9/4/1990*	0.75	0
4/20/1992*	0.75	0
3/7/1998	1.75	0
7/2/2009	1.75	0
5/25/2010	1.75	0

Source: NCDC

*These dates are listed as for Hancock County. There is no direct record of hail in Bay St. Louis, but these are included since there may have been hail in the City on these occasions.

Lightning

Table 4.15 reflects the number of lightning occurrences for Bay St. Louis, as recorded in the NCDC database.

Table 4.15. Lightning Events in Bay St. Louis between 1993 and 2010

Date	Cost of Damages (\$)	Comments
6/26/1997	2,800	Lightning struck the Sheriff's Office communication center causing extensive damage to equipment.
7/26/1999	2,000	Lightning strikes caused fires at a house and business resulting in minor damage to each structure.

Source: NCDC

Frequency/Likelihood of Future Occurrence

Highly Likely—Bay St. Louis is reported to average 70 to 80 days per year when thunderstorms occur. Severe thunderstorms with high wind are likely to occur in Waveland at least once every year. It should be assumed that every area of the community is vulnerable to severe thunderstorms with high winds, hail, and lightning and that in any given year, several of these storms will occur.

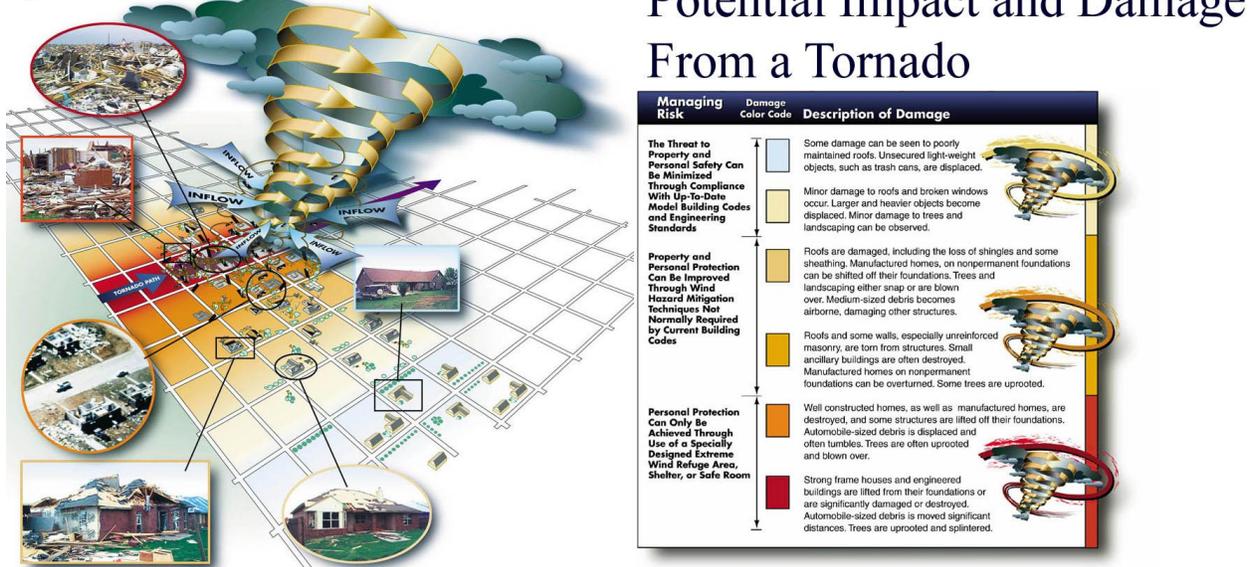
4.2.5 Tornado

Hazard Profile

A tornado is defined by FEMA as “a violently rotating column of air, pendant from a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise. On a local scale, it is the most destructive of all atmospheric phenomena.” Tornadoes are nature’s most violent storm. Spawned from powerful thunderstorms, tornadoes can cause fatalities and devastate a neighborhood in seconds with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Figure 4.16 illustrates the potential impact and damage from a tornado.

Figure 4.16. Potential Impact and Damage from a Tornado

Figure 2-2 Potential impact of a tornado



Source: FEMA

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado. Table 4.16 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity. Table 4.17 shows the wind speeds associated with the Enhanced Fujita Scale ratings.

Table 4.16. Traditional Fujita (F) Scale

Fujita (F) Scale	Fujita 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.

Fujita (F) Scale	Fujita Scale Wind Estimate (mph)	Typical Damage
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 yards); trees debarked; incredible phenomena will occur.

Source: National Oceanic and Atmospheric Administration Storm Prediction Center

Table 4.17. Enhanced Fujita (EF) Scale

Enhanced Fujita (EF) Scale	Enhanced Fujita Scale Wind Estimate (mph)
EF0	65-85
EF1	86-110
EF2	111-135
EF3	136-165
EF4	166-200
EF5	Over 200

Source: National Oceanic and Atmospheric Administration Storm Prediction Center

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 become very still. A cloud of debris can mark the location of a tornado even if a funnel is not evident. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

A waterspout is a tornado that forms over a body of water and siphons large amounts of water aloft that is dumped when the waterspout dissipates. Waterspouts sometimes come ashore with extremely heavy rainfall when they dissipate. A funnel cloud is a cloud formation that demonstrates the characteristics of a tornado but does not actually reach the ground.

Tornadoes are not limited by location; every home in Bay St. Louis has a probability of being impacted by a tornado. Due to the City's waterfront location adjacent to the Bay of St Louis and the Mississippi Sound, Bay St. Louis has a higher probability of a waterspout making landfall and causing damage to properties near the waterfront.

Past Occurrences

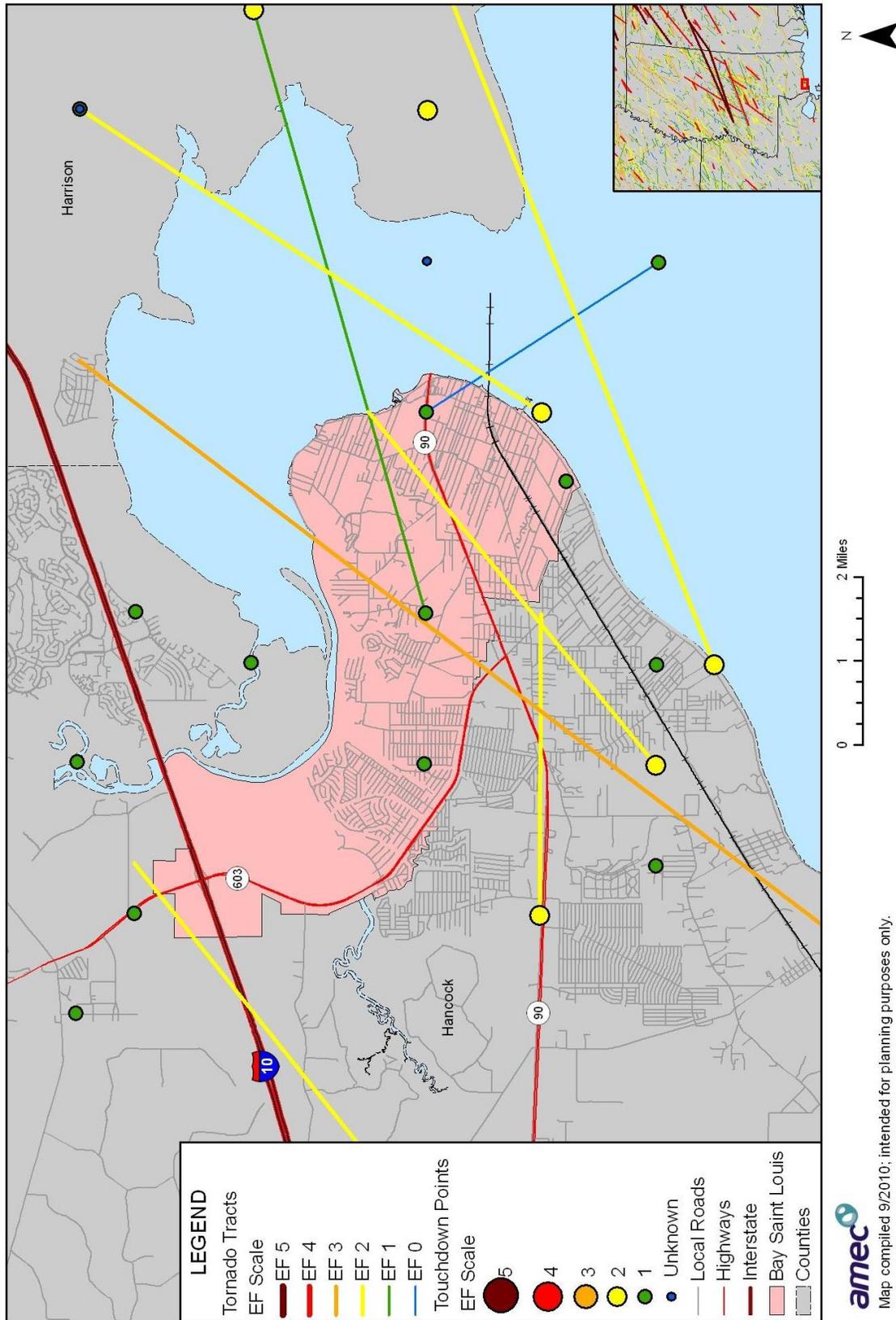
Table 4.18 lists historic tornado activity in Bay St. Louis. Figure 4.17 shows the location of tornado touchdowns and paths in the Bay St. Louis area.

Table 4.18. Tornadoes, Funnel Clouds and Waterspouts Sighted in Bay St. Louis 1969 – 2009

Date	Time	Type	Magnitude	Deaths	Injuries	Damage
4/2/09	13:05	Tornado	F0	0	0	\$0
8/12/03	11:15	Tornado	F0	0	0	\$0
7/2/01	08:10	Waterspout		0	0	\$0
7/2/01	08:08	Waterspout		0	0	\$0
10/6/00	11:15	Funnel Cloud		0	0	\$0
7/1/99	09:00	Water spout	-	0	0	\$0
9/20/98	08:50	Tornado	F0	0	0	\$10,000
4/29/96	09:17	Waterspout	-	0	0	\$0
5/21/85	13:25	Tornado	F1	0	0	\$25,000
4/18/82	17:00	Tornado	F2	0	0	\$250,000
3/2/72	17:40	Tornado	F2	0	0	\$250,000
7/14/69	13:30	Tornado	F0	0	0	\$0

Source: NOAA National Climatic Data Center

Figure 4.17. Bay St. Louis Tornado Paths and Touchdowns



The four waterspouts were documented in waters immediately adjacent to Bay St. Louis. An F0 tornado on August 13, 2003 originated as a waterspout which moved on shore and quickly dissipated. Two waterspouts were seen on the same day within minutes of each other on July 2, 2001. On July 1, 1999 a waterspout was seen approximately 1 mile off the coastline of Bay St. Louis.

Frequency/Likelihood of Future Occurrence

Likely—In the past 60 years 7 tornadoes have been sighted within the City Limits or about one every 8.5 years and 41 reported in Hancock County. MEMA Planners in the *State of Mississippi Standard Mitigation Plan* quote the National Weather Service, indicating that projection of tornado events is not possible with accuracy, stating:

“Tornado occurrence is too random to scientifically establish the probability of future events in any one county. Tornadoes have occurred and could reoccur in any of the Mississippi 82 counties. The recorded period shows an average of 32 tornado events per year throughout the State of Mississippi.”

According to the *State of Mississippi Standard Mitigation Plan*, based upon past activity, Hancock County has an annual probability of occurrence of 0.66, ranking it 10th among Mississippi Counties. To develop this probability, the total number of events occurring in the County was divided by the number of years in the period of record.

4.2.6 Coastal Erosion

Hazard Profile

Coastal erosion is defined as the wearing away of land or the removal of beach or dune sediments, wave action, tidal currents or drainage. Coastal erosion is primarily created by hurricanes, tropical storms and coastal flooding which are addressed in their prospective sections. Wind can also cause erosion and wearing away of the sand by blowing it to upland areas.

In the 1920's, a seawall was constructed along the bay and beach from Cedar Key to Bayou Caddy in Hancock County to protect Beach Boulevard and upland properties from encroaching waves. The Hurricane of 1947 breached the seawall in several places, prompting the Board of Supervisors to seek funding to construct a sand beach on the seaward side of the seawall to mitigate of wave action that was eroding away the seawall. While the combination of sea wall and sand beach mitigated wave action, the sand beach brought its own problem – sand blowing onto the roadway creating hazardous driving conditions, at times so severe that Beach Boulevard has been closed to traffic until the sand can be removed. The City experienced significant wind borne erosion during February of 2004, when a series of winter storms brought sustained easterly winds to Hancock County, forcing waters above mean high tide and blowing sand onto Beach Boulevard along low lying locations from Citizen Street south.

According to the State of Mississippi Hazard Mitigation Plan, Coastal erosion is primarily caused by coastal flooding and hurricanes, which are addressed in their Sections 4.2.2 and 4.2.2, respectively.

Past Occurrences

As previously mentioned, significant erosion has been experienced from wind borne erosion through the years, especially when winter storms with strong southeast winds force tides above normal and blow sand onto the roadway and private properties. In the past, crews have removed the sand and re-profiled the beach after those events.

Public infrastructure experienced no permanent damage associated from blowing sand events, however sand accumulations made driving hazardous and necessitated closure of the road for a period of time until the sand could be cleared away. In most cases, sand left on the roadway is contaminated and cannot be returned to the beach. Over time, the beach becomes eroded to the point that replenishment of the sand is necessary.

Frequency/Likelihood of Future Occurrence

Highly Likely—The man-made sand beach is subject to coastal erosion from normal tidal activities and moderate to severe erosion from coastal storms and southeasterly winds. A new seawall project to mitigate storm surge is under construction and will also eliminate coastal erosion.

4.2.7 Earthquakes

Hazard Profile

The *State of Mississippi Standard Mitigation Plan* defines an earthquake 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 and the energy will decrease with distance. 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 structures is not designed or built to accommodate the shaking, the vibration can cause damage to or failure of the building, infrastructure or critical facility. The state plan finds that Hancock County where Bay St. Louis is located has a low vulnerability to earthquake activity.

Magnitude and intensity are two ways earthquakes are measured. Magnitude measures the energy released at the source of the earthquake and is measured by a seismograph. Intensity is a measure of the shaking produced by an earthquake at a certain location. A comparison of magnitude and intensity is shown in Table 4.19.

Table 4.19. Richter and Modified Mercalli Scales for Measuring Earthquakes

Magnitude (Richter Scale)	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 – 6.0	VII – IX
7.0 and higher	VIII or higher

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.

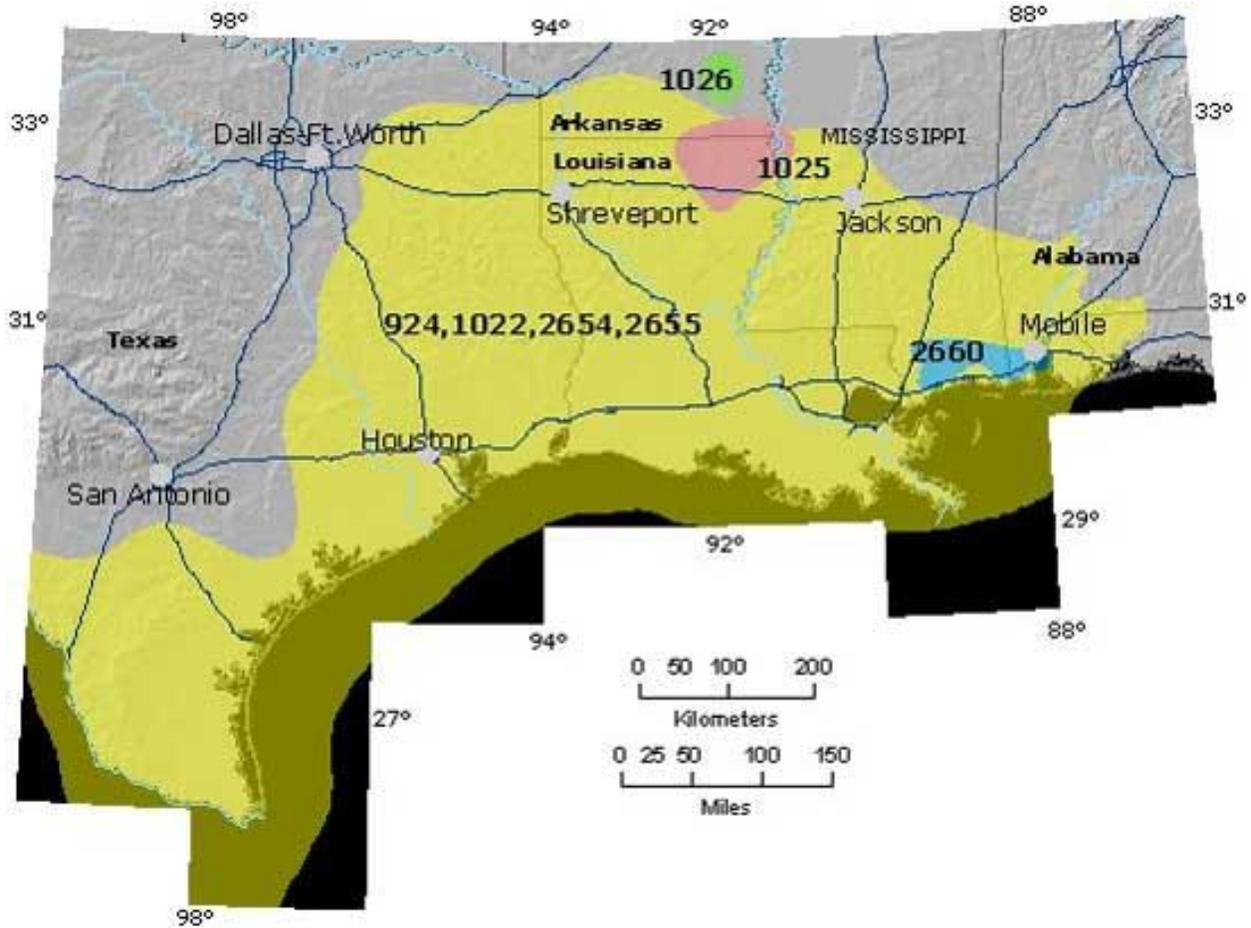
Table 4.20. Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Mississippi Standard Hazard Mitigation Plan 2006

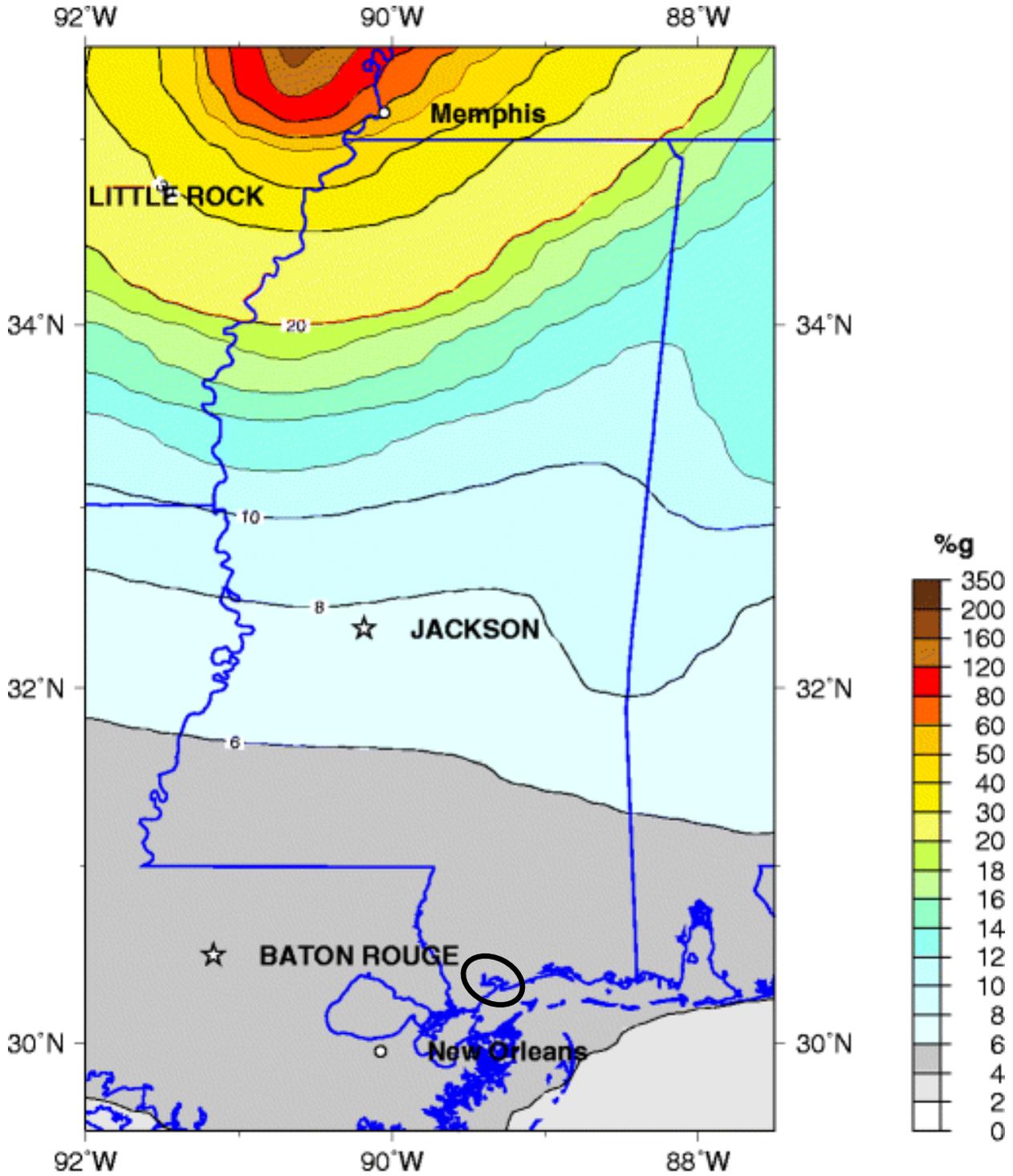
There are a series of seaward facing normal fault lines along the northern Gulf of Mexico from western Florida to Texas, including Mississippi. The Gulf Margin faults along the Mississippi Coast are classified by the USGS as Class B since they have indicated low seismic activity and existing geologic information is unclear on the threat from damaging ground motion. The fault closest to the planning area is the Wiggins uplift (shown on Figure 4.18 as 2660 in blue). Unlike flood and other hazards, there is no specific area in Bay St. Louis that would be affected any more or less from the impacts of an earthquake within the region.

Figure 4.18. Fault Lines in the Bay St. Louis Area



The U.S. Geological Survey (USGS) issues National Seismic Hazard Maps as reports every few years. These maps provide various acceleration and probabilities for time periods. Figure 4.19 depicts the peak horizontal acceleration (%g) with 2% probability of exceedance in 50 years for the planning region. The figure demonstrates that almost the City falls in the 4%g area (represented by the darker gray shade). This data indicates that the expected severity of earthquakes in the region is fairly limited, as damage from earthquakes typically occurs at peak accelerations of 30%g or greater. However, the potential, though remote, does exist for damaging earthquakes.

Figure 4.19. Seismic Hazard Map of Bay St. Louis, 2% Probability of Exceedance in 50 Years



**Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years
 site: NEHRP B-C boundary
 National Seismic Hazard Mapping Project (2008)**

The *State of Mississippi Standard Mitigation Plan* lists earthquakes as a hazard to the State of Mississippi but focuses their analysis mainly toward the northwestern part of the state due to the juxtaposition of that area to the New Madrid Fault line. Additional geologic research has been conducted by the University of Mississippi to determine location, activity and history of other possible fault lines and their threat to the State.

Past Occurrences

Historically, not many earthquakes are centered within Mississippi and most earthquakes that do originate in Mississippi have a magnitude of 3.5 or less. The State’s inventory of earthquakes beginning in 1923 lists only two as originating along Gulf Coast, see Table 4.21. The USGS lists another earthquake in 2005 that occurred 75 miles to the north and west of the City. This earthquake occurred in Louisiana, so it is not shown in the *State of Mississippi Standard Mitigation Plan*.

Table 4.21. Earthquakes in the Bay St. Louis Area

Date	Origin	Magnitude	Maximum Intensity
February 1, 1955	30 miles of coastline	not available	VII
September 9, 1975	Along the Gulf Coast	2.9	IV
December 20, 2005	Near Hammond, LA	3.0	III

Source: State of Mississippi Standard Hazard Mitigation Plan Sec. 3: 248; USGS and MDEQ Office of Geology

No verifiable damage is reported to have occurred with any of the three earthquakes originating along the Gulf Coast. Only reports of dishes rattling and minor shaking has ever been reported in an earthquake affecting the Mississippi Gulf Coast.

Frequency/Likelihood of Future Occurrence

Unlikely—There have been 3 minor earthquakes that have affected Bay St. Louis since 1923. There are known faults located on the Gulf Coast and the possibility of future earthquakes is there. The *State of Mississippi Standard Mitigation Plan* maps three earthquake epicenters along coastal Mississippi, one in central Hancock County, one on the central Harrison County coastline and one on the coastline at the boundary between Jackson and Harrison Counties. It is possible and probable that an earthquake could occur at any of these three locations. Any earthquake, though rare, should be considered potentially dangerous.

4.2.8 Extreme Heat

Hazard Profile

Extreme heat can have severe impacts on human health and mortality and natural ecosystems, as well as agriculture and other economic sectors. For this reason, this hazard is addressed.

Extreme heat is described in the *State of Mississippi Standard Mitigation Plan* as follows:

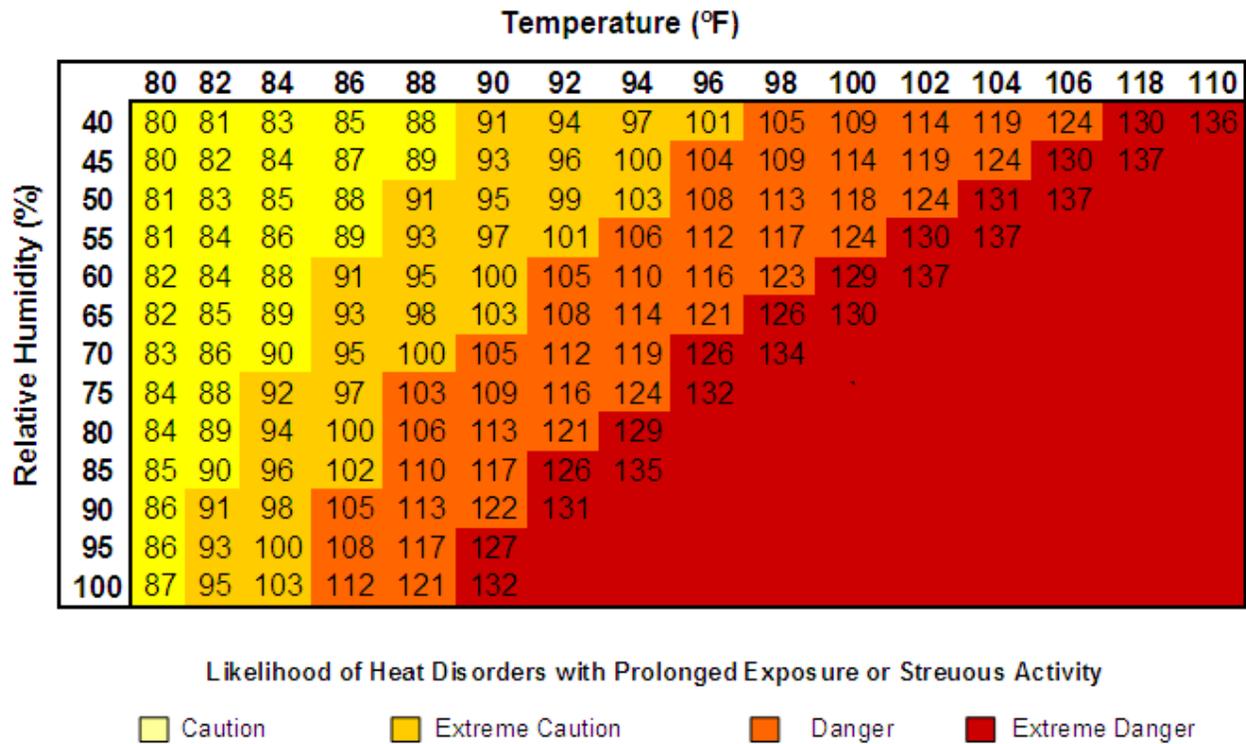
“Temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks.”

Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. According to the National Weather Service (NWS), among natural hazards, only the cold of winter—not lightning, hurricanes, tornados, floods, or earthquakes—takes a greater toll. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died.

Heat disorders generally have to do with a reduction or collapse of the body’s ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body’s inner core begins to rise and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions, especially during heat waves in areas where moderate climate usually prevails. Figure 4.20 illustrates the relationship of temperature and humidity to heat disorders.

Along the Mississippi Coast where Bay St. Louis is located, it is not unusual for temperatures to reach and exceed 90 degrees Fahrenheit during June, July, August, and into September. On occasion, the temperature may approach or exceed 100 degrees Fahrenheit. The waterfront location and sub-tropical climate introduces humidity into the air and combined with the temperature, can result in dangerous conditions for strenuous outdoor activity. In weather terms, the combination of heat and humidity is referred to as heat index.

Figure 4.20. National Weather Service’s Heat Index



The NOAA National Weather Service has developed a guide for prediction of heat index or the “as felt” temperature that reveals the following:

- A temperature of 90 degrees Fahrenheit with 50% humidity results in heat index or “as felt” temperature of 95 degrees triggering **High Caution** for heat related disorders with prolonged outdoor activity.
- A temperature of 90 degrees Fahrenheit with 70% relative humidity results in heat index of 105 degrees, in the **Danger** level for heat disorders with prolonged exposure or strenuous activity.
- A temperature of 90 degrees and relative humidity of 95% results in heat index of 127 degrees, a temperature considered **Extremely Dangerous** for likelihood of heat disorders with prolonged exposure or strenuous activity.

Past Occurrences

The NCDC reports no extreme temperature events in Bay St. Louis. However, temperatures of more than 90 degrees with relative humidity approaching 70% are not unusual for the Gulf Coast area and Bay St. Louis. Most homes and businesses are equipped with air equipment to cool the air to a safer level. These conditions are normal and should be expected every summer.

Frequency/Likelihood of Future Occurrence

Highly Likely—High heat and relative humidity are normal weather features of the area and will continue to occur every summer of every year. Individual mitigation measures are necessary and used by a majority of the population.

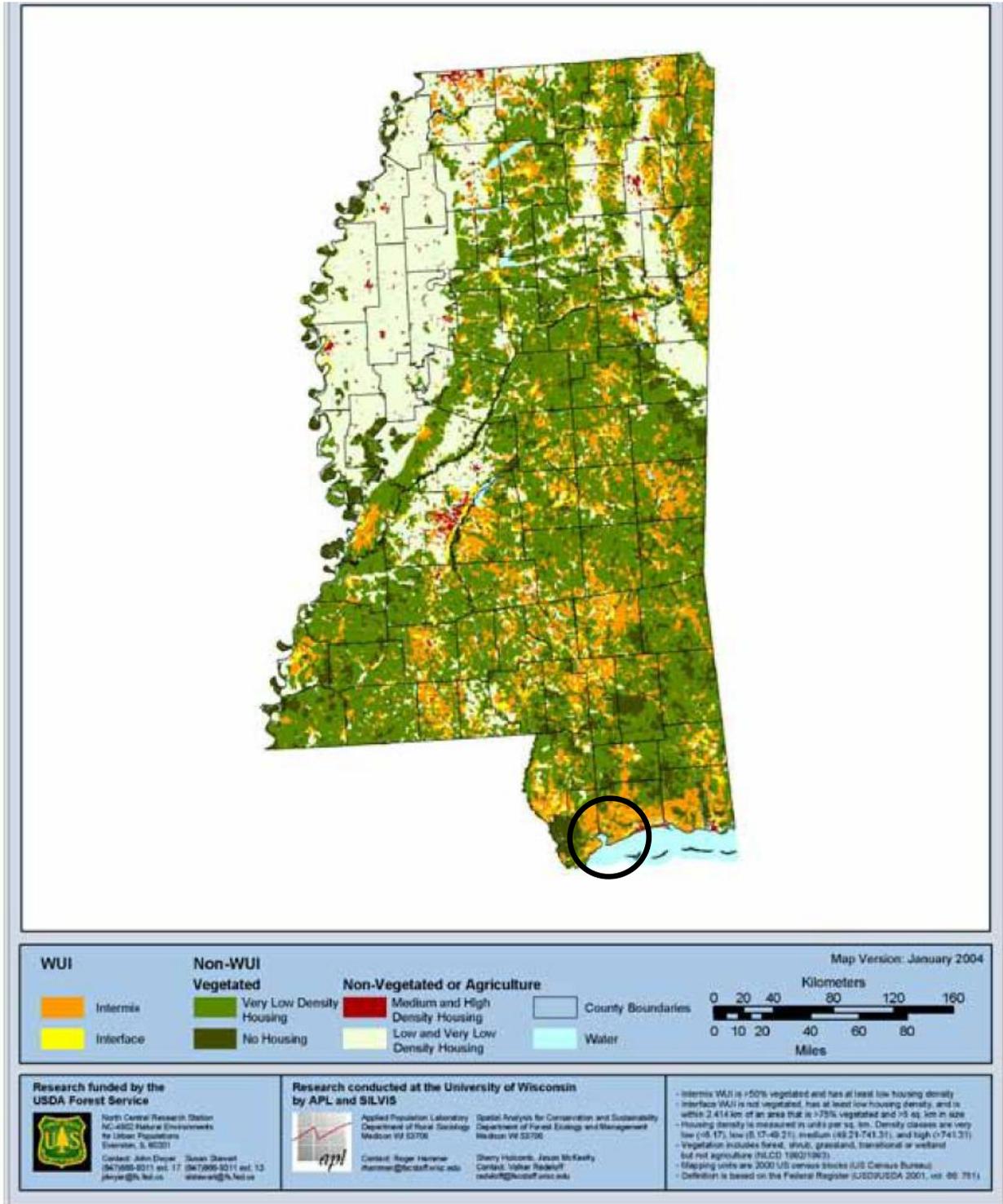
4.2.9 Wildfire

Hazard Profile

The *State of Mississippi Standard Mitigation Plan* defines a wildfire as 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 a natural wildfire 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 specific tasks such as fuel reduction, site preparation, wildlife habitat improvement, and disease control.

As population in rural areas increase, so do the issues facing Wildland/Urban Interface (WUI). Wildland/Urban Interface is the development of residential and commercial areas adjacent to or comingled with vegetative areas. This trend in development increases wildfires in urban areas and threatens human life, structures and wildland resources. WUI is broken into two categories, intermix and interface. Intermix defines housing and commercial development that is mixed with wildland vegetation. Interface describes housing and commercial development in proximity to wildland vegetation. Much of the land area of Bay St. Louis is located in an Intermix area, as shown in Figure 4.21.

Figure 4.21. State of Mississippi WUI in 2000



Source: State of Mississippi Hazard Mitigation Plan

The area of most concern to the City of Bay St. Louis is the marshy, undeveloped area and other areas made vacant by Hurricane Katrina in the northwestern area of the community. With a

driving wind, a fire in that area could quickly spread and become dangerous. Due to the marshy location, fighting a fire in those areas would be very difficult if possible at all.

Past Occurrences

There have been no past occurrences of wildfires in Bay St. Louis. Prior to the annexation, Bay St. Louis was built out and had little vacant or wooded areas that could fuel a wildfire. That changed with the annexation north to the Interstate 10. Lying between I-10 and the old City limits is a large area of woods and marsh land that could fuel a significant fire. Also, Hurricane Katrina in 2005 left many vacant lots that have become overgrown in the past five years and some have debris remaining on them from the storm.

Frequency/Likelihood of Future Occurrence

Unlikely—There have been no past occurrences in the City. The State of Mississippi Standard Hazard Mitigation Plan states that debris accumulation from Hurricane Katrina will pose a threat toward future wildfires in the next few years. Since Katrina communities have worked with local agencies to remove debris and dead standing trees but five years later, many lots are now overgrown, adding to the potential fuel for fires. Some properties where damaged structures still remain vacant can be an attractive target for arsonists, setting up the possibility of a fire being set and burning out of control for some time prior to be discovered.

4.2.10 Winter Weather/Freeze

Hazard Profile

According to MEMA Planners, the National Weather Service defines a winter storm as having three factors, cold air, moisture and lift. These three factors acting together create conditions suitable for a winter storm. The NWS defined three categories of winter storm events 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 for 12 hours for the northern one-third of the state.

Ice Storm: Any accumulation of ice ¼ inch or more within a 12 to 24 hour period.

Winter Storm: Any combination of ice or snow above. A mixture of snow and freezing rain would trigger a winter storm warning issued by the NWS.

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. Other secondary problems included flooding from melting ice and snow, and rainfall on heavily glazed and saturated surfaces. Icy, snow-covered areas can create a hazard to drivers and to walkers with increased accidents. Downed power lines can create a risk of electrocution to residents and to electric power workers. Finally, frozen

and broken water lines in homes are not only costly to repair, but create additional hazards from electrocution.

Nearly every winter, hard freeze warnings are issued advising residents to protect exposed pipes, plants and outdoor pets. Additionally, shelter locations are given and those who do not live in heated homes to go to shelters overnight. Temperatures rarely remain below freezing for more than 24 hours.

Past Occurrences

Based upon this definition, the National Climatic Data Center identified one winter storm occurring in Bay St. Louis since 1969; however residents remember significant snowfalls in 1964 and the 1940's. The most recent winter storm to affect the City of Bay St. Louis was Christmas Day, 2004. Approximately one quarter to one half inch of frozen precipitation fell across the City. The frozen precipitation stayed on the ground for less than 24 hours. A number of single vehicle accidents were reported, however there were not power outages reported.

A low pressure system in the Gulf of Mexico produced snow accumulations of 1 to 2 inches on December 18, 1996, however heat from the from the ground and roadways melted the frozen precipitation nearly as quickly as it fell.

Frequency/Likelihood of Future Occurrence

Occasional—The area most likely to receive an ice storm, heavy snow, or winter storm activity is the area north of Interstate 20, or the northern half of Mississippi. Based upon historic winter events in Bay St. Louis, there is a 3.5% change each year, or one chance every 10 years that a winter storm will impact the City of Bay St. Louis. Calculations are based upon documentation of two winter storms since 1959 (2 events/46 years). The area can expect hard freeze warnings to be issued at least once each winter. No significant damage has been reported due to winter storms in Bay St. Louis.

4.2.11 Natural Hazards Summary

Table 4.22 summarizes the results of the hazard identification and hazard profile for Bay St. Louis based on the hazard identification data and input from the HMPC. For each hazard profiled in Section 4.2, this table includes the likelihood of future occurrence and whether the hazard is considered a priority hazard for the City.

Table 4.22. Overall Summary and Impact of Probably Hazards City of Bay St. Louis

Hazard	Likelihood of Future Occurrence	Vulnerability	Priority Hazard
Hurricane/Tropical Storm/ Storm Surge	Category 1 – every 10 years Category 2 – every 21 years Category 3 – every 34 years Category 4 – every 68 years Category 5 – every 160 years	High	Yes
Flood	Every 100 years Coastal flooding every other year	High	Yes
Thunderstorms/Wind/Hail	Every Year	Moderate	Yes
Tornado	Every 10 Years	High	Yes
Coastal Erosion	Every year	Moderate	No
Earthquake	Very Low	Low	No
Extreme Heat	Every Year	Low	No
Wildfire	Low	Low	No
Winter Weather/Freeze	3.5% every year	Low	No

- Coastal erosion is recognized as a hazard primarily from wind borne sand and road closing along Beach Boulevard. Mitigation measures are being taken by the City to construct approximately 2 miles of new seawall from the U.S. Highway 90 Bridge across the Bay of St. Louis to Washington Avenue. Funded by a grant from the U.S. Army Corps of Engineers, the new seawall will be approximately 24 feet MSL and protect the down town area from most storm surge and coastal erosion.
- Minor earthquakes have occurred in the area and will probably occur again, however, there is no indication that earthquakes will cause any significant damage to Bay St. Louis.
- Extreme temperatures, both heat and cold (winter weather/freeze) occur from time to time, but usually are of short duration and do not usually result in more than inconvenience. Bay St. Louis and Hancock County are placed at low risk by for these hazards in the State of Mississippi Standard Mitigation Plan. Temperatures in the 90 to 100 degree range are not uncommon in summer and combined with high humidity can produce heat indices that can result in heat related illnesses and even death. The State’s plan recognizes extreme heat as a hazard but states that heat related hazards but does not set forth any criteria or actions for mitigation.
- There is no history of significant wildfires in Bay St. Louis, however with annexation of tracts of vacant land and land made vacant by Hurricane Katrina, Bay St. Louis recognizes the possibility that wildfires could occur.

4.3 Vulnerability Assessment Summary

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

With Bay St. Louis’ hazards identified and profiled, the HMPC conducted a vulnerability assessment to describe the impact that each hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to natural hazards and estimates potential losses.

Vulnerability assessments followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses*. The vulnerability assessment first describes the total vulnerability and values at risk and then discusses vulnerability by hazard.

Data used to support this assessment included the following:

- County GIS data (hazards, base layers, and assessor’s data);
- GIS Datasets shared by Gulf Regional Planning Commission
- FEMA’s HAZUS-MH MR3 GIS-based inventory data (January 2007)
- Written descriptions of inventory and risks provided by the earlier City Hazard Mitigation Plans
- Existing plans and studies;

Bay St. Louis Assets at Risk

Hancock County’s parcel layer was used as the basis for the inventory of developed parcels. Three keys were used to derive the Property Type Categories. The codes were simplified into ten categories that are represented in the detailed analysis table below which shows the count and improved value of parcels that are sorted by property type. Table 4.23 shows the count, land value, and improved value of parcels in Bay St. Louis.

Table 4.23. Bay St. Louis Property at Risk by Property Type

Property Type	Property Count	Improved Value	Land Value	Total Value
Beach	101	-	\$1,752,513	\$1,752,513
Commercial	160	\$27,477,242	\$22,613,679	\$50,090,921
Industrial	4	\$2,531,226	\$347,760	\$2,878,986
Other	331	\$191,939	\$9,348,140	\$9,540,079
Recreational	34	\$5,459,955	\$1,340,130	\$6,800,085
Residential	4,483	\$298,872,462	\$118,658,256	\$417,530,718
Resource Production	49	\$10,248	\$151,900	\$162,148
Services	208	\$81,072,545	\$29,290,587	\$110,363,132
Transportation/Communication/Utility	292	\$1,325,606	\$8,541,806	\$9,867,412
Undeveloped Land & Water Areas	6,013	\$730,422	\$110,128,601	\$110,859,023
Total	11,675	\$417,671,645	\$302,173,372	\$719,845,017

Source: Hancock County

Critical Facility Inventory

Of significant concern with respect to any disaster event is the location of critical facilities in the planning area. Critical facilities are often defined as those essential services and facilities in a major emergency which, if damaged, would result in severe consequences to public health and safety or a facility which, if unusable or unreachable because of a major emergency, would seriously and adversely affect the health, safety, and welfare of the public.

The City of Bay St. Louis generally defined critical facilities in its 2000 and 2004 Hazard Mitigation Plan as:

- Hospitals, nursing homes and housing likely to contain occupants who may not be sufficiently mobile to avoid death and injury during a flood or other emergency.
- Police stations, fire stations, vehicle and equipment storage facilities and emergency operations centers needed for disaster response activities before, during and after a flood or other disaster.
- Public and private utility facilities vital to maintaining or restoring services to areas before, during and after a flood or other disaster.
- Structures or facilities that produce, use or store highly volatile, flammable, explosive, toxic and/or water reactive materials.

The following structures were recognized as critical facilities: City Hall Annex, city Hall, Valena C. Jones Public Safety Complex, Hancock County Sr. Citizens Center, Mississippi Power Co., Coast Electric Power Association, South Central Bell, Evacuation Shelters, Hancock County Emergency Management Agency, Hancock Medical Center, Dunbar Village Nursing Home,

Notre Dame De La Mer Senior Housing, Highway 90 Bay St. Louis Bridge, CSX Railroad, four water wells, a natural gas regulator station, and a cell phone tower on Necaise Street.

Nearly every critical facility including public safety buildings in Bay St. Louis were flooded, damaged or destroyed in Katrina. Some were repaired and temporarily reoccupied, however inspections immediately after Katrina revealed that nearly all public safety buildings (fire and police protection), and the City Hall and Annex building should be moved or reconstructed. Nearly every other existing critical facility and public building in Bay St. Louis was damaged.

In late 2005, Coast Electric Power Association decided to relocate their headquarters into rural Hancock County where its base of customers are and offered Bay St. Louis an opportunity to purchase its site located on the East and West corners of Main Street and Highway 90 at an extremely reasonable price. Included at the site is a well constructed, two story brick office building to use as City Hall administrative offices suitable for the Mayor's Office, City Clerk, Accounting, Building Department, and Utility Department. A separate auxiliary building suitable to house the Police Department, and a construction yard with storage and office space to house the Public Works Department already existed on the property. The site also contained sufficient area to construct a new Central Fire and Public Safety Building. As soon as the sale was consummated, City operations and offices were moved to the Main Street and Highway 90 location.

This was considered an excellent move for the City because it consolidates all city government offices and facilities in an area that had minimal storm surge flooding in Katrina and places all major public services and departments at a central location, well away from the waterfront. U.S. 90 and Main Street are both well maintained major thoroughfares offering easy access to the site from all directions. The historic City Hall is being restored and will be used as a museum and community cultural building. The new Fire and Public Safety Center is near completion.

All County offices located in Bay St. Louis, including the Courthouse, Tax Assessor's and Collector's offices and Sheriff's Department were inundated by storm surge from Katrina. Most county offices were temporarily relocated to a site on Longfellow Drive while the Court house was being repaired and restored. Work on the Courthouse was recently completed and some county functions have moved back. Other County offices will be housed in a new building being constructed on U.S. Highway 90 west of the City Hall location.

Civil Defense headquarters was inundated by storm surge, placing personnel in danger of drowning at the height of Katrina and shutting down emergency operations at the time they were needed most. All survived, but equipment and records were destroyed. Temporary offices were set up in the Kiln Community in an old school building pending construction of a new permanent location north of Interstate 10 away from the threat of ever flooding again.

The Hancock County Medical Center at Drinkwater Drive and Highway 90 had its first floor flood and basement flooded, however the facility never stopped delivering emergency medical care to the community. Significant but repairable damage was sustained temporarily closing the

facility until it could be cleaned, repaired and reopened. All diagnostic equipment and other equipment located below the second floor level were destroyed and had to be replaced. Immediately after Katrina temporary clinics were opened by the National Institute of Health and private services to fill the gap for critical and walk in care until the medical center could be restored and completely operational.

Lower floors of the Notre Dame De La Mer Senior Housing Center were flooded but damage has been repaired and the facility reopened. The Dunbar Village Nursing Home on Dunbar Avenue near Felicity Street was evacuated and sustained some flood and wind damage. It was reopened and available for occupancy in 2006.

For the 2010 update to the plan, the City of Bay St. Louis has inventoried its critical facilities and classified them by function.

- Essential Public Safety - Facilities housing first responders to emergency situations
- Lifeline Utilities – Gas and electric distribution, water, sewer collection and treatment, communication systems
- Critical Care – Hospitals; also facilities where vulnerable populations may be present when an emergency occurs.
- Public Infrastructure – Public utilities and services maintenance
- Schools – Public, private and parochial schools where large, vulnerable populations may be present when an emergency occurs
- Senior Services – Senior Center and Senior Housing where vulnerable populations may be present when an emergency occurs
- Long Term Nursing Care – Location(s) where vulnerable populations may be present when an emergency occurs.

Table 4.24. Bay St. Louis Inventory of Critical Facilities

Facility	Location	Function
Police Station	598 Hwy. 90	Essential Public Safety
Fire Station(s)	Main Street and Highway 63	Essential Public Safety
City Hall	688 Highway 90	Government Services
Public Works	688 Highway 90	Public Infrastructure
Sr. Center	Bookter Street	Senior Services
Miss. Power Co.	300 Hwy. 90 East	Lifeline Utilities
Hancock Medical Center	149 Drinkwater Drive	Critical Care
Dunbar Village Nursing	725 Dunbar Ave.	Long Term Nursing Care
Notre Dame De La Mar	US 90	Senior Services
Hwy 90 Bay Bridge	US 90	Transportation
CSX Railroad Bay Bridge	Bay Bridge	Transportation/
Natural Gas Regulator	Ulman Ave.	Lifeline Utility

Facility	Location	Function
Water Well	Esterbrook Street	Lifeline Utilities
Water Well	St. Charles Street	Lifeline Utilities
Water Well	Harry Street	Lifeline Utilities
Water Well	10th Street	Lifeline Utilities
Second Street Elementary	400 N. 2nd Street	School
North Bay Elementary	740 Dunbar Ave.	School
Bay Waveland Middle School	600 Pine Street	School
Bay High School	750 Blue Meadow Rd.	School
St. Stanislaus	304 S. Beach Blvd.	School
Our Lady Academy	222 S. Beach Blvd	School
St. Rose De Lima School	301 S. Necaize St.	School
Cell Phone Tower(s)	Necaize Street	Lifeline Utilities
Bell South	Old Spanish Trail	Lifeline Utilities

Source: City of Bay Louis

Cultural and Historic Resources

Assessing Bay St. Louis' vulnerability to disaster also involves inventorying the natural, historical, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of natural, historical and cultural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian habitat which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Bay St. Louis has a stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from the following of sources.

- The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

- The **Historic American Buildings Survey (HABS)** and the **Historic American Engineering Record (HAER)** collections document achievements in architecture, engineering, and landscape design in the United States and its territories through a comprehensive range of building types, engineering technologies, and landscapes.
- The **Historic Preservation Division of the Mississippi Department of Archives and History** works with individuals and local governments across the state and provides grants, tax incentives, and technical assistance from on-staff architectural historians and archaeologists for preservation projects. It oversees, among others, the State Historical Marker, Mississippi Landmark, and National Register of Historic Places programs.

Historical resources included in the programs above are listed in Table 4.25.

Table 4.25. Bay St. Louis Historical Resources

Name	Address	Date Listed
Beach Boulevard Historic District	Roughly bounded by Beach Blvd., Necaise Ave., Seminary Dr., 2nd and 3rd Sts.	11/25/1980
Building at 242 St. Charles	242 St. Charles St.	11/25/1980
Glen Oak--Kimbrough House	806 N Beach Blvd.	11/21/1986
Main Street Historic District	Main St.	11/25/1980
Onward Oaks	972 S. Beach Blvd.	11/01/1996
Rocket Propulsion Test Complex	National Space Technology Laboratories (NSTL)	10/03/1985
Sycamore Street Historic District	Sycamore St.	11/25/1980
Taylor House	808 N Beach Blvd.	11/21/1986
Taylor School	116 Leonard St.	01/15/1987
Washington Street Historic District	Washington St.	11/25/1980
Webb School/Gulf Coast Community Action Agency	300 Third St.	11/21/1986

Source: National Historic Register of Historic Places

The **Historic American Buildings Survey (HABS)** and **Historic American Engineering Record (HAER)** document America’s architectural and engineering heritage. Table 4.26 lists the HABS and HAER structure in Bay St. Louis.

Table 4.26. Bay St. Louis HABS and HAER Structures

Area	Historic Building/Structure
Bay St. Louis	Mississippi Army Ammunition Plant

Source: Historic American Building Surveys Engineering Records, <http://hdl.loc.gov/loc.pnp/hhh.ms0287>

Natural Resources

Natural resources are important to include in cost/benefit analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community

goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetlands areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the planning area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Information from the U.S. Fish and Wildlife Service was accessed to create an inventory of special status species in Bay St. Louis. Table 4.27 lists national and state endangered or threatened species in Bay St. Louis by species type.

Table 4.27. Threatened and Endangered Species in the Bay St. Louis Area

Group	Name	Scientific Name	Status
Birds	Arctic peregrine Falcon	<i>Falco peregrinus tundrius</i>	Recovery
Clams	Stirrupshell	<i>Quadrula stapes</i>	Endangered
Ferns and Allies	Louisiana quillwort	<i>Isoetes louisianensis</i>	Endangered
Fishes	Gulf sturgeon	<i>Acipenser oxyrinchus desotoi</i>	Threatened
Fishes	Pearl darter	<i>Percina aurora</i>	Candidate
Mammals	West Indian manatee	<i>Trichechus manatus</i>	Endangered
Mammals	American black bear	<i>Ursus americanus</i>	Similarity of Appearance (Threatened)
Reptiles	Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered
Reptiles	Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered
Reptiles	Green sea turtle	<i>Chelonia mydas</i>	Threatened
Reptiles	Loggerhead sea turtle	<i>Caretta caretta</i>	Threatened
Reptiles	Ringed map turtle	<i>Graptemys oculifera</i>	Threatened
Reptiles	Gopher tortoise	<i>Gopherus polyphemus</i>	Threatened

Source: US Fish and Wildlife Service

In addition to endangered species, the City of Bay St. Louis is also home to a variety of wetlands. The U.S. Fish and Wildlife Service defines wetlands as:

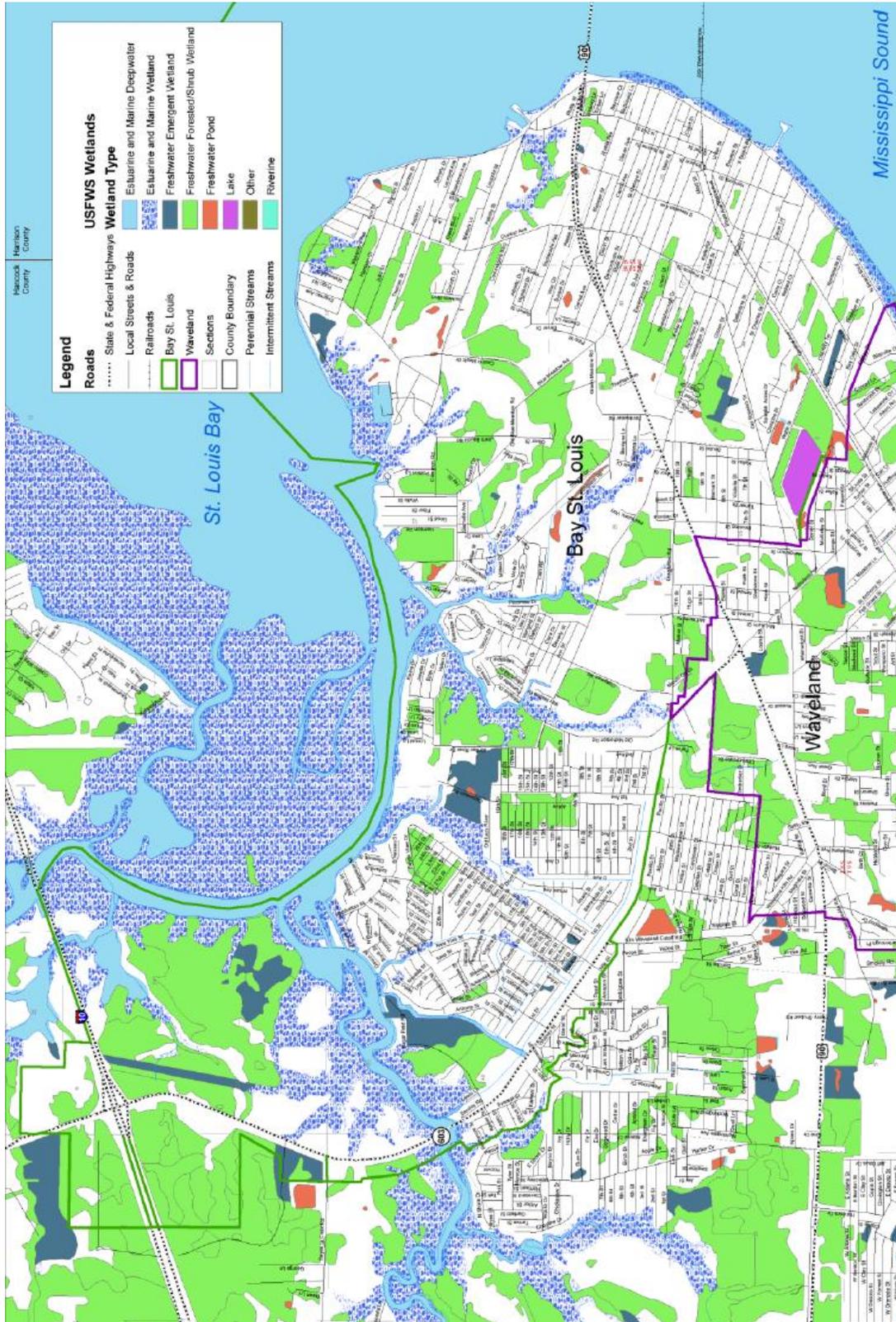
“Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes (plants specifically adapted to live in wetlands); (2) the substrate is predominantly undrained hydric (wetland) soil; and (3) the

substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.”

Figure 4.22, from the Bay St. Louis Comprehensive Plan, indicates the potential location of wetlands within the City of Bay St. Louis. The City is prone to three types of wetlands. These include estuarine or marine wetlands, which are wetlands which are brackish in nature, and often part of an estuary. Two types of freshwater wetlands have the potential to be located within the City of Bay St. Louis. These are freshwater emergent wetlands and freshwater forested or shrub wetlands. Freshwater emergent wetlands are areas which are subjected to extended period of flooding. Freshwater forested or shrub wetlands are wetlands that develop in rich organic soils, such as hydric loamy or clayey soils or hydric sandy soils.

Estuarine wetlands have the potential to exist within estuaries along the Bay St. Louis and Jourdan River coastlines. Much of the Jourdan River delta can be defined as estuarine wetlands, and potentially, areas along the Bayous that punctuate the shoreline in Shoreline Park and in areas located north of Highway 90 may also be estuarine wetlands. Additionally, soils provide an indication that other areas throughout the City could potentially be freshwater emergent wetlands or freshwater forested or shrub wetlands. It should be noted that the wetlands map is not a definitive indication of wetlands areas.

Figure 4.22. City of Bay St Louis Wetlands Map



Source: City of Bay St. Louis Comprehensive Plan

Growth and Development Trends

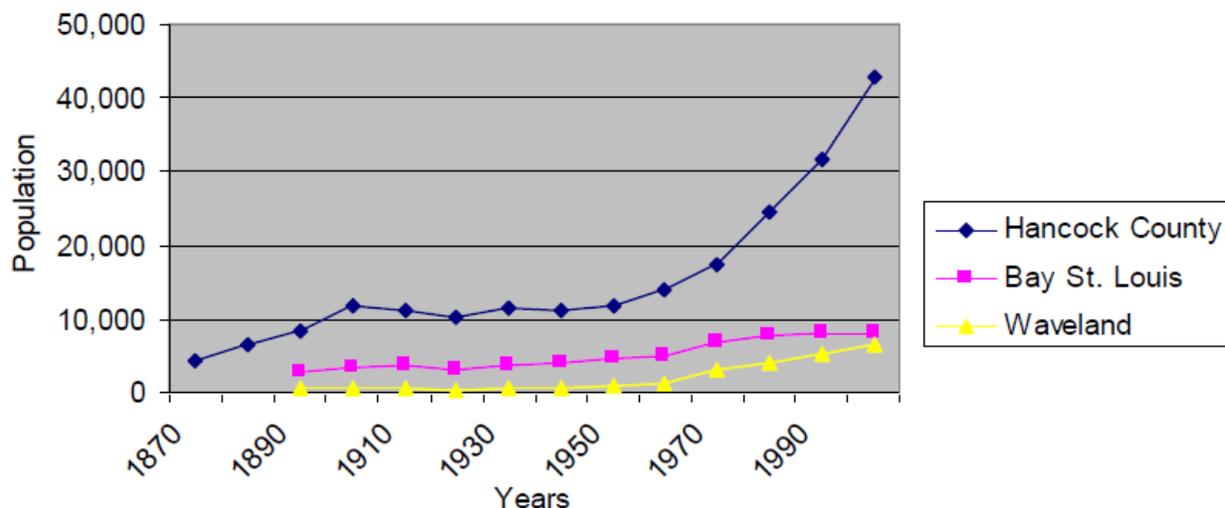
As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability. New development is occurring throughout the City of Bay St. Louis. As indicated in the DFIRM and the storm surge maps provided by MEMA, Bay St. Louis is subject to flooding in the future from storm surge of hurricanes. With exception of a few small areas, all of Bay St. Louis is at risk.

As the new development and rebuilding occurs, Bay St. Louis is prepared to enforce elevation requirements identified in the City's Flood Ordinance and all of the requirements of the 2006 International Building Codes. These development tools will ensure that rebuilding and new development is held to the highest possible standards, throughout the City of Bay St. Louis.

Population

Historically, population growth in Bay St. Louis has been positive growth. (see Figure 4.23 and Table 4.28). There have been periods of history where population change has been negative, but positive population growth has been a historical norm for the City.

Figure 4.23. Population of Bay St. Louis Between 1870 and 2000



Source: Hancock County Comprehensive Plan Demographic Overview, January 18, 2007

Table 4.28. Population in Bay St Louis From 1890-2000

Year	Population	Change from Previous Decade
1890	2,872	N/A
1900	3,588	24.9%
1910	3,588	0%
1920	3,033	-15.5%

Year	Population	Change from Previous Decade
1930	3,724	22.8%
1940	4,138	11.1%
1950	4,652	12.4
1960	5,073	9.0%
1970	6,752	33.1%
1980	7,891	16.9%
1990	8,063	2.2%
2000	8,209	1.8%

As of 2005, the City was bordering on built-out status. With the annexation in 2006, the City added over 3,000 people to the population of the City (see Table 4.29).

Table 4.29. Current and Future Population Growth in Bay St. Louis

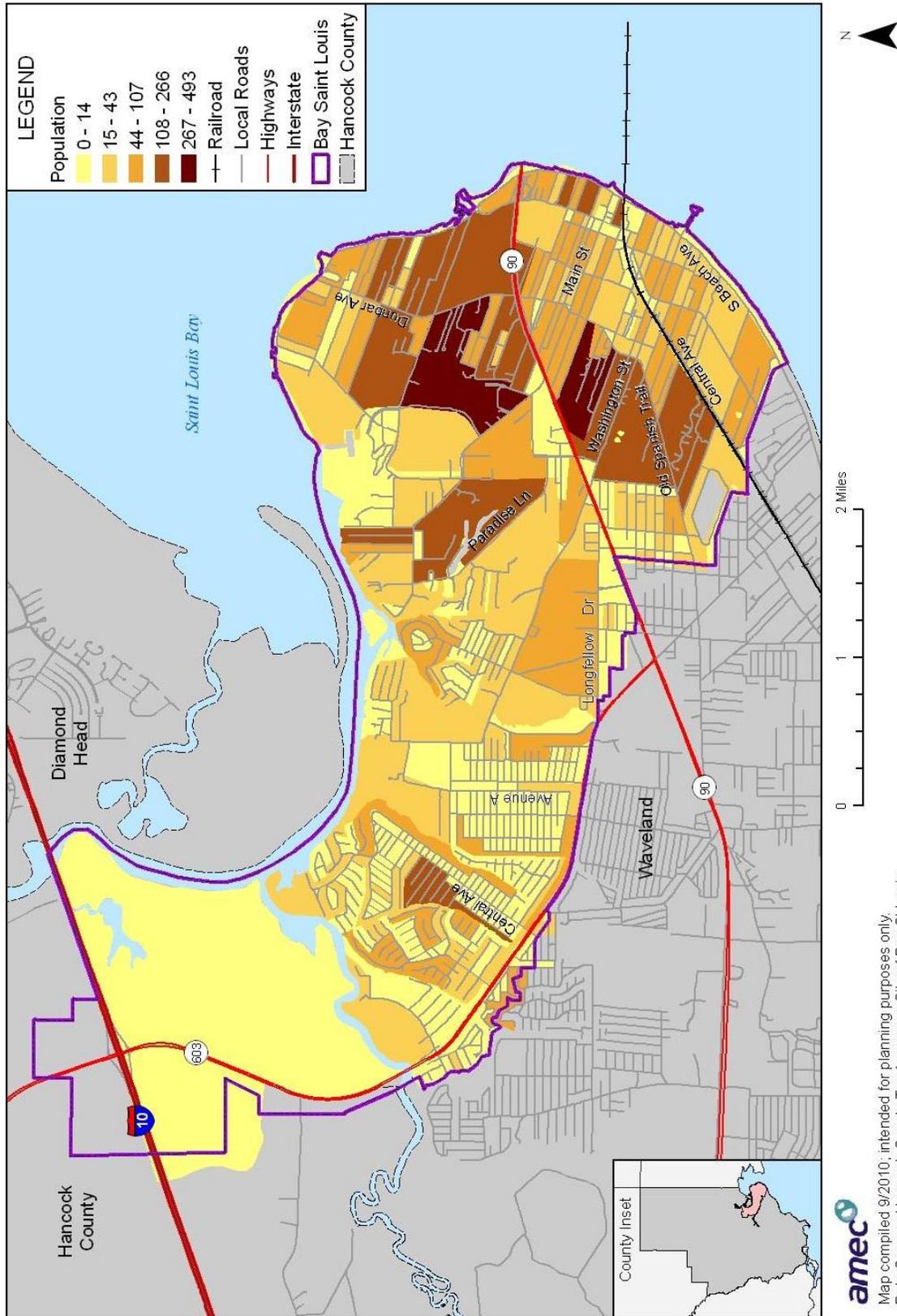
2000 US Census	Bay St Louis Population after Annexation in 2006	Population Change after Annexation	Population Project for 2030*
8,209	11,531	43.0%	18,896

Source: US Census Bureau

*Hancock County Comprehensive Plan Demographic Overview, January 18, 2007

Figure 4.24 shows the distribution of population in Bay St. Louis. The map divides the City by Census Block from the 2000 US Census.

Figure 4.24. Bay St. Louis Population by Census Block



Housing

Census data from the 2000 Census indicated that there were 6,016 housing units located within the area which is now the City's current limits. About 3,806 of these housing units were located within the pre-annexation limits of the City of Bay St. Louis and an estimated 2,210 housing units were located within the newly annexed area. This is shown in Table 4.30.

Table 4.30. Housing Units within the City of Bay St. Louis

Year	New City Limits of Bay St. Louis	Former City Limits of Bay St. Louis	Annexed Area
2007*	5,167	3,186	1,981
2000	6,016	3,806	2,210

* represents house count from land use survey prepared by Gulfport Regional Planning Commission

Source: U.S. Bureau of Census, Provisional Census Estimates and 2000 Census and Gulf Regional Planning Commission.

Historically, the Cities of Bay St. Louis and Waveland have been seaside retreats for residents of New Orleans and other large cities across the south. Many coastal homes were maintained by families for generations as summer homes and camps along the Mississippi Sound. Table 4.31 shows the growth in vacation homes in Bay St. Louis as a result of the annexation.

Table 4.31. Number of Seasonal or Vacation Homes within the City of Bay St. Louis

Year	New City Limits of Bay St. Louis	Former City Limits of Bay St. Louis	Annexed Area
2000	893	241	652

Source: U.S. Bureau of Census, Provisional Census Estimates and 2000 Census and Gulf Regional Planning Commission.

A number of existing residential areas are recommended to remain as residential land uses until at least 2030. Although it is recognized that because of the condition of housing, inadequacy of community facilities, proximity of other land uses, these residential areas may give way to commercial or other land uses at some time in the future. Conversely, certain areas of business and industry are likely to remain in the commercial land use until 2030, even though the land could be used more appropriately for residential purposes.

Table 4.32. Total New Dwelling Unit Requirements City of Bay St. Louis, 2030

Bay St. Louis Housing Needs for 2030	
Current Number of Units	5,167
Estimates of Total Units by 2030	8,215
Losses Due to Hurricane Katrina	1,383
Allowance for 5.75% Vacancy Rate	472
Total New Units Needed by 2030	3,048

Source: U.S. Bureau of Census, Gulf Regional Planning Commission

Based upon a projected city population of 18,896 people by 2030, the City of Bay St. Louis will require a minimum of an additional 3,048 residential units.

Land Use

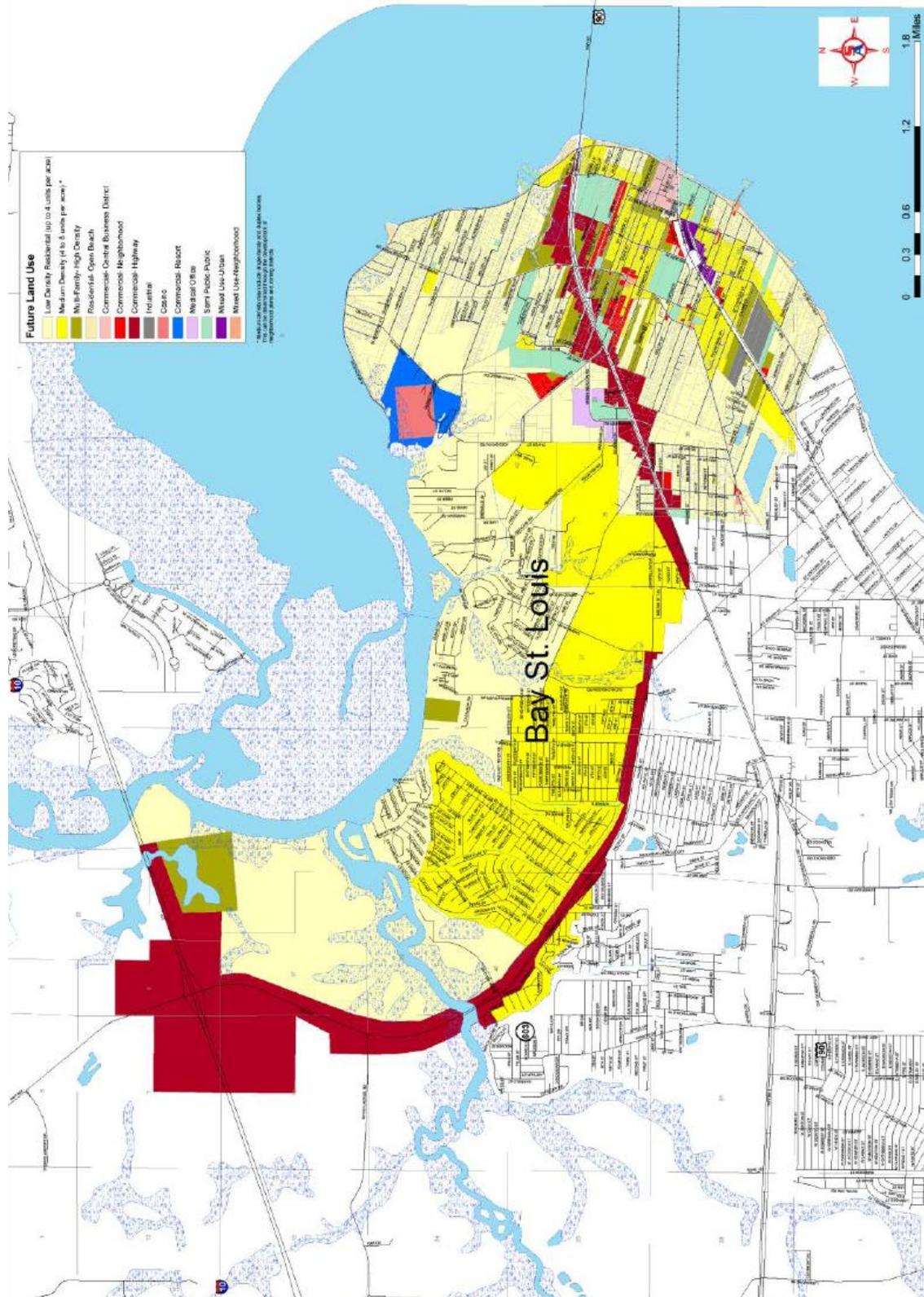
During the creation of the most recent Bay St. Louis Comprehensive plan, the Gulf Regional Planning Commission performed an Existing Land Use Study for the Bay St. Louis' incorporated area of 15.8 square miles. The field inventory of existing land use was conducted from November 2006 to March 2007. The land use inventory was completed for the entire area of Hancock County, including the cities of Bay St. Louis and Waveland. Land uses in this study were grouped into twelve (12) major categories.

- 1) Residential: This category included single family (low density), multi-family duplex to quadraplex (medium density), apartments (high density) and mobile homes. Within the corporate limits of Bay St. Louis, 65% of the developed land area is devoted to residential uses. This shows an increase of 15% from the previous land use survey completed in 1999, when 50% of the developed land within the corporate limits was under residential development. This equated to 1,630 acres of land developed residentially. Nearly 91% of the residential land was developed as low-density residential development.
- 2) Industrial: This category included a variety of manufacturing and construction establishments. There are 19 acres of industrial land representing less than 1% of the total developed land in the combined incorporated and unincorporated planning area.
- 3) Transportation/Communication/Utilities: This category included railroads, motor freight transport, airports, marine terminals, communication facilities and utilities. There are 79 acres with these types of land uses within Bay St. Louis.
- 4) Commercial: All types of wholesale, retail trade establishments; hotels, motels, eating and drinking establishments, and related types of businesses and heavy commercial such as automotive repair were included in this category. This category of land use contains 168 acres or 7% of the developed land within the corporate limits.
- 5) Services: This category included education, business, personal and professional services. There are 105 acres or 4% of the developed land within Bay St. Louis devoted to this category.
- 6) Public and Semi-Public: This category included governmental and other related community serving uses. There are 284 acres or 3% of the total developed planning area occupied by these uses.
- 7) Churches and Related: This category included all parcels associated with religious activities. Churches and associated uses encompassed 178 acres within the total planning area.
- 8) Cultural/Entertainment/Recreational: This category included parks, golf courses, camping, swimming areas, libraries, fairgrounds and other similar activities. There are 119 acres or 1% of the total area of Bay St. Louis devoted to these types of uses.
- 9) Resource Production and Extraction: This category included field crop farming, livestock farming, fruit and vegetable farming, forestry and mining. None of these types of land uses occurred within the current city limits of the City of Bay St. Louis.

-
- 10) Undeveloped or Non-Urban: This category included undeveloped and unused land, water areas, wetlands and flood plains, and agricultural land. Within the present corporate limits of the City of Bay St. Louis, there are 5,087 acres of land that are undeveloped. Due to the coastal location of Bay St. Louis, there is a large portion of vacant land in wetlands, floodplains, floodways and large lot residential development.
 - 11) Rights-of-Way and Water Areas: This category included highways, streets, railroads and areas covered by water. Fifteen percent (15%) of the total land area land in Bay St. Louis is used for rights-of-way.
 - 12) Casinos: This category included casino, and related ancillary functions on the site of the casino grounds. Approximately 165 acres of land was devoted to casino land uses within the City of Bay St. Louis, including ancillary land uses located on the same lot as the casino. Casino land uses accounted for about 2% of all land uses within the City of Bay St. Louis.

These use categories indicate only how the land is presently being used and does not indicate the zoning classification. The Existing Land Use Map in Table 4.33 presents the various categories in relationship to total land area and the total developed area.

Table 4.33. Future Land Use in the City of Bay St. Louis



Source: Bay St. Louis Comprehensive Plan

Future Land Use

One of the primary determinants of the location of development and land use within this community has been shaped by the coastal nature of the area. Hurricanes and severe weather have transformed the community on several occasions. Hurricane Katrina is not the first, nor will it likely be the last hurricane to have an effect on this community. But as a result of Hurricane Katrina the community is grappling with rebuilding. And local, state and federal agencies are proposing or have imposed various programs, both regulatory and voluntary, which have the intent to remove people from harm that has been caused or is projected to be caused by another hurricane making landfall within the local area.

In the consideration of rebuilding, the community will need to consider the special circumstances are areas of the City that may be effected by updated FEMA floodplain maps which were released for review in December 2007 and a projected proposal by the U.S. Army Corps of Engineers, which would seek to implement structural and non-structural solutions to property damage caused by flooding throughout the region, including the purchase of up to 365 homes within the City of Bay St. Louis and restoration of the property that these homes were on.

In late summer 2007, the U.S. Army Corps of Engineers and the Mississippi Department of Marine Resources held meetings to discuss the Mississippi Coastal Improvement Program. The intent of the program is:

“to reduce hurricane and storm damage, reverse impacts of salt-water intrusion, preserve fish and wildlife and their habitats, prevent shoreline erosion, and other water resource purposes.”

The U.S. Army Corps of Engineers was the lead investigator on this project, and the agency is coordinating with the Mississippi Department of Marine Resources, through the Mississippi Coastal Restoration Initiative. The U.S. Army Corps of Engineers was responsible for developing this plan and presented the plan to Congress on January 14th of 2010. The plan suggests engineered and non-structural solutions to reduce hurricane and storm damage. More information about the plan can be found in the Capabilities discussion in Section 4.4.

4.3.1 Vulnerability of Bay St. Louis to Specific Hazards

The Disaster Mitigation Act regulations require that the HMPC evaluate the risks associated with each of the hazards identified in the planning process. This section summarizes the possible impacts and quantifies, where data permits, the County’s vulnerability to each of the hazards identified as a priority hazard in Table 4.22 in Section 4.2.11 Natural Hazards Summary. The hazards evaluated, in order of risk to the City, further as part of this vulnerability assessment include:

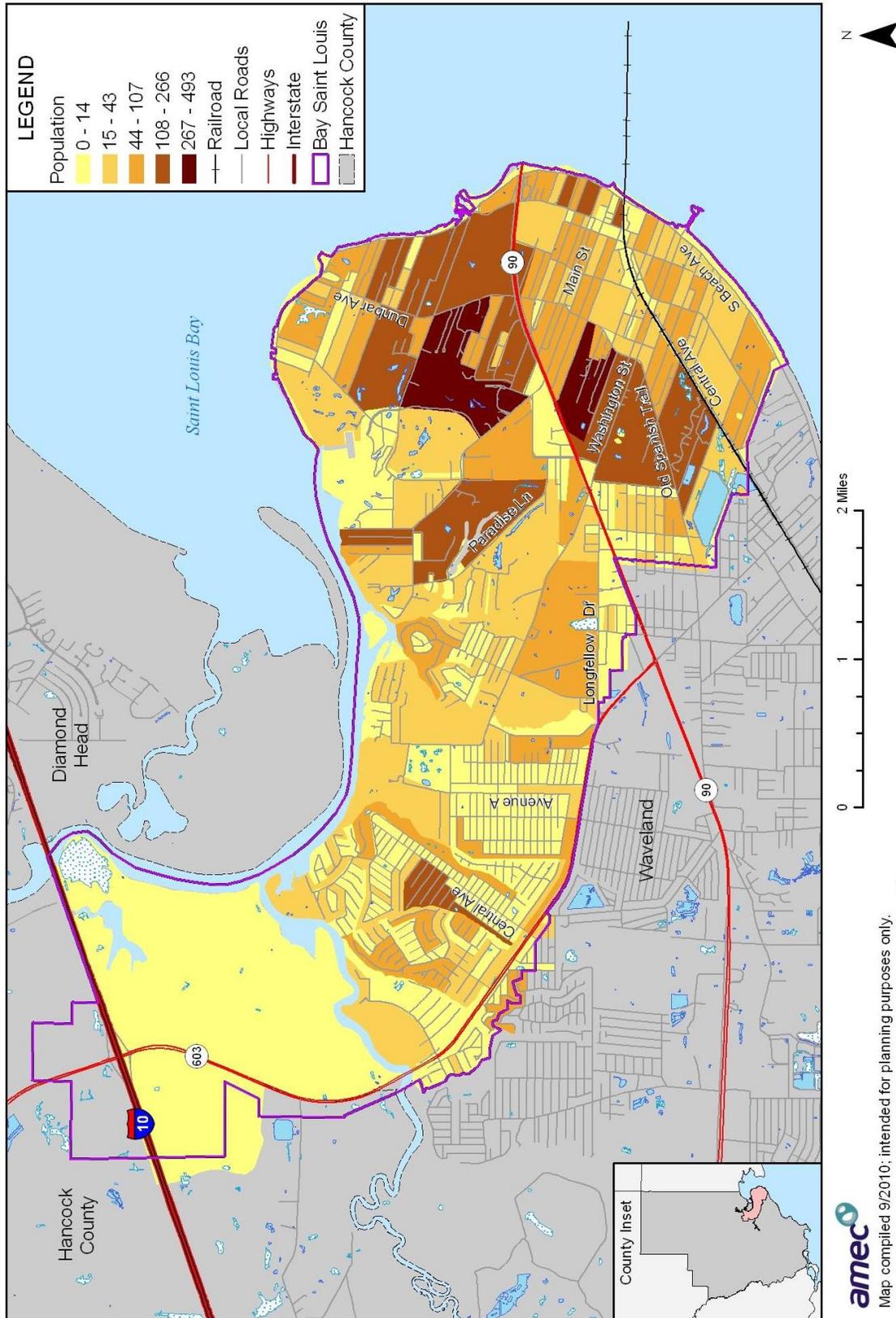
- Tropical Storm, Hurricane, and Storm Surge
- Flood

-
- Severe Weather: Thunderstorm/Wind/Hail
 - Tornado

Bay St. Louis' vulnerability to hurricane, tropical storms, and flooding from storm surge cannot be overstated. These hazards outstrip every other identified hazard that can affect the community. According to SLOSH Model maps developed by the U. S. Army Corps of Engineers, the entire City of Bay St. Louis is subject to flooding from storm surge from Category 3 or stronger hurricanes. Additionally, FEMA DFIRM adopted by the City in 2009 place the majority of the community in flood hazard areas.

The City of Bay St. Louis Population Map indicates that the highest concentration of population in Bay St. Louis is located within the pre-annexation boundaries of the City. The area annexed by the City is located almost entirely in AE or V flood zones where most of the structures were flooded and many destroyed by Hurricane Katrina.

Figure 4.25. Bay St. Louis Population Density



By overlaying the DFIRM with the City's current Zoning Map and County Land Roll data the City was able to determine the number and values of properties located in recognized flood hazard areas of the City. The following charts address values and types of properties located in X-Zones (500 year or .02% annual chance of flooding – see Table 4.34), AE Zones and VE Zones (100 year or 1% annual chance of flooding – see Table 4.35 and Table 4.36), as follows:

Table 4.34. Parcels by Classification in 0.2% Annual Chance

Property Type	Property Count	Improved Value	Land Value	Total Value
Commercial	100	\$18,894,826	\$13,191,031	\$32,085,857
Industrial	3	\$2,523,936	\$343,760	\$2,867,696
Other	34	\$72,821	\$1,034,811	\$1,107,632
Recreational	13	\$591,433	\$553,096	\$1,144,529
Residential	1,508	\$119,728,047	\$45,828,152	\$165,556,199
Residential Empty PK	16	\$14,290	\$652,998	\$667,288
Residential Temporary PK	19	-	\$441,094	\$441,094
Resource Production		-	\$8,500	\$8,500
Services	134	\$17,366,679	\$8,114,505	\$25,481,184
Transportation/Communication/Utility	59	\$539,045	\$2,067,587	\$2,606,632
Undeveloped Land & Water Areas	502	\$551,136	\$9,450,741	\$10,001,877
Undeveloped Land PK	111	\$93,773	\$5,043,636	\$5,137,409
Total	2,500	\$160,375,986	\$86,729,911	\$247,105,897

Table 4.35. Parcels by Classification in 1% Annual Chance - Zone AE

Property Type	Property Count	Improved Value	Land Value	Total Value
Beach PK	5	\$0	\$15,280	\$15,280
Commercial	41	\$7,264,539	\$9,147,008	\$16,411,547
Industrial	1	\$7,290	\$4,000	\$11,290
Other	186	\$119,118	\$4,902,631	\$5,021,749
Recreational	11	\$1,709,091	\$396,393	\$2,105,484
Residential	1,812	\$115,553,465	\$37,946,836	\$153,500,301
Residential Destroyed PK	6	-	\$48,600	\$48,600
Residential Empty PK	5	-	\$63,193	\$63,193
Residential Temporary PK	123	\$4,288	\$3,585,003	\$3,589,291
Resource Production	2	\$10,248	\$60,600	\$70,848
Services	48	\$62,405,652	\$20,831,553	\$83,237,205
Transportation/Communication/Utility	151	\$493,809	\$3,682,562	\$4,176,371

Property Type	Property Count	Improved Value	Land Value	Total Value
Undeveloped Land & Water Areas	3,266	\$56,544	\$34,284,945	\$34,341,489
Undeveloped Land PK	651	\$18,843	\$19,559,858	\$19,578,701
Total	6,308	\$187,642,887	\$134,528,462	\$322,171,349

Table 4.36. Parcels by Classification in 1% Annual Chance - Zone VE

Property Type	Property Count	Improved Value	Land Value	Total Value
Beach PK	96	-	\$1,737,233	\$1,737,233
Other	28	-	\$1,430,880	\$1,430,880
Recreational	8	\$3,159,431	\$390,641	\$3,550,072
Residential	323	\$26,928,137	\$12,290,758	\$39,218,895
Residential Empty PK	5	-	\$135,000	\$135,000
Residential Temporary PK	55	\$1,115	\$3,241,216	\$3,242,331
Resource Production	46	-	\$82,800	\$82,800
Transportation/Communication/Utility	72	\$283,180	\$2,691,801	\$2,974,981
Undeveloped Land & Water Areas	801	\$8,535	\$19,250,023	\$19,258,558
Undeveloped Land PK	466	\$612	\$19,632,216	\$19,632,828
Total	1,900	\$30,381,010	\$60,882,568	\$91,263,578

In assessing vulnerability to damage and loss of life from hurricanes and tropical storms, at the top of the list is loss of life and property due to flooding. The very young, the elderly and the handicapped are particularly vulnerable to harm from hurricanes. Not only are residences vulnerable to hurricanes but public buildings infrastructure and natural resources are all subject to damage.

Torrential rains from hurricanes can produce extensive urban and riverine flooding long before the storm reaches land. Off shore winds drive sea water up the mouth of the rivers, streams or canals, compounding the severity of inland overbank flooding. In addition to the combined destructive forces of wind, rain and lightning, hurricanes cause a surge which can raise the sea level as high as 25 feet in the strongest hurricanes. This surge can also have the opposite effect in the sea level which can be lowered below mean sea level at the back side of a hurricane. Losses attributable to flooding that is caused by hurricanes is further addressed in the flood section of the risk assessment.

Vulnerability of People to Hurricanes

According to the Census Estimates, the population of Bay St. Louis estimated population of the City was 8,404 persons as of July 2009. Based upon the latest National Weather Service Sea, Lake and Overland Surges from Hurricanes or SLOSH Model storm surge data, the entire

community is at risk from storm surge flooding from a Category 3 or stronger storm. The entire population of the community must be prepared protect properties and evacuate or seek shelter well in advance of a major hurricane.

In past hurricane events, the SLOSH Model developed in 2000 was effectively implemented in an evacuation of people in their vehicles. 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 upon the areas most vulnerable to storm surge. The assignment of zones enables local residents to assess their own vulnerability to a hurricane given their location and local officials can call for an evacuation of the particular zone when the opportunity presents itself.

If used in a timely manner, given sufficient warning the SLOSH Model is effective in saving lives in the Gulf Coast region where Hancock County and Bay St. Louis are located. The Mississippi Department of Transportation (MDOT) has developed routes to aid in speedy and effective evacuation out of the coastal area and in to the interior of the state and neighboring states. Using these advanced evacuation methods, the vulnerability of people can be minimized prior to the onset of a hurricane.

Loss of Life from Hurricanes

Loss of life and property due to high winds is largely confined to the coastal area. This loss is usually attributable to injuries from wind-borne glass, building materials, limbs and shrubs. Upland losses can be attributed to rain damage and flooding as well as sustained high wind gusts and tornados. Flooded road crossing seem to involve a greater loss of life to people in automobiles.

Most deaths due to hurricanes are flood related and both coastal and inland flooding is a common occurrence in hurricanes and tropical storms. The death toll in Mississippi hurricanes in the past 30 years totals 428 persons; 283 persons died in Mississippi in Hurricane Katrina in 2005 and 143 died in Hurricane Camille in 1969. Ninety percent of deaths in hurricanes involve water related or flooding deaths with the remaining deaths due to impacts of wind and wind-borne projectiles.

Vulnerability of Natural Resources in 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. Storm Surge and subsequent erosion of the shoreline leads to loss of property. Katrina and other hurricanes have resulted in significant damage to the barrier islands - Cat, Horn, Petit Bois and Ship - that protect the Mississippi Coastline and unless loss of land is arrested, they may disappear in years to come. Inland rivers and lakes can become clogged with debris with obstructions becoming a cause for future storm water flooding.

Marshes and wetlands suffer loss of vegetative cover from salt water surge intrusion. Wildlife habitat is disturbed or lost and estuaries are damaged and may never fully recover resulting in ongoing erosion and permanent losses.

Vulnerability of Private Improvements to Hurricanes

Homes, businesses and manufactured homes are especially vulnerable to the effects of hurricane winds, rain and tornados generated by hurricanes. The effects of storm surge can flatten buildings. Although hurricane winds can exert tremendous pressure against homes, much of the damage is not from the wind itself but from airborne missiles such as tree limbs and branches, signs and sign posts, roofing, metal siding and other pieces of buildings, including entire roofs in major storms. The wind borne debris penetrates doors and windows, allowing the force of the wind to act against interior walls and ceilings not designed to withstand such forces, blowing the building apart.

Assessing Vulnerability Methodology/HAZUS-MH Modeling

When the *State of Mississippi Standard Mitigation Plan* was updated in 2007, HAZUS-MH hurricane loss modeling capabilities were used to quantify expected losses and differentiate vulnerability by county. HAZUS-MH can model specific hypothetical or historical scenarios and probabilistic scenarios, based upon information on location of past hurricanes and tropical storms, the highest risk is to the coastal counties of Mississippi, including Hancock County.

During the 2007 update of the State Plan an annualized loss scenario was run for the entire state using the probabilistic scenario to model annualized losses by county. This scenario was chosen over a deterministic analysis largely because the impacts of 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 (Hancock, Harrison and Jackson).

HAZUS-MH Annualized Hurricane Loss Estimation Results: Building Impacts by Highest Building Losses ranks Hancock County are shown in Table 4.37.

Table 4.37. Building Loss Estimation in Hancock County

Building Damage (\$)	Loss Ratio	Contents Damage and Inventory Loss (\$)	Income Loss (\$)	Total Building Loss (\$)	Loss Ratio Rank
\$12,028,000	0.52	5,274,000	2,980,000	20,283,000	3

Source: HAZUS

Using HAZUS-MH deterministic scenarios with a point of impact in Hancock County, a Category 5 Hurricane with peak wind speed gusts of 175 mph, could result in the damage shown in Table 4.38.

Table 4.38. Category 5 Building Damage in Hancock County

Classification	Minor	Moderate	Severe	Destroyed	Total
Total Residential	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

Source: HAZUS

Summaries for the scenarios for Category 3 and Category 1 hurricanes with point of impact in Hancock County are as follows:

Category 3 Storm Vulnerability: Peak Wind Speed (mph) 148: Hancock and 19 other counties received more than \$500,000 each in damage in this scenario.

Category 1 Storm Vulnerability: Peak Wind Speed (mph) 104 – Hancock and 12 other counties received more than \$500,000 each in damage in this scenario.

Impact on Existing and Future Development

According to the 2005 plan all structures located in identified Special Flood Hazard Areas in Bay St. Louis would be expected to flood during even a minimal hurricane or tropical storm. It was expected that development in the areas most vulnerable to hurricane winds and tide would continue into the future. Not only were all properties located in Special Flood Hazard Areas flooded by surge from Hurricane Katrina, most were totally destroyed or severely damaged. With current DFIRM adopted in 2009 and changes made to development ordinances made post Katrina, future development and rebuilding of damaged or destroyed structures in flood hazard areas will be far more sustainable.

Development in Bay St. Louis is restricted in velocity zones and waterfront areas that are likely to be affected by surf and tide action. Damage caused by hurricanes, tropical storms and other coastal storms remain the most serious and dangerous weather systems the area is likely to experience. Structures built in Bay St. Louis and especially along the coast line where storm surge will occur in the future will receive the brunt force impact of storm surge, wind and rising tides and must be constructed to withstand those conditions. The mitigation measures required to ensure the safety of these structures and insuring them will be costly, a factor that will certainly impact how existing and future development is regulated and constructed.

Recommendations

Due to their potential for severe damage from storm tide flooding, residents and property owners in Bay St. Louis and along the Gulf Coast must be prepared to survive and protect their property from the coastal storm surge flooding. To mitigate damage, the city must continue to enforce strong ordinances mandating elevation above flood hazard areas and storm velocity zones. As demonstrated in Hurricane Katrina and surge probability used in prediction, there is little or no

part of Bay St. Louis that is safe from storm surge flooding caused by a major hurricane. To save lives and prevent injuries, it is imperative that all residents of the City of Bay St. Louis secure their properties and evacuate to a safe place well in advance of a hurricane approaching landfall. The city must continue to enforce and strengthen its ordinances regulating development in storm surge areas.

Residents must be encouraged to develop and maintain individual action plans in order to protect themselves and their properties when a storm threatens. To the extent possible, mandatory evacuations must be issued earlier and a system put in place to move every resident to areas safe from flooding.

Flood Vulnerability

Flood damage is directly related to the depth of flooding and a two foot deep flood usually results in about 20 percent damage to the structure which translates to 20 percent of the structure’s replacement value. According to the DFIRM, a large portion of the Bay St. Louis is located in areas vulnerable to 100-year flooding under normal flood circumstances. When compared to the vulnerability of predicted flood level models (SLOSH) resulting from hurricane storm surge, the entire City becomes vulnerable to property damaging flooding from a Category 3 or stronger hurricane.

Methodology

Hancock County’s parcel layer was used as the basis for the inventory of developed parcels in Bay St. Louis. In some cases, there are parcels in multiple flood zones, such as Zone AE, VE, and X500 (1% and 0.2% annual chance) floodplains. GIS was used to create a centroid, or point, representing the center of each parcel polygon, which was overlaid on the floodplain layer. For the purposes of this analysis, the flood zone that intersected the centroid was assigned as the flood zone for the entire parcel. The parcels were segregated and analyzed for the entire City. The results are summarized in the discussion that follows.

Three keys were used to derive the Property Type categories. The codes were simplified into ten categories that are represented in Table 4.39 which shows the count and improved value of parcels that are sorted by property type in the floodplain. This table shows the count and improved value of parcels that fall in a floodplain, by 1% annual chance flood, 0.2% annual chance flood, and total flood (1% and 0.2% annual chance floods combined).

Table 4.39. Total Flooded Parcels by DFIRM 1% and 0.2% Annual Chance

Property Type	Property Count	Improved Value	Land Value	Total Value
Beach	101	-	\$1,752,513	\$1,752,513
Commercial	141	\$26,159,365	\$22,178,039	\$48,497,404
Industrial	4	\$2,531,226	\$347,760	\$2,878,986

Property Type	Property Count	Improved Value	Land Value	Total Value
Other	248	\$191,939	\$7,356,929	\$7,560,261
Recreational	32	\$5,459,955	\$1,340,130	\$6,800,085
Residential	3,872	\$262,229,342	\$103,972,466	\$366,462,192
Resource Production	49	\$10,248	\$151,900	\$162,148
Services	182	\$79,772,331	\$28,938,650	\$108,718,389
Transportation/Communication/Utility	282	\$1,316,034	\$8,441,950	\$9,757,984
Undeveloped Land & Water Areas	5,797	\$729,443	\$106,326,646	\$107,950,862
Total Flooded Parcels	10,708	\$378,399,883	\$280,806,983	\$660,540,824

Source: Hancock County Tax Assessor

Table 4.40 shows calculation of loss estimate values. The estimated contents value is 50% of the improved value; the total value is the sum of the improved and estimated contents values; the loss estimate is 20% of the total value. This table is also broken up by 1% and 0.2% annual chance flood, and total flood (1% and 0.2% annual chance floods combined).

Table 4.40. Loss Estimate Values

DFIRM	Total # of parcels	Improved Value	Estimated Contents Value	Total Value	Loss Estimate
1% Annual Chance	8,208	\$218,023,897	\$109,011,949	\$327,035,846	\$65,407,169
0.2% Annual Chance	2,500	\$160,375,986	\$80,187,993	\$240,563,979	\$48,112,796
Total Flood	10,708	\$378,399,883	\$189,199,942	\$567,599,825	\$113,519,965

Source: Hancock County Tax Assessor

Limitations

The Hancock County Assessor's Office does not attribute their parcel layer with land use types. Therefore, AMEC had to use 3 keys provided by the Assessor's Office and Gulf Regional Planning Commission (GRPC) to identify parcel land uses. First the I_TYPE field was used to match up with a key called IType Key which categorized 4,301 parcels. From the empty fields left over, the Prime_LU field, in the Assessor's land roll, was used to match up with a key called Land Use Categories which categorized 5,463 parcels. Lastly, a Katrina Land Use key was used to try and fill in any gaps left over from the other keys and categorized 1,580 parcels. This Katrina Land Use key was a study done after the Katrina event where an assessment was done on properties and given a classification based on parcel number and the status of the physical property. 331 parcels were left without a land use classification and these were put into a category of "Other". The fields that were able to be matched fell into these categories and totaled 11,344 parcels in the following categories: Beach, Commercial, Industrial, Recreational, Residential, Resource Production, Services, Transportation/ Communication/Utility, and Undeveloped Land & Water Areas.

In addition, a parcel layer and land roll database from the Hancock County Assessor's Office was used in this analysis. The parcel layer was joined, based on the PARNUM # (parcel numbers), to a 2009 land roll table. The parcel layer is for the whole Hancock County so parcels were selected for analysis based on an intersect between the parcel layer and the annexed city limits of Bay St Louis, obtained by Hancock County.

Methodology Summary

Based on this analysis, the Bay St Louis has significant assets at risk to 100-year and greater floods. 8,208 improved parcels are within the 1% annual chance floodplain for a total value of \$22,295,333. 2,500 improved parcels fall within the 0.2% annual chance floodplain for a total value of \$60,511,650. There are 967 improved parcels outside of either floodplain with a value of \$39,271,762. The valuation details for Bay St Louis are broken out in Section Table 4.23 of this plan.

Observations Affecting Risk to Flooding in the City of Bay St. Louis

Due to the increase in size of Bay St Louis city limits after the annexation in 2006, there is a dramatic increase in population, properties and risk for the City. The 2005 hazard mitigation plan listed 711 properties at risk compared to the 10,708 in this plan. Another observation, the previous plan shows the total number of properties in the floodplain as 697.

Mississippi State Plan Findings

Using HAZUS-MH runs the planners preparing the *State of Mississippi Standard Mitigation Plan* were able to analyze the impacts of flooding by county jurisdictions and assess flood losses. The results show potential losses and loss ratios as highest in the three coastal counties, including Hancock County where coastal and riverine flood hazards are extensive. The countywide 100-year flood scenario losses for Hancock County indicates losses of from \$500,001 - \$1,684,230 including property damage and business interruption losses.

The Loss Ratio for the percentage of the total value of structures in the County that could be damaged by a 100-year flood is 6.01% to 16.76% and Hancock County ranked third behind Harrison and Jackson Counties in the HAZUS-MH 100-year flood loss estimation with projected building damage of \$391,267,000 and \$319,840,000 in contents and inventory loss damage. Income losses were projected to be \$313,149,000 and total building loss \$1,024,256,000.

Hancock County also ranked third in the "Flooding Impacts on Populations" ranked by projected numbers of displaced people (23,972) and people needing shelter (18,009). In 2004, with 23 Repetitive Loss Properties, Bay St. Louis was ranked number 12 in the list of 50 'At Risk' Communities in Mississippi. Given the large number of repetitive loss (RL) properties now located in the City that were counted in Hancock County in 2004, Bay St. Louis is now ranked much nearer the top if not number 1 in the state.

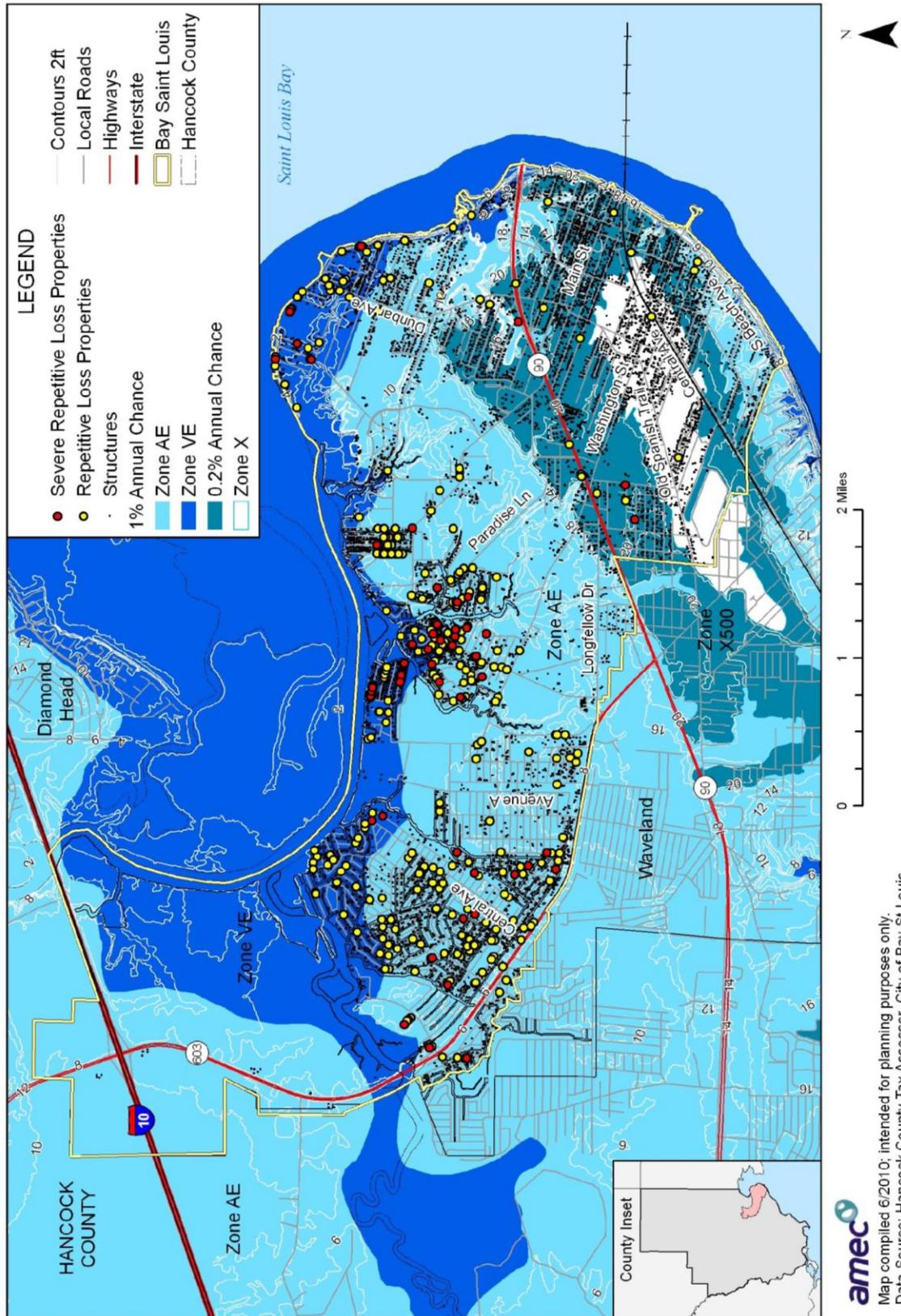
Repetitive Loss Properties

When the 2005 plan was completed using June 2004 NFIP Repetitive Loss Data, the City of Bay St. Louis had 21 repetitive loss properties. As a result of the annexation in 2006, the 2009 Repetitive Loss List indicates Bay St. Louis now has 425 repetitive loss properties. When repetitive loss properties are mapped, as shown in Figure 4.26, the highest concentrations are in the north and northwest areas of the city in the annexed area. As demonstrated by flooding from Hurricane Katrina, there is actually no area of Bay St. Louis that will not flood, given similar circumstances.

At present it is not possible to determine use of Bay St. Louis' repetitive loss properties, primarily due to recent annexation of the majority of the properties and recent publication and adoption of the DFIRM (2009). Classification by use of repetitive loss properties will be included via amendment to the plan at a later date as data becomes available. A new action is being added to the Chapter 5 of this document calling for development of a repetitive loss plan for the annexed area of the City and will appear as Activity 2011.02.

Numerous repetitively flooded structures in the annexed area were damaged or completely destroyed, so the actual number of repetitive loss properties with structures may be significantly lower than the 425 properties on the repetitive loss list. Many of the structures were second homes or camps held for part time occupancy by out of town owners. Rebuilding has been slow in those areas but when the economy improves it is expected structures will be rebuilt on many of those properties; as that occurs, new, stronger structures will be elevated to conform with the DFIRM and the City's Flood Ordinance and should be more resistant to future flooding.

Figure 4.26. Bay St. Louis RL Properties and FEMA DFIRM 1% and 0.2% Floodplains



The NFIP Community Rating System (CRS) requires participants in the program to indicate at risk flood hazard areas in the community. Most of the flooding in Bay St. Louis can be attributed to coastal and storm tide or surge flooding. Based upon SLOSH models it is not unreasonable to assume that while a small area of the City will not flood in a Category 1 or 2 hurricane, the entire land area of the City is at risk for flooding from a Category 3 or stronger hurricane. While DFIRM VE and A zones carry the highest risk of repetitive flooding, it could be concluded that the X500 and X Zones in Bay St. Louis should be considered at risk of flooding and appropriate protective active be taken when a hurricane is predicted to landfall in the area.

Transportation Systems. Both the vehicular and railroad bridges across the Bay of St. Louis were destroyed by Katrina's storm surge and had to be completely rebuilt. The Highway 90 bridge was rebuilt at a much higher elevation and was reopened about 18 months after Katrina, reconnecting Bay St. Louis and southern Hancock County to the rest of the coast. CSX Railroad reconstructed its bridge and rail traffic was restored by the end of 2005.

Most major thoroughfares in Bay St. Louis were damaged by flood and wave action. Those not heavily damaged by Katrina were damaged by heavy equipment used to remove debris and work to restore and replace underground utilities during the following years. Suffering the most significant damage was the section of South Beach Blvd. that was completely destroyed when the bluff that marks the highest elevation in Bay St. Louis was eroded away by the storm surge and wave action. The downtown section of that thoroughfare has been reconstructed. In 2010, Sections of South Beach are still under construction but nearing completion and will once again allow uninterrupted access to Waveland and westward to Bayou Caddy.

Lifeline Utility Systems. Storm surge and winds from Katrina disrupted all utility systems in Bay St. Louis. The entire grid of Mississippi Power Company was down for up to several weeks. Natural gas service to most areas of Bay St. Louis was disrupted when wave action along the beach front uncovered and ruptured lines. The only telephone communication available for several months was cellular and that was touch and go in the weeks immediately after the storm. Water distribution lines suffered the same fate as gas lines. Sewage collection lines and lift stations were clogged with sand and broken, allowing raw sewage to spill. The regional wastewater treatment plant was flooded and required major renovation. Temporary repairs were made to get the plant up and running but it was sometime later before it was able to operate at capacity loads.

The first several weeks post-Katrina, Bay St. Louis was without public utilities and systems of any sort. Pre-Katrina utility service connections of 3,771 customers dropped to 1,978 as of March 2006, six months after the storm. As repairs were made and services were restored, temporary housing was made available to residents and those who could do so returned to begin the rebuilding process but as of August 2010, many former residents still had not made any effort to return or rebuild.

In 2010, critical public utilities have been restored to most areas of the community where they existed prior to Katrina. As redevelopment continues to progress the need for utilities will be met.

Recommendations

Due to the potential for severe damage from storm-tide flooding, residents and property owners in Bay St. Louis and along the Gulf Coast must be prepared to survive and protect their property when these events occur. To mitigate damage, the city must continue to enforce strong ordinances mandating stronger construction techniques and elevation above flood hazard areas and storm velocity zones.

As demonstrated in Hurricane Katrina, there is little or no part of Bay St. Louis that is safe from surge flooding caused by a major hurricane. In order to save lives, it is imperative that all residents of the City of Bay St. Louis secure their properties and evacuate to a safe place prior to a hurricane making landfall.

Through strengthening planning, zoning, and property protection ordinances and adoption of higher regulatory standards, the community could expect to mitigate structural damage from flooding. Low density construction should continue to be encouraged in surge zones. Environmentally sensitive areas such as marshes, coastal estuarine and wetlands should continue to be set-aside as conservation areas. Development permitted in these areas needs to be compatible with wetlands uses.

Bay St. Louis should continue to disseminate information concerning personal safety and methods to protect property from flooding to the public at every opportunity. Officials must stress the need for additional safe evacuation routes away from the coast when hurricanes threaten the population and safe refuges must be made available to populations fleeing the coastal area when hurricanes such as Katrina threaten. Residents must be encouraged to develop and maintain individual action plans in order to protect themselves and their properties when a storm threatens. Mandatory evacuations must be issued earlier, and a system put in place to as nearly as possible move every resident to areas safe from flooding.

Thunderstorms, High Winds, and Hail Vulnerability Assessment

Types of Buildings and Community Assets in Hazard Area

Winds and hail from thunderstorms are most likely to impact the outside envelope of structures and are most likely to cause property damage to items situated outside and unprotected. Hail can cause significant cosmetic damage to cars as well as to the roof and siding of structures. Over time the cosmetic damage can rust or weaken, putting the exterior of vehicles or the structure at risk.

Winds can cause damage to structures, trees and utility systems. All of the damages documented by the National Climatic Data Center indicate that trees fell on power lines creating disruptions. Winds can also damage roofs, windows, doors and garage doors and outbuildings. Strong lightning strikes can damage electrical services, trees and cause property damaging fires. Lightning can also damage electrical appliances and equipment. Occasionally, structures are burned down or severely damaged by lightning strikes. Lightning can also cause electrocution of individuals and animals caught out of doors during a storm.

Community Assets

Critical Facilities. Critical buildings are not any more vulnerable than other buildings to thunderstorm damage. Thunderstorms, wind and lightning can impact community facilities and critical facilities---most notably utility systems.

Essential Services. Contingency planning has been done to ensure that emergency operations can continue during the loss of power from thunderstorms. These facilities house dispatch, police and fire services as well as the Public Works Yard and Equipment Storage. Emergency generators with automatic switching capacity have been installed on all critical facilities and public facilities in Bay St. Louis. Hancock Medical Center is equipped with generators and operate under an Emergency Operations plan during hazard events.

Lifeline Utility Systems. Lifeline utility systems such as telephone systems, utility systems and sewer systems may be impacted by severe thunderstorms with high wind. Post Katrina, large amounts of funding was made available to install standby generators throughout the city to ensure electrical service is available ensuring these systems remain operational in the most severe weather. Above ground electric power systems are subject to lightning strikes; particularly vulnerable are aboveground, elevated transformers; strikes to power supplies can knock out sewer lift stations, water pumping stations and other utilities.

Estimated Losses for Critical Facilities and Infrastructure. In the *State of Mississippi Standard Mitigation Plan*, State Planners do not address or establish estimated losses from this cause but address losses from tornados, severe weather, winds, etc. in other sections including Section 4.1.2 and 4.1.4. In their plan, the state recognizes that hail storms can occur but are not typically a state wide occurrence and best addressed at the local level. Other than occasional lightning strikes that could damage motors and other electrical equipment, thunderstorms and their accompanying features – lightning, wind, tornados, hail, and rain – should not result in significant losses for critical facilities and infrastructure.

Impact on Existing and Future Development

As indicated in the historic damage data for this hazard, the value of damages attributable to thunderstorms is very minor when compared to other more severe hazards. The possibility for damage does exist, however, so it should be assumed that every structure in Bay St. Louis could at some point in time be susceptible to damage from one of these storms.

Thunderstorms and their accompany hazards (lightning, tornadoes, flash flooding, hail) are common to the area and should not have a significant impact on whether or where new development occurs, as long as the possibility is taken into account in development planning and developers adhere to strict interpretation of existing building codes and practices. The most important mitigation action to prevent damage from thunderstorm wind, tornadoes, and flooding is continued enforcement of wind-resistant building requirements and elevation requirements.

Recommendations

Severe thunderstorms with high wind, lightning, tornados, funnel clouds, water spouts, and hail are weather features common to this area that will continue to occur on a regular basis. As indicated in the historic data provided, damage from these storms in the past has been minor. The possibility does exist for more significant damage and that possibility should be taken into account during planning for new development.

All future development occurring in Bay St. Louis should continue to be required to conform to high wind zone construction techniques. Additionally, plans for all future development should take into account the possibility of flash flooding from heavy rainfall. The City has ordinances in place designed to mitigate flooding, including drainage design, street design, across the board elevation of structures, regulating the amount of fill introduced to sites, and riparian easements along natural streams and drainage ways. Also, the city should continue to pursue funding to correct drainage problems in areas where flash flooding from thunderstorms and other rain system causes street flooding and threatens to enter homes and businesses.

Additionally, the city should encourage setting aside as conservation areas sites prone to ponding and poor drainage. These areas reduce flooding by providing natural storage areas for stormwater produced by weather systems such as severe thunderstorms, allowing water to absorb slowly into the ground or slowly discharging the stormwater into the drainage system.

Common sense, personal safety measures during a thunderstorm to prevent injury or death from lightning strikes are well known and practiced. Grounding of electrical appliances is required in the city's Electrical Codes and using surge protectors on electronic equipment helps prevent losses due to lightning. Safe rooms constructed within existing structures or included in new construction can prevent loss of life should high winds or tornadoes accompany thunderstorms.

Fortunately, the advanced technology utilized by weather forecasters makes it possible to identify storm systems likely to spawn severe thunderstorms and accompanying problems before they occur and issue warnings to populations in the path of the storm. NOAA weather radios have been placed in all schools and other public building. All residents of the community should be encouraged to purchase and monitor NOAA weather radios.

Tornado Vulnerability Assessment

Vulnerability of Natural Resources to TORNADOS

Trees and all 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, which could be result in pollution. 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 pollution.

Streams can become clogged with wind blown debris and downed trees, causing flooding. If debris is not removed from vacant land it could become a threat to health and safety, fire hazard and haven for unwanted vermin or pests. Habitat for local wildlife may be destroyed resulting in a reduction of urban species.

Vulnerability of Public and Private Improvements to TORNADOS

Residential Structures. Older frame houses and mobile homes are particularly vulnerable to tornados. If houses are not constructed to high wind standards, the likelihood of significant roof damage if not roof failure will occur. Unless mobile homes are placed on an anchored foundation, the force of tornado winds will likely lift the structure and overturn it. It is unlikely that damaged mobile homes will ever be returned to habitable status. Private improvements such as houses with roofs and mobile/manufactured homes are vulnerable to tornados and straight line winds that often accompany a tornado.

Critical Facilities. A tornado may affect any critical facility or the infrastructure in Bay St. Louis. The City requires new buildings and infrastructure structures such as water tanks and towers to be built to hurricane resistant wind standards.

Essential Services. In 2004/2005 when the existing plan was being prepared, it was not expected that any new buildings would be built in Bay St. Louis in the near future. Storm surge and winds from Hurricane Katrina disproved that assumption shortly after the plan was adopted when it displaced nearly every essential service provider in Bay St. Louis. Over the past five years, nearly every essential services provider in the city has either moved into a different, already constructed building or are anticipating completion of new facilities. Replacement buildings not already wind resistant are being retrofitted to withstand high winds.

As Bay St. Louis rebuilds from Hurricane Katrina it is mitigating wind damage to new structures through the International Building Codes and wind resistant standards. All new community buildings are being constructed to a higher standard than previously and public safety buildings where personnel must remain on duty during a severe storm are being constructed to FEMA 361 Shelter standards further ensuring the building will not only withstand the assault of a major hurricane but be operational in the critical period post-disaster when search and rescue missions are essential to saving life and property. Generators have been or are being installed at these

facilities to ensure power is not lost and emergency water and sanitary facilities are being constructed.

Bay St. Louis participates in Emergency Operations with the Hancock County Emergency Management Agency. The County Operations Center was destroyed by Katrina and the agency has moved north of Interstate 10 where it intends to remain. All public and essential service buildings in Bay St. Louis are still at risk from a direct strike from a tornado; however, there is nothing to indicate that those buildings are more vulnerable than any other building in the city. With the unpredictable nature of tornados and the possibility of tornado damage it is essential to have designated areas that are safer than other areas in all public and essential service buildings.

Potential Losses. It is difficult to determine losses from tornado events. Variables to determining potential losses include the strength of the tornado, the location of the tornado in the community and the number of tornados. Two F2 Tornados struck Bay St. Louis in the past and each storm caused approximately \$250,000 in damage. Based upon an annual 20% probability that a tornado will touch down in Bay St. Louis in any given year, and based upon an average damage estimate of \$250,000, an annualized estimate of potential damage to Bay St. Louis from a tornado occurrence may be \$50,000 each year ($\$250,000/.20$).

Land Use Trends in Hazard Area. Bay St. Louis is still recovering from the ravages of Hurricane Katrina and 2009 Census Estimates place the population slightly over the pre-Katrina and pre-annexation level. It is expected that the City will continue to grow and rebuild. Bay St. Louis has recently had its Zoning Map and development ordinances revised, taking into account the damages sustained in Katrina. New DFIRMS extend Velocity Zones further inland requiring construction of stronger structures. Enforcement of these standards will result in more tornado resistant as well as hurricane resistant buildings.

Estimated Losses for Critical Facilities and Infrastructure. Using HAZUS MH State Planners determined that Hancock County where Bay St. Louis is located has a Medium Low Tornado Vulnerability

4.4 Capacity Assessment

Bay St. Louis participates in the National Flood Insurance Program and is a Repetitive Loss Community. It is in compliance with the minimum requirements of the National Flood Insurance Program. The City continues to review and incorporate mitigation plan requirements with other city programs and regulations. Many of the City regulation and programs were designed to protect health, safety and welfare of City residents and visitors and relate to preventing damage from many different types of hazards that may affect the City. A summary of those programs follows:

Bay St. Louis' Regulatory Capabilities

Zoning Regulations

The Building Official of the City of Bay St. Louis administers the City's Zoning Ordinance. The ordinance protects the health, safety, and welfare of residents by reinforcing the City's floodplain management ordinance. Among the protective measures of the ordinance:

- The City's floodplain ordinance is included within the City's Zoning Ordinance – Section 611 – Use Requirements for a Floodplain District, F-1.
- The Residential Beach Boulevard District – Section 614 – allows single family dwellings, accessory structures, gardens, playgrounds, parks, and public buildings including libraries, churches, public and private schools.
- The Open Beach District is designated on the official zoning map. This area includes VE Zones. Section 615 indicates that no structures, except for those defined within the County and City adopted Sand Beach Master Plan, be allowed within these districts.
- Special Provisions of the Zoning Ordinance in Article VIII requires that all lots facing on South or North Beach Boulevard located in Residential Districts have a lot area of at least 15,000 square feet and setback distance of at least 50 feet.

Subdivision Regulations

Bay St. Louis has adopted, administers and enforces subdivision regulations on lands within the City. Any lot which is subdivided is subject to the regulations, except for agricultural lands that do not require dedication of infrastructure to the City.

Land owners are requested to meet with City staff prior to the development of a subdivision to discuss the conceptual layout. The City requires a site plan review of the subdivision to determine if the plan meets city standards for the design of the subdivisions and for construction of infrastructure. Safety concerns are foremost in the requirements of Bay St. Louis subdivision regulations. The following language is included to address natural hazards and flooding:

Section 401.1(I) The Planning Commission shall not approve streets which will be subject to inundation or flooding. All streets must be located at elevations which will make them flood free in order that the portions of the subdivision will not be isolated by floods. Where flood conditions exist, the Planning Commission shall require profiles and elevations of streets in order to determine the advisability of permitting the proposed subdivision activity. Drainage will be adequate to handle the Standard 10-year rainfall with runoff factors approved by the planning Commission.

Section 401.3 (B) Flooding. Each lot in a subdivision shall contain a building site completely free from the danger of flooding. Where platted lots and lands of the

subdivision are subject to inundation, the limits of such areas subject to inundation shall be clearly indicated on the preliminary plan and final plat.

Section 401.5 (F) Where a subdivision is traversed by a water course, drainage way, channel or stream, there shall be provided a storm water easement for drainage of not less than fifteen (15) feet in width, conforming substantially with alignment of such water course, drainage way, channel or stream. Storm water easements for drainage may be of greater width as determined by the Engineer of the Planning Commission to accommodate anticipated storm flows, future construction and channel maintenance. No building, fence, poles or other obstruction shall be permitted within the drainage easement, unless specifically approved by the Planning Commission. Fences and poles may be permitted along the edge of drainage easement if such fences and poles do not obstruct the water flow of a ten (10) year flood. The Planning Commission may change the time period of flood frequency to that deemed appropriate for the particular location and subdivision.

Building Codes

The City of Bay St. Louis adopted the 2006 International Building Codes and their Appendices. More recently the City has adopted the updated 2006 International Building Codes and their Appendices. Specifically referenced were the International Building Code, the International Residential Code, the International Existing Building Code, the International Fire Code, the International Mechanical Code, the International Plumbing Code, the International Fuel Gas Code, the International Private Sewage Disposal Code, the ICC Electrical Code and the ICC Performance Based Code. These codes have provision to protect properties from damage, flooding, high winds and seismic activities.

Drainage Ordinance

Section 42-32, et seq. of the City's Municipal Code or Ordinance No. 285: An Ordinance of the City of Bay St. Louis providing that the Code of Ordinances be revised by adding Chapter 10.5 entitled "Drainage," protects public and private property from damage resulting from development that could disturb natural drainage. This ordinance requires that a permit be secured for any alteration to the flow of water in any drainage way in the City, including unintentional actions that result from construction or filling activities. The City's ordinance indicates that (natural drainage patterns should be maintained as much as possible, (2) alterations that diminish or restrict the flow of any drainage way not permitted and (all drainage alterations must be evaluated in the context of the entire drainage basin to determine the effect on future development in the area. The City's ordinance also sets forth the criteria for the determination of culverts.

Floodplain Management Ordinance

The City of Bay St. Louis adopted Flood Damage Prevention Ordinance, Ordinance No. 521 on August 10, 2009 and the ordinance became effective October 16, 2009. Ordinance 521 replaces and updates Ordinance No. 400 that was in effect when the 2005 LHMP was updated. The reasons for updating the ordinance was (1) publication of the new 2009 DFIRM by FEMA and (2) annexation of a large area flood prone area north and west of the City in 2006 and (3) extensive redevelopment necessary post Hurricane Katrina.

The intent of the new ordinance is to regulate development in flood hazard areas of the City of Bay St. Louis. The ordinance sets forth actions to reduce flood hazards by requiring the following actions in flood Hazard Areas in Article 5. Provisions for Flood Hazard Reductions, A General Standard. Following are provisions required within all Special Flood Hazard Areas of Bay St. Louis:

- 1) New construction and substantial improvements shall be anchored to prevent flotation, collapse and lateral movement of the structure;
- 2) Manufactured homes shall be anchored to prevent flotation, collapse and lateral movement. Methods of anchoring may include but are not limited to, use of over the top or frame ties to ground anchors. This standard shall be in addition to and consistent with applicable state requirements for resisting wind forces.
- 3) New construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage.
- 4) New construction or substantial improvements shall be constructed by methods and practices that minimize flood damage.
- 5) Electrical, heating, ventilation, plumbing, air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding, such facilities shall be located at or above Base Flood Elevations.
- 6) New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.
- 7) Any alteration, repair or improvements to a building that is or is not in compliance with the provisions of the ordinance shall be undertaken only if said non-conformity is not furthered, extended or replaced.
- 8) All new construction and substantial improvements shall have the lowest floor at least one foot above the centerline of the designated street, unless topography of the property does not allow for strict adherence as determined by the Floodplain Administrator.

Stream Dumping Ordinance

The Stream Dumping Ordinance declares it illegal to place dirt, rubbish, or waste within streams, channels, ditches, swales or receiving basins, or in areas where the actions of sun, wind and rain

may contribute to the moving of the water into waterways within the City. The penalty includes a fine and the cost of abatement of the alternation of the drainage way.

Storm Water Ordinance

In 2004, Bay St. Louis adopted two ordinances designed to control stormwater. These ordinances include: No. 441 - An Ordinance Regulating and controlling Erosion and Sediment on Development Sites within the City of Bay St. Louis Mississippi, and Ordinance No. 442 - An ordinance Regulating Stormwater Runoff from Development Sites Within the City of Bay St. Louis, Mississippi.

Ordinance No. 441: An Ordinance Regulating and Controlling Erosion and Sediment Control, addresses erosion and sediment leaving a construction site since erosion and sediment can reduce water quality and require the need for repair and dredging of drainage conveyances and ditches. The ordinance requires the landowner proposing land disturbance activity meet the intent of the ordinance. Land owners proposing the development of a single family home or multi-family complex of less than three units must submit a permit application; landowners proposing the development of commercial or multi-family units of commercial or multifamily complexes of four or more units on a site of less than one acre must submit a Stormwater Management Plan and a Stormwater Maintenance Agreement as part of their Site Plan Review Documentation. Commercial, industrial and multifamily units of four or more units on a site of an acre or more must submit a copy of their Stormwater Maintenance Plan to the Department of Environmental Quality under the NPDES Phase I and Phase II Programs, as well as providing a Stormwater Maintenance Agreement. Exceptions to the erosion and sediment control law include existing nursery, forestry, logging or agricultural operations that are conducted in the City as the permitted main or accessory use of the land. To date only one parcel qualifies for this exception.

Ordinance 441 requires the adoption of best management practices as defined within the book **Planning and Design Manual for the Control of Erosion, Sediment and Stormwater** written by Mississippi Department of Environmental Quality, the Mississippi Soil and Water Conservation Commission and the USDA Soil conservation Service. Erosion and sediment control devices and best management practices must be installed before clearing of the site can begin. The ordinance requires that those devices be kept in working order during construction and requires inspections by the City to insure that the devices are working. The City can enforce the ordinance through a stop work order, fines and the restoration of lands.

No. 442: An Ordinance Regulating Stormwater Runoff from Development Sites within the City of Bay St. Louis, Mississippi was adopted by the City of Bay St. Louis in 2004. The ordinance established a set of water quality and water quality policies to regulate stormwater runoff. Through this ordinance the City seeks to protect public health, safety and welfare by the regulation of stormwater runoff discharges from land development projects and other construction activities in order to control and minimize increases in stormwater runoff rates and volumes, soil erosion, stream channel erosion and nonpoint source pollution.

Ordinance No. 442 applies to all development or redevelopment projects within the city. Landowners of all development or redevelopment projects must provide a stormwater Control Plan to the City as part of their site plan review process and prior to any disturbance on the site. Landowners of single family and multi family units under four units must submit a Stand Erosion Control Plan and Drainage a Plan on a worksheet provided by the Bay St. Louis Building Office prior to land disturbance. Landowners of projects larger than one acre must submit a copy of the Stormwater Control Plan required by the Mississippi Department of Environmental Quality through the NPDES Phase I or Phase II Permit.

Ordinance No. 442 requires all discharges from a project site up to and including the 100 year storm event must be released at rates not to exceed the pre-development peak discharge for the site. Ordinance No. 442 requires that owners of the stormwater treatments direct their engineer to certify that annual maintenance as completed for this certification must be provided to the Building Official.

Historic Preservation Ordinance

The Bay Saint Louis City Council voted on April 3, 2007 to pass a "Historic Enabling Ordinance". In December of that same year, residents of an area which was roughly that of the old Beach Boulevard Historic District that had been established in 1980, voted with the approval of 80% of the property owners of the district to establish the Beach Boulevard Historic District. Other districts are anticipated to be established in the future.

Bay St. Louis formed and appointed members to the Historic Preservation Commission which is charged with assisting property owners in developing plans for structures compatible with the unique character of the district. The commission serves as an advisory board to the City Council and the nine members review and issue comments on all building permits for construction in the district.

Other City Ordinances

Section 42-176 of the City's Municipal Code finds that it is unlawful to place waste and/or litter upon city streets, sidewalks, neutral grounds, beaches, parks, drainage pipes and/or ditches, vacant lots and any other property within the City. The ordinance assists in keeping drainage ditches and drainage pipes in the City clear of debris that might impede flow.

Section 42-101 of the City's Municipal Code provides for the preservation of trees within the City, in order to encourage the protection of existing trees and to promote the planting of new trees to preserve several valuable functions including the control of soil conservation. The City requires a permit to remove trees, and requires that before site disturbance can begin, a site plan must be provided to the City and Tree Advisor for review to ensure that the intent of the ordinance is met.

Standard Operating Procedures

The City of Bay St. Louis adopted Standard Operating Procedures (SOP) for the City Public Works Department to inspect, maintain and clean streams, ditches and drainage channels in the City of Bay St. Louis. The SOP was originally adopted in March 1995 and substantially revised and re-adopted on November 1, 1999. The SOP directs the Director of Public Works or his designee to inspect all major watercourses within the City at least once a year and if a problem is reported or a complaint is made, the SOP directs the Director of Public Works or his designee to inspect choke points along the drainage way 24 within 24 hours of a major storm.

The SOP allows the Public Works director to issue a Flood Protection Alert, thereby allowing all public works personnel to be in the field to ensure drainage facilities are functioning properly. Maintenance policies include obstruction on public property be removed by the City within two days of being reported and on state, county or private property, obstructions are reported to the property owner. If the property owner does not remove the obstruction within seven days, the City will assume responsibility for the problem, as long as maintenance easements exist for private property. The City maintains a record of their Work Request Form which is entered into the City's database. This system is utilized by the City to report for the Community Rating System and to report for the MPDES Phase II MS4 permit.

Other Mitigation Capabilities

NFIP Community Rating System

The City of Bay St. Louis participates in the NFIP Community Rating System Program and has achieved a Class 7 CRS Rating. The CRS program allows local governments to proactively address mitigation issues through the adoption of programs and regulation that ultimately will reduce the amount and types of damage within the community from flooding. The results of the proactive steps that local governments take result in lowered flood insurance rates to property owners within the local government's jurisdiction. Bay St. Louis undertakes many educational and outreach programs to alert property owners of mitigation actions and programs that they can take, and the building Office encourages property owners to purchase flood insurance.

Warning Systems and Response Systems

The City of Bay St. Louis addresses this program in detail in the City of Bay St. Louis Hazard Mitigation and Flood Protection Plan, October 2000.

Fire Department Mitigation Capabilities

The City of Bay St. Louis achieved a Class 5 Fire Insurance Rating and is so certified by the Mississippi State Rating Bureau. The City of Bay St. Louis achieved a Class 5 Fire Insurance Rating and is so certified by the Mississippi State Rating Bureau. The new fire station on Main Street adjacent to the City Hall has been completed and is now occupied. This station is

constructed in an area with low storm surge flooding probabilities. It was constructed to FEMA 361 near absolute protection standards using FEMA HMGP and HUD CDBG funds. This facility will be the first responder shelter and command center during emergencies such as hurricanes. The City has also completed construction on a new three bay fire station located on Highway 603 and it will serve the annexed area and northwestern Bay St. Louis. This new station was also constructed to mitigate flooding and wind damage.

Police and Sherriff's Department Mitigation Capabilities

Since Hurricane Katrina, the City of Bay St. Louis, the City of Waveland and the Hancock County Sheriff's Office have established centralized dispatch and communication for all city and county emergency services in Hancock County. Dispatch services are temporarily relocated with E-911 on Rocky-Hill Road in central Hancock County. The County is nearing completion a new Emergency Operations Center in the central area of the County away from the coastline. Dispatach services and E-911 will relocate to the new facility.

Mississippi Coastal Improvements Plan

The Mississippi Coastal Improvements Plan (MsCIP) comprehensive plan for coastal Mississippi consists of structural, nonstructural and environmental project elements. The project elements address:

- Hurricane and storm damage reduction
- Salt water intrusion
- Shoreline erosion
- Fish and Wildlife Preservation

The plan recommends comprehensive water resources improvements associated with hurricane and storm damage reduction, flood damage reduction, and ecosystem restoration in the three coastal counties of Mississippi. This report is in partial response to authorizing legislation contained in the Department of Defense Appropriation Act of 2006 (P.L. 109-148), dated 30 December 2005. The study authorization states, in part, the following:

“... the Secretary shall conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes at full Federal expense; Provided further, that the Secretary shall recommend a cost-effective project, but shall not perform an incremental benefit-cost analysis to identify the recommended project, and shall not make project recommendations based upon maximizing net national economic development benefits; Provided further, that interim recommendations for near term improvements shall be provided within 6 months of enactment of this act with final recommendations within 24 months of this enactment.”

Included in this plan are items that directly and indirectly mitigate coastal flooding in Bay St. Louis as shown in Figure 4.27. One of the actions called for in the MsCIP is a seawall along the shoreline of Bay St. Louis. Once built, the wall will follow the grade of Beach Boulevard and stretch 1.7 miles from U.S. Highway 90 to the south along the beach. Construction began in September of 2010, and is estimated to last 18 months. In addition, the barrier islands of Cat, Ship, Horn, and Petit Bois will be restored. As of the writing of this plan, the barrier island restoration was in a design phase and expected to be underway in 2011.

Figure 4.27. MS Coastal Improvements Plan Program Plan Elements



Requirement §201.6(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for the Bay St. Louis Hazard Local Mitigation Plan (LHMP) Update. It describes how City met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

5.1 Mitigation Strategy: Overview

The results of the planning process, the risk assessment, the goal setting, and the identification of mitigation actions led to the mitigation strategy and mitigation action plan for this LHMP update. As part of the plan update process, a comprehensive review and update of the mitigation strategy portion of the plan was conducted. Some of the initial goals and objectives from the 2005 plan were refined and reaffirmed, some goals were deleted, and others were added. The end result was a new set of goals, reorganized to reflect the completion of 2005 actions, the updated risk assessment and the new priorities of this plan update. To support the new LHMP goals, the mitigation actions from 2005 were reviewed and assessed for their value in reducing risk and vulnerability to the planning area from identified hazards and evaluated for their inclusion in this plan update (See Section 2.0 What’s New). Section 5.2 below identifies the new goals and objectives of this plan update and Section 5.4 details the new mitigation action plan.

Taking all of the above into consideration, the following umbrella mitigation strategy for this LHMP update was developed:

- **Communicate** the hazard information collected and analyzed through this planning process as well as HMPC success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- **Implement** the action plan recommendations of this plan.
- **Use** existing rules, regulations, policies, and procedures already in existence.
- **Monitor** multi-objective management opportunities so that funding opportunities may be shared and packaged and broader constituent support may be garnered.

5.1.1 Continued Compliance with NFIP

Given the flood hazard in the planning area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP) and participation in the Community Rating System. Detailed below is a description of City of Bay St. Louis' flood management program to ensure continued compliance with the NFIP.

Bay St. Louis' Flood Management Program

Bay St. Louis joined the NFIP in 1971, shortly after its inception. Since then, the City has administered floodplain management regulations that meet and exceed the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. It is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. Bay St. Louis joined the CRS in 1995 and is currently a Class 7 community, which gives a 15% premium discount to individuals in Bay St. Louis in the Special Flood Hazard Area.

The activities credited by the CRS provide direct benefits to Bay St. Louis and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;
- Reduction of human suffering; and
- Protection of the environment.

The activities that Bay St. Louis implements and receives CRS credits include:

- **Activity 310 – Elevation Certificates:** The Building Department in Bay St. Louis requires and retains Elevation Certificates for all buildings constructed in flood hazard areas of the City. Elevation Certificates are maintained in a computer format and are available upon request.
- **Activity 320 – Map Determinations:** The Building Department of Bay St. Louis retains digital copies of the DFIRM and can make parcel level information available upon request.
- **Activity 340 – Hazard Disclosure:** Bay St. Louis participates in and receives credit for this activity. Credit is provided for the local real estate agents disclosure of flood hazards to prospective buyers. Credit is also provided for state and community regulations requiring disclosure of flood hazards.
- **Activity 350 – Flood Protection Information:** Documents relating to floodplain management are available in the reference section of the Hancock County Library. Credit is also provided for floodplain information displayed on the community's website. Bay St.

Louis has flood protection information available in its building department and on its website.

- **Activity 410 – Additional Flood Data:** Credit is provided for conducting and adopting flood studies for areas not included on the flood insurance rate maps and that exceed minimum mapping standards. Credit is also provided for a cooperating technical partnership agreement with FEMA. Bay St. Louis maintains a cooperating technical partnership with FEMA.
- **Activity 420 – Open Space Preservation:** Credit is provided for preserving acreage in the Special Flood Hazard Area (SFHA) as open space. Bay st. Louis receives credit for this activity and supports the value of open space in flood mitigation.
- **Activity 430 – Higher Regulatory Standards:** Credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, foundation protection, cumulative substantial improvement, lower substantial improvement, natural and beneficial functions, other higher regulatory standards, and state mandated regulatory standards. Credit is also provided for staff education and certification as a floodplain manager. Bay St. Louis retains the services of several Certified Floodplain Managers in its Building Department. All of the building inspectors are certified in their field of expertise.
- **Activity 440 – Flood Data Maintenance:** Credit is provided for maintaining and using digitized maps in the day-to-day management of the floodplain. Credit is also provided for establishing and maintaining a system of elevation reference marks and maintaining copies of all previous FIRMs and Flood Insurance Study Reports. Historically, Bay St. Louis has maintained FIRM reference marks throughout the City. All reference marks have been revised through development of the DFIRM.
- **Activity 450 – Stormwater Management:** The community enforces regulations for stormwater management, freeboard in non-SFHA zones, soil and erosion control, and water quality. Credit is also provided for stormwater management master planning. Bay St. Louis participates in this activity.
- **Section 502 – Repetitive Loss Category:** Based on the updates made to the NFIP Report of Repetitive Losses as of July 31, 2010, Bay St. Louis has 425 repetitive loss properties and is a Category B community for CRS purposes. All requirements for a Category B community have been or are being met. Credit is provided for the adoption and implementation of the Floodplain Management Plan.
- **Activity 530 – Flood Protection:** Credit is provided for buildings that have been elevated to protect them from flood damage. Bay St. Louis has required that all building substantially damaged in Katrina be elevated during repair or reconstruction.
- **Activity 540 – Drainage System Maintenance:** Credit is provided for enforcing regulations prohibiting dumping in the community’s drainage system. Bay St. Louis has a written SOP for drainage maintenance and schedules regular maintenance of all drainage ways throughout the city.
- **Activity 610 – Dam Safety:** Bay St. Louis and all CRS communities in Mississippi receive credit for the State’s Dam Safety Program.

5.2 Goals and Objectives

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals, objectives, and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative mitigation strategy as described further throughout this section.

During the initial goal-setting meeting, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to formulate planning goals and objectives and to develop the mitigation strategy for Bay St. Louis

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

HMPC members were provided with the list of goals from the 2005 plan as well as a list of other sample goals to consider. They were told that they could use, combine, or revise the statements provided or develop new ones, keeping the risk assessment in mind. Each member was given three index cards and asked to write a goal statement on each. Goal statements were collected and grouped into similar themes and displayed on the wall of the meeting room. The goal statements were then grouped into similar topics. New goals from the HMPC were discussed until the team came to consensus. Some of the statements were determined to be better suited as objectives or actual mitigation actions and were set aside for later use. Next, the HMPC developed objectives that summarized strategies to achieve each goal.

Based on the risk assessment review and goal setting process, the HMPC identified the following goals and objectives, which provide the direction for reducing future hazard-related losses within the Bay St. Louis Planning Area.

Goal 1: Protect the lives and property of the residents in Bay St. Louis from natural hazards.

Objective 1.1: Use the best approaches and technology to protect buildings including relocation, acquisition and elevation, if feasible.

Objective 1.2: Implement innovative capital programs to address infrastructure issues.

Objective 1.3: Continue to enforce existing regulatory measures that ensure that new development will not increase threats to existing properties or to new development.

Goal 2: Through education, maintain a flood and hurricane alert and aware resident population.

Objective 2.1: Establish educational libraries and programs in conjunction with partners to bring new information to the residents and businesses located in Bay St. Louis.

Objective 2.2: Provide outreach efforts on mitigation and the threat of flooding to residents and businesses located in areas that are specifically threatened by flooding.

Objective 2.3: Where possible provide model projects.

Goal 3: Increase the number of households that voluntarily adopt measures that protect their homes and property.

Objective 3.1: Provide information about existing mitigation technologies, options and programs to assist with mitigation of structures against hazards to residents and businesses in hazard areas.

Objective 3.2: Seek model projects.

Goal 4: Ensure the continuity of emergency services during storms and high water situations.

Objective 4.1: Make structural improvements to city and school district buildings to ensure the continuity of emergency services during major hazard events.

Objective 4.2: Provide for general purpose shelter within the City.

Objective 4.3: Establish emergency routes or retrofit existing roadways to insure continued use during hazardous situations.

Objective 4.4: Ensure that dispatchers are prepared for emergency situations.

Goal 5: Increase the capacity of the Public Works Department to serve the residents of the City of Bay St. Louis

Objective 5.1: Implement innovative capital programs to address infrastructure issues.

Objective 5.2: Continue existing programs to ensure existing drainage ways are unimpeded.

Objective 6.3: Improve evacuation routes.

Goal 6: Participate actively with Hancock County to provide the best possible emergency services to the residents of Bay St. Louis.

Objective 6.1: Participate in the development of the Update of the County's Hazard Mitigation Plan.

Goal 7: Develop a partnership with the Hancock County Board of Supervisors and the City of Waveland to find effective solution to flooding problems in Bay St., Louis

Objective 7.1: Participate in the County's Hazard Mitigation Plan.

Objective 7.2: Coordinate with county programs that provide additional data to the City.

Objective 7.3: Participate with county programs that provide additional data to the City.

5.3 Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified in Section 4.1 Identifying Hazards: Natural Hazards was evaluated. Only those hazards that were determined to be a priority hazard were considered further in the development of hazard-specific mitigation actions. The following were determined to be priority hazards:

- Hurricanes, Tropical Storms, and Storm Surge
- Floods
- Tornado
- Thunderstorms, high wind, and hail
- Winter Weather/ Freeze
- Coastal Erosion
- Extreme Heat
- Earthquake
- Wildfires

During the evaluation it was determined that a number of hazards would not be included in the plan. This decision was based upon the belief that they were not prevalent hazards within Bay St. Louis or the local area. Following is a brief description of those hazards and the reason for their exclusion:

- Avalanche
- Dam Failure
- Drought
- Expansive Soils
- Land Subsidence
- Landslide
- Tsunamis
- Volcano

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- Prevention
- Property protection
- Structural projects
- Natural resource protection
- Emergency services
- Public information

The HMPC was also provided with examples of potential mitigation actions for each of the above categories. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. This was followed by a brainstorming session that generated a list of preferred mitigation actions by hazard.

5.3.1 Prioritization Process

Priority Listing of Mitigation Actions

It was agreed that the following four criteria would be used to determine the priority of the action items:

- Contribution of the action to save life or property
- Availability of funding and perceived cost-effectiveness
- Available resources for implementation
- Ability of the action to address the problem

Based upon these four criteria, the mitigation actions were divided into a high priority, a moderate priority, a low priority list and a dropped or omitted priority. In addition to reviewing the actions from the 2005 plan, the committee also considered and defined several new actions.

The Bay St. Louis Hazard Mitigation Committee determined that cost benefit review of each of the mitigation actions was clearly an important criterion in the prioritization process. They discussed the contribution of the action to saving lives or property as first and foremost. If the action addresses this criterion, then the council prioritized the elements based upon cost benefit analysis. Table 5.1 indicates the action items for the 2011 Plan Update.

5.4 Mitigation Action Plan

Requirement §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

The individual worksheets for each mitigation action item identify other mitigation partners. In addition, many of the more regional actions where the county or other jurisdictions are identified as the lead, the action will provide a mitigation benefit to all participating jurisdictions. This action plan was developed to present the recommendations developed by the HMPC for how

Bay St. Louis can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Emphasis was placed on both future and existing development. The action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. Each action summary also includes a discussion of the benefit-cost review conducted to meet the regulatory requirements of the Disaster Mitigation Act. Table 5.1 identifies the mitigation actions.

The following actions have been completed or are no longer applicable in post-Katrina Bay St. Louis, as follows:

The action plan detailed below contains both new action items developed for this plan update as well as old actions that were yet to be completed from the 2005 plan. Table 5.1 indicates whether the action is new or from the 2005 plan and Section 2.0 contains the details for each 2005 mitigation action item indicating whether a given action item has been completed, omitted, or deferred.

Table 5.1. Bay St. Louis Mitigation Actions

Action Item	Priority	New Action/ 2011
New 2011 Actions		
2011-01. Apply to ISO to Further Lower CRS Rating	High	Yes
2011-02 Develop a Repetitive Loss Plan for the Annexed Area of the City	High	Yes
2011-03 Require that New Development in Annexed Area Include Neighborhood green Space for Absorption of Runoff and Wildfire Control.	High	Yes
2005 Actions		
2005-40 Establish a Program to Offer CEUs to Real Estate and Insurance Professionals on Hazard Mitigation.	High	No
2005-43 The Building Office Should Continue to offer Site Specific Information to Property Owners and Update the Data Available as it is Made Available by the Tax Assessor, FEMA and MEMA.	High	Yes (modified from 2005)
2005.46 Seek Funding to Assist Homeowners Located in Special Flood Hazard areas to Mitigate Their Homes from Flooding through Elevation and Acquisition.	High	No
2005.47 Market the Hazard Mitigation Loan Program to Home and Businesses	Low	No
2005-48 Participate in the Development of the County Hazard Mitigation Plan	High	No
2000 Actions		
2001-01 Continue to Maintain FEMA Elevation Certificates on Buildings in Bay St. Louis	High	No
2000-02 Continue to Enforce Ordinance No. 400 Requiring One Foot of Freeboard.	Omitted	No
2000-03a Continue to Enforce City Ordinance No. 285 to Protect Natural Drainage from Development.	High	No
2000-03b Continue to Enforce City Ordinance No. 285 to Include Erosion, Coastal Erosion, and Sediment Control BMPs as Required by NPDES Phase II program.	High	No
2000-04 Continue to Enforce the City's Subdivision Regulations to Require that Streets in Subdivisions are Located Above Flood Elevation to Prevent Isolation.	High	No
2000-5 Continue to Mail Out a City-Developed Brochure to Owners of Property	High	No
2000-6 Continue to Implement the City's Substantial Drainage Rule.	High	No
2000-7 Continue to Implement Drainage Standard Operating Procedure.	High	No
2000-8 Continue to Enforce the Stream Dumping Ordinance to Prohibit Depositing of Debris in the Drainage System.	High	No
2000-9 Continue to Enforce Standards for Hurricane Resistant Construction and the International Building Code.	High	No
2000-10 Post Awareness Posters in City Offices	High	No
2000-13 Continue to Enforce the City's Tree Ordinance.	High	No
2000-15 Digitize Property maps to include BFE and Flood Hazard Information	High	No
2000-16 Continue an Internet Website to Make Hazard Mitigation Information and Programs and Requirements in Bay St. Louis Available to the Public.	High	No
2000-17 Participate in Hurricane Awareness Week by Adopting a Proclamation.	High	No

Action Item	Priority	New Action/ 2011
2000-18 Participate in the Annual Mississippi Homebuilders Association Fair and Exposition, Providing Hazard Mitigation Information and Related City Programs and Regulations.	High	No
2000-20 Continue Hurricane and Storm Safety Curriculum in Bay-Waveland High School	High	No
2000-21 Implement Flood Awareness/Storm Surge Markers in Special Flood Hazard Areas.	High	No
2000-22 Partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information for All Hazards	Moderate	No
2000-23 Develop a five-Year Capital Improvement Program and Continue to Upgrade Drainage Facilities throughout the City to Protect Public and Private Properties.	High	No
2000-35 Continue to Update Floodproofing, Retrofitting, and Construction Technology Resources in the Hancock County Library-Bay St. Louis Branch and in the Building Office of the City of Bay St. Louis	High	No
2000-36 Coordinate with Adjacent Communities to Assure that Actions Taken in one Community will not Contribute to Greater Impact by Hazards in the Shared Floodplain.	High	No

New Actions for the 2011 Plan Update

1. 2011-01: Apply to Insurance Services Office (ISO) to Further Lower the NFIP Flood Insurance Rating.

Bay St. Louis is a participant in the NFIP Community Rating System and enjoys a Class 7 flood insurance rating. The City can qualify to lower its rating further by preparing an amendment to its CRS application. In conjunction with the preparation of the Update of the Hazard Mitigation Plan, the City should apply to ISO to further lower its Flood Insurance Rating.

Responsible Entities: CRS Administrator; Floodplain Insurance Administrator

Supporting Entities: MEMA Floodplain Administrator; ISO

Deadline: 2012

Hazards Addressed: Flooding

Priority: High

Issue/Background: Bay St. Louis is a NFIP Community with large areas that will flood.

Other Alternatives: None

Cost: Staff time

Funding: Local Funds

Timeframe: 2012

2. 2011-02: Develop a Repetitive Loss Plan for the Recently Annexed Area of the City.

Bay St. Louis was awarded annexation of a large area north and west of the 2005 City Limits in June 2006. Along with the annexed area, Bay St. Louis also increased its number of repetitive loss properties from 11 to 425, ranking it among the communities with the highest number of NFIP repetitive flood loss properties in Mississippi. Bay St. Louis needs to prepare a stand alone Repetitive Loss Plan so it can realistically address this problem. The plan would determine how many of the properties were left vacant after Hurricane Katrina, the condition of each property, and make recommendations concerning manageable project areas to be addressed with HMGP, FMA and SRL grant funds in the future.

Responsible Entities:

- City of Bay St. Louis Flood Insurance Administrator
- City Council, CRS Coordinator

Supporting Entities: MEMA, FEMA

Hazards Addressed: Flooding

Priority: High

Issue Background: Bay St. Louis' Repetitive Loss Properties increased from 11 to 425 in past five years.

Other Alternative: None

Cost: \$10,000

Funding: MEMA Planning funds, Local Funds

Timeframe: 2016

3. 2011-03: As Development Occurs in the Annexed Area, Require that Green Space be Set Aside for Absorption of Runoff and Wildfire Control .

Responsible Entities: City Council

Supporting Entities: Bay St. Louis Planning Commission

Hazards Addressed: Flooding, Wildfire

Priority: High

Issue Background: Much of the annexed area was subdivided into small lots which may not be considered standard by Bay St. Louis Zoning regulations. As redevelopment occurs in areas where structures were demolished, the city should require that green, open space be set aside for community usage. Green space serves as absorption area for rainwater absorption and runoff. Additionally, CRS Credit can be received for green space preservation.

Responsible Entities: City Council

Supporting Entities: Planning Commission, FEMA, MEMA

Hazards Addressed: Flooding

Priority: High

Alternative: None

Cost: Unknown

Funding: FEMA, Local funds

Timeframe: 2012

Ongoing Actions from 2005 Plan Update

1. 2005-40: Establish a Program to Offer CEUs to Real Estate and Insurance Professionals on Hazard Mitigation.

The City of Bay St. Louis will provide an educational program for Real Estate and Insurance Professionals that provide services within Bay St. Louis. The intent of the educational program is to alert these professionals of the types of hazards that are likely to impact the community, laws the city enforces to mitigate damages and options that are available for property owners who choose to live in hazard prone areas.

Responsible Entities: Building Official

Supporting Entities: MEMA, FEMA, City Council

Hazards Addressed: Flooding, Wind Damage, Coastal Flooding

Priority: High

Alternative: Possibly an activity that could be undertaken by MEMA and or FEMA

Cost: Unknown

Funding: MEMA, Local Funds

Timeframe: 2016

2. 2005-43: *The Building Office should continue to offer site specific information to property owners and update the data available as it is made available by the Tax Assessor, FEMA and MEMA.*

The Building Official and the Building Permit Office is the first office a property owner visits within the City prior to development or redevelopment of property. Oftentimes, people visit the Building Office prior to purchasing of property to determine the land use and constraints on the property. It is important for the Building Official to be able to access site specific information and provide this information to the property owner in order for the owner to make smart decisions about the locations of buildings on the site.

Bay St. Louis has purchased equipment and a printer to provide this information to customers. Information available includes data layers including elevation data, DFIRM data and other hazard indicative data. This activity was modified and renamed from the 2005 plan, where it was titled “2005-43: Equip the Building Office with Software and Printer to Allow the Building Official to Print Hazard Threat Maps for Customers”

Responsible Entities: Building Official

Supporting Entities: Hancock County Tax Assessor, City Council MEMA, FEMA

Hazards Addressed: Flooding, Hurricanes

Priority: High

Alternative: None

Cost: Staff Time; cost of occasionally upgrading equipment

Funding: Local Funds

Timeframe: Ongoing

3. 2005-46: *Seek funding to assist homeowners located in the Special Flood Hazard Areas to mitigate their homes from flooding through elevation and acquisition.*

Prior to annexation, Bay St. Louis had only 12 appearing on the NFIP Repetitive Loss List. With the DFIRM and the annexation, the City finds itself with 425 Repetitive Loss Properties. Grant funding through FEMA programs should be sought to offer assistance to residents to mitigate their properties from flooding or at their request to acquire those properties. Due to the

magnitude of the problem brought about by Hurricane Katrina and the annexation, this activity is being moved from low to high priority.

Responsible Entity: City Council

Supporting Entity: Floodplain Administrator and CRS Coordinator, FEMA, MEMA

Hazards Addressed: Flooding

Priority: High

Alternative: None

Cost: Staff Time, application preparation fees, project management fees

Funding: FEMA HMGP, FMA, SRL funding, CDBG and other programs as available.

Timeframe: 2012

4. 2005-47: Market the Hazard Mitigation Loan Program to home and business owners.

The Hancock County Board of Supervisors, in conjunction with the Cities of Bay St. Louis and Waveland, established a Mitigation Loan Program for property owners within Hancock County. The loan program offers a 10% rebate to the property owner when the loan is paid in full. The 10% loan rebate is an estimation of the cost of interest and closing costs for the initiation of a loan for mitigation improvements to property. The program is initiated by a new loan, and is subject to the bank's credit limitations.

Responsible Entity: Hancock County Board of Supervisors

Supporting Entities: Hancock County Banks, Building Officials

Alternative: None

Priority: Low

Cost: Staff Time

Funding: FEMA Disaster Resistant Community Funds

Timeframe: Ongoing

5. 2005-48: Participate in the Development of the County Hazard Mitigation Plan

The City of Bay St. Louis will participate in the development of the Hancock County Multi Hazard Mitigation Plan Update and Repetitive Loss Plan. The city initiated actions to annex lands in Hancock County identified as the Shoreline Park Community

Bay St. Louis participated in development of the 2005 update of the Hancock County Plan. It is now time for Hancock County to undertake another update of its plan. Bay St. Louis should also participate in that plan update and any future updates of the Hancock County Hazard Mitigation Plan. This item should be changed to an ongoing action.

Responsible Entities: Bay St. Louis Building Department, Public Safety Departments

Supporting Entities: City Council, MEMA, FEMA

Hazards Addressed: Hurricanes, Flooding, Wind

Priority: High

Alternative: None

Cost: Staff Time

Funding: Local funds

Timeframe: Ongoing

Ongoing Actions from Original 2000 Plan

1. 2000.01: Continue to Maintain FEMA Elevation Certificates on Each Building in Bay St. Louis

Bay St. Louis will continue to maintain elevation certificates for all post-FIRM structures built within the City. The elevation certificates are maintained in digital format in the Building Office and are accessible upon request for review by insurance agents and other interested parties. This activity is required by the City's participation in the CRS Program and is ongoing.

Responsible Entity: Build Official; CRS Coordinator

Supporting Entities: City Council

Hazards Addressed: Flooding

Priority: High

Alternative: None

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

2. 2000-03a. Continue to Enforce City Ordinance No. 285 to Protect Natural Drainage from Development.

The Building Official will continue to enforce the City's storm water ordinance. The ordinance requires that the volume or rate of post development runoff not exceed the pre development runoff for developments consisting of five acres or more. Additionally, the City adopted a new ordinance which now requires that the volume or rate of runoff for developments less than five acres which equates to all lots in the City, including single family home sites.

Responsible Entities: Building Official

Supporting Entities: Public Works Department

Hazard Addressed: Flooding

Priority: High

Alternative: None

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

3. 2000-03b. Continue to Enforce City Ordinance No. 285 to Include Erosion, Coastal Erosion, and Sediment Control Best Management Practices (BMP's) as Required by NPDES Phase II Program.

Bay St. Louis adopted Ordinance 441 that calls for the control of erosion and sediment associated with construction site activities. The ordinance requires that sediment cannot leave the construction site, or fill natural drainage ways. The City requires contractors to provide an erosion and sediment control plan utilizing BMP's recommended in **Planning and Design Manual for the Control of Erosion, Sediment Stormwater** developed by the Mississippi Department of Environmental Quality, Mississippi Soil and Water Conservation Service and USDA Soil Conservation Service.

Responsible Entities: Building Official

Supporting Entities: Hancock County Storm Water Task Force, City Council

Hazard Addressed: Flooding, coastal erosion

Priority: High

Alternative: None

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

4. 2000-04: Continue to enforce the City's Subdivision Regulations to require that streets in subdivisions are located above flood elevation to prevent isolation.

Bay St. Louis restricts permitting of subdivisions that have streets located below the flood elevation in flood hazard areas. The City enforces this ordinance in order to prevent isolation during flooding occurrences.

Responsible Entities: Building Official

Supporting Entities: Site Plan review Committee and Planning Commission

Hazard Addressed: Flooding

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local funds

Timeframe: Ongoing

5. 2000-05: Continue to mail out a brochure to owners of property located in Special Flood Hazard Areas which suggests methods for flood proofing properties.

The Building Official will mail a brochure detailing steps that can be taken to protect property located in SFHA's of the City annually. The brochure will be updated each year. The brochure advised owners that additional materials are available at the Hancock County Library and the City's Building Department.

Responsible Entities: Building Official, CRS Coordinator

Supporting Entities: City Council

Hazard Addressed: Flooding, Hurricanes and Tropical Storm, Tornados, Thunderstorms/High Wind.

Alternative: None

Priority: High – CRS Requirement

Cost: Staff Time, Printing

Funding: Local Funds

Timeframe: Ongoing

6. 2000-06: Continue to implement the City's Substantial Damage Rule

Ordinance No. 400 empowers the City to require compliance with current building codes and the floodplain management ordinance if a building located in a SFHA sustains cumulative damage equaling 50% of the value of the building over a ten year period. Continued enforcement will bring many existing structures into compliance with existing building codes and ordinances.

Responsible Entities: Building Official

Supporting Entities: City Council

Hazard Addressed: Flooding, Hurricanes and tropical storms

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

7. 2000-07: Continue to Implement Drainage Standard Operating Procedure, (SOP)

Bay St. Louis adopted and enforces SOP for the maintenance of drainage ways within the City and has implemented drainage SOP since 1986. The SOP was revised in 1997 and requires the Public Works Director to visually inspect all drainage ways in the City at least once each year and schedule regular maintenance of all drainage ways. Additionally, the SOP requires inspection of all drainage ways within 24 hours prior to predicted storm events to ensure that no

potential blockages exist. Additionally, workers check known choke points in the system during and immediately after a storm to insure water is not blocked by collection of debris.

Responsible Entities: Public Works Director

Supporting Entities: City Council

Hazards Addressed: Flooding

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

8. 2000-08: Continue to Enforce the Stream Dumping Ordinance to Prohibit Depositing of Debris in the Drainage System.

Bay St. Louis has an effective stream dumping ordinance that does not allow depositing of debris in or adjacent to any stream or drainage way in the City, including roadside ditches. This ordinance is a regulatory tool to ensure that drainageways work efficiently. This ordinance should continue to be enforced.

Responsible Entity: Public Works Director

Supporting Entity: City Council

Hazards Addressed: Flooding

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

9. 2000-09: Continue to Enforce Standards for Hurricane Resistant Construction and International Building Codes.

The International Code Council developed codes establishing minimum acceptable construction methods for high wind areas, including coastal areas that are subject to hurricane force winds. Bay St. Louis has adopted the codes and updates and presently enforces the IBC 2006 version which is the latest version of the code.

The IBC exceeds FEMA Hurricane Resistant Construction recommendations. The City should continue to enforce the IBC and adopt newer versions as soon as they are published and are available.

Responsible Entity: Building Official

Supporting Entity: City Council

Hazard Addressed: Hurricanes, tornados, high wind, earthquake, wildfire, winter storms, extreme heat

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

10. 2000-10: Post Awareness Posters in City Offices.

FEMA offers free posters concerning hazard awareness. Bay St. Louis will post Hazard Awareness Posters in their offices and public areas to educate residents and property owners of the types of hazards that affect Bay St. Louis and mitigation actions that can be taken to avoid damage.

Responsible Entity: Building Official

Supporting Entity: City Council, FEMA, MEMA

Hazards Addressed: Hurricanes, Flooding, Tornados, High Wind, Thunderstorms, Lightening, Heat.

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

11. 2000-13: Continue to Enforce the City's Tree Ordinance

Live Oak and Magnolia trees are protected by ordinance and required to be replaced when lost to development. These and other trees can mitigate erosion along stream banks and bluffs. While trees occasionally contribute to damage to buildings and utilities, a healthy tree canopy contributes to air quality and serves as a refuge for wildlife. Tree canopies capture rainwater, allowing for slower absorption of rainfall. In storm surge situations tree canopies also mitigate wave action and block and slow high wind.

Much of the urban canopy was damaged or destroyed by Hurricane Katrina. Property owners should be urged to replace destroyed trees on their properties and planting new trees where possible.

Responsible Entity: City Tree Officer

Supporting Entity: City Council

Hazards Addressed: Flooding, Storm Surge, Hurricanes

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

12. 2000-15: Digitize Property Maps to Include Base Flood Elevations and Flood Hazard Information.

The City of Bay St. Louis partnered with the Hancock County Tax Assessors Office to complete digitization of county property maps and to establish additional data layers. Existing data layers include building footprints. The City and County are working cooperatively to overlay flood zones, contours and elevations. This will allow buildings, zoning and city and county officials to make better development decisions based upon accurate, available and visual data.

As of 2010, Bay St. Louis digital capabilities have been significantly improved. This is however, an ongoing process and should be continued as new data becomes available. Additionally, the DFIRM is fully digitized.

Responsible Entity: Hancock County Tax Assessor

Supporting Entity: Bay St. Louis Building Department

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

13. 2000-16: Continue an Internet Website to make Hazard Mitigation Information and Programs and Requirements in Bay St. Louis available to the public.

Bay St. Louis established a Internet web site to make the following information available to the public: Hazard and flood zone information, Building permit information, Building Code Information and a listing of where additional information concerning hazards can be obtained.

Responsible Entity: Building Official

Supporting Entity: City Council, FEMA, MEMA

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local funds

Timeframe: Ongoing

14. 2000-17: Participate in Hurricane Awareness Week by Adopting a Proclamation.

The Mayor and City Council will continue to participate in Hurricane Awareness Week by adopting a proclamation annually to support awareness. The intent of this activity is to increase awareness and alert the community to the potential damage caused by hurricanes and stresses

personal, family and business planning for hurricanes, including development of preparedness and evaluation plans.

Responsible Entity: Community Development Director

Supporting Entity: City Council

Alternative: None

Priority: Moderate

Cost: Staff Time

Funding: Local Funds

Timeframe: Annually

15. 2000-18: Participate in the Annual Mississippi Homebuilders Association Fair and Exposition, Providing Hazard Mitigation Information and Related City Programs and Regulations.

Each year in April the Mississippi Homebuilders Association hosts a Fair and Expo at the Coast Coliseum and Convention Center in Biloxi. The event showcases all areas of home construction, including installation of tie downs and wind retrofitting. Bay St. Louis Building Official and CRS Coordinator participate in this activity.

Responsible Entity: Building Official, CRS Coordinator, Fire Department

Supporting Entity: City Council

Alternative: None

Priority: Moderate

Cost: Staff Time

Funding: Local funds

Timeframe: Ongoing

16. 2000.20: Continue Hurricane and Storm Safety Curriculum in the Bay St. Louis High School.

Bay St. Louis Fire and Police Departments have introduced a Community Emergency Response Training (CERT) in the Bay St. Louis High School. The goal of this activity is to allow youth to discover new careers, while training them to assist with response within the community.

Responsible Entity: Bay St. Louis Fire and Police Departments

Supporting Entity: Bay Waveland School System

Alternative: None

Priority: Moderate

Cost: Staff Time

Funding: Local funds

Timeframe: Ongoing

17. 2000-21: Implement Flood Awareness/ Storm Surge Markers in Special Flood Hazard Areas.

The City will inventory FIRM elevation reference markers annually and replace any that are removed, destroyed or lost in order to have elevation markers clearly visible throughout the City and assist surveyors to determine elevations of property and structures.

With the post Katrina DFIRM, all reference marks have changed since the plan was updated in 2005.

Responsible Entity: Building Official

Supporting Entity: City Engineer, City Council, Public Works

Alternative: None

Priority: Moderate

Funding: Staff Time

Timeframe: Ongoing

18. 2000-22: Partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information for Additional Map Based Information for All Hazards.

The City will continue to partner with NASA's Commercial Remote Sensing Department for Additional Map Based Information.

Responsible Entity: Planning Department

Supporting Entity: City Council, Hancock County GIS Department

Hazards Addressed: Hurricanes, and other severe weather, flooding, earthquakes, wildfire, climate change including heat and winter weather, coastal erosion

Alternative: None

Priority: Moderate

Cost: Staff Time

Funding: Local Funds

Timeframe: Ongoing

19. 2000-23. Develop a Five Year Capital Improvement Program and Continue to Upgrade Drainage Facilities Throughout the City to Protect Private and Public Property.

A Capital Improvement Program is a guide for major capital improvements and investment within the City with public funds over a prescribed period of time. Hurricane Katrina destroyed or damaged many of the drainage structures in Bay St. Louis, fortunately, federal disaster funding helped the City to replace and upgrade much of its system as it rebuilt the pre-annexation areas of the City.

The City should continue to revisit its Capital Improvement Program on a regular basis and include long range plans to upgrade and mitigate drainage and flooding problems in the annexed area and throughout the entire City. This item is being revised to ongoing.

Responsible Entity: City Council

Supporting Entity: Public Works Director, Floodplain Manager

Alternative: None

Priority: High

Cost: Staff Time

Funding: Local Funds, grant funds for implementation

Timeframe: Ongoing

20. 2000-35: Continue to Update Floodproofing, Retrofitting, and Construction Technology Resources in the Hancock County Library located in Bay St. Louis

Since entering the CRS Program in 1996, Bay St. Louis has furnished materials concerning floodproofing, retrofitting and construction technology resources in the public library located in Bay St. Louis. The City should continue to update this collection with new materials as they are made available from various sources including FEMA, MEMA, NFIP and others.

Responsible Entity: CRS Coordinator

Supporting Entity: Library System, FEMA/MEMA

Alternative: None

Priority: High

Cost: Staff Time

Funding: FEMA, Staff Time

Timeframe: Ongoing

21. 2000-36: Coordinate with Adjacent Communities to Assure that Actions Taken within one Community will not Contribute to a Greater Impact by Hazards within the Floodplain and Neighboring Communities.

Portions of the Cities of Bay St. Louis and Waveland and unincorporated Hancock County lie within the same watershed and in some cases share the same floodplain. Development actions within one of the jurisdictions or regulatory actions taken by one of the three governments could have a less than positive impact on properties within the adjoining jurisdiction.

Responsible Entity: City Council

Supporting Entity: Site Review Committee, Planning Commission

Alternative: None

Priority: High

Funding: Staff Time

Timeframe: Ongoing

6 PLAN ADOPTION

Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

The purpose of formally adopting this plan is to secure buy-in from the City of Bay St. Louis, raise awareness of the plan, and formalize the plan's implementation. The adoption of this plan completes Planning Step 9 of the 10-step planning process: Adopt the Plan, in accordance with the requirements of DMA 2000. The Bay St. Louis City Council has adopted this Local Hazard Mitigation Plan by passing a resolution. A copy of the generic resolution and the executed copies are included in Appendix B: Adoption Resolution.

7 PLAN IMPLEMENTATION AND MAINTENANCE

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of the plan is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

Section 3.0 Planning Process includes information on the implementation and maintenance process since the 2005 plan was adopted. This section includes information on the implementation and maintenance process for this plan update.

7.1 Implementation

Once adopted, the plan faces the truest test of its worth: implementation. While this plan contains many worthwhile actions, the City of Bay St. Louis will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful plan implementation.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other plans and mechanisms, such as the City's Comprehensive Plan. Bay St. Louis already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government. Implementation will be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits to each program and the Bay St. Louis community. This effort is achieved through the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities. Simultaneous to these efforts, it is important to

maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions.

This will include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the City will be in a position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal earmarked funds, benefit assessments, and other grant programs, including those that can serve or support multi-objective applications.

7.1.1 Role of Hazard Mitigation Planning Committee in Implementation and Maintenance

With adoption of this plan, Bay St. Louis will be responsible for the plan implementation and maintenance. Bay St. Louis agrees to continue its relationship with the HMPC and:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the various governing boards or councils of all participating jurisdictions; and
- Inform and solicit input from the public.

The primary duty is to see the plan successfully carried out and report to the City Council, MEMA, FEMA, and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the City's website (and others as appropriate).

7.2 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate plan implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized.

7.2.1 Maintenance Schedule

The City of Bay St. Louis' CRS Coordinator is responsible for initiating plan reviews. In order to monitor progress and update the mitigation strategies identified in the action plan, Bay St. Louis will revisit this plan annually and following a hazard event. The City will submit a five-year written update to the State and FEMA Region IV, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

7.2.2 Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or further annexation).

Updates to this plan will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the City will adhere to the following process:

- A representative from the responsible office identified in each mitigation measure will be responsible for tracking and reporting on an annual basis to the City lead on action status and provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities.
- If the action does not meet identified objectives, the jurisdictional lead will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.

Changes will be made to the plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as is appropriate and necessary, and as approved by the City Council. In keeping with the five-year update process, the HMPC will convene public meetings to solicit public input on the plan and its routine maintenance and the final product will be adopted by the City Council.

7.2.3 Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other City plans and mechanisms. Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. As previously stated in Section 7.1 of this plan, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. The point is re-emphasized here. As described in this plan's capability assessment, the City of Bay St. Louis already implements policies and programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include:

- City Comprehensive Plan
- City Emergency Operations Plans
- City ordinances
- Flood/stormwater management/master plans
- Capital improvement plans and budgets
- Other plans and policies outlined in the capability assessments in the jurisdictional annexes
- Other plans, regulations, and practices with a mitigation focus

Those involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this plan with these other plans, programs, etc, as appropriate. As described in Section 7.1 Implementation, incorporation into existing planning mechanisms will be done through the routine actions of:

- monitoring other planning/program agendas;
- attending other planning/program meetings;
- participating in other planning processes; and
- monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

7.2.4 Continued Public Involvement

Continued public involvement is imperative to the overall success of the plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stories from the plan implementation and seek additional

public comment. The plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the plan. In reconvening, the HMPC plans to identify a public outreach subcommittee, which will be responsible for coordinating the activities necessary to involve the greater public. The subcommittee will develop a plan for public involvement and will be responsible for disseminating information through a variety of media channels detailing the plan update process. As part of this effort, public hearings will be held and public comments will be solicited on the plan update draft.



APPENDIX A: PLANNING PROCESS

Memo

To Ronald Jones

File no:

From Eddie M. Bigelow

Tel 228-363-0443

Fax 228-831-2572

Date March 17, 2010

Subject Local Hazard Mitigation Plan (LHMP): Hazard Mitigation Planning Committee

Ron:

As discussed, I am providing you with recommendations for the makeup of the Hazard Mitigation Planning Committee (referred to as the HMPC). We recommend being inclusive rather than exclusive for a couple of reasons. First, a larger, diverse group of people generally results in more comprehensive information for the plan development process. Second, the FEMA planning process requires coordination and incorporation of information from a wide-range of stakeholders.

The Disaster Mitigation Act of 2000 (DMA 2000) places a great emphasis on the planning process in the development of the LHMP. The regulations require establishing a planning committee as well as coordinating with other departments and agencies. To best meet the DMA requirements and to facilitate plan development, we suggest the following people be invited to be part of the HMPC and/or attend the meetings as an interested party.

HMPC

- City of Bay St. Louis
 - Administrative Services
 - Community Development
 - Emergency Services
 - Engineering
 - Health Care Facilities
 - Fire
 - Floodplain Manager
 - GIS
 - Senior Services
 - OES
 - Parks and Recreation

-
- Police
 - Public Works
 - Redevelopment/Economic Development
 - Planning

 - Hancock County
 - Member of Board of Supervisors
 - Assessor
 - Public Safety, Fire
 - Floodplain Manager
 - Housing and Redevelopment
 - Historic Preservation
 - Information Services: GIS
 - OES
 - Parks, Recreation, and Community Services
 - Planning & Development
 - Police Department

 - Other
 - County Watershed and Coastal Resources
 - Fire/Police – neighboring jurisdictions
 - Community-based residential facilities
 - Child-care facilities
 - Salvation Army
 - SMPDD
 - GRPC
 - Public at Large

It is important to invite everyone to the initial meeting. This will allow us and them to determine their level of interest and possible assistance with the plan development process. Please expand this list to include others that might be interested and/or helpful. Keep in mind that we will want to document this list of initial invites to include in the planning process section of the LHMP.

Coordination with other Departments/Agencies

It is also recommended that the following agencies be invited to participate in the HMPC meetings and to be part of the LHMP development process.

- FEMA Region IV – Hazard Mitigation
- MEMA – Hazard Mitigation/Planning
- MS Floodplain Management Program
- Cal Fire– Wildfire Program

-
- National Weather Service
 - Red Cross/ Salvation Army
 - U.S. Army Corps of Engineers
 - U.S. Bureau of Reclamation
 - U.S. Forest Service
 - Department of Marine Resources
 - Mississippi Development Authority
 - Historic Preservation
 - Soil and Water Conservation District

Please call if you would like to discuss this further. I am looking forward getting this project kicked-off.

Thanks and talk to you soon.

Eddie Bigelow

AMEC Earth & Environmental

(228) 464-0443

Table 1 Hazard Mitigation Planning Committee

Position	Name	Phone Number	Email/Mailing Address
City of Bay St. Louis			
Admin. Services	David Kolf	228-466-5450	dkolf@earthlink.net
Comm. Development	Buz Olsen	228-466-9000	stofbaystlouis@bellsouth.net
Emergency Services	Brian Adams	228-466-8320	6069 Cuevas Town Road Kiln, MS 39556
Health Care	Hal Leftwich	228-467-8744	hleftwich@hancockmedical.net
Fire	Pam SanFillippo	228-467-4736	pam4@yahoo.com
Flood Plain Manager	Josh Hayes	228-469-0531	jhayesbsl@yahoo.com
Senior Services	Arlene Johnson	228-467-9292	601 Bookter Street Bay St. Louis, MS 39520
Parks & Recreation	Jimmy Loiacano	228-463-7120	1928 Depot Way, Bay St.
Police	Tom Burleson	228-467-9222	thomasburleson61@yahoo.com
Public Works	Candee Breaux	228-467-5505	candeebbsl@yahoo.com
Hancock County			
Member of Supervisors	Board of Super.	228-467-0172	3068 Longfellow Dr., Unit 3 Bay St. Louis, MS 39520
Assessor	Jimmy Ladner	228-466-2670	taxjladner@co.hancock.ms.us
Floodplain Manager	Kevin Ladner	228-467-4157	kevinladner@co.hancock.ms.us
County Engineering			3068 Longfellow Dr., Unit 4 St. Louis, MS 39520
Planning & Develop.			3068 Longfellow Dr., Unit 27 Bay St. Louis, MS 39520
Sherriff's Office		228-467-4718	3068 Longfellow Dr., Unit 13 Bay St. Louis, MS 39520
Other			
Fire/Police	David Garcia	228-467-6154	wavelandchief@bellsouth.net
Neighboring Comm.			355 Coleman Ave., Bldg #1 Waveland, MS 39576
County Watershed	Tyree Harrington	228-831-0881	12238 Ashley Drive
Coastal Resources	District Conserv		Gulfport, MS 39505
Community Based Residential Facilities	Chris Cheek		725 Dunbar Ave. Bay St. Louis, MS 39520
Child Care Facilities	Laura Maderus	228-467-8050	
Salvation Army		228-868-1188	2019 22nd Street Gulfport, MS 39501
SMPDD	Leslie Newcomb	228-868-2311	9229 Hwy. 49 Gulfport, MS 39503
GRPC	Buz Olsen	228-466-9000	stofbaystlouis@bellsouth.net
Public at Large			
FEMA Region IV-HMA	Clayton Saucier	770-220-5488	clay.saucier@dhs.gov
MEMA-HMA	Bill Brown	601-933-6362	bbrown@mema.ms.gov P.O. Box 5644 Pearl, MS 39288
MS Floodplain Management Program	Al Goodman	601-933-6362	algoodman@mema.ms.gov
National Weather Service			1325 E. West Highway Silver Spring, MD 20910

Position	Name	Phone Number	Email/Mailing Address
Red Cross		228-896-4511	2782 Fernwood Road Biloxi, MS
U.S. Bureau of Reclamation	Dan Dubraq/ Chief Public Affairs		1849 C Street NW Washington, DC 20240
U.S. Forest Service		601-965-1600	100 W. C Capitol St. Ste.1141 Jackson, MS 39269
DMR		228-374-5000	1141 Bayview Avenue Biloxi, MS 39530
MDA		228-863-6272	10430 Three Rivers Road Gulfport, MS
Historic Preservation	Chet LeBlanc		chetdbci@aol.com
MEMA	Bob Boteler Hazard Mitigation Officer	601-933-6606	bbotler@mema.ms.gov
MEMA Local Coordinator	BJ Wakefield	225-614-0279	jwakefield@meme.ms.gov

**Building Department
688 Hwy 90
Bay St. Louis, MS 39520
228-469-0531**

March 31, 2010

RE: City of Bay St. Louis – Update of Local Hazard Mitigation Plan

To: All Interested Parties, Agencies and Persons

The City of Bay St. Louis has received FEMA Hazard Mitigation Grant funding to develop an update of its Local Hazard Mitigation Plan (LHMP). The purpose of this plan is to reduce or eliminate long-term risk to the people and property of the City of Bay St. Louis from the effects of natural hazard events. The Disaster Mitigation Act of 2000 requires all local governments to assess their risks to natural hazards and identify actions that can be taken in advance to reduce future losses. The law requires all local governments and districts to have an approved Local Hazard Mitigation Plan after November 1, 2004 and update those plans every five (5) years to be eligible for certain federal disaster assistance and hazard mitigation funding programs. Bay St. Louis' Hazard Mitigation Plan was prepared and adopted in 2005 prior to Hurricane Katrina and the Annexation.

The City of Bay St. Louis' Flood Plain Manager and Building Official have taken the lead in developing this plan and the City has hired a consultant, AMEC Earth and Environmental, Inc. to manage and facilitate the planning process, collect the necessary data, and perform other technical services, including preparing the risk assessment and plan document. However, the City and AMEC will need your help to successfully complete this project.

The hazard mitigation planning process is heavily dependent on the participation of representatives from local government agencies and departments, residents and members of the public, and other stakeholder groups. A Hazard Mitigation Planning Committee is being formed to support this project and will include representatives from City, County, other Communities, special districts, and other local, state, and federal agencies in or that serve the City of Bay St. Louis. Members of the Public at Large are also cordially invited to attend, and participate in the planning process, the Kickoff Meeting and subsequent planning meetings and participate as members of the Planning Committee and Council.

Your participation on the Planning Committee and Council is requested due to your ability to contribute needed information, technical knowledge, or other valuable experience to the plan. Please designate a representative to serve on the committee and attend the kickoff meeting, which will discuss the benefits of developing a hazard mitigation plan, the project schedule, and the hazards that affect the City of Bay St. Louis, such as hurricanes and tropical storms, floods, wind storms, and more.

City of Bay St. Louis Local Hazard Mitigation Plan Kickoff Meeting
Tuesday April 13, 2010
9:30 AM to 12:00 PM
Bay St. Louis Conference Center
598 Main Street (Behind Shell Station at U.S. 90 and Main Street)
City of Bay St. Louis, MS

AGENDA

HAZARD MITIGATION PLANNING COMMITTEE MEETING (HMPC) 1

1. Introductions
2. Mitigation, Mitigation Planning, & the Disaster Mitigation Act Requirements
3. The Role of the Hazard Mitigation Planning Committee (HMPC)
4. Planning for Public Input
5. Coordinating with Other Agencies
6. Introduction to Hazard Identification
7. Data Collection Needs (Handout)
8. Questions and Answers/Adjourn

May 11, 2011

RE: City of Bay St. Louis – Update of Local Hazard Mitigation Plan

To: All Interested Parties, Agencies and Persons

The City of Bay St. Louis received a FEMA Hazard Mitigation Grant funding in 2010 to develop an update its Local Hazard Mitigation Plan (LHMP). The purpose of this plan is to reduce or eliminate long-term risk to the people and property of the City of Bay St. Louis from the effects of natural hazard events. The Disaster Mitigation Act of 2000 requires all local governments to assess their risks to natural hazards and identify actions that can be taken in advance to reduce future losses. The law requires all local governments and districts to have an approved Local Hazard Mitigation Plan after November 1, 2004 and update those plans every five (5) years to be eligible for certain federal disaster assistance and hazard mitigation funding programs. Bay St. Louis' Hazard Mitigation Plan was prepared and adopted in 2005 prior to Hurricane Katrina and the Annexation.

The City of Bay St. Louis' Flood Plain Manager and Building Official have taken the lead in developing this plan and the City hired a consultant, AMEC Earth and Environmental, Inc. to manage and facilitate the planning process, collect the necessary data, and perform other technical services, including preparing the risk assessment and plan document. Work on the update of the plan nears completion and a draft of the plan is ready for review by interested agencies, organizations and persons.

A copy of the draft plan is available at the following web site for review: <ftp://BaySt.Louis:BSLLHMP@amftp.amec.com/>. When asked for username and password enter these details: Username - BaySt.Louis Password – BSLLHMP.

Copies of the plan are also available for review at the following locations: Building Office at City Hall and Hancock County Public Library in Bay St. Louis. Please address written comments as follows: Bay St. Louis Building Department, Attention: Josh Hayes, 688 Highway 90, Bay St. Louis, Mississippi 39520. Written comments will be received until close of business, Friday, June 17, 2011

Public Hearing Notice

The City of Bay St. Louis, Mississippi has completed a draft of its 2011 Hazard Mitigation Plan. Public Hearings are being conducted to present the plan and receive comments concerning the plan, prior to adoption by the City Council. The hearings will be conducted on the dates, at the times and places indicated below:

Wednesday June 15, 2011 at 9:00 AM. CDT at the Bay St. Louis Conference Center located at 598 Main Street, Bay St. Louis, MS

Thursday, June 16, 2011 at 2:00 PM, CDT at the Bay St. Louis Conference Center located at 598 Main Street, Bay St. Louis, MS.

Members of the public and interested parties, groups, agencies and persons are cordially invited to attend the public hearing and comment on the draft of the 2011 Hazard Mitigation Plan. Copies of the draft of the Plan are on file and available for review and copying at the following locations: Hancock County, Bay - Waveland Public Library, 312 Highway 90, Bay St. Louis, MS. or at City Hall located at 388 Highway 90 Bay St. Louis, MS. during business hours.

Draft copies are also available for viewing and printing at the following internet websites: <http://www.baystlouis-ms.gov/documents>. Also at the following ftp site: <ftp://BaySt.Louis:BSLLHMP@amftp.amec.com/>. (Username - BaySt.Louis Password – BSLLHMP)

Written comments concerning the plan can be delivered or mailed to the following address: Floodplain Manager, 388 Highway 90, Bay St. Louis, MS 39520. All comments will be considered for inclusion in the plan. Written comments should be received no later than 4:00P.M. CDT on Friday, June 17, 2011.

Agenda
Bay St. Louis Public Hearings
June 15, 2011 9:00 AM
June 16, 2011 2:00 PM
Bay St. Louis Conference Center
Bay St. Louis, MS

- Welcome and Call to Order
- Introductions
- Overview of Hazard Mitigation Plan
- Overview – Chapter 1 – Introduction and Purpose
- Overview – Chapter 2 – What’s New in the 2011 Update
- Overview – Chapter 3 – Planning Process
- Overview – Chapter 4 – Risk Assessment
 - Vulnerability Assessment
 - Growth and Development Trends
 - Population Growth – Development Projections, Historic, Present and Future
 - Future Growth Corridors
 - Conservation Corridors
 - Repetitive Loss Properties

 - Capacity Assessment, Regulatory, Planning, Hazard Warning Systems

 - Administrative and Technical Capacities

 - Fiscal Capacity
- Overview – Chapter 5 - Mitigation Strategy
- Overview – Chapter 6 – Adoption
- Overview Chapter 7 – Maintenance and Implementation
- Questions and Comments
- Adjourn

SIGN-IN SHEET
Bay St. Louis, MS
LOCAL HAZARD MITIGATION PLANNING PROJECT
HMPC #1 - Kickoff Meeting

April 13, 2010
 Bay St. Louis Conference Center
 598 Main Street
 Bay St. Louis, MS 395320

Name/Title	Jurisdiction/Organization/Citizen	Address	Phone	E-mail
Larry Beeland FEMA Trainer		200 Pops Ferry Rd Biloxi, MS 39532		larry.beeland@hhs.gov
Lore Ha Robinson Memo Ponce		200 Pops Ferry Rd Bx MS 39532	228-896-9686 228-601-5407-3311	Robin.Soren@memos.gov
Raouane Raphael	Hancock County		228-467-0130	brapad@cc.hancock.ms.us
Hank Wheeler	HANCOCK MEDICAL	195 DENISE WHEELER ROAD BSC MS 39570	228-467-8680	hwalker@hancockmedical.net
NAC LOEWICH	"	"	228-467-8744	hwt@wca.com
GREG FARVE	BAY ST. LOUIS		(228) 547-7908	
MIKE SMITH	WAUVELAND	335 COLEMAN	228-467-6754	FINEMAN39576@ATT.NET
BILL JOHNSON	HANCOCK CO		228 255 3367	roadmanager at CO. hancock.ms.us
B.J. WAKFIELD	MEMA	P. LOPEZ 220 POPS FERRY	228.614.0279	JWAKFIELD@MEMA.MS.GOV
Josh Hayes	BSL	688 Hwy 90	228-469-0551	Josh Hayes BSL@bsl.ms.gov
Bruce Olsen	BSL	608 Hwy 90	728-466-0100	STOEBAN@STLOUIS.CZELL SOUTH.ME

Note to Reviewers: When this plan has been reviewed and approved pending adoption by FEMA Region IV, the adoption resolutions will be signed by the participating jurisdictions and added to this appendix. A model resolution is provided below:

Resolution # _____

Adopting the Bay St. Louis Local Hazard Mitigation Plan

Whereas, the City of Bay St. Louis, Mississippi recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S. Congress passed the Disaster Mitigation Act of 2000 (“Disaster Mitigation Act”) emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments;

Whereas, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, the City of Bay St. Louis, Mississippi fully participated in the FEMA-prescribed mitigation planning process to prepare this local hazard mitigation plan; and

Whereas, the Mississippi Emergency Management Agency and Federal Emergency Management Agency, Region IV officials have reviewed the Pearl River County Local Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body;

Whereas, the City of Bay St. Louis, Mississippi desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Bay St. Louis Local Hazard Mitigation Plan;

Whereas, adoption by the governing body for the City of Bay St. Louis, Mississippi demonstrates the jurisdiction’s commitment to fulfilling the mitigation goals and objectives outlined in this Local Hazard Mitigation Plan.

Whereas, adoption of this legitimacies the plan and authorizes responsible agencies to carry out their responsibilities under the plan.

Now, therefore, be it resolved, that the City of Bay St. Louis, Mississippi adopts the Pearl River County Local Hazard Mitigation Plan as an official plan; and

Be it resolved, that the City Council of the City of Bay St. Louis, Mississippi adopts the Bay St. Louis Local Hazard Mitigation Plan as an official plan, and

Be it further resolved, the City of Bay St. Louis, Mississippi will submit this adoption resolution to the Mississippi Emergency Management Agency and FEMA Region IV officials to enable the plan's final approval in accordance with the requirements of the Disaster Mitigation Act of 2000.

Passed: _____
(date)

Certifying Official

Proceedings of the City Council meeting of the city of Bay St. Louis, State of Mississippi, taken at a meeting held October 18, 2011 in the City Council Chambers at the Bay St. Louis Conference Center on Main Street. The meeting began at 5:30 p.m.

ATTENDANCE:

COUNCIL: Jeffrey Reed, President, (Ward 3), Wendy McDonald, (Ward 2), Doug Seal, (Ward 1), Bill Taylor (Council Member-at-Large), Bobby Compretta (Ward 4), Joey Boudin (Ward 5), Ray Kidd (Ward 6).

COUNCIL STAFF: Jane Carrow, Clerk of Council

ADMINISTRATIVE STAFF: Les Fillingame, Mayor, David Kolf, City Clerk

ABSENT: None

Council Member Reed called the meeting of October 18, 2011 to order.

Council Member Reed delivered the invocation and led the Pledge of Allegiance.

MAYOR'S REPORT

Motion to Approve the Consent Agenda

Council Member Taylor moved, seconded by Council Member Boudin, to approve the consent agenda consisting of:

- a) Approval to close the 300 Block of DeMontluzin St., Jackson Blvd. at Felicity Street, Corinth at Dunbar Ave., Spanish Acres, and Housing Authority Streets: Shieldsboro Drive, Bookter, and Iberville from 5 to 7pm.
Halloween Evening October 31, 2011;
- b) Approve the appointment of Bill LeBlanc
To the Library Board of Trustees four year term
To begin on October 1, 2011 and continue to September 30, 2015;
- c) Approve Lease agreement and Fee Schedule for the rental of 1905 City Hall;
- d) Travel
Date: Dec.4-6, 2011
Department: Police
Employee: James Burch
Location: Meridian, MS
Reason for Travel: Shoot House Instructor
Sponsoring Organization: Meridian Police Dept./Team One Network
Registration: \$450.00
Meals: \$153.00
Transportation: City Vehicle
Lodging: \$178.00;
- e) Approve payment to the Police Department for
Narcotics buy money in the amount of \$1,000.00;
- f) Change Order #10
Location: Bay St. Louis New City Hall Complex
Contractor: G.M. & R. Construction Company, Inc.
Reason: Removal of existing ceiling and installation of
New 2x4 ceiling in restroom
Contract sum prior to increase: \$747,153.00
Increase by this change order: \$ 488.00
New contract sum: \$747,641.00;
- g) Adopt Resolution Authorizing the City of Bay Saint Louis to
Amend the fiscal 2012 budget for addition of unemployment
Revolving fund surety bond;
- h) Adopt Resolution Authorizing the City of Bay Saint Louis
To amend the fiscal 2012 budget for approved Katrina Recovery
Related Project expenditures;
- i) Declare the following Police Department items surplus and dispose of through
Auction or other avenues:

Year/Make	VIN Number	Mileage
2007 Ford Crown Vic	71WX7X101798	100,500
2007 Ford Crown Vic	71W37X101805	95,000
2007 Ford Crown Vic	71W17X101799	110,000

- | | | |
|---------------------|--------------|----------|
| 2007 Ford Crown Vic | 71W67X101801 | 90,000 |
| 2007 Ford Crown Vic | 71W47X101814 | 100,000; |
- j) Authorization to Submit Modification to Harbor Permit with Corps of Engineers for Events Deck and Pedestrian Ramp per Recommendation by Brown, Mitchell and Alexander, Inc.;
- k) Adoption of the 2010 Hazard Mitigation Plan and Amendment;**
- l) Change Order No. 1
Project: Splash Pad at McDonald Park
Contractor: Twin L Construction, LLC
Reason: Time Extension Only
The Contractor requested a time extension of Fifty-Two (52) days. A Thirty (30) day Extension has been accepted
- | | |
|-------------------------------------|---------------|
| Contract sum prior to Change Order: | \$182,374.23 |
| Increase by this Change Order | <u>0.00</u> |
| New Contract Sum | \$182,374.23; |
- m) Authorization for Purchase of New HIDTA Police Vehicle – Toyota Tundra From Allen Toyota in Gulfport with funds From HIDTA Grant - \$34,894;
- n) Authorization to Donate Oleanders Removed from Melody Lane to Bay Waveland School District; and
- o) Authorization to permit the Hancock County Development Commission to borrow 100 barricades for the Hancock County Chamber of Commerce/Kiln Business Council's Craft Beer Fest on October 22, 2011. The Airport staff will pick up the barricades on Wednesday or Thursday and will return them on Monday.

A vote was called for with the following response:

VOTING YEA: McDonald, Taylor, Kidd, Compretta, Seal, Boudin and Reed

VOTING NAY: None ABSENT: None

CERTIFICATION

I, Jane Carrow, Clerk of Council for the City of Bay St. Louis, do hereby certify that the foregoing is a true and accurate extract of the minutes of a City Council meeting held October 18, 2011, a quorum of the governing bodies being present and recorded in minute book 46.

Given under my hand and the official seal of the City of Bay St. Louis, the 9th day of November, 2011.



Jane Carrow
Clerk of Council

AMEC Data Collection Guide

Bay St. Louis Comprehensive Plan and Background Report, Slaughter and Associates (2009)

Bay St. Louis Drainage Ordinance and SOP March 1995; Stream Dumping Ordinance

Bay St. Louis Historic Preservation Ordinance April 30, 2007

Bay St. Louis Storm Water Ordinances No. 441 and 442 Regulating Erosion and Sediment Control, 2004

Bay St. Louis Subdivision Ordinance, Zoning Ordinance, August 10, 2009

City of Bay St. Louis Planning and Development Department

City of Bay St. Louis Inventory of Critical Facilities – 2010

City of Bay St. Louis Multi-Hazard Mitigation Plan, 2005, Susan D. Chamberlain.

City of Bay St. Louis, Building Department, Floodplain Manager, Building Official, Building Inspector, 2011

Department of Atmospheric Sciences at the University of Illinois at Urbana-Champaign

Disaster Mitigation Act of 2000 (PL 106-390) and implementing regulations set forth in Interim Final Rule published in the Federal Register on February 26, 2002 (44 CFR 201.6) and finalized on October 31, 2007

FEMA 549/July 2006, Mitigation Assessment Team Report Hurricane Katrina on in the Gulf Coast

Gulf Regional Planning Commission, Gulfport, MS, GIS Department, Transportation Improvement Plan, 2011, Traffic Counts, 2011

Hancock County Board of Supervisors

Hancock County Civil Defense Agency, Comprehensive Emergency Management Plan (CEMP) and Standard Operating Procedures (SOP), 2010

Hancock County Comprehensive Plan, January 18, 2007

Hancock County Port and Harbor Commission

Hancock County Road Manager

Hancock County Tax Assessor, 2010

Historic American Buildings Survey (HABS) and Historic American Engineering Record (HAER), March 2011

Mississippi Coastal Improvement Plan (MsCIP), Department of Defense, Appropriation Act (PL 109-148) December 30, 2005

Mississippi Emergency Management Agency; U.S. Army Corps of Engineers, Mobile District City of Bay St. Louis SLOSH Model, 2011

National Flood Insurance Studies for Hancock County and City of Bay St. Louis, January 16, 2009

National Oceanic and Atmospheric Agency (NOAA) Data Center Satellite and Information Services (NESDIS), 2010

National Oceanic and Atmospheric Agency (NOAA) National Climatic Data Center, Storm Events Database, 2010

National Oceanic and Atmospheric Agency (NOAA) National Climatic Data Center Extreme Events, 2010

National Oceanic and Atmospheric Agency (NOAA) National Severe Weather Laboratory, 2010

National Oceanic and Atmospheric Agency (NOAA) National Weather Service Heat Index Information, 2010.

National Oceanic and Atmospheric Agency (NOAA) Storm Prediction Center, 2010

National Oceanic and Atmospheric Agency (NOAA) Storm Prediction Center, 2010

National Register of Historic Places, March 2011

National Seismic Hazard Map Project, 2008

SHELDUS, Hazards Research Lab, University of South Carolina, www.sheldus.org/ 2010

Southern Mississippi Planning and Development District, Comprehensive Economic Development Plan 9 (CEDP), 2010

State of Mississippi Standard Mitigation Plan, Mississippi Emergency Management Agency (MEMA) 2010

Surface Water Division, Licensing and Dam Safety Division and the Office of Land and Water Resources, Mississippi Department of Environmental Quality (MDEQ).

U.S. Bureau of the Census, 2002 Economic Census; Summary Statistics by 2002 NAICS for Hancock County, Mississippi

U.S. Bureau of the Census, Census 2000, 1990, 1980 and Annual Estimates of Population for Incorporated Cities, Places and Counties in Mississippi 2009.

U.S. Fish and Wildlife Service Species by County Report March, 2010

U.S. Geological Survey, Earthquake Data.