State of Louisiana

Hazard Mitigation Plan

Military Department
Office of Emergency Preparedness

Developed by the
Disaster Recovery Division

Revised for DR-1357 & 1380-LA

State of Louisiana

Hazard Mitigation Plan

People and property in the State of Louisiana are at risk from a variety of hazards which have the potential for causing wide-spread loss of life and damage to property, infrastructure, and the environment.

The purpose of hazard mitigation is to implement actions which eliminate the risk from hazards, or reduce the severity of the effects of hazards on people and property. Mitigation actions are both short-term and long-term activities which reduce the cause or occurrence of hazards; reduce exposure to hazards; or reduce effects of hazards through various means to include preparedness, response, and recovery measures.

The State of Louisiana Hazard Mitigation Plan has been prepared in compliance with Public Law 93-288, as amended. This plan implements hazard mitigation measures intended to eliminate or reduce the effects of future disasters throughout the State, and was developed in a joint and cooperative venture by members of the State Hazard Mitigation Team.

Following each major disaster declaration, the state is required to review and update the Administrative Plan. It is however, recommended that the plan be reviewed annually to ensure it remains current. Updates, amendments, or plan revisions should be submitted to FEMA for review. If updates are not necessary, the state should notify FEMA in writing that the plan was review and it is determined that a plan update is not required. Updates may include new policy guidance or changes in program administration. Annual updates are an eligible activity under the Hazard Mitigation Grant Program (HMGP).

This plan is accepted for implementation upon approval by the Director and Assistant Director of the Louisiana Office of Emergency Preparedness, and supersedes all previous editions.

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State Hazard Mitigation Officer

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I. Introduction

1. Purpose

It is the intent of the State of Louisiana to establish policies, programs, strategies, and actions to be implemented by State and Local governments, using legal authorities and various financial assistance programs, to greatly reduce or eliminate the long-term effects and vulnerability from natural hazards.

2. Scope

The implementation of this plan will be statewide and not limited to one particular declared disaster area. Both structural and non-structural opportunities will be addressed, with a focus on short-term and long-term mitigation measures. The overall goal of this plan and the attached appendices is to greatly reduce or eliminate the loss of human life, property, and the associated costs of future disaster events. This plan is the strategy for hazard mitigation activities to be implemented by the effective use of existing programs within the Federal and State government. The state programs will evaluate hazards, provide education and training, assist in development or revision of existing regulatory statutes, develop mitigation plans, and provide technical assistance to local governments in development and implementation of mitigation measures. In addition, innovative concepts and strategies for mitigation measures that extend beyond existing activities will be investigated and evaluated.

3. Eligibility Requirements

All state and local governments, Indian Tribal organizations**,** Private non-profit organizations or institutions that own or operate a private non-profit facility as defined in 44 CFR 206.221 (e).

4. Permissible Uses of Funds

The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. §13.20 Standards for financial management systems,

§13.21 Payment, and §13.22 Allowable costs. Grants awarded under the IEB program are restricted to the payment of approved overtime salaries, benefits and force account equipment. Grant funds may not be used retroactively for the salaries paid prior to the grant award.

5. Period of availability of funds and Local match

The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. §13.23 Period of availability of funds, and §13.24 Matching or cost sharing. Under the Hazard Mitigation Grant Program and the Flood Mitigation Assistance program, the Federal share will not be less than seventy-five percent of the net eligible repair, restoration, acquisition, elevation, reconstruction, or replacement costs of a project. The Interim Emergency Board match will be on a case by case bases. However, the Director of LOEP shall determine the methodology of the State and Local match requirements.

6. Non-Federal Audit, Changes, Property, and Contracts

The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. § 13.26 Non-Federal audit, §13.30 Changes, §13.31 Real Property, §13.32 Equipment, §13.33 Supplies, $13.34 Copyrights, §13.35 Sub-awards to debarred and suspended parties, §13.36 Procurement contracts, and §13.37 Sub-grants.

II. General

1. How to Apply

All applicants need to follow the format provided in the Project Application Instruction's Package. Failure to complete and return the documents generated from this package will result in denial of, or delay in processing the application. If an application is submitted on behalf of more than one agency, the relationship between agencies must be described in the application. In addition, one agency must be designated as the payee to receive and disburse funds and to be responsible for supervision and coordination of grant activities. Please provide this information on a separate sheet of paper. All necessary forms must be type written. All of the required materials should be stapled together or otherwise bound. Any narrative portions of the application should be single-spaced, typewritten and printed on one side of 8 ½" by 11" paper. Applicants are discouraged from including other materials beyond what is required. Video presentations are permitted. All applicants must

provide a budget information form, assurances, and certifications and have the appropriate officials sign all forms.

2. Monitoring and Reporting Requirements

All applicants will be required to participate in grant monitoring activities of the HMGP, FMA, and IEB programs. The monitoring process may include the submission of written reports and telephone and/or site visits concerning financial administration of the grant and progress toward achieving the applicant's goals of their mitigation or CRS plan. The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. §13.40 Monitoring and reporting requirements.

3. Paperwork Reduction Act Notice

The public reporting burden for this collection of information is estimated to be up to eight hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of this information. Applicants are discouraged from including other materials beyond what is required.

4. Technical Assistance

Technical Assistance is available to applicants at no cost. Assistance with completing applications may be obtained from the Louisiana Office of Emergency Preparedness office at 1-225-342-5470. Written inquires may be sent to: Military Department, Office of Emergency Preparedness, Hazard Mitigation Section, Post Office Box 44217, Baton Rouge, LA 70804-4217. This technical assistance may be particularly useful to new local government officials and OEP Directors or those that are in the early stages of implementing mitigation policies and need help formulating their long-term plans.

5. Administrative Requirements for Applicants

The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. §13.41 Financial Reporting, §13.42 Retention and access requirement for records, §13.43 Enforcement, and §13.44 Termination for convenience.

6. After-the-grant requirements

The Director of LOEP shall finalize the interpretation of each section. This section is taken directly from CFR 44 Part 13 Subpart C—Post Award Requirements; Financial Administration. §13.50 Closeout, §13.51 Later disallowance's and adjustments, and §13.52 Collections of amounts due.

7. Single Point of Contact

Each applicant will designate a single point of contact to represent the applicant. This person will represent the applicant with regards to the project.

8. Civil Rights

All recipients of Federal and state grant funds are required to comply with nondiscrimination requirements contained in various Federal and State laws. All applicants should consult the assurances to understand the applicable legal and administrative requirements.

III. Environment

A. Geography

Louisiana is situated entirely within the southern margin of the Gulf Coastal Plain, and relief is relatively slight across the state. Nevertheless, the state, with of a series of low ridges and valleys paralleling the coast, can be divided into three major physiographic regions: hills, terraces, and lowlands. In reality, however, the boundaries between the regions are not always distinct.

Hills - North of the 31st Parallel, local elevations are some of the highest in the state. This region, which occupies the area north and west of a line running from Leesville to Jena to Monroe, contains the oldest rocks in the state. In this zone, valleys of local streams are sufficiently narrow that roads and settlements are on the divides rising between the river valleys, excepting the ten-to-fifteen mile wide Red River Valley. Two 'ranges' of small hills are noticeable within the region primarily because the regions are composed of erosion-resistant sandstone: the Kisatchie Uplands on the southern margin and the Nacogdoches Uplands, which are 30-50 miles farther inland. The highest point in the state, Mount Driskill, rises 535 feet within the latter.

Terraces - The terraces, along with the lowlands, are geomorphic features that were formed during relatively recent times geologically. These represent

former river floodplains or coastal areas that have been raised above the present floodplains between periods of glacial advances. As the glaciers far to the north of Louisiana melted, sea level rose, causing streams to slope more gently than before. This resulted in slower stream velocity and greater deposition of the sediments that build the terraces. Four major terraces (corresponding to the five major glacial advances of the past two million years) have formed like steps rising up from the Gulf of Mexico, in successive order from highest and oldest from north to south. The terraces are areas in which the land is gradually rising, to counterbalance the sinking of the deltaic area south of the terraces at the Coastal Hinge Line.

Terraces in Louisiana are found in two major areas. The first zone extends through the Florida Parishes, excepting a narrow portion of East Baton Rouge Parish south of Baton Rouge where the Mississippi floodplain encroaches eastward, and the extreme southern portions of Livingston, Tangipahoa, and St. Tammany Parishes bordering Lakes Pontchartrain and Maurepas. The second extensive area of terraces in the state lies west of the Atchafalaya floodplain and south of the Kisatchie region and extends to within approximately 25 miles of the Gulf of Mexico.

Lowlands - The lowlands are comprised of river floodplains and marsh. In these areas, relief is very slight, and elevation is low, in some cases being below sea level. North of the headwaters of the Atchafalaya, the Mississippi floodplain extends from the Mississippi River to approximately 30 to 70 miles west of the River. In the southern part of the state, the floodplains generally fan out on either side of the Mississippi and Atchafalaya Rivers, and encompass the entire coastal zone. Two streams primarily generate the floodplains: the Mississippi and Atchafalaya (which combines waters of the Mississippi and Red Rivers). Several other major streams flow out of the Mississippi in the southern part of the state, including Bayous Lafourche, Plaquemine, and Manchac. However, flow into these streams is controlled by an extensive levee system along the lower Mississippi River. During the past several thousand years, these streams have meandered within the floodplains, creating some geomorphic features within the region, such as meander scars and oxbow lakes such as False River north of Baton Rouge. Perhaps the most distinguishing feature of the Mississippi River is its “birdfoot” delta, produced by the deposition of sediments as the human-controlled river flows into the Gulf of Mexico.

Forested marshlands extend along the entire coastal sections of the state south of the Coastal Hinge Line, and can be subdivided into the Chenier Plain (west of Marsh Island) and the Deltaic Plain (east of Marsh Island). Landforms of the Chenier Plain are dominated by the presence of a westward “longshore drift” in the Gulf of Mexico, which has moved Mississippi/Atchafalaya sediments against the shore to create a broad mud flat. Other features of the Chenier Plain are beaches and ridges running parallel to the coast. The Deltaic Plain is characterized by several systems of old natural levees striking at right angles to the coast. Former

channels of the Mississippi created these. In addition, several barrier islands exist in this part of the state, most notably Grand Isle, and the Timbalier, Dernieres, and Chandeleur Island chains.

B. Climate

Maritime air masses originating over the Gulf of Mexico, coupled with Louisiana's sub-tropical latitude and minimal elevations, combine to produce the state's characteristic warm and humid climate. Average annual temperatures range from the mid- to upper-60°s across the state. Precipitation is well-distributed through the year, with annual totals ranging from a low of less than 50" in the northwestern corner of the state to more than 70" in sections of the Florida Parishes. It is especially noteworthy that Louisiana's statewide precipitation average of approximately 58" proves to be one of the highest totals for any state in the entire country. Furthermore, annual statewide average precipitation has been above normal during recent years, with the last 15 years proving to be some of the "wettest" of this century.

Louisiana springs (March, April & May) are highlighted by steadily warming temperatures and frequent rainfall. This is a season of pronounced storminess, with surface fronts marking the boundaries between cool, dry continental air masses from the north and those originating over the Gulf. Distinct contrasts between these air mass properties promote the potential for violent weather; spring is Louisiana's peak season for severe thunderstorms, which may produce heavy rains, high winds, large hail and tornadoes. In addition, spring-season fronts often stall while passing over the state, occasionally producing rainfall totals in excess of ten inches within a period of a few days. With soils tending to be near-saturation at this time of year, spring typically becomes the period of maximum stream-flow across the state. Collectively, these characteristics increase the potential for high water, and low-lying, poorly drained areas are particularly subject to flooding during these months.

Southerly flow of warm and moist air from the Gulf is dominant during the summer months (June, July & August), resulting in a generally consistent climate regime through the middle of the year. Temperatures during this season remain fairly consistent, with summer average temperatures generally in the low-80°s statewide. Daytime highs generally range between 85°F and 95°F, while overnight lows typically remain in the 70°s. Frontal passages are rather infrequent during summer, but the steady inflow of moist, unstable Gulf air masses promotes frequent development of showers and thundershowers, particularly across the southern parishes. The state's precipitation gradient is most pronounced at this time of year, with average summer totals increasing from roughly 10" to 12" inches in the northernmost parishes up to near 20" along the coast. Yet periods of drought are possible, particularly across the northern tier of parishes, when weak high pressure

may inhibit the development of convective showers for days, or even weeks, at a time. Severe weather is also a concern, but events tend to be somewhat less violent and not as widespread as those reported in spring. Summer thunderstorms are capable of producing heavy downpours, with strong winds and large hail, but tornadic activity is greatly reduced compared with spring, particularly over the southern half of the state. However, summer marks the start of the Atlantic tropical cyclone season, with Louisiana being susceptible to the impact of systems which are fueled by the warm waters in the Gulf.

Autumn (September, October & November) serves as a period of moderating temperatures and is often considered the best season within the state in terms of outdoor comfort. Although tropical weather activity actually reaches its peak at this time of year, the duration of such events tends to be only a few days. During the remainder of the season, daytime humidities tend to be somewhat lower than other times of the year. And while frontal activity returns to the state during these months, the contrasts between continental and Gulf air masses are minimized, resulting in weak frontal systems, many of which produce little or no rainfall. Indeed, autumn proves to be the "driest" season of the year for this state.

Louisiana winters (December, January & February) are characterized by a strong thermal gradient across the state, with average seasonal temperatures ranging from the mid-40°s over northern Louisiana to the low-50°s across southern parishes. While seasonal average temperatures remain above freezing statewide, winter is marked by large shifts in daily temperatures associated with frontal passages. Cold Canadian air does extend through the state and into the Gulf at least once during most winters. Indeed, freezing temperatures are fairly common, with only the extreme coastal margins occasionally avoiding these 'Arctic outbreaks' for an entire season. Fortunately, however, these freeze events seldom continue uninterrupted for periods beyond a week. The vast majority of winter precipitation arrives as rain, but accumulations of snow do occur. In the northern half of the state, ground-cover is usually modest and of short duration, whereas measurable accumulations in the southern half of the state are rather uncommon. Thus, although snowfall is not a major concern, freezing rain and ice storms can create significant problems within the state.

C. Natural Hazards

Extreme Temperatures - Summer temperatures of 100°F or more are not uncommon in the northern half of the state, particularly during runs of dry weather when clear skies permit increased solar radiation to reach the surface. Daytime highs in the northwestern parishes have occasionally reached 110°F, with Louisiana's all-time extreme of 114°F being recorded in Plain Dealing (Bossier Parish). Higher humidities and more consistent cloud-cover in the southern parishes

reduce insolation and moderate daytime temperatures. As a result summer maximums generally remain in the low-90°s, only occasionally reaching triple-digits.

In terms of heat index values (HIs), the combination of very warm temperatures and high humidities produces maximum heat index values in excess of 110° on a relatively frequent basis, with values periodically topping 120°F. These stress-related temperature extremes, often occurring in conjunction with periods of reduced air quality, produce potentially unhealthy conditions, which can negatively impact the elderly, the very young and those with respiratory problems.

Freezing temperatures are a relatively common feature of winters in Louisiana; however, during milder winters they may not be recorded along the state's coastal margin. Although a relatively uncommon occurrence, winter temperatures can remain below freezing for runs of up to several days in the northernmost parishes. Temperatures in this portion of the state have dipped below 0°F, with the state's absolute minimum of -16°F recorded in Minden (Webster Parish). By contrast, in the southern parishes, temperatures rarely fall into the single-digits and freezes seldom extend for periods of more than 48 hours. During 'Arctic outbreaks,' which are often accompanied by strong northerly winds, windchill temperatures can dip below 0°F. Much of the state is ill prepared for prolonged freezes, and extended conditions such as these can have seriously detrimental effects on regional utilities and plumbing. In addition, hard freezes can have drastic consequences on some aspects of Louisiana agriculture, such as the Plaquemines Parish citrus industry, and on some species of native sub-tropical and horticultural vegetation.

Precipitation Extremes - Historical records for Louisiana display an amazing array of rainfall totals for periods ranging from one day to one year. Although a number of large precipitation storm totals have been produced by frontal weather, the vast majority of state extremes have been associated with tropical systems, with most of the state precipitation records being observed in the southern third of the state.

Single-day totals of 4" or more can be expected almost annually across the state. "Once-in-25-year" daily totals display a strong north-to-south gradient over the state, ranging from under 8" in the northern parishes to well-above 10" over several southwestern parishes. Historical review shows that several sites have recorded one-day totals above 15", with the state's maximum 24-hour total of 22" recorded at Hackberry (Cameron Parish) in August 1962. The state's seven-day maximum of more than 30" occurred over southwestern Louisiana during August 1940, produced by a slow-moving tropical system. Monthly accumulations in excess of 30" have been

reported during the past one hundred years at a handful of sites across the state, primarily the result of above-normal frontal activity in northern Louisiana, while being linked to enhanced summer tropical activity in the south.

Annual rainfall accumulations of more than 80" have been reported at numerous sites statewide over the past 100 years. In fact, the 1991 area-weighted total for the entire state topped 80", establishing an all-time statewide record. During that same year, several southeastern Louisiana sites recorded 100" or more of rainfall, including the state's all-time station record of 113.74" at New Orleans' Audubon Park.

Flooding - Flooding is a potential threat in virtually every section of Louisiana during every season, as the state's sub-tropical climate has the potential for producing heavy rainfalls during any time of the year. Rains of up to 10" over a two-day period are not rare, and such events are capable of producing considerable flooding in a number of basins within the state. Indeed, minor flooding is virtually a yearly occurrence for a number of rivers.

From a climatic perspective, flood events within the state can be categorized as either tropical (*i.e.*, tropical storms and hurricanes) or frontal. Over the past century, there has been an apparent increase in large rainstorms and resultant flooding associated with frontal activity, particularly in the late winter and spring, whereas widespread flooding due to tropical systems seems to have become less common.

Recently there has been increased concern regarding flood frequencies in several basins, particularly within areas of active growth and development. In addition to the state's increased precipitation totals during recent years, the frequency of widespread events of 6" or more has also increased, particularly in the southern half of the state, where flooding is already a persistent problem.

Floods along the Mississippi and Atchafalaya Rivers are also important events, but these events result from runoff far upstream; rainfall within the state has little or no impact on the stages of these rivers. In addition, the natural floodplains for these waterways are protected by extensive levee systems. However, as principal transportation routes, major flooding on these waterways can have serious impacts on river and barge traffic. This is particularly important along the Mississippi, as cargo handling at the Port of New Orleans is the one of Louisiana's major industries.

Drought - Even though Louisiana is one of the nation's "wettest" states in terms of area-averaged rainfall, the state has experienced drought conditions on an occasional basis. A true moisture shortage requiring urban and suburban water restrictions is a rare event, but agricultural drought does occur, particularly across the northern parishes.

From a crop-development perspective, soil-moisture depletion to critical levels can occur throughout the growing season. Fortunately, extended runs of days without rainfall are unusual, although data show summer periods in north Louisiana extending well over a month when rainfall was insufficient for agricultural purposes. Fortunately, water is generally available for short-term irrigation purposes, but extended dry spells through the summer season can result in catastrophic agricultural losses.

As the Mississippi and Atchafalaya Rivers are dependent upon rainfall well beyond the state's borders, droughts in other sections of the country can significantly reduce the flows of these rivers. For example, the 1988 drought in the U.S. upper Midwest and High Plains resulted in record low river stages in the lower Mississippi, even though rainfall in Louisiana was above-normal for that year. As a result, waterway traffic was brought to a near-standstill for several weeks and water supplies for several river parishes were threatened by low flow and salt-water intrusion.

Severe Thunderstorms and Tornadoes - Although strong thunderstorms and tornadoes can occur during any month within Louisiana, late winter and spring is the peak period for these severe weather events. The clash of distinct air masses associated with spring frontal boundaries provides the energy for powerful thunderstorms, occasionally producing squall lines that extend over the entire state. The most powerful thunderstorms are capable of generating heavy downpours, wind gusts of 75 mph or more, and hailstones in excess of two inches in diameter.

By summer, severe thunderstorm activity diminishes significantly in the northern half of the state, but actually increases in south Louisiana. Summer thunderstorms, produced by convective activity associated with thermally unstable air, generally are shorter-lived, cover smaller areas and tend to be less destructive than their spring counterparts. Occasionally, however, these summer storms can be quite powerful.

For Louisiana, tornadic activity displays a peak in April and May, but occur year-round. Frequencies of formation are greater in the northern and western parishes as compared to others within the state. During the winter and spring, more tornadoes develop over north Louisiana, while the focus of activity shifts southward during the summer and fall. From a diurnal perspective, Louisiana tornadoes most frequently develop during the mid-afternoon.

Since 1975, Louisiana has averaged more than thirty tornadoes per year, but inter-annual variability has been quite high, ranging from fewer than ten tornadoes to more than sixty. Although small in area coverage, these systems can be some of the most destructive weather events to impact our state. Data indicate that seven

tornadoes since 1950 have produced in excess of $5 million in damage within the state. In addition to economic losses, these storms have resulted in an average of one death per year during the last twenty years, with Louisiana ranking near the top for all states in numbers of tornado-related injuries per land area.

Icing - Limited primarily to the late winter and early spring, most Louisiana ice storms are of short duration. Major ice storms rarely occur in the southern half of the state but have created significant problems for many northern and central parishes, where icing of up to two inches or more has been reported on occasion.

The principal impact of Louisiana ice storms is roadway hazards. However, the most severe storms are capable of generating millions of dollars in damage, due to damage resulting from the weight of large accumulations of ice. Significant losses attributed to these weather events have included the widespread interruption of electric-power delivery to thousands of customers as a result of the downing of powerlines and utility poles, and substantial losses to the state's timber industry as a result of damage or destruction to young trees.

Fog Hazards - Fog is a year-round weather occurrence in Louisiana, creating potential transportation hazards for both roadways and waterways. With the state's frequent rainfall, the proximity of the Gulf of Mexico and its moist air masses, and the high percentage of area covered by marshes, lakes and bayous, abundant moisture is available for fog formation at virtually any time of the day or year.

Particularly during summer, nighttime radiational cooling results in surface temperatures which are lower than the moist air above it, resulting in condensation and ground fog. This type of fog forms frequently prior to dawn, particularly in sections of south Louisiana, and can persist well into the late morning hours. In winter and spring, the heaviest fogs are generally related to the advection of warm and moist Gulf air over cooler land and inland-water body surfaces. These cooler surfaces chill the moist air masses above them, producing fog banks in which visibility can be reduced to zero for hours at a time.

These advection fogs are considerable navigational problems, particularly on the Mississippi River. Occasionally these fog banks can halt navigational traffic near the mouth of the river for days at a time. In addition, during the spring months, the Mississippi River water temperature may be more than 20°F cooler than the air above it, further exacerbating the problem. The levee system along the river adds to the problem by containing the fog within the river channel, resulting in a ribbon of fog extending well inland along the waterway.

Tropical Systems - Tropical systems, including tropical depressions, tropical storms and hurricanes, are Louisiana's greatest weather hazards. These systems can

produce strong thunderstorms, very heavy rains, significant flooding, major wind damage and even tornadoes. Although primarily a south Louisiana concern, since they weaken rapidly over land, hurricanes are capable of maintaining their intensity well-inland, occasionally extending hurricane-force winds over most of the state.

While the Atlantic Basin hurricane season officially extends from June 1 to November 30, a review of past tropical events indicates that Louisiana has experienced storms as early as late May, with the state's season essentially ending in October. No storms have made landfall in the state during the month of November in more than 100 years, with only three systems extending west of 90° longitude in the Gulf of Mexico during that month. The peak of activity over all years occurs in September. During the 20th century, approximately seventy tropical systems have made landfall in or near the state, including more than two dozen hurricanes. Storms have entered Louisiana along the entire coastline, but an historical review suggests that the area extending from Marsh Island to the Mississippi Delta is the most susceptible. Of all Louisiana hurricanes, only two have made landfall as 'major' storms (Category 4 or 5 intensity): Audrey (1957) and Camille (1969).

Hurricanes have proven to be Louisiana's costliest and most deadly natural phenomena. At least three storms have produced 200 or more deaths in the state, including the storm of 1893, in which roughly 2000 lives were lost. Losses on the order of $1 billion (estimated in 1990 dollars) have occurred at least twice: during Betsy (1969) and Andrew (1992).

Louisiana's fragile coast has proven to be most sensitive to these systems. High winds and the associated storm surges are capable of breaching and dissecting the state's barrier islands, while destroying thousands of acres of marshland. In addition to lost revenues and potential hazards resulting from storm damage to Louisiana's oil and gas industry, post-storm recovery from these systems within the state's wetlands may take from years to decades, resulting in potential losses to the state's important fisheries industry.

IV. Mitigation Strategies

A. Flood (Coastal, Inland, and Riverine)

1. Floodplain Management and Building Codes

Improved floodplain management, including land use planning, zoning, and enforcement at the local and State levels can reduce flood related damages. There are still communities and municipalities without zoning ordinances to reduce flood risks or plans to mitigate flood related damages. The use of the National Flood Insurance Program (NFIP) is critical to the reduction of future flood damage costs to

the taxpayer. The Louisiana Department of Transportation and Development (DOTD) is the primary agency responsible for the administration of the NFIP for the State of Louisiana. Work should continue in this area, with efforts from multiple agencies to assist local governments in the enforcement of NFIP policies. Local governments should also strive to upgrade the current floodplain ordinance, providing future homeowners an increased level of protection.

Within floodplain management as a whole, the education process must play an important role. An effective education program to show local governments the importance of building codes and ordinances and how cost effective they could be in reducing future damages should be implemented.

2. Acquisition / Elevation / Relocation of Structures

The acquisition or "buyout" option is considered the ultimate solution to continued flooding to structures and is given the highest priority for allocation of mitigation funds. However, the option to elevate or relocate a repetitive loss structure is an effective method of mitigation. Those options are to be considered after acquisition as the preferred solution to flooding. Due to widespread effects from flooding in Louisiana this option can prove to be difficult and may take longer to implement. In certain parts of Louisiana, many of the entire regions are in the floodplain but this option can be used and justified on severely flooded structures. There are, however, areas within the floodplain which are more severely impacted than others and thus localized buyouts could prove to be effective. Due to the problem of repetitive-loss in Louisiana, the acquisition option is the highest priority for projects to be funded with the available mitigation programs in Louisiana. The criteria for acquisition of repetitive loss structures will be in accordance with the structures ranking on the FEMA repetitive loss list from highest ranked to lowest ranked regardless of parish or community.

3. Retrofitting of Structures

The retrofitting of structures prone to periodic flooding is another effective mitigation strategy to reduce the future loss of property. Approximately 2/3 of all structures in Louisiana are of concrete slab type construction, which inspired State and local agencies to introduce a pilot project of elevating a house of this type construction. While realizing that this type elevation is very expensive, the project proved that the technology is available within the state to perform a very effective solution to the structures with substantial flood damage. Other retrofitting options, such as sealants, wraps, and floodwalls present a more cost-effective solution to structures with low-level flood damages have been considered but presently none of the methods are eligible for funding under any of the FEMA mitigation programs.

4. Drainage

One consistent theme noted in each of the declared parishes is the need for improved drainage capacity around roads and low-lying areas. It is obvious that some canals and laterals are not maintained for reasons usually associated with site accessibility and cost. Other laterals and canals are of insufficient design to carry runoff from increased development.

To maximize efficiency of existing drainage systems, local governments need to ensure that their existing systems are regularly maintained and free of debris and vegetative growth. Furthermore, local governments are encouraged to improve all existing drainage systems to protect against a minimum of a 10 - 25 year rainfall event.

5. Early Warning

With sufficient warning of a flood, normally a community and its residents can take protective measures such as moving personal property, cars and people out of harms way. When a flood threat recognition system is combined with an emergency response plan that addresses the community's flood problems, considerable flood damage can be prevented. This system must be coupled to warning the general public, carrying out appropriate response tasks, and coordinating the flood response plan with operators of critical facilities. A comprehensive education / outreach public awareness campaign is critical to the success of early warning systems so that the general public, operators of critical facilities, and emergency response personnel will know what actions to take when warning is disseminated.

B. Wind (Tropical and Tornadic)

1. Building Codes

The lack of effective building codes and inadequate enforcement and compliance of existing building codes have consistently been identified as major contributors to structural damages resulting from recent storm events.

Building code adoption and enforcement should be a part of all communities' legal mechanisms for reducing natural hazard damage. When properly enforced, building codes provide one of the most effective forms of hazard mitigation possible,

particularly regarding wind damage. This holds true for new construction and rehabilitation of structures damaged during a natural disaster.

2. Retrofitting of Risk Structures

Structures damaged by or at risk to damage by tornadic and tropical storm force winds should be retrofitted to meet long-established wind load designs. Retrofitting to assure roofs, walls and windows meet minimum wind-load design factors have proven to significantly reduce wind related damages. Use of storm shutters by individual property owners can greatly reduce wind damage even with a total lack of code enforcement.

3. Early Warning

Communities should develop or enhance their comprehensive early warning system to incorporate the interpretation of National Weather Service Data, activation of warning sirens, and implementation of the Emergency Operations Plan. Communities should consider enhancing their system by providing critical facilities such as hospitals, schools, nursing homes and other public buildings with NOAA Weather Radio Receivers.

C. Ice

1. Shielding / Protection of Essential Services

As a result of an ice storm event, ice accumulates on tree branches resulting in broken limbs and up rooted trees falling on power-lines and transmission stations. All providers of electrical services should inspect rights-of-way and establish a program of routine brush and limb removal. It may be appropriate in some cases to purchase or lease additional right-of-way to help eliminate potential damages by limbs or trees.

Because of the costs associated with the placement and maintenance of underground lines and the immediate need to restore power to a disaster area, efforts to bury lines during a disaster are usually not appropriate. However, as new lines are considered and/or replacement lines are needed, the providers should thoroughly investigate replacing these lines with underground lines. This concept may be more appropriate with more urban or defined incorporated areas.

D. All Hazard

1. Public Awareness

Insurance industry and emergency management research has demonstrated that awareness of hazards is not enough. People must know how to prepare for, respond to, and take preventative measures against threats from natural hazards. This research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns.

Although concerted local and statewide efforts to inform the public exist, lives and property continue to be threatened when segments of the population remain uninformed of, or choose to ignore, the information available. Educating the public of these life and property saving techniques must remain a high priority item at the local, State, and Federal level.

V. Funding Sources for Implementing Mitigation Measures

A. State

1. Louisiana Statewide Flood Control Program

The State of Louisiana, Department of Transportation and Development administers an annual fund of $10 million for flood damage reduction projects. These funds are distributed based on project merit and a formula to ensure statewide participation. Project funds are usually cost-shared up to 70% - 30% state-to-local ratio. While these funds are limited, parishes across the state have utilized this program with significant benefit.

2. State Hazard Mitigation Grant Program

The State of Louisiana through the Louisiana Office of Emergency Preparedness (LOEP) has a limited program where hazard mitigation projects are funded. The state legislature has made funds available through Capital Outlay appropriations several times in the past several years. Program guidelines mirror that of the Federal Hazard Mitigation Grant Program, with some emphasis placed on the small watershed and drainage projects. In addition, past projects have been funded that do not fit the traditional definition of mitigation (i.e. flood warning networks, public awareness, and planning), but have resulted in reduced response time possibly saving life and property. Project funds are usually cost shared at a 50% - 50% ratio.

2. Interim Emergency Board

The Interim Emergency Board (IEB) meets after the Governor declares a State of Emergency, in an effort to aid local and state agencies. All IEB requests must follow the HMGP grant procedures in order to be considered for funding. In most cases the

local or state agencies do not have adequate funds budgeted for the unexpected disaster expenses. The appropriation requested would be to reimburse local parishes and state agencies for expenditures made in connection with declared state emergencies.

B. Federal Emergency Management Agency (FEMA)

1. Hazard Mitigation Grant Program

FEMA makes funds available after a Presidential declared disaster for mitigation measures. The funds are available for both structural and non-structural projects with an approved Federal share up to 75%. The grant program is authorized by The Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (P.L. 93-288), and was amended by the Hazard Mitigation and Relocation Assistance Act of 1993 (P.L. 103-181) and the Disaster Mitigation Act of 2000 (P.L. 106-390). The amendment of 1993 increases the Federal share of a mitigation project from 50% to 75%, increases funding to 15% of all disaster assistance provided under the Stafford Act, and clarifies the conditions of acquisition of flood prone structures. The amendment of 2000 establishes a new requirement for local and tribal mitigation plans; authorizes up to 7% of HMGP funds available to a State to be used for development of State, local, and tribal mitigation plans; and, provides for States to receive an increased percentage of HMGP funds (from 15% to 20%) if, at the time of the declaration of the major disaster, they have in effect an approved State Mitigation Plan that meets the factors in the law. The State will create a list of priority projects to be funded under this program.

2. Flood Mitigation Assistance Program

As a result of the Reigle Community Development and Regulatory Improvement Act of 1994, the Flooded Property Purchase Program (Section 1362 of P.L. 95-128) was repealed. In its place is a new National Flood Mitigation Fund, which, under Title V, authorizes $20 million annually (less during a three-year phase in period) to be transferred to the mitigation fund from the National Flood Insurance Fund. The fund will provide grants to state and local jurisdictions on a 75% - 25% cost share ratio for planning and implementation of mitigation projects such as acquisition, elevation, relocation, flood-proofing, and technical assistance. Major structural flood control projects are specifically excluded from funding.

3. Project Impact

Building a Disaster Resistant Community is an initiative that challenges the individual communities to undertake actions that protect families, businesses and communities by reducing the effects of natural disasters. It is designed to help build a

partnership between all facets of a community including: Government, Business, Education, and Industry. Ultimately, reducing the effects of natural disasters makes economic sense and is good public policy because it protects our citizens and our future. The collaboration, preparation and prevention found in ***Project Impact*** should be the way in which our nation, our states and our communities conduct their day-to-day business.

C. Corps of Engineers

1. General Investigations

The Corps of Engineers, operating under Congressional authority to investigate the feasibility of providing flood damage reduction measures for the Mississippi River and its Tributaries (of which the Atchafalaya River Basin included) is currently conducting two flood control studies that compass the study area. In the Lower Atchafalaya and Morganza to the Gulf studies, comprehensive alternative plans, that would reduce flood damages from riverine, tidal and stormwater sources, will be evaluated. General Investigation Studies requires local cost sharing (50%). The State of Louisiana, Department of Transportation and Development, is the local sponsor for effective and environmentally sound, may qualify for federal participation. Currently, qualified projects can receive up to 75% federal funding. The parishes in the study area could receive significant benefits from these projects. The lower Atchafalaya and Morganza to the Gulf studies will be completed in four years with subsequent project construction occurring 5 to 10 years thereafter.

2. Continuing Authorities

Under a blanket congressional authority that allows the Corps to respond more quickly to water resource development needs, the Corps currently administers its Continuing Authorities program. The Corps may take direct action under this program provided that the specific project is under a specific cost limit. For these smaller projects, a one-year feasibility study is performed. Like General Investigation studies, these studies require 50% local cost sharing. Projects identified as cost-effective and environmentally sound may qualify for up to 75% federal funding. Specifically, there are three types of Continuing Authorities projects that may assist the parishes with their flood damage needs.

* Section 205; General flood damage projects under $5,000,000
* Section 208; Waterway clearing and snagging projects under $500,000.
* Section 14; Emergency streambank and shoreline protection under $500,000.

3. Floodplain Management Systems

The Corps of Engineers also administers a flood plain management program (Flood Plain Management Systems (FPMS) to encourage and guide state and local governments towards prudent use of the nation's floodplain for the benefit of the national economy and welfare. The Corps has the capability to provide a full range of technical services and planning guidance on floods and flood plains. Over the year the Corps has developed a wealth of information that can be helpful to state and local governments. This includes historical flood data, field survey data, aerial photography and maps. The Corps has performed numerous flood control, flood insurance and flood hazard evaluation studies that are valuable sources of flood information. This data may include information on flood formation and timing, flood depths, flood water velocity, extent of flooding, duration of flooding, flood frequency, obstruction to flows, regulatory floodways, and natural and cultural resources values of flood plains. A wide range of technical assistance can be provided to state and local governments. Some of those services are flood warning studies, floodway studies, flood damage reduction studies, flood forecasting studies, flood-proofing studies, flood damage surveys, GIS/Digital mapping, flood awareness workshops, non-structural measures, workshop, and to provide technical information for local community rating systems.

D. Department of Housing and Urban Development

1. Community Development Block Grants

The Department of Housing and Urban Development Community Development Block Grants (CDBG) provide funds for some limited flood damage reduction projects and renovate or elevate homes in the 100-year flood plain. The criteria for the block grants require that a homeowner be of low income. Homeowners are considered low income if their annual income is below 50% of the average annual income of the parish they reside in. Currently there is a $20,000 per house renovation cap. Community Development Block Grants can be used to relocate floodplain homes to locations out of the flood plain where they want to relocate to and the relocation must be tied-in with the renovation of the structure. These grants must be used with other programs because $5,000 to $10,000 of the maximum allocated $20,000 must be used to relocate the home; thus, additional funds for renovation would be required from other sources.

E. Natural Resources Conservation Service

1. River Basin Studies

Cooperative river basin studies are implemented whereby a steering committee of interested agencies, governmental bodies, and individuals is formed to coordinate the assimilation of existing resource information. The group analyzes the information and alternatives are formulated without regard how they are funded.

This process is program neutral so that the best alternative will be selected. Potential funding sources for the selected alternative are identified.

2. Watershed Projects

Watershed projects are usually smaller scale projects that are attached to a funding mechanism that requires cost sharing by a local sponsor. Most of these projects are multipurpose in nature, including drainage, flood protection and prevention. Currently the highest priority for funding includes projects for water quality improvement and wetland restoration.

3. Floodplain Management Studies

Floodplain management studies are requested by a local unit of government to address a flooding situation. The studies are usually focused on a specific stream or stream system. These studies consist of surveying the area and doing hydrologic and hydraulic analyses to determine water elevations that will be reached for a given storm event. Based on results of the study, recommendations are made to the sponsors on how to best manage the floodplain.

4. Emergency Watershed Protection

The objective of emergency watershed projects program is to assist in relieving imminent hazards to life and property from floods and products of erosion created by natural disasters that cause sudden impairment of a watershed.