

# HURRICANE IKE

## IMPACT REPORT



## Foreword by Jack Colley, Chief, Governor's Office of Homeland Security

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December 8, 2008

The 2008 hurricane season came on the heels of six months of an already challenging period for homeland security in Texas. The entire spectrum of threat, risk and vulnerability in Texas has been tested and measured. The State has continued to secure and protect our border with Mexico and at the same time endured the longest and prolonged wildfire season in our State's history. In less than 60 days during the summer, Texas was assaulted by Hurricanes Dolly, Gustav, Ike and Tropical Storm Eduardo. Of these, Hurricane Ike will likely go down in history as the most costly and destructive storm ever to hit Texas.

Since then, Texas has been dealing with the extensive damage to our coastal infrastructure, businesses and neighborhoods. Hurricanes Katrina and Rita reminded the nation that recovery from catastrophic disasters has to be a combined effort of individual, governmental, private and non-profit organizations who must work together. The State is working closely with both local and federal partners to secure the relief needed so that affected Texans can continue the process of rebuilding.

An important part of recovery is the identification of all damages and assessing the impact on individuals and their communities. This assessment has been ongoing at various levels since the day of hurricane landfall. Quick assessments guided the response efforts while more deliberate assessments helped identify counties to be added to the federally declared disaster. Various agencies and organizations conducted assessments to fulfill their governmental responsibilities or to fulfill business agreements such as insurance policies. The Governor's Commission for Disaster Recovery and Renewal conducted an interim assessment in order to prepare an outline of Texas' funding needs entitled "Texas Rebounds".

The *Hurricane Ike Impact Report* will also greatly contribute to improving the knowledge base of the impacts of this hurricane. It combines assessments from numerous agencies which have the common goal of community and economic recovery. I thank everyone who contributed to this report and look forward to witnessing the renewal of the impacted communities of this State.

Sincerely,

A handwritten signature in black ink, appearing to read "Jack Colley".

Jack Colley  
Chief

## Foreword by Federal Coordinating Officer, Stephen M. DeBlasio, Sr.

We knew before Hurricane Ike even made landfall that it was going to be big, and that the recovery process was likely to be among the most complex the nation has ever experienced. So far, the numbers are proving this to be true, with latest estimates making Ike the third costliest storm in U.S. history.

From the outset, this report is intended to be a living document that will be refined as more information about the impacts of Hurricane Ike becomes known. It is a starting point, a snapshot of our current understanding, and it is hoped that it will be useful as a tool that can inform and guide our recovery efforts during a period of upheaval for so many residents of the upper Texas Gulf Coast.

This *Hurricane Ike Impact Report* is a first-ever attempt to comprehensively compile the damage assessment and impact information of federal, state and local governments for use in the long-term recovery process. As with most firsts, suggestions for how to improve the joint assessment process will certainly arise, and they will always be welcome.

It is my sincerest hope that the *Impact Report* will help fill the need for more collaboration and coordination as we attempt to address long-term community recovery.



Stephen M. DeBlasio, Sr.

Federal Coordinating Officer, DR-1791-TX  
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## Acknowledgements

Developing a document such as the *Impact Report* requires many hours of work and a commitment to community recovery beyond measure. Recognizing the contributions of the organizations and individuals involved in this effort only begins to extend appreciation for the dedication and work that culminated in this publication.

This document contains the original research of over 17 federal agencies, offices and programs:

- U.S. Department of Housing and Urban Development (HUD)
- U.S. Department of Health and Human Services (HHS)
- U.S. Department of Transportation (USDOT) - Volpe National Transportation Systems Center
- U.S. Department of Agriculture (Farm Service Agency and USDA Rural Development)
- Corporation for National and Community Service (CNCS)
- Environmental Protection Agency (EPA)
- U.S. Department of Labor - Bureau of Labor Statistics (USDOL-BLS)
- Economic Development Administration (EDA)
- U.S. Small Business Administration (SBA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Geological Survey (USGS)
- Department of Homeland Security (DHS) Private Sector Office
- DHS Office for Civil Rights and Civil Liberties
- Texas ESF #14 Long-Term Community Recovery

Other agencies that contributed damage and impact assessment information include:

- National Oceanic and Atmospheric Administration (NOAA)
- Texas General Land Office (GLO)
- Texas Department of Housing and Community Affairs (TDHCA)
- Texas Office for Rural and Community Affairs (ORCA)
- Texas Commission on Environmental Quality (TCEQ)
- Texas A&M University - The Texas Sea Grant Program
- Texas Governor's Office
- Texas Governor's Division of Emergency Management (Public Assistance, Hazard Mitigation and Human Services programs)
- Texas Parks and Wildlife Department (TPWD)

Texas Department of Transportation (TXDOT)

Texas Association of Regional Councils

U.S. Army Corps of Engineers (USACE)

U.S. Coast Guard (USCG)

U.S. Department of the Interior (DOI)

FEMA Public Assistance Program, Individual Assistance Program, Mitigation Programs,  
and Environmental and Historic Preservation Branch

FEMA National Disability Coordinator and Office for Equal Rights and Opportunities

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## Executive Summary

On Saturday, Sept. 13, 2008, Hurricane Ike made landfall over Galveston, Texas, around 2 a.m., with maximum sustained winds nearing 110 mph (175 km/h) and some higher gusts. At the time, Ike was an extremely large Category 2 hurricane with hurricane-force winds extending outward up to 120 miles (195 km) from the center and tropical storm-force winds extending outward up to 275 miles (445 km). At its biggest, Ike would have covered most of Texas.

Damages from Ike are still being tallied, although estimates suggest that the total could reach into the tens of billions of dollars. Ike may very well become one of the costliest hurricanes in U.S. history.

Ike followed Hurricanes Gustav, Dolly and Rita, as well as Tropical Storm Eduardo, all of which struck the upper Texas Gulf Coast within a three-year span. Devastating storms such as Ike have plagued the Southeast Texas coast for centuries, costing thousands of lives and placing overwhelming strains on communities, families and individuals.

History illustrates that the upper Texas Gulf Coast will always live with the potential for disaster. However, communities that call the coast their home may be able to reduce or even avoid many of the impacts of these storms by examining the effects, areas of vulnerability and incorporating these elements into their recovery. This report provides a starting point for bringing together the full scope of Hurricane Ike's impacts.

### GOAL

The primary objective of this effort is to provide a central point for the collection and dissemination of information gathered from preliminary damage and impact assessments of various federal, state and local agencies and private-sector organizations.

### AUDIENCE

The primary audiences for this report include:

- State and federal agencies that seek to effectively use and coordinate program resources to support community recovery.
- Public and private organizations, businesses, associations and universities that have resources and/or expertise that can help communities recover from Hurricane Ike.
- Local officials and residents interested in learning about the overall impacts of Hurricane Ike.

### IMPACTS OF HURRICANE IKE

This report discusses the impacts of Ike on the social, built, economic and natural environments, as well as the cumulative impacts of storms in this region and steps for mitigation and long-term recovery. Some of the key issues facing communities along the upper Texas Gulf Coast are summarized below:



## **Social Environment**

Ike has placed immediate and long-term strains on the ability of impacted communities to provide access to health care and specialty health services; basic, yet essential human services, including child care, public education and senior support systems; and temporary support and financial assistance for many individuals and families. The storm caused major damage to six hospitals in the greater Houston metropolitan area and three in the greater Beaumont area. The University of Texas Medical Branch - Galveston estimated damages totaling nearly \$710 million, including lost revenue due to the closure of the hospital's facilities. Certified nursing homes lost much of their bed capacity, including up to a 45 percent loss in Chambers County.

At the same time, communities may face a number of public health concerns following a disaster, ranging from mental health issues (i.e., Post-Traumatic Stress Disorder, depression, etc.) to a variety of physical hazards (i.e., disease, smoke inhalation, lead poisoning, etc.). Communities will need to evaluate ways to mitigate these hazards, such as improving public education regarding these issues, immunization and other safety measures.

The impacts of Hurricane Ike have had compounded effects on individuals with disabilities, the elderly and others with special needs who rely on support to live independently in the community. Special needs populations will require focused attention and assistance to successfully recover from the disaster, and engagement of these populations, as well as nongovernmental and nonprofit organizations that represent their special interests, will be key to a successful recovery.

## **Built Environment**

The built environment is comprised of human-made structures, which may include buildings, roads, bridges and other infrastructure. Estimates from cities and counties in the areas impacted by Ike indicate approximately \$3.4 billion in total housing damage. Of those losses, an average of 27 percent of wind damages were uninsured, and an average of 61 percent of flooding damages were uninsured. These individuals and families will face difficult decisions regarding whether to rebuild or not, and if so, how.

The State of Texas has also identified a need of \$2.4 billion for erosion, waterway dredging and other infrastructure repairs to navigable waterways, ports and coastlines. The Port of Galveston, which is owned and operated by the City of Galveston, sustained extensive damage to its cruise terminal, including sediment deposits and saltwater damage. Estimates of damages to water and wastewater plants along with damages to government buildings are in excess of \$1.7 billion, including the improvement of storm preparation equipment. In addition, the State of Texas has identified a need of \$131.8 million to repair damage to the impacted areas' transportation systems.

During the recovery process, there will be a need for strategies to rebuild residential and municipal structures in a manner that meets hazard mitigation standards while achieving affordability and accessibility objectives. Communities should consider the accessibility needs of individuals who are elderly and/or have disabilities, especially when rebuilding housing and transportation systems.

## Economic Environment

The 2.7 million workers in the counties of Harris, Galveston, Chambers, Orange and Jefferson - those most affected by Ike - represent 26.6 percent of the state's total employment and contribute \$123.5 billion to the state's economy. Workforce shortages were already a problem in many parts of the upper Texas Gulf Coast, which has only been exacerbated by disruption in the economy.

Flooding from Ike's surge will require the replacement of machinery, computers and other equipment crucial to the operation of business. In addition, hundreds of miles of fencing, farm machinery and equipment also sustained significant damage. Land inundated by saltwater could possibly take two to three years to become fertile again, hence affecting the ability of ranchers to rebuild their livestock populations.

The overall economic impact is still being assessed, but preliminary estimates suggest Ike may become one of the costliest hurricanes on record. Ike has impacted numerous industries in the area, including the petrochemical, health care, agriculture and forestry, fishing, tourism, nonprofit and small business sectors. However, despite the devastation, economic development professionals remain positive, and many local officials note that the region has begun to recover very quickly thanks to fairly well-organized communities.

## Natural Environment

Saltwater intrusion from Ike's surge has left large swaths of the upper Texas Gulf Coast in ecological upheaval, including wetlands and other natural habitats. Natural processes may eventually return portions of these areas to their pre-disaster states, but the recreation, leisure and ecotourism uses of these areas will be disrupted in the meantime.

Other ecosystems suffered serious effects that could have lasting impacts for decades, including the oyster beds and fishing grounds that have been covered by sediment from the retreating storm surge in Galveston Bay, Trinity Bay, Sabine Lake, the Chenier Plain marshes and marshes inland from the eroded beach ridge at the McFaddin National Wildlife Refuge. Oyster beds provide important habitats for other species and also contribute to the overall quality of the water in these areas since they naturally remove nutrients, algae and pollutants through their filter feeding process. The full impact to these environments and on the catch value for oysters and other species may not be known for at least a year, and perhaps longer.

In addition, millions of yards of debris still exist in the affected areas, including on private residences and agricultural lands, as well as in wetlands. On Nov. 27, 2008, the federal government agreed to pay 100 percent of the cleanup costs for an additional six months, but once this time passes, FEMA reduces its rate to the standard 75 percent.

\*\*\*\*\*

The number of entities involved in this report demonstrates the commitment of many organizations and people across the country to rebuilding Texas. State and federal partners are actively working with communities as they move from disaster response and short-term planning to long-term recovery. It is critical that all parties continue to share information, ideas, knowledge, talent and time as the lengthy, challenging work of long-term community recovery continues.

## Chapter I – Social Environment

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### Introduction

Hurricane Ike delivered a heavy blow to the communities along the upper Texas Gulf Coast. The damage to homes, personal property, the environment and local businesses in the midst of a national economic downturn have set these communities on a challenging road to recovery. Limited access to essential life services (i.e., health care, child care, individual support services, etc.) has greatly impacted quality of life for many individuals and families and will require the reestablishment of a variety of social support networks. Many people will need temporary support and financial assistance to cope with the aftermath.

Individuals with special needs (i.e., individuals who have disabilities, who live in institutionalized settings, who are elderly, who are children, who are from diverse cultures, who have limited English proficiency or are non-English speaking, or who are transportation disadvantaged) often require additional support before, during and after a disaster to maintain their independence and involvement in a community. Compared to other regions in Texas, the areas impacted by Ike have generally higher rates of these populations.

Nonprofit organizations meet critical needs through a wide array of programs and services related to disaster relief services, emotional trauma, employment and job loss, housing, and other social services. However, nonprofit organizations themselves also face difficult challenges following a disaster and may need significant levels of support from funders, including local, state and federal governments, in order to resume operations or provide additional assistance.

This chapter will identify the social impacts of Ike in terms of the overall health, welfare, safety and livelihood of individuals and families in the impacted areas, including challenges particularly faced by the special needs populations and the organizations that support them.

## Key Issues

### A. Availability of Health Care Services

Following a disaster, communities face a multitude of challenges in their ability to provide adequate medical treatment, especially emergency room services, due to damage to medical facilities as well as an influx of people seeking care. Increased financial stress places additional limits on the ability of individuals and families to acquire basic health services, and increased rates of unemployment and loss of insurance benefits only exacerbate these issues.

Ike damaged several of the long-term care facilities (i.e., nursing homes, assisted living facilities and intermediate care facilities) and hospitals, and their recovery will greatly impact the health and wellness of people in these communities. In addition, specialty health care services, particularly those important to special needs populations, can take much longer to reestablish.

### Nursing Homes<sup>1</sup>

Chambers County saw a 45.5 percent capacity loss of certified nursing home beds, more than any other county as a result of the storm. The Anahuac Healthcare Center, which held 100 beds, was evacuated to Hearne and Hamilton due to severe damages and has been closed permanently. With only 120 certified beds, capacity in Chambers County has decreased from 7.6 to 4.2 beds per 1,000 people. The county now has an immediate need for at least 45 beds to meet its pre-hurricane occupancy (Texas Department of State Health Services, Select Health Facts, 2002).

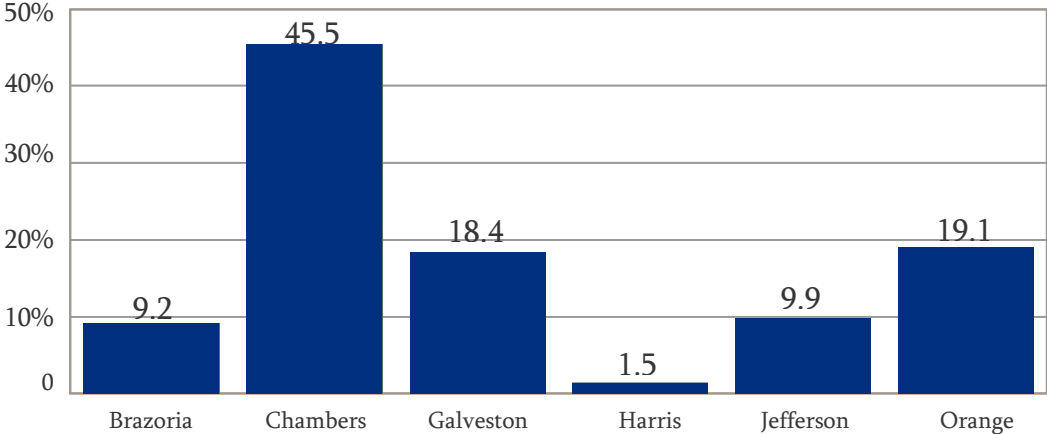
Other counties also suffered severe losses. In Galveston County, the Gulf Health Care Center (150 beds) and the Turner Geriatric Center (164 beds) were evacuated and remain closed for an undetermined period. In Orange County, the Orange Villa Nursing and Rehabilitation home (112 beds) was also evacuated but anticipates reopening in February of 2009. The City of Beaumont in Jefferson County has eight nursing homes, of which the College Street Health Care Center (50 beds) and the Pine Forest Nursing and Rehabilitation Center (130 beds) have not yet reopened due to damages. The Pine Forest Nursing and Rehabilitation Center will remain closed until February of 2009. In the City of Alvin in Brazoria County, the Winchester Lodge Healthcare Center (94 beds) has been closed indefinitely due to severe damages with no available timeframe for repair or reopening. In Harris County, the Lawrence Street Health Care Center (150 beds) sustained major roof damage and plans to reopen sometime in early January of 2009.

Information on the number of certified nursing home beds before and after the storm, as well as the overall percent capacity loss for each county impacted by Hurricane Ike, is summarized in the table and chart below:

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<sup>1</sup> Data verified through reference <http://local-nursing-homes.com>, and Texas Department of Aging and Disability Services

**% Capacity Loss of Nursing Home Beds by County**



Population by County					
287,898	28,779	283,987	3,886,207	243,914	84,243
Pre-Disaster Number of Available Certified Beds					
1,017	220	1,705	9,727	1,817	587
Post-Disaster Number of Available Certified Beds					
917	120	1,391	9,577	1,637	475
Change in Beds per Capita per 1000 People					
3.5-3.2	7.6-4.2	6.0-4.9	2.5	7.5-6.7	7.0-5.6

**Assisted Living Facilities<sup>2</sup>**

At 15.9 percent, Galveston County experienced the greatest capacity loss of assisted living facility beds, resulting in a decrease in overall capacity from 2.1 to 1.8 beds per 1,000 people. Three of the county’s 15 facilities included the Transitional Learning Centers in Galveston, which together held a total of 62 beds and have been closed indefinitely, with tentative plans to reopen in January or February of 2009. In all, Galveston County lost nearly 100 certified beds in the storm.

In Jefferson County, the Rose House (58 beds) sustained significant damage and has not set a timeframe for reopening. In Brazoria County, the Evening Shade and Kozy Korner facilities, which each held six beds, have been evacuated and closed with no word yet on when they plan to reopen. In Harris County, Home Away From Home Care Services, Inc., (12 beds) also sustained significant flood damage, with repairs estimated to be completed in late November of 2008.

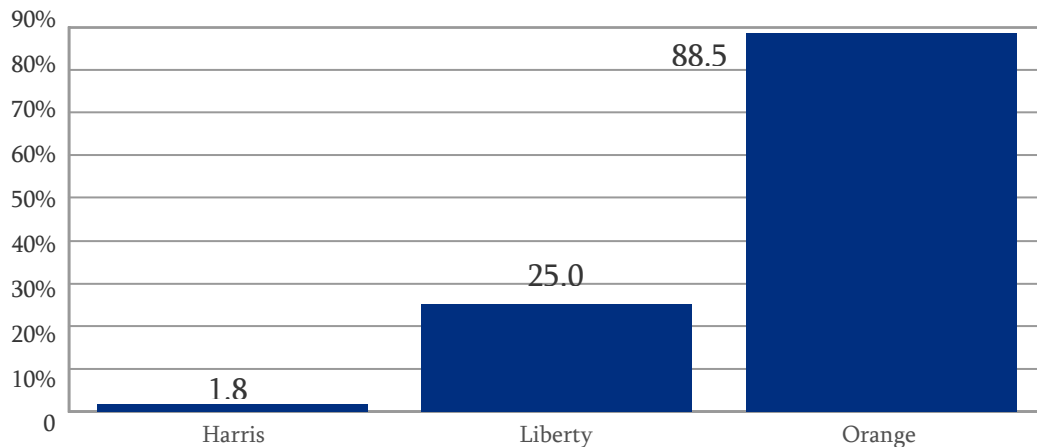
<sup>2</sup> Data verified through Texas Department of Aging and Disability Services

### Intermediate Care Facilities Serving People with Intellectual Disabilities<sup>3</sup>

Orange County had an 88.5 percent capacity loss of intermediate care facilities, thereby reducing its overall capacity from 0.6 to 0.1 beds per 1,000 people, well below the state average of three beds per 1,000 people. Closed facilities include the Green Acres Development Center (40 beds) and the Westmount Community Home (six beds). The Green Acres Development Center has been closed permanently. Likewise, in Liberty County, Avenue B House (six beds) has been closed due to major roof damage, with no estimated timeframe for repairs or reopening. Although capacity remains unchanged in Harris County, the Bosworth Living Center (six beds) also sustained significant damage.

Information on the capacity loss of intermediate care facility beds for each county is summarized in the table and chart below:

**% Capacity Loss of Intermediate Care Facility Beds by County**



Population by County		
3,886,207	75,685	84,243
Pre-Disaster Number of Available Certified Beds		
651	24	52
Post-Disaster Number of Available Certified Beds		
639	18	6
Change in Beds per Capita per 1000 People		
0.2	0.3-0.2	0.6-0.1

<sup>3</sup> Data verified through Texas Department of Aging and Disability Services.



## Hospitals

As of late October, five hospitals serving the areas impacted by Hurricane Ike remain closed while one hospital is operating at limited capacity.

The University of Texas Medical Branch (UTMB), a Level I Trauma Center on Galveston Island, received substantial damage, and except for a few clinics, has been closed since the storm. Before the hurricane, UTMB was the third largest hospital in the Houston-Galveston region and the only hospital in Galveston, serving a nine-county region in Southeast Texas, including the Greater Houston area and a range of patients requiring specialized services from across the state. UTMB's entire health care complex spans 85 acres and includes seven hospitals, as well as an assortment of specialized clinics, centers, institutes and a medical school.

Even before Ike, UTMB was in the process of reducing its number of hospital beds from 600 to 500. UTMB estimates damage from Ike will cost nearly \$710 million, which includes \$276 million from the loss of revenue due to the closure of the hospital's facilities. Storm insurance covers only \$100 million of these costs. The hospital, which is the medical school's main source of income, is operating at substantially reduced capacity, and as of late November, is still not functioning as an emergency care facility. Emergency vehicles are being sent to the mainland.



Photo: University of Texas Medical Branch-Galveston (UTMB)<sup>4</sup>

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<sup>4</sup> <http://www.flickr.com/photos/utmb/2888070490/in/set-72157607488167328/>

In addition to UTMB, the losses of the East Houston Regional Medical Center (EHRMC) and Winnie Community Hospital pose the greatest negative impacts to their respective communities. With 131 beds and 600 employees, EHRMC is the only Level IV Trauma Center in East Harris County and is projected to remain closed through mid-December. Winnie Community Hospital, on the other hand, is operating at limited capacity, treating patients who only need minor urgent care. It is designated as a Critical Access Hospital by the Medicare Rural Hospital Flexibility Program, holds 25 beds and serves the communities of East Chambers County and West Jefferson County with a total service population of 2,500.

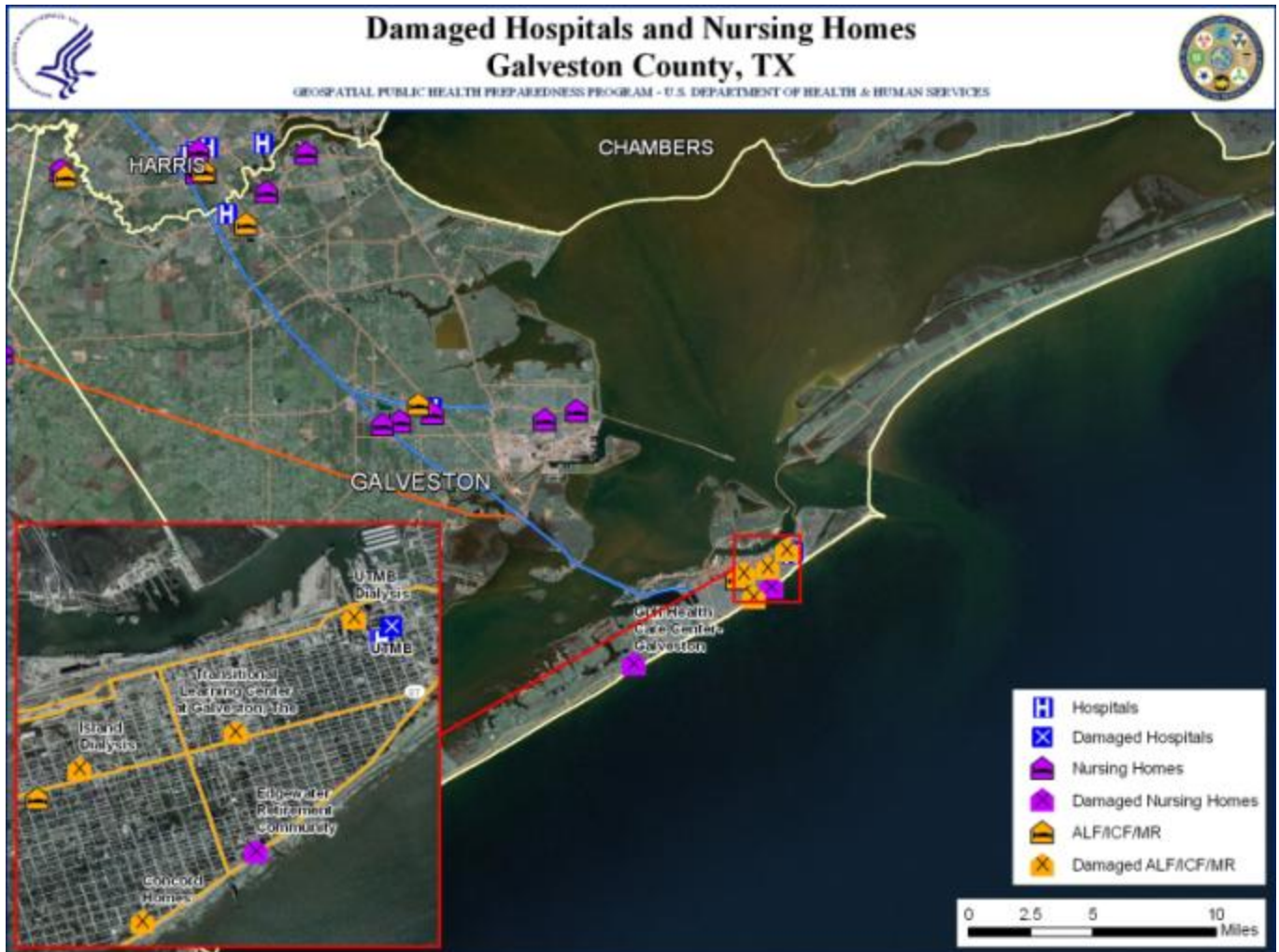
Other hospitals that experienced damage and closed during the storm include:

- 1) Dubuis Hospital, a 15-bed, hospital within a hospital that treats long-term acute patients (reopened on October 15);
- 2) Renaissance Hospital, a 39-bed, hospital specializing in gastric bypass surgery; and
- 3) Doctors Hospital Parkway, a 180-bed, acute-care hospital that provides a broad range of primary care and specialty services in the medically underserved communities of North Houston.

The closure of Doctors Hospital Parkway affected 300 full-time employees and is expected to remain closed through March of 2009. Many of the employees relocated to the hospital's second campus, Doctors Hospital Tidwell (101 beds), which is still in operation.

The map below illustrates the number of hospitals and long-term care facilities damaged in the impacted areas.





## B. Public Health Concerns

Disasters can also lead to a variety of public health issues, some of which will be mitigated during the initial response period, and others that have the potential to remain issues for years to come.

Research indicates that the need for mental health services significantly increases approximately six months following catastrophic disasters, especially for treatment related to depression and Post-Traumatic Stress Disorder. Although most individuals will not develop ongoing behavioral and mental health problems, the World Health Organization estimates that between five and 10 percent of disaster survivors will experience more serious, long-term issues that can result in lasting public health and social consequences.<sup>5</sup> As the initial shock subsides, these reactions may surface within weeks, months or even years following the event.

<sup>5</sup> Bearne C, Diaz E, Friedman M, Norris F, Watson P. 60,000 Disaster Victims Speak: Part I. An Empirical Review of the Empirical Literature, 1981-2001.

Disasters also put people at risk for a wide range of physical health problems. Disaster survivors and workers may face a variety of residential and occupational hazards as they attempt to restore housing and businesses. There is also a greater potential for exposure to hazardous materials throughout the rebuilding process. Some of these health hazards include:

- Diseases
- Air Contamination
- Smoke Inhalation
- Lead Poisoning

Children have an increased risk of injury when returning to hurricane damaged areas, as they often play among debris and other hazards.<sup>6</sup> In addition, they are subject to an increased likelihood of physical abuse, as parents and guardians become stressed in the aftermath.<sup>7</sup>

### **C. Impacts on Access to Child Care Services**

The recovery of child care services and after-school programs is critical to the overall social and economic long-term recovery process, as many families rely on these support services so that they can return to work. A large percentage of child care providers in the region face serious financial challenges. Early estimates indicate that Ike damaged at least 68 percent of the child care centers and family child care homes. Twelve percent of these providers report major damage or damage so severe that they will likely not reopen. Galveston Island and other coastal communities report much higher rates of major and catastrophic damage.

In addition, approximately 90 percent of child care providers depend on parent tuition paid for services rendered. However, many of them were unable to collect fees from the day before the storm up until at least one week after. As a result, these providers do not have the financial resources to repair their facilities or pay their staff. The State of Texas, along with a collaboration of local agencies and other organizations, estimates it will take approximately \$4 to \$6 million in assistance programs to help child care providers become whole again.

In Harris County, Collaborative for Children, the region's child care resource and referral agency, estimates that the parents of 44,000 to 50,000 young children currently enrolled in area child care centers will have to find temporary solutions. The group has partnered with the YMCA, Galveston Independent School District (GISD), Save the Children and Kaplan Early Learning Company to create a temporary child care center in the GISD San Jacinto campus, which will serve up to 176 young children on Galveston Island.

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<sup>6</sup> Child injuries another danger after hurricane with parents overwhelmed by storm's aftermath, accidents happen, By TODD ACKERMAN and CINDY GEORGE  
Copyright 2008 Houston Chronicle

<sup>7</sup> Increased incidence of inflicted traumatic brain injury in children after a natural disaster. American Journal of Preventative Medicine. Volume 26, Issue 3, Pages 189-193. H. Keenan

#### **D. Concerns about Public Education**

Education is the foundation upon which a community shapes its youngest members who will one day contribute innovation and creativity to the social and civic arenas. However, disasters can significantly impact a community's ability to provide quality educational services, especially for children with special needs. Ike damaged several early childhood education and Head Start programs, which cater to children of economically disadvantaged families. The hurricane flooded the Head Start Center in the West Orange-Cove Consolidated Independent School District in Orange County, which served 239 children. In Galveston County, the Ziegler Head Start Center, which served 100 children, sustained shattered windows and water damage to its five buses, two vans and two trucks. Ike also destroyed the Bolivar Head Start Center, which served 18 children. These centers will need to repair or rebuild their facilities and replace their transportation fleets.

Children who have intellectual or physical disabilities or have been diagnosed with autism will require educational opportunities tailored to meet their special needs. Many families returning to their communities may be concerned that the restoration of special education services in the restored schools will lag behind other general educational programs. The physical damage to schools and displacement of families can also lead to a loss of key records, including the Individualized Education Program (IEP) documents for children with special needs. IEP's contain carefully crafted learning objectives for each student and can serve as authorization for supportive services that are critical for the student's success over several years. It is vital that schools reestablish these plans as soon as possible and without a loss in services following a disaster.

In addition, state education representatives report that nearly one-quarter of the population in Galveston lives in poverty and more than 60 percent of the children in this area receive free or reduced-price lunches in school. These percentages indicate another pivotal role of schools for many low-income families during long-term recovery.

#### **E. Challenges with Individual Support Systems**

Many individuals with special needs may not be able to maintain their independence without the aid of individualized support systems. For instance, some individuals who are elderly rely on home-delivered meals or regular housekeeping assistance, and many individuals with intellectual disabilities require assistance with daily activities, such as developing a grocery list, paying bills and balancing their checkbooks. Disasters often result in the loss of these systems, thus jeopardizing the independence of the people who rely on them and their ability to remain active within their communities. Recovery of these systems will involve reestablishing an array of public, private and nonprofit providers who deliver these key services.

Based on recent experiences after Hurricane Rita, communities should expect a significant increase in the demand for individualized support services. This demand will also lead to an increased need for coordinators and volunteers to manage and deliver these services. For instance, in the months following Rita, area centers for independent living found that a significant number of individuals needed first-time services and training, as their families who once supported them had moved away following the disaster.

Throughout long-term recovery, communities may face challenges in terms of attracting and retaining personal care attendants who provide some individuals with assistance for everyday activities. These professionals typically receive relatively low wages, making it difficult for them to obtain affordable housing and transportation in close proximity to their clients. In addition, sign language interpreters for people who are hearing-impaired are often self-employed or part of small contract businesses that have been displaced during the disaster. Thus, locating and attracting qualified providers will be critical to supporting many of the special needs populations.

## F. Financial Security and Other Concerns

Many of the challenges families face while rebuilding are compounded by disruptions to some of the basic social support services discussed above, including child care and individual support systems. These issues can result in significant financial hardships for many of the disaster survivors as they struggle to rebuild their homes and return to work. Additional financial considerations include:

- **Cost of Accessibility** - Individuals who need home repairs or modifications for accessibility accommodations will face particularly daunting financial challenges. These individuals will encounter extraordinary expenses to replace accessibility features and other living arrangements.
- **Cost of Mental Health Services** - Other individuals may need additional services, such as mental health or drug treatment, in order to ensure their life safety, as well as assistance with the transition into more permanent housing.

Damages to senior services and centers include:

- Houston-Galveston Area Agencies on Aging (AAA) (serving Chambers, Galveston, and Brazoria Counties) provides over 1,620 congregate meals. Galveston County Senior Citizen island sites sustained severe flooding and damage.
- Neighborhood Centers, Inc. will be closed six to seven weeks for repairs to be completed.
- YWCA of Houston Bordersville Senior Center will be closed six to seven weeks. An alternate location is being considered for their congregate program.
- Bridge City Senior Center was flooded and is being rebuilt.
- Orange Community Action Association, Wallace Center sustained damage to their vans and needs replacements.

Ike will also have significant impacts on the care of displaced foster children and youth whose custody was already complicated prior to the storm. One example includes a group of undocumented children between the ages of 13 and 17 from South America and Mexico who took on the status of “unaccompanied minors” during the disaster. These children were living with caregivers who had no legal authority and were ultimately evacuated to a faith-based youth camp without caregivers. Their long-term residence status is uncertain. Foster care and child protective services will play key roles throughout the recovery process to ensure children in similar situations continue to be adequately cared for, supported and supervised.

### **G. Nonprofit Organizations and Community Groups**

The nature of many nonprofit organizations reflects a limited number of paid staff supplemented by many volunteers. Following the devastation of Ike, these organizations will find themselves stressed to the limit and their needs among some of the last issues considered in the recovery process. As a result, the overall impact of the hurricane on nonprofit organizations may not be known for several months.

Prior to Ike, approximately 30,000 nonprofit organizations existed in the 38 disaster-declared counties, half of which were located in Harris County. According to the National Civil Community Corps, damages to the nonprofit sector, including lost revenue (e.g., donations), are estimated to total \$78.3 million, which does not include estimates from Harris County or damages to churches and other cultural or civic organizations that also provide support. Some of the key challenges of nonprofit organizations include:

- Inability to repair or replace damaged facilities or other real property due to high deductibles
- Loss of client-based revenue due to the evacuation of clients
- Significant increase in clients due to impacts on family, social and community wellbeing
- Inability to meet increased needs due to the impact on the nonprofit organizations themselves or lack of additional funding to expand and increase services
- Loss of staff due to evacuation or other impacts (traumatic loss of property)
- Lack of knowledge regarding available federal and other assistance for long-term recovery
- Lack of centralized coordination and communication within the nonprofit sector itself
- Limited outreach by federal agencies that may be able to assist nonprofit organizations

The incapacitation of other community institutions, as well as the diversion of donations and other resources to immediate disaster relief efforts, may rapidly reduce sources of financial, volunteer and other support for local nonprofit organizations. Delayed, disrupted or otherwise unmet social, mental health and substance abuse treatment needs may have long-term consequences for individuals and families, thus placing an even greater strain on community services. Delay and disruption to these types of ongoing services will impact low-income communities disproportionately, as the availability of services typically provided by nonprofit organizations was already limited prior to the hurricane. These communities will experience greater challenges in



developing sufficient resources to reestablish community services, while at the same time experiencing the greatest increases in requests for assistance.

Nonprofit organizations that contribute to community life in other ways will most likely also experience a significant drop in support, especially from the local community. For instance, youth development organizations, cultural and arts organizations, sports programs and other similar community groups may lose critical funding, volunteer support or other resources due to the redirection of resources to disaster recovery efforts. One of the challenges to long-term recovery planning will be assessing the role of these types of organizations in a community's overall wellbeing and ensuring that recovery planning includes meeting the community's cultural, recreational, youth and family development needs.

### **Conclusion**

Many of the most severely impacted communities may face years of recovery before they can even begin to see their communities made whole again. The complete reestablishment of many of the social support networks will also rely heavily on the pace of recovery of the region's built and economic environments. For instance, access to health care services may depend on the rebuilding and economic viability of regional hospitals and other specialty care facilities. Other services, such as child care and individualized support systems, will depend largely on the ability to once again attract these service providers to the region.

Because the social environment deals with diverse groups of people with varying needs and desires, the engagement of all populations will be crucial to long-term community recovery. The inclusion of nongovernmental, nonprofit and faith-based organizations that represent different populations will greatly benefit communities throughout this process. These groups will serve as valuable resources in not only collecting information, but also ensuring the voices of all community groups are heard throughout the planning process.

## Chapter II – Built Environment

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### Introduction

Following most disasters, reports of damages to the built environment tend to be the most prevalent in the news. These damages include flooded homes, stores and office buildings, destroyed bridges and roads, and debris piles stretching for miles inland. Second only to the death toll, the damage to structures is what many people view as the most important measure of the scope and scale of a disaster.

Damage from Hurricane Ike is extremely extensive and widespread. Preliminary estimates from a variety of state and federal agencies place total damages in the billions of dollars, generating a consensus that when the entire damage assessment is fully understood, Hurricane Ike might very well prove to be the third costliest hurricane in recorded U.S. history, behind Andrew in 1992 and Katrina in 2005. These preliminary estimates have yet to include losses covered by the National Flood Insurance Program.

During Hurricane Ike, hundreds of thousands of homes along the upper Texas Gulf Coast were severely damaged or destroyed as a surge of up to 20 feet hit in conjunction with the high tide. Entire cities were inundated with the mud and debris that accompanied the surge. In the tiny town of Bridge City, only 14 of its 3,400 homes remain inhabitable. In Gilchrist, located on the Bolivar Peninsula, only one home was left standing when the winds stopped. Months after the storm, thousands of families across the region continue to struggle with finding places to live near their jobs and children's schools in an effort to restore some normalcy to their lives.

Observations of damage along the storm track suggest that wind was not the most significant source of storm damage, and therefore, the consensus is that most of the serious damage to homes along the upper Texas Gulf Coast was the direct result of flood water from the storm surge. The probable damage is the long-term saturation and resultant deterioration of key building elements, including framing, insulation, wall board, flooring and electrical wiring. Fortunately, most of Hurricane Ike's flood waters receded fairly quickly, meaning that some localities in Texas may avoid the total losses experienced in parts of Louisiana, where Hurricane Katrina's flood waters remained for weeks.

Most of the built environment is still being assessed for damages, and it might be some time before the data can be synthesized and analyzed to tell a complete story. Still, there was undoubtedly

catastrophic damage in several parts of the upper Texas Gulf Coast, especially on Galveston Island, the Bolivar Peninsula, Anahuac, Bridge City, and smaller fishing communities, such as San Leon and Oak Island, and these communities have extensive recovery needs. However, much of the region's built environment managed to escape serious damage. By early October, almost all water and sewer systems were back online, most schools were open, and power was back up for most homes and businesses that were in good enough condition to use it.

Amid the devastation of the coastal communities, there is a ray of hope; Ike provided the evidence that modern building and floodplain codes work when well enforced. The vast majority of housing damage in the Galveston Bay rim communities was to 1960s and 1970s vintage homes that were built prior to current floodplain regulations requiring elevation of structures. Homes built since the 1990s that were properly elevated survived, many without serious damage. The Category 2 hurricane winds were devastating to the homes on Galveston Island built to the old Southern Building Code, while modern homes built to the 130 mph standard of the International Residential Code were still standing the morning after. Modern condominiums on the island, built to 130 mph wind codes and on top of a parking garage, easily survived both the wind and surge and point the way to how areas not behind the seawall might be developed in a sustainable fashion. In the Sabine River basin in Jefferson County, the storm surge flooding devastated 1970s-era homes built on the ground. Here, the water rose to elevations greater than the 100-year flood level. But even here, those homes that were properly elevated suffered only shallow flooding and are repairable.

## Key Issues

### A. Housing

The region, which already had a housing shortage, lost over 8,000 housing units due to the storm. Concentrations of lost housing are primarily located in the cities of Port Arthur/Sabine Pass, Bridge City, City of Orange and Rose City. A number of expansion projects in the petrochemical industry were underway or ready to begin when Ike hit. These projects required a specialized labor force to be temporarily located in the region to augment existing labor. This specialized labor force is estimated to have consumed 4,000 or more housing units, placing significant pressure on the existing housing supply. The pre-Ike housing shortage coupled with the loss of existing housing supply, has placed barriers to continuing the expansion projects, thus impacting the economic stability and stimulus of the region.

According to Governor Perry's *Texas Rebounds* report, estimates from cities and counties in the disaster area indicate approximately \$3.4 billion in total damage to housing in their jurisdictions. Of that \$3.4 billion, an average of 27 percent of wind damages and 61 percent of flooding damages were uninsured. As of Dec. 1, 2008, a total of \$20,132,658 in FEMA housing assistance had been approved for 109,045 eligible applicants who had completed the registration process.



The table below shows by county the number of eligible real property losses by level of damage assessed as of Dec. 3, 2008.

County	Eligible Real Property Losses (Owners) by Level of Damage				Real Property Destroyed	
	Up To \$8,000	\$8,001 - \$15,000	\$15,001 - \$28,800	OVER \$28,800	Total Real Property Losses (Owners)	Total Count Destroyed
Orange	3,656	781	2,254	986	7,677	99
Harris	56,583	1,933	1,417	609	60,542	482
Galveston	11,420	2,427	3,495	2,232	19,574	2,228
Chambers	2,130	181	128	249	2,688	345
Jefferson	11,277	306	320	223	12,126	218
<b>Total</b>	<b>85,066</b>	<b>5,628</b>	<b>7,614</b>	<b>4,299</b>	<b>102,607</b>	<b>3,372</b>

Source: FEMA Individual Assistance

### Insurance and Rebuilding

For the most part, households with flood insurance are likely to have the ability to rebuild. The probability of having flood insurance typically increases with: (a) location in a FEMA-designated, 100-year floodplain; (b) having a mortgage; and (c) occupation by the owner.<sup>8</sup>

Absent other assistance, only people covered by the National Flood Insurance Program (NFIP) will be covered for loss due to flooding, because typical homeowners' insurance does not cover flood damage. The Standard Flood Insurance Policy will cover direct physical losses by a flood. If a dwelling has an insurance policy with a value at of at least 80 percent of the dwelling's full replacement cost value, the NFIP will pay the cost to repair without depreciation up to the policy limits or \$250,000, whichever is less.<sup>9</sup>

Single-family rental properties stand the greatest likelihood of being abandoned, even if they only sustain relatively modest damage. Single family property owners are often local residents who may own a rental unit as an investment; as landlords, they are less likely to have either economic or sentimental motivation to rebuild a property they do not occupy. As a result, many rental properties may be abandoned and could become government-owned through the tax foreclosure process. If this happens, even properties that might have been recoverable shortly after the disaster may ultimately require demolition, because the longer a unit remains unoccupied, the greater likelihood decay and mold will make the unit unrecoverable.

In the Houston MSA, about 1.91 million housing units (92 percent of the total housing stock) were undamaged, while 144,843 received minor damage (assumed to be under \$15,000, which is less than 25 percent of the median home value), and 10,747 received major damage (over \$15,000).

<sup>8</sup> Lenders generally require borrowers to have flood insurance if they are located in a FEMA designated 100-year flood plain. In addition, according to data from the American Housing Survey and Residential Finance Survey, homeowners are many times more likely to have hazard insurance, and possibly flood insurance, than either renters or landlords owning single family properties.

<sup>9</sup> Source: <http://www.fema.gov/nfip/10110412.shtm>.

**Most likely to rebuild** - 144,843 units: Owners with minor damage. Households in a FEMA-defined flood hazard area and with a mortgage are the most likely to have had flood insurance.

**Most likely to be abandoned** - 2,149 units: This is based on the assumption that 20 percent of the 10,747 homes with major damage might be abandoned. Owners of renter-occupied, single-family properties may be less likely to rebuild as there may be little financial or sentimental reason to do so, especially if they did not have wind or flood insurance and did not have equity in their homes. Due to aesthetic and high-value reasons, it is expected that damaged homes near the shore are less likely to suffer abandonment than would comparably damaged homes further inland.

**Uncertainty** - 2,687 units: This represents 25 percent of the homes with major damage. It is unclear if the remaining owner households and the landlords of the rental units will rebuild. Some will have flood insurance and rebuild. Others will have the ability and desire to rebuild through other resources such as a loan, most likely from the Small Business Administration (SBA). Some may also choose to abandon their homes altogether. Owners with a mortgage but without flood insurance may be in the most difficult position, as they are still responsible for payments on a home that may not exist anymore, but are forced to get further financing to rebuild or repair the home.

As additional inspections are performed, the estimates will change. Anecdotal reports suggest FEMA's damage estimates may be significantly lower than the actual costs of repairs, meaning the jurisdictions' estimates of \$3.4 billion might be more accurate.

Experience shows that the longer it takes to begin rebuilding, the likelier it becomes that property owners will choose to relocate rather than rebuild. Hence, it behooves communities to deliver aid as soon as possible to the property owners who need it.

### **Housing for People with Special Needs**

Following the storm, local service providers reported that while the majority of the sheltered populations have been successfully placed in transitional housing, a disproportionate number of elderly residents, large lower-income families, and individuals who are homeless, many of whom have extensive mental health needs, remained in shelters for a longer period. In several cases, retirement communities evacuated and their residents dispersed to general population shelters. As a consequence, the communities have had difficulty locating their residents to let them know when living conditions have been restored enough to enable their return.

State agency representatives reported that many elderly individuals within evacuation areas did not leave their homes. Some individuals are living in unhealthy, mold-damaged dwellings, in tents in their yards or in vehicles. Nongovernmental organizations (NGO) and governmental agencies are joining together to locate these individuals and assist in the cleaning and restoration of their homes.

### **Workforce Housing**

The number of onsite construction workers necessary to rebuild housing in the impacted areas is estimated to be 6,000 to 8,000, depending on a number of variables. For planning purposes, it would be useful to estimate an initial housing production of 5,000 units per year and also reasonable to expect that the production rate could increase.

Substantial expansion of the available Recreational Vehicle (RV) park capacity may offer the best potential for rapidly increasing workforce housing. In this regard, the buyout grants available under the FEMA Hazard Mitigation Grant Program offer a dual benefit: they both meet a housing need for an impacted homeowner and create vacant land that can be rapidly reconfigured into new, albeit temporary, RV parks.

### **B. Rural Infrastructure and Facilities**

Hurricane Ike will have a substantial long-term impact on rural communities, which often take longer to recover than urban areas because they have fewer resources at their disposal. This issue is further exacerbated as many rural areas are still recovering from previous storms, including Hurricanes Katrina and Rita. According to the U.S. Department of Agriculture (USDA), many of the facilities that it helps finance experienced light to moderate damage. Eleven facilities of the USDA Rural Development Water and Environmental Programs (WEP) were damaged, but have returned to full operation. A significant problem after the hurricane was a lack of power with no backup generators in place. An initial assessment of dollars needed for repairs and upgrades to the affected facilities was estimated to be \$9.7 million. However, these are only preliminary estimates, as USDA Rural Development has experienced some difficulty reaching or communicating with the managers of these rural facilities. Some managers have been displaced or have not yet contacted USDA Rural Development to discuss options.

### **C. Business Establishments and Industrial Facilities**

As of 2007, the 29 counties originally designated as disaster areas by FEMA are home to more than 26 percent of the total business establishments in Texas. Two-thirds of these establishments were located in Harris County (97,500 worksites) and Fort Bend County (8,100 worksites), which accounted for 72.3 percent of the establishments in all of the affected counties.

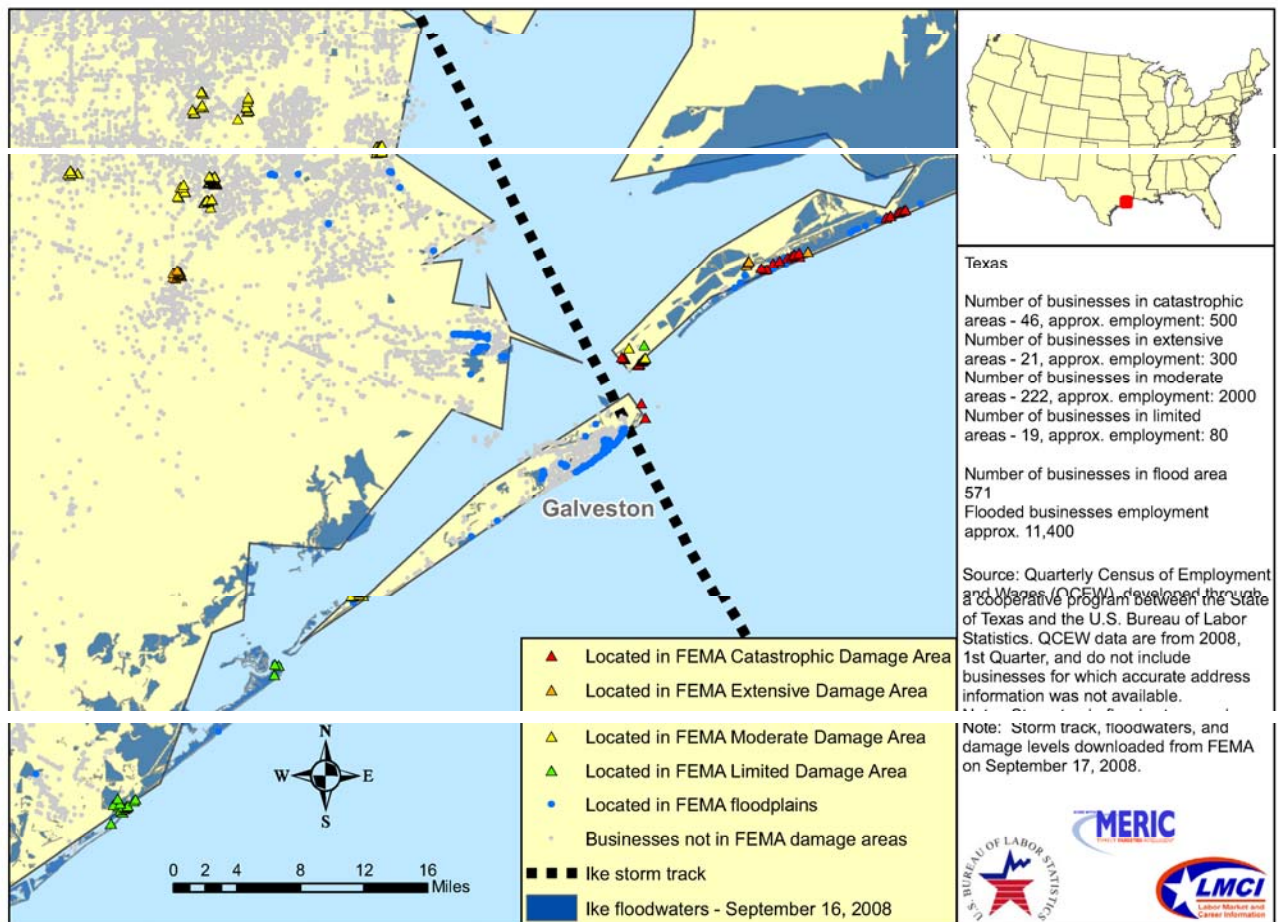
Small locally owned businesses were hit particularly hard by Ike. The majority of experts interviewed by the U.S. Department of Commerce's Economic Development Administration (EDA) stated that there is a great need for financing to get these businesses back up and running. There are concerns that if immediate steps are not taken to provide assistance to these businesses, they may never come back. This could cause great economic upheaval because many of the affected communities rely on small businesses for much of their revenue and the businesses are essential to their local economies. Of particular concern is that many small businesses sustained over 50 percent damage and may be required to elevate their businesses, rebuild them at an

elevated level or pay increased rent to finance the elevation of their businesses. Such endeavors are extremely costly and may be out of reach for small businesses that have already lost significant revenue from downtime and lost inventory.

The major industry in the region affected by Ike is the petrochemical industry. Oil refineries and supporting industries are located throughout the coastal area that has been damaged by the hurricane. Based on the interviews conducted for this report, it appears that the damage to the refineries varies significantly. However, despite the damage, the industry appeared to be well prepared for the flood, and many of the refineries are already coming back online.

As is discussed in greater detail in the Economic Environment chapter of this report, it is quite likely that the economy of the upper Texas Gulf Coast will return to pre-Ike levels. The economic and employment pillars of the region’s economy are the petroleum, petrochemical and shipping industries, which for good reason are in close proximity to the oilfields and the harbors of the coast. In addition, the costs already invested in the refineries, plants and ports in the region all but ensure that these industries are not likely to move anywhere.

**Hurricane Ike: business establishments in damage areas in Texas as identified by FEMA**



## **D. Transportation Systems**

There are more than 300,000 miles of public roads in Texas, including over 3,200 miles of Interstate highways and nearly 48,000 road bridges, as well as 11,377 miles of Class I railroad track, 382 public airports and numerous other transportation facilities.

### **Roads and Bridges**

The State of Texas has identified a need of \$131.8 million to repair damage to the transportation system, including \$53.7 million to repair damage to roads and bridges and \$78.1 million in reimbursement costs to city and county governments for debris removal from public rights-of-way, as well as aid in property and recovery efforts.

Estimated Texas Department of Transportation (TxDOT) costs include \$36.5 million to remove debris from rights-of-way not removed by the U.S. Army Corps of Engineers. The type of debris left from the storms creates specific challenges, including the removal of boats, vehicles and other large equipment from rights-of-way, some with hazardous materials.

The Rollover Pass Bridge in Gilchrist was significantly damaged, and TxDOT awarded a \$643,381 contract to SCR Construction Co., Inc., to repair it. Construction is currently underway, and an additional lane to the existing open lane opened in late November. Because of the immediate need for access, it is unclear whether there was an opportunity to redesign and rebuild the bridge to be more resilient to future disasters.

The restoration of State Highway 87 to pre-disaster condition is also underway. This highway runs along the coast of Galveston Island and the Bolivar Peninsula. There is a potential opportunity to elevate State Highway 87 to serve as a barrier to protect the wetlands, funding permitting. Likewise, portions of County Road 257 in Brazoria County were also destroyed by Ike. If the road is not repaired, the wetlands behind it will be subjected to inundation from the Gulf of Mexico and will be at risk of becoming open water.

### **Transit**

Galveston Island Transit sustained considerable damage from Hurricane Ike, including the flooding of 12 of its 21 buses, two of its five para-transit vans and all four rail trolleys. The Federal Transportation Authority has no discretionary emergency funding, so funding must come from elsewhere, such as the EDA and HUD's Community Development Block Grants (CDBG) programs. The bus maintenance and rail maintenance facility also flooded, and an oil storage tank toppled, spilling oil within the rail maintenance facility. Prior to Ike, there had been a pending grant programmed for rehabilitation, so it is uncertain whether reconstruction is eligible for FEMA funds.

### **Rail**

The Vice President for Port Operations at Galveston Railway, which serves the Port of Galveston, reported that the railway sustained \$628,000 in damages including administrative offices,



locomotives and track. The Federal Railroad Administration reported that a start date of mid-October for one of three locomotives was targeted, but uncertain. The rail serves an important economic role as an intermodal link for freight movement providing connections to the Burlington Northern Santa Fe (BNSF) Railway and Union Pacific (UP) railroad systems. Without a railroad connection to ports, the use of trucks increases, which then increases pollution and congestion around the ports.

### **Ports**

The State of Texas has also identified a need of \$2.4 billion for erosion, waterway dredging and other infrastructure repairs to navigable waterways, ports and coastlines. The Port of Galveston, which is owned and operated by the City of Galveston, sustained extensive damage to its terminal, including sediment deposits and saltwater damage. Cruises are now operating out of Houston and Galveston. Some of the repair work is covered by insurance, and the Port is working with FEMA for other funding. Storm surge damaged the Beaumont Reserve Fleet as well as its landside facilities.

### **Airports**

A \$1 million grant from the Federal Aviation Administration's Airport Improvement Program has been given to the TxDOT Aviation Division to assess damage of airports due to Ike. TxDOT plans to conduct the assessment in the spring of 2009.

## **E. Critical Infrastructure**

Critical infrastructure includes assets that are essential for the functioning of a society and an economy, including electricity, gas distribution, water supply, transportation, education and security services (e.g., police, fire department, etc.). Preliminary estimates by the State of Texas have identified critical infrastructure damages in excess of \$1.8 billion needed to assist state agencies and local governments, including \$89.2 million to repair or replace infrastructure for state government agencies, and \$1.7 billion for repair/replacement of water and wastewater plants and lines, and other government facilities. All state and local infrastructure is eligible for FEMA Public Assistance reimbursement.

Hurricane Ike downed power lines; flooded streets, wetlands and low-lying areas; tore roofs and windows from buildings; and damaged or destroyed emergency equipment. Following the storm, nearly two million people were without power. In areas like Galveston Island and the Bolivar Peninsula, water and wastewater plants will have to be rebuilt. Similarly, water and wastewater lines will have to be replaced in areas where the storm reconfigured the state's shoreline. Restoration of these basic services and other governmental services, such as public safety, fire protection, access to justice and general government administration, has already cost state and local governments hundreds of millions of dollars, a figure that will rise as costs of rebuilding are more clearly estimated by FEMA and the local jurisdictions.

### Water and Wastewater

The State of Texas has identified damages to water and wastewater plants along with damages to government buildings in excess of \$1.7 billion. The Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA) Region 6 office personnel conducted assessments on 1,384 community water systems and 734 municipal wastewater treatment systems in 10 of the declared counties in Texas. In general, damage was light to moderate, and most, if not all, systems were operational by late November of 2008. The largest concern after the storm was the lack of backup power, which forced many communities to issue boil water advisories for public drinking water systems, and also caused problems at wastewater treatment plants.

### Electrical Utilities

Electrical utilities serving the impacted area include Entergy Texas, Inc.; CenterPoint Energy, Inc.; and multiple rural electrical cooperatives. Entergy Texas experienced 392,600 outages, while CenterPoint Energy counted 2.15 million outages. Collectively the cooperatives experienced 126,735 outages. As of late October, all transmission lines had been repaired and service had been restored to all electrical utility customers who were capable of being reconnected to the system. Homes that were substantially damaged or completely washed away are, of course, without power connections.

### Schools and Universities

The state has identified needs of over \$1 billion to repair public and private colleges and universities and public schools damaged during the 2008 hurricane season.

Hurricane Ike caused widespread damage to many two and four-year colleges and universities that have unreimbursed damage totaling \$982.5 million. As discussed previously, the institution that received the most damage was the University of Texas Medical Branch (UTMB), located on Galveston Island with damages totaling \$427.8 million, including major damages to the infrastructure; clinical, research and technical equipment; and \$225.0 million in building damages. UTMB is the third-largest hospital in the Houston/Galveston region and a major employer with 12,000 employees throughout the state. The UTMB health system has 753,000 outpatient visits and 41,000 inpatient admissions annually.

According to the Governor's *Texas Rebounds* report published in November of 2008, the cost of damage to public and private colleges and universities includes:

Public and Private Colleges and Universities	\$ (Millions)
University of Texas Medical Branch	427.8
San Jacinto College	48.3
University of Houston	40.0
Houston Baptist	33.0

Texas A&M University—Galveston	28.6
Texas Southern University	15.5
University of Texas—MD Anderson	7.5
Houston Community College	7.1
Lamar State College—Orange	7.0
Lamar State College—Beaumont	5.5
Texas Engineering Extension Service	3.6
University of Texas Health Science Center—Houston	3.4
Texas A&M University—Texas Forest Service	3.3
Rice University	3.0

Many school districts sustained extensive damage from Hurricane Ike ranging from roof damage to total destruction. Public secondary schools suffered damages totaling \$72 million. Fortunately, almost every school district was open and conducting classes by the middle of October, within weeks of Ike's landfall.

The Texas Education Agency (TEA) sent \$3 million in emergency funds to two school district regions. This money was spent on immediate cleanup and recovery efforts and an additional \$1 million were spent on public school emergency shelter costs.

## Conclusion

Individuals, neighborhoods and entire communities will have a series of important decisions to make regarding the rebuilding of their lives. There may be many who decide not to rebuild their homes or businesses, and instead, opt to relocate. Most people will probably choose to rebuild because the upper Texas Gulf Coast is their home.

Most housing decisions will be made by individual property owners. Assuming they have the capability and funds to rebuild, each one must answer questions as to whether to rebuild or not. Should they elevate their homes? Should they use flood-resistant materials? Certainly, emotion and sentiment will play a part in the decision-making process, especially for those families who have been living in their homes for years, or even generations. The individual decisions of several hundred thousand people will determine the overall housing market.

Business owners will be faced with extremely difficult decisions regarding whether to rebuild, relocate or simply cut their losses and close. Those decisions will depend in large part on the collective decisions of both property owners and the municipalities. The uncertain reinvestment of business owners and the potential loss of a customer base further complicate the decisions of the community.



The complexity is amplified by community level decisions as each municipality wrestles with questions regarding development regulations, zoning ordinances, building codes, city planning, and utility and public safety service delivery. City and county officials will be faced with huge recovery costs, when at the same time the tax base is a fraction of its previous size. Especially problematic for these communities is the fact that much of the storm damage was to the public infrastructure, the most capital-intensive portion of a municipality's responsibilities.

Further complicating the recovery scenario is the need to wisely balance planning with pressures to "just get things done." The faster people resume living, working and playing again in the upper Texas Gulf Coast the better, and in many respects, the longer the delay, the worse some problems will get. On the other hand, the better the decisions are made now, the better prepared the community will be for the next storm that will inevitably come.

As communities begin discussions on appropriate reconstruction of the upper Texas Gulf Coast's housing, neighborhoods and infrastructure, they will inevitably do so without all of the information they could possibly need. For instance, new floodplain management maps that dictate how high to elevate structures will not be ready until the second half of 2009. Without complete data, communities will need to make educated assumptions on the post-Ike local economy, nature of potential future housing demand, land use choices, extent of damage and potential motivations of local property owners. While the assumptions are likely to change as more information becomes available, they provide a good starting point for consideration of what needs to be done for reconstruction.

## Chapter III – Economic Environment

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### Introduction

The success of this recovery is inextricably linked to long-term community recovery: if businesses close, jobs will be lost, communities will lose population, nonprofits will experience difficulty raising funds, and tax bases may shrink.

While disaster recovery is always challenging, Hurricane Ike hit Texas during a time of great economic uncertainty in the United States, making it imperative to consider recovery issues within the larger national economic context. Credit markets are tight. Many of the businesses affected by Ike will need to borrow in order to rebuild, pay utilities and purchase inventory. Given the global credit crunch, it may become important to explore alternative avenues for businesses to obtain the financing necessary to get back on line and continue growing.

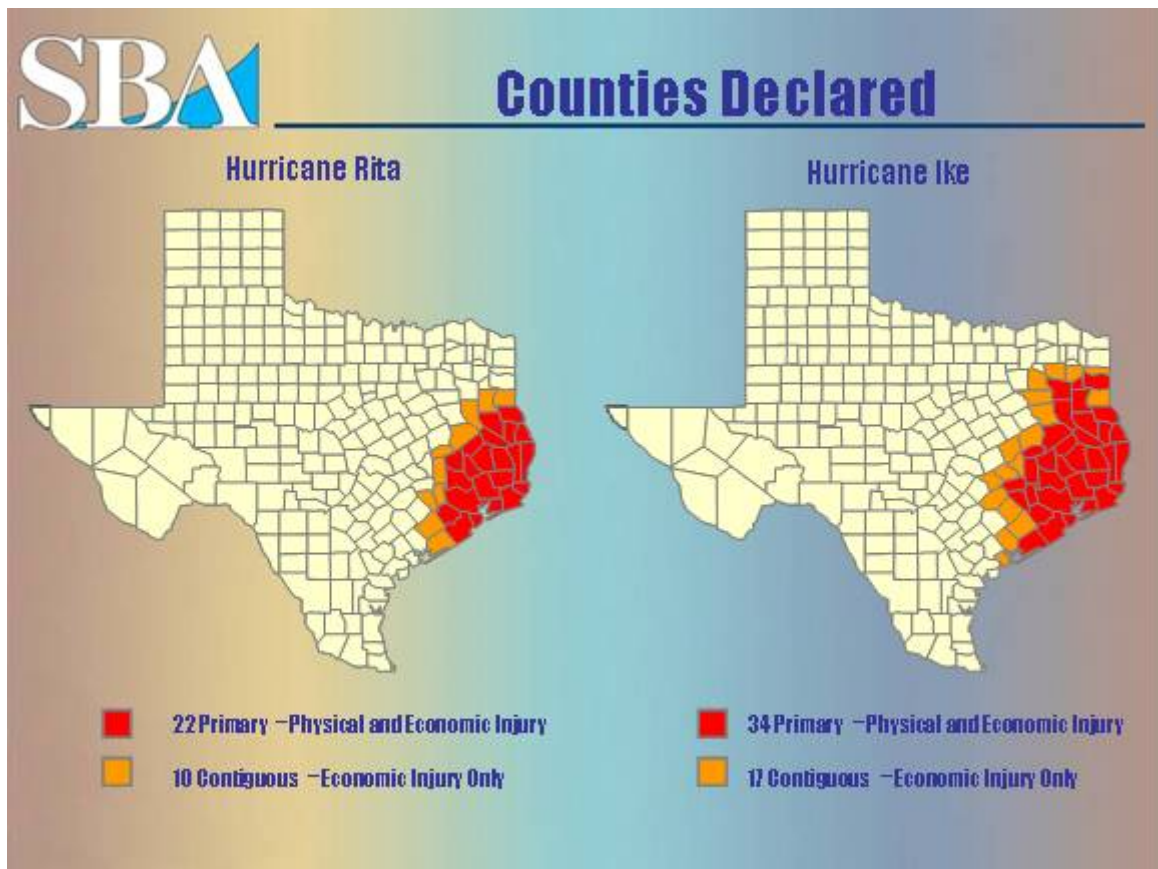
In general, it is far too early to assess the true economic effects of Ike. Indeed, it will take months, or even years, for the economic toll to be fully known and understood. The numbers provided here, particularly the damage estimates, are only initial figures based on the limited information currently available. For the purposes of this initial assessment, those counties sustaining the most damage from Ike - Harris, Galveston, Chambers, Orange and Jefferson – are given the most consideration and analysis. These five counties fall into two different federally designated economic development districts (EDD). Harris, Galveston and Chambers Counties are represented by the Gulf Coast Economic Development District, which is affiliated with the Houston-Galveston Area Council (H-GAC). Jefferson and Orange Counties are represented by the South East Texas Regional Planning Council (SETRPC).

A general picture of the overall region and the impact is provided through discussions of specific communities; it should not be viewed as a comprehensive account of all communities affected or all the economic damage caused by Ike. Many communities that experienced significant damage, such as the unincorporated area of San Leon, are not covered in this report. Additional research into the economic impacts of Ike will be warranted, so that communities and the state have more comprehensive data to use for recovery planning purposes.

Despite the challenges ahead, Texans do have cause for optimism. Many local businesses are making a comeback and reopening. The homebuilding industry should for some time be in far

better shape along the recovering upper Texas Gulf Coast than in most parts of the country. Key industries like the petrochemical, maritime and shipping industries are dependent on their geographic locations and will likely remain the core of the region's economy despite the impacts of Ike.

The recovery process is also an opportunity to address economic issues that have faced the region for some time and to rebuild an upper Texas Gulf Coast that is better prepared for future storms.



The map above indicates the counties of Texas that suffered the effects of two major hurricanes within three years. The counties marked in red experienced actual physical damage from the storms. Those in orange did not, but because of the interdependence of the economy, they still deal with significant indirect economic effects from the disruption in neighboring counties.

## Key Issues by Industry

### A. Petrochemical Industry

Based on interviews conducted by the U.S. Economic Development Administration, it appears that the damage to petrochemical refineries varies significantly, with refineries in the Orange and Jefferson County areas sustaining more damage than those to the south. Facilities in Jefferson and

Orange Counties experienced significant flooding; however, despite the damage, the industry appears to have been well-prepared, and many plants are already back online.

The health of the petrochemical industry is of particular concern because the region is extremely reliant on the industry for its economic well-being. As the major employer and economic driver in the region, the ability of the petrochemical industry to recover and operate at pre-Ike levels is paramount to minimizing the economic effects of the storm, such as unemployment. Prior to Ike, the affected counties were already looking for ways to diversify the economy of their communities. The storm caused substantial and long-lasting damage to a large percentage of the other major industries supporting the region, and without meaningful intervention, effects of Ike could eventually prove to be a major setback in efforts to improve the economic diversity of the region.

The damage to the industry goes far beyond the refineries. Eight chemical companies in an area referred to as “chemical row” were severely damaged by Ike; all but one had four to ten feet of salt water inside the plants. It was estimated that the losses to these companies will be in the hundreds of millions of dollars to replace all their mechanical and electric equipment, in addition to the lost productivity in the months since the storm.

Because the heavy industries (shipping, refining, and chemicals) along the upper Texas Gulf Coast were not significantly damaged by the hurricane, it is unlikely that there will be significant loss of heavy industry businesses and jobs. To the contrary, significant investment in refinery capacity is occurring in Port Arthur as plants are expanded. The proximity to the Gulf of Mexico oil and gas fields make it likely that the industries associated with oil and gas exploration will maintain their presence. The immense difficulty and expense in building new oil refineries means that this industry will not be relocating and will contribute to the post-Ike economy. Furthermore, because these industries are high-wage with average annual pay well in excess of the U.S. average for all industries, it is more likely that workers would be willing to “move to the job.”

## **B. Health Care Industry**

The University of Texas Medical Branch (UTMB) is the seventh-largest employer in the Houston-Galveston region and the largest employer in Galveston. UTMB experienced deep financial losses from Ike, with submerged equipment and flooding in 750,000 square feet of its buildings. Since Hurricane Ike made landfall, the institution has been losing an estimated \$40 million per month. The University of Texas System’s Board of Regents announced in November that UTMB will be scaled back and that 3,800 full-time jobs will be cut.

Damage to the healthcare infrastructure will have a significant impact on the local economy. Large hospitals often serve as an economic magnet for other healthcare-related businesses, including doctor’s offices, specialty service providers and long-term care providers. In addition, large hospitals attract patients from outside the immediate community, which infuses non-local dollars into the local economy. Much of a hospital’s income is based on stable government-reimbursed services, such as Medicare and Medicaid. As a result, the closure or reduction in size of a hospital

may result in the emigration of hospital employees and the possible decline in the attractiveness of the local community.<sup>10</sup>

### **C. Small Businesses**

Small businesses are a major part of any economy, accounting in the U.S. for approximately 75 percent of all net new jobs. Small businesses are also the most vulnerable to a disaster. In fact, Hurricane Katrina touched more than 80,000 small businesses across the Gulf Coast region in 2005. Some experts believe that 60 percent of those businesses are not coming back.<sup>11</sup>

Small businesses in the upper Texas Gulf Coast region were also hit very hard by Ike. There is a great need for financial assistance for these businesses. Experts generally agree that without financing and assistance, these businesses may not return, which could cause great economic upheaval since many of the communities affected by the storm rely on small businesses for much of their revenue. Of particular concern is that many small businesses sustained more than 50 percent damage, and may be required to rebuild elevated structures or pay increased rent to cover the costs incurred by the property owner to rebuild in compliance with current codes. Such endeavors are extremely costly and may be out of reach for small businesses that have already lost significant revenue from downtime and lost inventory.

### **D. Government Employment**

As the major regional economic and population center, the Houston Metropolitan Statistical Area (MSA) had a large number of government employees. According to the Bureau of Labor Statistics, federal, state and local government employment in the Houston MSA was approximately 353,500 in 2008, or about 13 percent of total private sector and government employment. Of this total, federal employment accounted for almost 29,000; state employment 71,500; and local employment 253,100. The federal political imperative would suggest that federal employment will not be significantly lower in post-recovery upper Texas Gulf Coast. During the recovery, federal employment is likely to be at least somewhat higher than the pre-Ike level.

### **E. Agriculture and Forestry Industries**

Agricultural land sustained a wide variety of damage as a result of Hurricane Ike. The storm surge damaged thousands of acres of pasture and cropland up to 14 miles inland, killing grasses and other plants, and inundating ponds and stock tanks with salt water. The erosion and salinity issues that

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<sup>10</sup> Measuring the Economic Importance of the Health Sector on a Local Economy: A Brief Literature Review and Procedures to Measure Local Impacts, Gerald Doeksen, Oklahoma State University, Tom Johnson, Virginia Tech, funded by The Southern Rural Development Center, January 1997.

<sup>11</sup> <http://www.sba.gov/advo/research/proceedings06.pdf>

will affect these areas will negatively impact soil productivity for two to three years. The storm surge destroyed fences, scattered debris, uprooted trees and eroded soil.

The Texas Forest Service has conducted a preliminary assessment, which indicates an estimated \$351 million in timber damage. History has shown that crews have about six weeks to get the timber out of the affected areas before significant value is lost due to blue staining from a species of fungus. Associated impacts also include an increase in wildfire threats, damage to watersheds, reduction in wildlife habitat and a decline in fishing and recreational opportunities.

Initial reports indicate that approximately 20,000 head of cattle were affected by the surge, and that an estimated 4,000 to 5,000 adult cows perished along with an undetermined number of calves.

The following table shows the estimated economic impact of Hurricane Ike to the agricultural community.

Hurricane Ike Losses	
CROP	LOSS \$
Rice	\$11,000,000
Cattle	\$13,300,000
Hay	\$1,800,000
Forestry (stumpage)	\$351,000,000
Nursery	\$10,900,000
Fence	\$21,500,000
Supplemental Feed	\$640,000
Fishing/ Sea Food	\$8,000,000
Poultry	\$700,000
Equipment/Buildings	\$15,000,000
Producer Loss Estimate	\$433,840,000
Lost Business Activity	\$92,680,000

Source: Texas Department of Agriculture

## F. Fishing Industry

The fishing and seafood industry also sustained significant damage in the affected counties. The clam, oyster, and shrimp industries in Chambers County and the shrimp industries in Jefferson and Orange Counties are currently inoperable, not only because of the depletion of the seafood populations themselves, but also the damage to supporting industries such as processing and independent fishing operations--especially in the community of Oak Island, which was completely destroyed.



According to an analysis by the Texas Parks and Wildlife Department (TPWD), the commercial and recreational fishing industries have suffered significant losses. Sabine Lake, Trinity Bay and Galveston Bay make up approximately 37 percent of the inshore waters of the Texas coast. The commercial fishing industry in these waters accounts for approximately \$16 million in sales each year for finfish, shellfish and bait, and an overall economic impact of over \$25 million to the State of Texas. The recreational fishing industry accounts for about \$356 million in retail sales each year for fishing expenditures, which equates to \$650 million in overall economic impact.

The amount of Ike-related losses to these important industries will be difficult to calculate, as these losses depend on how long it takes to rebuild or repair infrastructure such as boat ramps, hotels, bait facilities, and commercial processor and/or distribution facilities, as well as the supporting infrastructure for those businesses.

The upper Texas Gulf Coast also offers two locations where marine activities occur--Galveston Bay and Sabine Lake near Port Arthur. The jobs related to the fishing, shipping, and ports industries are fixed to the locations; therefore, neither the businesses nor the jobs are likely to move.

### **G. Tourism Industry**

Tourism is another primary industry in parts of the affected areas. About 6.5 million tourists visit Galveston's beaches each year, infusing more than \$705 million to Galveston Island in 2006 alone. The beaches were badly damaged by the storm and need to be restored.

Local economies that depend on tourism are vulnerable to seasonal spending. The tourism market is extremely "price elastic," meaning that if the economy (national or local) is suffering, tourism also slows. Tourism is contingent upon an optimal economic situation, as it typically constitutes luxury spending rather than survival spending. The double jeopardy of Ike and the general economic slowdown do not bode well for the tourism industry in the foreseeable future.

Many towns also had burgeoning eco-tourism industries. In particular, birding was a major attraction to the coastal area. The five counties are participants in the Great Texas Wildlife Trails. The upper Texas Coast region offers more than 15 suggested driving tours and several hundred bird watching locations. The extent of damage to the natural vegetation has affected much of the wildlife and thus will affect this industry as well.

### **H. Local Tax Base**

Some local governments estimate a loss of 50 percent or more to their tax base, including losses this year from people not paying taxes on heavily damaged and unusable property, and losses next year from a decline in overall property values.

Whether individual local governments will lose significant sales tax revenue remains unclear. Communities with retail businesses that sold building supplies and necessities, particularly large retailers, have benefited from increased sales. The influx of relief and construction workers to the areas has also helped bolster retail sales. In contrast, those areas with business communities

consisting of mainly small businesses have already lost significant sales tax revenue and do not expect the revenue stream to return to pre-Ike levels in the near future.

### **I. Nonprofit Organizations and Social Service Providers**

As of 2006, the State of Texas was home to more than 96,000 nonprofit organizations, employing 385,000 people, or approximately five percent of the state's workforce.<sup>12</sup>

The need for nonprofit services – particularly housing, food, health, mental health and social services – skyrockets after a major disaster. However, employees of nonprofit organizations experience the same trauma and loss of property as other members of the community, and may not be able to provide services due to evacuation, personal trauma or lack of resources.

In addition, nonprofit organizations themselves are often directly and severely impacted by a disaster and may need significant levels of support from local, state and federal governments in order to resume operations and provide assistance to disaster victims. At the same time, sources of financial, volunteer and other support for local nonprofit organizations may be rapidly reduced or even disappear due to the disruption of other community institutions, as well as diversion of donations and other resources to immediate disaster relief that under normal circumstances would be directed to them.

### **J. Housing and Workforce**

The damage to housing in the region will have a major effect on the local economy and should be accounted for in future economic assessments and in identifying opportunities for economic development in the area. Petrochemical companies and other similar industries will have difficulty attracting the highly-skilled workforce due to the devastating effects of Ike. In some areas, much of the housing that sustained over 50 percent damage was "affordable" housing necessary to attract and maintain a sufficient workforce. In addition, many small independent contractors, including those that support both the petrochemical and the fishing/seafood industries, operated out of their homes and/or required vehicles or boats to carry out their trade. It is not at all clear that those who have lost both their businesses and homes will reestablish their businesses.

Ironically, given economic conditions at the national level, the homebuilding industry in the Ike-affected region is likely to be far more robust than most other parts the country. Business will be good for building materials suppliers, contractors, craftsmen (carpenters, roofers, electricians, painters, etc.) and furniture storekeepers in the neighborhood.

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<sup>12</sup> <http://nccsdataweb.urban.org/PubApps/profile1.php?state=TX>



## Key Economic Recovery Considerations by Region

### A. Galveston Bay

The three-county area of Chambers, Galveston, and Harris is very diverse. Harris County is home to Houston, the fourth largest city in the U.S. with a population of 3.9 million. Chambers County, on the other hand, is very rural with a population of 26,031. In addition to the large petrochemical industry, the region is home to University of Texas Medical Branch (UTMB), Johnson Space Center, ports and waterways, rice farming and ranching, and eco-tourism.

Ike disrupted many of the economic drivers in the region, including UTMB, the ports and waterways, agricultural and natural resources, and the tourist industries. It has also done much damage to vital infrastructure, including power lines, substations, and water and sewer infrastructure.

The Houston-Galveston Area Council (H-GAC) conducted an analysis of the area that received 10 feet or more of water due to the storm surge. Within this heavily affected area, there were 81,000 households and a total population of 205,000, more than 5,000 businesses and 99,000 jobs. There were also 41 sub-stations and 131 waste water treatment plants. Although not all businesses, sub-stations and waste water treatment plants were necessarily lost in the floods, the economic loss to the area is catastrophic. Indeed, even if individual businesses were not directly affected by the 10 feet or more of water, it is likely that Ike has affected their ability to conduct business in the area.

### Galveston County

In Galveston County (Pop. 283,341), initial estimates by H-GAC found that more than 53,000 employees were put out of work; more than 3,800 businesses were interrupted; and more than 18,000 businesses were damaged in Galveston County. These estimates do not include information from some severely impacted areas, such as Galveston Island. As a result of Ike-related losses, the county expects that it will need to cut its budget by 25 percent this year and an additional 25 percent next year because of losses in property tax revenues. This year, people may not pay property taxes on property that was rendered unusable. The following year, it is expected that losses will be attributable to declines in property values.

### City of Galveston

The City of Galveston (Pop. 56,940) is a significant part of the county's economy and is home to half the county "resident jobs" (or jobs within the county that are held by residents of the county). The top employers in the city include the Port of Galveston (home port to several cruise lines and several large employers), UTMB, the banking/finance sector, and the tourist industry.

It is estimated that up to 85 percent of the city's business base is gone. Of note, the downtown historic strand was significantly damaged. The businesses are working hard to reopen, but they cannot succeed without financing and support.

As the county's economic engine, the destruction to the city due to Ike is going to have long-lasting effects on the entire county. In her address to Congress in September 2008, Lyda Ann

Thomas, mayor of the City of Galveston, provided preliminary damage estimates of up to \$2 billion to the City’s housing, infrastructure, hospitals, ports and beaches.

### **Waterfront Cities of Dickinson, Kemah, League City and Clear Lake Shores**

Hurricane Ike also devastated the waterfront cities between the cities of Galveston and Houston. These cities have organized themselves for the purposes of creating a regional recovery strategy and leveraging recovery funds. The coalition includes the cities of Dickinson, Kemah, League City and Clear Lake Shores in Galveston County, as well as El Lago, La Porte, Nassau Bay and Seabrook in Harris County.

These waterfront communities provide employees, employers and purchasing power that contribute to the economic health of the Houston-Galveston region. However, they are also equally critical as a sub-regional economy that is supported by tourism, water recreation, the science industry (NASA) and the ports, as well as by industry and offices located in the area. The economies of the communities in this sub-region are heavily intertwined; the health of one community is dependent on the health of all the communities in the area (e.g. the availability of housing in one community helps support businesses in another, etc.).

Kemah, in particular, suffered severe damage to the “Boardwalk,” a major tourist attraction in the region. The majority of restaurants and other businesses are small, family-owned businesses, and it is unclear whether they will return. As of the second week of October, only two restaurants on the boardwalk were open again. Initial estimates indicated that a high business closure rate could result in the city losing 87 to 90 percent of its business income. Kemah also lost much infrastructure that will need to be replaced in order for the city to get back on its feet.

There is also a great need to maintain housing stock for people who work in local industries and a need for better transportation systems. The major challenge identified by the communities in this sub-region is the tendency to get “lost” between the major cities of Galveston and Houston, which is of particular concern now that so much of the sub-regional economy was destroyed by Ike. Estimated losses for Kemah (Pop. 2,464), Dickinson (Pop. 17,796) and League City (Pop. 68,178) are described below.

Estimated losses in Kemah include at least:

- 202 residential units substantially damaged or destroyed
- \$100 million in commercial damage
- \$2.4 million in damage to infrastructure and facilities
- 1,700 employees out of work
- \$100,000 in sales tax lost per month

Estimated losses in Dickinson include at least:

- 716 residential units substantially damaged or destroyed
- \$1.8 million in commercial damage

Estimated losses in League City include at least:

- 648 residential units substantially damaged or destroyed
- \$5.5 million in commercial damage
- \$5.4 million in damage to infrastructure and facilities
- 2,500 employees out of work

The ability to work together is a key asset of these waterfront communities. As referred to above, these cities have already formed a coalition designed to assess their needs and leverage public funds. While it is likely that forming this coalition will make them a stronger contender for funds, it also provides additional benefits from an economic development perspective, because this type of regional cooperation will facilitate the long-term, coordinated and collaborative economic development approaches that are central to economic growth.

The coalition has also already identified strategic areas that should be addressed in regional economic recovery, including additional regional strategic planning, adding new and improved infrastructure, and creating strategies to retain and rebuild the region's businesses, as well as recruiting new business investments.

Finally, it is worth noting that the cities of Texas City and La Marque fared remarkably well after Ike, compared to other waterfront communities, most likely due to the levee that protected the cities from the storm surge. However, while the hurricane protection levees on the upper Texas Gulf Coast performed adequately, this local success must also be balanced against the generally poor reliability record of this technology.

### **Harris County**

Harris County (Pop. 3.9 million) was severely affected by the winds and storm surge from Ike. In particular, its waterfront communities, which were not protected by a levee, suffered major damage. Harris County estimated \$10 billion in overall damage. H-GAC estimates that more than 67,000 business establishments were disrupted with 1,300,000 employees unable to work.

Another major issue for Harris County businesses and residents was the loss of electricity for as long as a month. Due to lost revenue, many businesses could not pay their employees, and thus lost their employees as well. Because of these issues, some of the existing businesses may decide not to reopen at all.

### **Waterfront Cities of Seabrook, El Lago, La Porte and Nassau Bay Seabrook**

The waterfront cities of Harris County that have formed a coalition with the waterfront cities of Galveston County face challenges that include damage to tourism, housing and transportation systems. Like Kemah, Seabrook's economy is supported by the tourism industry because of its prime location on the water. Small businesses and the city's fish market serve as the primary anchors of this industry. Seabrook also attracts many eco-tourists who come to see more than 291

species of birds in the area. The estimated losses for the cities of Seabrook (Pop. 11,483), El Lago (Pop. 2,974), LaPorte (Pop. 34,261) and Nassau Bay (Pop. 4,071) are described below.

Estimated losses in Seabrook include at least:

- 1,966 residential units substantially damaged or destroyed
- \$35 million in commercial damage
- \$5.7 million in damage to infrastructure and facilities
- \$127,000 in lost tax revenue

Estimated losses in El Lago include at least:

- \$93.9 million in residential, commercial and personal damage
- \$1 million in damage to infrastructure and facilities
- \$10,000 in sales tax lost
- A potential FY 08 and 09 budget deficit of \$40,000

Estimated losses in LaPorte include at least:

- 3,861 residential units substantially damaged or destroyed
- \$11 million in commercial damage
- \$2.9 million in damage to infrastructure and facilities

Estimated losses in Nassau Bay include at least:

- 409 residential units substantially damaged or destroyed
- \$47 million in commercial damage
- \$2 million in damage to infrastructure and facilities
- 300 employees out of work
- \$50,000 in lost sales tax

### **Pasadena**

The City of Pasadena (Pop. 146,518) is a bedroom community just outside of Houston. Sixty percent of its residents work in the petrochemical industry. Because the bulk of the city is located inland, Pasadena fared relatively well in the storm, but it still sustained extensive damages. The majority of losses involved damage to city property and buildings. It is estimated that the total impact to the city is \$4.5 million, and that the city lost 20 percent of its sales tax revenue.

### **Baytown**

The City of Baytown (Pop. 70,135), which straddles Harris and Chambers Counties and relies heavily on the petrochemical industry, suffered severe infrastructure losses due to Ike. It is estimated that the city has more than \$10 million in infrastructure damage, including the loss of two waste water treatment plants and 82 lift stations. Baytown also lost 871 dwelling units in multifamily homes, as well as 60 family homes. Early estimates indicate that costs of recovery for Baytown will total between \$50 and \$70 million.

### Chambers County

Chambers County (Pop. 28,771) is largely rural and relies heavily on “natural” industries, such as rice farming, ranching, hunting, fishing, marine trades and eco-tourism, particularly on the east side of the county. The industrial-based west side of the county, on the other hand, is made up mostly of the petrochemical industry. The county also has some retail, particularly in the City of Winnie, which caters to people living on the Bolivar Peninsula in Galveston County. Prior to Ike, one of the county’s major priorities was to attract primary jobs. To do that, the county needed good water and sewer infrastructure, as well as warehouses and industrial parks.

The storm surge from Ike brought more than 20 feet of water into Chambers County. Preliminary damage assessments assembled by the County on behalf of the City, Port Authority and District entities is in excess of \$430 million. This estimate does not include the preliminary damage estimates of private industry and facilities, or those owned by state or federal organizations. The preliminary damage assessments related to infrastructure, public buildings and other facilities include:

Preliminary Damage Assessments – infrastructure, public buildings and other facilities.	
Unincorporated Chambers County	\$15,000,000
City of Anahuac	9,800,000
City of Beach City	100,000
City of Baytown (included in Harris Co estimates)	
City of Cove	100,000
City of Mont Belvieu	1,119,000
City of Old-River-Winfree	100,000
Trinity Bay Conservation District (water, storm water, waste water system repairs)	56,200,000
Chambers-Liberty Navigation District (water system repairs)	50,000,000
Independent School Districts	17,250,000
Anahuac ISD	1,000,000
Barbers Hill ISD	15,000,000
East Chambers County ISD	1,250,000
Chambers County Public Hospital District #1	875,000
Port of Houston Authority (Chambers Co)	80,000,000

The loss of several industries in Chambers County could result in a rise in unemployment in the area. Over 143,000 acres of land in the county was damaged by the storm surge. The rice fields and grazing pastures are not expected to recover from the saltwater intrusion for another two to three

years. While Chambers County expects these industries to return, it is estimated to take between five and 10 years for full recovery.

Damages to the upper Texas Gulf Coast fishing industry included the loss of two processing plants, the largest private employers in the area, as well as supporting industries, including clam, oyster, and shrimp fishermen who lost their boats and homes. The tourist industry has also been devastated by the saltwater, especially eco-tourism along the Great Texas Wildlife Trails in Anahuac National Wildlife Refuge and Bolivar Flats, which together brought in 60,000 tourists to the area.

The fate of businesses in the community is also a concern. The Winnie area relied heavily on residents of the Bolivar Peninsula to support their retail businesses. As the vast majority of houses on the peninsula were destroyed, the market, which consisted of around 4,000 customers, is gone. Many businesses that have reopened no longer have a healthy customer base, and therefore, will have difficulty staying open.

Housing is also a major concern in Chambers County. In the unincorporated area of Oak Island, only 50 of 350 houses were left standing, only 25 of which are inhabitable. Many of those who lost their homes also worked in the community. In the case of Oak Island, many of those who lost their homes were independent clam fishermen who supported the seafood processing plants. In addition to losing their homes, their boats and livelihoods were also destroyed.

## **B. Southeast Texas**

### **Jefferson County and Orange County**

With five storms impacting this region over the last three years, Jefferson (Pop. 241,975) and Orange (Pop. 82,669) Counties struggle to maintain any forward momentum.

The region is highly reliant on the petrochemical industry. ExxonMobil Oil Corporation is the third largest employer in the region, just after the Christus Hospital System and the Beaumont Independent School District. It is estimated that 40 percent of paychecks come from the petrochemical industry and carry 75 percent of the tax burden.

While the petrochemical industry has bolstered the economy and provided some economic protection after Ike, the region recognizes the need to diversify its economy and to lessen its dependence on one industry. In addition to the petrochemical industry, other major industries in the area include agriculture, ranching, eco-tourism and shrimp fishing. Recently, the region has begun to build a “new industry” around call centers and has also made improvements to the port authorities of Beaumont, Orange and Port Arthur.

The region faces a high unemployment rate and is still recovering from Hurricane Rita, which hit just three years before Ike. The region also faces a shortage of workers with the skills needed by the petrochemical industry. This labor shortage is attributed, in part, to a dearth of affordable housing.



## Conclusion

Despite the devastation of Ike, the economic development professionals in the upper Texas Gulf Coast remain positive. The prospects for the upper Texas Gulf Coast economy are good. The economic anchors of the petrochemical, fishing, and shipping industries remain firmly tied to their proximity to the Gulf of Mexico and its oil fields. The saltwater intrusion from Ike's storm surge will mean rather bleak short-term prospects for the agricultural industry, and the disruption to the ecology of the bays and coastal areas will hurt the fishing and tourist industries for a while. However, those natural processes are cyclical, and they will eventually return to some semblance of equilibrium closer to pre-Ike conditions. For the most part, small business and retail industries will eventually return to normal as well, as the people of the upper Texas Gulf coast begin living, working and playing again.

It has been noted by other government entities that the region has begun to recover very quickly thanks to fairly well-organized communities. A healthy economy, so fundamental to any community's well being, thrives on innovation and creativity, and therefore efforts should be made to foster this entrepreneurial spirit and local initiative throughout the ongoing recovery process.

## Chapter IV – Natural Environment

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### Introduction

The upper Texas Gulf Coast ranks high among the nation's great bay systems and is made up of a number of diverse ecosystems, such as barrier islands, salt grass marshes, large bays and estuaries, cypress swamps, tallgrass prairies and tall woodlands of oak and pine. In addition to the tremendous natural resources, it also provides an economic benefit to both the region and state.

However, ecological problems existed within the upper Texas Gulf Coast prior to the arrival of Hurricane Ike. In the 2004 National Coastal Condition Report, the Environmental Protection Agency (EPA) described the state's coastline as having poor water and sediment quality.

Furthermore, shoreline development has resulted in habitat alteration and destruction, increased pollution, and loss of fish and wildlife abundance and diversity. Diversion of freshwater and navigation channels (e.g., dredging and the construction of roads and levees) has significantly altered the natural circulation and salinity patterns in coastal bays and estuaries. These estuaries and associated habitats are productive nursery areas for fisheries, birds and other species and also function to stabilize shorelines, moderate flooding and remove pollution.

Ike's hurricane-force winds, record-breaking levels of storm surge and extensive coastal and inland flooding left a devastating mark on the natural environment, which may take years to fully recover, especially when compounded with the area's existing ecological problems. The direct impacts to the coastal wetlands include significant marsh loss, scouring and compression, as well as downed trees from the surge and wind force. Secondary effects of saltwater intrusion, in which freshwater habitats and species are displaced by more salt-tolerant associates caused by elevated soil salinities from the surge overwash and sediments, may not be realized for days, weeks or even years following the storm's passage.

This chapter assesses the impacts of Ike on the upper Texas Gulf Coast's natural environment, including its ecosystems and natural resources. The incidence of successive surge events and hurricanes within a span of a few years, like Gustav and Ike, is an important science question now thrust upon the coastal wetlands and resource managers of the northern Gulf Coast region.

## Key Issues

### A. Saltwater Intrusion

Biologists with the Texas Parks and Wildlife Department (TPWD) and other experts have been assessing Ike's ecological impacts in two main categories, one of which is saltwater intrusion.

Ike's long-term impact to the coastal marshes in Galveston Bay is thought to be negligible. These coastal fringe marshes contain salt-tolerant vegetation, are formed on mineral soils and are sloped toward the bay. Therefore, surge water drained quickly from these marshes, reducing the potential for long term-impacts.

However, the Chenier Plain marshes surrounding Sabine Lake will most likely experience significant long-term impacts. These marshes are concave in shape, and under normal conditions, do not drain as rapidly as tidal fringe marshes. The normal drainage of these marshes is also impaired by numerous human-caused hydrologic modifications within and adjacent to these marshes, such as the Gulf Intracoastal Waterway and its spoil banks, the Sabine Neches Waterway and its spoil banks, numerous roads and other infrastructure. This infrastructure, coupled with the concave shape of the marsh systems, resulted in slow drainage of Ike's surge waters, which exacerbated the natural damage from the storm surge.

The marshes of Sabine Lake are also generally brackish and intermediate marshes, and the vegetation adapted to these salinity ranges is not tolerant of the higher salinity of Ike's storm surge. Therefore, the high salinity water was either lethal to these plants or will have sub-lethal effects ranging from reduced seed production, vegetative stress and increased vulnerability to disease. Further compounding the problem is the organic soils that are typical of these marshes, and when exposed to saline waters, can produce high amounts of hydrogen sulfide, which can lead to sulfide toxicity and death in marsh plants. Organic soils are also dependant on plant roots for cohesion; therefore, upon plant death, these soils are subject to rapid erosion and dissolution in normal marsh conditions, making matters only worse.

Hurricane Ike also further eroded the beach ridge at the McFaddin National Wildlife Refuge. This already thinned, low ridge protects the entire Salt Bayou marsh system from full-strength seawater. The refuge is also generally the source that feeds freshwater into the Salt Bayou system. Regular inundation of this area by beach water will have potentially devastating impacts to the fresh, intermediate and brackish marshes in this system.

Ike may be the pivotal factor that transforms many of these freshwater, intermediate and brackish marshes into saltwater marshes, interspersed with vast amounts of shallow open water. Increased marsh loss could alter the entire food chain in these areas by having long-term impacts on the plant community. Marsh loss could also have devastating long-term impacts on fisheries production in terms of species like red drum, white shrimp and blue crab, as well as on use of these marshes by migrating waterfowl and wading birds.

## **B. Contaminants from Spills and Releases**

TPWD biologists and other experts also evaluated the presence of toxic spills. Hurricane Ike caused hundreds of localized oil and other toxic spills that threaten fish and wildlife throughout the affected area. Immediately following the storm, the EPA, U.S. Coast Guard (USCG), Texas General Land Office (GLO) and TCEQ formed a Unified Command for spill response. Experts at TPWD were also involved in the fish and wildlife spill response efforts.

As of Oct. 1, 2008, the Unified Command had assessed more than 200 pollution reports, which include more than 180 sites in the Houston-Galveston area and 47 in the area from Port Arthur to Lake Charles, Louisiana. The type and amount of pollution included oil and diesel from vessels, as well as industrial chemicals. About 35 percent of the spills reported have been cleared with no further action needed.

The Coastal and Inland Fisheries spill response team is focused on sheens of oil coating the landscape in the High Island area, which has a significant concentration of oil and gas production facilities. Approximately 3,000 acres in this area are affected by visible oil sheening and staining.

The Minerals Management Service (MMS), which oversees oil production in federal waters offshore, reported that the storm destroyed at least 52 of roughly 3,800 oil platforms in the Gulf of Mexico. Thirty-two more were severely damaged, but there was only one confirmed report of an oil spill - a leak of 8,400 gallons that officials said left no trace because it dissipated with the winds, currents and rough water.

The TPWD Wildlife Division and the U.S. Fish and Wildlife Service (USFWS) have responded to other spills at the J.D. Murphree Wildlife Management Area (WMA), the Bessie Heights Marsh (Nelda Stark Unit) of the Lower Neches WMA, and also the Anahuac, McFaddin and Sabine National Wildlife Refuges. Estimates indicate that spills affect approximately 500 to 2,000 acres on the refuges. Concerns about these spills are elevated due to the winter migrating waterfowl that arrived in late October.

## **C. Impacts to the Ocean Floor**

Scientists at the University of Texas at Austin who surveyed the inlet between Galveston Bay and the Gulf of Mexico discovered that Hurricane Ike significantly reshaped the seafloor and likely carried an enormous amount of sand and sediment into the Gulf. The ongoing survey work will identify any changes to the inlet channel that could affect navigation.

Ike's surge filled Galveston Bay with 12 feet of water, which subsequently drained back into the Gulf. Although considerable amounts of water flowed over the Bolivar Peninsula and other lower-lying portions of the barrier system, most of the surge and back surge likely passed through Bolivar Roads, by far the deepest access between the Gulf and the Bay. The very high rate of flow that passed through the inlet had the potential to cause substantial erosion, as well as transport sediment over long distances.

Scientists also determined that the surge and back surge significantly modified the seabed over broad areas. Ike either erased or substantially degraded large shell-gravel ridges up to 10 feet high. The storm gouged out sediments that had been deposited hundreds of thousands of years ago,

which created erosion pits up to five feet deep in one area. The storm appears to have mobilized and re-deposited sediments over large regions in a layer eight to 40 inches thick, as well as in isolated spots up to 6.5 feet thick.

Sediment from the surge also smothered benthic communities (organisms that live in or on the seabed, such as anemones, coral, crabs and other crustaceans). Many of the oyster beds along the coast are now covered with sediment, including Galveston Bay. TPWD estimates the bay may have lost as much as 60 percent of its oyster resources at an estimated cost of \$320 million to restore.

Initial assessment also found significant impacts to the Flower Garden Banks National Marine Sanctuary, located approximately 120 miles southeast of Galveston Island. The Flower Garden Banks contain a large number of marine species. Almost 300 species of fish, 21 species of coral, sponges and a wide variety of sharks, as well as the Loggerhead Sea Turtle (an endangered species) call this natural reef home, which is also a popular scuba diving destination. Damage from the storm included sponge injuries, mechanical injury to the *Madracis* fields on the East Flower Garden Bank, and extraction and movement of coral colonies up to 13 feet.

#### **D. Impacts to Shorelines and Barrier Islands**

Coastal wetlands and barrier shorelines and islands help provide valuable protection from severe storm damage for communities, infrastructure and citizens who live within the coastal zone of Texas. Wetlands and coastal barriers create a natural buffer in reducing storm surge and flooding. The U.S. Army Corps of Engineers (USACE) has estimated that every 2.7 miles of wetlands may absorb an average of one foot of storm surge.

Barrier islands are in a constant state of change due to the impacts of long-shore currents, wave energy, tides, sea level change, wind and storms, which all work to move sand along its length from the shoreline to the bayside. Because of their proximity to the ocean and scenic beauty, barrier islands have been heavily modified and developed. However, these areas are increasingly threatened by intensifying storms. Property damage and the cost of rebuilding have grown dramatically in recent years. For instance, as shorelines retreat and structures are threatened by the intruding sea, hard structures (e.g. jetties, seawalls, revetments and bulkheads) have been built to protect developed areas. Protective hard structures divert the ocean's energy temporarily from developed areas, but usually refocus that energy on the adjacent natural beaches, thus causing more severe erosion of those beaches and robbing many beaches of vital sand replacement. Projects to repair that damage are costly and complex and usually provide only a temporary solution.

#### **E. Impacts to Fisheries**

Ike also impacted the recreational and commercial fisheries in Galveston Bay and Sabine Lake. The hurricane devastated fishery infrastructure, impacted oyster reefs and caused fish kills in these bay systems and beyond. Over 200 incidents of fish kills occurred in tidal streams and rivers along the upper Texas Gulf Coast from Sargent to Orange Counties. Furthermore, TPWD assessments indicate that 60 of the 127 boat ramps, which provide vital access points to the state's estuarine

waters, were closed due to damage in Galveston Bay alone. After Hurricane Rita, the average cost of boat ramp repairs in the Sabine Lake system was \$125,000.

The Texas oyster fishery is the second largest in the country with Galveston Bay accounting for approximately 18 percent of total oyster landings. The average annual catch value of Galveston Bay oysters for the period between 2005 and 2007 was in excess of \$10.4 million. The estimated losses for the remainder of 2008 are in excess of \$4.5 million. These figures do not take into consideration any multiplier effects of this lost production to the local economies of the communities, and thus, should be considered conservative estimates. Furthermore, more than 60 percent of the vessels in the entire Texas oyster fleet were potentially damaged in the storm. Therefore, the full effects of the storm on catch rates may not be known for at least a year.

In addition to supporting a large commercial fishery, oyster reefs provide important habitats for numerous commercially and recreationally important fishery species, such as red drum and brown shrimp. Oysters are also vital to maintaining the water quality of Galveston Bay. Through their filter-feeding activities, oysters remove nutrients, pollutants and algae from the water column. Preliminary assessments of TPWD side scan sonar survey results indicate that Ike-induced sedimentation impacted between 50 and 60 percent of the reefs in Galveston Bay. This preliminary data also indicates that East Bay had the greatest oyster reef impact with 80 percent of the reefs showing evidence of siltation. The loss of these oyster reefs will not only impact the oyster fishery, but could result in bay-wide ecological impacts. TPWD will continue to monitor these reefs to further refine the extent and duration of these impacts.

## **F. Wildlife Impacts**

The upper Texas Gulf Coast is a primary wintering grounds for migratory waterfowl from North America's Central Flyway. It is also an important annual stopover for migrating neo-tropical birds in the fall and spring. Impacts to wintering waterfowl habitats, coastal woodlots and prairie habitats from the storm surge were immediate and direct. Seasonal seed crops were diminished and bird use for this winter will be significantly less than average. Ike wiped out many of these species' food sources, stripping berries from trees and nectar-producing flowers from plants, according to Gina Donovan, executive director of the Houston Audubon Society, which operates 17 bird sanctuaries in Texas.

Mid-winter waterfowl surveys and spring wildlife surveys will help determine the actual impacts of Hurricane Ike on coastal wildlife communities. Population reduction and overcrowding in the near surge uplands have likely heavily impacted furbearers, reptiles, amphibians, rodents, wild feline and canine in the affected areas. Most evident will likely be the immediate population density impacts on the very prominent American alligator in the coastal marshes and bayous. Amphibian species, such as pig frogs and cricket frogs, which live in coastal freshwater and intermediate marshes, will also likely be significantly affected for several years.

Abundant rain is needed to leach the salt from the soil and dilute the salinity of freshwater sources. Rain is also needed to allow the plant community to recover and provide forage for deer



and other grazing animals, as well as trees which provide habitat and food sources for birds. Rain would freshen and refill the stock tanks and ponds, which serve as the primary water sources for the wild and domesticated animals living in the area.

### **G. Impacts to National Wildlife Refuges and Preserves**

According to the USFWS, the impacts of Ike forced the closure of four National Wildlife Refuges on the upper Texas Gulf Coast. In particular, the Texas Chenier Plains Complex, which encompasses 110,000 acres of coast stretching from Houston to the Louisiana border and includes the Anahuac, Texas Point, Moody and McFaddin Refuges, caught the full force of the storm. At one point, the storm surge covered the refuges with more than 10 feet of sea water, destroying all facilities.

The Anahuac Refuge received severe damage to all buildings within the refuge boundary. A significant storm surge swept through the buildings, carrying with it equipment as it moved through the area. All that remains of these buildings are the cinder block walls and roof structures. In comparison, the McFaddin and Texas Point Refuges received catastrophic damage. Some buildings were reduced to rubble; one of refuge office has only three walls remaining.

The Texas Point Refuge opened for public access on Nov. 1, 2008. The Mud Bayou Hunt Unit on the McFaddin Refuge has also reopened for the regular waterfowl season; however, all other portions of the McFaddin Refuge remain closed to the public at this time. As of Nov. 4, portions of the McFaddin and Anahuac Refuges are expected to reopen in the coming weeks. Risk to public safety is the main reason for the continued closure due to obstructed roads, boat canals and bayous that contain storm debris.

In addition to the extensive damage to a number of refuge facilities, the storm also negatively impacted the sensitive wildlife habitats that are managed and protected by these refuges. Debris from the storm still litters most of the refuges, and an oil spill significantly affected the McFaddin Refuge, which is now in its cleanup stages.

Of greatest concern, however, is the amount of saltwater intrusion into the freshwater marshes, which are important habitats for birds along their winter migration. Traditionally, between October and March, visitors to these refuges are likely to see as many as 27 species of ducks, including green-winged teal, gadwall, shoveler and northern pintail. Huge flocks of snow geese, sometimes in excess of 80,000 geese, feed in the rice fields and moist soil units within the Anahuac Refuge. The full range of impacts to migratory and resident wildlife will not be completely known for some time.

Hurricane Ike also affected many other refuges and preserves, such as the Trinity River Refuge in Liberty County, Brazoria Refuge in Brazoria County, and the Big Thicket Preserve, which sustained less damages and have been reopened to the public. All other units remain closed, while officials advise the public to use caution on the roads and in the Preserve, as numerous hazards such as fallen timber, leaning trees and debris still exist.

Rebuilding programs are underway in the coastal refuges to ensure they can continue to prove to be essential habitats for the wintering waterfowl and other wildlife. The cost of cleaning up field

stations and replacing or repairing an array of administrative and recreational facilities was initially estimated at more than \$260 million. The costs of repairing service facilities elsewhere that were flooded or otherwise damaged by the remnants of the Hurricane Ike are still being tallied.

#### **H. Impacts to State Wildlife Management Areas (WMA)**

Hurricane Ike also impacted TPWD lands. These properties include the J.D. Murphree WMA in Jefferson County (where nearly 24,500 acres of coastal marsh habitats were inundated with 11 to 16 feet of surge water flooding), the Lower Neches WMA with approximately 5,500 acres of coastal wetlands in Orange County and the Candy Abshier WMA, which is a 207-acre coastal prairie woodlot habitat in Chambers County. The Candy Abshier WMA has been closed to the public until further notice due to hurricane impacts and damages by order of the TPWD Executive Director. Several TPWD State Parks were also heavily impacted by the storm, including the San Jacinto Battleground State Park, Galveston Island State Park and Sea Rim State Park.

Impacts to the TPWD WMAs include:

- Storm surge scour converting emergent marshes to open water.
- Cut bank erosion along the Gulf Intracoastal Waterway where tidal waters erode into adjacent freshwater and intermediate marshes.
- Damages to the infrastructure, including many water control structures and wetland management levees where large debris, such as boats, commercial vessels and barges, were driven overland by the storm surge.
- Many acres of debris fields, including over 70 acres of mixed debris filling marsh habitats in the J.D. Murphree WMA and over 30 acres of heavy debris from the Bolivar Peninsula covering much of the Candy Abshier WMA at Smith Point. The debris represents public health and safety hazards within these public lands.

TPWD staff is working to assess the full impacts of Hurricane Ike to wetland habitats, wildlife resources and infrastructure within the state WMAs. Immediate impacts of storm surge flooding and saltwater in freshwater, intermediate and brackish marshes will be monitored for secondary impacts to plant communities and wildlife. For instance, plant succession will be followed in subsequent growing seasons to determine the duration of the salinity impacts on the coastal zone soils, plants and wildlife.

#### **I. Storm Debris**

There is a significant amount of debris in wetlands, some of which was deposited in these areas from Ike's wind and storm surge, while some is being stored there temporarily by the affected communities and needs to be moved as soon as possible. FEMA estimates about 25 million yards of debris exists in the declared counties, which is enough to fill up Reliant Stadium in Houston, Texas, more than 7.5 times. Many of the discussions above detailed the impacts of debris to the National Wildlife Refuges, State WMAs, as well as other key habitats along the coast.

The General Land Office (GLO) reported the abundance of marine or wet debris; approximately 300 vessels were partially submerged and will be costly to remove. There are also containers in the Gulf and along the shoreline, some of which contain hazardous waste, which will also need to be removed. GLO is contracting with an entity to survey submerged vessels.

In some sensitive areas, mechanical removal of debris could be more damaging than allowing it to remain. More definitive guidance is also needed on debris removal from private residences, as well as debris on ranches and farms.

## Conclusion

Hurricane Ike caused widespread changes to the natural environment of the upper Texas Gulf Coast region, including on the area's wetlands, coastal marshes, wildlife and waters. The lasting impacts may not be known for many years to come. However, part of the region's natural environment may rebound on its own; some of the impacts of the disaster may be less catastrophic than they initially appear. Some areas may even begin to see beneficial changes to their ecosystems or impacts that will provide opportunity for future mitigation, such as the destruction of invasive species. For instance, while saltwater intrusion has impacted many of the native species, it has also begun to kill many of the invasive species, providing opportunity for some of the native species to grow back. Impacted natural areas will likely suffer from Ike's effects and may take many years to recover, which may result in low productivity of plants and aquatic resources, conversion of marsh to open water, loss of wildlife populations, low fisheries production and severe impacts on migratory birds.

Preliminary reports indicate that recent marsh restoration sites fared relatively well during the hurricane. However, large parts of the upper Texas Gulf Coast will be drastically changed due to Hurricane Ike. Oyster reefs in East Bay that were silted over due to shell dredging over 30 years ago have still not recovered. It is unknown how much of the silted oyster reef in Galveston Bay will recover within the short- or long-term. The Salt Bayou marsh system adjacent to Sabine Lake (the largest marsh system in Texas) will likely not recover to its pre-Ike conditions without radical intervention, including rebuilding the beach ridge that separates this marsh from the Gulf of Mexico, restricting saline water flows into the marsh from the Sabine Neches Waterway and reconnecting this marsh with freshwater flows from north of the Gulf Intracoastal Waterway.

At the same time, the devastation of Hurricane Ike has provided an opportunity to focus on federal, state and local efforts in enhancing coastal resilience. Coastal areas have an abundance of important natural resources, specifically coastal wetlands and barrier shorelines, which help provide valuable protection for wildlife, pastures, communities, infrastructure and citizens who live in the coastal zone. State and federal agencies will continue to actively support coastal restoration and protection as primary tools for coastal resilience and remain active in the long-term planning and recovery efforts for the upper Texas Gulf Coast region. Achieving coastal resilience will require joint efforts to restore and protect these valuable natural resources that help lessen the impact of hurricanes on Texas communities.

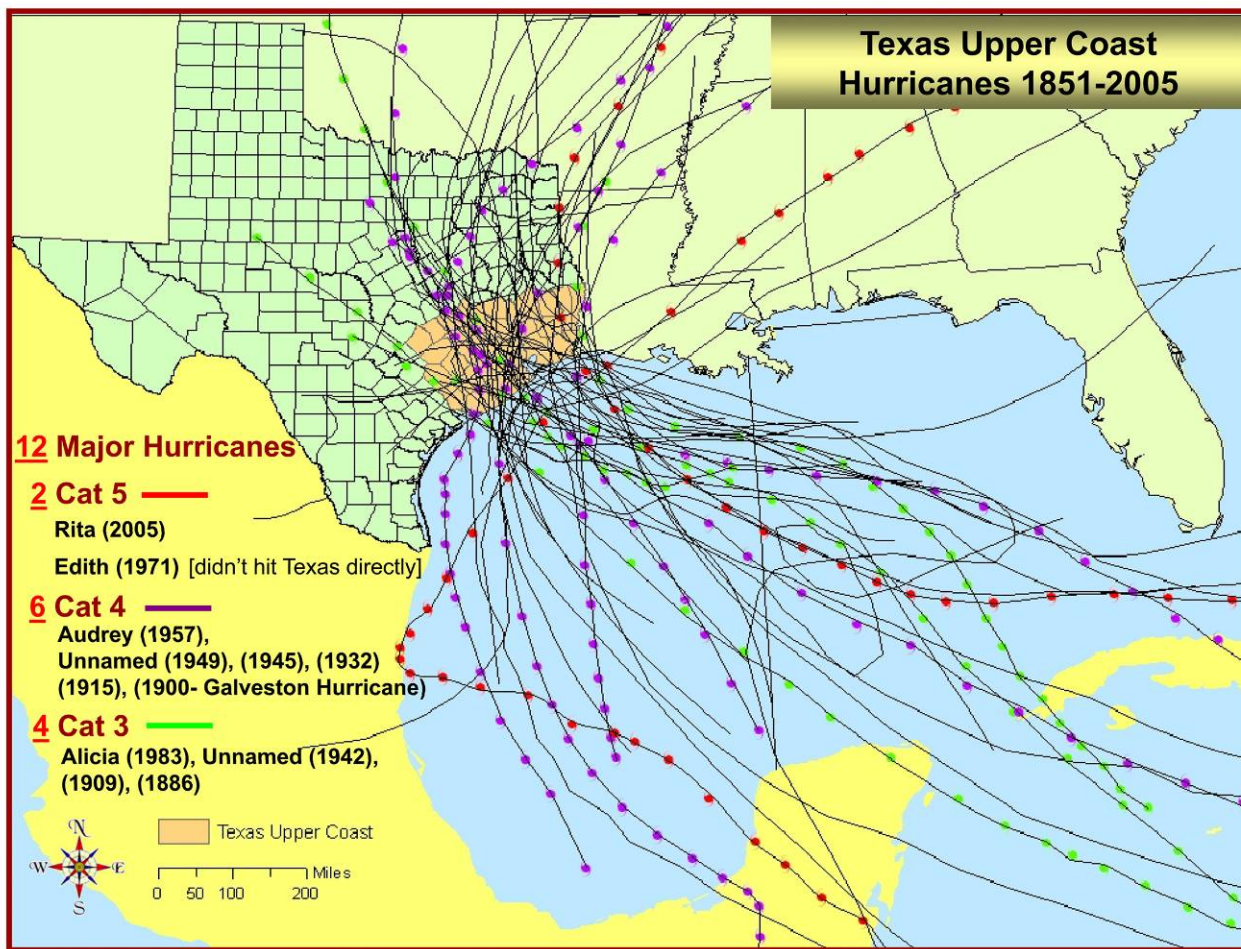
Coastal erosion, rising sea level, land subsidence and increasing severe storms and hurricanes along with continued coastal development all affect the natural environment. Protecting resources, livelihoods and homes must be balanced with the recognition that we are limited in our ability to stabilize the natural processes that affect the coastline and barrier islands.

## Chapter V: Cumulative Impacts and Recovery Considerations

The history of hurricanes and tropical storms along the upper Texas Gulf Coast provides evidence of the need for a long-term perspective. As devastating as Ike has been, it is but the latest storm to hit the area, and it will not be the last.

Since the 16<sup>th</sup> century, 26 major storms have made landfall on the Southeast Texas coast, with estimated damage totals of over \$80 billion (USD 2007), an average of \$205 million per event. The cost for Ike has yet to be tallied, but FEMA's December 2008 damage figures show almost \$300 million in housing, almost \$1.8 billion in public assistance, and approximately \$300 million in assistance from FEMA "Other Needs Assistance."

In the last three years, the upper Texas Gulf Coast was hit by Hurricanes Gustav, Dolly, and Rita and Tropical Storm Eduardo. As of November 2008, FEMA Individual Assistance (IA) alone has provided \$254 million in only five of the Hurricane Ike declared counties, for a total of \$812 million over the last 10 years of disaster declarations.





## **The Role of Mitigation**

A successful recovery is often thought to be one that brings communities back healthier, more sustainable and more poised for success than they were before the disaster. A key element following a natural disaster to ensure this success is the recognition of the natural hazards affecting the area, and an infusion of hazard mitigation into all elements of recovery and reconstruction. FEMA, as well as other federal and state agencies, has contributed substantial efforts and funding to ensure a more sustainable future for Texas communities. This trend should continue.

### **FEMA Mitigation Grant Programs**

Since 1972, the FEMA Mitigation grant programs have granted almost \$551 million to Texas communities totaling 465 disaster mitigation projects. From 1992 to 2008, FEMA-Mitigation has granted \$92 million for 38 projects in the counties hardest hit by Hurricane Ike. The scopes of work for those 38 projects included acquiring and demolishing properties and returning the lots to open space, strengthening the public infrastructure, and improving sustainability.

Currently, in the wake of Hurricane Ike, many jurisdictions have expressed interest in enhancing their backup power capability by participating in the FEMA Hazard Mitigation Grant program; over \$15 million will be available for this type of project. The problem will be finding appropriate matches between needs and appropriate funding programs.

### **The National Flood Insurance Program**

The National Flood Insurance Program (NFIP) provides for flood insurance in communities that participate in the program. Communities must adhere to minimum floodplain management and building standards in exchange for their citizens to be enabled to purchase flood insurance. FEMA Flood Insurance Rate Maps (FIRM) determine the Special Flood Hazard Area and any federally backed mortgage or loan for a structure that must be covered by flood insurance.

### **FEMA Repetitive Loss Grant Program**

Our nation has many structures that have been damaged repetitively by flooding. These properties, defined as Repetitive Loss and Severe Repetitive Loss, constitute a \$9.3 billion drain to the National Flood Insurance Fund. They are so numerous that a special grant program has been established by FEMA to mitigate or purchase these properties and remove them permanently from the floodplain.



The Texas coast has its share of Repetitive Loss properties. Galveston County has 2,533 Repetitive Flood Claim (RFC) properties and Severe Repetitive Loss (SRL) properties out of 62,790 properties. Jefferson County has 945 RFC and SRL properties out of 61,253. Orange County has 275 out of 24,436 properties. The Repetitive Damage in Affected Areas as of 10/08/2008 map shows the repetitive loss areas showing the degree of sustained repetitive loss in Texas Upper Coastal counties.

Approximately \$10 million in FEMA RFC funds have been available annually to reduce flood damages of insured properties with one or more claims to the National Flood Insurance Program (NFIP).

### **Disaster Mitigation Act of 2000**

The Disaster Mitigation Act of 2000 requires that every community must have a mitigation plan in order to be eligible for certain disaster aid and grant programs. This planning regulation has taken an important first step to begin risk identification and vulnerability for thousands of communities but it lacks the authority to incorporate these mitigation actions and assessment into community comprehensive plans. The Disaster Mitigation Act of 2000 also lacks the requirement for recovery planning in communities that face catastrophic or near catastrophic events such as coastal areas.

FEMA Mitigation has initiated and completed thousands of projects to protect individual homes and community infrastructure. Additionally the planning requirement has come a long way to promote hazard risk identification and vulnerability assessment. But for areas that face devastating hurricanes year after year, a much more comprehensive approach may be necessary to enhance sustainability. Florida coastal communities that have been affected by several hurricanes have begun to develop long term community recovery plans with the assistance of NOAA and FEMA. Hurricane Ike may prove to be a catalyst for the Texas coast communities to begin the process of building back sustainable communities.

### **Mitigation—Best Practices**

#### **City of Friendswood**

In the City of Friendswood, 122 homes had flooded with \$1,000 or more damage in the last 10 years. The area where repeated flooding was reported included a total of 500 homes. The city extended an offer to buy out some of those homes and 136 homeowners accepted. Friendswood bought the houses, demolished them and left the lots vacant. During Hurricane Ike, the area flooded, without damage to any property and returned a taxpayer savings of \$32,520,000.

#### **Memorial Hermann Baptist Hospital**

Fearing the wrath of Hurricane Rita, which turned out to be the fourth most destructive storm on record, staff hurriedly evacuated patients a little more than 20 miles away to the hospital's affiliate in Beaumont, Texas. Their actions came just in time. The Category 3 hurricane rolled in with a vengeance on September 24, 2005, rendering the hospital inoperable for more than two weeks. That hard lesson prompted hospital officials to take similar mitigation measures for all future events.

Working with funds from a \$933,750 federal grant, the hospital moved the power units from the lower floor to the second floor, elevated the automatic transfer unit and installed electrical roll-down shutters to deter wind-borne debris and water intrusion. When Hurricane Ike closed a nearby hospital in Beaumont, this hospital remained operational, providing medical services and economic support during the response and early recovery phases.

#### **Rice University**

As a leading research institution in Harris County with strong commitments to undergraduate education, Rice University parlayed its proactive stance to countering repeated flooding. To protect its property against floods, the university invested over \$2 million to move its power system to upper floors. When Hurricane Ike slammed into Texas in September of 2008, the university experienced rising water from the deluge of rainfall that accompanied Ike, but did not flood, allowing classes to continue and the university to extend assistance to the community as it responded to those affected by Hurricane Ike.

## **Long-Term Community Recovery: A path to resilient and sustainable communities**

For communities to bounce back, resilient and sustainable, many difficult discussions and collective decisions will need to be made. For this reason, fully engaging residents in community recovery planning is critical to charting a better, safer future.

Understandably, the urgency to return to normalcy for residents and business owners following a disaster builds quickly and is amplified by a substantial inflow of capital for reconstruction. Such windows of opportunity do not typically stay open long following a disaster, and resolution must be found between the immediacy of reconstruction and the longer term efforts to enhance local resilience.

Planning at all levels of government can be a powerful process for achieving resiliency and sustainability by balancing development, economic, and environmental interests while providing safe and livable places.. The integration of hazard mitigation plans with local and regional comprehensive plans can reduce future losses and improve resilience through the careful use of land use planning and development management.

The upper Texas Gulf Coast is, by definition, vulnerable to hurricanes. To protect against future storms, communities will need to consider strategies for larger-scale and more complex recovery and hazard mitigation actions. Steps for reducing hurricane threats include restoring marshes, planning reconstruction away from vulnerable areas, and elevating structures for flood protection. In addition, innovative building techniques are emerging that use lower cost, streamlined, modular designs with materials that withstand hurricane force winds. During the recovery, there will be opportunities for strategies to rebuild residential and municipal structures in a manner that meets hazard mitigation standards while achieving affordability and accessibility objectives.

Achieving livable communities that provide disaster-resistant housing, employment, transportation, and public services means taking a closer look at what it means to be sustainable. An essential characteristic of sustainable communities is their ability to reduce their vulnerability to disasters. This impact assessment should reveal those vulnerabilities, and then may open doors for an approach that strives for more disaster-resistant communities along the upper Texas Gulf Coast.

As municipalities begin to wrestle with questions of where and how to rebuild their communities to be better prepared for future disasters, they must balance a long-term view with the short-term pressures to just move forward when recovering from a devastating disaster.

### **SUCCESSFUL RECOVERY**

A clear understanding of the key recovery issues and opportunities is critical to coming back as stronger, more resilient and more sustainable communities. The drivers of successful recovery are:

### **Locally-driven recovery process**

The importance of gaining full public involvement in the long-term recovery process cannot be overstated. Community engagement – the process of working collaboratively with and through groups of people affiliated by geographic proximity, special interest or similar situations to address issues affecting the well-being of those people – is a primary and necessary tool. Community engagement can also promote environmental and behavioral changes that will improve the health of the community, foster the development and growth of relationships among partners, and bring about beneficial changes in policies and programs. When clearly heard and considered by decision-makers, the voices of community members can be the most powerful guiding force in achieving successful long-term recovery.

The mobilization and engagement of community stakeholders should occur in a manner that fosters empowerment. Many residents will be actively involved in this process through direct membership in local committees, by providing input to local and state administrators and legislators, and by other means to ensure they are actively engaged. It is also imperative that members of special-needs populations and the organizations supporting these populations are among the stakeholders engaged in this process. Inclusive community engagement not only benefits individual stakeholders, but also contributes to the sustainability of the entire community.

**Recovery Coordination** - A multitude of partners from the federal, state and local levels offer an array of recovery resources, including dollars, in-kind donations, and technical expertise. A key function in the recovery process is the coordination of recovery agencies and activities, including the identification of resources, streamlining assistance, sharing information, and ensuring the inclusion of all essential groups in the process. This report provides a foundation for all of those functions.

**Concurrent Recovery Activities** - As with most planning activities, there are uncertainties surrounding what will happen, and when. The major challenge is the interdependence of employment and housing. Businesses cannot operate without employees, and employees cannot work without having a place to live. Similarly, communities they must work toward mitigating the impacts of future disasters by building back smarter and more sustainably, while simultaneously improving individual, family and community emergency preparedness.

## Conclusion



One of the keys to the success of the long-term recovery of communities, large and small, is the ability to align needs and priorities into one coherent roadmap for the future. This can be challenging, as it is oftentimes difficult for communities to focus on the long-term impacts of the decisions being made while other more pressing needs are being addressed. Months after Hurricane Ike made landfall, communities along the upper Texas Gulf Coast continue to struggle with debris, damaged homes and buildings. Many families are working tirelessly to return to their homes while others are displaced indefinitely, living in HUD-managed apartments. Meanwhile, decisions that affect the future of these communities are undoubtedly being made, and it would behoove everyone to make sure those decisions carefully consider the ramifications.

Many of the most severely impacted communities will face years of recovery activities and efforts before their communities are made whole again. Preliminary estimates indicate that these communities face huge recovery costs compounded by other issues related to the hurricane's impacts, including loss of population and thus a lower tax base. These issues are further exacerbated by the current economic downturn. Damage to the built environment is extensive and may result in as much as \$1 billion in FEMA funding alone to repair the Texas coast. Economic impacts based on damages to the petrochemical industry, natural resources and housing may result in a reduced capacity to quickly recover. Impacts from the widespread changes to the natural environment of the upper Texas Gulf Coast region, including on the area's wetlands, coastal marshes, wildlife and water may take years to fully comprehend.

At the same time, the devastation of Hurricane Ike has provided an opportunity to focus on federal, state and local efforts which may include, stronger, safer and more sustainable communities, reducing loss from natural disasters, enhancing coastal resilience, rebuilding in a way that is designed not only to put back what was lost, but to make it better. Many jurisdictions have already expressed interest in enhancing their backup power capability by participating in the FEMA Hazard Mitigation Grant program; over \$15 million will be available for this type of project.

In order to take advantage of these opportunities, there must be involvement, engagement and action on the community level to shape the direction of the recovery. When clearly heard and considered by decision-makers, the voices of community members can be the most powerful guiding force in achieving successful long-term community recovery.

A careful recovery planning process can increase the likelihood that a community can establish a common vision for the future work toward a safer, stronger community. Taking time to think about the direction a community is going and then figuring out the most efficient way to get there can help not only bring the community together, but also determine how best to identify, target and leverage available resources.

## NEXT STEPS

The *Hurricane Ike Impact Report* is the result of a collaborative process between federal and state departments and agencies, with input from a wide variety of other sources. This initial effort mainly involved entities with a limited role in response and short-term recovery effort in order to allow the critical work of stabilization to take place. Now that the early stages have passed and stabilization of communities is underway, the collaboration and communication process can be expanded to more fully engage the impacted communities and local organizations.

The information contained in this report can serve as the starting point for communities to begin evaluating the direction they seek to go in their recovery. It will provide information to allow communities to understand some of the recovery issues and opportunities and envision what to do next. Outside entities can also use this information to determine where and how to engage communities to expand their support roles. Collaboration and communication to link resources with community needs will be an ongoing effort for all involved.

Partnerships are a vital element to the nation's disaster management system because of the growing complexity of our society. We need robust partnerships in order to coordinate the actions of numerous federal agencies, private businesses and nongovernmental organizations. It is anticipated that the partnership with the newly formed Governor's Commission for Disaster Recovery and Renewal will continue to move this effort forward. Additional reports may be developed in the future. Such subsequent reports could provide additional information to further inform community and state recovery planning, as well as serve as a benchmark of progress. Reports will aim to keep recovery partners focused, highlight important changes and add new data sources and assessments as they become available.

For sharing additional damage assessment and impact analysis information, please contact:

[FEMA-ESF14-Coordinator@dhs.gov](mailto:FEMA-ESF14-Coordinator@dhs.gov) .

## About the Editor

### Emergency Support Function #14 Long-term Community Recovery

Emergency Support Function #14 (ESF #14) is one of the 15 emergency support functions under the National Response Framework (NRF). The NRF establishes the structure that guides the country's disaster management system. As a support function, ESF #14 Long-term Community Recovery (LTCR) is responsible for conducting impact analyses, providing interagency coordination, and technical assistance to states and local communities in long-term recovery efforts where such capabilities may be partially or completely compromised following a large-scale disaster. ESF #14 LTCR works in partnership with federal, state, and local entities to enable communities to identify opportunities, create partnerships and maximize recovery resources for a more effective recovery.

ESF #14 was activated in Texas for Hurricane Ike DR-1791 by the Federal Coordinating Officer. Activation was made prior to landfall due to the potential widespread impacts of the approaching hurricane. Since arrival, ESF #14 has worked with the State of Texas and partnering federal agencies to implement the mission, including working directly with the most heavily impacted communities to develop their recovery strategies and with the State to develop a coordination framework to maximize recovery resources.

A result of this effort is the development and compilation of the *Hurricane Ike Impact Report*. As lead agency for ESF #14, FEMA has solicited input from each of the ESF #14 partnering agencies in preparation of this report. ESF #14 has also served as the editor, bringing together the damage assessments and impact analyses of various federal and state agencies, as well as private and public-sector organizations. This process has encouraged information sharing and resulted in the compilation of information into one place to articulate a shared understanding of disaster impacts and recovery opportunities facing the upper Texas Gulf Coast.

This report is also intended to serve as a basis for informing and bringing together current and potential recovery partners. If the communities of the upper Texas Gulf Coast are to recover in a way that truly reduces their vulnerability to future disasters, the cumulative cost over the years – both in terms of funds and human resources – will be more than one community, one state or even the government can do alone.

Strong partnerships will be fundamental, and a shared understanding of the road ahead, a necessity.