2017

Chambers County
Hazard Mitigation Plan

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Acronym List

RHMP	Regional Hazard Mitigation Plan
HMAP	Hazard Mitigation Plan
H-GAC	Houston-Galveston Area Council
FEMA	Federal Emergency Management Agency
TDEM	Texas Division of Emergency Management
TX	Texas
CRS	Community Rating System
NFIP	National Flood Insurance Program
HMGP	Hazard Mitigation Grant Program
CHARM	Community Health and Resource Management
mph	miles per hour
NOAA	National Oceanic and Atmospheric Administration
NSSL	National Severe Storm Laboratory
OEM	Office of Emergency Management
ArcGIS	Geographic Information System
RL	repetitive loss
KBDI	Keetch-Byram Drought Index
WUI	Wildland Urban Interface
FM	Farm to Market road
PHSI	Palmers Hydrological Severity Index
USDA	United States Department of Agriculture
LAL	Lightning Activity Levels
NCDC	National Climate Data Center
CDC	Centers for Disease Control and Prevention
NCEI	National Centers for Environmental Information
SPIA	Sperry-Piltz Ice Accumulation
NWS	National Weather Service
LEP	Linear Extensibility Percent
COLE	Coefficient of Linear Extent

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Part 1: Introduction

Part 1: INTRODUCTION

Chambers County's previous Hazard Mitigation Plan was adopted in 2006 and updated in 2011 as part of a seven-county Regional Hazard Mitigation Plan (RHMP). Due to new regulation and planning recommendations, Chambers County prepared a new countywide multi-jurisdictional Hazard Mitigation Plan (HMAP). Chambers County partnered with the Houston-Galveston Area Council (H-GAC) for both the 2006 and 2011 plans and continued this partnership during the development and adoption of the HMAP.

Image source: https://www.wikipedia.org/

History

On April 28, 2006, the Federal Emergency Management Agency (FEMA) and the Texas Division of Emergency Management (TDEM) approved the first RHMP. H-GAC prepared the regional plan in coordination with FEMA and TDEM to ensure it met all applicable state and federal requirements. H-GAC updated the RHMP in 2011 to re-assess vulnerabilities and increase the number and diversity of mitigation action items. The plan includes a more robust assessment of natural hazards, newly uncovered vulnerabilities, more advanced analysis techniques, and a more effective and informed mitigation strategy.

Purpose of Plan

The purpose of Chambers County's HMAP is to reduce the loss of life and property within the county and lessen the negative impacts of natural disasters. Vulnerability to several natural hazards has been identified through research, analysis, and public input. These hazards threaten the safety of residents and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and play in the county. While natural hazards cannot be eliminated, the effective reduction of a hazard's impact can be accomplished through thoughtful planning and action.

The concept and practice of reducing risks to people and property from known hazards is generally referred to as hazard mitigation. One of the most effective tools a community can use to reduce hazard vulnerability is developing, adopting, and updating a hazard mitigation plan as needed. A hazard mitigation plan establishes the broad community vision and guiding principles for reducing hazard risk, including the development of specific mitigation actions designed to eliminate or reduce identified vulnerabilities.

Scope of Plan

Chambers County is in the east-central region of Texas, and scope of the HMAP includes the following participating jurisdictions:

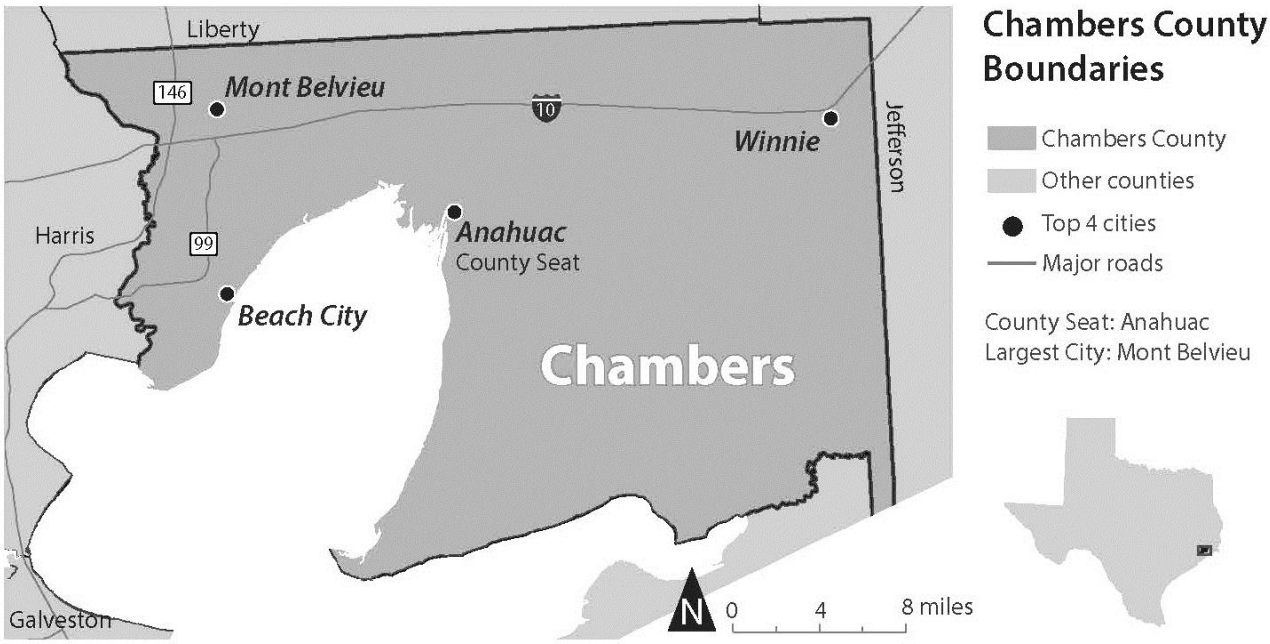
- Unincorporated Chambers County
- Anahuac
- Beach City
- Mont Belvieu
- Cove
- Chambers-Liberty Counties Navigation District
- Old-River-Winfree

Presidential Declared Disasters

Chambers County has persevered through many natural disasters. The table below lists the presidential declared disasters that the County has experienced in recent history. Each disaster is costly and challenging. The goal of this HMAP is mitigation and to reduce the impact of future disasters.

Declaration type	Declaration Date	Disaster Number	Type	Title
Major Disaster Declaration	7/28/1979	595	Flood	Storms& Flash Floods
Major Disaster Declaration	8/19/1983	689	Hurricane	Hurricane Allison
Major Disaster Declaration	10/18/1994	1041	Flood	Storms and Flash floods
Major Disaster Declaration	8/26/1998	1239	Severe Storm	Tropical Storm Charlie
Emergency Declaration	9/1/1999	3142	Fire	Extreme Fire Hazards
Major Disaster Declaration	6/9/2001	1379	Coastal Storm	Tropical Storm Allison
Emergency Declaration	2/1/2003	3171	Other	Loss of the Space Shuttle Columbia
Emergency Declaration	9/2/2005	3216	Hurricane	Hurricane Katrina Evacuation
Emergency Declaration	9/21/2005	3261	Hurricane	Hurricane Rita
Major Disaster Declaration	9/24/2005	1606	Hurricane	Hurricane Rita
Major Disaster Declaration	1/11/2006	1624	Fire	Extreme Wildfire Threat
Emergency Declaration	8/18/2007	3277	Hurricane	Hurricane Dean
Emergency Declaration	8/29/2008	3290	Hurricane	Hurricane Gustav
Emergency Declaration	9/10/2008	3294	Hurricane	Hurricane Ike
Major Disaster Declaration	9/13/2008	1791	Hurricane	Hurricane Ike
Major Disaster Declaration	8/25/2017	4332	Hurricane	Texas Hurricane Harvey

Planning Area Map



The HMAP profiles the following hazards:

- Flooding
- Hurricanes and Tropical Storms
- Drought
- Lightning
- Heat Events
- Hail
- Tornado
- Expansive Soils
- Coastal Erosion

The plan, developed in accordance with state and federal rules and regulations governing local hazard mitigation plans, was adopted by the participating jurisdictions and shall be routinely monitored and revised to maintain compliance with all state and federal regulations.

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Part 2: Planning Process

Part 2: PLANNING PROCESS

This section includes a description of the process used by H-GAC, the County, and participating jurisdictions to develop the 2017 HMAP.

Overview

Hazard mitigation planning can be described as the means to break the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that pre-disaster investments will significantly reduce the demand for post-disaster assistance by alleviating the need for emergency response, repair, recovery, and reconstruction.

Hazard mitigation planning is the process of identifying natural hazards, understanding community capabilities and resources, identifying and assessing hazard vulnerability and risk, and determining how to minimize or manage those risks. In partnership with Liberty County, H-GAC approached the hazard mitigation planning process by establishing a Planning Team. The next step of the planning process was the assessment of hazards and how they can impact specific assets. H-GAC conducted a hazard analysis that was provided to the Planning Team and presented at a public meeting on October 19, 2017.

After hazard identification and analysis, communities considered their vulnerability to the identified threats. Crucial input from the participating jurisdictions and members of the public helped inform a vulnerability and risk assessment for the entire county. H-GAC used information gathered from meetings with the Planning Team, online participation and input from the participating jurisdictions, and natural hazard modeling techniques to produce a comprehensive vulnerability assessment.

The planning process culminated in a mitigation strategy, i.e. identification of specific mitigation actions, which when viewed, represents a comprehensive strategy to reduce the impact of hazards. The Planning Team met on December 18, 2017, to begin the process of developing an overarching mitigation strategy, and a long-term approach to update and maintain the HMAP. Specific mitigation actions are identified in this plan and included in Appendix E. Responsibility for each mitigation action is assigned to a specific individual, department or agency along with a schedule for its implementation. Plan Maintenance procedures (Part 8 of this plan) establish procedures to monitor progress, including the regular evaluation and enhancement of the Plan. Multijurisdictional coordination and integration of the HMAP into local planning mechanisms was also addressed. The established maintenance procedures ensure that the plan remains a dynamic and functional document over time.

Plan Development Resources

The Liberty County HMAP was developed using existing plans, studies, reports, and technical information. Materials and historic data were used to inform participants throughout the planning process, evaluate and analyze hazards, and develop the mitigation strategy.

Plan Development Resources: Existing Documents and Data	
FEMA Disaster Declarations	FEMA Flood Map Services
H-GAC Land Use & Demography Database	Houston-Galveston Area Regional Plan
State of Texas Hazard Mitigation Plan	NOAA Storm Event Database
US Census American Fact Finder	Texas A&M Forest Service Wildfire Reports
USGS Homeland Infrastructure Foundation-Level Data	USDA Census of Agriculture Reports
Liberty County Community Plan	2011 Regional Hazard Mitigation Plan

Plan Adoption

Liberty County's Commissioner Court adopted this HMAP on October 9 2018. The signed resolution can be found in Appendix E.

Planning Team

Liberty County and H-GAC established the Planning Team in Fall 2017 in preparation for the first public meeting and hazard mitigation planning workshop held on October 19, 2017. Members were asked to attend all public meetings in person but were provided an online alternative if they were unable to do so. Online materials, surveys, forms, and documentation are provided in Appendix A. Representatives from the County Office of Emergency Management served as liaisons between H-GAC and stakeholders, staff, and members of the public who were unable to attend the meetings.

Jurisdiction/ Agency Represented	Title	Contact Method
Liberty County	Emergency Management Coordinator	Email
Liberty County	Deputy Emergency Management Coordinator	Email
Liberty	Assistant Fire Chief	Email
Cleveland	City Manager	Email
Cleveland	Fire Chief	Email
Cleveland	Public Works Director	Email
Cleveland	Finance Director	Email
Cleveland	Police Chief	Email
Daisetta	City Manager	Email
North Cleveland	Mayor	Email
Ames	Mayor	Email
Dayton	Mayor	Email
Dayton Lakes	Mayor	Email
Devers	Mayor	Email
Hardin	Mayor	Email
Kenefick	Mayor	Email
Plum Grove	Mayor	Email

Stakeholders

There were a variety of stakeholders throughout the community and neighboring jurisdictions that were a part of the planning process; these stakeholders either attended meetings, contacted the planning team with their input or both. The chart below shows these stakeholders and their titles. Their input was utilized throughout the plan and specifically in the Hazard Analysis and Mitigation Strategy sections of this plan.

Stakeholder	Title	Contact Method
Texas A&M AgriLife	Extension Program Specialist	Email/ Hosted CHARM Meeting
Texas Department of State Health	Public Health Nurse	Email/ Attended CHARM Meeting
Liberty Dayton Hospital	CEO	Email/ Attended CHARM Meeting
U.S Army Corps of Engineers	Civil Engineer	Email/ Attended CHARM Meeting
State Representative	District Director	Email/ Attended CHARM Meeting
US Fish and Wildlife Service	Biologist	Email/ Attended CHARM Meeting
Chambers County	Emergency Management Coordinator	Email/ Phone Call

Meeting Dates & Details

A variety of meetings were held throughout the planning process of the HMAP. These are listed below. The public meeting on October 19th was advertised through press releases to local papers and through radio (See Appendix A for details). The CHARM meeting was open to all plan participants as well as stakeholders throughout the county; this meeting was advertised through email and phone calls to stakeholders and planning team members. Feedback from meetings was incorporated throughout the hazard analysis and mitigation strategy sections; meetings and the planning team helped identify or clarify vulnerabilities and mitigation actions throughout the jurisdictions.

The meetings followed shortly after Hurricane Harvey. Many residents and local staff were busy with recovery efforts at the time, and attendance was difficult. To ensure the public's ability to participate in the planning process, H-GAC hosted all HMAP-related materials online and advertised both the meetings and the website link (http://www.h-gac.com/community/community/hazard/liberty-county-hazard-mitigation.aspx).
Online surveys, resources, a mitigation action submittal portal, and a place to submit comments on the draft plan were made public on the H-GAC website (see Appendix A).

October 19, 2017: Hazard Mitigation Kickoff Meeting

H-GAC and the Planning Team hosted a public meeting at the Liberty County Jack Hartel Building on October 19, 2017. The purpose of the meeting was for H-GAC staff to gather feedback and input on the draft Hazard Analysis and discuss local vulnerabilities. The planning team and members of the community were given a presentation and provided large maps displaying the analysis of various hazards. Participants worked with H-GAC staff to improve the accuracy of the analysis and pinpoint the vulnerabilities of each hazard within their communities. Meeting participants also discussed their current ability to mitigate these threats and how to draft a mitigation action to address them. Prior to the meeting, community members and stakeholders were invited through press releases, public service announcements, and other advertisements. See Appendix A for the meeting agenda, attendee information, and press release.

December 18, 2017: Hazard Mitigation Strategy Meeting

H-GAC hosted a planning team meeting at its offices in Houston on December 18, 2017. The purpose of this meeting was to begin the development of a Mitigation Strategy and determine Plan Maintenance procedures. H-GAC staff gave a presentation on both topics and led a discussion about strategy development. Planning Team

members outlined a mitigation strategy and refined their mitigation actions. See Appendix A for the meeting agenda and attendee information

April 13, 2017: Community Health and Resource Management (CHARM) Workshops
The County had the opportunity to partner with Texas A&M's AgriLife to host a workshop for all jurisdictions in the county (https://tcwp.tamu.edu/charm/); members of the planning team attended as well as local stakeholders (See Appendix A for a complete sign-in sheet). The workshop utilized GIS to explore current conditions including data such as 100 year-floodplain and social vulnerability throughout the jurisdictions. After current conditions were presented, the workshop participants discussed what they wanted future land use to look like given the current conditions.

Planning Team Participation

The chart below shows which jurisdiction participated in each opportunity throughout the planning process.

Jurisdiction	Attended Kickoff Meeting	Attended CHARM Workshop	Online Participation
Unincorporated Liberty	x	x	x
Ames		x	
Cleveland	x	x	x
Daisetta	x	x	
Dayton		x	
Dayton Lakes			x
Devers			x
Hardin			x
Kenefick			x
Liberty	x	x	
North Cleveland	x	x	
Plum Grove		x	

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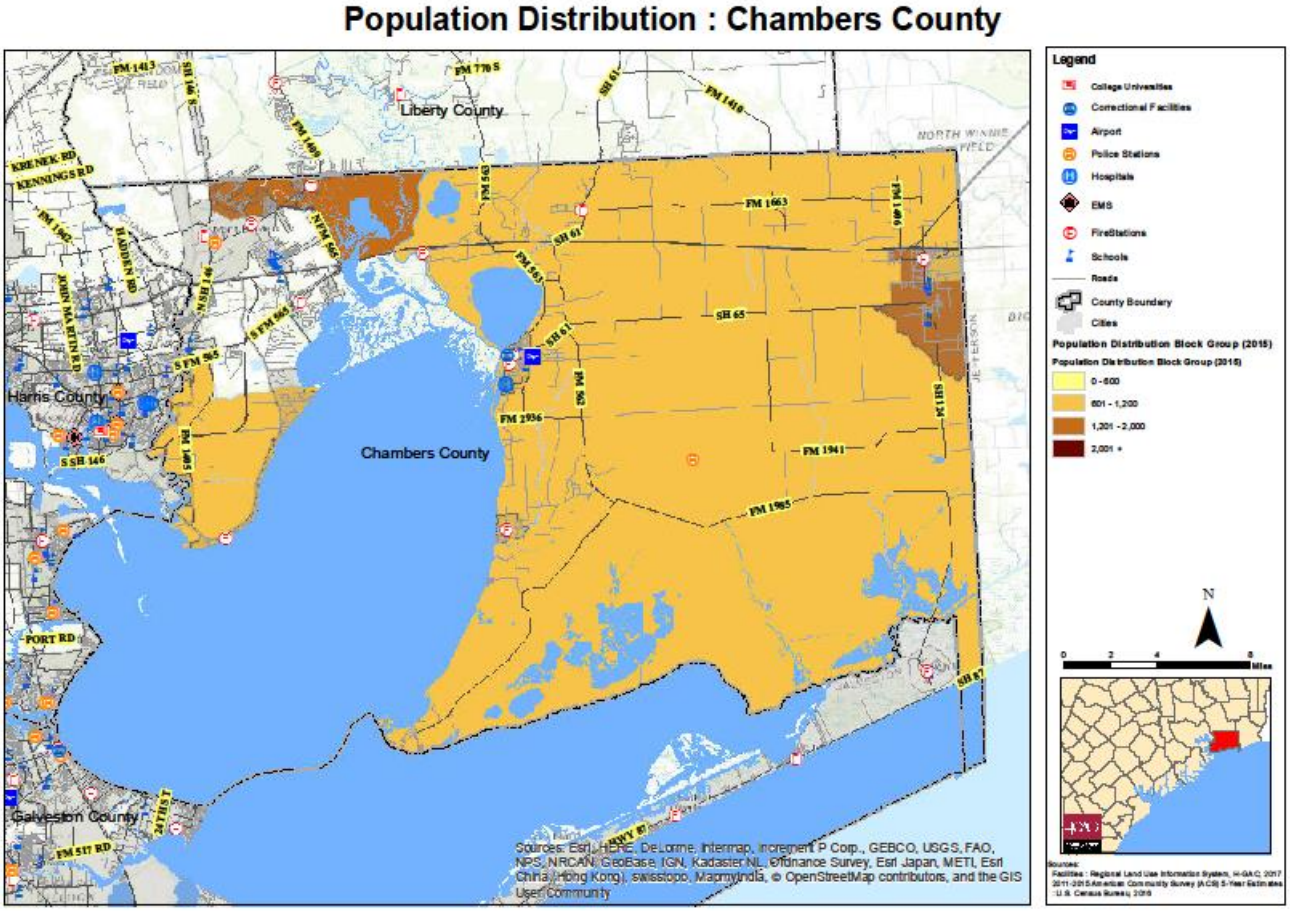
Part 3: County Profile

Part 3: COUNTY PROFILE

Chambers County is a rural and coastal county east of Houston. It is bound by Cedar Bayou to the west, Trinity Bay to the south and west, and Galveston Bay and Bolivar Peninsula to the south. Its landscape is defined by marshes along the southern coast and near the mouth of the Trinity River in the west. The remainder of the county is flat prairie land. Interstate 10 crosses the northern end of the county. Other major highways include State Highways 61, 65, 99, and 146.

Chambers County is home to 39,899 residents and is forecast to reach 59,000 by 2040. West of the Trinity River are the communities of Beach City (2,614), Cove (510), Mont Belvieu (5,584), Old River-Winfree (1,190), and a portion of Baytown.[i] Anahuac with a population of 2,339, is the only incorporated community east of the Trinity River, although the Winnie/Stowell area is an important population center.[ii]



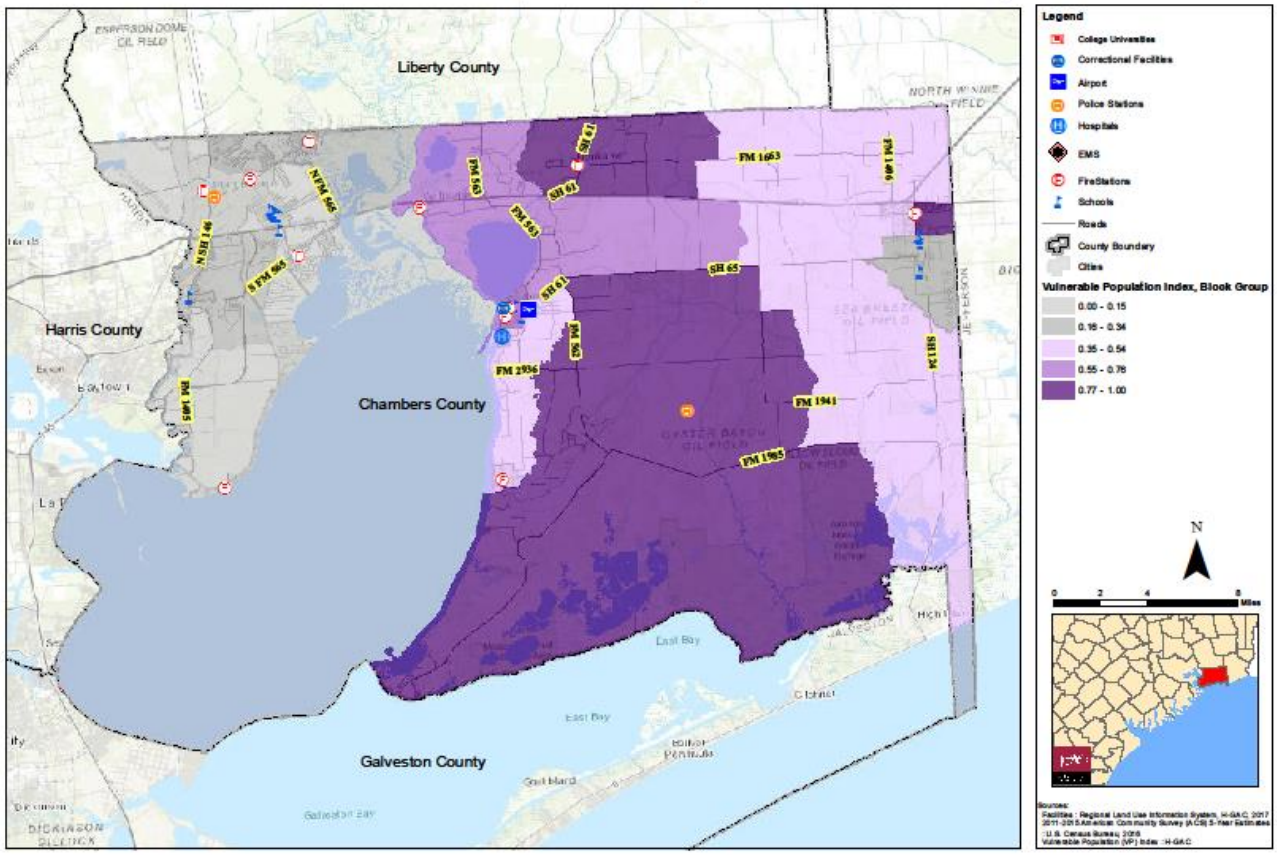
Chambers County is economically divided between the communities and petrochemical complexes west of the Trinity River that are part of the Houston metropolitan region and the largely rural areas east of the Trinity River. Liquefied petroleum gas production and ancillary businesses are the primary economic drivers for the county. While most of these companies are in Harris County, the economic cluster extends into Chambers County. The Cedar Crossing Industrial Park is the fifth largest industrial park in the world, at 15,000 acres.[vi] It is home to large distribution centers for retailers including Walmart, Home Depot, and IKEA. The economy in the eastern portion of the county is largely agricultural, along with a regionally significant fishery.

The Chambers-Liberty Navigation District, a participating district in the plan, helps to maintain the waterways and water supply that agriculture, local industry, and local municipalities depend on; their planning area are various water waterways throughout Chambers and Liberty County. While there was no current map available,

water ways include the Trinity River Channel, Anahuac Channel, Cedar Bayou Channel, Double Bayou Channel, Trinity River Channel at Smith Point, and Lake Anahuac. Assets are a main pump plant, a main canal system, and the Upper Texas Coast Water-Borne Education Center all three of these assets are in Anahuac. The plant has a pumping capacity of 240,000 gallons per minute utilizing four pumps. The district also maintains a series of waterways listed directly above.

Chambers County's median household income is $70,500, the second highest in the region.* The county's homeownership rate (81%) is much higher than the state (62%) and residents spend around 56% of their income on costs related to housing and transportation. A testament to its rapid growth in recent years, over 40% of Chambers County's housing units were built since 2000 compared to 25% in the State of Texas. Although the county is not home to any post-secondary institutions, it had the highest high school graduation rate in the region in 2015 at 98%.

Vulnerable Population Map : Chambers County



The Vulnerable Population Index identifies areas throughout Chambers County that may not have the means or the resources to act when a natural disaster occurs in Chambers County. For the purposes of this plan, vulnerable populations include any households without a car, single female household with child/ children in the home, individuals living below the poverty line, individuals who are disabled, individuals who are Hispanic, individuals who are non-Hispanic, and non-white, and individuals 65 years and older. The areas in the county with the greatest proportion of these individuals is defined as the most vulnerable areas in Chambers County. On the map, the areas in dark purple (or dark grey if printed in black and white) are the areas that have greatest proportion of the vulnerable population in Chambers County. The map shows that the southwest of the county near the Anahuac National Wildlife Refuge has the largest proportion of the vulnerable population in Chambers County. Defining and mapping

vulnerable populations provides the opportunity to demonstrate where perhaps the most need is throughout Chambers County.

References

*The region includes Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller and Wharton counties.

[i] U.S. Census [ii] U.S. Census [iii] Houston-Galveston Area Council [iv] U.S. Census [v] Baytown-West Chambers County Economic Development Foundation [vi] Baytown-West Chambers County Economic Development Foundation [vii] Baytown-West Chambers County Economic Development Foundation

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Part 4: Hazard Identification

Part 4: HAZARD IDENTIFICATION

The State of Texas's Hazard Mitigation Plan has identified 5 major natural hazards that affect the region. These include hurricane, flood, wildfire, drought, and tornado[i]. The local planning team identified 9 natural hazards which could affect the county and local jurisdictions.

Flooding

Flooding is one of the most frequently occurring, destructive, and costly natural hazards facing Texas.[ii] There are two main categories for floods: general and flash flooding. General flooding is typically a long-term event that can last from a couple of days to weeks. This type of flooding is characterized by an overflow of water from an existing waterway, including rivers, streams, and drainage ditches. Flash flooding is an event that typically lasts a few minutes to less than 6 hours. Either type of flooding can destroy infrastructure, homes, and other structures, and pulling cars off roads. However, flash flooding typically is considered the most dangerous type of flooding, because of its "speed and the unpredictability"[iii]. Generally, the impact of flooding is intensified in urban areas because of less impervious surfaces and in suburban or rural areas because of building in vulnerable areas. While 100 and 500-year floodplains are identified throughout the county and local jurisdictions, flooding can occur outside of these areas.

Lightning

Lighting can be seen throughout thunderstorms, hurricanes, intense forest fires, and winter storms. Lightning occurs when positive and negative charges build within a cloud leading to a rapid discharge of electricity[iv]. While there are several types, lightning is typically classified as ground flashes or cloud flashes. One of the more common lightning strikes are cloud-to-ground lightning; these strikes are classified as ground flashes. Cloud-to-ground lighting starts as a channel of negative charge, called a stepped leader, zigzagging downward in roughly 50-yard segments in a forked pattern [v]

Lightning often strikes tall structures, such as trees and skyscrapers, but can also strike open fields or other areas depending on where the electrical charges form. Lightning causes an average of 80 deaths and 300 injuries each year in the United States.[7] In 2017, 16 people were killed by lightning in the United States, two of these deaths occurred in Texas, but not in the county. [vi]

Hail

Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into balls of ice. To be considered hail, frozen precipitation needs to be at least .2 inches. Size of hail can range from pea-sized (1/4 inch in diameter) to softball-sized (4 ½ inches in diameter). Quarter sized hail (1 inch in diameter) and above is considered severe by the National Oceanic and Atmospheric Administration's (NOAA) National Severe Storm Laboratory. Hail storms can result in significant damage to vehicles, buildings, and crops. Severe hail and hail swaths can result in an accumulation of hail on roadways and roofs, which may result in car accidents or roofs collapsing.[vii]. As of 2015, Texas had the highest level of hail loss claims throughout the country. According to the National Insurance Crimes Bureau, hail loss claims totaled 400,000 dollars in Texas from 2013 to 2015. However, damage from hail typically occurs in northern Texas rather than southern Texas.

Hurricanes and Tropical Storms

Tropical cyclones with sustained winds of 74 mph and above are classified as hurricanes. Hurricanes can reach wind speeds of 156 mph or more, which would be considered a category five on the Saffir-Simpson scale with potential for catastrophic damage. Hurricanes generally have a well-defined center, called the eye. Hurricane season is generally June 1st through November 30th each year.[viii]However, hurricanes can and have formed outside of this season. Hurricanes are one of the top natural hazards affecting the region, with flooding and high winds considered the main impacts from hurricanes and tropical storms. [ix]

Tropical cyclones (rotating low-pressure weather systems that have organized thunderstorms, but no fronts) with sustain winds of at least 39 mph and no higher than 73 mph are classified as tropical storms. Tropical storms generally have ill-defined centers and slower moving winds than hurricanes.[12]

Hurricane Harvey is a recent example of the impact hurricanes and tropical storms have on the region, county, and local jurisdictions. Hurricane Harvey made landfall on August 25th, 2017 as a category four hurricane near Rockport, Texas; Hurricane Harvey traveled further inland as a tropical storm over the next few days. The tropical storm triggered general and flash flooding throughout the region with recorded rainfall measuring as high as 60.58 inches in the region. Flooding was seen throughout the county and local jurisdictions.

Tornado

Tornadoes are a violently rotating column of air touching the ground, usually attached to the base of a thunderstorm.[x] However, tornadoes have formed during hurricanes and tropical storms. Tornadoes form when there is a change in a storm's speed and direction. Tornadoes can have wind speeds that range from 40 mph to 300 mph and move at 10 mph to 20 mph. However, tornadoes typically last a few minutes. The damage seen from a tornado is largely due to the strength of the winds, but strong hail and lighting often accompany tornadoes.[xi]

Windstorms, an identified common hazard throughout the region, are addressed through the hurricane and tornado sections.

Drought

Drought varies greatly in length and extent. High temperatures, high winds, and low humidity can worsen drought conditions and can make areas more susceptible to wildfire. Human demands and actions, such as farming and animal grazing, can also hasten drought-related impacts. There are typically four types of drought: meteorological, agricultural, hydrological, and socio-economic. Meteorological droughts are typically defined by the level of dryness over a given period. Hydrological droughts are defined by the decline of soil/ground water or stream flow or lake/ river levels. Agricultural droughts refer to the impact of low rainfall and storm water or reduced ground water or reservoir levels needed for agriculture. Socio-economic drought considers the impact of drought conditions on supply and demand of some economic goods such as grains.[18, xii]

There are a wide range of effects that can occur from drought, including decreased land prices, loss of wetlands, increased energy demand, and increase of mental health disorders.[xiii] Impacts seen in Texas from drought in the past, include wildfires, loss of agricultural crops including rice and wheat fields, and increase in energy cost and demand. [xiv]

Expansive Soils

Expansive soils are soils and soft rock that tend to swell or shrink due to changes in moisture content. Expansive soils (bentonite, smectite, or other reactive clays) expand when the soil particles attract water and can shrink when

the clay dries. Changes in soil volume present a hazard primarily to structures built on top of expansive soils. In Texas, most expansive soils are in band 200 miles west of the coastline, stretching approximately from Beaumont to Brownsville. These areas receive the most moisture and are also vulnerable to droughts, which can cause the soils to contract. Problems associated with expansive soils are sinking or broken foundations or ruptured pipelines. In the region, the problems associated with expansive soils typically occur during drought periods.[xv]

Land subsidence is another typical hazard identified in the region that affects the character of the soils throughout the region. However, during the public meeting and input from the planning team land subsidence was not a topic of concern and appears to have a negligible impact on the county.

Coastal Erosion

There are several types of erosion including soil and coastal erosion. Soil erosion is comprised of two types: wind erosion and water erosion. Wind erosion is a common occurrence, which typical occurs when winds blow across flat, sparsely vegetated, or disturbed land, lifting soil into the air or displacing soil to a new location. Wind erosion can cause soil deterioration and air pollution.[xvi] Water erosion can occur over land or in streams and channels. Water erosion that takes place over land may result from rain, shallow sheets of water flowing off the land, or surface flow, which is concentrated in areas of lower elevation. Stream channel erosion may occur as the volume and velocity of water flow increases enough to cause movement of the streambed and bank soils.[xvii] Major storms, such as hurricanes, may cause significant erosion by combining high winds with heavy surf and storm surge to significantly affect the rate of coastal erosion.[xviii]

Coastal erosion in the county is a central concern for communities located along the coast. Coastal erosion is the wearing a way of beaches and bluffs due to storms, wave action, sea level rise, and human activities. Coastal erosion is responsible for an estimated 500 million dollars per year in property loss throughout the U.S. Coastal erosion can impact local economies that depend on tourism and ports, and high property values for beachfront homes and establishments. Additionally, coastal erosion can greatly impact wetlands and destroy natural ecosystem and natural barriers that can help to protect from other natural hazards including hurricanes.

Heat Events

While the National Weather Service defines excessive heat as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks, a Heat Event is more loosely defined. A heat event could be a period where the county experiences high temperatures which could affect residents particularly children and the elderly. According to the National Weather Service, the county particularly in summer months experiences typical daily temperatures more than 90 degrees and humidity more than 75 percent. These high temperatures mixed with high percentage of humidity can affect the elderly and children even though these are not above average temperatures for the county.

References

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Part 5: Risk Assessment

Part 5: RISK ASSESSMENT

A Vulnerability Assessment is the process of identifying threats by natural hazards to the population and infrastructure. By identifying the greatest vulnerabilities within the County, it becomes possible to develop a Mitigation Strategy that effectively allocates resources for addressing the most serious vulnerabilities. For this assessment, the Planning Team conducted three main processes to identify the vulnerabilities within Chambers County:

- Cataloging critical and valuable assets within the County.
- Conducting a capability assessment.
- Assessing the County's vulnerability to each hazard and ranking these hazards according to degree of risk.

H-GAC maintains a database of critical facilities. During a public meeting on October 17, 2017, Chambers County officials reviewed and updated this list, including adding additional valuable assets within the community. Following this process, the Planning Team determined 138 facilities are critical or valuable assets. Through a Hazus analysis, the Planning Team identified residential and commercial units. Appendix B contains a comprehensive list of the facilities and the capability survey assessment. The full Hazus analysis is catalogued in Appendix C. A summary of the facilities is provided below.

Critical Facilities & Valuable Assets

Asset Description	Quantity
Schools and Universities	12
Dams	13
Electric Substation	26
EMS	5
Fire Station	11
Hazardous Waste Treatment Facility	2
Hospital	2
Emergency Operation Center	1
Police Station	13
Shelters & Housing Facilities	11
Fire Stations	11
Toxic Release Inventory Facility	23
Power Plant	5
Wastewater Treatment Plants	3

Capability Assessment

The participating jurisdictions completed a capability assessment survey to collect data on hazards that affect communities, the communities' ability to mitigate damages from these hazards, and current plans or programs in place to help mitigate natural hazards. The jurisdictions also identified factors impacting their capability to address hazards in their communities. The Planning Team used information to assess the risk within each community and to determine a strategy to integrate the HMAP into their current planning mechanisms. A condensed version of the information is provided below.

Existing Plans & Regulations

DRP: Disaster Recovery Plan
FMP: Floodplain Management Plan
EOP: Emergency Operations Plan
COOP: Continuity of Operations Plan
RP: Regional Planning
SO: Subdivision Regulation
WPP: Wildfire Protection Plan
CRS: Community Rating System
SARA: SARA Title III Emergency Response Plan

Jurisdiction	DRP	FMP	EOP	COOP	RP	SO	SARA
Unincorporated Chambers County		x	x				x
Anahuac		x	x				x
Beach City		x	x				x
Mont Belvieu		x	x	x			x
Cove		x	x				x
Chambers-Liberty Counties Navigation		x	x				x
Old-River Winfree						x	

Expand and Improve

Participating jurisdiction examined their existing authorities, policies, programs and resources. Participating jurisdiction then identified ways to improve upon and expand their existing authorities to support the mitigation strategy.

Jurisdiction	Capability Expansion Opportunities
Unincorporated Chambers County	Identified their local budget as a factor that decreases their capability to implement mitigation actions and reduce future damages. Chambers County will apply for state and federal funding to help fund mitigation actions that reduce the impact of natural hazards.
Anahuac	Need for technical staff and larger budget. Will apply for state and federal funding to help fund mitigation actions that reduce the impact of natural hazards.
Beach City	Low local budget and technical staff as a weakness in their current funding. Will apply for federal funding to help reduce the impacts of natural hazards within the community
Mont Belvieu	Identified the low local budget as a barrier for implementing the mitigation strategy. Will apply for state and federal funding to help fund mitigation actions that reduce the impact of natural hazards.
Cove	Low local funding as a barrier for implementing projects. Will apply for state and federal funding to help fund mitigation actions that reduce the impact of natural hazards.
Chambers-Liberty Counties Navigation	Identified a low local budget to implement mitigation actions. Will apply for federal funds to reduce the impact of natural hazards within the jurisdiction.
Old-River Winfree	Old-River Winfree will supplement their local budget by applying for state and federal funding to help fund mitigation actions that reduce the impact of natural hazards.

Risk Assessment Survey

The hazards were ranked by scoring the frequency, impact, and vulnerability of each. Impact and vulnerability ratings were weighted more heavily than frequency scores when determining overall risk. Additionally, communities described the loss or damage, and provided specific data that expand on the descriptions provided below.

Frequency Ratings	Impact Ratings	Vulnerability Ratings
Unlikely: Rare and isolated occurrences; Unlikely to occur within the next 5 years.	**Negligible:** Less than 10 percent of property and population impacted in the planning area.	**Low:** Hazard results in little to no damage, and negligible loss of property, services, and no loss of life. Planning area is not vulnerable to this hazard.
Likely: Frequent and regular occurrences; Likely to occur within the next 5 years.	**Limited:** 10 to 25 percent of property and population impacted in the planning area.	**Moderate:** Hazard results in some damage, and moderate loss of property, services, and potentially loss of life. Planning area is moderately vulnerable to this hazard.
Very Likely: Consistent and predictable occurrences; Likely to occur more than once in the next 5 years.	**Significant:** 25 to 75 percent of property and population impacted in the planning area.	**High:** Hazard results in extensive damage, and extensive loss of property, services, and potentially loss of life. Planning area is highly vulnerable to this hazard.
	Extensive: 75 to 100 percent of property and population impacted in the planning area.	**Extreme:** Hazard results in catastrophic damage, loss of property, services, and loss of life. Planning area is extremely vulnerable to this hazard.

Hazards Ranked by Risk

Each identified hazard poses a risk to Chambers County. Ranking the hazards from greatest to lowest risk allows the communities to prioritize their resources and focus efforts where they are most needed.

Risk Rating	Ranking	Hazards
High	1	Flooding
	2	Hurricanes and Tropical Storms
	3	Tornado
Moderate	4	Drought
	5	Heat Events
	6	Expansive Soils
	7	Lightning
Low	8	Coastal Erosion
	9	Hail

2017

Part 6: Hazard Analysis & Vulnerability Assessment

Part 6: HAZARD & VULNERABILITY ANALYSIS

Introduction

After the potential hazards in the county were identified, the Planning Team reviewed historic data and conducted an analysis in ArcGIS for each hazard. This analysis was presented at the October 17, 2017, public meeting. At this meeting, stakeholders provided many firsthand accounts of damage caused by natural disasters. These reports were taken into consideration and included in the hazard analysis when possible. The result of that process has determined 9 different natural hazards require mitigation efforts. The maps and the discussion that follow are a compilation of data analysis, historic information, and public feedback.

2017

Part 6.1: Flooding

6.1 Flooding

Floodplains are the primary tool used by FEMA to determine areas at risk of flooding. The periodic flooding of lands adjacent to rivers, streams, and shorelines is a natural and inevitable occurrence that can be expected based upon established recurrence intervals. The recurrence interval of a flood is the average time interval, in years, that can be anticipated between flood events of a certain magnitude. Using the recurrence interval with land and precipitation modeling, forecasters can estimate the probability and likely location of flooding. These are expressed as floodplains. The most commonly used floodplain measurements are the 100-year floodplain and the 500-year floodplain. The 100-year floodplain has a 1 in 100 chances of flooding each year. The 500-year floodplain is estimated to have a 1 in 500 chances of occurring each year.

Flooding causes widespread and varying degrees of damage. The magnitude or extent of flood damage is expressed by using the maximum depth of flood water during a specific flood event. Structures inundated by 4-feet or more of flood water are considered an absolute loss. Other forms of loss. such as roads, bridges, agriculture, services, or death or injury are also summarized by jurisdiction in this plan.

Historic Occurrences

Damage and occurrence data for Chambers County flood events is listed below. The data reported no crop damage, loss of life, or injuries as the result of these events.

Jurisdiction	Date	Property Damage (2015 Dollars)	Notes
Unincorporated	5/20/2000	$50,000	Flooding on SH 124 with street flooding in Anahuac. Rainfall totals up to 8 inches in western part of county.
Unincorporated	6/8/2001	$0	Flooding from the remnants of T.S. Allison. Damage included in previous report.
Unincorporated	6/9/2001	$0	Flooding from the remnants of T.S. Allison. Damage included in previous report.
Countywide	11/5/2002	$25,000	Numerous roads closed due to high water on extremely saturated grounds.
Unincorporated	12/4/2002	$9,000	Flooding around Highway 124 near Winnie; numerous roads underwater and impassable.
Mont Belvieu	3/13/2003	$5,000	Street Flooding in and around Mont Belvieu.
Winnie	8/31/2003	$3,000	Portions of Highway 124 flooded.
Unincorporated	8/31/2003	$3,000	Roads in Smith Point flooded.
Unincorporated	9/1/2003	$3,000	High water across Hwy 124 between Winnie and High Island.
Mont Belvieu	6/23/2004	$25,000	Flooding in and around Mont Belvieu.
Winnie	6/25/2004	$10,000	Flooding at intersection of Interstate 10 and Highway 124 in Winnie.
Winnie	5/29/2006	$50,000	Flooding in and around the city with at least twenty homes receiving water damage.
Unincorporated	7/6/2007	$40,000	Water entered a Post Office building.
Unincorporated	8/5/2008	$5,000	Interstate 10 was closed near SH 61 due to heavy rains from Tropical Storm Edouard.
Unincorporated	4/24/2009	$1,000	Heavy rainfall due to slow moving thunderstorms produced brief road closures along Interstate 10, with four feet of water reported over the road at the intersection of Highway 61 and the interstate.
Winnie	3/21/2015	$15,000	There were flooded and impassable roadways, with a few flooded vehicles, around town. A local rain gauge at Spindletop Bayou near Winnie reported 6.89 inches of rainfall.
Mont Belvieu	6/4/2016	$10,000	High rainfall lead to flooded roadways from Mont Belvieu east down I-10 to the town of Cove. High water that lead to road closures were reported at the intersection of Highway 146 and FM 1942 in Mont

			Belvieu, Highway 146 near I-10 south of Mont Belvieu, and Hackberry Gully at Highway 565 southwest of Cove.
Winnie	12/3/2016	$5,000	Street flooding was reported in around the town of Winnie. The road was closed at the intersection of I-10 and Highway 124 due to high water.
Mont Belvieu	3/29/2017	$0	Street flooding caused car stalling in and around FM 565 south of Interstate 10, especially between the Grand Parkway and the Cove area.
Unincorporated	6/4/2017	$3,000	Highway 124 became impassable and one car was flooded.
Beach City	8/27/2017	$0	Sections of I-10, FM 565 at I-10 and SH 146 at Cherry Point Drive were all flooded and therefore closed across the county. Major lowland flooding occurred along the Trinity River. Extensive flooding was observed in the Milam Bend subdivision (Baytown) along Cedar Bayou.
Mont Belvieu	8/27/2017	$0	Sections of Highway 99 the Grand Parkway were inundated with flood waters.
Mont Belvieu	8/28/2017	$0	Sections of Interstate 10 across Chambers County were closed due to flood water inundation.
Unincorporated	8/28/2017	$0	Sections of FM 1724 south of I-10 were closed due to flooding.
Anahuac	8/28/2017	$0	Parts of FM 562 south of Anahuac were closed due to flooding.
Unincorporated	8/29/2017	$0	Sections of Interstate 10 west of Winnie were inundated and closed due to high flood waters.
Unincorporated	8/29/2017	$0	Flooding occurred over Texas Roads 61 and 65 just east of Anahuac.

Source: https://www.ncdc.noaa.gov/stormevents/

Chambers County Disaster Declarations

There have been 2 federally declared flood disasters in Chambers County since 1979 and 10 Tropical Storms & Hurricanes. While there is a separate section for Tropical Storms & Hurricanes the county identified flooding as a major concern during these storms. These events are considered the most significant flood events in Chambers County's recent history. The worst flooding reported by Chambers County was due to Hurricane Harvey in 2017.

Year	Description	Disaster Declaration Number
1979	Storms and Flash Floods	595
1983	Hurricane Allison	689
1994	Storms and Flash Floods	1041
1998	Tropical Storm Charlie	1239
2001	Tropical Storm Allison	1379
2005	Hurricane Rita	3261
2005	Hurricane Rita	1606
2007	Hurricane Dean	3277
2008	Hurricane Gustav	3290
2008	Hurricane Ike	3294
2008	Hurricane Ike	1791
2017	Texas Hurricane Harvey	4332

Source: https://www.FEMA.gov/

NFIP Participation & Repetitive Loss Properties

The National Flood Insurance Program (NFIP) is a voluntary program that aims to reduce the impacts of flooding by incentivizing communities to adopt and enforce floodplain management regulations. The NFIP provides affordable flood insurance for property owners, renters, and businesses in participating communities. This reduces the socio-economic impacts of flooding on communities through risk reduction via flood insurance and reduces the physical impacts of flooding through beneficial floodplain regulation.

Each of the participating jurisdictions function under the regulatory umbrella of Chambers County. Chambers County employs a floodplain administrator who acts to oversee communities throughout the county. All jurisdictions in the plan, except the Navigation District, currently participate in the NFIP.

The county adopted a Floodplain Management Ordinance adopted on March 10, 2015. To remain NFIP compliant, the CFM's office conducts jurisdiction wide permitting of new development, permit review, engineering review, flood code enforcement, document development and flood zones using GIS, educate the public, and provide public assistance. To improve flood mitigation efforts and enhance their NFIP program, the participating jurisdictions will adopt and enforce stronger floodplain management regulations for new construction in Special Flood Hazard Areas (SFHAs).

Throughout the participating jurisdictions there are a total of 65 repetitive loss properties (RL). RLs are properties that have received at least two insurance payments of $1,000 or more from the NFIP within the last 10 years.

Jurisdiction	Residential RLPs	Non-Residential RLPs	SRL Properties	Total RLPs
Unincorporated Chambers County	54	6	5	60
Anahuac	2	0	1	2
Beach City	1	0	0	1
Mont Belvieu	0	2	0	2

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the average number of events in each jurisdiction annually and then calculates the percent chance of the event occurring within a year.

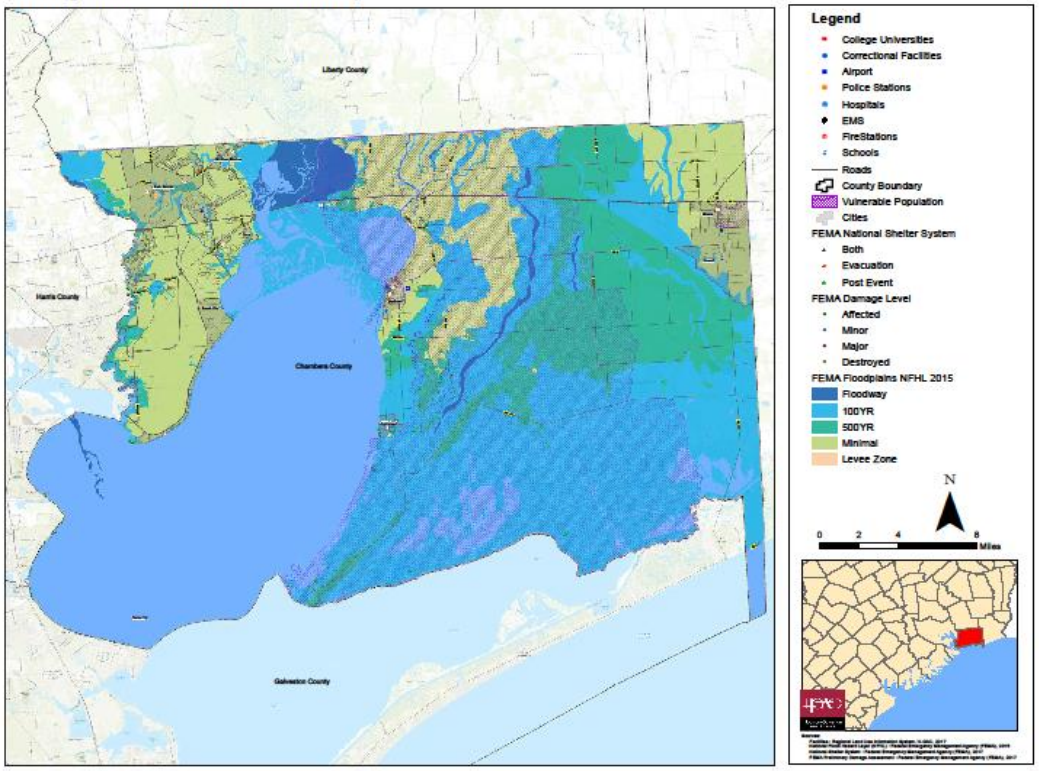
The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders, FEMA, NOAA, and the Department of Homeland Security (DHS) are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- FEMA's Hazus analysis software
- GIS analysis of critical facilities in the floodplain; and
- Stakeholder identified vulnerabilities.

Hazus was used to determine the economic loss and calculate the buildings stock that's at risk of flooding in Chambers County. The complete HAZUS report is in Appendix C. H-GAC maintains a database of critical facilities in Chambers County. Using GIS, this plan identifies any critical assets located within the 500-year floodplain. Stakeholders then provided valuable insight into additional vulnerabilities within their communities.

Floodplains: Chambers County



Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	14
Area Affected:	75 %	**Annual Event Average:**	.82
Probability: Very Likely; 82 percent chance the event will occur in a year			
Extent: According to past events the county has experienced 46 inches of floodwater; the county can experience 50 to 56 inches of water.			

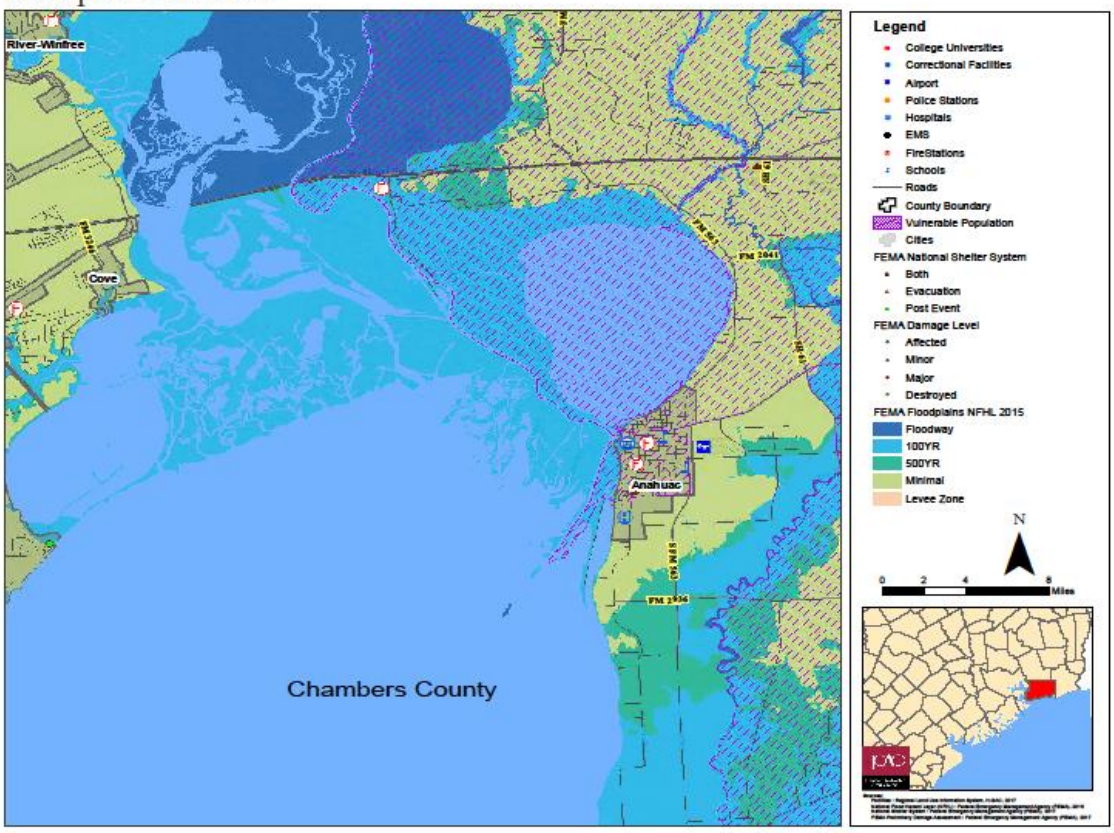
Identified Vulnerabilities:

- Vulnerable populations concentrated throughout the southeast of the county
- Approximately 4,000 homes flooded throughout the county particularly near cotton creek and north of I-10
- Oyster and rice farming are a significant part of the county's economy with over 734 farms throughout the county- Crops account for $15,049,000 of total revenue from farms and livestock accounts for $10,544,000 of total revenue from farming

Identified Impacts:

- Vulnerable populations (defined in the Community Profile Section) include residents without cars, funds or other resources to evacuate in case of a flood event; significant injury, loss of life could occur because of the inability evacuate to dry land
- Financial and economic loss for residents throughout the county whose homes may flood in an event
- Financial and economic loss for farmers and the county due to loss of crops, agricultural lands and/ or cattle

Floodplains: Anahuac



Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	2
Area Affected:	75 %	**Annual Event Average:**	.11
Probability: Likely; 11 percent chance the event will occur in a year			
Extent: According to past events the county has experienced 44.5 inches of floodwater; the jurisdiction can experience 50 to 55 inches of water.			

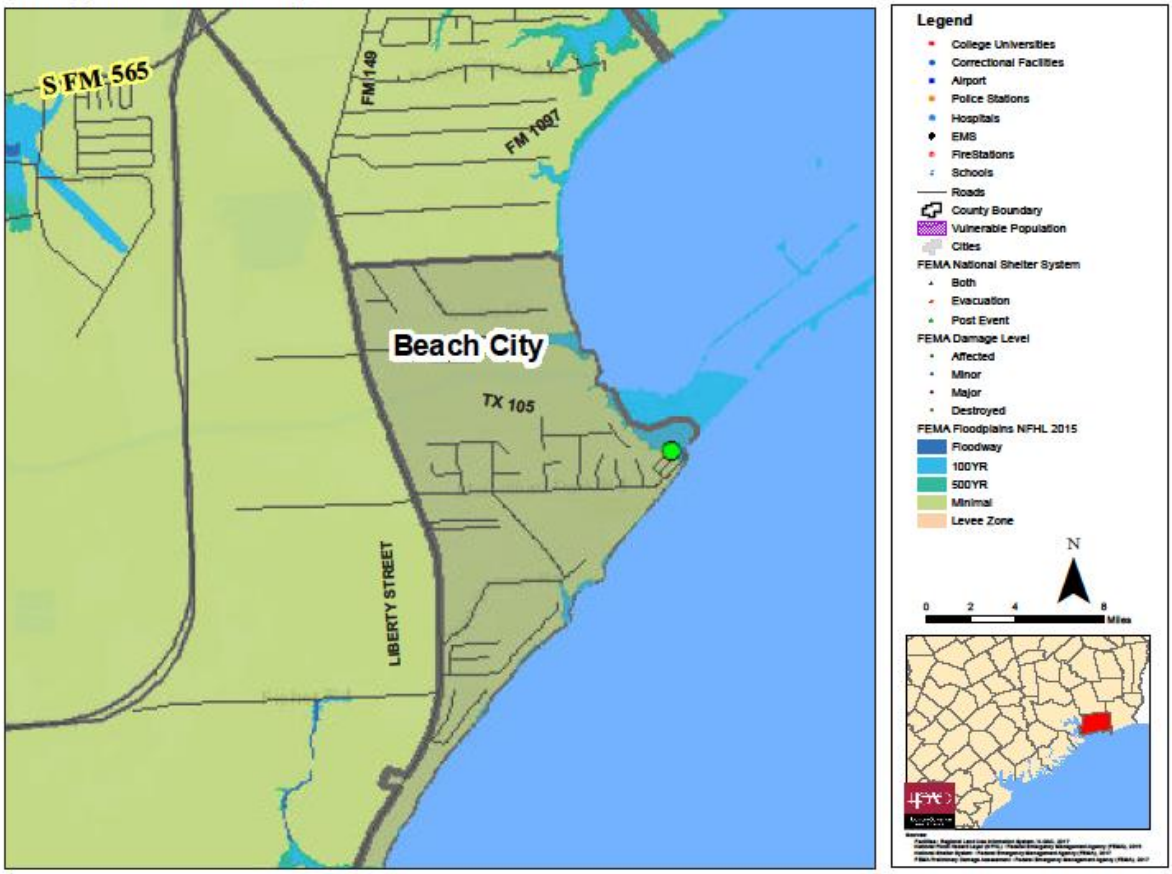
Identified Vulnerabilities:

- Critical facilities including: 3 shelters, 2 schools, 2 EMS, 3 fire station, 1 hospital, 1 EOC, 3 police stations, 1 correctional facility, 1 solid waste landfill, 1 water treatment plant
- Floodplain throughout southeast of the jurisdiction
- Vulnerable populations concentrated to the northwest of the city
- Has the only water treatment plant in the county

Identified Impacts:

- Vulnerable populations (defined in the Community Profile Section) include residents without cars, funds or other resources to evacuate in case of a flood event; significant injury, loss of life could occur because of the inability to evacuate to dry land
- If the water treatment plant floods this may impact water quality throughout the county during and after event

Floodplains: Beach City



Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	2
Area Affected:	75 %	**Annual Event Average:**	.11
Probability: Likely; 11 percent chance the event will occur in a year			
Extent: According to past events the county has experienced 42 inches of floodwater; the jurisdiction can experience 47 to 52 inches of water.			

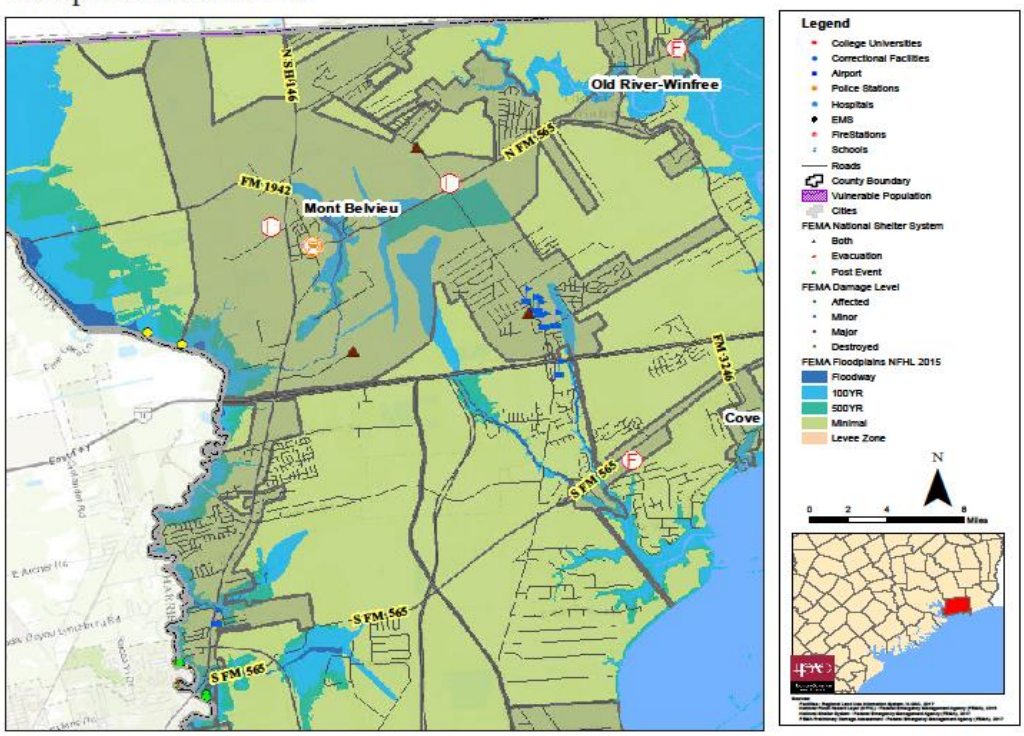
Identified Vulnerabilities:

- Southeast of the city is on the coast and located within the 100-year floodplain
- Critical Facility: 1 fire station; fire station has flooded in past flood events

Identified Impacts:

- If the fire station floods in future flood events this could prolong response time potentially leading to increase in serious injury or loss of life throughout the jurisdiction
- Loss of life, commercial or residential property throughout the southwest of the city

Floodplains: Mont Belvieu



Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	7
Area Affected:	75 %	**Annual Event Average:**	.41
Probability: Very Likely; 41 percent chance the event will occur in a year			
Extent: According to past events the county has experienced 49 inches of floodwater; the jurisdiction can experience 54 to 60 inches of water.			

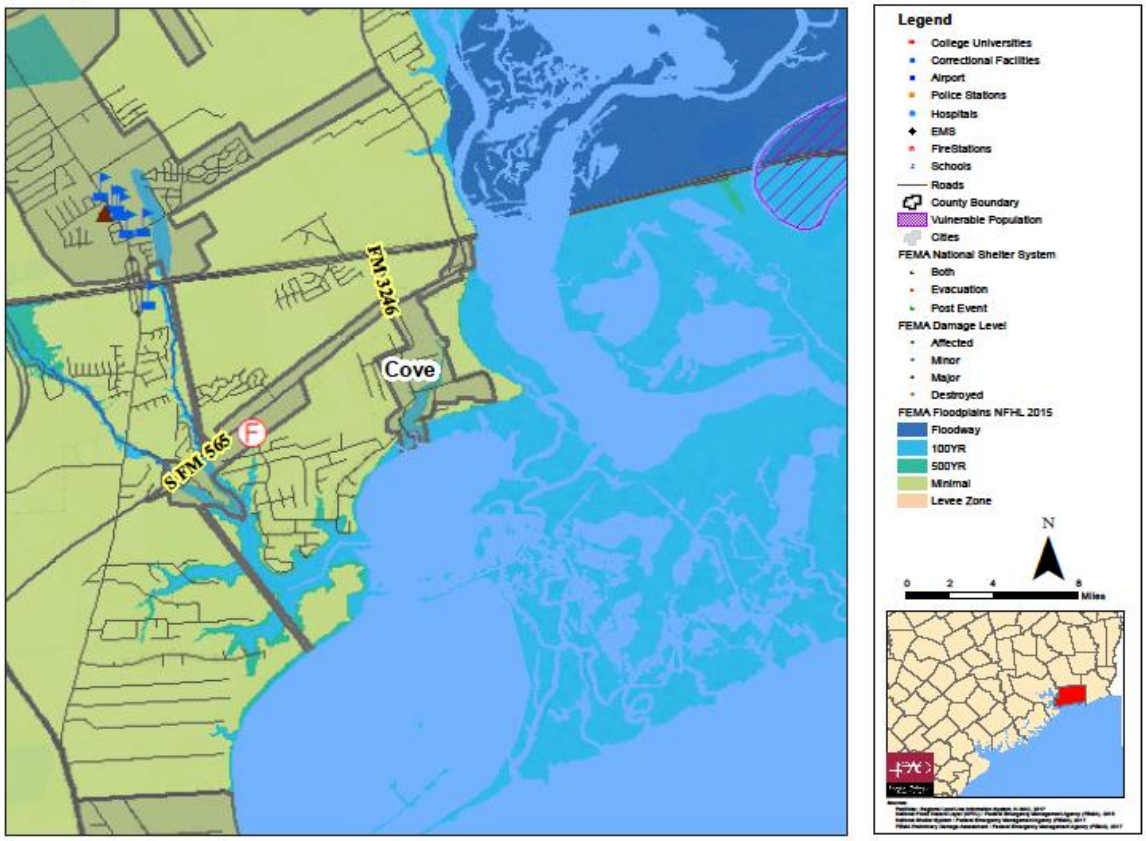
Identified Vulnerabilities:

- Critical facilities including: 2 fire stations, 7 schools, 1 EMS, 2 police stations, 2 shelters, 6 toxic release sites, 1 EMS
- 1 shelter located within the flood hazard zone
- City is located north of I-10- During past flood events 1-10 acted as a barrier for flood waters; everything north of I-10 experienced more extreme flooding

Identified Impacts:

- Financial loss throughout the jurisdiction for residents if homes and commercial property is damaged by floodwaters
- Loss of a shelter in the jurisdiction may lead to increase of serious injury or loss of life within the jurisdiction.

Floodplains: Cove



Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	1
Area Affected:	75 %	**Annual Event Average:**	.05

Probability: Likely*; 5 percent chance the event will occur in a year

*Although the recorded events suggest that there is a low percent chance of the event occurring, Cove is one of the smallest jurisdictions participating in the plan. Perhaps the events have been underreported in this jurisdiction, with the jurisdiction seeing a greater number of events than officially reported.

Extent: According to past events the county has experienced 42 inches of floodwater; the jurisdiction can experience 47 to 52 inches of floodwater

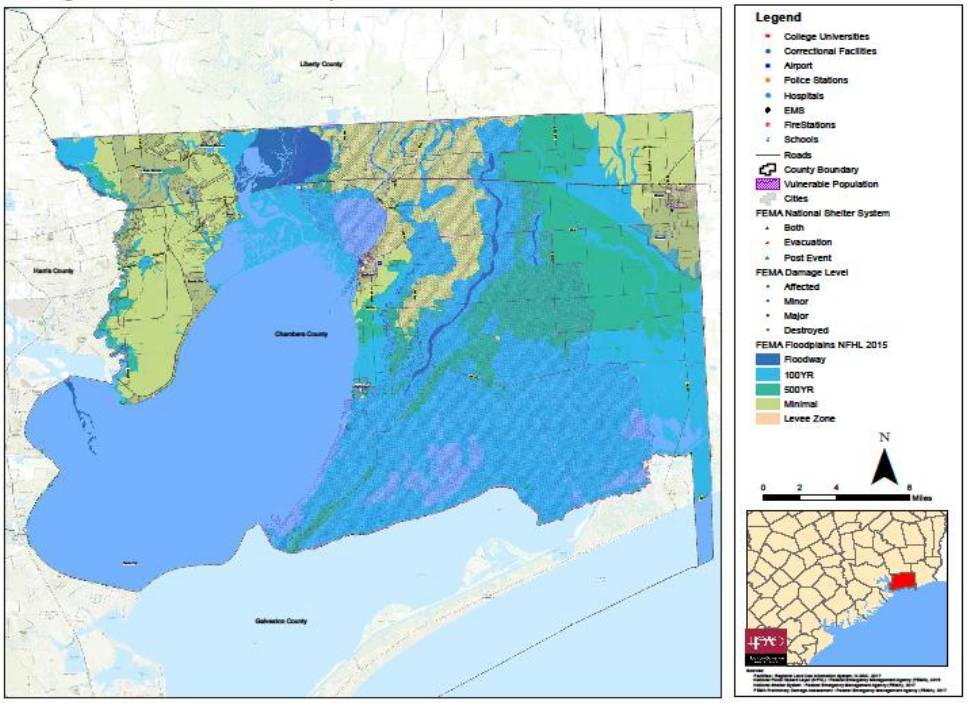
Identified Vulnerabilities:

- Critical facilities including: 1 fire station and 1 EMS
- Located near Cotton Creek- residential and commercial areas flooded along Cotton Creek

Identified Impacts:

- Financial and economic loss for residents and jurisdiction due to commercial and residential properties damaged due to flooding throughout the jurisdiction

Floodplains: Chambers County



Chambers-Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	0
Area Affected:	75 %	**Annual Event Average:**	0
Probability: Although the District does not have any recorded past events, the District is throughout the county. Perhaps the District's probability is similar to unincorporated areas throughout the county: Very Likely; 82 percent chance the event will occur in a year			
Extent: Although the District does not have any recorded past events, the District is throughout the county. Perhaps the District's extent is similar to unincorporated areas throughout the county: According to past events the county has experienced 46 inches of floodwater; the county can experience 50 to 56 feet of water.			

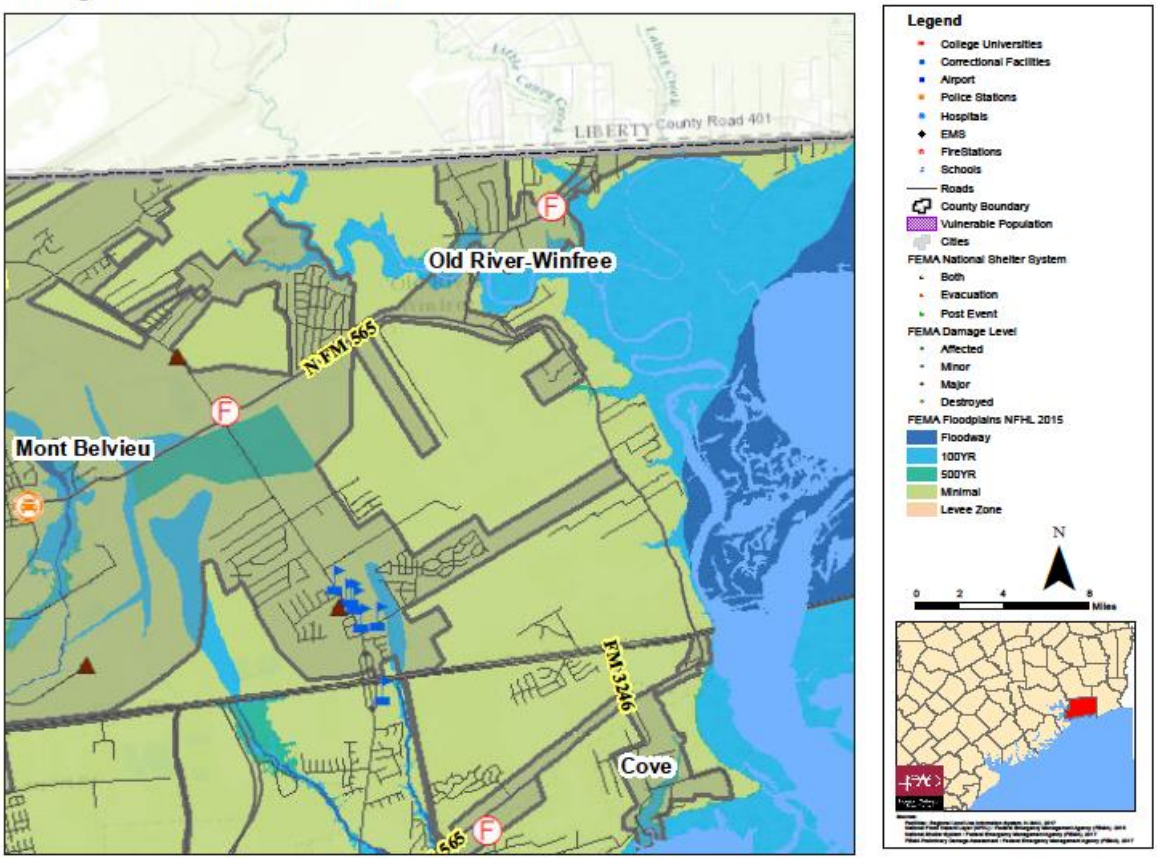
Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure is damaged due to flooding this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply
- A lack of a water may lead to serious injury or loss of life throughout the county
- Damage to the levee or pumps due to flooding may lead to an increase in flooding in the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center and trails

Floodplains: Old-River Winfree



Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	1
Area Affected:	75 %	**Annual Event Average:**	.05

Probability: Likely*; 5 percent chance the event will occur in a year

*Although the recorded events suggest that there is a low percent chance of the event occurring, Old- River-Winfree is one of the smallest jurisdictions participating in the plan. Perhaps the events have been underreported in this jurisdiction, with the jurisdiction seeing a greater number of events than officially reported.

Extent: According to past events the county has experienced 44 inches of floodwater; the jurisdiction can experience 49 to 54 inches of water.

Identified Vulnerabilities:

- Critical facilities including: 1 fire station, 1 school, 1 shelter, 1 toxic release site, 1 EMS, 1 police station
- Police Station in the south east of the city has flooded in past flood events

Identified Impacts:

- Potential damage to police station may delay first responders trying to reach those in need. This may increase response time and increase loss of life and serious injury throughout the county

2017

Part 6.2: Hurricanes & Tropical Storms

6.2 Hurricanes and Tropical Storms

The Saffir-Simpson Scale ranks hurricanes that are formed in the Atlantic Ocean and Northern Pacific Ocean east of the international date line. The scale considers winds and the amount of damages that could be sustained by the storm. Category 1 is the lowest category of storm, while Category 5 is the strongest level storm. As noted in the Hazard Identification section, tropical storms are tropical cyclones that have winds between 39 to 73 mph. While tropical cyclone winds do not reach the wind speeds for the Saffir- Simpson scale, according to the Beaufort Wind Scale, tropical storms can produce winds that could break or uproot trees or create considerable structural damage.

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt. 119-153 km/h	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap, and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt. 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (Major)	111-129 mph 96-112 kt. 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (Major)	130-156 mph 113-136 kt. 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped, or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months
5 (Major)	157 mph min. 137 kt. min. 252 km/h	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Source: https://www.nhc.noaa.gov/

Beaufort Wind Scale		1-min Wind speed	Effects on land
0	**Calm**	0 - 1 mph	Calm. Smoke rises vertically.
1	**Light air**	1 - 3 mph	Smoke drift indicates wind direction and wind vanes cease moving.
2	**Light breeze**	3 - 7 mph	Wind felt on exposed skin. Leaves rustle and wind vanes begin to move.
3	**Gentle breeze**	7 - 12 mph	Leaves and small twigs constantly moving, light flags extended.
4	**Moderate breeze**	12 - 17 mph	Dust and loose paper raised. Small branches begin to move.
5	**Fresh breeze**	17 - 24 mph	Branches of a moderate size move. Small trees in leaf begin to sway.
6	**Strong breeze**	24 - 30 mph	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult. Empty plastic bins tip over.
7	**Near gale**	30 - 38 mph	Whole trees in motion. Effort needed to walk against the wind.
8	**Gale**	38 - 46 mph	Some twigs broken from trees. Cars veer on road. Progress on foot is seriously impeded.
9	**Severe gale**	46 - 54 mph	Some branches break off trees, and some small trees blow over. Construction/temporary signs and barricades blow over.
10	**Storm**	54 - 63 mph	Trees are broken off or uprooted, saplings bent and deformed. Poorly attached asphalt shingles and shingles in poor condition peel off roofs.
11	**Violent storm**	63 - 73 mph	Widespread damage to vegetation. Many roofing surfaces are damaged; asphalt tiles that have curled up and/or fractured due to age may break away completely.
12	**Hurricane**	73 - 99 mph	Very widespread damage to vegetation. Some windows may break; mobile homes and poorly constructed sheds and barns are damaged. Debris may be hurled about.

Source: https://www.nhc.noaa.gov/

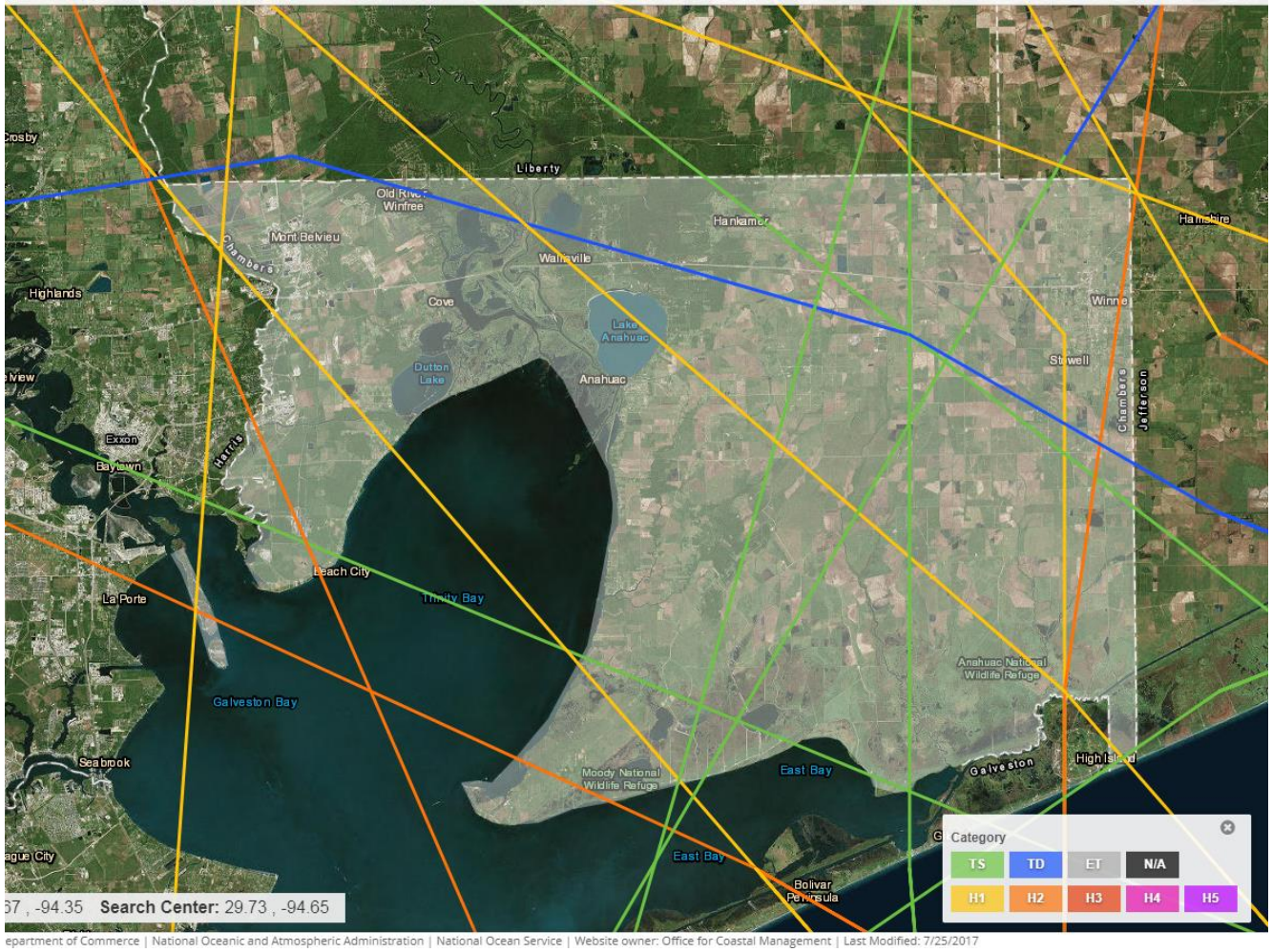
Historic Occurrence

Based on recorded data, 12 hurricanes and tropical storms had direct paths over Chambers County. There has been no reported deaths, serious injury or crop damage due to hurricanes.

Date	Storm Type	Property Damage	Notes
07/ 30/1989	Hurricane	$0	No recorded notes
6/5/2001	Tropical Storm	$ 597,000	No recorded notes
7/14/2003	Hurricane (Typhoon)	$ 0	No recorded notes
8/30/2003	Tropical Storm	$ 5,000	No recorded notes
9/1/2003	Tropical Storm	$ 8,000	
9/23/2005	Hurricane (Typhoon)	$ 8,000,000	No recorded notes
9/12/2007	Hurricane (Typhoon)	$ 500,000	Minor structural and roof damage were noted in the communities of Winnie and Stowell. Damage to private property was one structure destroyed, two with major damage, and three with minor damage. Overall, twenty-two structures were affected. Newspapers reported metal roof damage to the community center building. Much of the damage in the area were uprooted trees and broken limbs. Snapped power poles were witnessed about eight miles west of Stowell, or east of the Anahuac National Wildlife Refuge, along Highway 124. Power pole damage was also noted on southbound Highway 124 towards High Island.
8/5/2008	Tropical Storm	0	Tropical Storm Edouard moved ashore along the upper Texas coast between High Island and Sabine Pass in the McFaddin National Wildlife Refuge and produced minimal damage totaling $100,000. Damage from Edouard included minor storm tide flooding along portions of the Bolivar Peninsula and brief flash flooding along portions of Interstate 10 in Chambers County. Storm tide damage on the Bolivar Peninsula was confined to the Gilchrist area. Ten single family homes experienced flooding up to eighteen inches deep inside the home. Fifteen single family homes and two mobile homes experienced flooding up to six inches deep inside the home. Interstate 10 was closed in central Chambers County near State Highway 61 due to Edouard's heavy rainfall estimated to be between 3 and 5 inches.
9/12/2008	Storm Surge/Tide	$300,000,000	Storm tide pushed water 15 miles inland from East Bay and nearly 20 miles inland from the Gulf which overtopped the barrier island Bolivar Peninsula. Debris piles from destroyed structures on the Bolivar were found over interior Chambers County. Water marks suggest maximum storm surge of 17 feet, or perhaps higher, were observed.
6/15/2015	Tropical Storm	$0	There were low lying rural roads that experienced minor coastal flooding.
6/21/2017	Tropical Storm	$0	Chambers County was closest to the center of Cindy and experienced most of the highest rainfall totals with some areas receiving 3 to 5 inches.
8/25/2017	Tropical Storm	$1,000,000	Slow moving Tropical Storm Harvey produced torrential rainfall across Liberty and Chambers Counties. Major to record flooding occurred along the Trinity River and along numerous creeks and tributaries.

Source: NCDC: https://www.ncdc.noaa.gov/stormevents/

NOAA: Historical Hurricane Tracks in Chambers County



Source: NOAA https://coast.noaa.gov/hurricanes/

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the average number of events in each jurisdiction annually and then calculates the percent chance that an event will occur in the next year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders, FEMA, NOAA, and the Department of Homeland Security (DHS) are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- American Community Survey (ACS, 5-year, 2016) Data on structures and residents
- FEMA's Hazus analysis software
- Stakeholder identified vulnerabilities

Hazus was used to determine the economic loss and calculate the building stock at risk of hurricane damage in Chambers County for a 500-year event. The complete Hazus report is in Appendix C. Stakeholders provided valuable insight into additional vulnerabilities within their communities. These findings are provided in condensed charts for each jurisdiction.

All Participating Jurisdictions			
Planning Area:	Chambers County and all participating jurisdictions; 871 square miles	**Area Affected:**	Entire planning area
Greatest historic occurrence:	Hurricane Ike (Category 3 at Landfall); 117 mph wind gusts reported during event	**Occurrence:** **Event Average:**	12 events in 27 years 0.44 events per year
Extent:	Up to Category 5; 157 mph winds	**Probability:**	Very likely; 44 percent chance event will occur in the next year

All Participating Jurisdictions

Identified Vulnerabilities:

While participating jurisdictions identified flooding as one of the main effects of hurricanes, flooding is addressed in the first section. In this section vulnerabilities from hurricane winds are addressed. High winds can tear down powerlines, trees, barns, fences, and multitude of other debris can be blown into roadways and homes during the event.

Additionally, residences and commercial buildings could be damaged or destroyed due to events; older residential neighborhoods and structures without a permanent foundation were identified as one of the main vulnerabilities throughout the county. While current building codes address the vulnerability of wind damage to structures, older buildings (particularly residential buildings) were built when less stringent building codes were in place; therefore, older residential building and residences without a permanent foundation are a focus in this section.

- According to Hazus 517 (97 %) commercial buildings are at risk
- According to Hazus 11,490 (91%) residential buildings are at risk
- According to Hazus 3,724 individuals will be displaced from their homes
- Based on the Hazus reports residential buildings in comparison to commercial buildings are most at risk of the effects of hurricanes throughout the county

All Participating Jurisdictions

Identified Impacts:

- Downed powerlines could impact communication and daily active leading to a finical loss for the county, cities and individuals, and could impede first responders from reaching those in need or residents evacuating
- Strong winds could prevent first responders from traveling to assist individuals, because of unsafe driving conditions such as debris hitting emergency vehicles
- Critical facilities could sustain wind damage, potentially delaying first responders reaching those in need and city services after the event
- Economic and financial loss for cities and individuals including property loss:
    - According to Hazus there could be a potential of $ 2,996,153 in residential loss or 76 percent of total building loss
    - According to Hazus there could be a potential of $ 286,679 in commercial property loss or 8 percent of total building loss

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 1989:**	12
Area Affected:	100%	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- Vulnerable populations concentrated throughout the southeast of the county
- Approximately 4,000 homes flooded throughout the county particularly near cotton creek and north of I-10
- Agriculture including oyster and rice farming are a significant part of the county's economy with over 734 farms throughout the county- Crops account for $15,049,000 of total revenue from farms and livestock accounts for $10,544,000 of total revenue from farming

Identified Impacts:

- Vulnerable populations (defined in the Community Profile Section) include residents without cars, funds or other resources to evacuate in case of an event; significant injury, loss of life could occur because of the inability to evacuate to a safe location
- Financial loss for residents throughout the county whose homes may be destroyed
- Financial/ Economic loss for farmers and county due to loss of crops, agricultural lands and/ or cattle

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- 377 Residential buildings built before 1980 (66.8% of housing stock)
- 103 Mobile Homes (13.2% of housing stock)

Identified Impacts:

- Almost 79 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- 196 Residential buildings built before 1980 (32.5% of housing stock)
- 157 Mobile Homes (16.54% of housing stock)

Identified Impacts:

- Almost 50 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- 312 Residential buildings built before 1980 (35.6% of housing stock)
- 43 Mobile Homes (2.23% of housing stock)

Identified Impacts:

- Almost 39 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- 39 Residential buildings built before 1980 (46 % of housing stock)
- 32 Mobile Homes (23 % of housing stock)

Identified Impacts:

- Almost 70 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure is damaged due to wind damage this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply if wind damages main pump plant
- A lack of a water may lead to serious injury or loss of life throughout the county
- Damage to the levee or pumps may lead to increase in flooding throughout the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center and trails

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 1989:**	12
Area Affected:	100 %	**Annual Event Average:**	.44
Probability: Very Likely; 44 percent chance the event will occur in a year			
Extent: The strongest hurricane in the past was a category 3 hurricane; the unincorporated areas can expect to see a category 5 hurricane in the future.			

Identified Vulnerabilities:

- 217 Residential buildings built before 1980 (53.5 % of housing stock)
- 310 Mobile Homes (44.80 % of housing stock)

Identified Impacts:

- Almost 98 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

2017

Part 6.3: Drought

6.3 Drought

The Palmers Hydrological Drought Severity Index (PHDI) is the typical way extent of drought is observed throughout the United States. This regional index considers dry and wet spells over an extended period to calculate the range in the Index. The greater the number the more extreme the drought in a specific area.

Palmers Drought Severity Index	
< - 4.0	Extreme Drought
- 3.99 to - 3.0	Severe Drought
- 2.99 to - 2.0	Moderate Drought
- 1.99 to - 1.0	Mild Drought
- 0.99 to - 0.5	Incipient Drought
- 0.49 to 0.49	Near Normal
0.5 to 0.99	Incipient Moist Spell
1.0 to 1.99	Moist Spell
2.0 to 2.99	Unusual Moist Spell
3.0 to 3.99	Very Moist Spell
> 4.0	Extreme Moist Spell
Source: https://www.ncdc.noaa.gov/	

Drought has particularly adverse effects on agriculture which is a major industry in Chambers County. The most extreme conditions occurred in 2011. The county's PHDI rating was < - 4.0 (Extreme Drought) from March 2011 through January 2012. There were periods of severe drought preceding and following this period from August 2010 through October 2014. The agricultural loses are estimated at $5.2 billion for the entire state, though specific numbers by county are not available for this event.

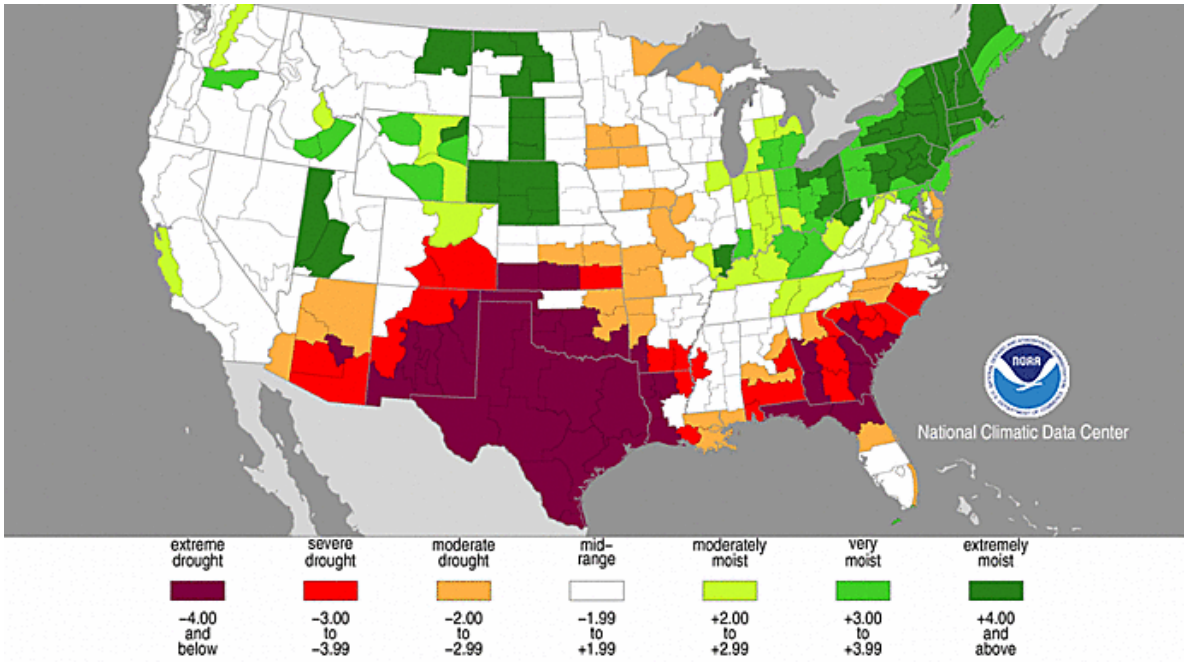
Historic Occurrences

In Chambers County's recent history, there have been three major droughts causing wildfires throughout the county. This information is listed below at the county level. There is no county-level data available for property and agricultural losses for the most recent and most extreme drought event which is displayed on the map below.

Date	Description	Notes
08/01/2000	Severe Drought	Severe drought continued across southeast Texas through the month of August. Rainfall for the month of August averaged only 30 to 50 percent of normal across southeast Texas. Several cities were placed under water rationing with large crop losses were noted across the area. Wildfires became increasingly common, especially toward the end of the month. Drought losses in dollars will be computed at the end of the summer growing season.
08/09/2000	Severe Drought	Severe drought continued across southeast Texas through September 2000. The combination of excessive heat and dryness caused many wildfires to burn.
10/1/2011	Extreme Drought	Although NOAA does not have a record of this drought on their database, the map below demonstrates the extent of the drought in 2011.

Source: https://www.ncdc.noaa.gov/

Palmers Drought Severity Index: October 2011



Map source: https://www.ncdc.noaa.gov/

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the percent chance that the event will occur in a given year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders and NOAA are the sources of data for the analysis.

Droughts often last multiple years have economic impacts that last longer than the droughts themselves. Chambers County's agricultural industry has been determined the most vulnerable asset to drought. Chambers County has 280,512 acres in agricultural production. According to the United States Department of Agriculture (USDA) Census of Agriculture, the market value of agricultural production in the county is $415,000 annually; with 54% of revenues from crops, and 46% of revenue from livestock production.

All Participating Jurisdictions			
Planning Area:	Unincorporated Chambers County and all participating jurisdictions; 871 square miles	**Area Affected:**	Entire planning area
Greatest historic occurrence:	1 year of extreme drought conditions; < -4.0 PHDI rating	**Occurrence:**	3 events in 17 years
		Event Average:	0.18 events per year
Extent:	18 months of extreme drought conditions; < -4.0 PHDI rating	**Probability:**	Likely; 18% chance that an event will occur within a given year.

Vulnerabilities

- Production of rice, soybeans, forage, cattle, and oyster and aquaculture enterprises are a significant part of the county's economy with over 734 farms throughout the county- Crops account for $15,049,000 of total revenue from farms and livestock accounts for $10,544,000 per year of total revenue from farming

Impacts

- Livestock and Agricultural production; approximately 253,743 acres of agricultural land.
- $8.3 million in agricultural losses are estimated long-term losses due to one year of extreme drought.

2017

Part 6.4: Lightning

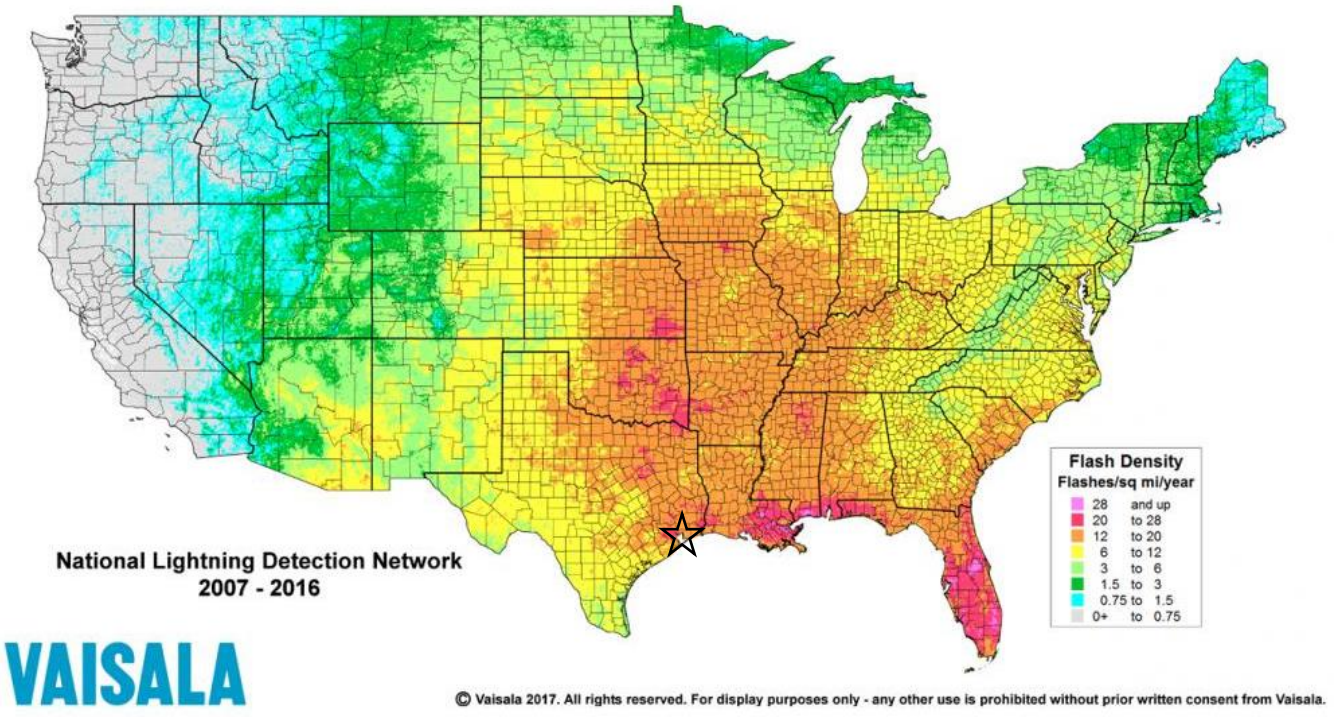
6.4 Lightning

There are two typical ways the magnitude of lightning is measured. The first is through the Lightning Activity Levels (LAL) grid. The National Oceanic and Atmospheric Administration (NOAA) considers how many cloud to ground strikes occur over a given period as well as rainfall to measure the amount of lighting activity occurring.

LAL	Cloud & Storm Development	Lighting Strikes/15 per minute
1	No thunderstorms	None
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 clouds to ground strikes in a five-minute period.	1 to 8
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 clouds to ground strikes in a 5-minute period.	9 to 15
4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 clouds to ground strikes in a 5-minute period	16 to 25
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 clouds to ground strikes in a 5-minute period.	Greater than 25
6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.	Greater than 25

Source: https://www.ncdc.noaa.gov/

The second method is through the National Lightning Detection Network by Vaisala. This Network works by recording when lightning strikes the ground, considering the location, time, and polarity of the strike. According to this Network, Chambers County is rated 12-20 flashes per square mile per year.



Source: https://www.vaisala.com/en. Star notes the general location of Chambers County

Historic Occurrences

There were 4 recorded lightning strikes in the county between 2000 and 2017. There was no crop damage reported during this timeframe. While there are few recorded events throughout the county, it is likely that more lightning strikes occurred during this time frame in the county, but were unreported.

Jurisdiction	Dates	Deaths	Injuries	Property Damage	Notes
Unincorporated	8/24/2000	1	0	0	Lightning struck and killed a 27-year-old man.
Unincorporated	6/24/2010	1	1	0	A lightning strike from an anvil cloud after a thunderstorm moved through their location struck two people on a boat near the Texas 124 bridge over the Intercoastal Waterway in Chambers County. One victim was killed and the other was injured.
Unincorporated	4/13/2016	0	0	30,000	A lightning strike damaged a nursing home's fire alarm system.
Beach City	5/12/2017	0	0	20,000	Lightning struck some crude oil tankers and set them on fire. Residents within a half mile radius were evacuated until the fire was contained.

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring within a given year. Then the analysis calculates the percent chance of the event occurring in a given year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders, Texas Forest Service, and NOAA are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- GIS analysis of structures and critical facilities exposed to lightning damage; and
- American Community Survey (5 year, ACS, 2016) Data on structures
- Stakeholder identified vulnerabilities

Extent

The magnitude of lightning was not recorded for each historical event; not all participating jurisdictions have a history of all lightning strikes that may have occurred in their jurisdiction; and lighting flashes per event for each jurisdiction was not found. Due to these data limitations and considering that lightning is not contained to a particular geographic area or jurisdiction, extent for the entire county was estimated; NOAA's Severe Weather Data Inventory does provide a history of flashes per event on the county level. According to NOAA’s Severe Weather Data Inventory the entire planning area saw an approximate average of 15 flashes of lighting per event between 2000 to 2017.

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	3
Area Affected:	100%	**Annual Event Average:**	.18
Probability: Likely; 18 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 415 residential structures at risk
- Critical facilities including: 1 fire station

Identified Impacts:

- 1 critical facility could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events.
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Likely*; Less than 1 percent chance the event will occur in a year *Although the occurrences since 2000 suggest that a lightning strike is unlikely to occur, lighting strikes may be unreported throughout the county. This is reflected in the probability of all participating jurisdictions.			
Extent: In the past, the jurisdiction has had 0 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 779 residential structures at risk
- Critical facilities including: 3 shelters, 2 schools, 2 EMS, 3 fire station, 1 hospital, 1 EOC, 3 police stations, 1 correctional facility, 1 solid waste landfill, 1 water treatment plant

Identified Impacts:

- 18 critical facilities could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events.
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.05
Probability: Likely; Less than 5 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded lightning strike in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 949 residential structures at risk
- Critical Facility: 1 fire station

Identified Impacts:

- 1 critical facility could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events.
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Likely; Less than 1 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 0 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 1,900 residential structures at risk
- Critical facilities including: 2 fire stations, 7 schools, 1 toxic release site, 1 EMS, 2 police stations, 2 shelters, 6 toxic release sites, 1 EMS

Identified Impacts:

- 22 critical facilities could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events.
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Likely; Less than 1 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 0 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 140 residential structures at risk
- Critical facilities including: 1 fire station and 1 EMS

Identified Impacts:

- 2 critical facilities could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Likely; Less than 1 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 0 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure- pump plant and canal system- is struck by lightning and damaged this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply
- A lack of a water may lead to serious injury or loss of life throughout the county
- Damage to the pumps from lightning may lead to increase in flooding throughout the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center if the education center is struck by lightning and cannot get electricity back

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Likely; Less than 1 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 0 recorded lightning strikes in a year. According to NOAA's Severe Weather Data Inventory the jurisdiction saw an approximate 15 to 20 flashes of lighting per event			

Identified Vulnerabilities:

- 692 residential structures at risk
- Critical facilities including: 1 fire station, 1 school, 1 shelter, 1 toxic release site, 1 EMS, 1 police station

Identified Impacts:

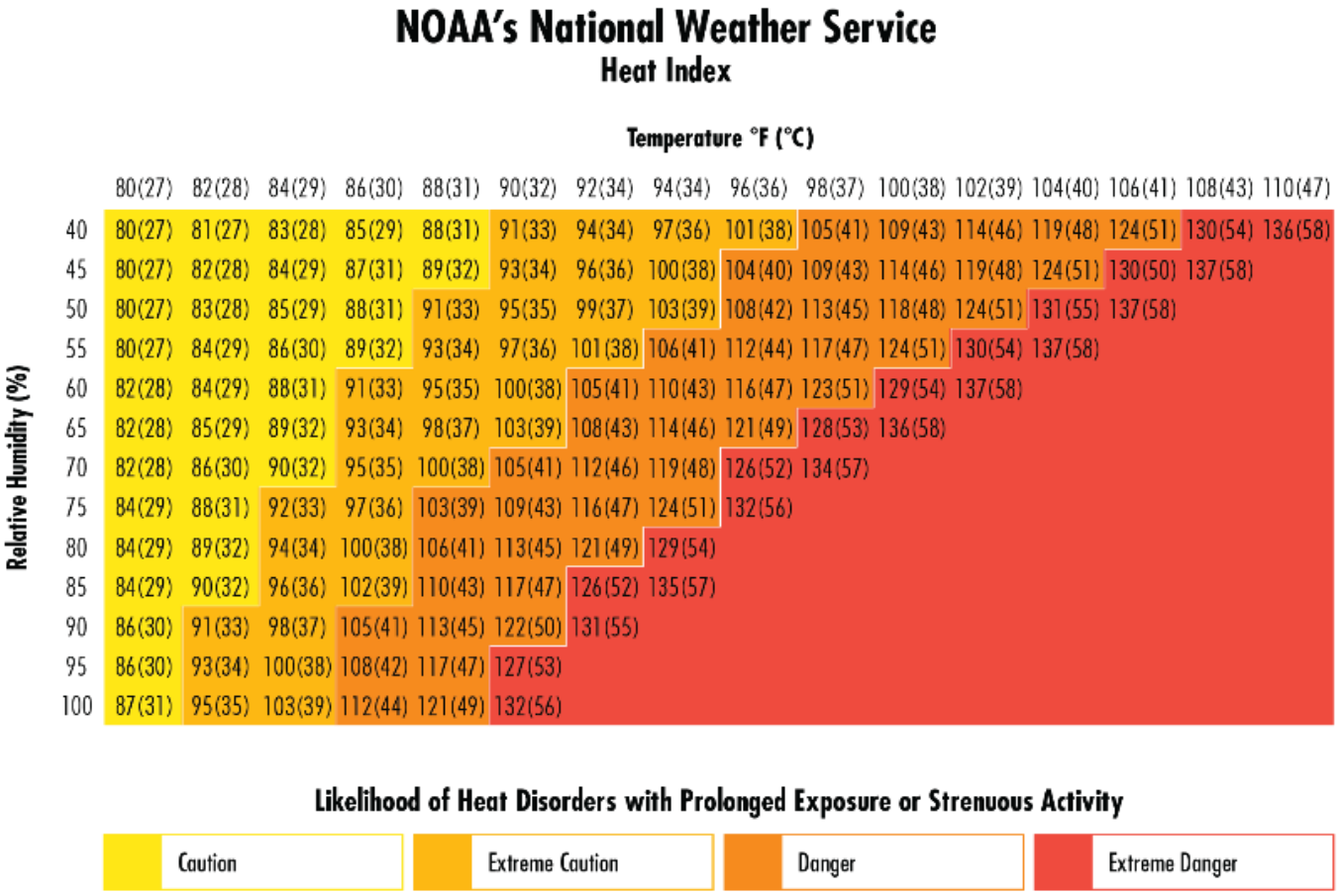
- 6 critical facilities could lose power or catch on fire if lightning strikes; this may slow down first responders and allow for greater loss of life, injury, or property damage particularly when lighting is accompanied by flooding or other hazardous events
- Damage to homes caused by lightning may lead to a financial loss for residents and/ or injury or loss of life in a house fire or electrical shock

2017

Part 6.5: Heat Events

6.5 Heat Events

Although Heat Events are more loosely defined than excessive heat, the Heat Index below provides a means to show how temperature and humidity act together to create a hazardous event for a community. During the public meeting participants noted that Chambers County experiences high temperature and relative humidity on a regular basis particularly during summer months.



Historic Occurrences

June to August are the months that Chambers County could experience severe heat, with average temperatures between 90 and 100 degrees. According to NOAA's database 1 death was reported between 2000 to 2017 due to Heat Events, but the Heat Index reached dangerous levels on five dates.

Date	Deaths	Injuries	Property Damage	Crop Damage	Notes
7/6/2000	0	0	0	0	Excessive heat impacted southeast Texas for much of the month of July. High temperatures ranged from 98 to 105 degrees daily over all but the immediate coast during a 2-week period. Only traces of rainfall were observed during this period.
8/29/2000	0	0	0	0	Excessive heat occurred over southeast Texas during the last 3 days of August. High temperatures reached well over 100 degrees over inland areas.
9/1/2000	0	0	0	0	A record setting heat wave continued over southeast Texas through the first week of September 2000. Temperatures over southeast Texas began to cool on the 6th. A heat wave with temperatures of this duration and magnitude is unprecedented for southeast Texas.
9/22/2005	1	0	0	0	Deaths were all associated with the evacuation for Hurricane Rita, both before and after Rita's arrival.
6/24/2009	0	0	0	0	Hot, humid conditions led to heat indices above 105 degrees for several days in late June.

Hazard Impact

Heat-related fatalities can go unreported because they occur several days after a Heat Event. Heat-related illnesses or crop damage are more likely to occur after several days of hot temperatures. As a result, analysis should consider extreme maximum temperatures and number of days of high temperatures. Listed below are maximum temperatures recorded each year and the number of days over 90 degrees as reported by NCDC.

The average number of days over 90 degrees in the region is 103 days. For the purposes of this plan, years that experienced more than a 10% increase in days of 90-degrees are considered notable events.

Year	Extreme maximum temperature	Number of days over 90 degrees F.
2000	110	114
2001	99	83
2002	98	104
2003	103	87
2004	99	100
2005	102	125
2006	101	114
2007	103	96
2008	103	102
2009	105	111
2010	105	120
2011	108	146
2012	103	101
2013	101	99
2014	98	78
2015	104	105
2016	99	97

Source: https://www.ncdc.noaa.gov/

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the average number of events in each jurisdiction within a year and then calculates the percent chance that the event will occur in a given year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders, USDA, US Census, CDC, and NOAA are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- GIS analysis of vulnerable populations
- American Community Survey (ACS, 2016, 5-year), Data on residents
- USDA livestock production projections; and
- Stakeholder identified vulnerabilities

According to the Centers for Disease Control and Prevention (CDC), adults over 65 years of age, infants, children, individuals with chronic illnesses, low-income, outdoor workers, and athletes are the most vulnerable populations to heat related illnesses. The data available on the populations suggests that approximately 44% of the population in Chambers County is vulnerable to heat related illnesses.

Agriculture and livestock are vulnerable to heat events. Chambers County has 280,512 acres in agricultural production. According to the USDA Census of Agriculture, the market value of agricultural production in the county is $34,513,000 annually; with 54% of revenues from crops, and 46% of revenue from livestock production.

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	5
Area Affected:	100%	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 35.5 percent of population are individuals 18 years and younger (472 children) • 8.7 percent of population are individuals 65 and older (115 older individuals) **Identified Impacts:** • 45 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 26.5 percent of population are individuals 18 years and younger (569 children) • 8.7 percent of population are individuals 65 and older (115 older individuals) **Identified Impacts:** • 36 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperatures above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 28.8 percent of population are individuals 18 years and younger (725 children) • 16 percent of population are individuals 65 and older (405 older individuals) **Identified Impacts:** • 55 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 26.4 percent of population are individuals 18 years and younger (1291 children) • 11 percent of population are individuals 65 and older (582 older individuals) **Identified Impacts:** • 37 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 19 percent of population are individuals 18 years and younger (57 children) • 20 percent of population are individuals 65 and older (61 older individuals) **Identified Impacts:** • 39 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • Visitors, staff, and residents working on or utilizing the trail system at the Education Center, or main pump plant or canal system **Identified Impacts:** • Any visitors or residents or maintenance staff who are visiting the trails or working outside to maintain the canal, pump system, or manage any of the levee or navigation channels throughout the district may sustain serious injury or loss of life due to extreme heat			

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	5
Area Affected:	100 %	**Annual Event Average:**	.29
Probability: Likely; 29 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1 recorded temperature above 110; the jurisdiction could experience temperatures above 115 in the future			
Identified Vulnerabilities: • 30.8 percent of population are individuals 18 years and younger (573 children) • 7.5 percent of population are individuals 65 and older (140 older individuals) **Identified Impacts:** • 39 percent of the total population may face serious illness or health conditions due to high temperatures and humidity			

2017

Part 6.6: Hail

6.6 Hail

NOAA's National Centers for Environmental Information (NCEI) intensity scale for hail is the typical way to measure the extent for hail storms. This scale considers the size of an individual piece of hail. A hail storm is considered severe if hail reaches one inch in diameter or roughly the size of a quarter.

Size	Hail Diameter (Inches)	Description
H0	1/4	Pea Size
H1	1/2	Small Marble Size
H2	¾	Penny or Large Marble Size
H3	7/8	Nickel Size
H4	1	Quarter Size
H5	1 ¼	Half Dollar Size
H6	1 ½	Walnut or Ping Pong Ball Size
H7	1 ¾	Golfball Size
H8	2	Hen Egg Size
H9	2 ½	Tennis Ball Size
H10	2 ¾	Baseball Size
H11	3	Teacup Size
H12	4	Grapefruit Size
H13	4 ½	Softball Size

Source: https://www.ncei.noaa.gov/

Historic Occurrences

Since 2000, Chambers County experienced 14 hail events. Eleven were considered severe (quarter sized and above). Golf ball sized hail or size H7 is the largest size hail the County experienced, with four of the nine events having a magnitude of 1 ¾ inches.

Jurisdiction	Date	Magnitude	Property Damage	Notes
Unincorporated	4/2/2000	0.75	10,000	None
Unincorporated	4/2/2000	1	10,000	None
Unincorporated	4/3/2000	1.75	15,000	None
Unincorporated	4/16/2001	1	15,000	None
Unincorporated	4/16/2001	1.75	20,000	None
Mont Belvieu	4/16/2001	0.75	10,000	None
Mont Belvieu	4/7/2003	1.75	7,000	None
Anahuac	4/10/2004	0.75	10,000	Penny-size hail reported in Anahuac
Mont Belvieu	4/10/2004	1	15,000	Quarter-size hail damaged sheriff vehicle's windshield.
Unincorporated	4/24/2006	1.75	15,000	Golfball-size hail.
Unincorporated	4/25/2006	1.75	15,000	Golfball-size hail.
Anahuac	2/12/2008	0.75	0	Isolated severe thunderstorms produced straight line wind damage and penny size hail.
Unincorporated	5/26/2011	1.75	1,000	Golf ball size hail occurred near Winnie.
Unincorporated	4/19/2015	1	0	Quarter sized hail was reported to the east northeast of Cove.

Source: https://www.ncdc.noaa.gov/stormevents/

Hazard Analysis & Vulnerability Identification

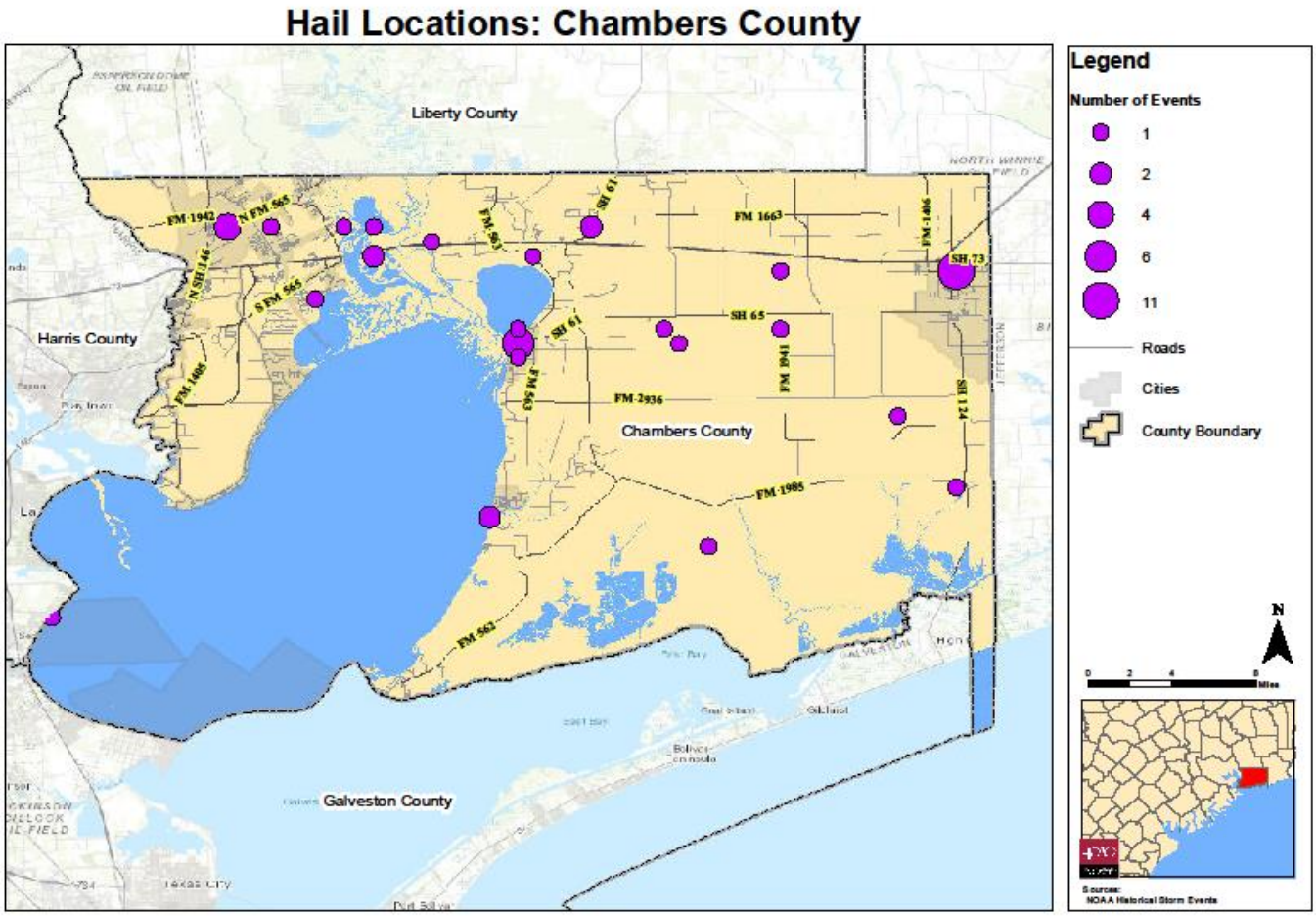
The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the average number of events in each jurisdiction annually then calculates the percent chance of an event occurring within a year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders and NOAA are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- NOAA historic event data; and
- Stakeholder identified vulnerabilities.
- American Community Survey (ACS, 2016, 5-year)

The map below demonstrates the location and quantity of hail events that have occurred throughout the County from 2002 to present.



Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	9
Area Affected:	100%	**Annual Event Average:**	.53
Probability: Very Likely; 53 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1.75 (H7, Golfball) sized hail recorded. The county could experience H8 to H9 in the future			

Identified Vulnerabilities:

- 415 residential structures at risk
- Critical facilities including: 1 fire station

Identified Impacts:

- Damage to critical facilities and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	2
Area Affected:	100 %	**Annual Event Average:**	.12
Probability: Unlikely; 12 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had .75 (H2, Penny) sized hail recorded. The jurisdiction could experience H3 to H4 in the future			

Identified Vulnerabilities:

- 779 residential structures at risk
- Critical facilities including: 3 shelters, 2 schools, 2 EMS, 3 fire station, 1 hospital, 1 EOC, 3 police stations, 1 correctional facility, 1 solid waste landfill, 1 water treatment plant

Identified Impacts:

- Damage to critical facilities and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction does not have recorded events, the jurisdiction is near Anahuac. Perhaps the jurisdiction's probability is similar to Anahuac: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, Anahuac's extent is: In the past, the jurisdiction has had .75 (H2, Penny) sized hail recorded. The jurisdiction could experience H3 to H4 in the future			

Identified Vulnerabilities:

- 949 residential structures at risk
- Critical Facility: 1 fire station

Identified Impacts:

- Damage to critical facility and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	3
Area Affected:	100 %	**Annual Event Average:**	.18
Probability: Unlikely; Less than 18 percent chance the event will occur in a year			
Extent: In the past, the jurisdiction has had 1.75 (H7, Golfball) sized hail recorded. The jurisdiction could experience H8 to H9 in the future			

Identified Vulnerabilities:

- 1,900 residential structures at risk
- Critical facilities including: 2 fire stations, 7 schools, 1 toxic release site, 1 EMS, 2 police stations, 2 shelters, 6 toxic release sites, 1 EMS

Identified Impacts:

- Damage to critical facilities and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction does not have recorded events, the jurisdiction is near Anahuac. Perhaps the jurisdiction's probability is similar to Anahuac: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, Anahuac's extent is: In the past, the jurisdiction has had .75 (H2, Penny) sized hail recorded. The jurisdiction could experience H3 to H4 in the future			

Identified Vulnerabilities:

- 140 residential structures at risk
- Critical facilities including: 1 fire station and 1 EMS

Identified Impacts:

- Damage to critical facilities and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction does not have recorded events, the jurisdiction is may be similar to the unincorporated county. The county's probability is: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, the county's extent is: In the past, the jurisdiction has had 1.75 (H7, Golfball) sized hail recorded. The county could experience H8 to H9 in the future			

Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure is damaged- pump and canal systems- due to hail this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply
- A lack of a water may lead to serious injury or loss of life throughout the county
- Pumps or canals damaged due to hail may lead to an increase in flooding throughout the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center if education center is closed due to hail damage

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction does not have recorded events, the jurisdiction is near Anahuac. Perhaps the jurisdiction's probability is similar to Anahuac: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, Anahuac's extent is: In the past, the jurisdiction has had .75 (H2, Penny) sized hail recorded. The jurisdiction could experience H3 to H4 in the future			

Identified Vulnerabilities:

- 692 residential structures at risk
- Critical facilities including: 1 fire station, 1 school, 1 shelter, 1 toxic release site, 1 EMS, 1 police station

Identified Impacts:

- Damage to critical facilities and equipment including uncovered emergency vehicles may impede response time and lead to increase loss of life or serious injury
- Financial loss for individuals whose homes or cars are damaged due to the event
- Economic loss for the jurisdiction due to public facilities that may be damaged

2017

Part 6.7: Tornado

6.7 Tornado

Before 2007, tornadoes were ranked through the Fujita Scale. The Enhanced Fujita Scale replaced the Fujita Scale in 2007 and is a set of wind estimates (not measurements) based on damage. The higher the number the more intense the tornado. Both the Fujita Scale and the Enhanced Fujita Scale are in the chart below.

Fujita Scale			Enhanced Fujita Scale		
Scale	**Fastest 1/4 mile (mph)**	**3 second gust (mph)**	**EF Number**	**3 Second Gust (mph)**	**Typical Damage**
F0	40-72	45-78	0	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
F1	73-112	79-117	1	86-109	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
F2	113-157	118-161	2	110-137	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-207	162-209	3	138-167	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
F4	208-260	210-261	4	168-199	Devastating damage. Whole frame houses Well-constructed houses and whole frame houses completely leveled; cars thrown, and small missiles generated.
F5	261-318	262-317	5	200-234	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly more than 109 yards; high-rise buildings have significant structural deformation; incredible phenomena will occur.

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

Historic Occurrence

Recorded data from NCDC is listed below. There have been no deaths reported due to tornadoes since 2000.

Jurisdiction	Date	Magnitude	Injuries	Property Damage	Crop Damage	Notes
Anahuac	4/3/2000	F1	0	$100,000	0	Tornado near FM 1985 with rice dryers demolished and major tree damage at several homes.
Unincorporated Areas	8/31/2001	F0	0	0	0	Tornado near Highway 65 between Monroe City and Winnie. Law enforcement reported no damage or injuries.
Beach City	11/17/2003	F0	0	0	0	Tornado touch down near Beach City.
Unincorporated Areas	11/17/2003	F1	5	$100,000	0	Tornado crossed the Old Trinity River Bridge on I-10, blowing over 10 semi-trucks. One eastbound semi was dumped onto two cars. Another westbound semi was picked up, blown across a stone retaining wall, ripped through metal fencing and landed on a car in the westbound lane. Description of trucks where one loaded with 60K pounds of nuts and bolts, another with 42K pounds of paper towels, and a tanker truck filled with spring water. 5 injured transported to local area hospital.
Unincorporated Areas	11/17/2003	F1	0	$300,000	0	Tornado touch down in White Harring Estates area between Oak Island and Smith Point. One home destroyed with seven other homes receiving damage.
Unincorporated Areas	7/8/2006	F0	0	0	0	Tornado caused no damage near the Intracoastal Bridge on Highway 124 near the Chambers-Galveston county line.
Beach City	8/21/2012	EF0	0	0	0	A waterspout moved inland near Beach City and produced no damage before dissipation.
Cove	3/29/2017	EF0	0	0	13000	This EF-0 tornado was the last of four brief tornadoes from an HP supercell which moved across southeast Harris County and southern Chambers County. This short-lived tornado was confined to the end of Kendall Road along Dutton Lake where there was some small tree damage. The Houston Hobby terminal doppler radar showed a brief couplet at this location, and the tree fall pattern supported this rotation. Estimated peak winds were 75 mph.

Source: https://www.ncdc.noaa.gov/stormevents/

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year. The analysis calculates the average number of events in each jurisdiction annually then calculates the percent chance that the event will occur in a given year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The greatest historic occurrence data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. The extent is the worst the jurisdiction could possibly experience. Information from stakeholders and NOAA are the sources of data for the analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- GIS analysis of structures exposed to tornado damage; and
- Stakeholder identified vulnerabilities.

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	4
Area Affected:	100%	**Annual Event Average:**	.24
Probability: Likely; 24 percent chance the event will occur in a year			
Extent: The strongest tornado in the past was an F1; the unincorporated areas can expect to see an EF 2 to EF 3 in the future.			
Identified Vulnerabilities: • Vulnerable populations concentrated throughout the southeast of the county • Agriculture including oyster and rice farming are a significant part of the county's economy with over 734 farms throughout the county- Crops account for $15,049,000 of total revenue from farms and livestock accounts for $10,544,000 of total revenue from farming **Identified Impacts:** • Vulnerable populations (defined in the Community Profile Section) include residents without cars, funds or other resources to evacuate in case of a flood event; significant injury, loss of life could occur because of the inability to evacuate to dry land • Financial and economic loss for residents throughout the county whose homes may be damaged • Financial/ Economic loss for farmers and county due to loss of crops, agricultural lands and/ or cattle			

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Unlikely; 6 percent chance the event will occur in a year			
Extent: The strongest tornado in the past was an F1; the jurisdiction can expect to see an EF 2 to EF 3 in the future.			

Identified Vulnerabilities:

- 377 Residential buildings built before 1980 (66.8% of housing stock)
- 103 Mobile Homes (13.2% of housing stock)

Identified Impacts:

- Almost 79 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	2
Area Affected:	100 %	**Annual Event Average:**	.12
Probability: Unlikely; 12 percent chance the event will occur in a year			
Extent: The strongest tornado in the past was an EF0; the jurisdiction can expect to see an EF 1 to EF 2 in the future.			

Identified Vulnerabilities:

- 196 Residential buildings built before 1980 (32.5% of housing stock)
- 157 Mobile Homes (16.54% of housing stock)

Identified Impacts:

- Almost 89 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction has no recorded events perhaps the probability is similar to Beach City which is nearby: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, Beach City's extent is: The strongest tornado in the past was an EF0; the jurisdiction can expect to see an EF1 to EF2 in the future.			

Identified Vulnerabilities:

- 312 Residential buildings built before 1980 (35.6% of housing stock)
- 43 Mobile Homes (2.23% of housing stock)

Identified Impacts:

- Almost 39 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Unlikely; 6 percent chance the event will occur in a year			
Extent: The strongest tornado in the past was an EF0; the jurisdiction can expect to see an EF1 to EF3 in the future.			

Identified Vulnerabilities:

- 39 Residential buildings built before 1980 (46 % of housing stock)
- 32 Mobile Homes (23 % of housing stock)

Identified Impacts:

- Almost 69 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the District has no recorded events since 2000 perhaps the probability is similar to the unincorporated areas': Likely; 24 percent chance the event will occur in a year			
Extent: Similarly, the unincorporated areas' extent is: The strongest tornado in the past was an F1; the unincorporated areas can expect to see an EF 2 to EF 3 in the future.			

Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure is damaged due to wind damage- canal or pump system- this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply
- A lack of a water may lead to serious injury or loss of life throughout the county
- Damage to the levee or pumps by wind may lead to increase in flooding throughout the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center and trails due to wind damage

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	0
Area Affected:	100 %	**Annual Event Average:**	0
Probability: Although the jurisdiction has no recorded events perhaps the probability is similar to Beach City which is nearby: Unlikely; 12 percent chance the event will occur in a year			
Extent: Similarly, Beach City's extent is: The strongest tornado in the past was an EF0; the jurisdiction can expect to see an EF 1 to EF 2 in the future.			

Identified Vulnerabilities:

- 217 Residential buildings built before 1980 (53.5 % of housing stock)
- 310 Mobile Homes (44.80 % of housing stock)

Identified Impacts:

- Almost 99 percent of the housing stock was either built before 1980 or does not have a permanent foundation; this may lead to an increase in home damage, a financial loss for residents, and potential increase in serious injuries or loss of life throughout the jurisdiction.

2017

Part 6.8: Expansive Soils

6.8 Expansive Soils

The chart below shows the Linear Extensibility Percent (LEP) and Coefficient of Linear Extent (COLE) to show the Shrink-Swell Class of expansive soils. COLE is a test frequently used to characterize expansive soils. COLE is a measure expressed as a fraction of the change in a soil sample dimension from the moist to dry state. The LEP is a measure expressed as a percentage of the change in a soil sample dimension from the moist to dry state. The Shrink-Swell Class is found in comparing these two measurements. A Moderate to Very High rating marks soils that have the potential to contract and expand, leading to broken foundations and water pipes, for example.

Shrink-Swell Class Chart

Shrink-Swell Class	Linear Extensibility Percent (LEP)	Coefficient of Linear Extent (COLE)
Low	3	0.03
Moderate	3 to 6	.03-.06
High	6 to 9	.06-.09
Very High	Greater than or equal to 9	Greater than or equal to 0.09

Source: https://www.nrcs.usda.gov

Expansive Soil Data by Jurisdiction

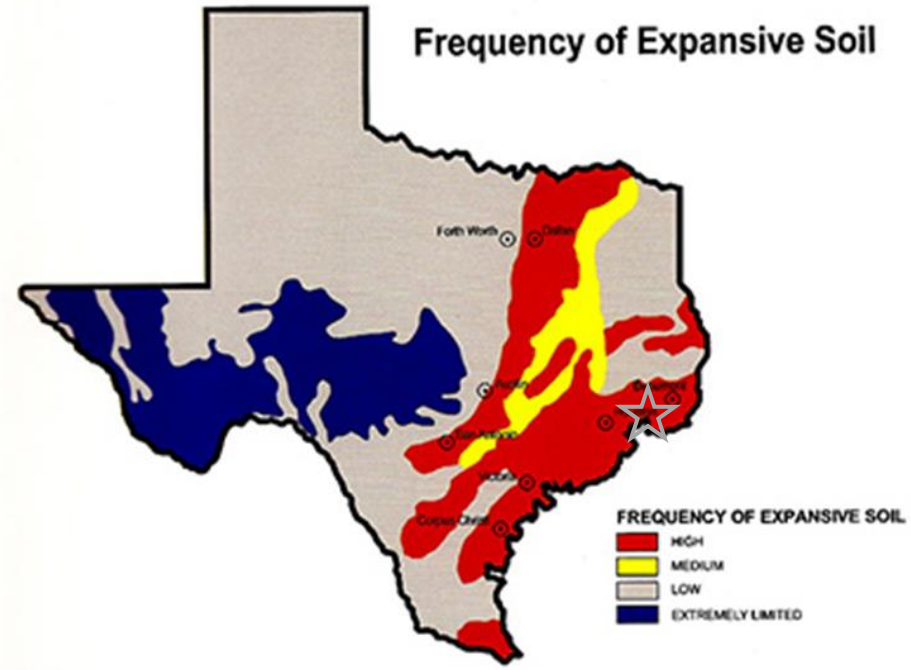
Jurisdiction	Low Swelling Potential	Moderate Swelling Potential	High Swelling Potential
Unincorporated Area	25%	15%	60%
Anahuac	10%	20%	70%
Beach City	10%	10%	80%
Mont Belvieu	10%	10%	80%
Old-River Winfree	10%	45%	45%
Chambers-Liberty Counties Navigation District	25%	15%	60%
Cove	10%	10%	80%

Historic Occurrences

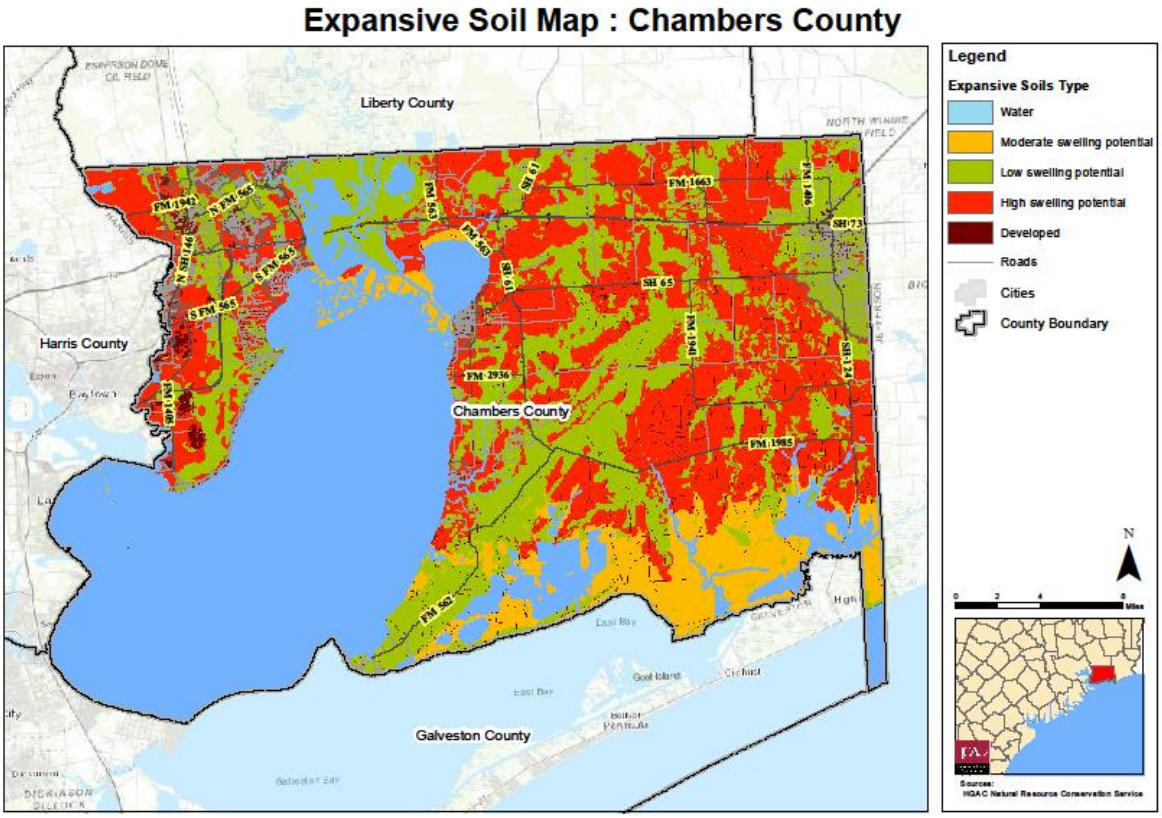
No specific occurrences, or property or crop damage has been reported due to expansive soils since 2000.

Expansive Soil Maps

While there are no previous reported occurrences, the chart directly above and the Expansive Soil Map and the Frequency of Expansive Soils map directly below help define the extent and location of expansive soils for each of the participating jurisdictions and help to demonstrate the probability of expansive soils in the planning area.



Source: http://www.tellafirma.com/find-texas-expansive-soils/. Grey star notes Chamber County's general location.



Hazard Analysis & Vulnerability Identification

The hazard analysis provides hazard extent data for each participating jurisdiction. The extent data is the most extreme data recorded during a storm or hazard event and represents the worst damage a jurisdiction has experienced in recent history. A data deficiency for "Occurrences" was addressed by assigning 1 occurrence for any jurisdiction that had Moderate to High shrink swell classes.

Information from stakeholders, USDA's Natural Resource Conservation Services**,** and H-GAC's critical facilities database were used for this analysis.

To identify vulnerabilities for each jurisdiction, this plan used the following methods:

- American Community Survey (ACS 2016, 5 year) data on residential structures
- GIS analysis of structures within the high to very high shrink swell classes; and
- Stakeholder identified vulnerabilities.

Chambers County (All Following Jurisdictions)
Identified Vulnerabilities: Broken foundations and water pipes in commercial and residential buildings and public property. While newer buildings can be impacted; older buildings including critical facilities and homes are more likely to be impacted; this is due to older buildings being exposed to numerous weather events and seasons, having building standards that do not take expansive soils into account, and the lack of engineering solutions to mitigate expansive soils in the past. Therefore, the vulnerabilities focus on older buildings in each of the jurisdictions.

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	1
Area Affected:	100%	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			
Identified Vulnerabilities: • 415 residential structures at risk • Critical facilities including: 1 fire station **Identified Impacts:** • Financial cost to county to repair foundations for public facilities • Cracked pipes in critical facilities may lead to a loss of service or increased response time to get to someone in need.			

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

Identified Vulnerabilities:

- 377 Residential buildings built before 1980 (66.8% of housing stock)
- Critical facilities including: 3 shelters, 2 schools, 2 EMS, 3 fire station, 1 hospital, 1 EOC, 3 police stations, 1 correctional facility, 1 solid waste landfill, 1 water treatment plant

Identified Impacts:

- Financial cost to residents and jurisdiction of repairing foundations for homes and public facilities
- Cracked pipes in critical facilities may lead to a loss of service or length the time first responders take to get to someone in need.

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

Identified Vulnerabilities:

- 196 Residential buildings built before 1980 (32.5% of housing stock)
- Critical Facility: 1 fire station

Identified Impacts:

- Financial cost to residents and jurisdiction of repairing foundations for homes and public facilities
- Cracked pipes in critical facilities may lead to a loss of service or length the time first responders take to get to someone in need.

Mont Belvieu			
Planning Area (Sq. mi):	15.3	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

Identified Vulnerabilities:

- 312 Residential buildings built before 1980 (35.6% of housing stock)
- Critical Facility: Critical facilities including: 2 fire stations, 7 schools, 1 toxic release site, 1 EMS, 2 police stations, 2 shelters, 6 toxic release sites, 1 EMS

Identified Impacts:

- Financial cost to residents and jurisdiction of repairing foundations for homes and public facilities
- Cracked pipes in critical facilities may lead to a loss of service or length the time first responders take to get to someone in need.

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

Identified Vulnerabilities:

- 39 Residential buildings built before 1980 (46 % of housing stock)
- Critical facilities including: 1 fire station and 1 EMS

Identified Impacts:

- Financial cost to residents and jurisdiction of repairing foundations for homes and public facilities
- Cracked pipes in critical facilities may lead to a loss of service or length the time first responders take to get to someone in need.

Chambers- Liberty Counties Navigation District			
Planning Area (Sq. mi):	400	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

Identified Vulnerabilities:

- District supplies agriculture and local municipalities throughout the county with raw water
- Navigation channels and levee systems throughout the county
- Lake Anahuac and Main Pump plant on Miller Street
- Upper Texas Coast Water-Borne Education Center

Identified Impacts:

- If district's infrastructure- pump or canal systems- are damaged due to pump plant's foundation or the concrete of the canal system cracking this could impede quantity of water throughout the district and lead to agriculture loss and financial loss for the county
- Financial loss for farmers who depend on District's water supply
- A lack of a water may lead to serious injury or loss of life throughout the county
- Economic loss for county and local businesses that depend on the navigation channels maintained by the district and loss of revenue from tourism from closure of the education center if the education center's foundation cracks.

Old-River-Winfree			
Planning Area (Sq. mi):	1.58	**Occurrences since 2000:**	1
Area Affected:	100 %	**Annual Event Average:**	.06
Probability: Very Likely; based off the frequency of expansive soils map above, the jurisdiction has a high chance of seeing expansive soils within the year.			
Extent: Based off Chambers County's expansive soils map above, the jurisdiction has a current shrink-swell class of high; the jurisdiction can see a high to very high shrink swell class in the future.			

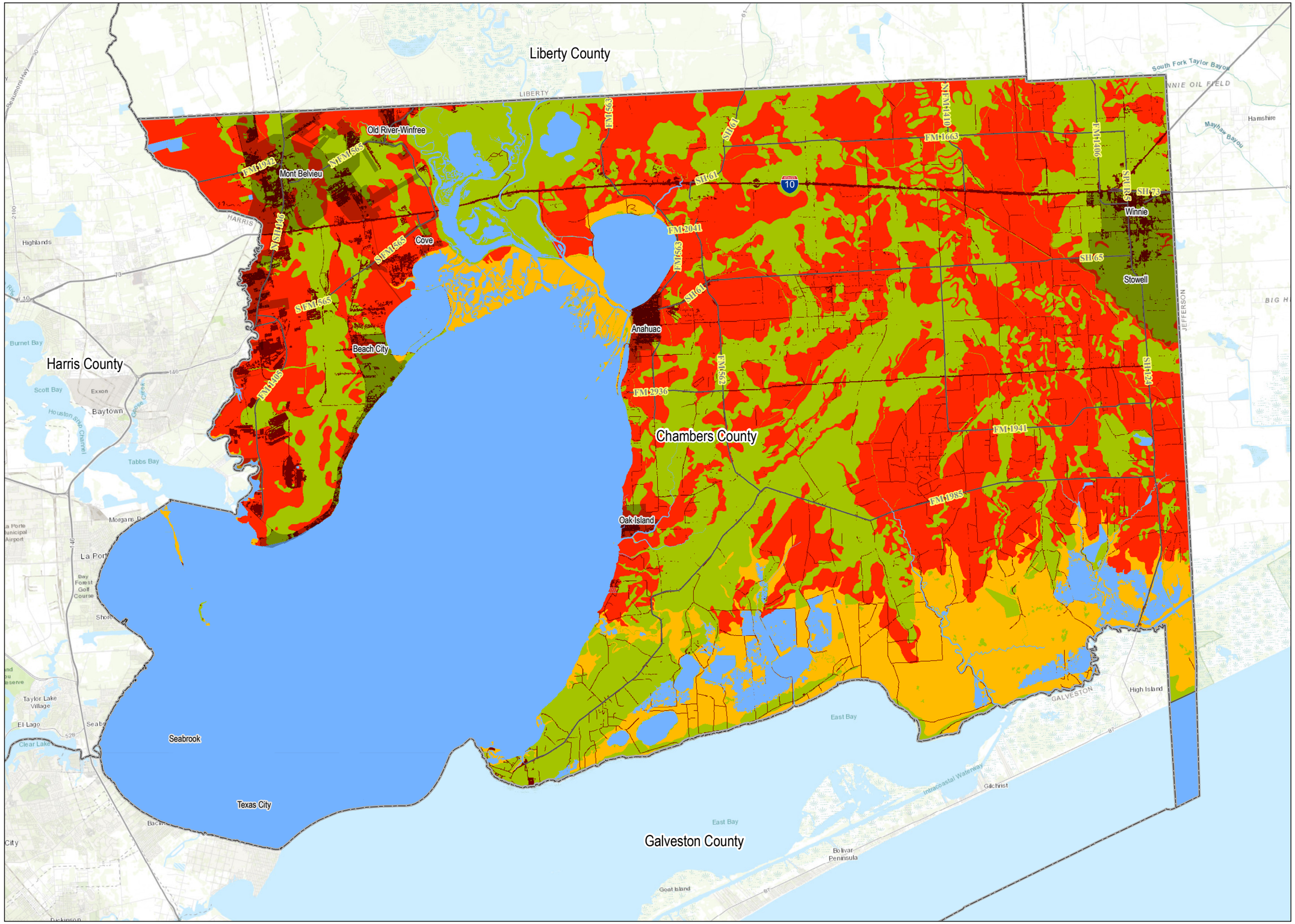
Identified Vulnerabilities:

- 217 Residential buildings built before 1980 (53.5 % of housing stock)
- Critical facilities including: 1 fire station, 1 school, 1 shelter, 1 toxic release site, 1 EMS, 1 police station

Identified Impacts:

- Financial cost to residents and jurisdiction of repairing foundations for homes and public facilities
- Cracked pipes in critical facilities may lead to a loss of service or length the time first responders take to get to someone in need.

Expansive Soil Map : Chambers County



Legend

Expansive Soils Type

- Water
- Moderate swelling potential
- Low swelling potential
- High swelling potential
- Developed
- Cities
- County Boundary

N

0 1.25 2.5 5 Miles

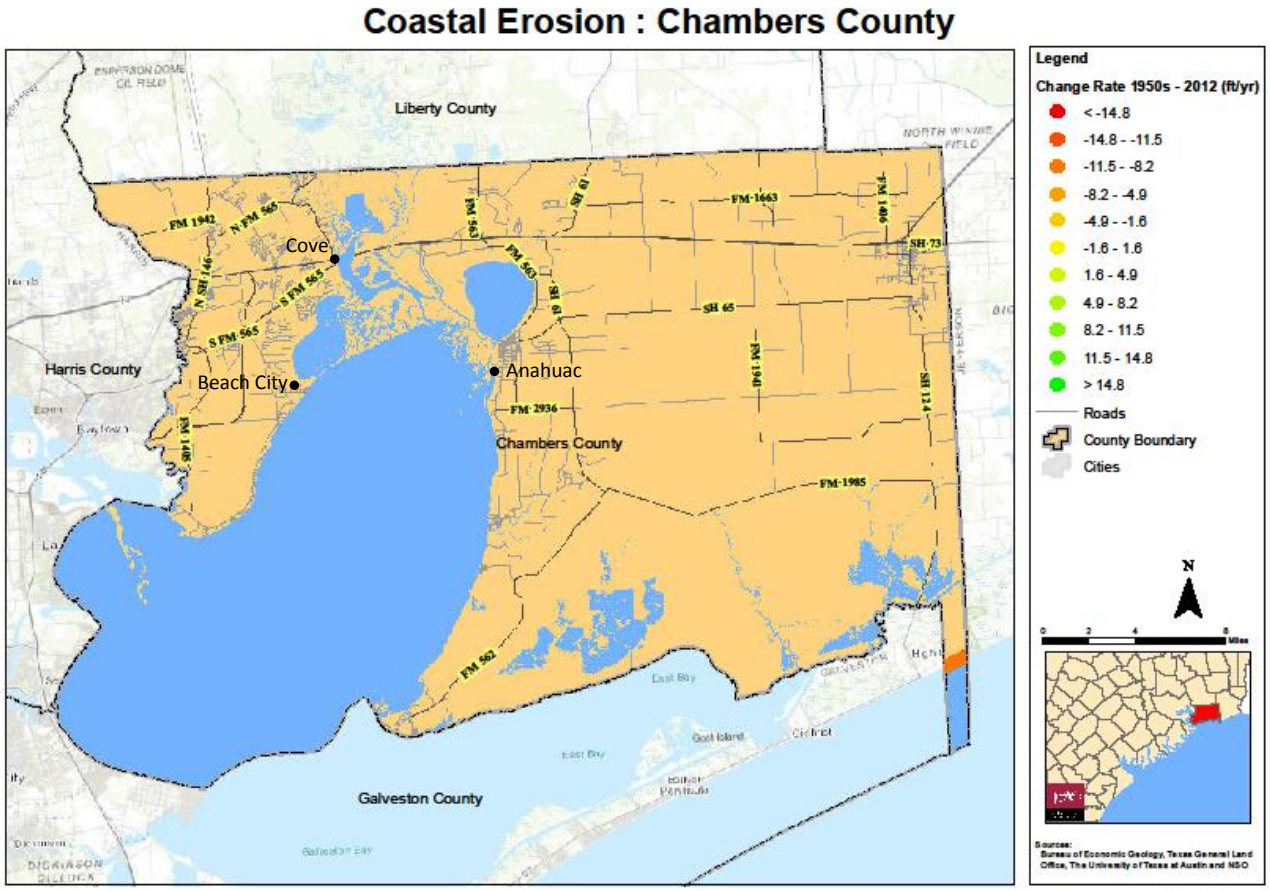
Sources:
HGAC Natural Resource Conservation Service

2017

Part 6.9: Coastal Erosion

6.9 Coastal Erosion

Coastal Erosion is measured through feet or meters lost per year. The map below shows the southeast coast of Texas with Chambers County labeled between Galveston and Jefferson counties. There is a current data deficiency throughout the county; there are no up to date accurate maps that depict how coastal erosion is affecting the county. The map below shows current known areas for coastal erosion in the county. More accurate maps are needed in order to fully understand how coastal erosion affects the county.



Historic Occurrences

There have been no recorded erosion events in the county between 2000 to 2017.

Hazard Analysis & Vulnerability Identification

The hazard analysis uses historic hazard event data to determine the probability of an event occurring again within a given year.

The hazard analysis also provides hazard extent data for each participating jurisdiction. The extent data is the most extreme data recorded during a storm or hazard event and represents the worst damage a

jurisdiction has experienced in recent history. Information from stakeholders, FEMA**,** and H-GAC's critical facilities database were used for this analysis.

The jurisdictions below are along the coast and are profiling this hazard. All other participating jurisdictions are not profiling coastal erosion.

Chambers County (Unincorporated)			
Planning Area (Sq. mi):	400	**Occurrences since 1989:**	0; Ongoing
Area Affected:	70%	**Annual Event Average:**	0; Ongoing
Probability: Likely; coasts are affected by storms and other natural events as well as development along the coast on a day-to-day basis.			
Greatest Extent of Damage: According to the map above the jurisdiction is seeing a rate of -11.5- -8.2 feet per year; the jurisdiction could expect to see greater than 14.8 feet per year			

Identified Vulnerabilities:

- Residential and commercial areas along the coast

Identified Impacts:

- Financial cost of beach replenishment for the jurisdiction
- Potential loss of revenue from tourism along the coast
- Loss of natural habitat and wildlife along the coast

Anahuac			
Planning Area (Sq. mi):	2.1	**Occurrences since 1989:**	0; Ongoing
Area Affected:	90 %	**Annual Event Average:**	0; Ongoing
Probability: Likely; coasts are affected by storms and other natural events as well as development along the coast on a day-to-day basis.			
Greatest Extent of Damage: According to the map above the jurisdiction is seeing a rate of -11.5- -8.2 feet per year; the jurisdiction could expect to see greater than 14.8 feet per year			

Identified Vulnerabilities:

- Residential and commercial areas along the coast

Identified Impacts:

- Financial cost of beach replenishment for the jurisdiction and jurisdiction
- Potential loss of revenue from tourism along the coast
- Loss of natural habitat and wildlife along the coast

Beach City			
Planning Area (Sq. mi):	4.5	**Occurrences since 1989:**	0; Ongoing
Area Affected:	90 %	**Annual Event Average:**	0; Ongoing
Probability: Likely; coasts are affected by storms and other natural events as well as development along the coast on a day-to-day basis.			
Greatest Extent of Damage: According to the map above the jurisdiction is seeing a rate of -11.5- -8.2 feet per year; the jurisdiction could expect to see greater than 14.8 feet per year			
Identified Vulnerabilities: • Residential and commercial areas along the coast **Identified Impacts:** • Financial cost of beach replenishment for the jurisdiction • Potential loss of revenue from tourism along the coast • Loss of natural habitat and wildlife along the coast			

Cove			
Planning Area (Sq. mi):	1.2	**Occurrences since 2000:**	0; Ongoing
Area Affected:	90 %	**Annual Event Average:**	0; Ongoing
Probability: Likely; coasts are affected by storms and other natural events as well as development along the coast on a day-to-day basis.			
Extent: According to the map above the jurisdiction is seeing is seeing a rate of -11.5- -8.2 feet per year; the jurisdiction could expect to see greater than 14.8 feet per year			
Identified Vulnerabilities: • Residential and commercial areas along the coast **Identified Impacts:** • Financial cost of beach replenishment for the jurisdiction • Potential loss of revenue from tourism along the coast • Loss of natural habitat and wildlife along the coast			

2017

Part 7: Mitigation Strategy

Part 7: MITIGATION STRATEGY

The planning process, hazard analysis, and vulnerability assessment serve as a foundation for a meaningful hazard mitigation strategy. The mitigation strategy provides an outline for how the county and the local jurisdictions aim to address and reduce the risks associated with the natural hazards identified in the HMAP and reduce the potential impact on residents and structures identified through the Vulnerability Analysis. The mitigation strategy is divided into three sections the mission statement and mitigation goal, and the mitigation action plan. The mission statement and mitigation goals provide the overall purpose of the mitigation strategy and the HMAP. The mitigation action plan details specific mitigation actions, or projects, programs, and polices the county aims to meet these goals and objectives.

Mission Statement

The HMAP aims to implement new policies, programs, and projects to reduce the risks and impacts associated with natural hazards, including public education and partnerships between local officials and residents.

Mitigation Goal A

Reduce the loss of life and serious injury due to natural hazards

Mitigation Goal B

Reduce the loss of personal and public property due to natural hazards

Mitigation Action Plan

The mitigation action plan explains the specific programs, policies, and projects that the county and the local jurisdictions aim to implement for the county to reach its HMAP objectives and goals. The mitigation action plan provides the details of each mitigation action including which local department will be in charge of implementing the actions, how the county or local jurisdiction plan to pay for these actions, and the estimated time for implementing these actions. Any mitigation action that did not meet a cost-benefit ratio of 1:4 was re-evaluated and amended or excluded.

Mitigation actions were prioritized based on their greatest vulnerabilities and needs. Actions were rated 1, 2, or 3 with 1 being the highest priority. Each action was evaluated for feasibility using FEMA's mitigation action evaluation worksheet (Appendix A). The actions were then ranked by highest priority and feasibility scores to the lowest priority and feasibility scores.

All Participating Jurisdictions

Jurisdiction:	All participating jurisdictions		**Action Number:**	A1
Hazard(s) Addressed:	Flooding, Hurricane, Drought, Lightning, Heat Events, Hail, and Tornado			
Project Title:	Educating public on mitigation techniques			
Project Description:	Implement an outreach and education campaign to educate the public on mitigation techniques for all hazards to reduce loss of life and property.			
Responsible Entity:	County Emergency Manager, All participating jurisdictions mayors and city councils			
Losses avoided:	Residents and business owners			
Cost Estimate:	7,000	**Timeframe:**	1 month	
Potential Funding Sources:	Local budget and salary, HMPG, Fire Prevention and Safety Grants	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County, Anahuac, Beach City, Mont Belvieu, Cove, Chambers-Liberty Counties Navigation District, and Old-River-Winfree		**Action Number:**	A1.1
Hazard(s) Addressed:	Expansive Soils			
Project Title:	Educating public on mitigation techniques			
Project Description:	Implement an outreach and education campaign to educate the public on mitigation techniques for erosion to reduce loss of life and property.			
Responsible Entity:	County Emergency Manager, All participating jurisdictions mayors and city councils			
Losses avoided:	Residents and business owners			
Cost Estimate:	7,000	**Timeframe:**	1 month	
Potential Funding Sources:	Local budget and salary, HMPG, Fire Prevention and Safety Grants	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County, Anahuac, Beach City, Mont Belvieu, and Cove	**Action Number:**	A1.2
Hazard(s) Addressed:	Coastal Erosion		
Project Title:	Educating public on mitigation techniques		
Project Description:	Implement an outreach and education campaign to educate the public on mitigation techniques for Coastal Erosion to reduce loss of life and property.		
Responsible Entity:	County Emergency Manager, All participating jurisdictions mayors and city councils		
Losses avoided:	Residents and business owners		
Cost Estimate:	7,000	**Timeframe:**	1 month
Potential Funding Sources:	Local budget and salary, HMPG, Fire Prevention and Safety Grants	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	All participating jurisdictions	**Action Number:**	A2
Hazard(s) Addressed:	Hail, Tornado, Hurricane		
Project Title:	Retrofitting structures for hail and wind protection		
Project Description:	All participating jurisdictions will retrofit city and county owned structures with roofs that can withstand hail and high wind damage		
Responsible Entity:	County Emergency Coordinator, Participating Jurisdictions Representatives		
Losses avoided:	Buildings, residents, and city/ county employees in county and city buildings when a hail storm hits.		
Cost Estimate:	20,000	**Timeframe:**	48 months
Potential Funding Sources:	HMGP, PDM, Local budgets	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	All participating jurisdictions		**Action Number:**	A3
Hazard(s) Addressed:	Heat Events			
Project Title:	Installing misting stations			
Project Description:	The county and partnering cities will install misting stations throughout city and county owned parks and property to help prevent heat related illness or loss of life			
Responsible Entity:	County Emergency Coordinator			
Losses avoided:	Loss of life; Especially the elderly and children in the county			
Cost Estimate:	3,000	**Timeframe:**	6 to 12 months	
Potential Funding Sources:	HMPG, current city and staff time	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	All participating jurisdictions		**Action Number:**	A4
Hazard(s) Addressed:	Drought			
Project Title:	Adopting ordinance for drought tolerant plants			
Project Description:	All participating jurisdictions will develop an ordinance to require incorporating drought tolerant landscape design into all new county and city owned properties.			
Responsible Entity:	Emergency Coordinators for the county and partnering jurisdictions.			
Losses avoided:	Structures throughout the jurisdiction impacted by drought			
Cost Estimate:	$1,000	**Timeframe:**	3 months	
Potential Funding Sources:	Current staff time	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	All participating jurisdictions		**Action Number:**	A5
Hazard(s) Addressed:	Lightning			
Project Title:	Rebate program for lightning rods			
Project Description:	All participating jurisdictions will work to develop a program that offers reduced price lightning rods and technical assistance for homeowners throughout the county.			
Responsible Entity:	County Emergency Coordinator			
Losses avoided:	Homes and residents who could be affected by lightning throughout the county.			
Cost Estimate:	$150,000	**Timeframe:**	12 months	
Potential Funding Sources:	HMGP, FP&S Grants	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County, Anahuac, Beach City, Mont Belvieu, Cove, Chambers-Liberty Counties Navigation District, and Old-River-Winfree		**Action Number:**	A6
Hazard(s) Addressed:	Expansive Soils			
Project Title:	Drip irrigation			
Project Description:	Jurisdictions will install drip irrigation around critical facilities' foundations throughout the county. This action mitigates the damage that shrinking and expanding soils cause on foundations and pipes.			
Responsible Entity:	Emergency Coordinator			
Losses avoided:	Cost of repair to critical facilities' foundations, water and sewer lines.			
Cost Estimate:	$250,000	**Timeframe:**	12 months	
Potential Funding Sources:	HMGP, FP&S Grants	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	All participating jurisdictions	**Action Number:**	A7
Hazard(s) Addressed:	Flood		
Project Title:	Updating Maps		
Project Description:	All participating jurisdictions will work to update dam and levee failure inundation maps, and update floodway maps throughout the county. The updated floodway maps will also be made available to the public.		
Responsible Entity:	County Emergency Coordinator		
Losses avoided:	Homes and residents (loss of life) who could be affected by flooding throughout the county		
Cost Estimate:	150,000	**Timeframe:**	12 months
Potential Funding Sources:	HMGP, FP&S Grants	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	All Participating jurisdictions	**Action Number:**	A8
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	Property Protection		
Project Description:	Project will clear obstacles, widen and reshape ditches, and upgrade culverts to restore adequate drainage to mitigate flooding throughout all participating jurisdictions		
Responsible Entity:	City Engineers and County Emergency Management Coordinator		
Losses avoided:	Homes, businesses, and public facilities		
Cost Estimate:	$500,000	**Timeframe:**	6 months
Potential Funding Sources:	HMGP	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			Yes

Jurisdiction:	Chambers County, Anahuac, Beach City, Mont Belvieu, and Cove		**Action Number:**	A9
Hazard(s) Addressed:	Coastal Erosion			
Project Title:	Creating Maps			
Project Description:	Jurisdictions will work to create maps depicting coastal erosion in the county. The updated maps will also be made available to the public. These maps will be created in order to make up for the data deficiency identified in Section 6 of this plan.			
Responsible Entity:	County Emergency Coordinator			
Losses avoided:	Homes and residents (loss of life) who could be affected by flooding throughout the county			
Cost Estimate:	150,000	**Timeframe:**	12 months	
Potential Funding Sources:	HMGP, FP&S Grants	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Chambers County Specific Actions

Jurisdiction:	Chambers County		**Action Number:**	B1
Hazard(s) Addressed:	Flooding and Hurricane/ Tropical Storm			
Project Title:	Anahuac, North of Canal Drainage			
Project Description:	In the city limits of Anahuac, the area north of the Chambers Liberty Counties Navigation District canal generally along N. Main Street, Texas Avenue, and Work Street.			
Responsible Entity:	Chambers County			
Losses avoided:	This area has been prone to flooding in the many recent rain events. Water filling the streets and coming near or entering homes.			
Cost Estimate:	$375,0000	**Timeframe:**	18 months	
Potential Funding Sources:	CDBG-DR Harvey Match or Chambers County General Fund	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				Yes

Jurisdiction:	Chambers County		**Action Number:**	B2
Hazard(s) Addressed:	Flooding and Hurricane/ Tropical Storm			
Project Title:	Hydroaxing Hackberry Gully and Cotton Bayou			
Project Description:	Hydroaxing the entire length of Hackberry Gully and Cotton Bayou from South of I-10 to Cotton Lake. Clearing out invasive species as well as other vegetation that are currently restricing the flow of storm water. Phases 1 and 2 have been completed, the requested funds will completed phases 3 through 6, completing the project. The requested funds will also pay for acquisition of permanent easements on both sides of the complete length of the project area.			
Responsible Entity:	Chambers County			
Losses avoided:	This area has been prone to flooding in the resent heavy rain events. Water filling the streets and coming near and/or entering homes. This is unincorporated area south of I-10 and East of 99 in the flood plains for Hackberry Gully and Cotton Bayou.			
Cost Estimate:	$2,500,000	**Timeframe:**	12 months	
Potential Funding Sources:	HMPG	**Benefit-Cost Ratio:**	More than a 1:4 cost-benefit ratio	

Does this action reduce effects of hazards on existing buildings?	Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?	Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?	Yes

Jurisdiction:	Chambers County		**Action Number:**	B3
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	Widen Mc Adams Ditch			
Project Description:	Widen Mc Adams Ditch that crosses FM 3180 South			
Responsible Entity:	County Engineer Offices and County Judge			
Losses avoided:	Residents and structures near Mc Adams Ditch			
Cost Estimate:	500,000	**Timeframe:**	24 months	
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County		**Action Number:**	B4
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	Bridge on Rhonda Rosa Lane			
Project Description:	Construct bridge on Rhonda Roas Lane in Ranches on Turtle Bayou to replace box culverts			
Responsible Entity:	County Engineer Offices and County Judge			
Losses avoided:	Residents and structures near Turtle Bayou			
Cost Estimate:	500,000	**Timeframe:**	24 months	
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County	**Action Number:**	B5
Hazard(s) Addressed:	Floods, Hurricane/ Tropical Storms, Tornado, Drought, Coastal Erosion, Heat Events and Hail		
Project Title:	Harden and Expand Ambulance Service		
Project Description:	Harden and expand the office and facilities for the Winnie area.		
Responsible Entity:	Winnie Emergency Services Department, County Judge, Department of Emergency Management		
Losses avoided:	Residents and visitors who are affected by a natural hazard		
Cost Estimate:	1,250,000	**Timeframe:**	36 months
Potential Funding Sources:	Winnie ESD (Ambulance Service) project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	Chambers County	**Action Number:**	B6
Hazard(s) Addressed:	Floods, Hurricane/ Tropical Storms, Tornado, and Hail		
Project Title:	Low Power Broadcast Radio		
Project Description:	3 remote power FM broadcast radio sites with one control site for public information and warning. Could also disseminate information before, during, and after an event		
Responsible Entity:	County Judge, County Engineers Offices, County Office of Emergency Management		
Losses avoided:	All residents in Chambers County during a natural disaster		
Cost Estimate:	500,000	**Timeframe:**	12 months
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			

Jurisdiction:	Chambers County		**Action Number:**	B7
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	West Bay Road and Bridge			
Project Description:	Raise West Bay Road- replace and raise bridge			
Responsible Entity:	County Judge, County Engineers Offices, and County's Office of Emergency Management			
Losses avoided:	Residents and structures near bridge, city, county, and regional residents traveling on West Bay Road			
Cost Estimate:	1,500,000	**Timeframe:**	36 months	
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County		**Action Number:**	B8
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	Desnagging, clearing, and grubbing of Turtle Bayou			
Project Description:	Desnagging, clearing, and grubbing of Turtle Bayou from mouth to north of IH 10 and beyond.			
Responsible Entity:	County Judge, County Engineers Department, Department of Emergency Management			
Losses avoided:	Residents and structures along Turtle Bayou			
Cost Estimate:	10,000,000	**Timeframe:**	24 months	
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County	**Action Number:**	B9
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	Dredging Cedar Bayou		
Project Description:	Dredging Cedar Bayou in West Chambers County		
Responsible Entity:	USACE, County Judge, County Engineers Offices, and Department of Emergency Management		
Losses avoided:	Residents and structures along Cedar Bayou		
Cost Estimate:	250,000,000	**Timeframe:**	36 months
Potential Funding Sources:	USACE Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	Chambers County	**Action Number:**	B10
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	Dredging West Fork- Double Bayou		
Project Description:	Dredge West Fork- Double Bayou from mouth to FM 562 bridge		
Responsible Entity:	USACE, County Judge, County Engineers Offices, Department of Emergency Management		
Losses avoided:	Residents and structures along Double Bayou		
Cost Estimate:	5,500,000	**Timeframe:**	36 months
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			No

Jurisdiction:	Chambers County		**Action Number:**	B11
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	Enlarge ditches and create retention- Spindletop Bayou			
Project Description:	Increase IH10 crossings, enlarge ditches and create retention along the Spindletop Bayou in east Chamber County			
Responsible Entity:	Chambers County Judge, County Engineers, and Department of Emergency Management			
Losses avoided:	Residents and structures along the Spindletop Bayou in Chambers County.			
Cost Estimate:	50,000,000	**Timeframe:**	36 months	
Potential Funding Sources:	Rebuild Texas Project	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

Jurisdiction:	Chambers County		**Action Number:**	B12
Hazard(s) Addressed:	Flooding and Hurricane/ Tropical Storm			
Project Title:	Shelving of Hackberry Gully and Cotton Bayou			
Project Description:	Shelving the entire length of Hackberry Gully and Cotton Bayou from South of I-10 to Cotton Lake; thereby increasing the capacity of both in regards to the amount of water that they will hold during a flood event.			
Responsible Entity:	Chambers County			
Losses avoided:	This area has been prone to flooding in the many recent heavy rain events. Water filling the streets and coming close to or entering homes.			
Cost Estimate:	$25,000,000	**Timeframe:**	12 months	
Potential Funding Sources:	CDBG-DR Harvey Match or Chambers County General Fund	**Benefit-Cost Ratio:**	Less than a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				Yes

City of Anahuac Specific Actions

Jurisdiction:	City of Anahuac	**Action Number:**	C1
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	North Anahuac Drainage		
Project Description:	Clean and enlarge road ditches and culverts. Channelized the drainage outfall for the area north of the Lonestar Canal		
Responsible Entity:	City of Anahuac		
Losses avoided:	Flooding of homes and City's water plant		
Cost Estimate:	3,250,000	**Timeframe:**	8 months
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			Yes

Jurisdiction:	City of Anahuac	**Action Number:**	C2
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	Raw water pond armoring		
Project Description:	Erosion proofing of the water treatment plant raw water pond		
Responsible Entity:	City of Anahuac		
Losses avoided:	Erosion of raw water pond; economic loss for residents depending on the pond		
Cost Estimate:	500,000	**Timeframe:**	6 months
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			Yes

Jurisdiction:	City of Anahuac	**Action Number:**	C3
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms		
Project Title:	Southwest Anahuac Ditch		
Project Description:	Channelization and crossing upgrades from Main Street to Bay		
Responsible Entity:	City of Anahuac		
Losses avoided:	Residents and structures from Main Street to Bay		
Cost Estimate:	500,000	**Timeframe:**	10 months
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			Yes

Jurisdiction:	City of Anahuac	**Action Number:**	C4
Hazard(s) Addressed:	Floods, Hurricane/ Tropical Storms, Coastal Erosion		
Project Title:	Southeast Drainage Ditch		
Project Description:	Channelization and crossing upgrades from Benton Lane to FM 563		
Responsible Entity:	City of Anahuac		
Losses avoided:	Flooding and Loss of homes, businesses		
Cost Estimate:	500,000	**Timeframe:**	12 months
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio
Does this action reduce effects of hazards on existing buildings?			Yes
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?			Yes
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?			Yes

Jurisdiction:	City of Anahuac		**Action Number:**	C5
Hazard(s) Addressed:	Floods and Hurricane/ Tropical Storms			
Project Title:	Lift Station Rehabilitation			
Project Description:	Rehabilitation of 3 sanitary sewer lift stations to alleviate flooding of pumps.			
Responsible Entity:	City of Anahuac			
Losses avoided:	Loss of life and structures that may be flooded			
Cost Estimate:	1,500,000	**Timeframe:**	36 months	
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				Yes

City of Mount Belvieu Specific Action

Jurisdiction:	City of Mount Belvieu		**Action Number:**	D1
Hazard(s) Addressed:	Floods, Hurricane/ Tropical Storms, Tornado, Drought, Heat Events and Hail			
Project Title:	Extend Langston Road			
Project Description:	Extend Langston Road to IH 10 Feed allowing 2 access points to McLeod Park Shelter			
Responsible Entity:	Mount Belvieu City Engineer			
Losses avoided:	Residents trying to get to the McLeod Park Shelter			
Cost Estimate:	9,000,000	**Timeframe:**	24 months	
Potential Funding Sources:	HMAP	**Benefit-Cost Ratio:**	Approximately a 1:4 cost-benefit ratio	
Does this action reduce effects of hazards on existing buildings?				No
Does this action reduce effects of hazards for new buildings, infrastructure, or future development?				No
Does mitigation action identify, analyze, and prioritize actions related to continued compliance with NFIP?				No

2017

Part 8: Plan Maintenance

Part 8: PLAN MAINTENANCE

To remain an effective tool, the HMAP will undergo continuous review and updates. This practice is known as plan maintenance and requires monitoring, evaluating, updating, and implementing the plan. To accomplish this, a Plan Maintenance Team (PMT) has been determined and is comprised of representatives from each of the County's participating jurisdictions.

Plan Maintenance Team	
Plan Maintenance Team Leader	Chambers County Emergency Management Coordinator
Jurisdiction	**Responsible Entity**
Unincorporated Chambers County	Chambers County OEM and County Judge
Cove	Mayor
Beach City	Mayor
Mont Belvieu	City Engineer
Chambers-Liberty Counties Navigation District	General Manager
Old River-Winfree	Mayor
Anahuac	Mayor
Members of the Public	Public

Public Involvement

Continued stakeholder and public involvement will remain a vital component of the HMAP. The HMAP will be hosted on the County and H-GAC websites, and public input can be submitted at any time. The PMT is responsible for documenting public feedback, and presenting the comments for discussion at each annual Plan Maintenance Meeting.

The PMT Leader will also conduct outreach and invite the public to annual Plan Maintenance meetings. The PMT Leader will advertise all annual meetings in local newspapers, post invitations on the County social media pages, and post fliers at city and county buildings 30 days prior to the meetings.

In addition, each participating jurisdiction will seek input from the public on the status of existing hazards, emerging vulnerabilities, and evaluate the entirety of the planning process and written plan with the public. During each meeting, the PMT will provide an open comment forum for interactive discussion with the public. The development of new goals and strategies will be a joint effort between the PMT and public participants.

Procedures & Schedule

Procedures to monitor and evaluate the HMAP were determined during the December 18th meeting. This ensures that the goals, objectives, and the mitigation strategy are regularly examined for feasibility, and that the HMAP remains a relevant and adaptive tool. The PMT will meet annually, and hold its first meeting within one year after the plan's approval date. An additional mid-year meeting will be held 18 months prior to the plan's expiration to develop a timeline and strategy to update the HMAP.

Plan Maintenance: Evaluation & Monitoring Procedures

Method and Procedures	Schedule	Responsible Entity
The PMT Leader will advertise all annual meetings in local newspapers, post invitations on the County social media pages, and post fliers at city and county buildings 30 days prior to the meetings.	30 days prior to annual meetings	Plan Maintenance Team Leader
The PMT Leader is responsible for evaluating the entire plan prior to the meeting. Each PMT member will be asked to identify and discuss any deficiencies in the plan as it relates to their jurisdiction. Each PMT member will discuss their findings followed by public input and comments.	Annually	PMT Leader, PMT member for each participating jurisdiction, and Public
Emerging hazards, risks, and vulnerabilities will be identified and discussed. 1) PMT members are responsible for monitoring each natural hazard in their jurisdiction, and providing a written and/or verbal update on any new occurrences and emerging risks. 2) The PMT Leader will seek input from participants and the public at the annual meetings by opening the meeting for public comment. 3) Newly identified hazards, risks, and vulnerabilities will be assigned to a PMT member to research and monitor.	Annually	Public and all participating jurisdictions
The PMT will evaluate the entirety of the planning process and written plan to ensure the HMAP remains relevant and the strategy continues to be effective. 1) PMT members will identify new projects and/or re-prioritize existing strategies based on changes in their jurisdiction, emerging hazards, and shifting priorities. 2) Mitigation strategies for the newly identified hazards, risks, and vulnerabilities will be proposed and discussed. 3) Funding sources and multijurisdictional cooperation for new initiatives will be determined. 4) The Plan Maintenance Team Leader will report on any suggestions for changing the whole written plan, planning, maintenance, or implementation process for the plan received by PMT members throughout the year. The PMT members will discuss which revisions/ suggestions they would like to implement.	Annually	PMT member for each participating jurisdiction
Each participating jurisdiction will evaluate their progress implementing the mitigation strategy. 1) Representatives will publicly discuss progress and submit written progress reports to the team leader. 2) Completed and ongoing mitigation actions will be discussed by responsible entity. 3) Unaddressed mitigation actions will be evaluated for relevancy and/or amended to increase feasibility. 4) Feasibility of the mitigation strategy will be evaluated, and any necessary revisions will be proposed. 5) The team leader will seek comment from the public after each participating jurisdiction's presentation.	Annually	PMT, the responsible department identified in the mitigation action up for discussion, and the public.

The PMT will develop a timeline and strategy to update the plan 18 months before it expires. The update strategy will include: 1) Establish entities responsible for drafting and submitting the update to TDEM 2) Send appropriate representatives to G-318 training. 3) Determine funding needs and funding sources for plan update.	Every 5 years	PMT

Existing Plans & Regulations

Several existing plans and programs that require integration of the HMAP have been identified by the participating jurisdictions. These known planning mechanisms will be amended to support mitigation efforts, and both plans will be reviewed for contradictions.

DRP: Disaster Recovery Plan
FMP: Floodplain Management Plan
EOP: Emergency Operations Plan
COOP: Continuity of Operations Plan
RP: Regional Planning
SO: Subdivision Regulation
SARA: SARA Title III Emergency Response Plan

Jurisdiction	DRP	FMP	EOP	COOP	RP	SO	SARA
Unincorporated Chambers County		x	x				x
Anahuac		x	x				x
Beach City		x	x				x
Mont Belvieu		x	x	x			x
Cove		x	x				x
Chambers-Liberty Counties Navigation		x	x				x
Old-River Winfree						x	

Plan Integration

Integrating the HMAP into county and local planning mechanisms is key to its success. Effective integration allows communities to benefit from existing plans and procedures to further reduce their vulnerability and risk. Upon approval of the plan and approval of updates or revisions as proposed by the Plan Maintenance team, each participating jurisdiction will follow the pre-determined actions:

Chart 1: Hazard Mitigation Plan Adoption and Integration Procedures	
Chambers County	HMAP will be presented to the Commissioner's Court by the Chambers County Emergency Management Office. An agenda for the meeting will be posted 60 days in advance, and a 30-day period of public comment will be provided. Upon approval by Commissioner's Court, the approved HMAP will be integrated into existing planning mechanisms described in Chart 2.
Cove	Cove's PMT representative will select mitigation actions to be budgeted into Cove's annual budget to be implemented the following year. The proposal will be presented to the Aldermen. An agenda will be published 30 days in advance.
Beach City	Beach City's Mayor will select mitigation actions to be budgeted into the annual budget. Mitigation actions will be included in the City Council's agenda before the next City Council's regularly called meetings.

Mont Belvieu	Mont Belvieu's PMT representative will select mitigation actions to be budgeted into the annual budget. Mitigation actions will be included in the City Council's agenda before the next City Council's regularly called meetings.
Chambers-Liberty Counties Navigation District	The PMT representative will select mitigation actions to present to the board to be approved by the board.
Old River-Winfree	Old River-Winfree's PMT representative will select mitigation actions to be budgeted into the annual budget to be implemented the following year. The proposal will be presented to the Aldermen. An agenda will be published 30 days in advance.
Anahuac	Anahuac's PMT representative will select mitigation actions to be budgeted into Cove's annual budget to be implemented the following year. The proposal will be presented to the Aldermen. An agenda will be published 30 days in advance.

To update and revise existing planning mechanisms to further integrate the HMAP, each participating jurisdiction will follow a basic process(is) described in this section.

1.) Propose a policy, strategy, or regulatory amendment to the proper governing body.
2.) Advertise the amendment 15 days prior to meeting where it will be discussed. Advertising procedures for the public meeting(s) is outlined in the public involvement measures described in Section 8 of this plan.
3.) Provide the public, elected officials, and governing bodies the opportunity to discuss and comment upon proposed change(s).
4.) If the proposal is accepted, the change is implemented by the appropriate governing authority.

Several existing plans and programs that require integration of the HMAP have been identified by the participating jurisdictions. The PMT will initiate the process described above. As each participating jurisdiction develops or approves new planning mechanisms, the mechanism's name and the integration method will be added to the HMAP

Planning Mechanism	Jurisdictions	Integration Method
Floodplain Management Plan	Unincorporated Chambers County Anahuac Beach City Mont Belvieu Cove Chambers-Liberty Counties Navigation	Adoption of codes that support mitigation strategy and mitigation activities.
Stormwater Management Plan	Unincorporated Chambers County Anahuac Beach City Mont Belvieu Cove Chambers-Liberty Counties Navigation	Both plans should be updated and maintained in accordance with the other plan's goals. Any Stormwater Management Plan updates will refer to, incorporate, and/or complement the HMAP.
Emergency Operations Plan	Unincorporated Chambers County Anahuac Beach City Mont Belvieu Cove Chambers-Liberty Counties Navigation	Both plans should be updated and maintained in accordance with the other plan's goals. Any Emergency Operations Plan updates will refer to, incorporate, and/or complement the HMAP.
Subdivision Ordinance	Old-River Winfree Mont Belvieu	Adoption of codes that support mitigation strategy and mitigation activities.

2017

Appendix A: Planning Process

Public Meeting Press Release & Advertisement

HOUSTON-GALVESTON AREA COUNCIL

PO Box 22777 • Houston, Texas 77227-2777• 713-627-3200

NEWS RELEASE

FOR IMMEDIATE RELEASE
September 29, 2017

Contact: Joey Kaspar: (713) 993-4547 or Joey.Kaspar@h-gac.com

Becki Begley: (713) 993-2410 or Becki.Begley@h-gac.com (Media Inquiries Only)

CHAMBERS COUNTY HAZARD MITIGATION PLAN KICK-OFF MEETING

The Houston-Galveston Area Council (H-GAC), in partnership with Chambers County, City of Anahuac, City of Mont Belvieu, and City of Old River-Winfree is hosting the first public meeting to develop Chambers County's Hazard Mitigation Plan. The meeting will be held from 1:00 p.m. to 4:00 p.m., October 17, at the Anahuac Courthouse Annex, 2128 Highway 6, Anahuac, TX 77514.

A Hazard Mitigation Plan is a strategic plan that proposes actions to reduce or eliminate long-term risk to people and property from future natural disasters. Public input and involvement is important for developing a comprehensive approach to reduce the effects of natural disasters on communities.

All Chambers County residents are invited to participate and contribute their local expertise during the planning process. Mitigation actions developed by participants will be considered for inclusion in the County's Hazard Mitigation Plan to be submitted to the Federal Emergency Management Agency (FEMA).

The meeting agenda is available on H-GAC's website at http://www.h-gac.com/community/community/hazard/documents/10-17-17-Chambers-County-Meeting-Agenda.pdf

More information on hazard mitigation plans is available on FEMA's website at https://www.fema.gov/hazard-mitigation-planning.

For more information about the meeting, contact Joey Kaspar at (713) 993-4547 or at Joey.Kaspar@h-gac.com, or Amy Combs, (713) 993-4544 or at Amy.Combs@h-gac.com.

Houston-Galveston Area Council

The Houston-Galveston Area Council (www.h-gac.com) is a voluntary association of local governments in the 13-county Gulf Coast Planning Region—an area of 12,500 square miles and more than 6 million people. H-GAC works to promote efficient and accountable use of local, state, and federal tax dollars and serves as a problem-solving and information forum for local government needs.

Public Meeting Agenda: October 17, 2017

Chambers County
Hazard Mitigation Plan Kick-Off Meeting

October 17, 2017
1:00 pm – 4:00 pm
Anahuac Courthouse Annex
2128 Highway 6
Anahuac, TX 77514

Agenda

12:30-1:00 pm Registration

1:00 pm Welcome & Overview of Hazard Mitigation Plans & Procedures
H-GAC Staff will provide an overview of meeting objectives, activities, and H-GAC's planning process. The presentation will also include project timelines, partner roles and responsibilities, in-kind match requirements, and exemptions.

1:15 pm Review 2017 Risk Assessment
H-GAC staff will present the County's draft risk assessment. Attendees will participate in a breakout session to review the draft risk assessment maps, charts, and provide feedback.

2:10 pm Local Risk Assessment & Capability Form
Meeting attendees will fill out a form describing the frequency of a hazard, and rate their mitigation capabilities in their jurisdiction.

2:15 pm 15-minute Break

2:30 pm Mitigation Actions Presentation & Activity
H-GAC staff will give a presentation on creating mitigation actions and facilitate a practice exercise in writing a mitigation action.

3:00 pm Update 2011 Mitigation Actions & Write New Actions
Review 2011 mitigation actions for viability, and update actions to meet new FEMA standards. With remaining time, draft new mitigations for 2017.

4:00 pm Adjourn

Sign In Sheet From October 17, 2017

Chambers County Hazard Mitigation Plan Kickoff Meeting

Your Name	Your Title	Organization, City, or County Represented	Phone Number	Email Address
JERRY SCHRODER	MANAGER	TBCD	409 296 3602	JERRY@TBCD.ORG
Joey Kaspar	Planner	H-GAC		
Diane Newsome	Project Manager	TBCD	409-296-3602	diane@tbcd.org
Cheryl Sanders	Mayor	City of Anahuac	409-267-1296	c.sanders@anahuac.us
Amy Combs		H-GAC		
ALEXIS HALL	HM COMMUNITY PLANNER	FEMA		
Jamieleigh Price	HM Community Planner	FEMA		
Roy Turner	EMC	Chambers County	409-267-2446	rturner@chamberstx.gov
Sarah Cervone	Ex Dep. Chambers Co.	Chambers Co	409-267-2693	scervone@chamberstx.gov

17 October 2017, 1 pm – 4 pm, 1:00 pm – 4:00 pm Anahuac Courthouse Annex 2128 Highway 6 Anahuac, TX 77514

Online Surveys

Capability Assessment

City Name (if applicable)

County representatives should list the county

Name

First Name Last Name

Your Title *

Please review the plans and programs listed below. Check which plans and programs your county/city currently has in place.

- HMP: Hazard Mitigation Plan
- DRP: Disaster Recovery Plan
- COMP: Comprehensive Land Use Plan
- FMP: Floodplain Management Plan
- SMP: Stormwater Management Plan
- EOP: Emergency Operations Plan
- COOP: Continuity of Operations Plan
- RERP: Radiological Emergency Plan
- SARA: SARA Title III Emergency Response Plan
- TRANS: Transportation Plan
- RPG Plan: Regional Planning
- HPP: Historic Preservation Plan
- SO: Subdivision Ordinance
- FDPO: Flood Damage Prevention Ordinance
- CRS: Community Rating System
- CIP: Capital Improvements Plan (that regulates infrastructure in hazard areas)

Does your county/city have current building codes in place?

Yes No Unsure

Does your county/city have current fire codes in place?

Yes No Unsure

For codes that apply to your jurisdiction, please indicate their effectiveness in mitigating damages.

	High	Medium	Low	None	Not Applicable
IRC (International Residential Code)					
National Flood Insurance Program Compliance					
Fire Protection Compliance					
Office zoning, building codes, upgraded MEP applications					

Hazard Mitigation Planning Team

Jurisdiction:	

Primary Point of Contact

Name:	
Title:	
Email:	
Phone:	

Please include the information of your jurisidiction's planning team. The planning team consists of anyone who will help your jurisdiction with the Hazard Mitigation Plan:

Other Team Members:

Name:	
Title:	
Email:	

Name:	
Title:	
Email:	

Name:	
Title:	
Email:	

Name:	
Title:	
Email:	

NFIP & Flood Plain Management Capability

Name

First Name Last Name

Your Title *

Email

example@yourorg.com

Name of Jurisdiction

County representatives should list the county

Is your jurisdiction a National Flood Insurance Program (NFIP) Participant?

Yes No

NFIP Policy Summary

	Total Number of Policies	Total Coverage	Total Number of Losses	Total Dollars Paid
Summary				

NFIP Staff Assessment

The following questions seek information on your community's participation in and continued compliance with the NFIP. Indicate the source of information.

Is the Community FPA or NFIP Coordinator certified?

Yes No

Source Information

Community FPA

Comments

Is floodplain management an auxiliary function?

Yes No

Source Information

Community FPA

Comments

Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)

Local Risk & Capability Survey

Please rate the cities/ counties ability to reduce the impact of the listed natural hazards.

Hazard	Applicable to your Community?			Current Perceived Risk			Current Ability to Reduce Damages from Hazard			Future Ability to Reduce Damages from Hazard		
Floods	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Hurricane/Tropical Storms	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Wildfire	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Severe Thunderstorms	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Tornado	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Drought	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Coastal Erosion	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Dam/Levee Failure	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Expansive Soils	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Extreme Heat	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Hail	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High
Winter Storms	Yes	No	Unknown	Low	Medium	High	Low	Medium	High	Low	Medium	High

Please rate the cities/ counties ability to reduce the impact of the listed natural hazards.

Hazard	Local Budget			Administrative Staffing			Technical Staffing			Political Determination/Resolve		
Floods	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Hurricane/Tropical Storms	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Wildfire	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Severe Thunderstorms	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Tornado	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Drought	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Coastal Erosion	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Dam/Levee Failure	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Expansive Soils	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Extreme Heat	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Hail	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Winter Storms	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High

Mitigation Prioritization Worksheet

Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
Local Plans and Regulations											
Structure and Infrastructure Projects											
Natural Systems Protection											
Education and Awareness Programs											

2017

Appendix B: Critical Facilities

APPENDIX B: Critical Facilities

TYPE	NAME
Correctional Facilities	Chambers County Jail
EMS	Anahuac Volunteer Emergency Medical Services
EMS	Smith Point Volunteer Fire Department and Emergency Services
Fire Station	Anahuac VFD
Fire Station	Smith Point VFD
Fire Station	Oak Island - Double Bayou VFD
Police Station	County Sheriff
Brownfields	Turtle Bayou Site
High Schools	Anahuac High School
Hospital	Bayside Community High School
Local Emergency Operation Center	Chambers County EOC
Police Station	Chambers County Constable Precinct 2
School	Anahuac Middle School
School	Anahuac Elementary
Shelter	American Legion Hall
Shelter	Double Bayou Community Center
Shelter	Whites Park
Solid Waste Landfill	Gulf West Landfill
Fire Station	Cove Fire & Rescue
Shelter	Eagle Heights Fellowship
Fire Station	Hankerer
Solid Waste Landfill	Chambers County Landfill
Fire Station	Mont Belvieu Fire Department
Fire Station	Barbers Hill Fire Department
Police Station	Mont Belvieu Police Dept
Police Station	Chambers County Task Force
School	Barbers Hill Kindergarten
School	Barbers Hill Primary School
School	Barbers Hill Middle School
School	Barbers Hill Middle School North
School	Barbers Hill Element School North
School	Barbers Hill Element School South
Shelter	Barber's Hill Middle School
Shelter	Mercy Gate Church
Toxic Release Inventory Facility	Enterprise Self Storage
Toxic Release Inventory Facility	Plastics Plant
Toxic Release Inventory Facility	Taraga Downstream Chemicals
Toxic Release Inventory Facility	Enterprise Complex
Toxic Release Inventory Facility	Pol-Tech International
Toxic Release Inventory Facility	Underground Storage
High Schools	Barber Hill High School
Police Station	Police Department
Police Station	ISD Police Department

Police Station	Chambers County Constable
EMS	Fire Department
Fire Station	Old River - Winfree VFD
Police Station	Police Department
Fire Station	Wallisville V.F. D
Police Station	County Constable Precinct 5
Shelter	Whites Park Community Building
Electric Substation	Unknown 307340
Fire Station	Winnie-Stowell VFD
Wastewater Treatments Plant	Winnie Waste Water Treatment Plant
Dam	Middleton Reservoir Dam 2
EMS	Volunteer Fire Department
High Schools	East Chambers High School
Hospital	Community Hospital
Police Station	County Constable Precinct 2
School	East Chambers Junior High Gym
School	East Chambers Intermediate School
School	East Chambers Middle
Shelter	St. Louis Catholic Church
Shelter	East Chambers Junior High Gym
Shelter	First Baptist Church Winnie
Dam	Jenkins Off Channel Reservoir Dam
Dam	E W Monteith 1 Levee
Dam	E W Monteith 2 Levee
Dam	E W Monteith 3 Levee
Dam	Jones and Allen Farms Levee
Dam	Stanolind Reservoir Dam
Dam	Lagow Reservoir 2 Dam
Dam	W Scott Frost Reservoir 1 Levee
Dam	Cedar Bayou Generating Pond Levee
Dam	Wallisville Dam
Dam	Lake Anahuac Levee
Dam	Trinity Bay Salt Water Barrier
Electric Substation	Chambers
Electric Substation	Unknown307394
Electric Substation	Unknown307395
Electric Substation	TAP303590
Electric Substation	Unknown307327
Electric Substation	Unknown307328
Electric Substation	Unknown307329
Electric Substation	Unknown307331
Electric Substation	Unknown307390
Electric Substation	Cedar Bayou Plant
Electric Substation	Trinity Bay
Electric Substation	Trinity Bay
Electric Substation	Unknown307752
Electric Substation	Unknown307753

Electric Substation	Unknown307754
Electric Substation	Unknown307755
Electric Substation	TAP303515
Electric Substation	TAP303571
Electric Substation	TAP303588
Electric Substation	TAP303589
Electric Substation	Warvue
Electric Substation	Unknown307334
Electric Substation	Unknown307335
Electric Substation	Unknown307589
Power Plant	Cedar Bayou
Power Plant	Cedar Bayou 4
Power Plant	Mont Belvieu Unit
Wastewater Treatments Plant	Cotton Bayou Waste Water Treatment

2017

Appendix C: Hazus Analysis

Hazus-MH: Flood Global Risk Report

Region Name: Chambers County

Flood Scenario: 100-Year

Print Date: Wednesday, November 08, 2017

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Flood. These results can be improved by using enhanced inventory data and flood hazard information.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Texas

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 630 square miles and contains 1,962 census blocks. The region contains over 12 thousand households and has a total population of 35,096 people (2010 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 13,675 buildings in the region with a total building replacement value (excluding contents) of 3,933 million dollars (2010 dollars). Approximately 93.41% of the buildings (and 76.17% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 13,675 buildings in the region which have an aggregate total replacement value of 3,933 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	2,996,153	76.2%
Commercial	286,679	7.3%
Industrial	503,717	12.8%
Agricultural	13,590	0.3%
Religion	44,268	1.1%
Government	11,921	0.3%
Education	77,078	2.0%
Total	**3,933,406**	**100.0%**

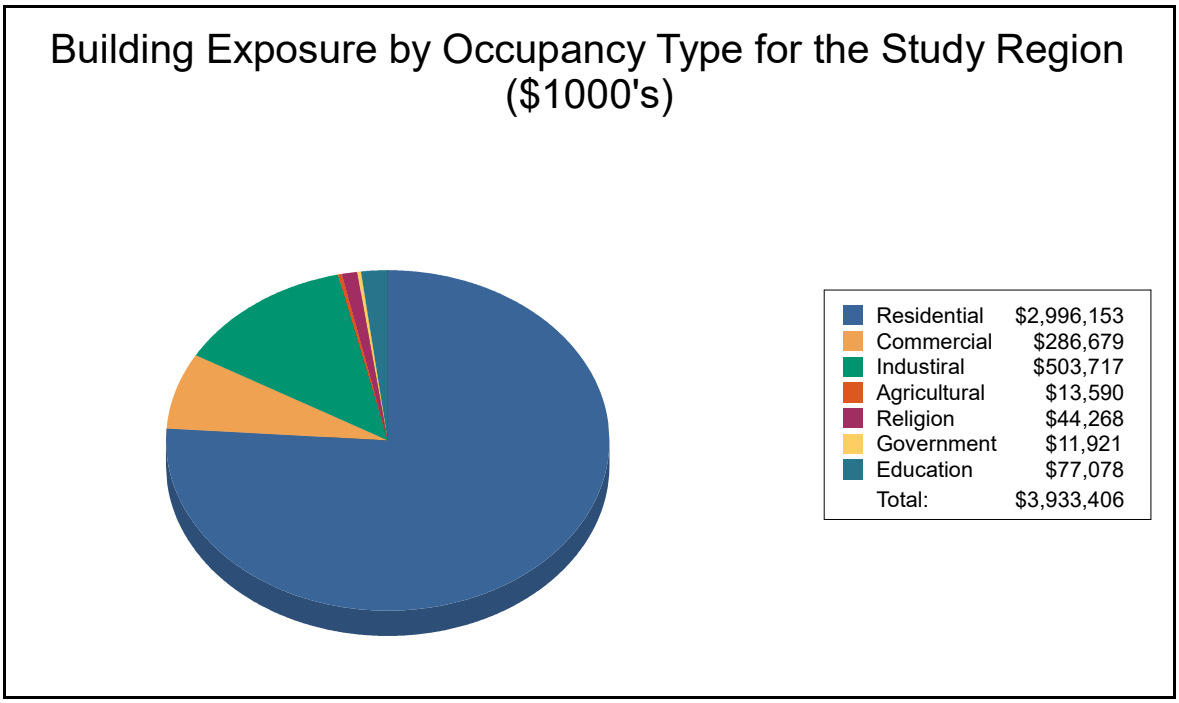
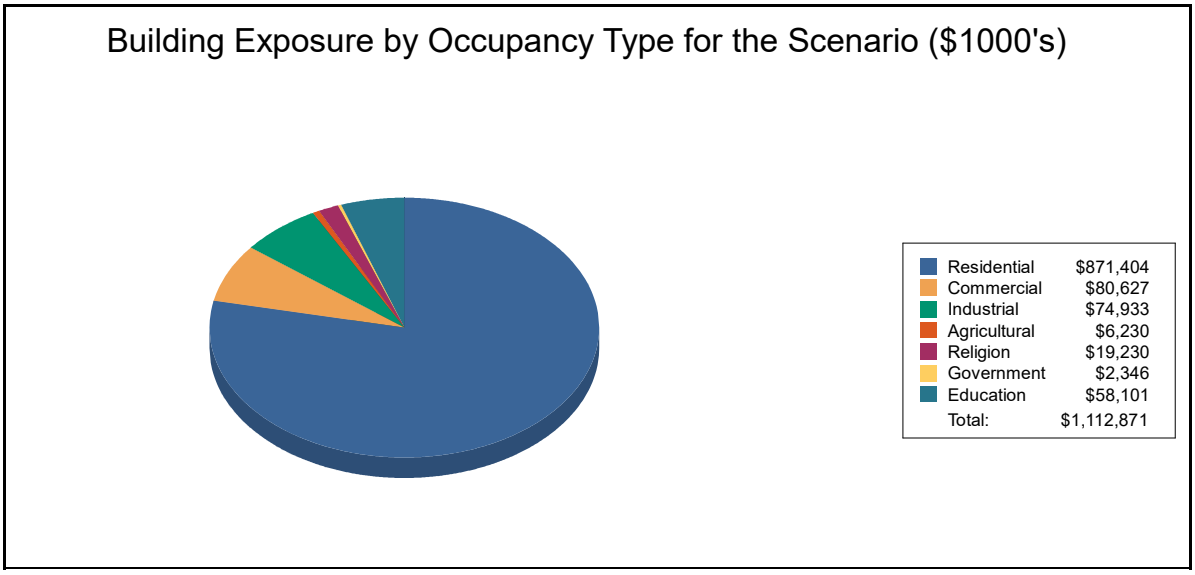


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	871,404	78.3%
Commercial	80,627	7.2%
Industrial	74,933	6.7%
Agricultural	6,230	0.6%
Religion	19,230	1.7%
Government	2,346	0.2%
Education	58,101	5.2%
Total	**1,112,871**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 14 beds. There are 12 schools, 8 fire stations, 3 police stations and no emergency operation centers.

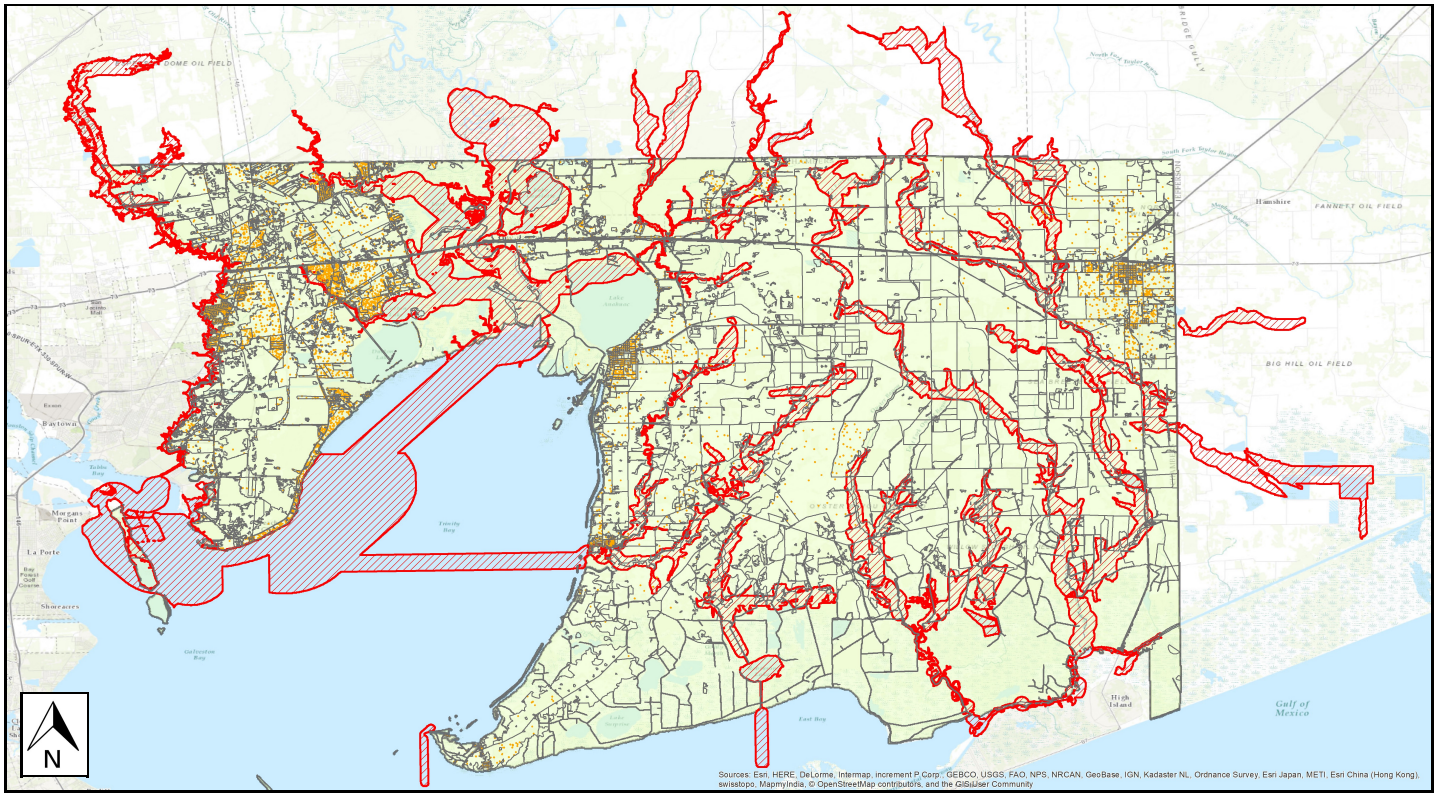
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Chambers County
Scenario Name:	100-Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 23 buildings will be at least moderately damaged. This is over 58% of the total number of buildings in the scenario. There are an estimated 4 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

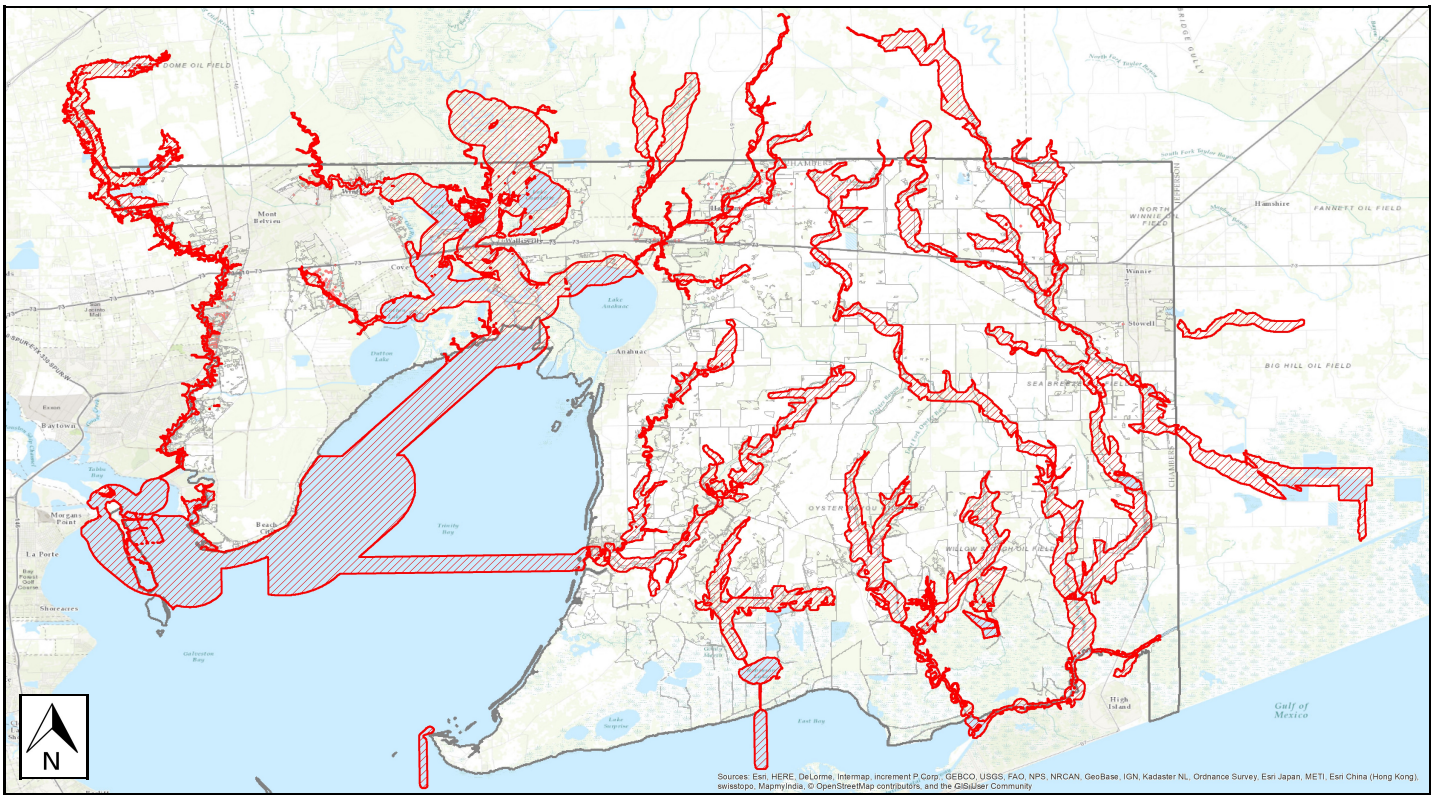


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	17	42.50	11	27.50	4	10.00	3	7.50	1	2.50	4	10.00
Total	**17**		**11**		**4**		**3**		**1**		**4**	

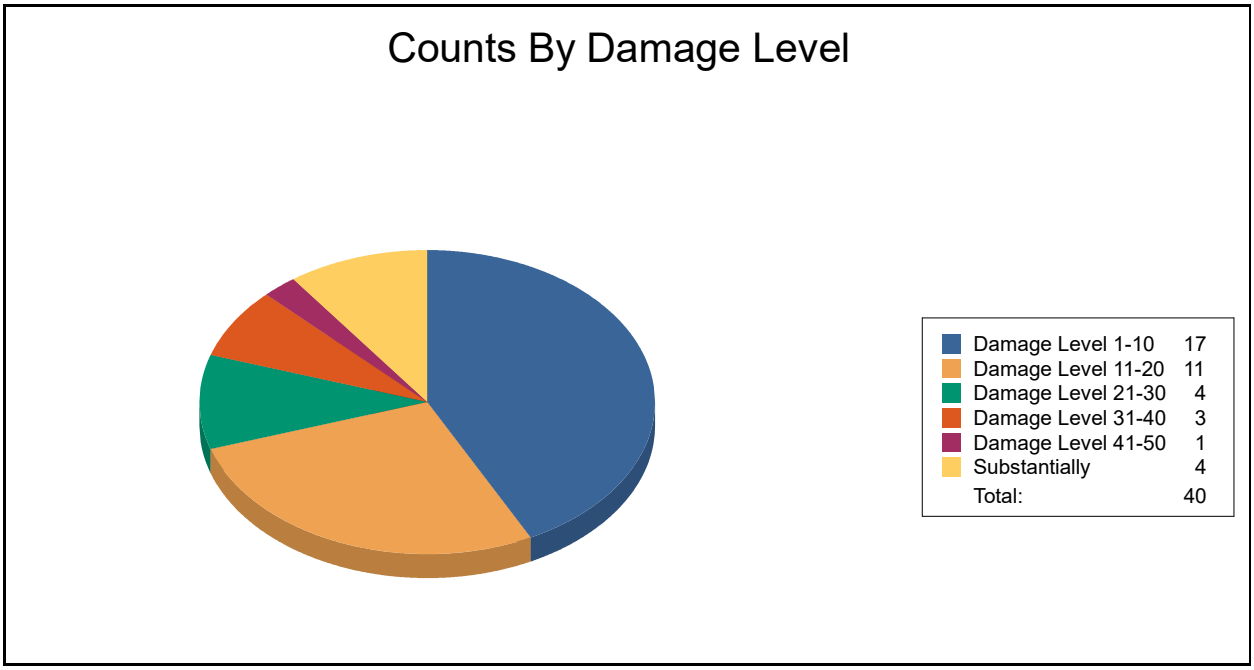


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	17	43	11	28	4	10	3	8	1	3	4	10

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 14 hospital beds available for use. On the day of the scenario flood event, the model estimates that 14 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	8	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	12	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

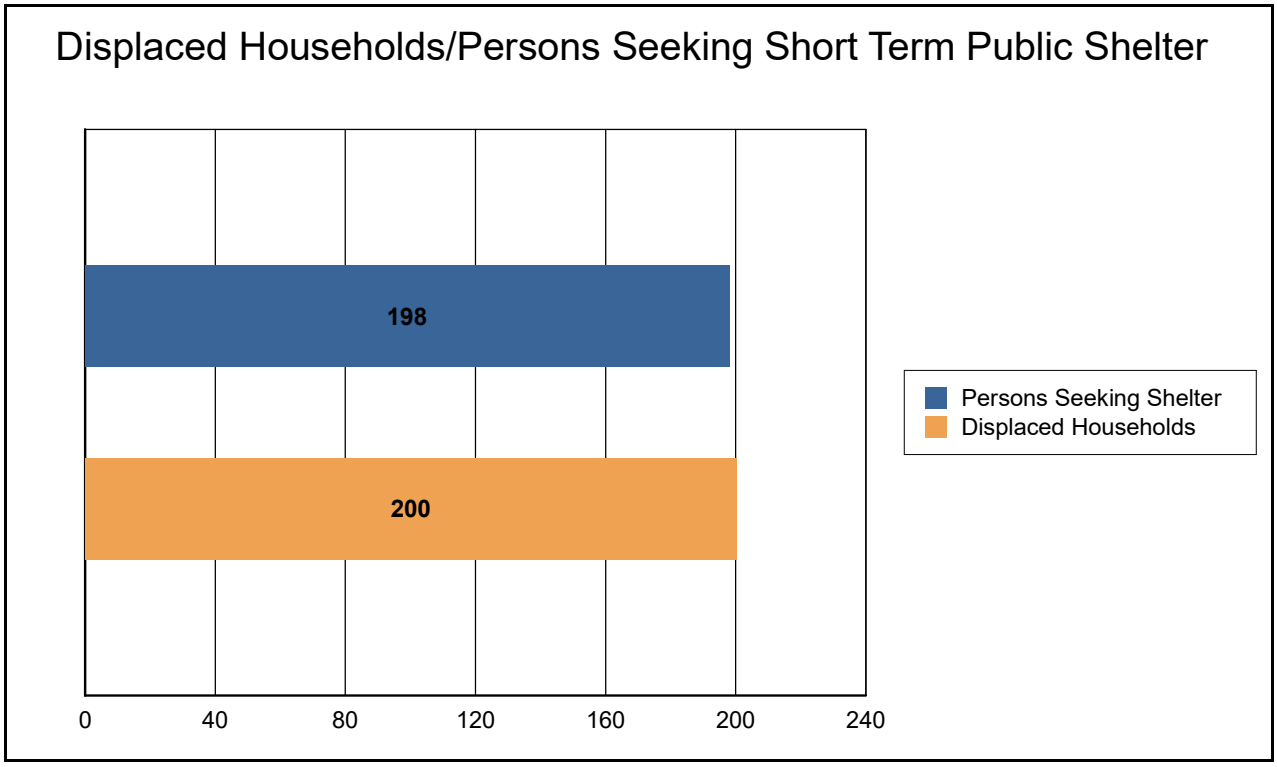
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 200 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 198 people (out of a total population of 35,096) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 15.94 million dollars, which represents 1.43 % of the total replacement value of the scenario buildings.

Building-Related Losses

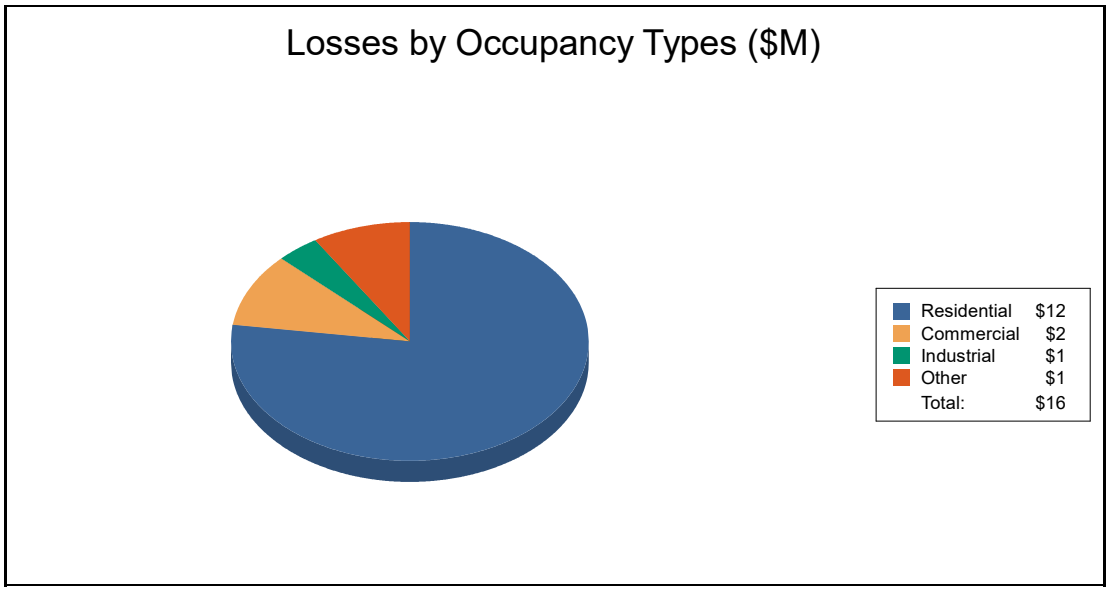
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 15.77 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 77.18% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	7.95	0.37	0.18	0.18	8.68
	Content	4.35	1.18	0.41	1.08	7.01
	Inventory	0.00	0.02	0.06	0.00	0.08
	Subtotal	**12.30**	**1.57**	**0.64**	**1.26**	**15.77**
Business Interruption						
	Income	0.00	0.01	0.00	0.03	0.04
	Relocation	0.01	0.00	0.00	0.01	0.02
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.10	0.11
	Subtotal	**0.01**	**0.02**	**0.00**	**0.15**	**0.18**
ALL	**Total**	**12.31**	**1.59**	**0.64**	**1.41**	**15.94**



Appendix A: County Listing for the Region

Texas

- Chambers

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Texas				
Chambers	35,096	2,996,153	937,253	3,933,406
Total	**35,096**	**2,996,153**	**937,253**	**3,933,406**
Total Study Region	**35,096**	**2,996,153**	**937,253**	**3,933,406**

Hazus-MH: Flood Global Risk Report

Region Name: Chambers County

Flood Scenario: 500-Year

Print Date: Wednesday, November 08, 2017

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

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Note:
Appendix A contains a complete listing of the counties contained in the region.

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There are an estimated 13,675 buildings in the region with a total building replacement value (excluding contents) of 3,933 million dollars (2010 dollars). Approximately 93.41% of the buildings (and 76.17% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 13,675 buildings in the region which have an aggregate total replacement value of 3,933 million (2014 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

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Government	11,921	0.3%
Education	77,078	2.0%
Total	**3,933,406**	**100.0%**

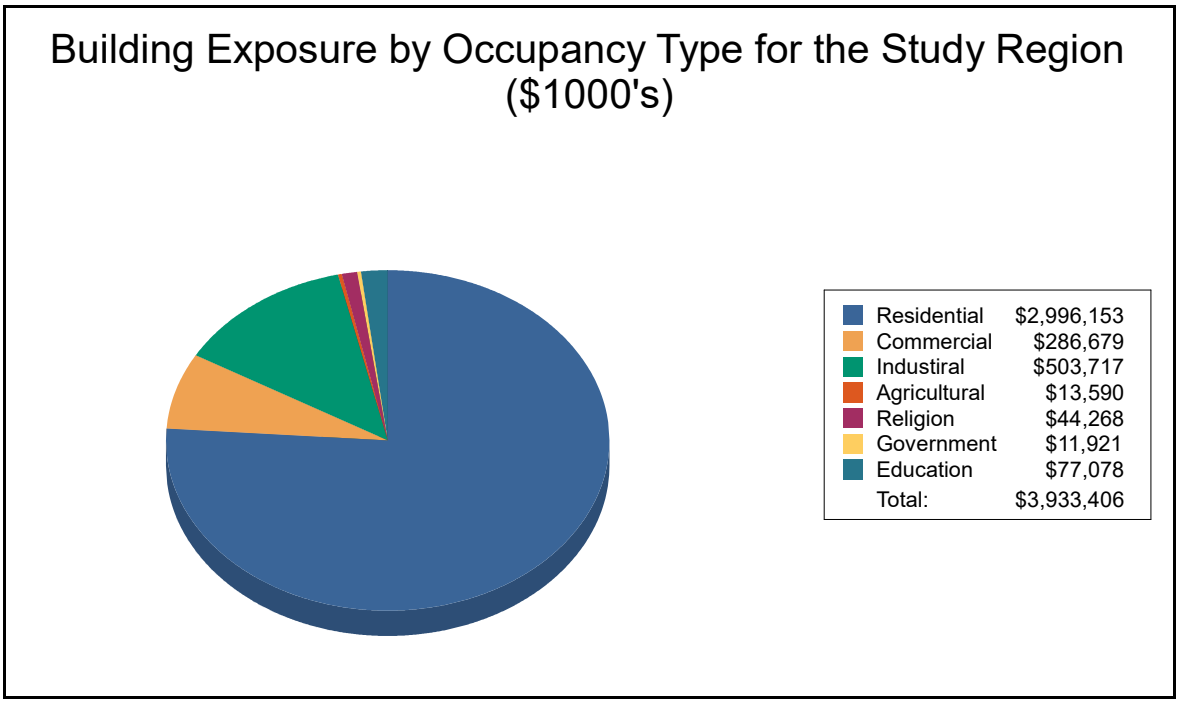
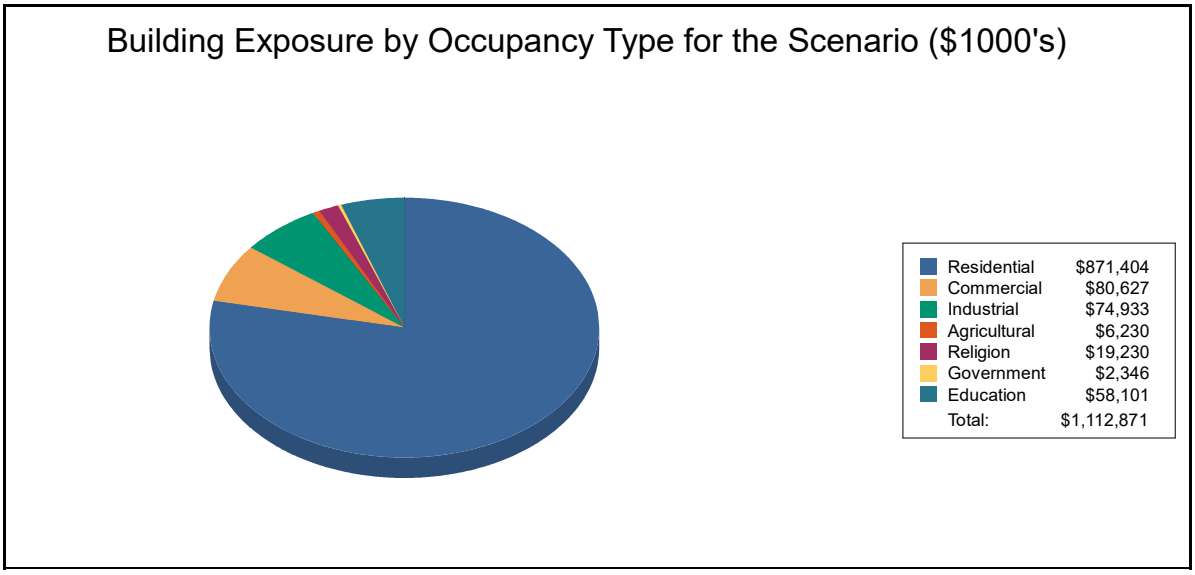


Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	871,404	78.3%
Commercial	80,627	7.2%
Industrial	74,933	6.7%
Agricultural	6,230	0.6%
Religion	19,230	1.7%
Government	2,346	0.2%
Education	58,101	5.2%
Total	**1,112,871**	**100.0%**



Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 14 beds. There are 12 schools, 8 fire stations, 3 police stations and no emergency operation centers.

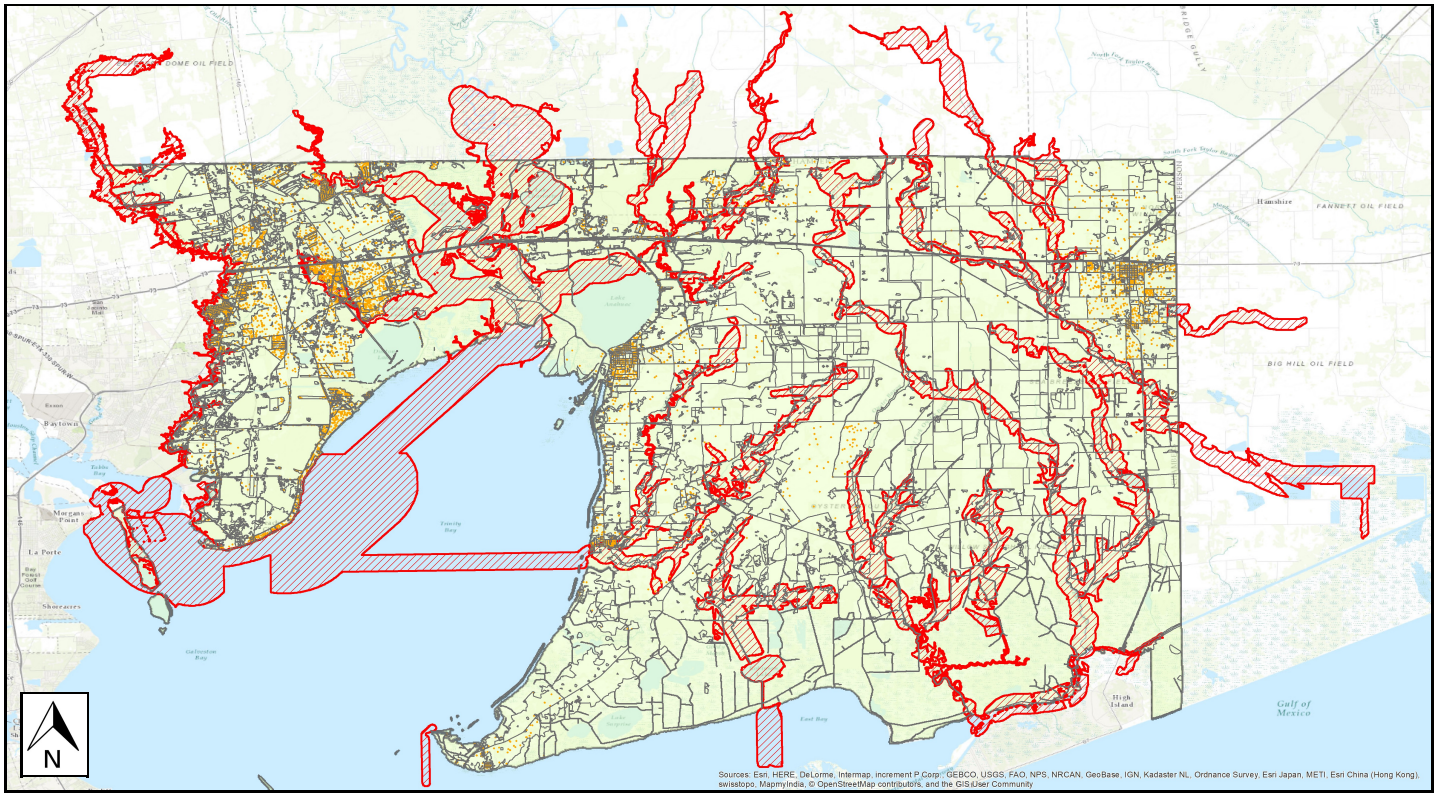
Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Chambers County
Scenario Name:	500-Year
Return Period Analyzed:	500
Analysis Options Analyzed:	No What-Ifs

Study Region Overview Map

Illustrating scenario flood extent, as well as exposed essential facilities and total exposure



Building Damage

General Building Stock Damage

Hazus estimates that about 45 buildings will be at least moderately damaged. This is over 54% of the total number of buildings in the scenario. There are an estimated 4 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Total Economic Loss (1 dot = $300K) Overview Map

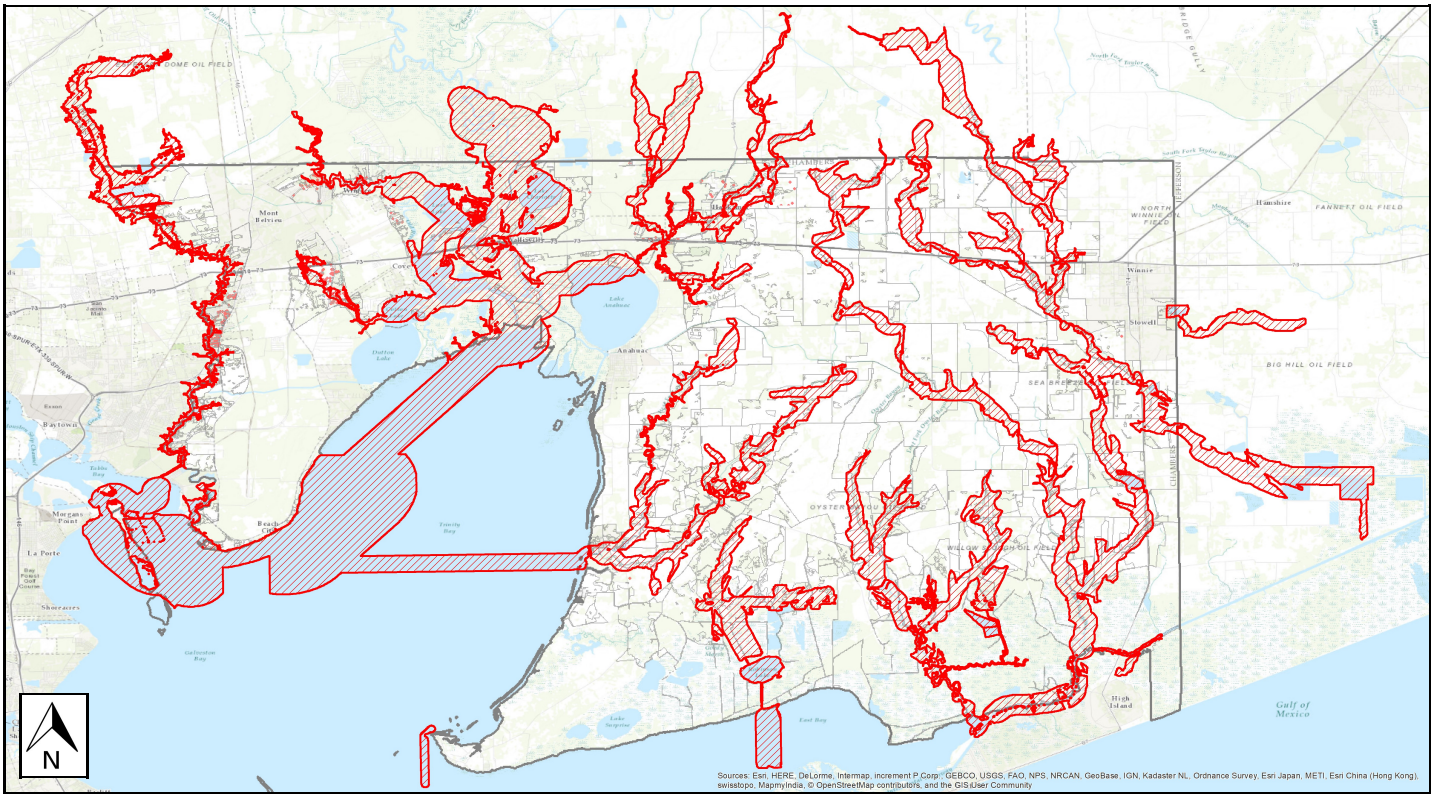


Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	35	43.75	28	35.00	5	6.25	5	6.25	3	3.75	4	5.00
Total	**35**		**28**		**5**		**5**		**3**		**4**	

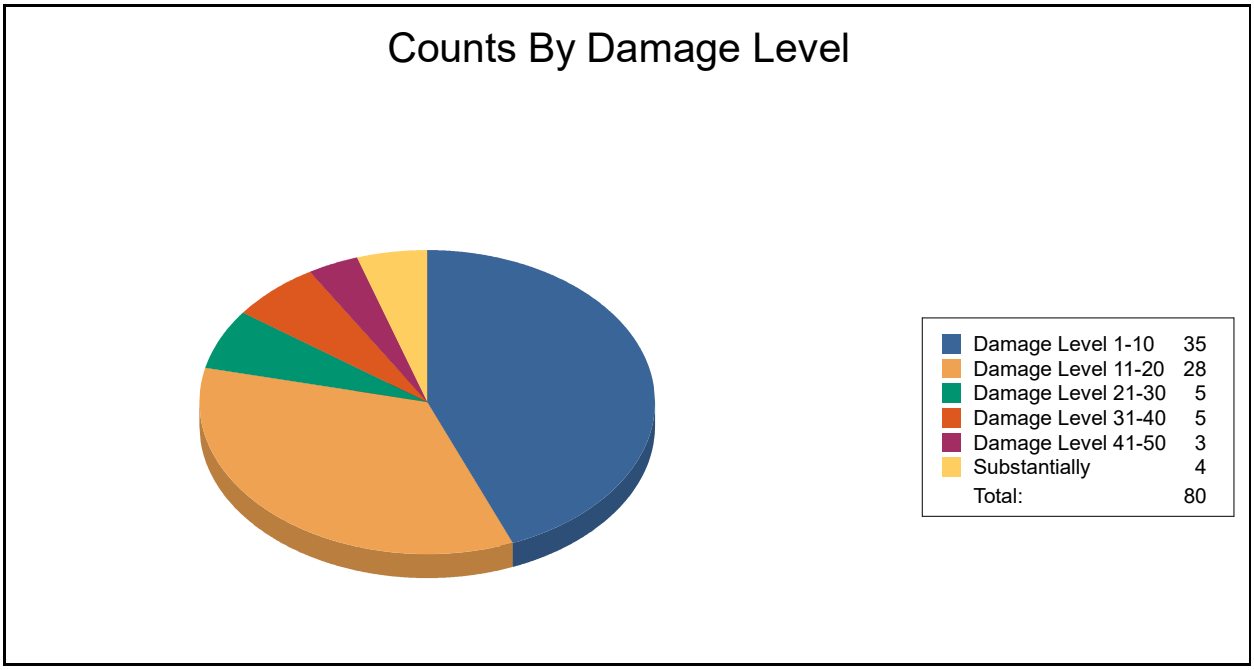


Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	1	100	0	0	0	0	0	0	0	0	0	0
Masonry	2	67	1	33	0	0	0	0	0	0	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	32	42	27	36	5	7	5	7	3	4	4	5

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 14 hospital beds available for use. On the day of the scenario flood event, the model estimates that 14 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	8	0	0	0
Hospitals	1	0	0	0
Police Stations	3	0	0	0
Schools	12	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

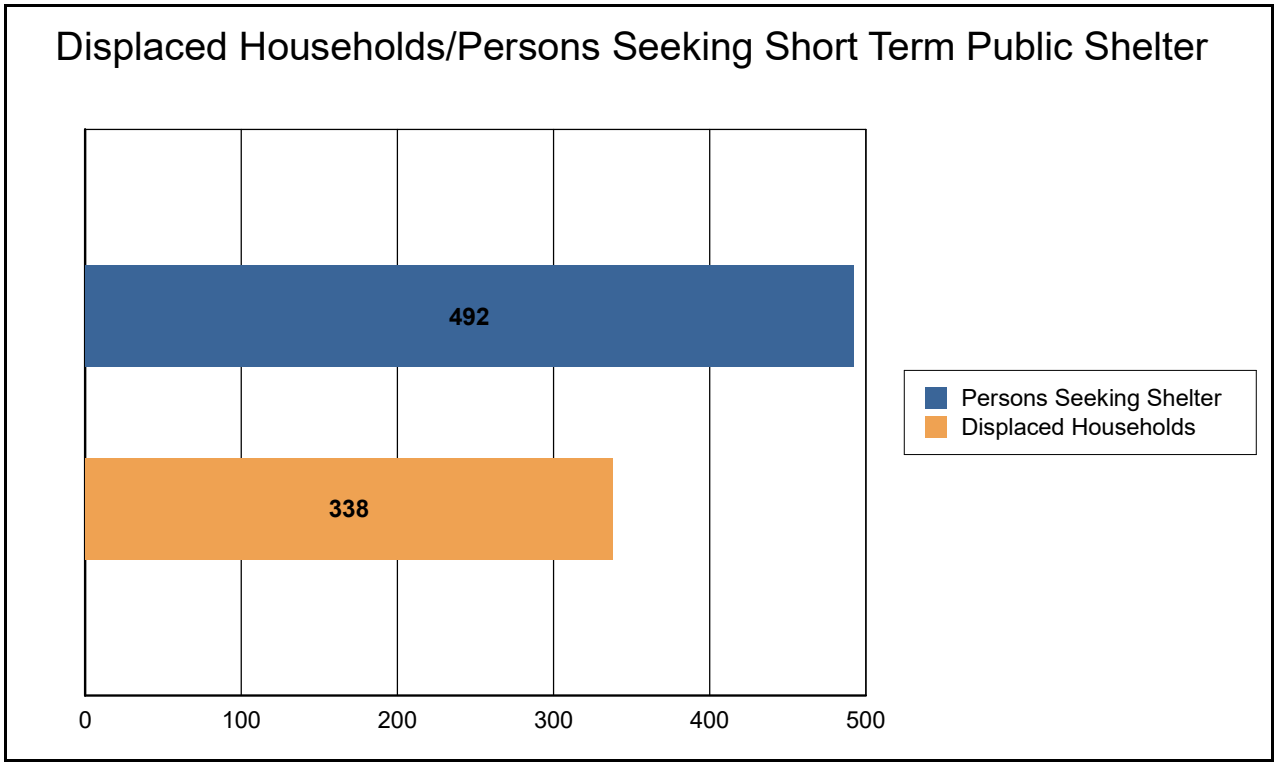
Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 338 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 492 people (out of a total population of 35,096) will seek temporary shelter in public shelters.



Economic Loss

The total economic loss estimated for the flood is 24.44 million dollars, which represents 2.20 % of the total replacement value of the scenario buildings.

Building-Related Losses

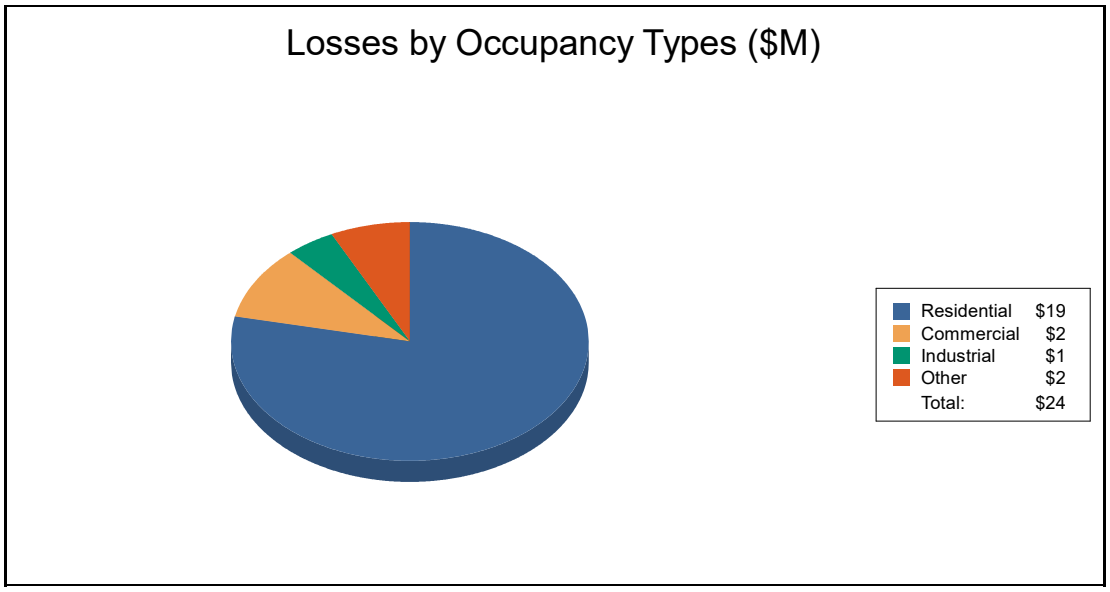
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 24.16 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 78.38% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	12.37	0.60	0.30	0.22	13.48
	Content	6.77	1.79	0.65	1.33	10.54
	Inventory	0.00	0.03	0.10	0.00	0.14
	Subtotal	**19.13**	**2.42**	**1.05**	**1.56**	**24.16**
Business Interruption						
	Income	0.00	0.01	0.00	0.05	0.07
	Relocation	0.02	0.00	0.00	0.02	0.04
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.01	0.00	0.15	0.17
	Subtotal	**0.03**	**0.02**	**0.01**	**0.23**	**0.28**
ALL	**Total**	**19.16**	**2.45**	**1.06**	**1.78**	**24.44**



Appendix A: County Listing for the Region

Texas

- Chambers

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Texas				
Chambers	35,096	2,996,153	937,253	3,933,406
Total	**35,096**	**2,996,153**	**937,253**	**3,933,406**
Total Study Region	**35,096**	**2,996,153**	**937,253**	**3,933,406**

Hazus-MH: Hurricane Global Risk Report

Region Name: Chambers County

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Wednesday, November 08, 2017

Disclaimer:
This version of Hazus utilizes 2010 Census Data.
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Texas

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 630.45 square miles and contains 6 census tracts. There are over 11 thousand households in the region and has a total population of 35,096 people (2010 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 13 thousand buildings in the region with a total building replacement value (excluding contents) of 3,933 million dollars (2014 dollars). Approximately 93% of the buildings (and 76% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 13,675 buildings in the region which have an aggregate total replacement value of 3,933 million (2014 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

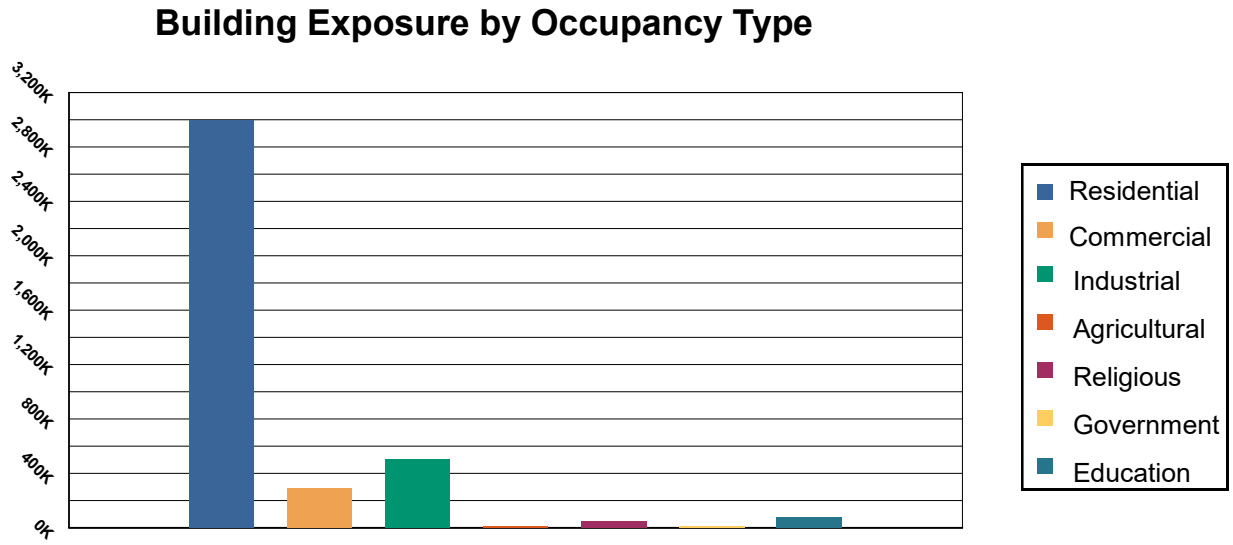


Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	2,996,153	76.17 %
Commercial	286,679	7.29%
Industrial	503,717	12.81%
Agricultural	13,590	0.35%
Religious	44,268	1.13%
Government	11,921	0.30%
Education	77,078	1.96%
Total	**3,933,406**	**100.00%**

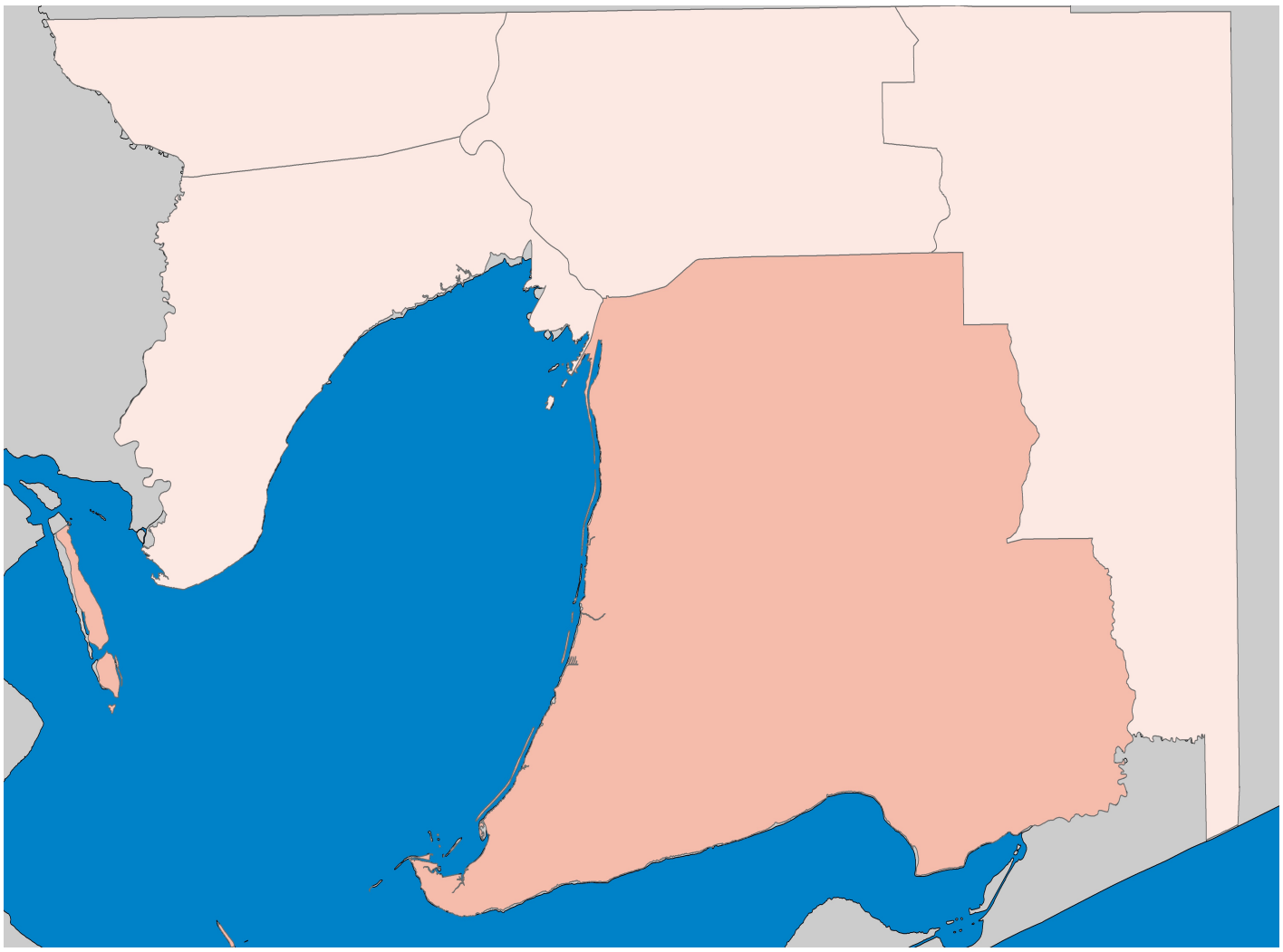
Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 14 beds. There are 12 schools, 8 fire stations, 3 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Thematic Map with peak gust windfield and HU track



Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 8,992 buildings will be at least moderately damaged. This is over 66% of the total number of buildings in the region. There are an estimated 2,295 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

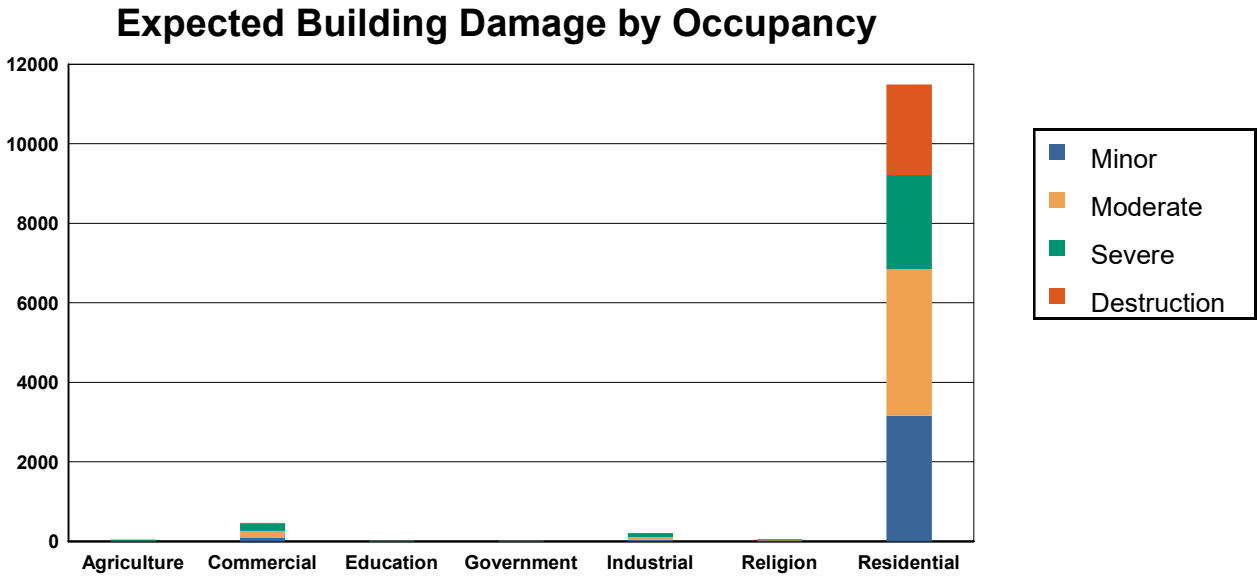


Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	4	8.40	5	11.20	11	23.87	18	38.76	8	17.78
Commercial	54	10.42	88	17.02	174	33.74	191	37.03	9	1.79
Education	2	9.22	3	12.19	7	28.95	11	49.27	0	0.38
Government	2	9.36	3	13.48	6	30.29	10	46.42	0	0.44
Industrial	27	11.71	36	15.27	72	30.61	97	41.58	2	0.84
Religion	6	10.46	12	19.27	20	32.83	22	36.84	0	0.60
Residential	1,284	10.05	3,157	24.72	3,689	28.88	2,369	18.54	2,275	17.81
Total	**1,380**		**3,303**		**3,979**		**2,718**		**2,295**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	11	11.25	12	11.56	31	30.08	48	47.05	0	0.06
Masonry	120	9.96	305	25.37	379	31.52	278	23.14	120	10.01
MH	1,808	79.34	68	2.96	131	5.74	42	1.86	230	10.11
Steel	27	12.02	25	11.25	66	29.70	101	45.52	3	1.50
Wood	717	7.61	2,457	26.10	2,773	29.46	1,906	20.25	1,561	16.58

Essential Facility Damage

Before the hurricane, the region had 14 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use by patients already in the hospital and those injured by the hurricane. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Thematic Map of Essential Facilities with greater than 50% moderate

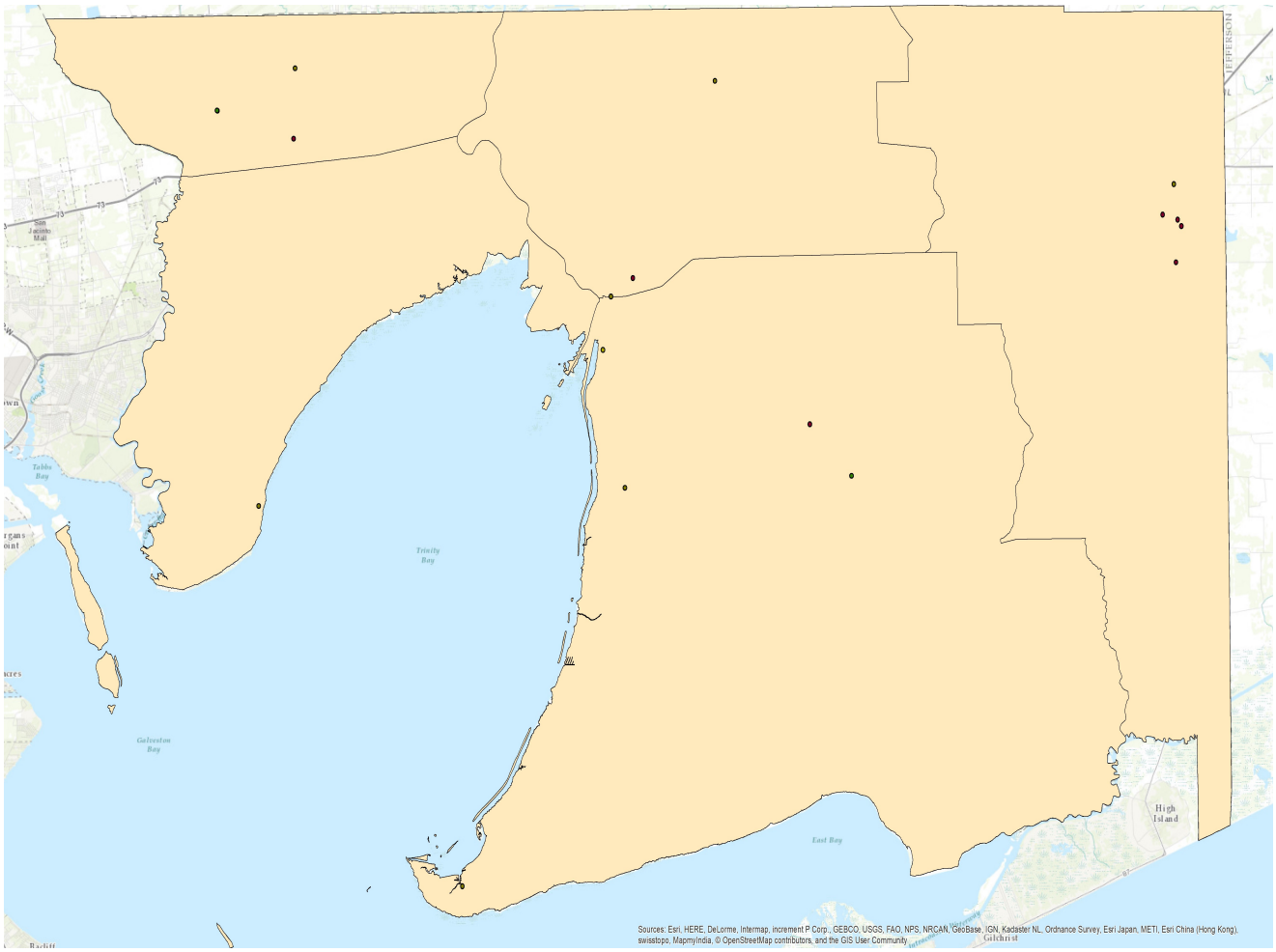
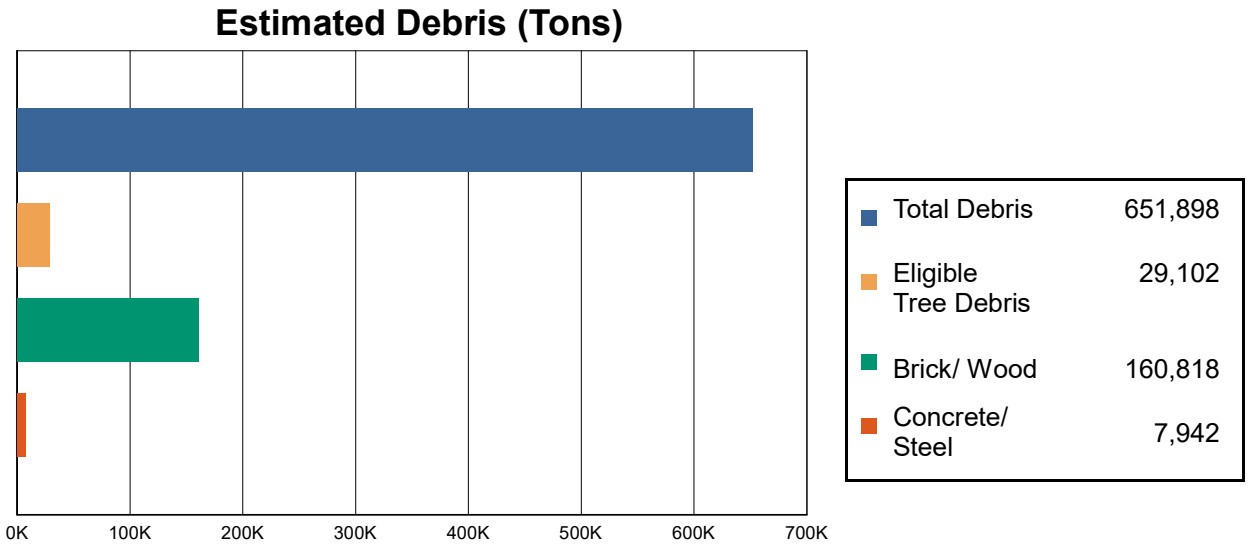


Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	8	8	0	8
Hospitals	1	1	0	0
Police Stations	3	3	0	0
Schools	12	12	0	0

Induced Hurricane Damage

Debris Generation

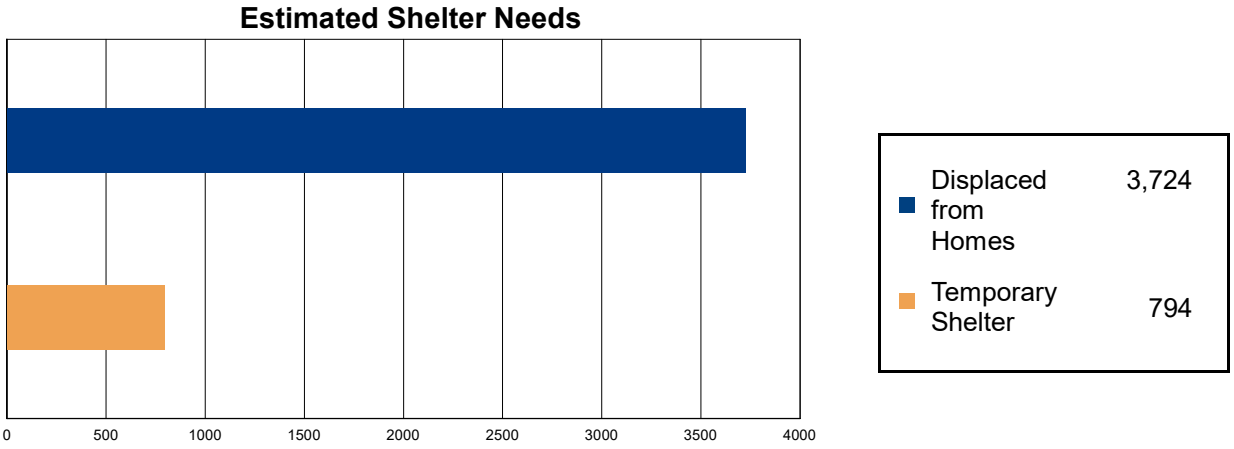


Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 651,898 tons of debris will be generated. Of the total amount, 453,357 tons (70%) is Other Tree Debris. Of the remaining 198,541 tons, Brick/Wood comprises 81% of the total, Reinforced Concrete/Steel comprises of 4% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 6778 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 29,102 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement



Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3,724 households to be displaced due to the hurricane. Of these, 794 people (out of a total population of 35,096) will seek temporary shelter in public shelters.

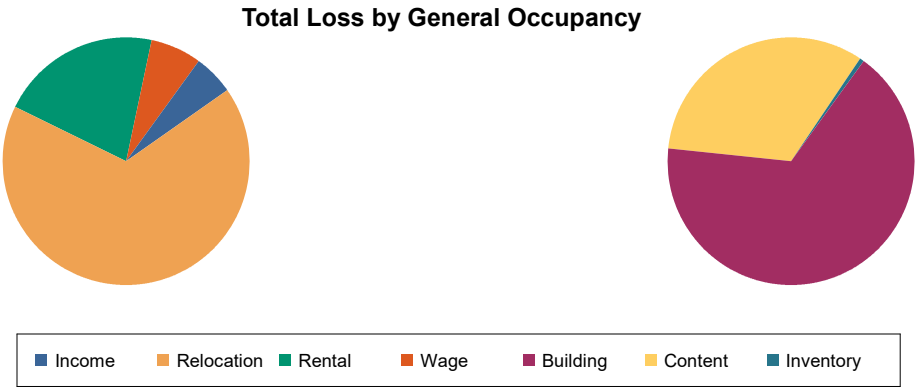
Economic Loss

The total economic loss estimated for the hurricane is 2121.9 million dollars, which represents 53.95 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 2,122 million dollars. 4% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 80% of the total loss. Table 5 below provides a summary of the losses associated with the building damage.



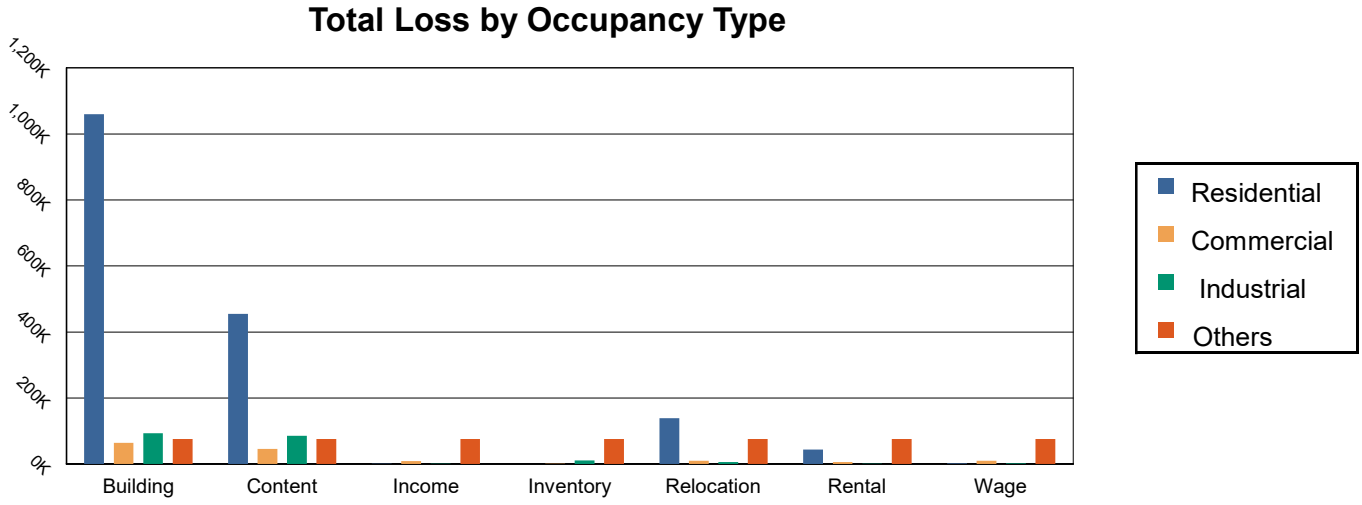


Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	1,060,285.71	64,106.15	93,453.30	35,478.79	1,253,323.95
	Content	454,476.58	45,495.92	85,830.93	29,895.44	615,698.86
	Inventory	0.00	1,664.90	10,530.45	403.90	12,599.25
	Subtotal	**1,514,762.29**	**111,266.97**	**189,814.67**	**65,778.13**	**1,881,622.06**
Business Interruption Loss						
	Income	805.11	9,372.98	1,683.93	510.71	12,372.73
	Relocation	138,547.50	9,829.85	5,677.11	7,010.97	161,065.42
	Rental	43,465.98	5,935.44	1,069.41	650.09	51,120.92
	Wage	1,887.04	10,150.47	1,991.42	1,673.31	15,702.25
	Subtotal	**184,705.62**	**35,288.74**	**10,421.86**	**9,845.08**	**240,261.31**
Total						
	Total	**1,699,467.92**	**146,555.71**	**200,236.54**	**75,623.21**	**2,121,883.38**

Appendix A: County Listing for the Region

Texas
- Chambers

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Texas				
Chambers	35,096	2,996,153	937,253	3,933,406
Total	**35,096**	**2,996,153**	**937,253**	**3,933,406**
Study Region Total	**35,096**	**2,996,153**	**937,253**	**3,933,406**

Quick Assessment Report

November 8, 2017

Study Region : Chambers County

Scenario : Probabilistic

Regional Statistics

Area (Square Miles)	630
Number of Census Tracts	6
Number of People in the Region	35,096

General Building Stock

Occupancy	*Building Count*	*Dollar Exposure ($ K)*
Residential	12,774	2,996,153
Commercial	516	286,679
Other	385	650,574
Total	13,675	3,933,406

Scenario Results

Number of Residential Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	13	0	0	0	13
20	887	75	2	3	968
50	3,836	1,117	170	140	5,263
100	3,505	1,625	639	652	6,421
200	4,233	2,777	1,145	1,059	9,213
500	3,818	3,556	1,820	1,595	10,789
1000	3,157	3,689	2,369	2,275	11,490

Number of Buildings Damaged

Return Period	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
10	17	0	0	0	17
20	939	87	3	3	1,033
50	4,041	1,250	208	142	5,640
100	3,687	1,785	742	659	6,873
200	4,441	3,029	1,329	1,069	9,867
500	3,997	3,848	2,099	1,609	11,553
1000	3,303	3,979	2,718	2,295	12,295

Shelter Requirements

Return Period	*Displaced Households (#Households)*	*Short Term Shelter (#People)*
10	0	0
20	0	0
50	58	11
100	877	207
200	1,409	317
500	2,464	513
1000	3,724	794

Economic Loss (x 1000)

	Property Damage (Capital Stock) Losses		***Business Interruption***
ReturnPeriod	***Residential***	***Total***	***(Income) Losses***
10	2,220	2,310	2
20	24,484	26,687	2,254
50	177,792	209,544	33,025
100	430,708	503,036	76,733
200	741,430	889,083	131,816
500	1,163,720	1,439,369	191,960
1000	1,514,762	1,881,622	240,261
Annualized	14,277	17,276	2,371

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

2017

Appendix D: Repetitive Loss Properties

APPENDIX D: REPETITIVE LOSS PROPERTIES

Property Locator	Insured?	City	Occupancy	Losses	Total Paid	SRL Indicator
0168736	NO	ANAHUAC	SINGLE FMLY	3	92,728.19	
0093935	NO	ANAHUAC	2-4 FAMILY	4	50,420.53	VU
0048698	NO	BAYTOWN	SINGLE FMLY	6	22,845.60	
0114157	NO	STOWELL		2	10,586.73	
0167201	NO	WINNIE	OTHR-NONRES	3	70,356.12	
0043585	NO	ANAHUAC	OTHR-NONRES	3	76,262.27	
0177112	NO	ANAHUAC		2	116,018.97	
0067281	YES	BAYTOWN	ASSMD CONDO	5	134,347.26	
0129818	NO	WINNIE	OTHR-NONRES	7	310,099.15	VNU
0036539	NO	ANAHUAC		2	15,856.10	
0179240	NO	ANAHUAC		2	216,789.91	
0260859	YES	WINNIE		2	8,194.69	
0039058	NO	WINNIE		2	12,892.42	
0260890	YES	BAYTOWN		2	64,196.60	
0043720	NO	ANAHUAC		2	41,997.40	
0076288	NO	HANKAMER	SINGLE FMLY	4	57,124.88	
0043754	NO	BAYTOWN		2	12,941.36	
0128781	NO	WINNIE	SINGLE FMLY	4	38,973.06	
0183929	NO	ANAHUAC		2	123,851.32	
0262767	YES	ANAHUAC		2	109,340.56	
0185875	NO	ANAHUAC		2	54,595.39	
0172248	NO	BEACH CITY	SINGLE FMLY	5	61,606.37	VU
0256789	YES	WINNIE	OTHER RESID	3	68,713.06	
0185981	YES	BAYTOWN	SINGLE FMLY	3	203,012.58	
0185417	YES	ANNAHUAC		2	35,349.40	
0128291	NO	BAYTOWN	SINGLE FMLY	3	41,905.75	
0048464	NO	BAYTOWN	SINGLE FMLY	8	85,790.90	VU
0185281	NO	WINNIE		2	71,071.08	
0122977	NO	BAYTOWN	SINGLE FMLY	3	14,426.90	
0013083	NO	WALLISVILLE	SINGLE FMLY	3	24,611.93	
0253866	NO	MONT BELVIEU		2	17,960.65	
0262766	YES	ANAHUAC		2	22,253.64	

0173588	NO	WINNIE		2	32,713.04	
0025611	NO	ANAHUAC	SINGLE FMLY	3	131,465.79	
0049014	NO	BAYTOWN		2	6,123.95	
0128499	NO	WINNIE	SINGLE FMLY	4	174,818.73	VU
0166581	YES	WINNIE		2	69,730.68	
0128527	YES	WINNIE	SINGLE FMLY	3	27,588.24	
0185763	NO	WINNIE		2	23,123.46	
0048774	NO	ANAHUAC		2	10,175.10	
0184508	NO	ANAHUAC		2	43,064.40	
0164489	NO	WINNIE		2	18,221.88	
0071533	NO	WINNIE	SINGLE FMLY	5	49,739.04	
0164474	YES	WINNIE		2	25,636.83	
0128350	YES	WINNIE		2	17,968.95	
0081312	YES	WINNIE		2	15,688.29	
0114852	NO	WINNIE		2	14,307.03	
0026000	NO	BAYTOWN		2	3,022.75	
0093933	NO	BAYTOWN	SINGLE FMLY	3	14,839.86	
0025392	NO	BAYTOWN	SINGLE FMLY	6	35,929.74	
0070093	NO	ANAHUAC	SINGLE FMLY	3	16,128.30	
0025448	NO	ANAHUAC		2	23,639.66	
0025403	NO	ANAHUAC	SINGLE FMLY	3	68,048.35	
0013237	NO	BAYTOWN	SINGLE FMLY	4	101,701.30	
0035099	NO	BAYTOWN	SINGLE FMLY	4	237,809.10	
0067282	NO	BAYTOWN	SINGLE FMLY	5	130,440.33	MVU
0164660	NO	HANKAMER		2	8,492.44	
0048755	NO	BAYTOWN		2	3,561.45	
0054784	NO	ANAHAUC		2	6,241.05	
0167934	NO	HOUSTON	SINGLE FMLY	3	113,563.84	
0182995	YES	ANAHUAC		2	67,438.62	
0179377	YES	ANAHUAC		2	159,053.68	
0184949	YES	BAYTOWN	SINGLE FMLY	3	229,693.71	
0185477	NO	BEACH CITY	OTHR-NONRES	2	32,455.38	
0185476	NO	BAYTOWN	OTHR-NONRES	2	17,180.97	

2017

Appendix E: Plan Adoption

RESOLUTION

FOR THE ADOPTION OF THE CHAMBERS COUNTY MITIGATION PLAN 2017

WHEREAS, certain areas of Chambers County are subject to periodic flooding and other natural hazards with the potential to cause damages to citizen's properties within the area; and

WHEREAS, Chambers County desires to prepare and mitigate for such circumstances; and

WHEREAS, under the Disaster Mitigation Act of 2000, the United States Federal Emergency Management Agency (FEMA) requires that local jurisdictions have in place a FEMA-approved Hazard Mitigation Action Plan as a condition of receipt of certain future federal mitigation funding after November 1, 2004; and

WHEREAS, Chambers County, in order to meet this requirement, has initiated development of a multi-jurisdictional Hazard Mitigation Plan, including the cities in Chambers County;

NOW, therefore, be it resolved, that Commissioners Court hereby:

Adopts the Chambers County Hazard Mitigation Plan 2017; and

Vests the Office of Emergency Management with the responsibility, authority, and the means to:

(a) Inform all concerned parties of this action.

(b) Develop an addendum to this Hazard Mitigation Plan if a city's, a county's or a district's unique situation warrants such an addendum.

Appoints the Office of Emergency Management to assure that the Hazard Mitigation Plan be reviewed at least annually and that any needed adjustment to the Hazard Mitigation Plan be developed and presented to the Commissioners Court for consideration.

Agrees to take such other official action as may be reasonably necessary to carry out the objectives of the Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED that this Resolution be spread upon the pages of the Chambers County Commissioners Court Records on October 23, 2018 in Anahuac, Texas.

PASSED AND APPROVED by the Chambers County Commissioners Court.

Jimmy Sylvia
County Judge

Jimmy R. Gore
Precinct 1 Commissioner

Gary Nelson
Precinct 3 Commissioner

Larry D. George
Precinct 2 Commissioner

A. R. Rusty Sessac
Precinct 4 Commissioner

Heather H. Hawthorne, County Clerk