Galveston County
Multi-Jurisdiction Hazard Mitigation Plan

Bayou Vista
Clear Lake Shores
Friendswood
Galveston County
Hitchcock
Jamaica Beach
Kemah
La Marque
League City
Santa Fe
Tiki Island

February 2017

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1.0 Introduction

1.1 Background

Galveston County is susceptible to a wide range of hazards, including hurricanes and tropical storms, thunderstorms, flooding, tornadoes and wildfires. These life-threatening hazards can destroy property, disrupt the economy and lower the overall quality of life for individuals. This was evident with the destruction and devastation caused by Hurricane Ike, which made landfall on September 13, 2008.[1]

While it is impossible to prevent a hazard event from occurring, the impact of hazards can be lessened in terms of their effect on people and property. This concept is known as hazard mitigation, which is defined by the Federal Emergency Management Agency (FEMA) as *sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.*[2] Communities participate in hazard mitigation by developing hazard mitigation plans. The Texas Division of Emergency Management (TDEM) and FEMA have authority to review and approve hazard mitigation plans through the Disaster Mitigation Act of 2000. Galveston County has been involved in mitigation planning since 2006. The evolution of the original plan development and subsequent updates are provided in Table 1.1.

Table 1.1: Hazard Mitigation Plan Development and Update Process

Plan Year	Funding	Developed by
2006-2010	Unknown	Houston-Galveston Area Council of Governments (HGAC)
2011-2016	Pre-Disaster Mitigation Program (PDM)	H2O Partners, Inc.
2016-2020	General budget	True North Emergency Management, LLC

1 Hurricane Ike is discussed in further detail in Section 5
2 www.fema.gov

1.2 Scope

The focus of the plan update is to mitigate hazards as determined through a detailed hazard risk assessment conducted for Galveston County. Hazards that pose a "low" or "negligible" risk will continue to be evaluated during future updates to the plan. This enables the county and its participating jurisdictions and partners to prioritize mitigation actions based on hazards which are understood to present the greatest risk to lives and property.

This plan update includes changes in which jurisdictions chose to participate in the multi-jurisdiction planning process. The cities of Galveston, Dickinson, and Texas City opted not to join and Friendswood, Santa Fe, and League City were added as participants. Table 1.2 includes a listing of those included in the update to the 2016-2020 plan who are seeking approval.

Table 1.2: Participating Jurisdictions Seeking Approval

Jurisdictions	
Galveston County (including unincorporated areas)	City of Kemah
City of Bayou Vista	City of La Marque
City of Clear Lake Shores	City of League City
City of Friendswood	City of Santa Fe
City of Hitchcock	Village of Tiki Island
City of Jamaica Beach	

1.3 Purpose

The overarching goal of the update is to minimize or eliminate long-term risks to human life and property from known hazards by identifying and implementing cost-effective mitigation actions. The purpose of the update is twofold: to protect people and structures, and to minimize the costs of disaster response and recovery. This multi-jurisdiction plan was developed to:

- Identify hazards
- Review past disasters
- Assess county and municipal hazard risk and vulnerability
- Identify and promote mitigation efforts

1.4 Authority

The updated plan is tailored specifically for Galveston County and the participating jurisdictions seeking approval therein, and reflects conditions that have changed since the completion of the 2011 to 2016 plan. When complete, the 2016 to 2020 plan will comply with the requirements promulgated by the TDEM and all applicable provisions of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004 (P.L. 108–264), which amended the National Flood Insurance Act (NFIA) of 1968 (42 U.S.C. 4001, et al). It also complies with FEMA's February 26, 2002 Interim Final Rule ("the Rule") at 44 CFR Part 201 which specifies the criteria for approval of mitigation plans required in Section 322 of the DMA 2000. The updated plan will also be developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies. In 2012, FEMA revised the crosswalk review process and developed the Local Mitigation Plan Review Tool.[3] The improved tool provides constructive recommendations from FEMA on areas that could be explored, with future updates added to strengthen the jurisdiction's plan for effective mitigation strategies. A copy of the completed Local Mitigation Plan Tool is provided in Appendix A-1 along with the formal approval letter from FEMA.

1.5 Summary of Sections

Section 2: ***Planning Process*** is a complete account of the planning committee and public/stakeholder meetings held during the planning process. Information provided includes meeting summaries of information presented and discussions made, sign in sheets, and communication used to gather data and advertise for public input. This section also includes the ***Plan Maintenance Process*** and how the GCHMC and their respective officials will integrate this plan with all other planning initiatives, regulations and ordinances. Procedures are also defined within this section to evaluate the effectiveness of this plan through a review of the progress made towards implementation of mitigation actions, public/stakeholder involvement and identification of additional risks that may surface following the development and approval of this plan update.

Section 3: ***Community Profile*** provides a general description of the participating jurisdictions within the Galveston County planning area with their respective demographic, geographic and economic characteristics. This section also addresses land use, housing and infrastructure for the planning area.

[3] Local Mitigation Planning Handbook (March 2013)

Sections 4 to 19: The ***Hazard Identification and Risk Assessment*** outlines hazards that are prone to the planning area and the process used to identify hazards for this plan. Relevant background data, location/extent, historical occurrences, probability of future impacts, estimating future losses, and mitigation strategies are also provided.

Section 20: ***Capability Assessment*** provides the ability of the participating jurisdictions to implement mitigation strategies and identify and areas where improvements/enhancements should be considered to further advance mitigation strategies.

Section 21: ***Mitigation Strategy*** provides a summary of the accomplishments and needs into a systematic approach to achieving the planning area's goals. This section includes an update of the goals and actions from the previous approved plans and the process used to redefine the goals into a multi-jurisdictional approach. Detailed 2016-2020 mitigation action plans by participating jurisdiction are also provided in this section.

Section 22: ***Repetitive Flood Properties*** documents each participating jurisdictions participation and compliance with the National Flood Insurance Program (NFIP) and Community Rating System (CRS). A summary of the number of repetitive loss properties listed in the NFIP and progress made on mitigating these structures is also provided.

1.6 Plan Adoption

The Galveston County Multi-Jurisdictional Hazard Mitigation Plan has been developed in accordance with 44 CRF §201.6 and has been adopted by each participating jurisdiction. Table 1.3 provides a summary of the dates each plan was formally adopted and copies of the executed adoption resolutions are provided in Appendix A-2.

Table 1.3: Participating Jurisdiction's Plan Adoption Process

Jurisdiction	Adoption Date
Galveston County	
Bayou Vista	
Clear Lake Shores	
Friendswood	
Hitchcock	
Jamaica Beach	
Kemah	
La Marque	
League City	
Santa Fe	
Tiki Island	

2.0 Planning Process and Plan Maintenance

2.1 Planning Process Overview

According to the Federal Emergency Management Agency (FEMA), any successful planning activity, such as the development of a hazard mitigation plan, involves bringing together a cross-section of stakeholders to reach a consensus in achieving a desired outcome or resolve a community problem.

The jurisdictions participating in this plan support this initiative through daily interaction with residents, officials and business leaders in local and surrounding communities and participate in various planning initiatives including the development of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan. By fostering these relationships, mitigation planning will move closer to achieving its objective of saving lives and reducing future losses resulting from natural disasters.

In developing the Plan update, the consultant team used the March 2013 "Local Mitigation Planning Handbook" to meet the Interim Final Rule for Local Mitigation Planning found in §44 CFR 201.6.

Meetings were held throughout the planning process and are described herein. The following factors used in updating the 2011 plan were taken into consideration for this plan update:

- Whether the goals address current and expected conditions;
- If the nature/magnitude of risks have changed;
- If there are current resources appropriate for implementing the Plan;
- Whether implementation problems, such as technical, political, legal or coordination issues hinder development;
- If outcomes have occurred as expected; and
- How communities, agencies, and partners participated in the implementation process.

2.2 Galveston County Hazard Mitigation Council and Planning Team

The Galveston County Hazard Mitigation Council (GCHMC) members identified in Table 2.1 were selected by county/city officials to serve as their designated representative. These individuals were given the responsibility to guide the decision-making process throughout the planning process, assist with the identification of data and needs for inclusion in the plan, and review the draft plan before submittal to the TDEM and FEMA for state and federal approval. The GCHMC members will present the approved, pending adoption plan to their respective county/city officials for formal

adoption; and on behalf of their jurisdiction, assist with the integration of the goals and plan maintenance procedures outlined in this plan with other planning initiatives and actions.

To facilitate effective communication and consensus with decisions, Galveston County's Emergency Management Coordinator and Deputy Emergency Management Coordinator served as chairmen of the GCHMC.

Table 2.1: Members of the Galveston County Hazard Mitigation Council

Jurisdiction	Representative and Title
Bayou Vista	Larry Whittington, Sr., Police Chief
Clear Lake Shores	Kenny Cook, Emergency Management Coordinator
Galveston County	Garret Foskit, Emergency Management Coordinator Meaghan Kennedy, Deputy Emergency Management Coordinator
Friendswood	Terry Byrd, Emergency Management Coordinator
Hitchcock	John Hamm, Emergency Management Coordinator
Jamaica Beach	John Brick, Emergency Management Coordinator
Kemah	Brent Hahn, Assistant Emergency Management Coordinator
La Marque	Charlene Warren, Emergency Management Coordinator
League City	Ryan Edghill, Emergency Management Coordinator
Santa Fe	Kenneth Campbell, Emergency Management Coordinator
Tiki Island	Bryan Springer, Emergency Management Coordinator

True North Emergency Management provided two planners, A. "Ryan" Williams and Rebecca Boone to work alongside the GCHMC members and develop the 2016 updated plan and present to TDEM and FEMA for approval.

Raymond Mejia, CPP, Hazard Mitigation Planner from TDEM's Mitigation Section provided technical assistance throughout the planning process.

2.3 GCHMC Plan Development Meetings

The GCHMC met three times during the planning process to systematically review data and planning documents, prioritize and rank hazards and mitigation actions, and provide input on jurisdictional needs and changes for inclusion in the plan update. Also, six mitigation strategy workshops were held throughout the planning area to solidify the mitigation goals, objectives, and actions for each participating jurisdiction. The GCHMC members were encouraged to invite officials and stakeholders to participate in these meetings.

Each of these planning steps resulted in critical work products and outcomes that collectively make up the updated plan. These events are described below and supporting documentation (agendas, sign-in sheets, presentations, etc. are provided in Appendix B.1.

Meeting 1	Agenda
Date: October 19, 2015	Introduction
Time: 3-5:00 p.m.	Plan Update Overview
Location: Doyle Center, 2010 5th Avenue, Texas City	Community Report
	Hazard Identification and Risk Assessment
	Mitigation Strategies
	Schedule
	Questions and Dismissal

Meeting Summary

Meaghan Kennedy, Deputy EMC, Galveston County welcomed the meeting participants and introduced True North Emergency Management as the consultant hired to update the county, and participating jurisdiction's, 2011-2016 hazard mitigation plan. Rebecca Boone, representing True North, opened the meeting with introductions from the planning team and then provided a brief overview of what this mitigation plan update entails and the importance of working together to develop an updated plan that will meet the participating jurisdictions' needs for the next five years were discussed. Projects and mitigation efforts outlined in the plan will assist with the development of grant applications and obtaining potential funding.

Rebecca invited the represented jurisdictions to share what their mitigation opportunities and challenges are. In general, funding and improving drainage have been a challenge for the majority of the planning area. Opportunities noted included enhancing outreach to the public (social media and reaching non-English speaking communities); continuance of elevation and buyout programs, having the support of officials and the public have led to many successes.

Ryan Williams, True North, reviewed the list of hazards profiled in the current hazard mitigation plan as compared to the current State of Texas plan, and FEMA guidance. Additional hazards will be brought forward for possible inclusion in this plan update: coastal erosion and retreat, land subsidence, expansive soils, tsunami, and lightning. Based on this analysis, the GCHMC selected the following hazards for inclusion in the plan update:

- Coastal Erosion and Retreat
- Dam/Levee Failure
- Drought
- Earthquake
- Expansive Soils
- Extreme Heat
- Flood (Coastal and Inland)
- Hailstorms
- Hurricane/Tropical Storm
- Land Subsidence
- Lightning
- Severe Winter Weather
- Tornado
- Tsunami
- Windstorms
- Wildfire (Urban and Rural)
- Pipeline failure
- Hazardous Material Incidents

Next the meeting participants received an overview of the mitigation strategy section of the plan and a list of the mitigation goals and objectives identified by the participating jurisdictions in their previous plans. Rebecca suggested the GCHMC representatives download and review the FEMA Mitigation Ideas Handbook and the HMA Unified Guidance to help them identify new mitigation actions for inclusion in the plan update. The planning team will work with each jurisdiction over the course of the next few months to determine changes and additions to their mitigation strategy section of the plan.

Meeting 2	Agenda
Date: November 17, 2015 Time: 2:00-3:30 p.m. Location: Doyle Center, 2010 5th Avenue, Texas City	Introduction Approval of Previous Meeting Minutes Plan Update Overview Review of Capability Assessment Public Online Survey Results Hazard List and Summarize Findings Hazard Ranking Next Steps

Meeting Summary

The main purpose of this meeting was to evaluate the hazard data trends and complete the hazard ranking process to determine the risk level of each jurisdiction. Ryan Williams presented an overview of the data obtained from the National Climatic Data Center (NCDC) to assist the GCHMC members to relate the impacts of previous events to the ranking methodology exercise.

The hazard ranking methodology analyzed hazard impacts based on the following criteria: area impacted, health/safety consequences, property damage, environmental damage, and economic disruption. These characteristics were evaluated along with the likelihood of occurrence to determine the overall vulnerability for each participating jurisdiction. See Section 4 – Hazard Identification and Risk Assessment Overview for details of this process.

Mitigation Strategy Workshops			
Date	Time	Location/Jurisdiction	Agenda
Jan. 5, 2016	9-11:00	1111 Bayou Road, La Marque	Review Mitigation Goals and Objectives Review Previous Plan's Mitigation Actions Review and Prioritize 2016 Mitigation Actions Identify Additional Mitigation Actions Review Critical Facilities/Infrastructure Lists
	1-3:00	3950 FM 646 North, Santa Fe	
	3:45-5:00	1600 Whitaker Drive, Friendswood	
Jan. 6, 2016	8:30-10:30	783c Marlin, Bayou Vista Bayou Vista, Hitchcock, Tiki Island, and Jamaica Beach	
	3:00-5:00	555 W. Walker, League City League City, Clear Lake Shores, and Kemah	
Jan. 7, 2016	10-11:00	1301 FM 646 Rd W, Dickinson Galveston County	

Rebecca Boone, True North, scheduled a mitigation workshop with each jurisdiction to conduct a formal review of the mitigation actions selected for inclusion in the plan, address any missing data, and provide a final review of their critical facilities and infrastructure lists. The GCHMC was asked to invite officials, stakeholders, and any other interested parties that have an interest in assisting with implementing mitigation strategies to this workshop. Tiki Island and Hitchcock were not able to attend the scheduled meeting, so their discussions were held on a conference call on January 20 and 22, 2016 respectively.

In summary, the following items were addressed:

- Review of how the previously approved plan's mitigation goals and objectives tie into the revised goals and objectives for the 2016-2020 plan update. (See Section 24 and Appendix D-1 for details)
- Review previous mitigation action tables and addressed missing data or provide clarification as to the progress made. (See Section 24, Tables 24.1 to 24.10)
- Review and prioritized 2016 mitigation action tables. Each action was reviewed, and missing data or clarification was provided. To further strengthen the mitigation strategies for each jurisdiction, a list of suggested mitigation actions was provided, and those applicable to the jurisdictions were incorporated into their final mitigation action plans. (See Section 24, Tables 24.11 to 24.21)
- Next, each jurisdiction walked through an evaluation process to determine the priority level (low, moderate, or high). (See Section 24, Subsection 24.3 for details)
- Lastly, a copy of the critical facilities and infrastructure locations was provided to each jurisdiction to look over to determine if all relevant facilities were included

In closing each workshop session, Rebecca provided an overview of the status of the draft plan and how the review process will be conducted. She also opened the floor for questions and comments related to the plan and ensuring that each jurisdiction's needs have been made known to the planning team for inclusion in the plan update.

Meeting 4	Agenda
Date: January 20, 2016	Welcome
Time: 10:00 a.m. to 12:-00 p.m.	Approval of Previous Meeting Minutes
Location: Bayou Vista Community Center, 783C Marlin, Bayou Vista	Plan Update Overview
	Review of Hazard Analysis
	Review of Repetitive Flood Loss
	Next Steps

Meeting Summary

This meeting was hosted by Bayou Vista in their community center. Meaghan Kenney, Deputy EMC, Galveston County welcomed the meeting participants and introduced Ryan Williams, True North. Subsequently, attendees introduced themselves by name, agency, and jurisdiction. The previous meeting minutes had been distributed with the meeting invitation and were approved by the group.

Natural hazards data compiled from the National Climatic Data Center (NCDC) and information from additional reference sources was presented. PowerPoint and hand out materials added depth to the quantitative analysis of risks through identified losses and number of occurrences and also solidified descriptions of individual hazards. Participating jurisdictions were asked to review their previous rankings and ensure they were in final form. Some minor revisions to the hazard list including the breakout of lightning, hailstorm, and windstorm took place; this brought the plan into better alignment with the State of Texas's Hazard Mitigation Plan.

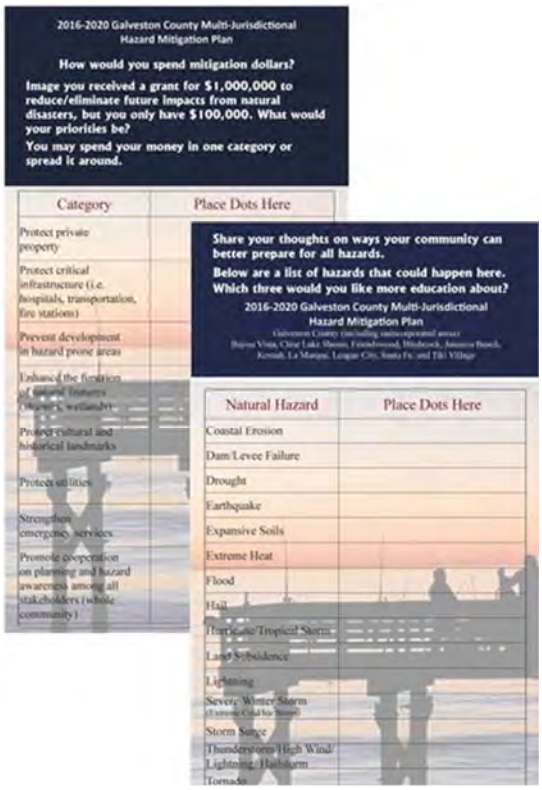
Concluding discussions on the hazards and some team collaboration on historical events such as Hurricane Ike ensued. Participants were informed the repetitive flood loss properties list was under final review and that it would be distributed to each community via email.

The meeting was then opened to questions and final comments. Before adjournment, special thanks were expressed to Bayou Vista for hosting the meeting and providing the facility.

2.4 Public and Stakeholder Engagement

An important component of mitigation planning is public participation and stakeholder involvement. Input from residents, business owners, etc. as a whole provides the planning team with a greater understanding of local concerns and increases the likelihood of successfully implementing mitigation actions. If citizens and stakeholders, such as local businesses, non-profits, hospitals, and schools, are involved, the more likely they are to gain a greater appreciation of the hazards present in their community and take steps to reduce their impact.

To allow for all interested individuals and stakeholders in the planning area to provide their input for the development and review of this plan, an online survey and public/stakeholder meetings were provided. These opportunities for engagement were advertised in local/statewide newspapers, Facebook, and the participating jurisdictions web pages (where available).



Activities provided during the October 19, 2015 and January 20, 2016 Public Meetings

Public/Stakeholder Participation

Public involvement, in the development of the Galveston County Hazard Mitigation Plan Update, was sought at two separate periods of the planning process: (1) the first five months of the plan development; and (2) upon completion of a final draft Plan but prior to official plan approval and adoption. Meeting formats were varied in an effort to appease to residents and stakeholders in the planning area. Three formats were used: (1) open public meetings; (2) online survey instruments; and (3) making copies of draft Plan deliverables available for public review on the county's website. These events are described below and supporting documentation (advertisements, social media, flyers, sign in sheets, survey questions and results, listing of outreach/stakeholder groups, etc.) are provided in Appendix B.2.

Input Meetings

The first series of open public meetings were held on October 19, 2015 following the GCHMC kickoff meeting at the Doyle Center in Texas City. This meeting provided an opportunity for the public/stakeholders to meet with their officials and the planning team to learn why hazard mitigation planning is necessary and how they can help. Two activities were made available to solicit input on which hazards more education is needed to prepare better for future events, and how they would like to see officials spend mitigation dollars to reduce/eliminate future impacts in their communities. Although there were no outside participants, several officials remained to meet the public and did complete the activities.

Participants completing activities at January 20, 2016 Public Meeting

An additional opportunity for the public/stakeholders to learn about the importance of a hazard mitigation plan for their community and provide their input was scheduled on January 6, 2016 at Lowe's in Texas City. This format and location was selected to make it convenient to obtain comments from shoppers as they departed the store. This meeting was successful in the fact that 12 people interacted with the planning team and GCOEM representative and participated in the two activities made available. The same activities as the October 20th meeting were made available. Provided below is a summary of the results provided on the activities at each public meeting:

Allocation of Mitigation Dollars		
Category	October 19, 2015	January 20, 2016
Protect private property	$0	$125,000
Protect critical infrastructure (i.e. hospitals, transportation, fire stations)	$75,000	$275,000
Prevent development in hazard prone areas	$75,000	$0
Enhance the function of natural features (streams, wetlands)	$30,000	$250,000
Protect cultural and historical landmarks	$10,000	$0
Protect utilities	$100,000	$250,000
Strengthen emergency services	$70,000	$150,000
Promote cooperation on planning and hazard awareness among all stakeholders (whole community)	$30,000	$75,000

Participant's selection of which hazards they would like more education on.	
October 19, 2015	January 20, 2016
• Dam/Levee Failure • Flood • Hurricane/Tropical Storm • Thunderstorm, High Wind, Lightning, and Hailstorm	• Coastal Erosion • Dam/Levee Failure • Drought • Earthquake • Extreme Heat • Flood • Hurricane/Tropical Storm • Land Subsidence • Severe Winter Storm • Storm Surge • Thunderstorm, High Wind, Lightning, and Hailstorm • Tsunami • Wildfire

Online Survey

In addition to the open public meeting, the participating jurisdictions were able to solicit input from residents and stakeholders through the use of a public survey conducted via Survey Monkey and linked to available web pages and social media. The desire of this survey was to capture the interest of those who are not available to attend traditional-style meetings and increase awareness through the contact distribution lists provided through social media.

The survey provided multi-choice and open-ended questions. The questionnaire consisted of 11 questions designed to solicit information about respondent's concerns and experience in dealing with hazards. The survey was launched on October 19, 2015 and concluded on November 22, 2015. During this time, a total of 315 residents completed the survey. Below is a summary of the number of respondents per jurisdiction.

Community	No. of Responses	Community	No. of Responses
Unincorporated Galveston County	29	La Marque	9
Bayou Vista	4	League City	41
Clear Lakes Shores	1	Santa Fe	11
Friendswood	176	Village of Tiki Island	2
Hitchcock	1	Other	35
Jamaica Beach	2	Skipped Question	1
Kemah	3	Total Responses	315

Draft Plan Review Meeting

As sections of the plan were completed, an electronic copy was emailed to each member of the GCHMC with instructions to thoroughly review the information presented and provide any changes to the Planning Team. This allowed additional review time for the GCHMC and their officials prior to releasing to the public for their comments.

The public and stakeholders were provided an opportunity to review the draft Plan on February 29, 2016 at the Galveston County Courthouse. The event was advertised in the Galveston County newspaper, *The Daily News*. Flyers, as shown on the right, were posted on public bulletin boards and distributed to stakeholders identified by the GCHMC representatives within their jurisdiction, and social media and web pages also helped promote the opportunity to review the draft plan. Plan developers were on hand to answer questions regarding the plan. A total of 15 visitors came by the booth.

To increase the circulation of the draft plan to residents and stakeholders the draft plan was also made available online at www.gcoem.org for review and comment from February 29 to March 7, 2016. Using Survey Monkey, online visitors were provided six questions designed to help communicate their level of acceptance and catalog places where changes or corrections should be made. A total of two responses were received.

2.5 Review and Incorporation of Existing Plans

Review

A variety of existing studies, plans, reports, and technical information were reviewed as part of the planning process. Sources of the information included FEMA, the United States Army Corps of Engineers (USACE), the U.S. Fire Administration, National Oceanic and Atmospheric Administration (NOAA), the Texas Water Development Board (TWDB), the TCEQ, Texas Forest Service, the Texas Division of Emergency Management (TDEM), and local hazard assessments and plans.

Sections 4-22 summarize the findings from these information sources. Some of these documents, including those from NOAA, provided histories of disasters in the area. The USACE studies were reviewed for their assessment of risk and potential projects in the region. Census data were used to obtain population and housing statistics. Materials from FEMA and TDEM were reviewed for guidance on plan development requirements. Jurisdictions included actions from other plans, such as Floodplain Management Plans and developed actions to implement and incorporate other plans such as Stormwater Management Plans.

Incorporation

Current projects and studies from numerous sources were utilized as a starting point for discussing mitigation actions among the jurisdictions. Previous hazard events, occurrences, and descriptions were identified through NOAA's National Climatic Data Center (NCDC). Results of past hazard events were found through searching the NCDC and included in hazard sections (5-20) of this update. This data was also presented at the meeting held January 20th in order to facilitate a discussion on risk to help participants verify their hazard rankings for their jurisdiction. The State of Texas Mitigation Plan (2013), developed by TDEM, was reviewed in initial planning meetings in order to develop a specific group of hazards to address in the planning effort. The State Plan was also used as a guidance document, along with FEMA materials, in the development of the Plan Update.

2.6 Plan Maintenance Procedures

The jurisdictions who sought approval in this planning initiative will implement the strategies outlined within this plan and update and maintain the plan according to the guidelines below. The jurisdictions will use the plan's goals, as well as continued analysis of hazard risks and capabilities, to weigh the available resources against the costs and benefits for each mitigation action. The participating jurisdictions understand the value of this plan and its positive impact on mitigating hazards and intend to continue updating this plan and implementing the plan's strategies.

The methods of keeping this plan current are monitoring, evaluating and updating the plan. FEMA defines these the following way[1]

1. Monitoring: Tracking the implementation of the plan over time.
2. Evaluating: Assessing the effectiveness of the plan at achieving its stated purpose and goals.
3. Updating: Reviewing and revising the plan at least once every five years.

Incorporation

Each participating jurisdiction will be responsible for further development and/or implementation of their mitigation action plans. This process will be overseen by the GCHMC member identified in Table 2.1. The following describes the process by which the participating jurisdictions will incorporate elements of the mitigation plan into other planning mechanisms and how information was incorporated where appropriate over the past five years.

Process of Incorporation

Once the plan update is adopted, each jurisdiction will implement actions based on priority and the availability of funding. The participating jurisdictions already implement policies and programs to reduce losses to life and property from hazards as described in the Capability Assessment found in Section 20. The mitigation actions developed for this plan update build upon that effort and will be implemented through other program mechanisms where possible.

Participating jurisdictions will integrate implementation of their mitigation actions with other existing jurisdiction plans such as capital improvement, comprehensive, land use, design and construction standards, and emergency management plans as identified in the Capability Assessment in Section 20. They will also participate in local and statewide studies, workshops, and committees that address hazards prone to Galveston County to ensure mitigation concepts are included where applicable to increase awareness and further reduce or eliminate future impacts from hazards. The GCHMC will provide a copy of this plan to their Mayor and/or applicable officials

[1] Local Mitigation Planning Handbook, FEMA March 2013.p.7-1

and assist in identifying key elements from this plan for incorporation into the plan updates, development/update of regulations and ordinances, and annual budgets.

Each participating jurisdiction will review their existing plans in light of this plan update and incorporate any mitigation policies and actions into these plans, as appropriate. The jurisdictions will ensure the actions in the mitigation plans are reflected in other planning efforts. The additional planning efforts, as identified in Section 23, will be used to advance mitigation strategies in participating jurisdictions.

Upon formal adoption of the updated plan, GCHMC members (see Table 2.1) will coordinate with officials (Mayor and appropriate department heads) to integrate the updated hazard mitigation strategies into existing plans as indicated in Table 2.2 below.

Table 2.2: Process of Incorporation by Planning Mechanism

Planning Mechanism	Incorporation of Plan Update
Grant Applications	The plan update will be consulted by GCHMC for each jurisdiction whenever grant funding through the programs offered by FEMA are sought for mitigation projects. If a project is not in the plan update, an amendment may be necessary to include the action in the plan. There is no specific timeline for applying for grants. As these grants are made available the GCHMC representative will inform the Mayor and/or applicable officials regarding the funding opportunity to determine
Annual Budget Review	Each participating jurisdiction representative that participated in the planning process (as indicated in Table 2.1) will review the update and mitigation actions therein when conducting their annual budget review with their jurisdictions Mayor and/or applicable officials. Allowances will be made in accordance with grant applications sought or mitigation actions that will be undertaken according to the implementation schedule of the specific action.
Regulatory Plans	All of the participating jurisdictions currently have regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Disaster Recovery Plans, Economic Development or Evacuation Plans as indicated in Section 23. The plan update will be consulted when participating jurisdictions review or revise their current regulatory planning mechanisms, or in the development of regulatory plans that are not currently in place. These regulatory plans should be reviewed annually by the GCHMC member to ensure provisions are made to incorporate procedures for hazards of concern. The GCHMC member will coordinate reviews of the regulatory plans with the Mayor and/or applicable official.

Capital Improvement Plans	Seven of the jurisdictions, including the county, have a Capital Improvement Plan (CIP) in place (See Table 23-1 in Section 23). Before any updates to the CIP are conducted, jurisdictions with CIPs will review the risk assessment and mitigation strategy sections of this plan update, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments. In addition, the plan update will be consulted if a CIP is developed for Clear Lake Shores, Hitchcock, Jamaica Beach, or Kemah. The GCHMC member for these communicates will coordinate the integration of this plan in the CIP with their respective Mayor and/or applicable official on an annual basis.
Comprehensive Plans	According to Table 23-1, which contains the results of the capability assessment, eight jurisdictions have a Comprehensive Plan in place. Since comprehensive plans involve developing a unified vision for a community, the mitigation vision and goals of the plan update will be reviewed in the development or revision of a Comprehensive Plan. For those communities who have a plan in place, the GCHMC member will coordinate the review of this plan with their appropriate official to determine if an update to the Comprehensive Plan is warranted. The Comprehensive plans should be reviewed every five years in conjunction with this plan update (every five years). Bayou Vista, Hitchcock, and Kemah do not have a comprehensive plan due to the lack of funding to develop it.
Floodplain Management Plans	Floodplain management plans include preventative and corrective actions to address the flood hazard. All of the jurisdictions developed mitigation actions to address vulnerabilities to inland and coastal flooding. Therefore the actions for flooding, and information found in Section 6 of this plan discussing the people and property at risk to flood, will be reviewed in revised when jurisdictions update their management plans or develop new plans. All of the jurisdictions currently have a plan in place except Friendswood and Hitchcock as shown in Section 23, Table 23-1. For those communities who have a plan in place, the GCHMC member will coordinate the review of this plan with their appropriate official to determine if an update to the floodplain management plan is warranted. This plan should be reviewed every five years in conjunction with the hazard mitigation plan update. Friendswood and Hitchcock's GCHMC will coordinate a review of this plan with their Mayor and/or applicable official to determine if a floodplain management plan should be developed.

Monitoring

The Galveston County Deputy EMC serves as Chairman of the Galveston County Hazard Mitigation Council and is responsible for ensuring the plan is monitored for effectiveness. When necessary, the Chairman will collect information from the participating jurisdictions to update the plan. The Chairman is responsible for the plan's general upkeep and oversight as it relates to compliance with the hazard mitigation grant program requirements, all files, and necessary documentation, as well as conducting routine plan reviews. Each participating jurisdiction's designated representative will be responsible for coordinating the administrative decisions and plan integration with future planning initiatives with their appropriate officials.

Each of the jurisdictions will independently implement their own jurisdiction-specific mitigation actions. Each mitigation action in this plan is prioritized and assigned to a specific department for implementation when opportunities and funding become available. Estimated timelines are given for each mitigation action where appropriate.

The role of the chairman includes the following tasks:

- Schedule, at a minimum, a biannual meeting with the GCHMC;
- Develop meeting agendas;
- Invite other agencies/departments to participate in meetings;
- Schedule post-disaster event meetings with the GCHMC for federally and/or state-declared disasters if significant damage was sustained or the hazard disclosed vulnerabilities within the planning area that need to be addressed;
- Coordinate updates to the public with participating jurisdictions when applicable (this may include but is not limited to plan amendments, completion of mitigation actions, notification of programs available to the public for mitigation, etc.).

During annual meetings, the GCHMC will address any issues that may have occurred since the last plan update, assess events impacting the planning area to determine if changes in the plan are required, and complete the evaluation and project implementation worksheets for documentation purposes.

If significant changes, updates, or amendments to the plan are suggested by the GCHMC, they will inform TDEM's Mitigation Section to determine the appropriate action that should be taken.

Evaluation

The Galveston County Hazard Mitigation Chairman and the members of the GCHMC will use the Plan Evaluation Checklist provided in Appendix B-3 to evaluate this plan and make recommendations for future plan updates and enhancements. The worksheet will be completed annually.

The Plan Evaluation Checklist includes the following components:

- Evaluate the goals and objectives ensuring they address current and expected conditions;
- Determine any changes in the nature or magnitude of risks identified in the plan;
- Evaluate current resources for adequacy in implementing the plan;
- Document any implementation problems with other agencies, including technical, political, legal or coordination issues;
- Evaluate the effectiveness of the GCHMC;
- Evaluate the effectiveness of the participating jurisdiction's capabilities.

To further support the Plan Evaluation Checklist, three worksheets were developed and are also provided in Appendix B-3.

- Mitigation Action Implementation Worksheet (listing of mitigation actions identified by each jurisdiction);
- Mitigation Planning Team Worksheet (FEMA's Local Mitigation Planning Handbook, Worksheet 2.1);
- GCHMC Meetings and Public Involvement Activities.

The Plan Evaluation Checklist and Mitigation Action Implementation Worksheet are completed annually and stored in Appendix H. The Mitigation Planning Team Worksheet is completed only if a change is recommended by the Chairman and/or the GCHMC.

Updating

At any time, minor technical changes may be made to the plan to keep it updated. However, any material changes to the mitigation actions or major changes in the overall direction of the plan or the policies contained within it must be subject to formal adoption by the Governing Bodies of participating jurisdictions. Any amendment to the plan must undergo an open public process. Participating jurisdictions will seek public input on any material change to the plan during a formal review and comment period.

At the end of the comment period, the proposed amendment and all comments will be forwarded to the Governing Bodies of each participating jurisdiction. If no comments are received from the reviewing parties within the specified review period, this will also be noted. The Governing Bodies will then review the proposed amendment and comments received and vote to accept, reject, or amend the proposed change. Upon ratification, the amendment will be transmitted to TDEM.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered:

- Errors or omissions made in the identification of issues or needs during the preparation of the plan;
- New issues or needs that were not adequately addressed in the plan; and
- Changes in information, data, or assumptions from those on which the plan was based.

Five Year Review

The plan will be thoroughly reviewed by the GCHMC every five years to determine whether there have been any significant changes in the area that may necessitate changes in the types of mitigation actions proposed.

As with the development of this plan update, the Office of Emergency Management for Galveston County will oversee the review process. Specifically, the EMC and Deputy EMC will act as Chairpersons for the GCHMC.

New development in identified hazard areas, an increased exposure to hazards, disaster declarations, the increase or decrease in capability to address hazards, and changes in federal or state legislation are examples of factors that may affect the content of the updated plan.

The plan review provides Galveston County and the participating jurisdictions with an opportunity to evaluate those actions that have been successful and to explore documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned.

Following the five-year review, any revisions deemed necessary will be summarized and utilized according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process, the revised plan will be submitted to TDEM for final review and approval in coordination with FEMA.

2.7 Continued Public Involvement

Input from the public was an integral part of the preparation of this updated plan and will continue to be essential as the plan grows and changes. As noted above, a significant change to this plan will require opportunities for the public to make its views known. Recommendations for continued public involvement are also included as mitigation actions for public education and awareness campaigns.

This plan will be posted on the GCOEM website, www.gcoem.org, where officials and the public are invited to provide ongoing feedback. Copies of the updated plan also will be kept for public review in the offices of each participating jurisdiction.

Further, if necessary, the county can designate voluntary citizens or willing members of the private sectors as members of the Planning Team as well as utilize local media to notify the public of any maintenance or periodic review activities taking place.

3.0 Community Profile

3.1 Overview

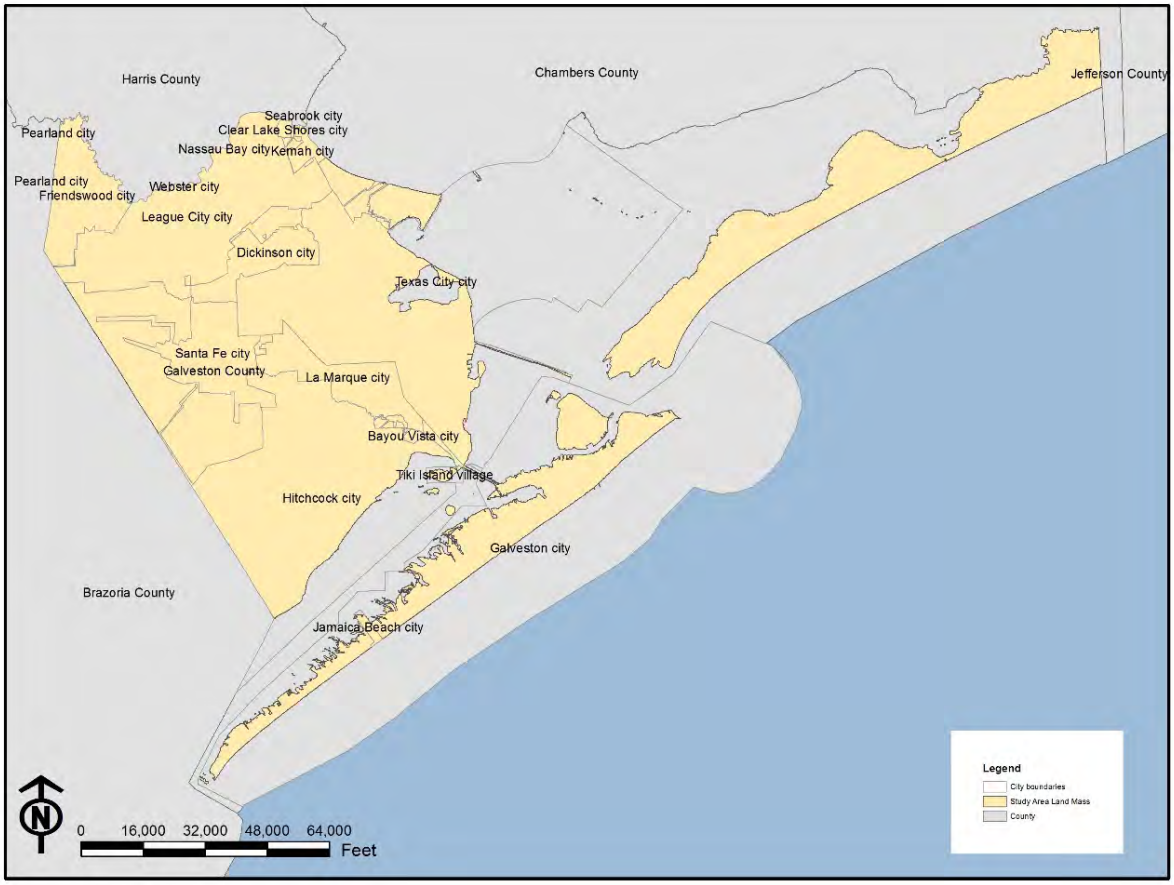
Galveston County is located on the Gulf Coast of Texas, east of Brazoria County, and west of Chambers County (Figure 3.1). The county is a 399 square mile area[1] bound by Clear Creek and Trinity Bay, where the county line crosses Galveston Bay to the eastern reaches of High Island. West Galveston County extends inland to the unincorporated community of Algoa and San Luis Pass on the coast. The Gulf of Mexico makes up the boundary on the southeast.

Galveston County was formally established in 1839 under the Republic of Texas and is comprised of the cities of: Bayou Vista, Clear Lake Shores, Dickinson, Friendswood, Galveston, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, Texas City, and the Village of Tiki Island. The City of Galveston is the county seat. As discussed in Section 1, all of the cities and unincorporated areas are participating in this Plan Update with the exception of Dickinson, Galveston, and Texas City. The participating jurisdictions range from larger urbanized areas to small residential beach communities nestled in the marshes, and although the area is diverse, each community faces the natural and man-caused hazards discussed in Sections 5-17 of this update. This section looks at a general profile of the county as a whole, providing data were available for each jurisdiction, including:

- Population and Demographics;
- Housing and Household Income;
- Economy and Industry; and
- Land Use and Development Trends

[1] United States Census Bureau

Figure 3.1: Overview of Galveston County

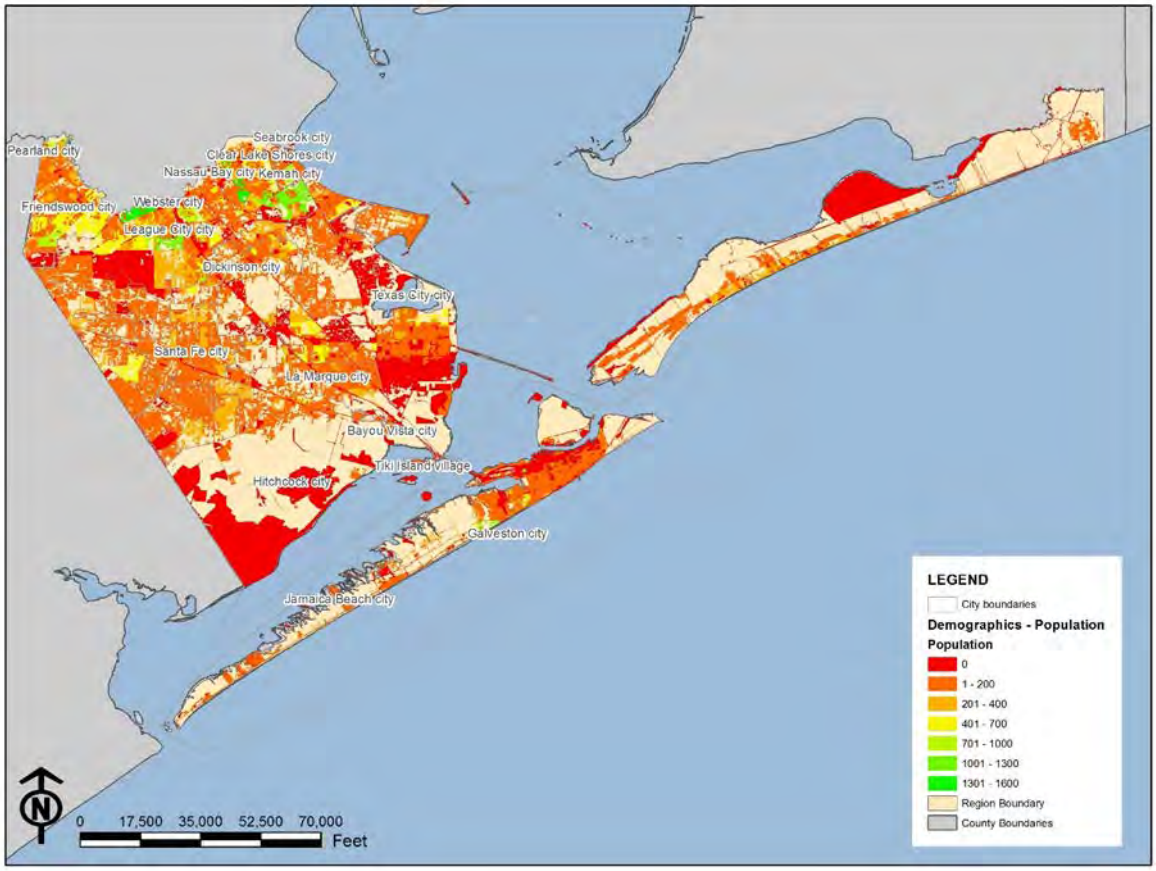


Source: HAZUS-MH 2010

3.2 Population and Demographics

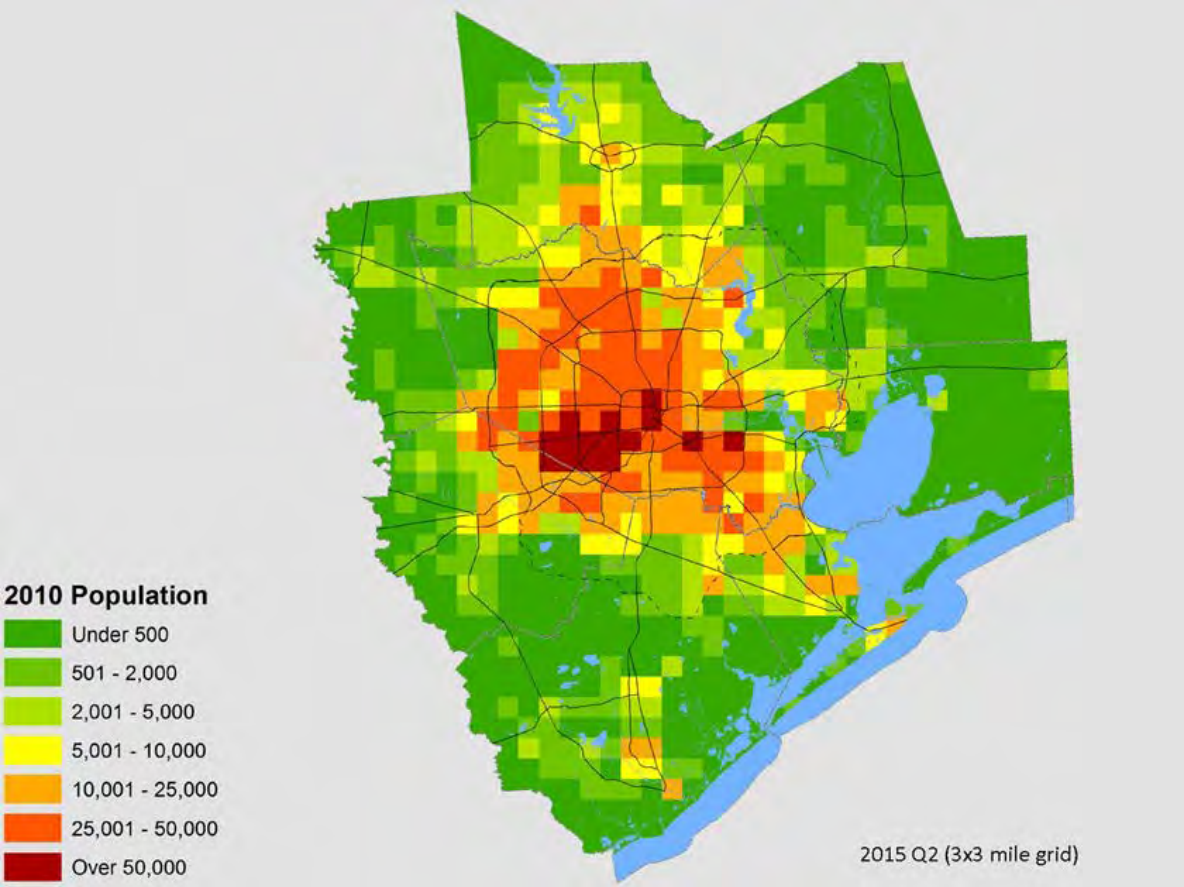
The population distribution (based on the United States Census Bureau for 2010) for Galveston County is depicted in Figures 3.2 and 3.3, which displays the county as a whole and as a part of the region, including unincorporated areas as well as the 10 participating jurisdictions. Census 2010 data was used to determine population distribution.

Figure 3.2: 2010 Population Distribution Map for Galveston County



Source: HAZUS, 2010 Census

Figure 3.3: 2010 Population Distribution Map for Galveston County Region



Source: Houston Galveston Area Council

Tables 3.1, 3.2, 3.3 and 3.4 provide a numeric breakdown of the population by jurisdiction. Several of the jurisdictions are tourist destinations and therefore experience seasonal population, an increased number of people at peak travel times in the summer months. The jurisdictions that experience seasonally-based population during the summer are listed in Table 3.1. A breakdown of the special needs population (elderly and low income) follows in Table 3.2.

Table 3.1: Participating Jurisdictions with Seasonal Population

Jurisdiction	Population Increase
Bayou Vista	50%
Tiki Island	80%
Jamaica Beach	120%
Bolivar (unincorporated)	5,000 additional/100,000 on major holidays

Source: Galveston County HMP 2009-2016

Table 3.2: Population Distribution by Jurisdiction

Jurisdiction	Total Population (2010 Census)	Total Number of Households (2013 ACS)	Special Needs Population		
			Elderly (Over 65)	Below Poverty	Low Income Households (>/= $20K)
Bayou Vista	1,537	947	342	229	96
Clear Lake Shores	1,063	512	164	237	26
Friendswood	35,805	12,850	4,198	7,001	891
Hitchcock	6,961	2,629	957	95	683
Jamaica Beach	983	525	192	226	3
Kemah	1,773	760	171	430	85
La Marque	14,509	5,318	2,006	62	683
League City	83,560	31,239	6,117	528	2,090
Santa Fe	12,222	4,468	1,742	238	499
Village of Tiki Island	968	433	243	26	17
Galveston County	291,309	110,032	32,804	38,856	17,264

Source: US Census 2010, Summary File, U.S Census ACS 5 year estimates 2009-2013

Population estimates from 1970 to 2015 and population projections from 2020 to 2040 are listed in Table 3.3 and illustrated in Figure 3-4 respectively, as provided by the U.S. Census Bureau. Over the past four decades Galveston County has become increasingly more developed and urbanized, with 93.9 percent of the population urban as of 2010. The county's total population in 1970 was 169,812 and increased by 47 percent to 291,309 by 2000. Between 2000 and 2010, the population increased another 16 percent to 291,309. By 2040, the county's population is projected to nearly double the 1970 population, for a projected population count of 321,886. Household population projections are included in Table 3-3 for each participating jurisdiction. Data limitations preclude inclusion of projections for total population at this time. All populations are expected to increase with the exception of Bayou Vista which is expected to maintain current population levels.

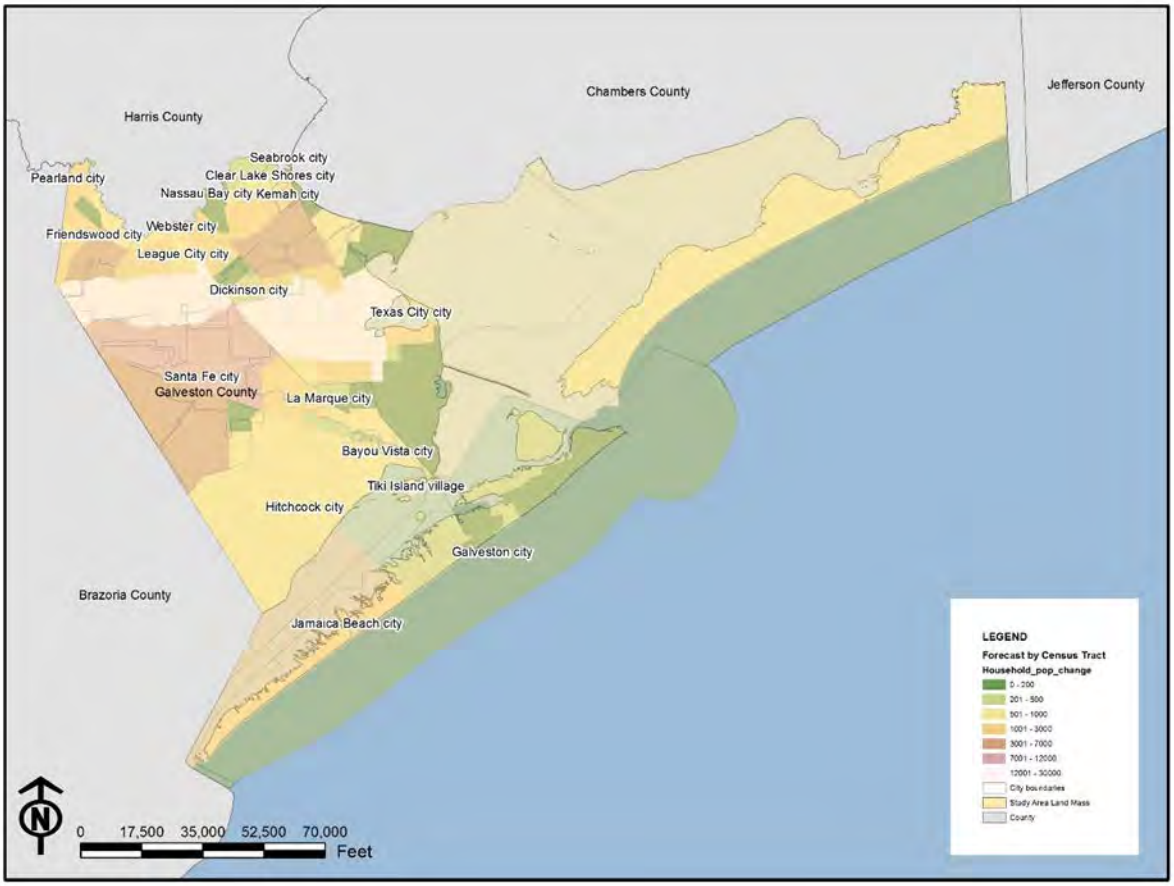
Table 3.3: Galveston County Household Population Projections and Estimates[2]

Jurisdiction	Year								% increase 2010-2050
	1970	1990	2000	2010	2015	2020	2030	2040	
Bayou Vista	-	-	-	1,537	1,537	1,537	1,537	1,537	0%
Clear Lake Shores	-	-	-	1,063	1,065	1,067	1,067	1,241	17%
Friendswood	-	-	-	35,598	41,177	45,813	55,704	63,065	77%
Hitchcock	-	-	-	6,960	8,038	8,999	9,706	10,273	48%
Jamaica Beach	-	-	-	983	1,002	1,017	1,017	1,017	3%
Kemah	-	-	-	1,773	1,995	2,173	2,368	2,569	45%
La Marque	-	-	-	14,370	16,327	17,029	17,693	22,300	55%
League City	-	-	-	83,089	108,713	128,471	159,236	162,135	95%
Santa Fe	-	-	-	12,217	13,380	14,245	15,596	19,139	57%
Village of Tiki Island	-	-	-	968	1,120	1,173	1,173	1,173	21%
Galveston County (Unincorporated)	-	-	-	32,259	35,420	38,091	49,636	69,195	114%
Galveston County (Household Population)*				286,922	-	375,527	478,819	568,159	98%
Galveston County (Total Population)*	169,812	217,396	250,158	291,309	299,971	307,372	318,459	321,886	10%

Source: Texas State Data Center; HGAC Regional Growth Forecast 2015 Q2; household population excludes population enumerated in institutional households such as national/provincial/municipal/city jails/detention centers, military camps, tuberculosis pavilions, mental hospitals, leprosaria/leper colonies or drug rehabilitation centers

[2] (p) = population projection based on no migration

Figure 3.4: Population Projections and Estimates by Census Tract



Source: Houston Galveston Area Council 2015 Q2 estimates based on US Census Data

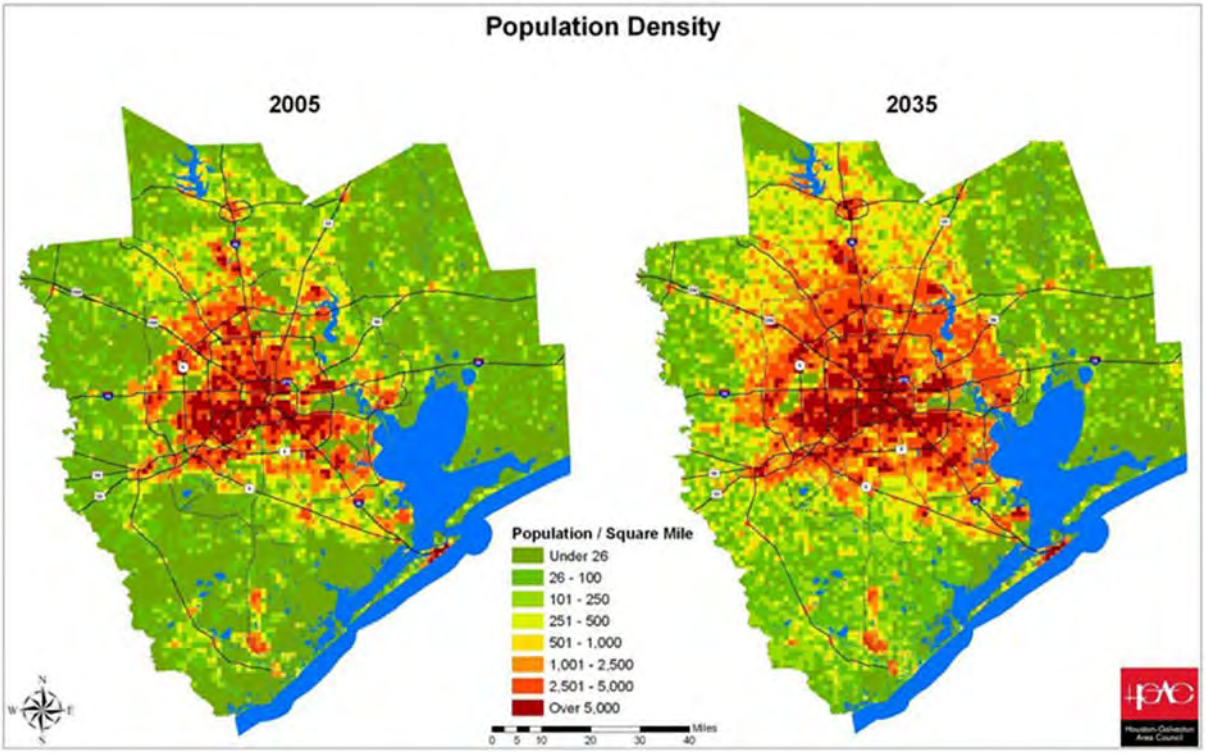
Table 3.4 provides the estimated population density by square mile during 1970 to 2010, and projected population density from 2020 to 2040, as tabulated by the U.S. Census Bureau and the Texas State Data Center. As of 2010, the population density in Galveston County was 770 people per square mile. By 2040, the population density is projected to increase to 1,056 people per square mile, which is nearly double that of 1990. Figure 3-5 geographically illustrates population density changes projected to occur during 2005 to 2035 in the Houston-Galveston region.

Table 3.4: Galveston County Estimated and Projected Population Density

Year	Population	Population Density (Per Sq. Mile)
1970	169,812	426
1990	217,396	545
2000	250,158	627
2010	291,309	770
2020 (p)	344,010	862
2030 (p)	386,888	970
2035 (p)	404,471	1,014
2040 (p)	421,361	1,056

Source: Texas State Data Center

Figure 3.5: Houston-Galveston Population Density Change (2005 – 2035)



Source: Houston Galveston Area Council

3.3 Ethnicity

The ethnic makeup of Galveston County according to estimates for 2014 by the United States Census Bureau is shown in Table 3.5 below.

Table 3.5: 2014 Ethnicity - Galveston County

Jurisdiction	Description						
	Hispanic or Latino alone	White Alone	Black African American Alone	American Indian and Alaska Native	Asian Alone	Native Hawaiian/ Pacific Islander	Two or More Races
Bayou Vista	9.10%	87.50%	0.40%	0.00%	1.00%	0.00%	1.70%
Clear Lake Shores	6.10%	90.30%	0.00%	0.00%	1.20%	0.00%	2.50%
Friendswood	14.90%	75.80%	3.00%	0.20%	4.80%	0.00%	1.30%
Hitchcock	23.80%	45.00%	29.70%	0.00%	0.30%	0.00%	1.20%
Jamaica Beach	12.50%	84.40%	0.90%	2.20%	0.00%	0.00%	0.00%
Kemah	14.90%	77.10%	1.70%	0.00%	5.40%	0.00%	0.90%
La Marque	24.20%	34.70%	37.40%	0.10%	1.30%	0.00%	2.20%
League City	18.90%	65.90%	7.40%	0.10%	5.60%	0.00%	1.90%
Santa Fe	12.70%	85.40%	0.20%	0.60%	0.30%	0.00%	0.80%
Village of Tiki Island	3.10%	91.00%	1.70%	0.00%	2.80%	0.00%	1.50%
Galveston County	23.7%	80.1%	13.6%	0.8%	3.4%	0.1%	1.9%

Source: Projections based on US Census 2010 data

Table 3.6 depicts numerical and percent change among ethnic and racial groups for Galveston County. From 2010 to 2050 it is estimated that the anglo population in Galveston County will increase by 7.0 percent, compared to a decrease by 6.8 percent statewide. The Hispanic population is projected to increase by 47.9 percent in the county. African-Americans and other racial and ethnic groups are also projected to increase for both state and county estimates.

Table 3.6: Present and Projected Ethnic and Racial Composition of Galveston County, 2010-2050

Ethnicity	2010	2020	2030	2040	2050	Numerical Change	Percentage Change
White	172,652	175,987	174,997	168,923	160,545	12,107	7.0
African American	39,229	40,842	41,919	41,950	41,433	2204	5.6
Hispanic	65,270	74,335	83,609	91,518	97,512	31,242	47.9
Other	14,158	16,208	17,934	19,495	20,645	6487	45.8
All	291,309	307,372	318,459	321,886	320,135	28,826	9.9

Source: Texas State Data Center and Office of State Demographer, Institute for Demographic and Socioeconomic Research (IDSER)

3.4 Age

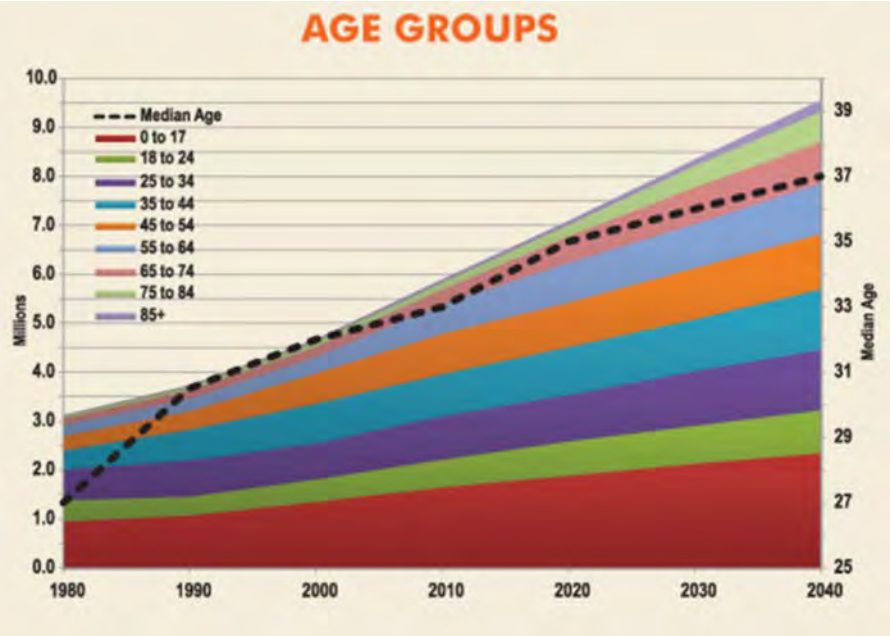
According to US Census 2010 data, the median age for persons living in Galveston County is 37, with 28.23 percent of the population at 19 or under and 16.66 percent 65 and older. The 2010 Census results for age for Galveston County are depicted in Table 3.7 below. Figure 3-5 illustrates the projected change in age composition of the population in Galveston County from 1980 to 2040. The median age is expected to increase.

Table 3.7: Age Composition in County and State

Age	Galveston County			Texas	
	Number	Percent		Number	Percent
Under 19 years	82,211	28.23		7,621,714	31.30
19 to 24 years	41,673	14.31		3,765,007	15.60
25 to 34 years	36,317	12.47		3,670,118	14.70
35 to 44 years	38,658	13.17		3,524,021	14.10
45 to 54 years	42,725	14.66		3,455,262	13.70
55 to 64 years	43,131	14.81		3,097,793	11.00
65 to 74 years	26,936	9.24		2,027,867	8.90
70 to 79 years	13,558	4.65		1,096,401	4.40
80 years and over	8,079	2.77		652,385	2.50

Source: US Census 2010

Figure 3-5: Age Projections for Galveston County



Source: Galveston 2040 Regional Transportation Plan

3.5 Education

School districts in Galveston County include the following: Clear Creek ISD, Dickinson, ISD, Friendswood ISD, Galveston ISD, High Island ISD, Hitchcock ISD, La Marque ISD, Santa Fe ISD and Texas City ISD. The county is also home to two community colleges, College of the Mainland and Galveston College and two major universities, Texas A&M University at Galveston and the University of Texas Medical Branch at Galveston. Table 3.8 depicts level education by jurisdiction.

Table 3.8: Level of Education 2013

Jurisdiction	High School Diploma or higher (%)	Bachelor's Degree or higher (%)
Bayou Vista	92.8%	22.5%
Clear Lake Shores	91.3%	42.4%
Friendswood	95.8%	49.1%
Hitchcock	82.5%	8.5%
Jamaica Beach	92.9%	36.7%
Kemah	84.8%	28.1%
La Marque	83.9%	14.9%
League City	94.9%	42.8%
Santa Fe	90.9%	14.2%
Village of Tiki Island	96.3%	40.0%
Galveston County	80.9%	22.7%
Texas	75.7%	23.2%

Source: U.S Census ACS 5 year estimates 2009-2013

3.6 Housing and Household Income

According to the 2010 U.S. Census, there were 94,782 total households in Galveston County. Of these, 33.8 percent had children under the age of 18 living with them, and 52.4 percent of the total number of households was comprised of married couples. Over 25 percent of all households were made up of individuals, with a total of 30.2 percent of non-families. In 2010 the average household size was 2.6, while the average family size was 3.12 persons per household.

Table 3.9 provides a summary of the housing units by type. Table 3.10 and Figure 3.6 depict the estimated and projected number of households based on Census estimates. In 2014, there are an estimated 136,160 households in Galveston County. Previous population projections showed the number of households increasing to 176,982 by 2040. These projections should be updated to reflect higher growth rates. The 2014 Census estimates are on track to exceed the 2020 projected number of household units, 139,329.

Table 3.9: Housing Unit Type

Jurisdiction	Units In Structure					
	Total housing units	1-unit, detached	1-unit, attached	2 units	3 units or more	Mobile home
Bayou Vista	1,252	1,221	4	27	0	0
Clear Lake Shores	617	542	7	0	68	0
Friendswood	13,593	11,087	357	91	1986	72
Hitchcock	3,273	2,315	8	76	521	353
Jamaica Beach	1,213	1,154	0	0	27	0
Kemah	886	696	62	46	71	0
La Marque	6,341	5,684	56	12	401	182
League City	33,098	25,041	1,038	245	6265	435
Santa Fe	5,261	4,345	52	175	259	396
Tiki Island	964	898	10	7	49	0
Galveston County	136,160	82,061	2,462	2,351	19,703	5,486

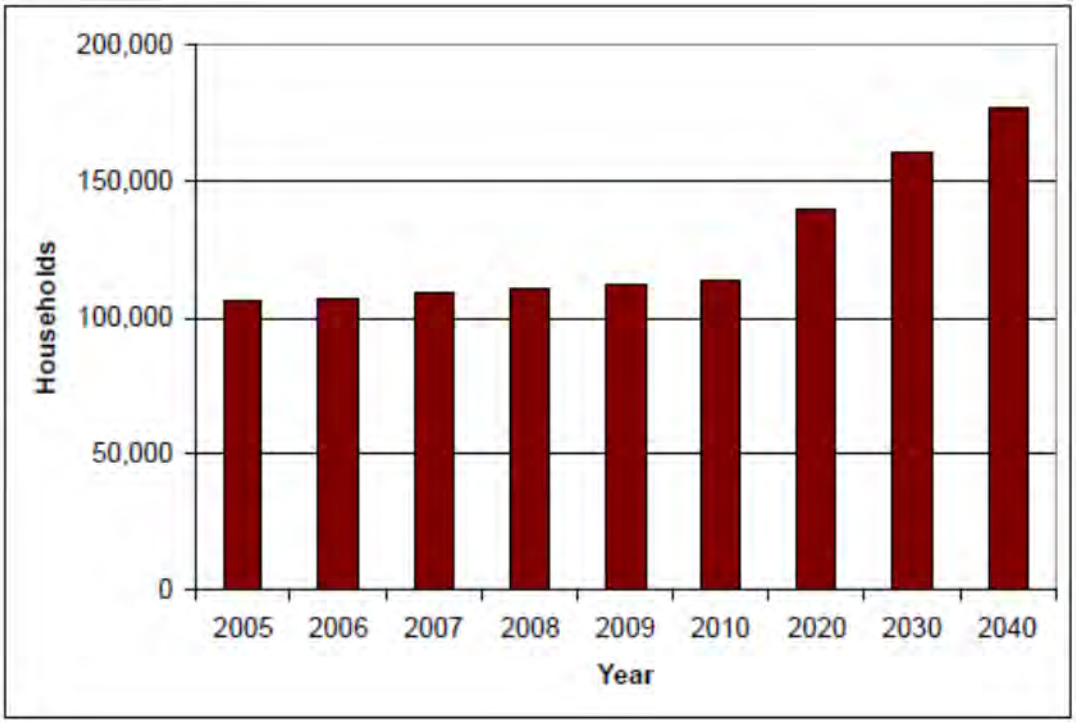
Source: US Census ACS 2010-2014; The ACS estimate of 10 was updated to reflect the specific number obtained in local counts. The updated information is within the margin of error of +/- 16 units of the ACS estimate.

Table 3.10: Estimated and Projected Number of Households in Galveston County

Year	Households
2005	105,619
2010	113,708
2020	139,329
2030	160,111
2040	176,982

Source: Galveston 2011-2016 Mitigation Plan Update

Figure 3.6: Estimated and Projected Number of Households in Galveston County



Source: Galveston 2011-2016 Mitigation Plan Update

The median household income for the county was $61,744 in 2014. The median income for non-family households was $35,044 dollars and $77,015 for family households. Males employed full-time year round received a much higher income at $58,240 versus $42,847 for females according to the Census.

3.7 Economy and Industry

The economy and industry of Galveston County continued to develop during the national recession and after the devastation caused by Hurricane Ike in 2008 and are now showing signs of economic recovery. Unemployment has decreased significantly, job growth in the region is higher than both state and national averages and the number of people and jobs are projected to increase steadily over the next decade.

Unemployment rates for the county increased from 4.9 percent in 2000 to 5.8 percent in 2008 and with estimates as high as 8.2 percent in 2009[3] during the height of the recession. The increase in unemployment was due not only to a downturn in the national economy, but the lasting effects of Hurricane Ike which devastated the County's economy in 2008. The economy has recovered with only 4.4 percent currently unemployed.

Gulf Coast regional indicators also show signs of recovery.[4] Per Capita person income growth increased 48 percent in the region between 2003 and 2013 and personal income rose from 181 billion to 334 billion in the same time frame. Job growth increased 23 percent in the region. This was slightly higher than the state increase of 19.6 percent and the U.S. increase of 4.7 percent.

The US Census (2009) reported the largest industry in the county was health care/social assistance; however, industries for the area vary by each jurisdiction. Table 3.12 lists main local industries in order of prominence for each community, as well as median income.

3 Texas Workforce Commission
[4] Texasahead.org regional profiles, 2014

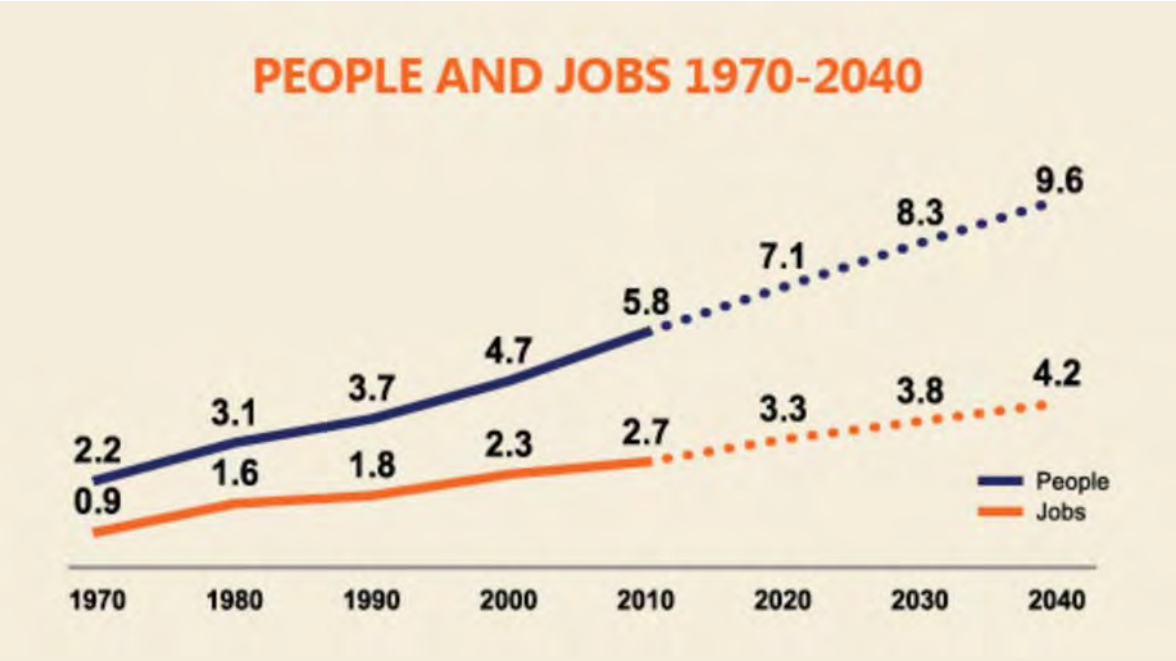
Table 3.12: Industry and Median Income by Jurisdiction

Jurisdiction	Median Income	Industries
Bayou Vista	$83,811	Educational Services, Health Care/Social Assistance, Construction, Retail Trade, Finance and Insurance
Clear Lake Shores	$98,289	Educational Services, Construction, Manufacturing, Health Care/Social Assistance, Professional Sci-Tech Services
Friendswood	$99,365	Manufacturing, Educational Services, Health Care/Social Assistance, Professional Sci-Tech Services, Retail
Hitchcock	$44,907	Construction, Health Care/Social Assistance, Retail, Educational Services, Manufacturing
Jamaica Beach	$79,125	Construction, Health Care/Social Assistance, Real Estate/ Rent/ Lease, Arts/ Entertainment/ Recreation, Accommodation/ Food Service
Kemah	$70,208	Manufacturing, Accommodation/ Food Services, Educational Services, Transportation/ Warehouse, Public Administration
La Marque	$42,369	Health Care/Social Assistance, Educational Services, Accommodation/ Food Services, Construction, Retail
League City	$89,339	Manufacturing, Health Care/Social Assistance, Educational Services, Retail, Professional Sci-Tech Services,
Santa Fe	$62,394	Health Care/Social Assistance, Manufacturing, Construction, Educational Services, Retail
Village of Tiki Island	$114,688	Health Care/Social Assistance, Manufacturing, Wholesale, Professional/Scientific/Technical Services, Educational Services, Construction
Galveston County	$61,877	Health Care/Social Assistance, Manufacturing, Educational Services, Retail Trade, Construction

Source: US Census, 2009-2013 ACS 5 Year Summary File, Table C24030

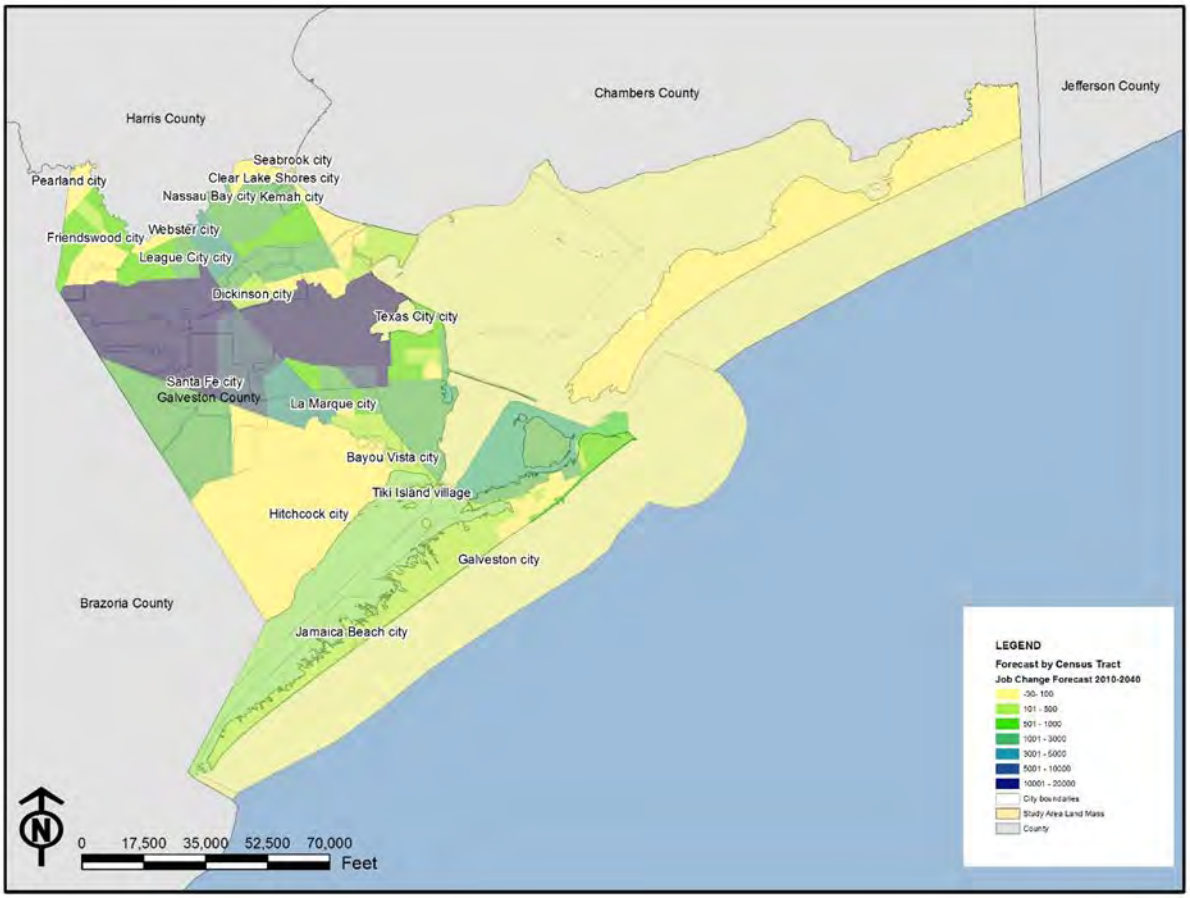
Data distributed by the Houston Galveston Area Council based on the 2010 Census illustrates positive growth in the County. The region is expected to grow to 9.6 million people and 4.2 million jobs by 2040 (Figure 3.7). 2040 job projections, illustrated in Figure 3.8, predict the highest numbers of job growth in the vicinity of Texas City, Dickinson, and Santa Fe. The increased purchasing power and tax revenue will lead to growth in 5 key areas: light vehicle fleet, real state gross domestic product, number of households, state vehicle miles traveled, and motor fuel taxes. Notably, the Real State Gross domestic product is expected to double from its 2009 rate (Figure 3.9).

Figure 3.7: People and Jobs 1970-2040



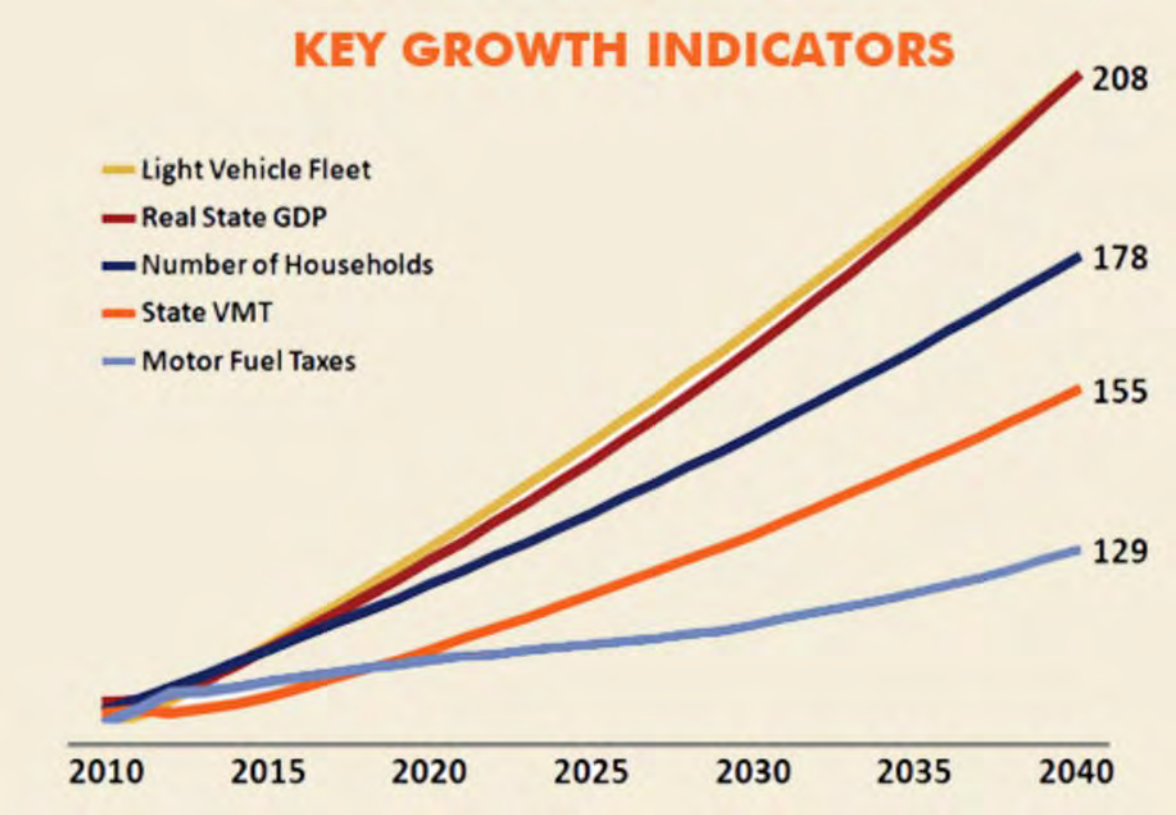
Source: Houston Galveston Area Council 2040 Galveston Regional Transportation Plan

Figure 3.8: 2010-2040 Job Change Estimates



Source: Houston Galveston Area Council 2010 Job Estimate and 2040 Job Projection

Figure 3.9: Key Growth Indicators



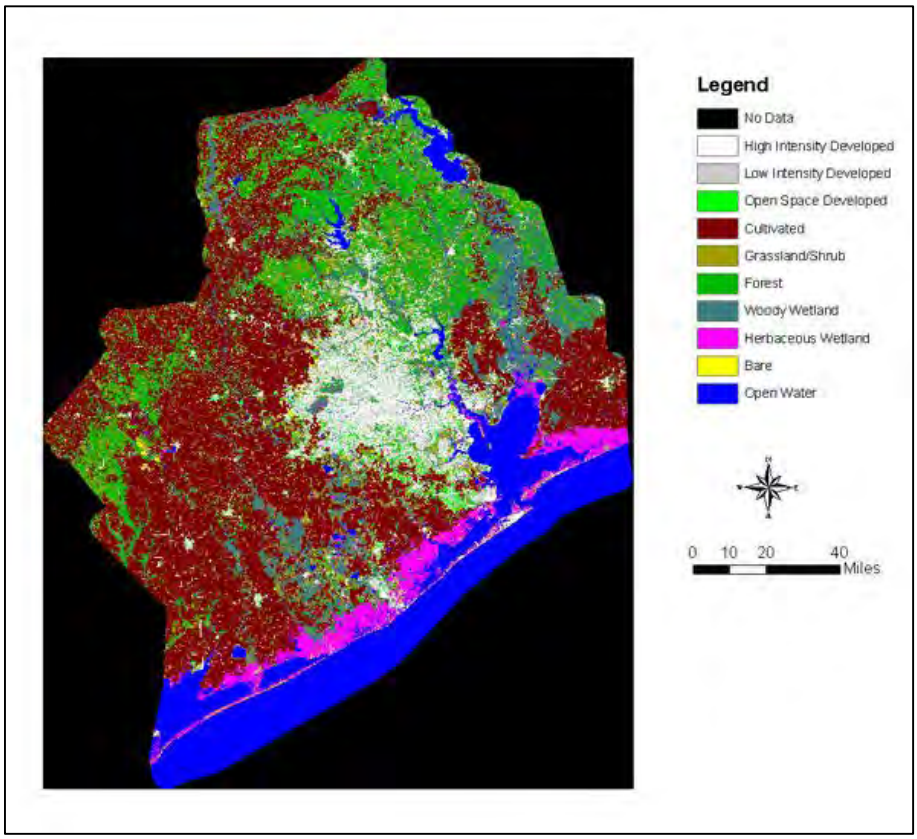
Source: Houston Galveston Area Council Data for 2040 Galveston Regional Transportation Plan

3.8 Land Use and Development Trends

Galveston County is located on the Texas Gulf Coast plains in the southeastern plains, bounded on the northeast by Galveston Bay and on the northwest by Clear Creek and Clear Lake. Most of the county covers Galveston Bay and is bounded to the south by the Galveston Seawall and Gulf of Mexico beaches. League City is the largest city in the county in terms of population, reaching 100,000 residents in 2015.[5]

Galveston County has a total land area of 399 square miles and total water area of 478 square miles. Generally, the land surface can be characterized as broad and nearly level. Elevation ranges from sea level to about 45 feet in the northwest part of the county (NRCS soils survey, 1985). Land use countywide supports the leading industries which include agriculture, oil and gas, shipping, and tourism. Figure 3.10 depicts land cover for the county.

Figure 3.10: Types of Land Cover (2010)



Source: Houston Galveston Area Council

[5] http://tx-leaguecity.civicplus.com/CivicAlerts.aspx?AID=1689

Agricultural land use of the 399 square miles of land (255,360 acres) comprises almost 1 percent of the state's cultivated land. The US Department of Agriculture Census (2012) reported that 89,554 acres were in cultivation in 2012 (See Table 3.13). Rice, hay, and grain are the major agriculture commodities grown. Countywide, rainfall averages 50.76 inches annually, and the growing season is 320 days a year.

Table 3.13: Agricultural Land Use 2012

	Number of farms	Land in farms (acres)	Harvested cropland (acres)	Irrigated land (acres)
Galveston County	612	89,554	7,713*	87,507*
State of Texas	248,809	130,153,438	29,147,537	4,489,153

Source: US Department of Agriculture Census (*2008, 2012)

There is one major drinking water reservoir that serves Galveston County. The Gulf Coast Water Authority operates and maintains the dam and reservoir and also oversees distribution to area Municipal Utility Districts (MUD) and Water Control Improvement Districts (WCID). Surveyed by the Texas Water Development Board (TWDB), the reservoir surface area is 859 acres, storage capacity is 7,360 acre feet and it is fed by the San Jacinto River. Other fresh water lakes and reservoirs in Galveston County are minor; each having storage capacities less than 5,000 acre feet making them below the threshold that the TWDB surveys.

The cities of Friendswood and League City purchase water from the City of Houston from the following sources:

- Lake Houston (Coastal water Authority)
- Lake Conroe (San Jacinto River Authority)
- Lake Livingston (Trinity River Authority)
- Future Allen's Creek Reservoir (Brazos River Authority)-70 percent owned by Houston

Development trends

Since Hurricane Ike in 2013, higher building codes have been adopted Bayou Vista, Clear Lake Shores, Friendswood, Jamaica Beach, Kemah, League City, Santa Fe, and Tiki Island that will lend to reducing impact to building stock and infrastructure from natural hazards. This measure will assist in reducing the vulnerability of future impacts by natural hazards as the new building stock and infrastructure will be designed to a standard suitable for the wind and flooding impacts associated with the Galveston County area. Modest household population growth in Friendswood, Hitchcock, and League City is expected over the next five years as shown in Table 3.3. No significant increases are expected with industrial and governmental development. Commercial development will have a moderate increase in the areas of Friendswood, League City, and the communities along the Bay and Gulf Coast areas. Overall, current development within the planning area has not impacted the vulnerability to the participating jurisdictions.

Table 3.14 is presented below as a means to organize the efforts made by each jurisdiction's development (current and future), implementation of mitigation measures, and changes in vulnerability since August 23, 2011. Each jurisdiction has demonstrated their continuous efforts in integrating mitigation strategies in hazard prone areas and have increased their public outreach and awareness campaigns to better inform their residents of measures they can employ to protect their property and family from future impacts.

Table 3.14: Summary of Jurisdictional Development Trends and Changes in Vulnerability

	Since August 23, 2011			2016-2020
Jurisdiction	Current Development	Advancements in Mitigation	Changes in Vulnerability	Future Development
Bayou Vista	Population 1,537 Limited increase in residential/ commercial development	Adopted 2012 IBC Developed Disaster Response Plan Generators installed at lift stations and WWTP Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 1,537 New residential / commercial development will be minimal
Clear Lake Shores	Population 1,063 Limited increase in residential/ commercial development	Adopted 2012 IBC Plans developed: Open Space, Post Disaster, Disaster Recovery, and Comprehensive Installed shutters to	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 1,067 New residential / commercial development will be minimal

Jurisdiction	Since August 23, 2011			2016-2020
	Current Development	Advancements in Mitigation	Changes in Vulnerability	Future Development
		community clubhouse Repairs to Clear Lake Road bridge Increased public outreach and awareness programs		
Friendswood	Population 35,598 Moderate increase in residential/commercial development	Reduced repetitive flood properties Rehab water plants #1, 5, 6, 7 Added fire hydrants Water Line replacements Install generators at lift stations, library, city hall, fire stations, activities building Increased surface water from City of Houston Retrofit city hall, public safety building, library, activities building, and fire stations Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 45,813 Significant increase in residential, commercial, industrial, and government development is expected to accommodate increasing population
Hitchcock	Population 6,960 Limited increase in residential/commercial development	Purchase fire water truck Addressed drainage issues on Gulf, Florida, Mill, Smith, and Washington Streets Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 8,999 Moderate increase in residential/commercial development

Jurisdiction	Since August 23, 2011			2016-2020
	Current Development	Advancements in Mitigation	Changes in Vulnerability	Future Development
Jamaica Beach	Population 983 Limited increase in residential/ commercial development	Adopted 2012 IBC Certified Storm Ready Community Established pre-disaster debris contracts Installation of a retaining wall around sewer plant Purchased NOAA weather radios for police and fire depts. Install generator at City hall Reduced repetitive flood properties Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 1,017 New residential / commercial development will be minimal
Kemah	Population 1,773 Moderate increase in residential/commercial development	Plans developed: Natural Resource, Drought Plan/Ordinance, Disaster Recovery, COOP, Storm Water, Floodplain Management, and Flood Response Updated ordinances Improvements to lift station Certified Storm Ready Community Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Loss to building stock and infrastructure still at risk with 2003 IBC in place	Projected population 2,173 New residential / commercial development will be minimal
La Marque	Population 14,370 Moderate increase in residential/commercial development	Plans developed: Economic Development, CIP, and Drought	No change in vulnerability to jurisdiction Loss to building	Projected population 17,029 Significant increase in residential, commercial,

Jurisdiction	Since August 23, 2011			2016-2020
	Current Development	Advancements in Mitigation	Changes in Vulnerability	Future Development
		Plan/Ordinance Add fire hydrants and increase water lines Purchase rescue pumper truck Install freshwater supply backflow preventer to ground water system Install generators at water wells, WWTP, fire station, and city hall Updated emergency communication system Increased public outreach and awareness programs	stock and infrastructure still at risk with 2003 IBC in place	industrial, and government development is expected to accommodate increasing population
League City	Population 83,089 Moderate increase in residential/commercial development	Reduced repetitive flood properties Increased public outreach and awareness programs Drainage improvements Bank stabilization Develop storm water and master drainage plan, floodplain management plan Retrofit and install generators at critical facilities	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 128,471 Significant increase in residential, commercial, industrial, and government development is expected to accommodate increasing population
Santa Fe	Population 12,217 Limited increase in residential/commercial development	Adopted 2012 IBC Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock	Projected population 14,245 Moderate increase in residential and commercial development

Jurisdiction	Since August 23, 2011			2016-2020
	Current Development	Advancements in Mitigation	Changes in Vulnerability	Future Development
		Retrofit critical facilities	and infrastructure.	is expected to accommodate increasing population
Tiki Island	Population 968 Limited increase in residential/ commercial development	Adopted 2009 IBC Increased public outreach and awareness programs Upgrade well Retrofit and install generator at public safety building Elevate water plan Planted trees	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 1,173 New residential / commercial development will minimal
Galveston County	Population 32,259 Moderate increase in residential/commercial/industrial development	Reduced repetitive flood properties Improved evacuation plans Developed a debris management and drought contingency plan Certified Storm Ready Community Generators installed on lift stations throughout the county Increased public outreach and awareness programs	No change in vulnerability to jurisdiction Reduction of loss to building stock and infrastructure.	Projected population 38,091 Moderate increase in residential, commercial, industrial, and government development is expected to accommodate increasing population

Source: Current development population from 2010 Census. Future population estimated 2020 population

4.0 Hazard Identification and Risk Assessment Overview

4.1 Identify Hazards and Inventory Assets

Hazard identification consists of defining the study area regarding scale and coverage, and collecting and compiling a list of prevalent hazards in the study area to help narrow the focus of the analysis.

Study Area Definition

Figure 4.1 shows the extent of the Galveston County study area, as well as the population distribution. There are ten incorporated jurisdictions participating in the study area (Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and the Village of Tiki Island), and all unincorporated areas are covered together in the risk assessments. Census data for 2014 was used to determine population distribution.

Figure 4.1: Population Distribution Map for Galveston County

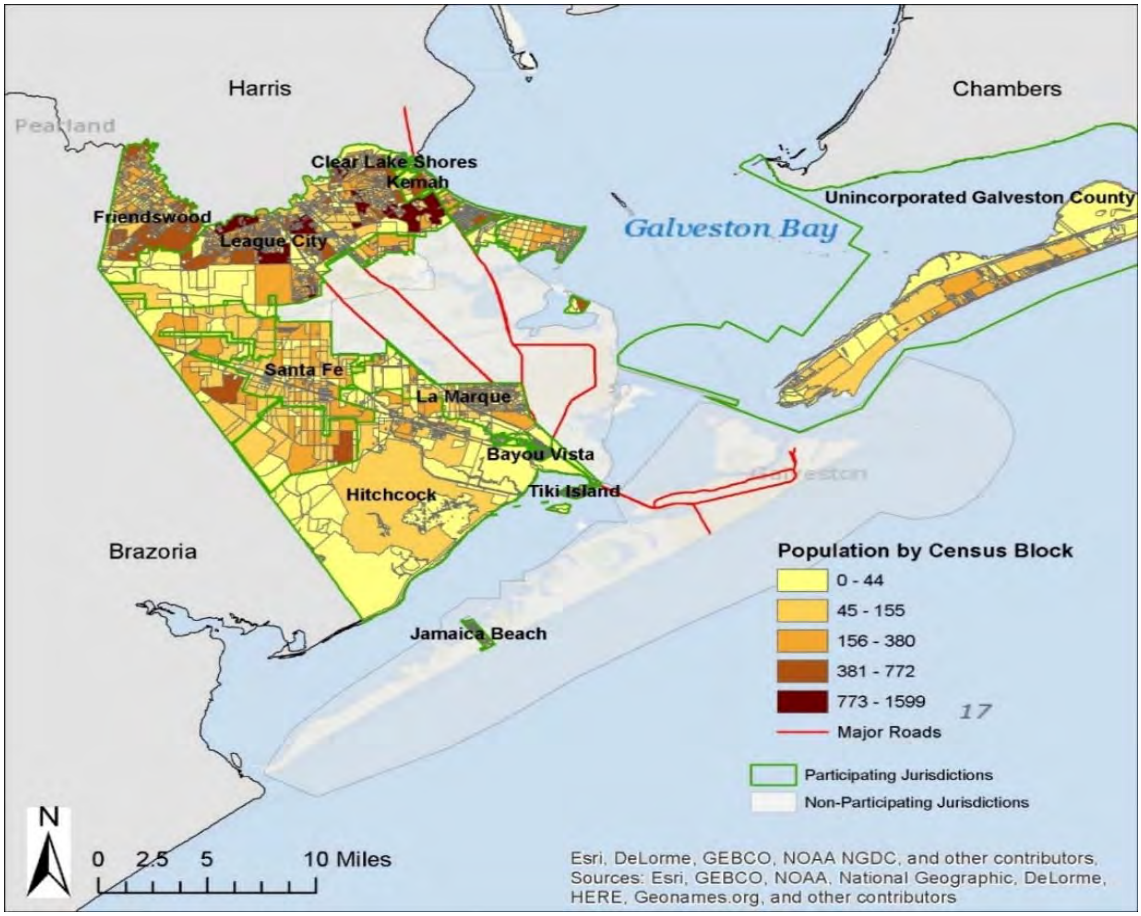


Table 4.1 provides parcel counts and the total estimated improved value of the parcels. The parcel data was based on the current property appraisals provided by the Galveston County Central Appraisal District. Replacement costs would likely exceed the assessed parcel values for several reasons: (1) replacement costs are typically 50 percent higher than the assessed value (per Galveston County), (2) replacement costs often include additional expense for building code and National Flood Insurance Program compliance, and (3) costs are typically higher after a disaster due to the higher demand and lower supply of skilled contractors. It is important to note that parcels within the Galveston area were used to derive information for this study; Friendswood and League City also have small portions of their jurisdiction within Harris County.

Table 4.1: Parcel Inventory by Jurisdiction

Jurisdiction	Total Estimated Number of Parcels	Total Improved Value of Parcels
Bayou Vista	1,324	$225,154,990
Clear Lake Shores	1,051	$243,448,194
Friendswood	14,761	$3,825,963,372
Hitchcock	6,337	$460,075,283
Jamaica Beach	1,590	$338,227,637
Kemah	1,221	$294,986,165
La Marque	8,972	$827,263,553
League City	36,314	$8,329,031,559
Santa Fe	6,457	$845,974,919
Village of Tiki Island	1,254	$445,402,231
Galveston County	30,438	$1,022,613,438
Total	88,210	$7,046,438,427

Source: Galveston Central Appraisal District (October 2015)

Table 4.2 provides the number and estimated values of critical facilities based on HAZUS-MH and additional layers for airports, ports, and ferries. Appendix F provides a comprehensive list of the critical facilities in the area as identified by each jurisdiction.

Table 4.2: Critical Facilities by Jurisdiction

Jurisdiction	Critical Facilities[1]	
	Number	Value
Bayou Vista	1	$1,246,000
Clear Lake Shores	1	$1,246,000
Friendswood	16	$108,937,004
Hitchcock	11	$24,656,002
Jamaica Beach	2	$1,246,000
Kemah	3	$8,740,000
La Marque	11	$68,064,005
League City	25	$234,215,010
Santa Fe	14	$72,536,002
Village of Tiki Island	2	$1,246,000
Galveston County Unincorporated	15	$17,207,002
Total	123	$539,339,028

[1] Comprised of fire stations, hospitals, police stations, schools, emergency operation centers, ferry facilities, airport facilities and port facilities as listed and valued in default HAZUS-MH inventory.

Table 4.3 includes the amount (in kilometers) of oil and gas pipelines, highways and railways, and the number of hazardous materials sites (i.e., includes georeferenced TRI and Tier 2 sites) in the study area.

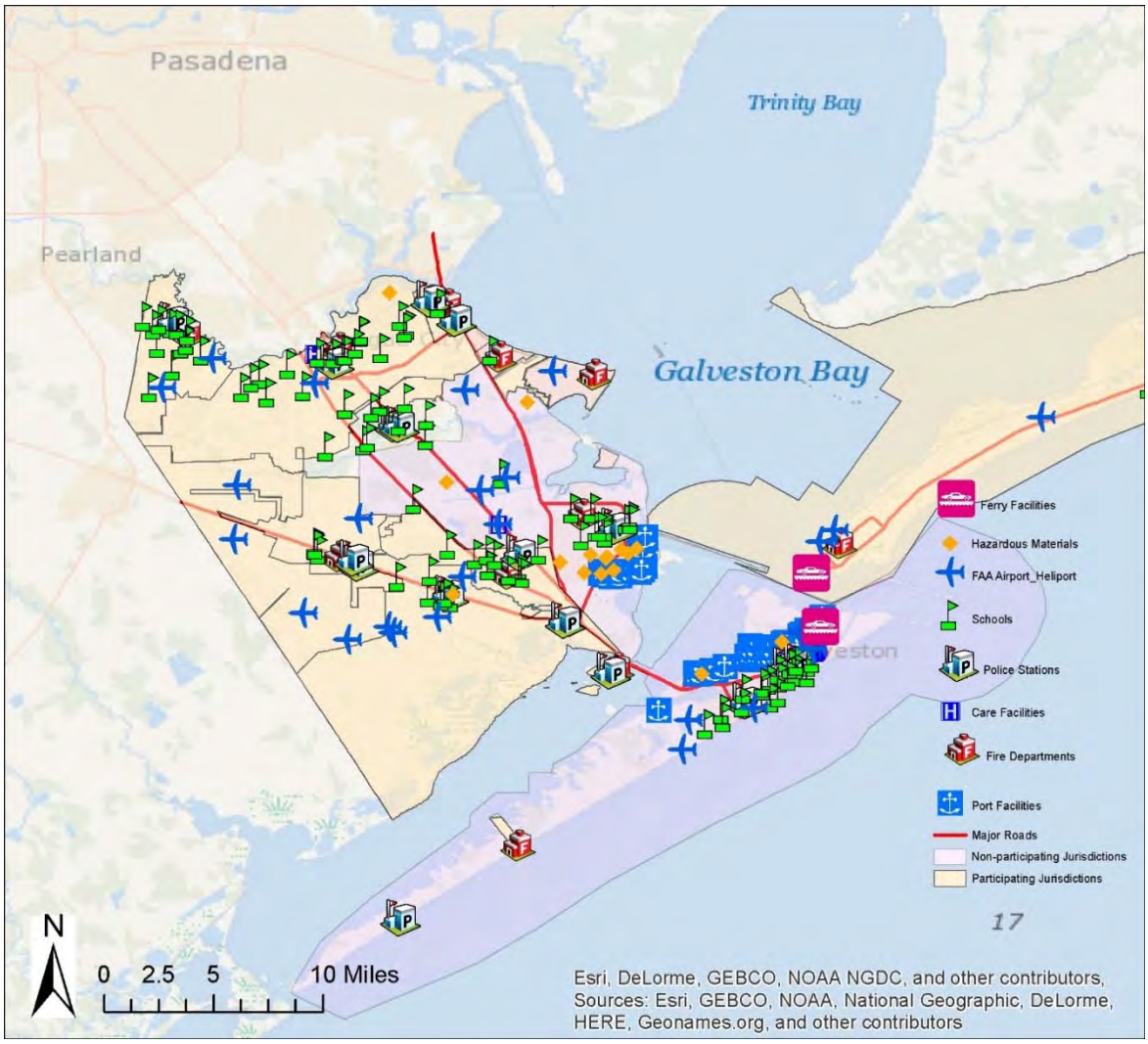
Table 4.3: Infrastructure, Lifelines, and Hazardous Materials by Jurisdiction

Jurisdiction	Infrastructure and Lifelines				No. of Hazardous Material Facilities***
	Oil Pipe (km)*	Gas Pipe (km)*	Highway (km)**	Railroad (km)**	
Bayou Vista	0.00	0.00	0.00	0.00	0
Clear Lake Shores	0.00	0.00.	.22	.19	1
Friendswood	23.15	41.73	0.00	0.00	7
Hitchcock	20.98	47.62	10.20	15.74	18
Jamaica Beach	0.00	0.00	0.00	0.00	1
Kemah	0.00	2.02.	5.11	1.47.	5
La Marque	11.49	1.01	20.71	7.04	15
League City	35.65	64.05	19.12	5.46	23
Santa Fe	19.39	24.53	6.35	4.49	8
Tiki Island	0.00	0.00	0.00	0.00	0
Galveston County Unincorporated	47.24	90.44	34.57	13.33	17
Total	157.90	271.40	96.28	47.72	95

Source: *Railroad Commission of Texas
**Galveston County
*** TRI and Tier 2 lists

Figure 4.2 shows the location of critical facilities in Galveston County as presented in the 2011 plan. This illustration shows all airports, ferry facilities, port facilities, fire stations, police stations, medical facilities, and schools within the county, including jurisdictions not participating in this risk assessment.[2] Individual hazard analyses utilize HAZUS-MH 3.0 critical facility building stock identified for the participating jurisdictions.

Figure 4.2: Critical Facilities in Galveston County



[2] The logic in displaying all critical facilities in Galveston County in this generalized figure is based on the idea that proximity of essential facilities may be relevant for reference and general planning purposes and a better understanding of critical facilities placement within the overall study region and surrounding areas.

Identification of Hazards

Hazard identification requires the recognition of risk-related events threatening a jurisdiction. Events are described as natural or human-caused hazards inflicting harm on people or property, or interfering with commerce or human activities. Such events include, but are not limited to, hurricanes/tropical storms, floods, severe storms (hail, lightning, high wind).

The GCHMC considered all hazards prone to the Texas Gulf Coast in accordance with 44 CFR 201.6 (c)(2)(i). Information from the National Climatic Data Center (NCDC), the United States Geologic Service (USGS), the online public survey, and other sources were reviewed to determine the type, location, and extent of natural hazards that may affect the planning area. A review of natural and technological hazards was conducted by comparing the hazards identified in the following mitigation plans: Galveston County (2011), Friendswood (2015), League City (2009), and the State of Texas (2013). Table 4.5 reflects the crosswalk of hazards identified in these plans and includes the revised list of hazards presented in the 2015 plan update. Although technological hazards are not a requirement of FEMA, the GCHMC determined it beneficial to include pipeline and hazardous material incidents in the plan in Appendix G.

Table 4.5: Hazard Identification

Hazards	2011 Galveston County	2015 Friendswood	2009 League City	2013 State of Texas	2016 City of Galveston	2015 Plan Update
Natural Hazards						
Coastal Erosion and Retreat				X	X	Limited
Dam/Levee Failure	X			X		Limited
Drought	X	X		X	X	Profiled
Earthquake				X		Non-Profiled
Expansive Soils				X	X	Limited
Extreme Heat	X		X	X	X	Profiled
Flood (Coastal and Inland)	X	X	X	X	X	Profiled
Hailstorm	X	X	X	X	X	Profiled
Hurricane/ Tropical Storm	X	X	X	X		Profiled
Land Subsidence		X		X		Limited
Lightning		X	X	X	X	Profiled
Severe Winter Storm	X	X		X	X	Profiled
Tornado	X	X	X	X		Profiled
Tsunami	X				X	Limited
Wildfire (Urban and Rural)	X			X	X	Profiled
Windstorm		X	X	X	X	Profiled
Technological *						
Pipeline Failure	X	X				Profiled*
Hazard Material Incidents	X	X			X	Profiled*
Other						
Biological Event					X	
Environmental Disaster					X	
Sea Level Change					X	

Note: Pipeline failure and hazardous material incidents are profiled in Appendix G as they are not considered a requirement by FEMA under 44 CRF §201.6.

Justification for Limited and Non-Profiled Hazards

The following hazards are limited to specific jurisdictions or have negligible probabilities of occurrence. These hazards are either approached in a limited fashion, or they are not profiled in this plan update.

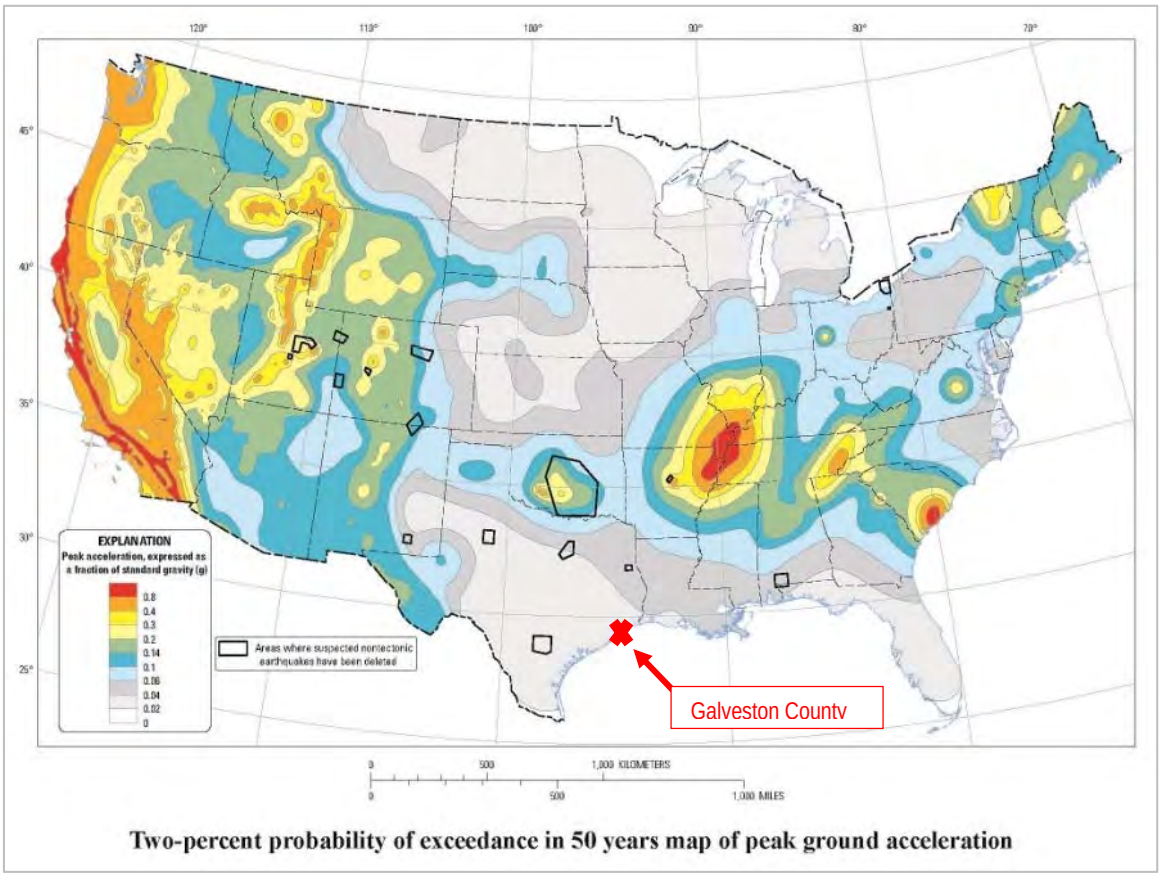
Limited:

- Coastal Erosion and Retreat – Coastal erosion applies only to jurisdictions that border the Gulf or tidal waterway. This includes Clear Lake Shores, Hitchcock, Jamaica Beach, Kemah, Tiki Island, and unincorporated areas of Galveston County.
- Dam/Levee Failure – According to the National Inventory of Dams, there is one high hazard dam, Galveston County Water Reservoir Dam, located in Dickinson Bayou in Texas City. The Galveston County Hurricane Flood Protection Levee, also located in Texas City and provides 17 miles of protection, and there are additional flood gates located near Clear Lake Shores and Kemah and a berm near Bayou Park. If these systems were to fail, La Marque, Kemah, and Clear Lake Shores could be impacted. Only these jurisdictions and the county, decided to include mitigation strategies to address these threats.
- Expansive Soils – There is no historical documentation for expansive soils. Galveston County, Friendswood, La Marque and League City are the only jurisdiction who opted to include this hazard as a potential risk.
- Land Subsidence - There is no current historical documentation of an incident. However, Bayou Vista, Clear Lake Shores, Hitchcock, Kemah, and the unincorporated areas of Galveston County considered this as a potential risk.
- Tsunami – The study area is not at a high risk from tsunami due to the local rarity of the geologic events that most often generate these dangerous waves. However, the jurisdictions of Hitchcock, Jamaica Beach, Kemah, Tiki Island, and the unincorporated areas of Galveston County considered this as a potential risk.

Non-Profiled:

- Earthquake - The State of Texas 2013 Hazard Mitigation Plan update indicated since 1882, 17 earthquakes have been reported throughout Texas but none were recorded in Galveston County. Furthermore, the National Seismic Hazard Maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the annual frequency of exceeding a set of ground motions. Figure 4.3 depicts probabilistic ground motions with a 2 percent probability of exceedance – 50 years. As shown, earthquake occurrence within Galveston County study area (including the jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe and Tiki Island) has a peak acceleration value of less than 0.02g.

Figure 4.4: Two percent probability of exceedance-50 years (USGS, 2014)



Source: USGS

4.2 Overview of Hazard Analysis

This multi-jurisdictional risk assessment was conducted with three methodologies, utilizing GIS-based analysis, HAZUS-MH software, and statistical risk assessment. Each hazard analysis is based on both qualitative and quantitative information, and each approach provides estimates of the potential impact of hazards by using a common, systematic framework for evaluation, including historical occurrence information. The results of the multi-jurisdictional risk assessment are provided as appropriate for each hazard profiled. The following are brief descriptions of the approaches used for the analysis.

GIS-Based Analysis

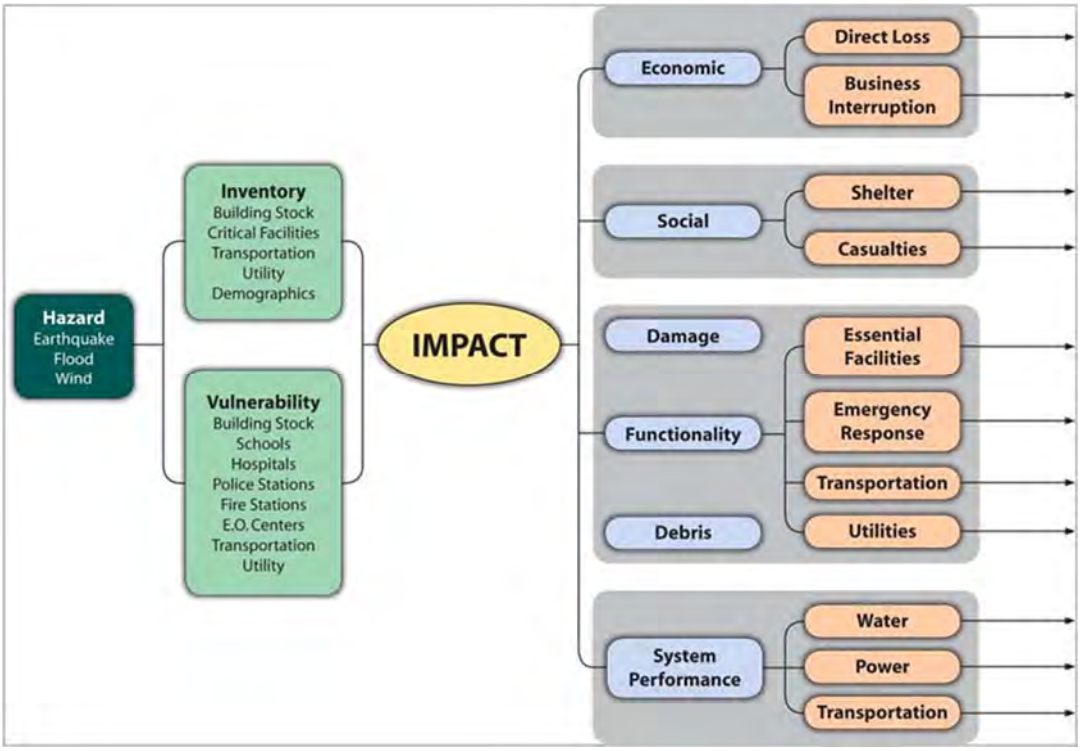
For GIS-based assessment, digital data was collected from local, state and national sources. ESRI® ArcGIS™ was used to assess risk utilizing digital data including local tax records for individual parcels and geo-referenced point locations for critical facilities. Using these data layers, the risks were evaluated by estimating the assessed building value associated with parcels determined to be located in identified hazard areas.

The objective of the GIS-based analysis was to determine the estimated vulnerability of people, buildings and critical facilities to the identified hazards for the participating jurisdictions using best available geospatial data. In so doing, local databases made available through Galveston County such as local tax assessor records, parcel boundaries, building footprints and critical facilities data, were used in combination with digital hazard data. The results of the analysis provided an estimated number of people, as well as the numbers and values of buildings and critical facilities determined to be potentially at risk of those hazards with delineable geographic hazard boundaries. GIS analysis was used on the following hazards: flood (coastal and inland), hurricane/tropical storm, dam/levee failure, wildfire (urban and rural), and technological hazards.

HAZUS-MH Analysis

HAZUS-MH is FEMA's standardized loss estimation software program built upon an integrated GIS platform (Figure 4.4) to conduct analysis at a regional level (i.e., not on a structure-by-structure basis). The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (i.e., damages and losses) on the built environment. This risk assessment applied HAZUS-MH to produce countywide profiles and estimate losses for flood and hurricane/tropical storm at the jurisdictional level. At the time this analysis was completed, HAZUS-MH 3.0 was used to estimate potential losses using HAZUS-MH default building stock inventory data.

Figure 4.4: Conceptual Model of HAZUS-MH Methodology



Statistical Risk Assessment Methodology

The statistical risk assessment methodology was primarily applied to analyze hazards of concern outside the scope of HAZUS-MH and the GIS-based risk assessment approaches. This methodology uses a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information. This methodology was explicitly used to assess the risk to the following hazards: hailstorm, windstorm, lightning, and tornado. Flooding, hurricane winds, and storm surge also incorporate statistical elements into their analysis. Available historical data for each hazard was used, and statistical evaluations were performed using manual calculations. The general steps used in the statistical risk assessment methodology are summarized below:

- Compile data from local, state and national sources, etc.
- Clean up data, including removal of duplicate records
- Identify patterns in frequency, intensity, vulnerability and loss
- Statistically and probabilistically extrapolate the patterns

- Produce meaningful results, including the development of annualized loss estimates

Loss Estimates

The economic loss results are presented here using two interrelated riskindicators:

1. The Annualized Loss (AL), which is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., county).
2. The Annualized Loss Ratio (ALR), which expresses estimated annualized loss normalized by property value.

The estimated AL addresses the key idea of risk: the probability of the loss occurring in the study area (largely a function of building construction type and quality). By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk. The ALR represents the AL as a fraction of the replacement value of the local inventory. This ratio is calculated using the following formula: ALR = Annualized Losses/Total Exposure

The ALR gauges the relationship between average annualized loss and replacement value. This ratio can be used as a measure of vulnerability in the areas, and since it is normalized by replacement value, it can be directly compared across different geographic units such as metropolitan areas or counties.

Risk (Vulnerability) Assessment is presented in terms of AL, whenever possible. In general, presenting results in the annualized form very useful on threefronts:

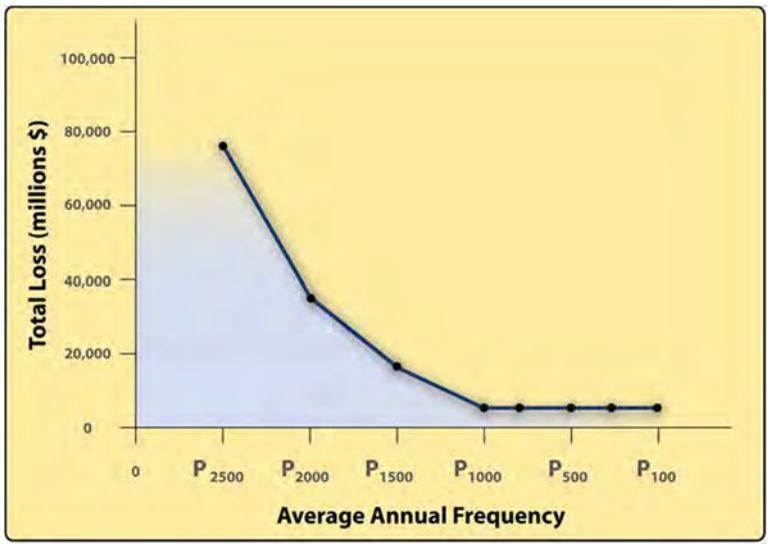
1. Contribution of potential losses from all future disasters is accounted for with this approach.
2. Results in this form from different hazards are readily comparable and hence easier to rank.
3. When evaluating mitigation alternatives, use of annualized losses is the most objective approach for this purpose.

Annualized Losses for the hazards where the parametric approach is utilized are computed in a three- step process:

1. Compute/estimate losses for a number of scenario events with different return periods (e.g., 10-year, 100-year, 200-year, 500-year, etc.).
2. Approximate the probability versus loss curve through curve fitting.
3. Calculate the area under the fitted curve to obtain annualized losses.

This approach is illustrated graphically in Figure 4.5. For other hazards where the statistical approach was used, the computations are based primarily on the observed historical losses.

Figure 4.5: Graphical Representation of the Annualized Loss Methodology



Economic Impact

Using the previously described methodology, results were obtained for the different hazards profiled earlier. The economic results are summarized in Table 4.6.

The economic loss results are presented here using AL, which is the estimated long- term value of losses to the general building stock in any single year in a specified geographic area (i.e., county). The estimated AL addresses the two key components of risk: the probability of a hazard occurring in the study area and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historical patterns of frequent smaller events with infrequent but larger events to provide a

balanced presentation of the risk. Specific information for individual jurisdictions is provided in the applicable hazard sections.

Table 4.6: Summary of Annualized Loss (AL) Estimates

Flood (Surge)	Hurricane (Wind)	Windstorm	Tornado	Flooding	Hail
*$702,705,416	$78,126,283	$1,684,380	$579,213	$91,037	$31,554

Note: *Countywide Estimate from HAZUS-MH

A summary of the ALR results is presented in Table 4.7. The ALR represents the AL as a fraction of the replacement value of the local inventory. The ALR gauges the relationship between average annualized loss and replacement value. This ratio can be used as a measure of vulnerability in the areas, and since it is normalized by replacement value, it can be directly compared across different jurisdictions. Specific information for individual jurisdictions is provided in the applicable hazard sections.

Table 4.7: Summary of the Annualized Loss Ratios (ALR)

Flood (Surge)	Hurricane (Wind)	Windstorm	Tornado	Flooding	Hail
*1.9%	0.44%	0.00%	0.00%	0.00%	0.00%

Note: *Countywide Estimate from HAZUS-MH

4.3 Risk Ranking

The GCHMC reviewed a hazard ranking process presented by the planning team as shown in Table 4.8. This methodology evaluates five risk characteristics against a scoring factor to establish a level of vulnerability and to assess the level of future occurrence.

Table 4.8 - Natural Hazard Identification Methodology

Risk Characteristic (Vulnerability)		Score
Area Impacted (The % of the jurisdiction at risk to an impact from each hazard)	No area in the jurisdiction directly impacted	0
	Less than 25% of the jurisdiction impacted	1
	Less than 50% of the jurisdiction impacted	2
	Less than 75% of the jurisdiction impacted	3
	Over 75% of the jurisdiction impacted	4
Health And Safety Consequences (The health and safety consequences that can occur)	No health and safety impact	0
	Few injuries or illnesses	2
	Few fatalities but many injuries or illnesses	3
	Numerous fatalities	4
Property Damage (The amount of property damage that can occur)	No property damage	0
	Few properties destroyed or damaged	1
	Few destroyed but many damaged	2
	Few damaged and many destroyed	3
	Many properties destroyed and damaged	4
Environmental Damage (The environmental damage that can occur)	Little or no environmental damage	0
	Resources damaged with short-term recovery	1
	Resources damaged with long term recovery	2
	Resources destroyed beyond recovery	4
Economic Disruption (The economic disruption that can occur)	No economic impact	0
	Low direct and/or indirect costs	1
	High direct and low indirect costs	2
	Low direct and high indirect costs	3
	High direct and high indirect costs	4
Future Occurrence		
Probability Of Future Occurrence Unlikely (Score 0-1) Likely (Score 2-3) Highly Likely (Score 4-5)	Less than 1 occurrence in the next 10 years	1
	1 - 4 occurrences within the next 10 years	2
	5 - 7 occurrences within the next 10 years	3
	8 – 10 occurrences within the next 10 years	4
	More than 10 occurrences within 10 years	5
Risk Level	Total Rating Score	
Low	0-33	
A low risk rating is expected to have little to no impact upon the jurisdiction. The hazard poses minimal health and safety consequences to the state's residences and is expected to cause little to no property damage. *The occurrence of a hazard with a low risk rating is rare; however, due to other factors such as geographical location, it is still possible for such a hazard to occur and even cause significant damage based upon the magnitude of the event.*		
Medium	34-67	
A medium risk rating is expected to have a moderate impact upon the jurisdiction. The hazard poses minor health and safety consequences with minor injuries expected and few to no fatalities. The hazard may cause some properties to be damaged or destroyed. *The occurrence of a hazard with a medium risk rating is likely at least once within the next 25 years.*		
High	68 to 100	
A high risk rating is expected to have a significant impact upon the jurisdiction. The hazard poses high health and safety consequences with numerous injuries and fatalities possible. The hazard may even cause some properties to be damaged or destroyed. *A hazard with a high risk rating is expected to occur at least once within a 12 month period, but can occur multiple times within a year.*		

To ensure a base line of understanding of each hazard and to assist with the process of risk rankings, information was gathered from the 2011 plan; the public survey; the NCDC storm data base; and TDEM and presented to the GCHMC prior to completion of the risk ranking exercise.

Once the risk characterization was completed for each identified natural hazard, the sum of the risk characteristics were added together and multiplied by the probability of occurrence to determine each hazard's total risk rating score. The maximum score possible was 100. Table 4.9 provides a recap of the risk level attained for each hazard. The completed scoring sheets for each jurisdiction are provided in Appendix C.

Table 4.9: Summary of Hazard Ranking

Jurisdiction	Flood (Coastal and Inland)	Hurricane/Tropical Storm	Tsunami	Tornado	Windstorm	Hailstorm	Lightning	Winter storm	Drought	Extreme Heat	Wildfire (Urban and Rural)	Coast Erosion and Retreat	Land Subsidence	Earthquake	Dam/Levee Failure	Expansive Soils	Pipeline Failure	Hazardous Material Incents
Bayou Vista	H	H	L	H	H	H	M	L	L	M	L	L	L	L	L	L	M	M
Clear Lake Shores	L	M	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Friendswood	H	L	L	L	L	L	M	L	L	L	L	L	L	L	L	L	L	L
Hitchcock	L	L	L	L	M	M	L	L	L	L	L	L	L	L	L	L	L	L
Jamaica Beach	M	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Kemah	H	H	L	H	H	H	H	M	H	H	M	H	M	M	M	M	H	H
La Marque	M	M	L	L	H	M	H	L	L	L	L	L	L	L	M	L	M	M
League City	M	L	L	L	M	M	L	L	L	L	L	L	L	L	L	L	L	L
Santa Fe	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Tiki Island	H	H	L	M	M	M	M	L	L	L	L	L	L	L	L	L	L	L
Galveston County	L	M	L	L	H	L	L	L	L	L	L	L	L	L	L	L	M	M

4.4 Conclusions

The results of this study are useful in following ways:

- ***Improving our understanding of the risk associated with the natural hazards in the study area through a better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad factors that influence risk***

  An understanding of these relationships is critical for making balanced and informed decisions about managing the risk.

- ***Providing a baseline for policy development and comparison of mitigation alternatives***

  The data used for this analysis present a current picture of risk in Galveston County. Updating this risk "snapshot" with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.

- C***omparing the risk of the natural hazards addressed***

  The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the natural hazards that are present in the study area. This final step in the risk assessment provides the necessary information for the GCHMC to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the region.

5.0 Hurricane/Tropical Storm

5.1 Description

By far the most severe, common and geographically extensive impact on the Galveston County planning area from a natural hazard is caused by hurricanes, coastal storms and the associated wind and storm surge.

Hurricanes and tropical storms are naturally occurring events that produce damaging high winds, generate dangerous storm surge flooding, cause pounding storm surf, spawn tornadoes, and produce torrential rainfall that can cause inland flooding.

On a recurring basis, hurricanes are the strongest natural hazard threat to human life and property. Tropical storms and hurricanes threaten the Galveston County planning area with high winds, rain, and storm surge. Galveston County and the participating jurisdictions participate with local media in educating the public about the dangers of hurricanes. Due to the size of hurricanes and tropical storms, the entire planning area can be impacted by these storms.

The Atlantic hurricane season begins June 1 and ends November 30, but hurricanes have developed outside of the designated season.

The following terms are used to describe tropical storms / hurricanes:

Tropical Wave: A trough or cyclonic curvature maximum in the trade-wind easterlies. The wave may reach maximum amplitude in the lower middle troposphere.

Tropical Depression: A tropical cyclone with maximum sustained surface wind speeds (using the U.S. 1-minute average) of 33 kts (38 mph or 62 km/hr) or less.

Tropical Storm: A tropical cyclone with maximum sustained surface wind speed (using the U.S. 1-minute average) ranges from 34 kts (39 mph or 63 km/hr) to 63 kts (73 mph or 118 km/hr).

Hurricane: A tropical cyclone with maximum sustained surface winds (using the U.S. 1-minute average) of 64 kts (74 mph or 119 km/hr) or more.

Storm Surge

According to the National Hurricane Center, along the coast, the greatest potential for loss of life related to a hurricane is from storm surge. Low pressure and strong circular winds "pile" the water into a dome shape that can be 50-100 miles wide. The surge travels with the storm and is most severe in the right quadrant of the storm; relative to the direction the storm travels. Surge can be 15 feet deep, topped by waves, and make landfall ahead of the center or "eye" of the hurricane. Wind-driven waves are superimposed on the storm tide. This rise in water level can cause severe flooding in coastal areas, particularly when the storm tide coincides with normal high tides.

Because much of the United States' densely populated Atlantic and Gulf Coast coastlines lie less than 10 feet above mean sea level, the danger from storm tides is tremendous. For example, Hurricane Ike produced storm surges up to 8 feet above the normal tide- level.

Hurricane Wind

Hurricane wind intensity is measured with the Saffir-Simpson Scale based on a 1-5 rating of a sustained wind speed at the time of measurement. This is used to estimate the potential property damage expected along the coast from a hurricane landfall. Hurricanes reaching Category 3 and higher are considered major hurricanes because of potential significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. Wind speed is the determining factor in the scale. All winds are described using the U.S. 1-minute average. Previously, storm surge was described by the Saffir-Simpson Scale but is no longer included.

The following excerpt from the National Hurricane Center explains the revised definition of the Saffir-Simpson Hurricane Scale and the separation of storm surge from storm category followed by an explanation of the need to change the new range of wind speeds:

> *Earlier versions of the Saffir-Simpson Hurricane Scale incorporated central pressure and storm surge as components of the categories. The central pressure was used during the 1970s and 1980s as a proxy for the winds as accurate wind speed intensity measurements from aircraft reconnaissance were not routinely available for hurricanes until 1990. Storm surge was also quantified by category in the earliest published versions of the scale dating back to 1972. However, hurricane size (extent of hurricane-force winds), local bathymetry (depth of near-shore waters), topography, the hurricane's forward speed and angle to the coast also affect the surge that is produced. For example, the very large Hurricane Ike (with hurricane force winds extending as much as 125 mi from the center) in 2008 made landfall in Texas as a Category 2 hurricane and had peak storm surge values of about 20 feet. In contrast, tiny Hurricane Charley (with hurricane force winds extending at most 25 mi from the center) struck Florida in 2004 as a Category 4 hurricane and produced a peak storm surge of only about 7 feet These storm surge values were substantially outside of the ranges suggested in the original scale. Thus*

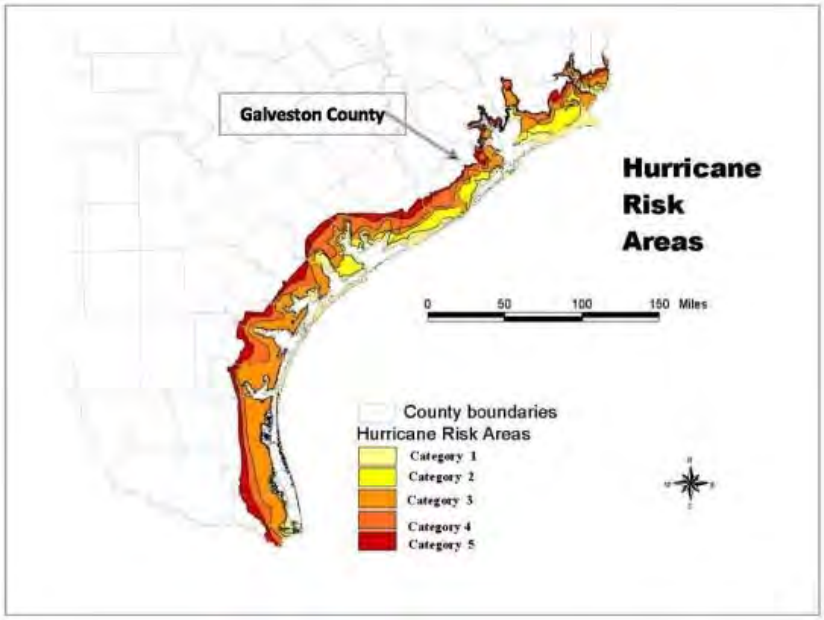
to help reduce public confusion about the impacts associated with the various hurricane categories as well as to provide a more scientifically defensible scale, the storm surge ranges, flooding impact and central pressure statements are removed from the Saffir-Simpson Hurricane Scale and only peak winds are employed in this revised version.

The Saffir-Simpson Hurricane Wind Scale (SSHWS) has undergone a minor modification for 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph. This change does not alter the category assignments of any storms in the historical record, nor will it change the category assignments for future storms.

5.2 Location

As a coastal community, Galveston County is vulnerable to threats directly and indirectly related to a hurricane event, such as high winds, storm surge, and flooding. Beachfront communities, including Jamaica Beach, face the primary impact of hurricane winds; however hurricanes and their secondary hazards can affect the entire county.

Figure 5.1: Hurricane Risk Areas



Although all areas of the county are impacted during a hurricane, the low-lying coastal areas receive the most flooding, and communities along rivers, bays and estuaries, including Tiki Island, Bayou Vista, Hitchcock, Clear Lake Shores and Kemah, experience flooding earlier. The effects of a hurricane begin to diminish as it moves inland; although no single area of the county is free of risk. For example, the winds alone from Hurricane Ike covered 120 miles, stretching across the county, but all areas were impacted by high winds and flooding. Figure 5.1 displays the location of hurricane risk by storm category along the Texas Gulf Coast.

5.3 Extent

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (See Table 5.1 on the next page). A Category 1 storm has the lowest wind speeds while a Category 5 hurricane has the highest. This scale only ranks wind speed, but lower category storms can inflict greater damage than higher category storms depending on where they strike, other weather they interact with and how slow they move. As a prime example, Hurricane Ike, which struck Galveston in 2008 and is discussed herein, was classified as a Category 2 storm, yet was one of the costliest natural disasters in Texas history.[1]

The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture and relatively light winds aloft. Persistent, favorable conditions can produce violent winds, destructive waves, torrential rains and powerful floods. In an average three-year period, roughly five hurricanes strike the US coastline, killing approximately 50 to 100 people anywhere from Texas to Maine. Of these, two are typically "major" or "intense" hurricanes (a Category 3 or higher storm on the Saffir-Simpson Hurricane Scale).

The Saffir-Simpson Hurricane Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure and storm surge potential. Wind, pressure and surge are combined to estimate potential damage. Categories 3, 4 and 5 are classified as “major” hurricanes. Major hurricanes comprise only 20 percent of total tropical cyclone landfalls, but they account for over 70 percent of the damage in the United States. Damage from hurricanes can result from spawned tornadoes, coastal flooding from storm surge, and inland flooding from heavy rainfall.

[1] FEMA. 2008. Hurricane Ike Impact Report. Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division. Washington, D.C.

Table 5.1: Saffir-Simpson Hurricane Wind Scale (revised 2012)

Category	Previous Range	New Range	Effects on Land
1	74-95 mph	No change	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	No Change	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	111-130 mph	111-129 mph	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 several days to weeks after the storm passes
4	131-155 mph	130-156 mph	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	Greater than 155 mph	Greater than 157 mph	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: National Hurricane Center

Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes. Debris such as signs, roofing material, and small items left outside become extremely hazardous in hurricanes. Extensive damage to trees, towers, water and underground utility lines (from uprooted trees), and fallen poles cause considerable civic disruption.

Table 5.2 profiles the potential winds speeds in miles per hour (MPH) that could be expected in Galveston County during a hurricane event for various return periods.

Table 5.2: Average Hurricane Wind Speeds in Galveston County

Jurisdiction	Wind Speed (mph) Verses Return Period (year)						
	10	20	50	100	200	500	1000
Bayou Vista	69	97	111	119	125	134	129
Clear Lake Shores	70	92	114	128	135	142	138
Friendswood	65	85	110	115	128	133	144
Hitchcock	69	95	111	116	123	133	134
Jamaica Beach	71	95	113	104	119	134	133
Kemah	69	92	113	127	133	141	140
Le Marque	69	96	111	120	125	134	139
League City	67	89	111	121	129	135	143
Santa Fe	67	93	110	114	123	132	132
Village of Tiki Island	71	97	113	119	124	136	136
Galveston County Unincorporated	66-75	89-99	110-117	104-132	119-138	130-147	116-150

Source: HAZUS-MH

5.4 Historical Occurrences

It is significant to note that the deadliest hurricane disaster in U.S. history, known as "the Galveston Hurricane of 1900," made landfall and inundated the entire island city of Galveston, Texas, around September 8, 1900. More than 8,000 people died when hurricane storm tides (the surge plus the astronomical tide) of 8 to 15 feet covered the city. More than half of all the homes and buildings were destroyed. Property damage has been estimated at $700 million (in today's dollars).

Path of Hurricane Ike

Even though only a Category 2 Storm at landfall, Hurricane Ike, which hit Galveston on September 13, 2008, is ranked as the third most destructive ever to make landfall in the United States.[2] Maximum sustained winds were 100 mph, with hurricane-force winds extending outward up to 120 miles from the center and tropical storm force winds extending outward up to 275 miles.

The majority of the housing damage in the Galveston Bay area was to buildings constructed in the 1960s and 1970s. Hurricane Ike demonstrated that enforced modern building and floodplain codes work well to reduce damage to the built environment. Many homes that were built since the 1990s that were properly elevated did not sustain serious damages, whereas winds devastated homes on Galveston Island that were built under older building codes. Modern homes that were constructed to 130 mph wind codes required by the International Residential Building Code were still standing the morning after Ike.

Other significant historical hurricane events that have impacted Galveston County include a large and violent hurricane on August 16, 1915 and Hurricane Alicia on August 18, 1983, which moved over the Texas coast about 25 miles southwest of Galveston causing a total of over $2.4 billion in damages (in today's dollars).[3] Table 5.3 provides a summary of hurricane/tropical storms from 1998 to 2015 as recorded by the NCDC. The data for hurricane/tropical storms is recorded on a countywide level and therefore includes Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, Tiki Island, and the unincorporated areas of Galveston County.

Table 5.3: Galveston County Hurricane/Tropical Storm Events 1998-June 2015

Date	Event Type/Name	Deaths	Injuries	Property Damage	Event Summary
8/21/1998	Tropical Storm Charley	0	0	$ 5,000	Damage was minimal across the area, with beach erosion accounting for the damage estimates.
9/7/1998	Tropical Storm Frances	2	0	$200,000,000	Impact and resultant damage occurred in Galveston, Harris, Brazoria and Matagorda counties of Texas. All four of these counties received a Presidential Disaster Declaration to help in the relief and recovery efforts. In these four counties, total damage exceeded $286 million dollars. Most of this damage was along the coast and around Galveston Bay where

[2] FEMA. 2008. Hurricane Ike Impact Report. Department of Homeland Security, Federal Emergency Management Agency, Mitigation Division. Washington, D.C.
[3] Hurricane history based on National Hurricane Center summaries.

Date	Event Type/Name	Deaths	Injuries	Property Damage	Event Summary
					high tides and winds destroyed dunes and personal property.
6/5/2001	Tropical Storm Allison	0	0	$31,740,000	Major flooding across the county.
9/5/2002	Tropical Storm	0	0	$0-	No details provided
7/14/2003	Hurricane (Typhoon) Claudette	0	0	$8,300,000	In Galveston County, 38 single family homes were destroyed, 25 received major damage, and 964 received minor damage. 33 businesses were affected with damage costs of an estimated $970,000. Total damage, including beach erosion, was estimated at $8.3 million. The highest recorded tide level, 7.56 feet above mean low-lower water, was recorded at Pleasure Pier.
8/30/2003	Tropical Storm Grace	0	0	$7,000	Heavy rainfall between 6 and 12 inches was observed from extreme eastern Galveston County to across the Bolivar Peninsula. Beach erosion was minor. Some of the higher rainfall amounts (August 30th to August 31st) included 6.19 inches in League City, and 2.09 inches at Jamaica Beach.
9/1/2003	Tropical Storm Grace	0	0	$7,000	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.
9/23/2005	Hurricane (Typhoon) Rita	0	3	$15,000,000	In Galveston County, tropical storm force sustained winds with gusts to hurricane force were reported across the county, especially on the Bolivar Peninsula. Numerous power poles and road signs were blown down on Bolivar. Many of the beach homes received roof damage. Numerous trees were down with small structure damage on High Island. Power was out to most of the county on Saturday. Total damage across the county was around $15 million.
8/5/2008	Tropical Storm Edouard and Storm	0	0	$95,000	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

Date	Event Type/Name	Deaths	Injuries	Property Damage	Event Summary
	Surge/Tide				single family homes and two mobile homes experienced flooding up to six inches deep inside the home.
9/12/2008	Storm Surge/Tide Ike	12	0	$4,000,000,000	Storm tide ranged from 10 to 15 feet above mean sea level along the Galveston Bay, Clear Lake and associated tributaries which caused major flooding of coastal areas. Some higher surge levels up to 17 feet were indicated on the Bolivar Peninsula. At least 10 direct fatalities occurred in Galveston County. Number of injuries unknown. Some towns hit hard by surge include Galveston, San Leon, Kemah, and all towns on Galveston Island and the Bolivar Peninsula.
6/15/2015	Tropical Storm Bill	0	0	$0-	There was minor coastal flooding on the Bolivar peninsula with some debris removal required off of State Highway 87. High surf caused erosion of Galveston Island beaches. Sand and debris washed up on the streets of various west end island communities. There was minor flooding damage to downstairs garages in Jamaica Beach with two temporarily closed roads.
Total		14	3	$4,255,154,000	

Source NCDC

5.5 Probability of Future Events

The return period in years for a hurricane passing within 50 nautical miles of Galveston County planning area is 9 years. Taking into account the previous occurrences and return period, a hurricane event for Galveston County, Bayou Vista Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island is likely within the next five years.

5.6 Vulnerability Assessment

HAZUS-MH wind speed data, inventory and damage functions, and methodology were used to determine the annual expected loss at the county level. Table 5.4 shows annualized property losses, and annualized percent loss ratios by jurisdiction and Table 5.5 shows the expected damage to critical facilities by jurisdiction.

Table 5.4: Potential Annualized Losses by Jurisdiction (Hurricane Wind)

Jurisdiction	Total Exposure*	Annualized Losses for Residential Buildings at Risk	Annualized Losses for Commercial Buildings at Risk	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Bayou Vista	$225,154,990	$1,041,508	$14,910	$1,056,418	0.47%
Clear Lake Shores	$243,448,194	$485,036	$48,550	$533,586	0.22%
Friendswood	$3,085,164,965	$10,400,291	$471,560	$10,871,851	0.35%
Hitchcock	$460,075,283	$2,352,932	$38,611	$2,391,543	0.52%
Jamaica Beach	$338,227,637	$2,322,548	$16,854	$2,339,402	0.69%
Kemah	$294,986,165	$708,720	$58,603	$767,323	0.26%
La Marque	$827,263,553	$5,305,660	$330,607	$5,636,267	0.68%
League City	$8,164,064,546	$30,257,633	$1,125,524	$31,383,157	0.38%
Santa Fe	$845,974,919	$5,700,942	$250,454	$5,951,396	0.70%
Tiki Island	$445,402,231	$2,253,333	$48,071	$2,301,404	0.52%
Galveston County Unincorporated	$2,931,109,729	$14,319,250	$574,686	$14,893,936	0.51%
Total	$17,860,872,212	$75,147,853	$2,978,430	$78,126,283	0.44%

Source: HAZUS-MH
Note: *Total Exposure is improved value of parcels in Galveston County

Table 5.5: Critical Facilities Potentially Damaged by Hurricane Wind

Jurisdiction	Total No. of Critical Facilities	100-Year Hurricane Wind			500-Year Hurricane Wind		
		Loss of Function	Partially Functional	Fully Functional	Loss of Function	Partially Functional	Fully Functional
Bayou Vista	0	0	0	0	0	0	0
Clear Lake Shores	1	0	1	1	2	0	0
Friendswood	14	0	7	7	12	2	0
Hitchcock	11	3	8	0	11	0	0
Jamaica Beach	1	0	0	0	0	0	0
Kemah	3	0	0	3	3	0	0
La Marque	13	0	13	0	12	1	0
League City	28	0	28	0	25	3	0
Santa Fe	9	0	9	0	8	1	0
Tiki Island	2	2	0	0	2	0	0
Galveston County Unincorporated	14	0	7	7	14	0	0
Total	96	5	73	18	89	7	0

Source: HAZUS-MH

5.7 Impact

According to the State of Texas Hazard Mitigation Plan (2013), the State Threat and Hazard Identification and Risk Assessment (THIRA) identified a Category 5 hurricane landfall at Galveston Island on Labor Day Weekend as one of the worst case scenarios for the State. Even though warning time for hurricanes has lengthened due to modern and early warning technology, the impact is substantial because it could result in multiple fatalities, a complete shutdown of facilities for 30 days or more, or leave more than 60 percent of property destroyed or severely damaged.

The Texas Gulf Coast has not suffered a direct hit from a Category 4 hurricane since August 1915 hurricane. According to the NWS, if a similar storm were to hit the area today, storm surge would start at 15 feet on the Island and reach 20 to more than 25 feet on the west side of Galveston Bay, flooding most of Galveston County east of I-45, all of Clear Lake Shores and into areas of Harris County. Sustained winds of 130 mph or more lasting for up to several hours would impact houses and businesses “built to code” which are designed to withstand winds less than 100 mph. The impacted number of homes would be substantial as over 600,000 people live in the Category 4 surge zone, which also includes petrochemical plants, the Johnson Space Center and several key industries along Galveston Bay. Unlike rainwater flooding, where the vast majority of people impacted are relatively safe in their homes, the combined surge and wind impact would require an evacuation of as many as 600,000 citizens in the surge zone in order to save lives.

6.0 Flood (Coastal and Inland)

6.1 Description

Floods result from excessive precipitation. The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography; urban drainage systems; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Floods may result from long-term rain events that may last for days and weeks, or they may be caused by short term excessive rainfall.

In this plan, the types of flooding are described in association with their area of impact. Inland flooding may occur due to flash flooding, urban flooding, and/or riverine flooding. Coastal flooding is considered to be storm surge or other wind driven flooding, although excessive rainfall in river basins and drainage systems do amplify the impacts of these events.

- ***Flash Flooding*** Flash floods are the product of heavy localized precipitation falling in a short time period over a given location. Flash floods occur within a few minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Flash floods can destroy buildings and bridges, uproot trees, and scour out new drainage channels. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms.

- ***Urban Flooding*** ponding of water of streets, low-lying areas, highways, underpasses, urban storm drains, and elevation of creek and small stream levels is occurring or imminent. Urban and small stream flood advisories are issued for flooding that occurs within 3 hours after the excessive rainfall.

- ***Riverine Flooding*** is a function of excessive precipitation levels and water runoff volumes within the watershed.

- ***Coastal Flooding*** is typically a result of storm surge, wind-driven waves, and heavy rainfall. These conditions are produced by hurricanes during the summer and fall, and other large coastal storms during the winter and spring. Storm surges may overrun barrier islands and push sea water up coastal rivers and inlets, blocking the downstream flow of inland runoff.

Inland flooding is a function of excessive precipitation levels and water runoff volumes within the drainage systems or watershed of a stream or river. Some river floods occur seasonally when winter or spring rains fill river basins with too much water, too quickly. Torrential rains from hurricanes or tropical storms can also produce riverine flooding. Inland flooding also occurs during flash floods which develop in under an hour and tend to occur in low-lying areas with poor drainage.

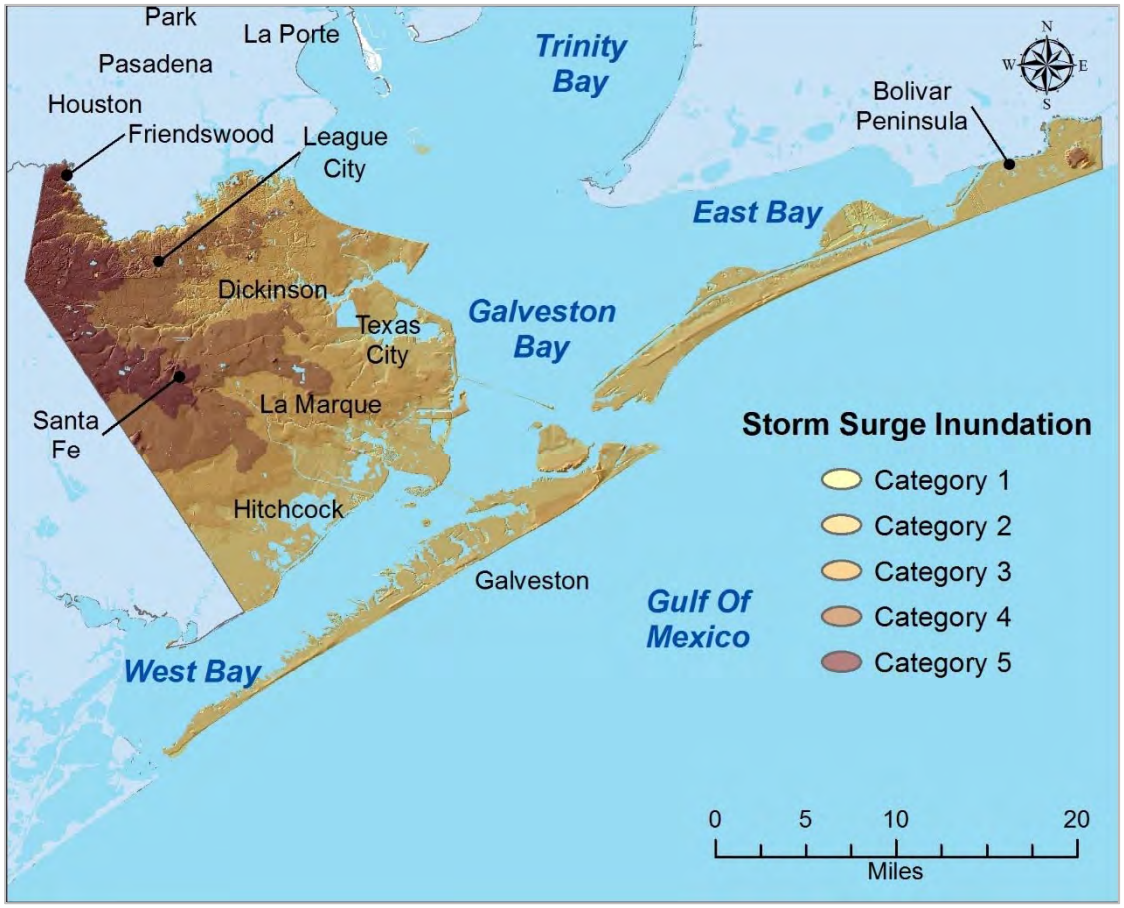
Coastal flooding is typically a result of storm surge, wind-driven waves and heavy rainfall produced by hurricanes, tropical storms, and other large coastal storms. Flooding in the coastal environment can be further exacerbated by tidal influence in the low-lying coastal areas. Higher tides will increase stream and river stage heights from the mouth while floodwaters rush in from upland areas. Flooding in coastal areas is defined by recurrence intervals and flood zones are determined. Coastal flood zones consider the velocity of wave action. Coastal flood results are provided for the five surge inundation zones, and Risk MAP VE zone results are provided in the coastal and inland flood section. Inland flooding is predominantly caused by coastal inundation from the Gulf of Mexico and the Galveston, East and West Bays.

6.2 Location

The coastal flood inundation zone is an area of high potential for property damage and loss of life due to storm surge induced high-velocity wave action. Figure 6.1 depicts these zones.

It is significant to note that Jamaica Beach is located on a barrier island. There are threats to this community that are not applicable to the majority of the other jurisdictions in Galveston County. Hurricane-generated storm surge could very possibly damage surrounding infrastructure, including the bridge leading off of the barrier island. Damage to the bridge could isolate residents from the mainland and deprive residents of essential utility and emergency services.

Figure 6.1: Coastal Flood Inundation Zones in Galveston County



Flooding Potential

The risk map data depicts the following flood hazard areas:

- Zone V/VE (areas of 100-year coastal flood with velocity)
- Zone A/AE (areas of 100-year flood)
- Zone B and X shaded (areas between the limits of the 100-year flood and 500-year flood)
- Zone C and X unshaded (areas of minimal flooding)

Figures 6.2 through 6.12 graphically illustrate the flood zones listed above and provide an indication of where there is potential for damage to property and loss of life in the Galveston County study region. Much of the flooding is attributed to coastal and bay flooding.

Figure 6.2: Flooding Potential (County Wide)

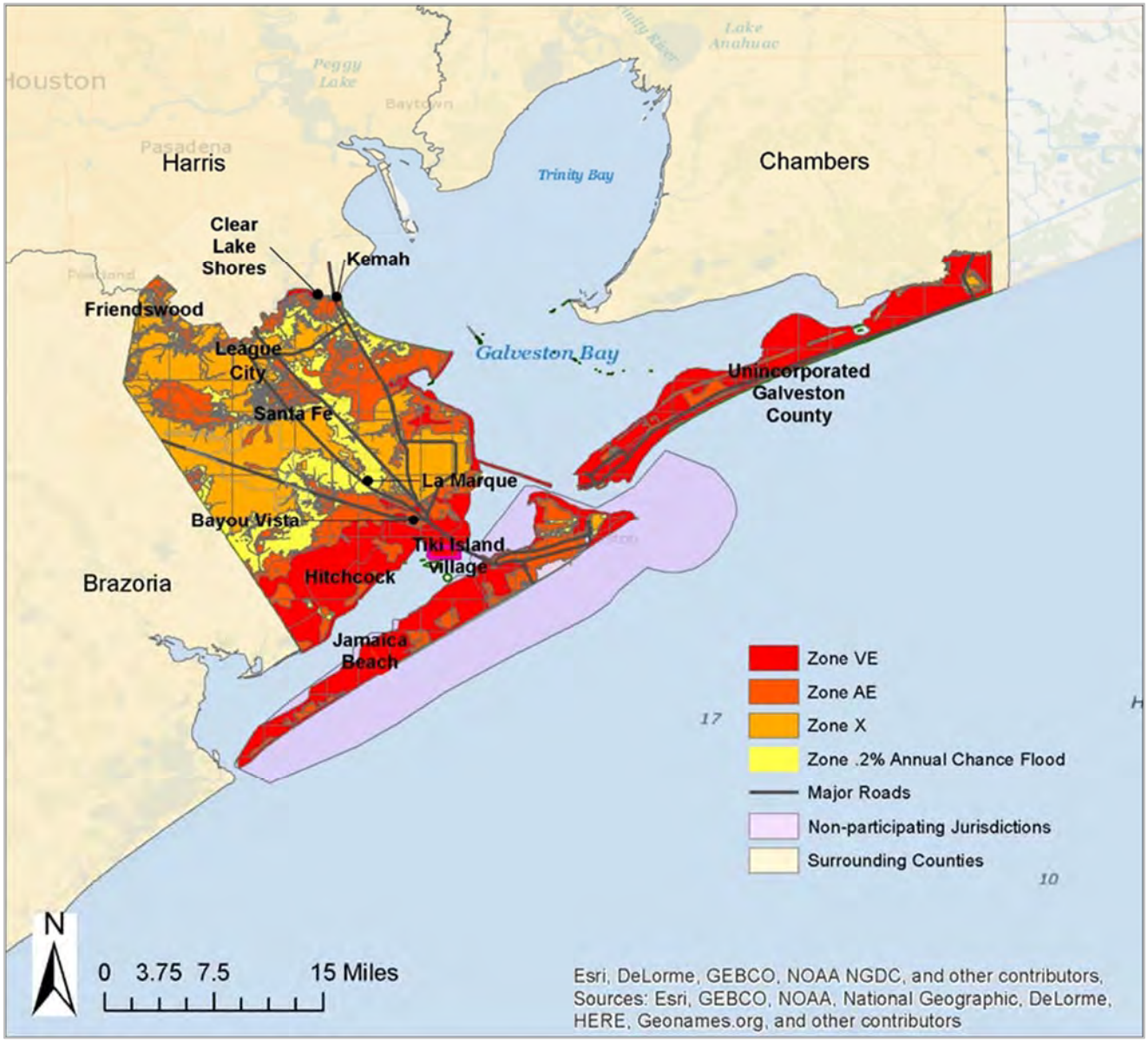


Figure 6.3: Flooding Potential (Bayou Vista)

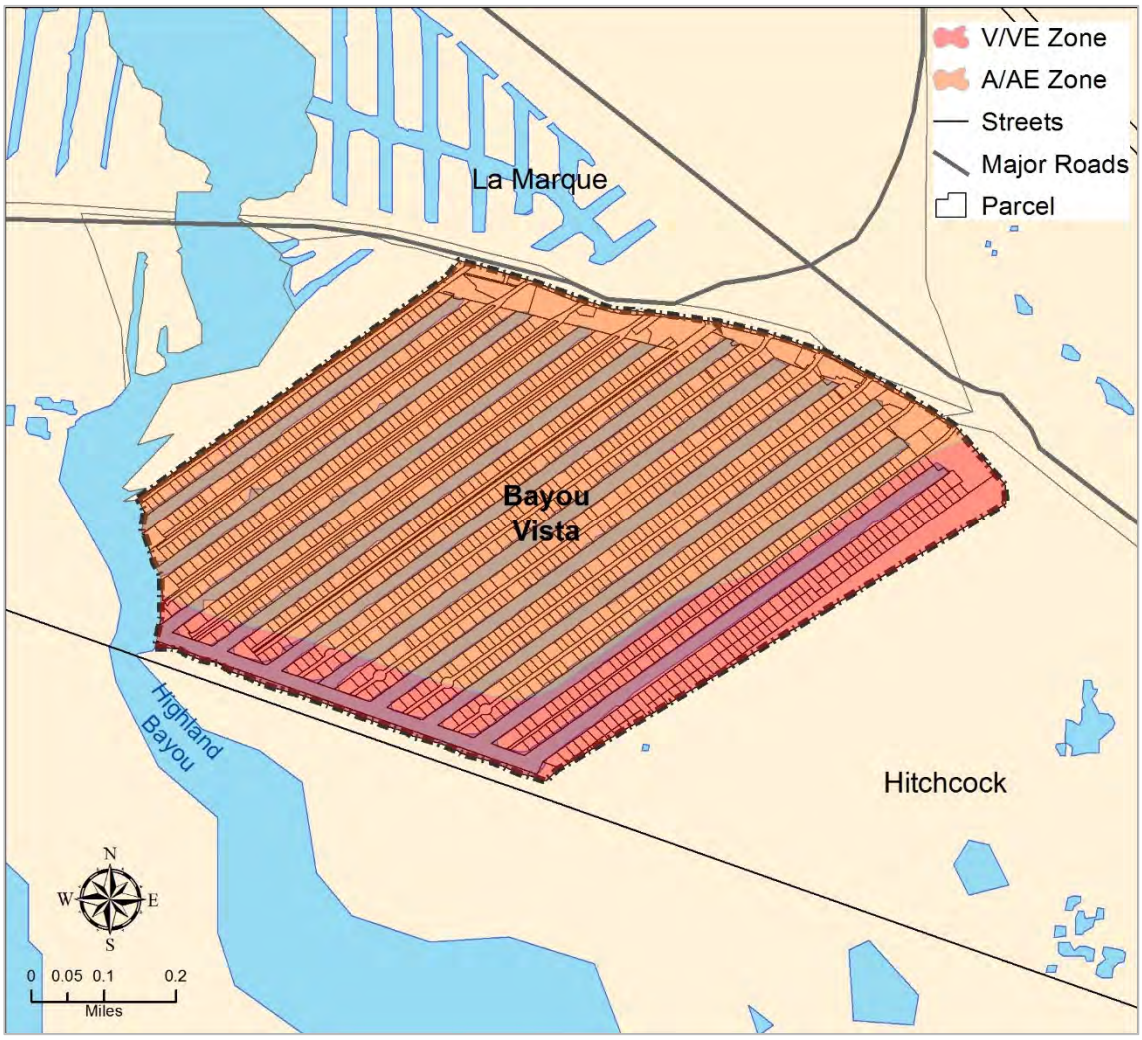


Figure 6.4: Flooding Potential (Clear Lake Shores)

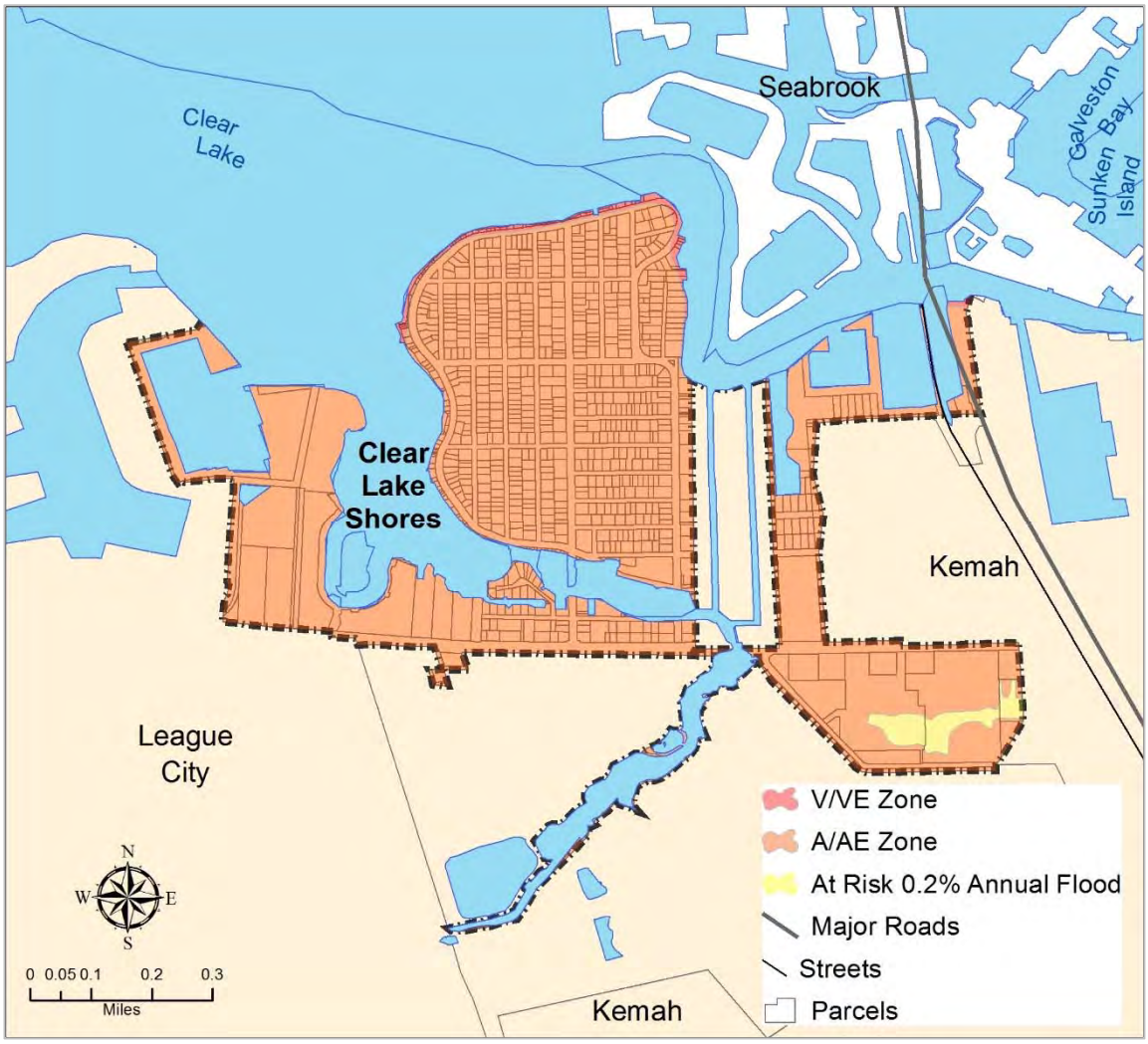


Figure 6.5: Flooding Potential (Friendswood)

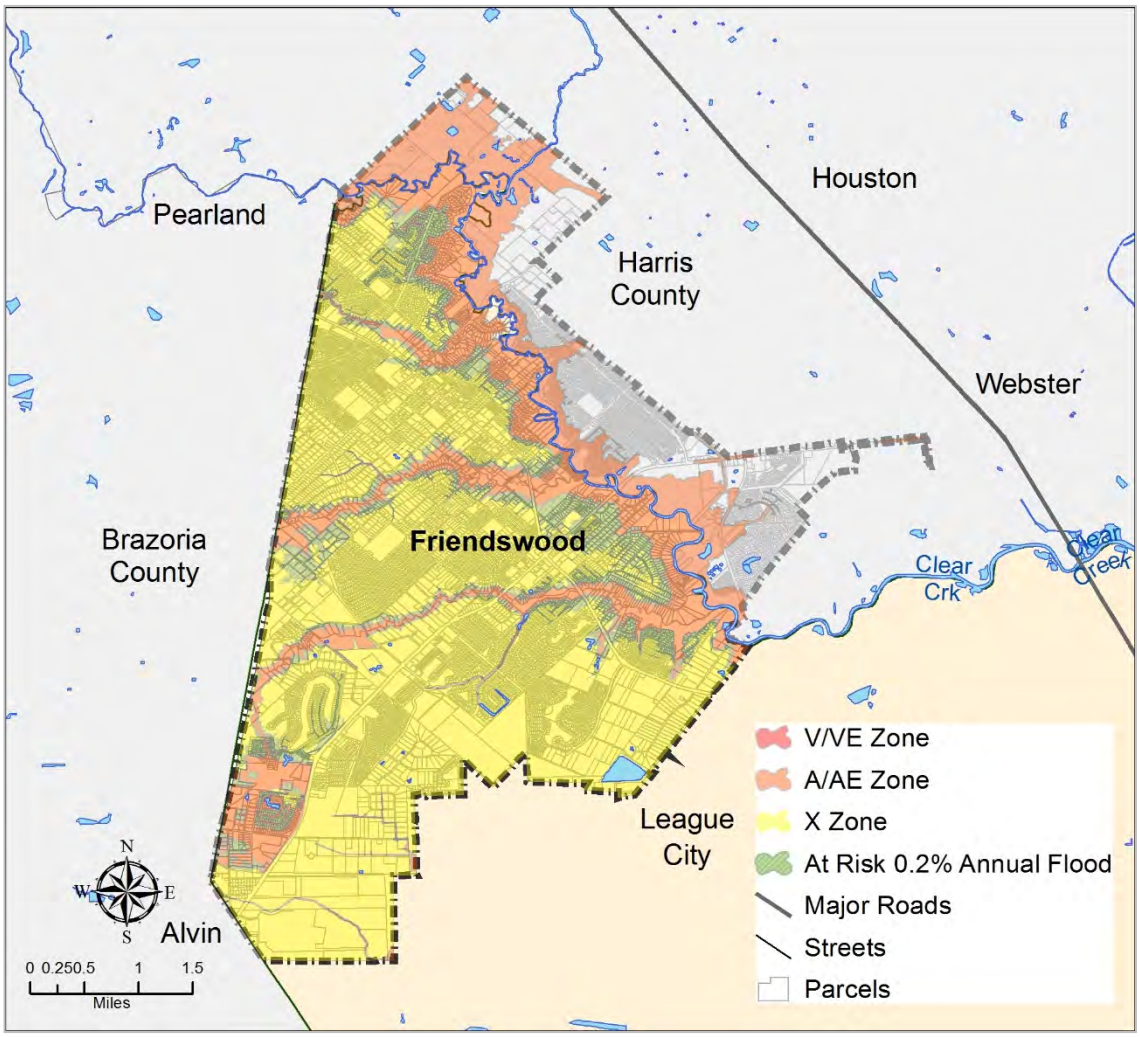


Figure 6.6: Flooding Potential (Hitchcock)

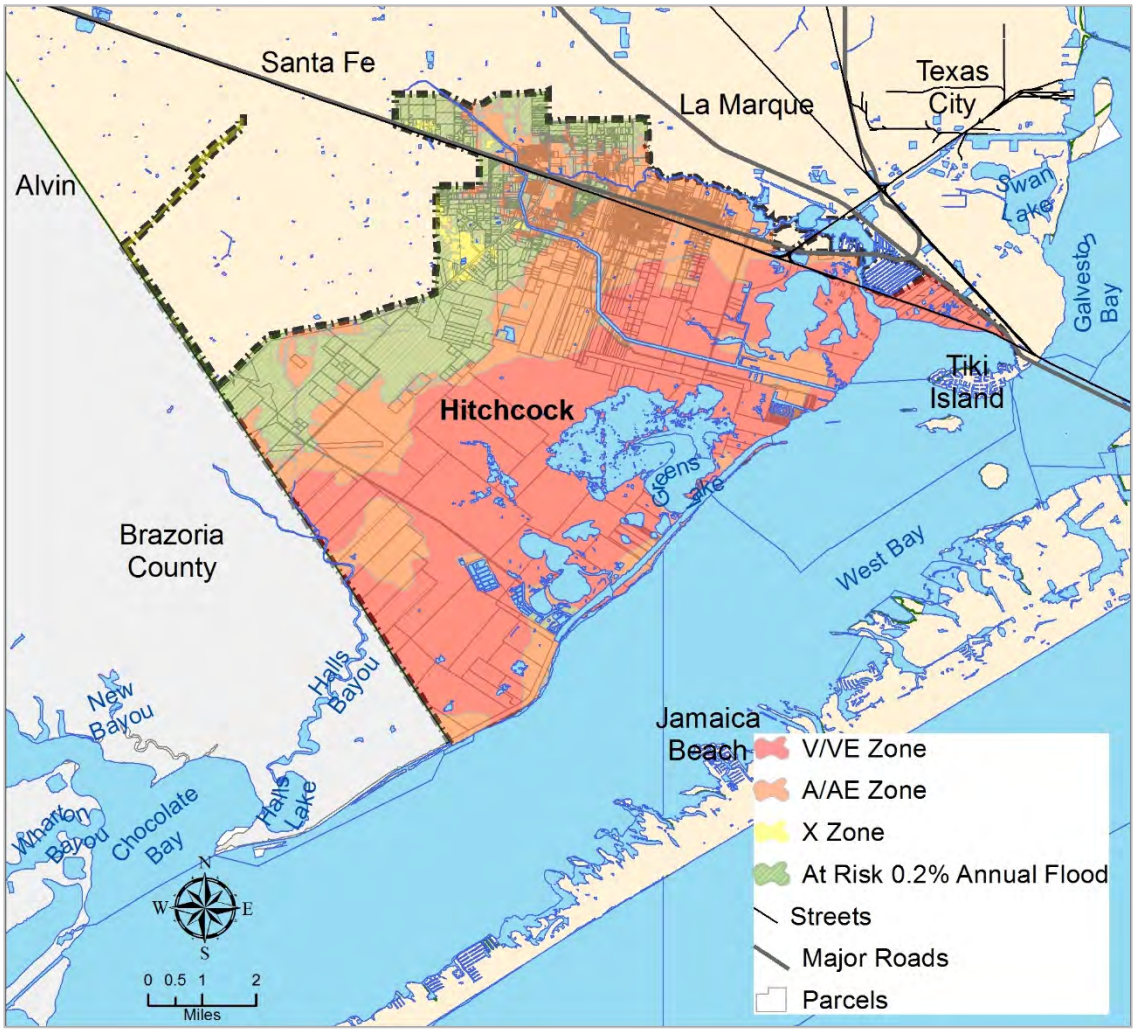


Figure 6.7: Flooding Potential (Jamaica Beach)

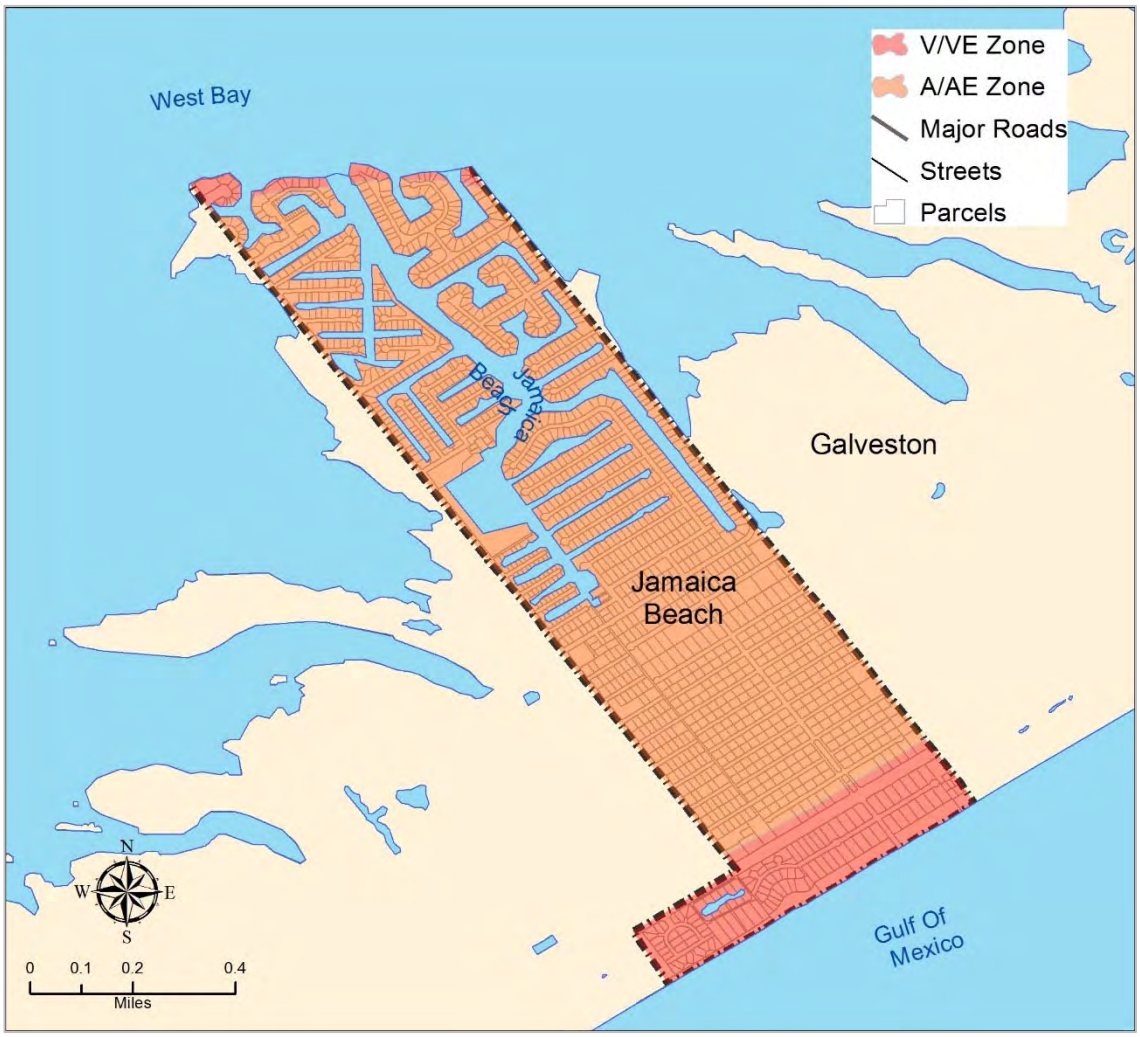


Figure 6.8: Flooding Potential (Kemah)

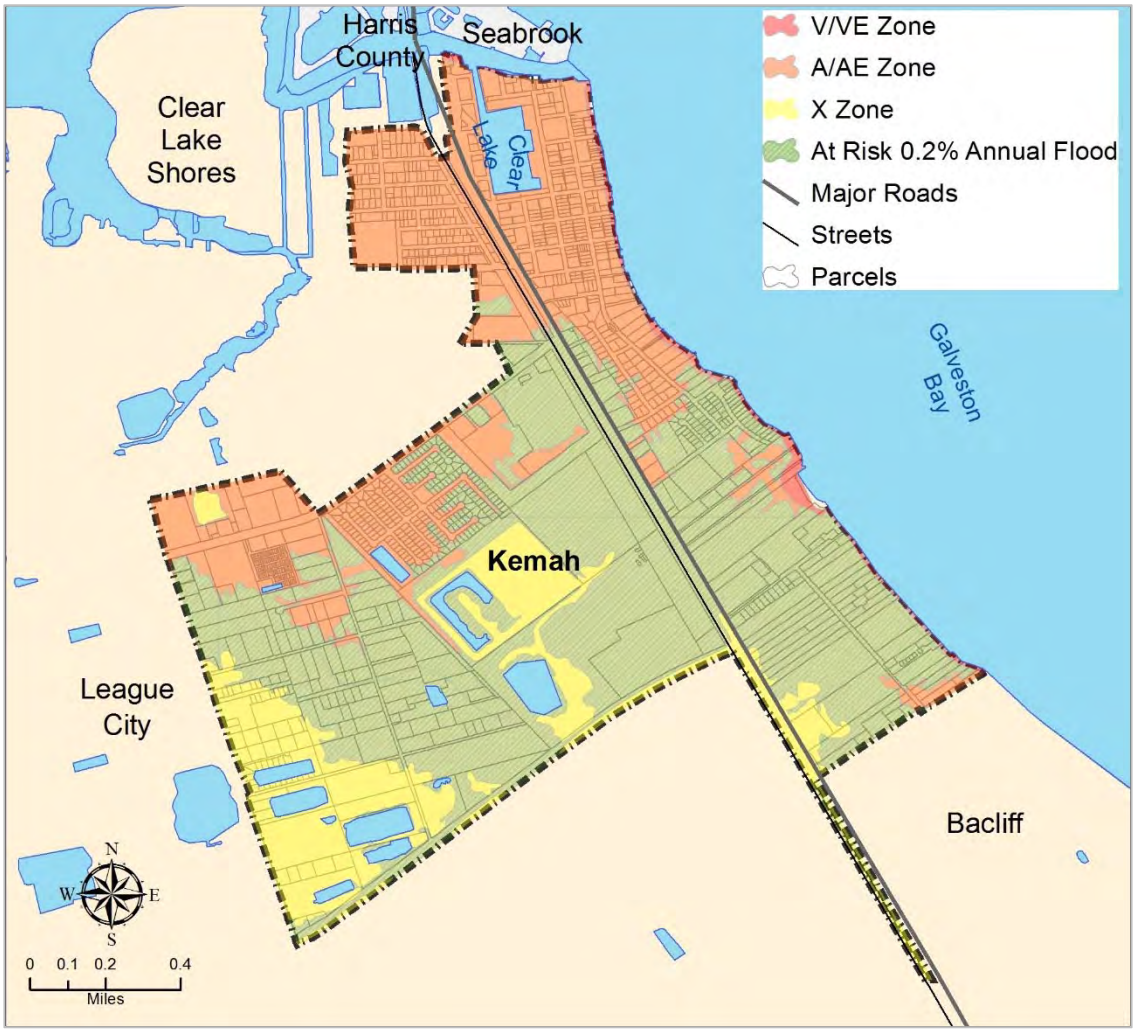


Figure 6.9: Flooding Potential (LaMarque)

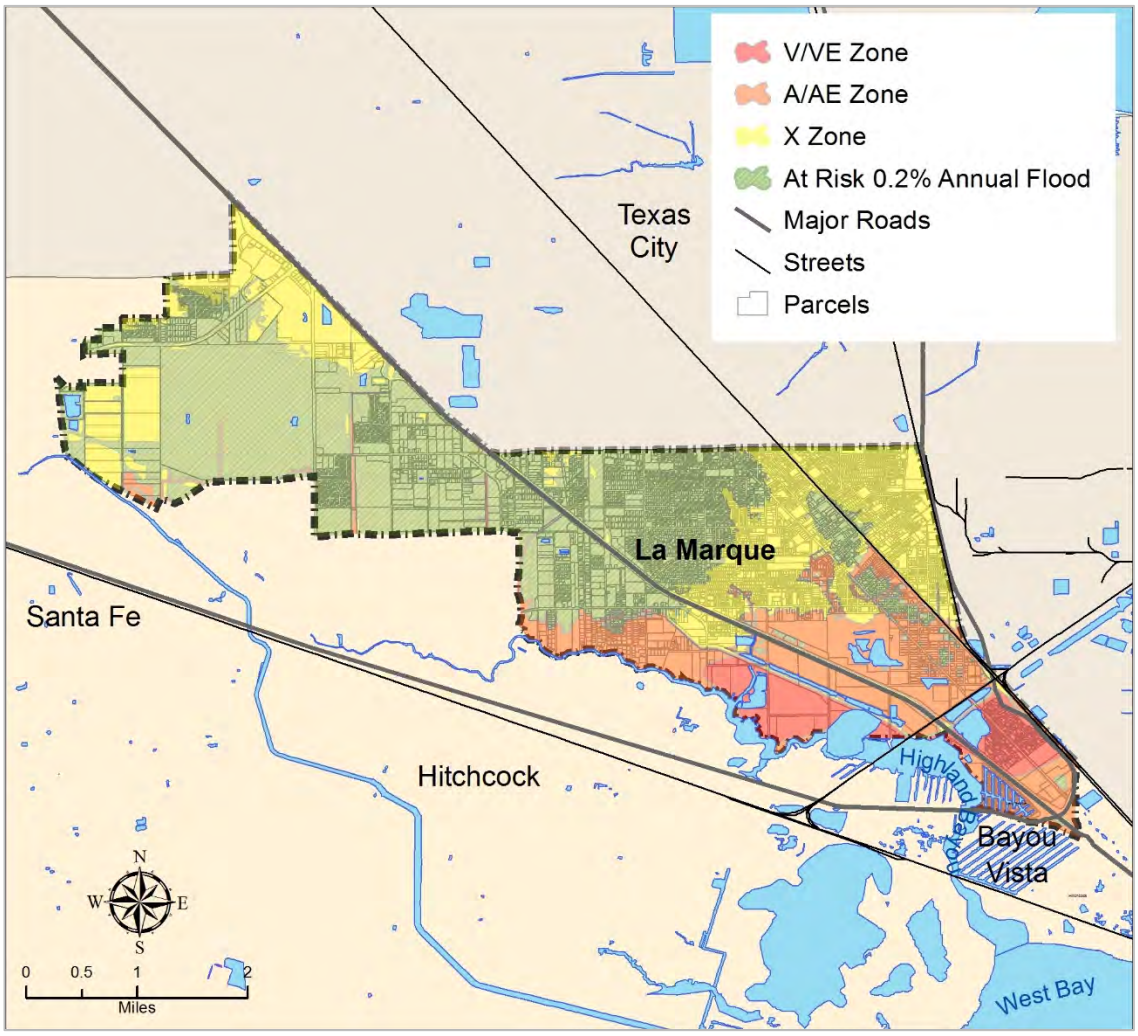


Figure 6.10: Flooding Potential (League City)

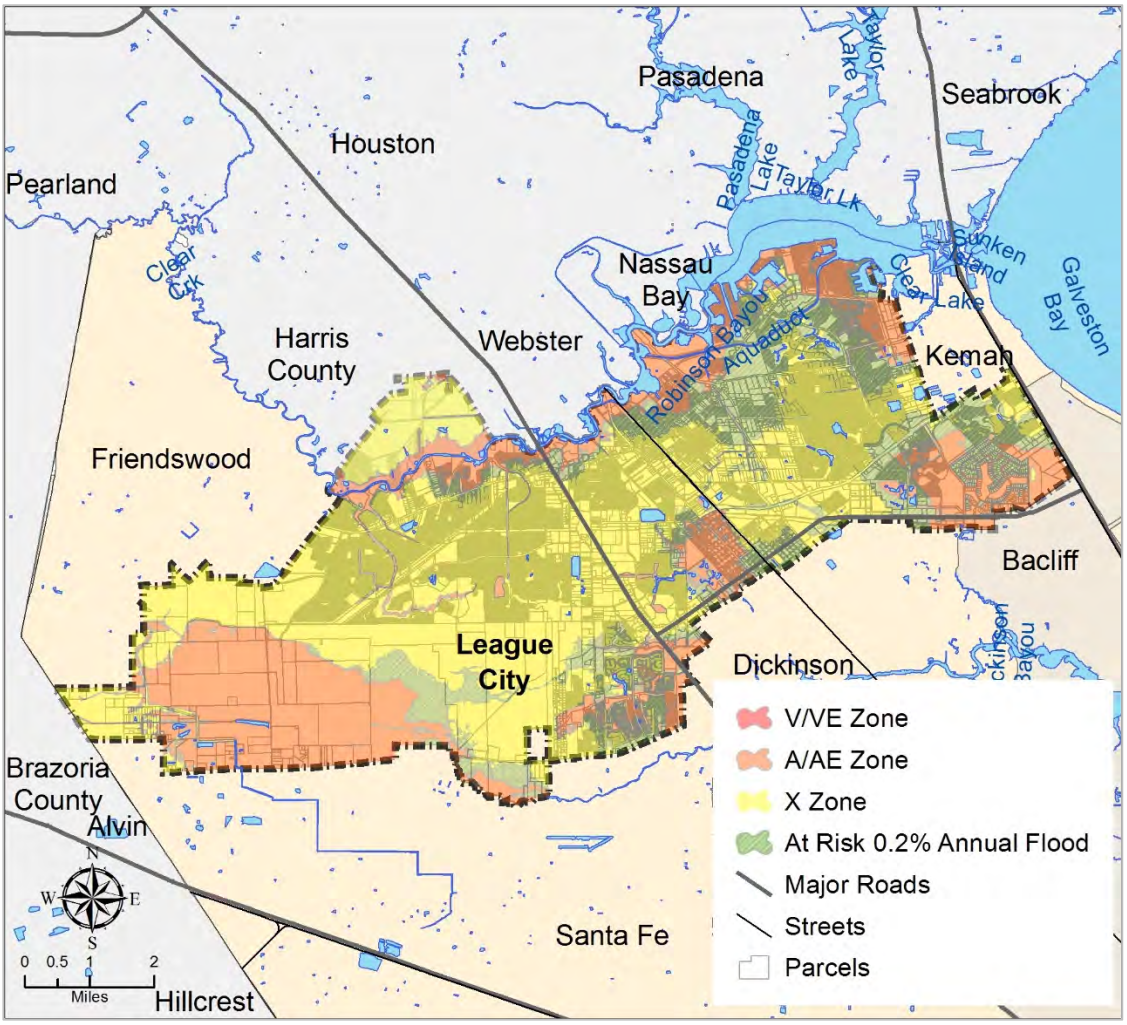


Figure 6.11: Flooding Potential (Santa Fe)

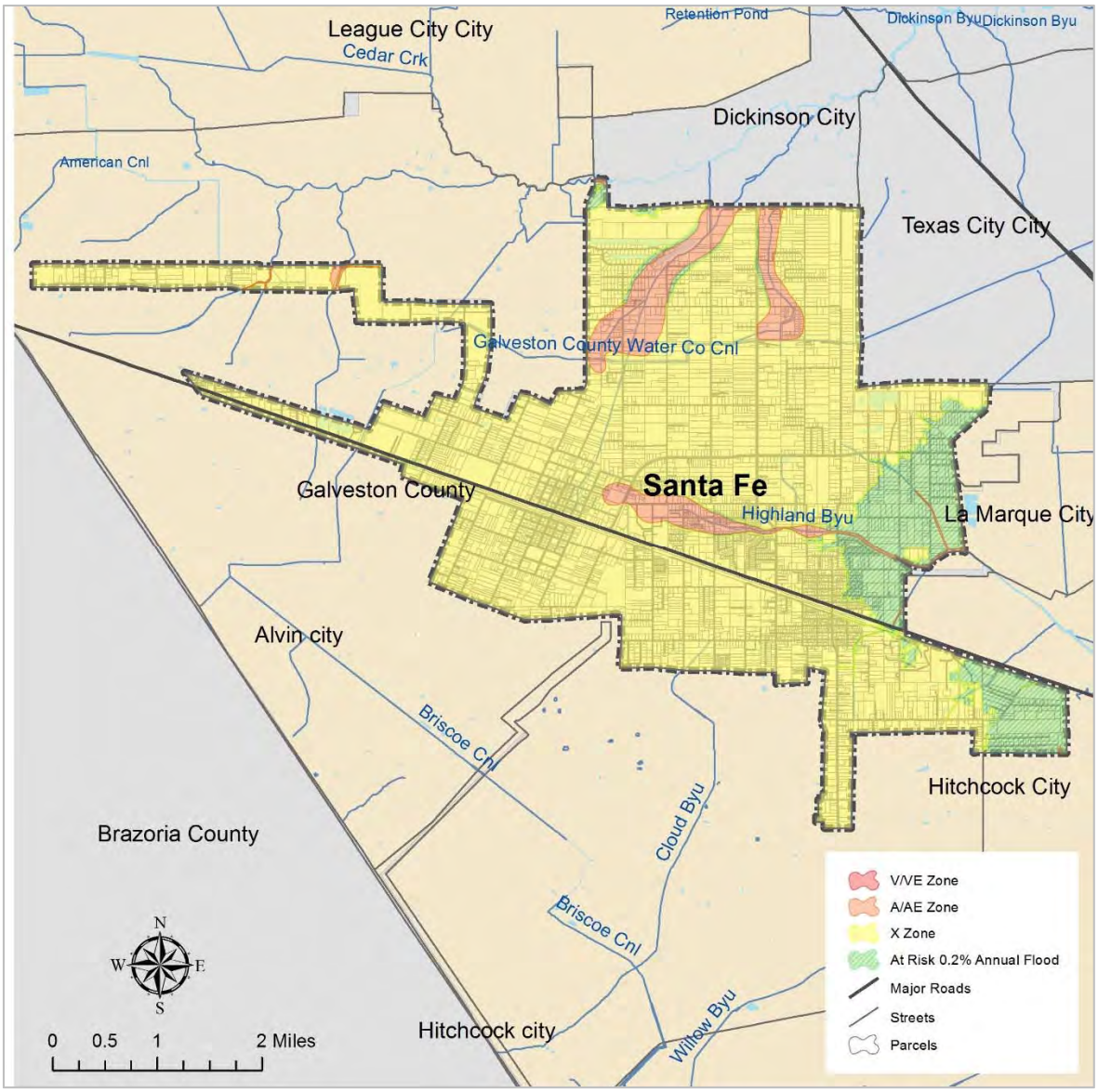


Figure 6.12: Flooding Potential (Village of Tiki Island)

6.3 Extent

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area. Figure 6.13 describes the flood impact in terms of severity or potential harm while Figures 6.2 through 6.12 depicts the flood location and potential magnitude of an event by jurisdiction. To determine the intensity of an event, the figures should be read together. For example, Tiki Island, as shown in Figure 6.12 is mainly in Zone V/VE, meaning that the area is subject to the 100-year flood with the velocity hazard or wave action.

A 100-year flood constitutes a threat to the county. Structures built in the Special Flood Hazard Area (SPHD) are subject to damage by rising waters and floating debris. Moving flood water exerts pressure on everything in its path and causes erosion of soil and scour around solid objects. Utility systems, such as heating, ventilation, air conditioning, fuel, electrical systems, sewage maintenance systems and water systems, if not elevated above base flood elevation, may also be damaged.

Figure 6.13: Description of Flood Zones

Flood Zones		
Zone A	The 100-year or Base Floodplain. There are six types of A zones:	
	A	The base floodplain mapped by approximate methods, i.e., BFEs are not determined. This is often called an unnumbered A zone or an approximate A zone.
	A1-30	These are known as numbered A zones (e.g., A7 or A14). This is the base floodplain where the firm shows a BFE (old format).
	AE	The base floodplain where base flood elevations are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.
	AO	The base floodplain with sheet flow, ponding, or shallow flooding. Base flood depths (feet above ground) are provided.
	AH	Shallow flooding base floodplain. BFE's are provided.
	A99	Area to be protected from base flood by levees or Federal flood protection systems under construction. BFEs are not determined.
	AR	The base floodplain that results from the de-certification of a previously accredited flood protection system that is in the process of being restored to provide a 100-year or greater level of flood protection
Zone V and VE	V	The coastal area subject to velocity hazard (wave action) where BFEs are not determined on the FIRM.
	VE	The coastal area subject to velocity hazard (wave action) where BFEs are provided on the FIRM.
Zone B and Zone X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and the 500-year floods. B zones are also used to designate base floodplains or lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	
Zone C and Zone X (unshaded)	Area of minimal flood hazard, usually depiction FIRMs as exceeding the 500-year flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as base floodplain. Zone X is the area determined to be outside the 500-year flood.	
Zone D	Area of undetermined but possible flood hazards.	

Source: Understanding Your Risks, identifying hazards and estimating losses, FEMA 386-2

To determine the extent of rainfall for the Galveston County planning area, data retrieved from the National Weather Service was reviewed to determine the level of impact recorded for the Houston/Galveston Area). The greatest one day rainfall event occurred on October 8, 1901 with a total of 13.93 inches recorded in the Houston/Galveston area. Since rainfall typically impacts a wide area, each jurisdiction can expect the same impact. Below is a summary of the events recorded.

Rain Totals (inches) – 2015 to 2011

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2015	5.44	0.70	7.69	5.30	3.05	2.75	0.23	6.40	11.13	9.80	5.55	3.49	61.53
2014	1.36	1.69	1.82	0.10	3.72	1.53	1.08	4.95	6.11	1.75	3.91	3.87	31.89
2013	7.18	2.24	0.72	3.46	1.12	3.26	2.40	3.85	5.06	6.85	2.45	0.65	39.24
2012	3.01	7.32	4.96	1.99	4.22	4.10	5.60	6.14	5.63	0.51	0.86	2.87	47.21
2011	3.86	0.67	2.70	0.12	0.38	0.94	1.11	0.10	1.70	4.60	2.36	4.41	22.95

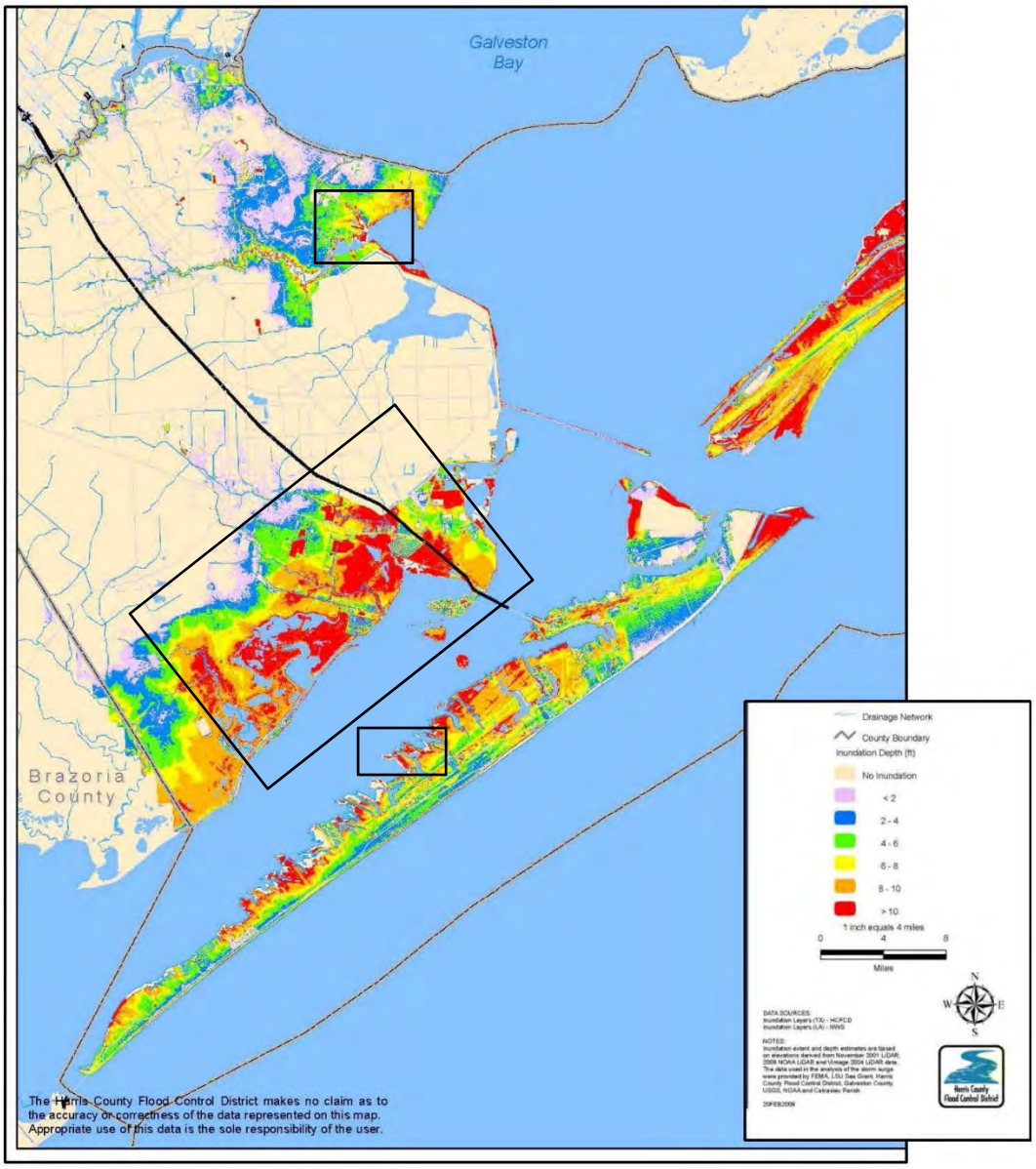
Normal Rainfall (inches) - 1981 to 2010

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
4.20	2.57	3.16	3.05	4.32	5.69	3.80	4.39	6.03	5.52	4.51	3.52	50.76

Source: http://www.weather.gov/hgx/climate_gls_normals_summary

Coastal communities, such as Clear Lake Shores, Kemah, Bayou Vista, Tiki Island, Jamaica Beach, and unincorporated areas of Galveston County will also be subject to coastal flooding caused by tropical storms and storm surge events. As shown in Figure 6.13, Hurricane Ike produced a range of 4 ft. to over 10 ft. of flood waters due to storm surge to these communities. Boundary boxes have been placed near the location of the coastal communities noted. This figure should be reviewed with the flood zone Figures 6.1 to 6.12 for additional geographic reference.

Figure 6.13: Hurricane Ike Storm Surge – Galveston County



6.4 Historical Occurrences

Rainfall averages 50.76 inches annually. When 50 inches fall periodically throughout the year, flooding is not an issue. However, when rain falls in less frequent rain events, flash flooding can result.

Previous occurrences for inland and coastal flood are depicted in Table 6.1. In most cases, the data reported to the NCDC was documented as countywide or general areas within the county (i.e. northern and southern portions, etc.). All participating jurisdictions within this plan update have experienced historical flood occurrences.

Table 6.1: Historic Flood Occurrences in Galveston County

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Clear Lake Shores	05/30/1995	Flash Flood	0	0	$50,000	$0
Coastal County	11/16/1996	Coastal Flood	0	0	$250,000	$0
Galveston	12/17/1995	Flash Flood	0	0	$20,000	$0
Galveston	12/18/1995	Flash Flood	0	0	$5,000	$0
Northern County	01/26/1996	Flash Flood	0	0	$30,000	$0
Countywide	01/27/1997	Flash Flood	0	0	$5,000	$0
Countywide	04/25/1997	Coastal Flood	0	0	$350,000	$0
East Portion	11/5/1997	Flash Flood	0	0	$20,000	$0
Central Portion	12/8/1997	Flash Flood	0	0	$14,000	$0
North Portion	1/4/1998	Flash Flood	0	0	$3,000	$0
South Portion	6/29/1998	Flash Flood	0	0	$0	$0
South Portion	9/10/1998	Flash Flood	0	0	$0	$0
South Portion	10/4/1998	Flash Flood	0	0	$35,000	$0
South Portion	10/4/1998	Flash Flood	0	0	$10,000	$0
Friendswood	10/18/1998	Flash Flood	0	0	$3,000	$0
Northwest Portion	06/25/1999	Flash Flood	0	0	$50,000	$0
Countywide	9/13/2000	Flash Flood	0	0	$100,000	$0

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
Countywide	6/5/2001	Flash Flood	0	0	$0	$0
Central Portion	6/8/2001	Flash Flood	0	0	$0	$0
Northern Portion	6/9/2001	Flash Flood	0	0	$0	$0
Northern Portion	6/9/2001	Flash Flood	0	0	$0	$0
League City	4/8/2002	Flash Flood	0	0	$5,000	$0
League City	5/17/2002	Flash Flood	0	0	$2,000	$0
South Portion	8/15/2002	Flash Flood	0	0	$75,000	$0
Countywide	8/15/2002	Flash Flood	0	0	$100,000	$0
Jamaica Beach	9/10/2002	Flash Flood	0	0	$45,000	$0
League City	9/19/2002	Flash Flood	0	0	$25,000	$0
East Portion	10/8/2002	Flash Flood	0	0	$15,000	$0
North Portion	10/24/2002	Flash Flood	0	0	$75,000	$0
Countywide	11/5/2002	Flash Flood	0	0	$55,000	$0
Central Portion	12/4/2002	Flash Flood	0	0	$20,000	$0
League City	8/31/2003	Flash Flood	0	0	$3,000	$0
Countywide	9/1/2003	Flash Flood	0	0	$4,000	$0
Friendswood	11/17/2003	Flash Flood	0	0	$5,000	$0
Santa Fe	6/23/2004	Flash Flood	0	0	$3,000	$0
League City	11/2/2004	Flash Flood	0	0	$3,000	$0
Coastal County	10/16/2006	Coastal Flood	0	0	$75,000	$0
Friendswood	10/16/2006	Flash Flood	0	0	$250,000	$0
League City-Arpt	9/14/2008	Flash Flood	0	0	$0	$0
League City-Arpt	4/18/2009	Flash Flood	0	0	Unknown	$0
League City-Arpt	4/24/2009	Flash Flood	0	0	$5,000	$0
League City	10/1/2009	Flash Flood	0	0	$5,000	$0

Location	Date	Type	Death	Injury	Property Damage	Crop Damage
League City-Arpt	10/22/2009	Flash Flood	0	0	$0	$0
Coastal County	11/8/2009	Coastal Flood	0	0	$0	$0
Coastal County	12/1/2009	Coastal Flood	0	0	$0	$0
GLS-Airport	5/14/2010	Flash Flood	0	0	$0	$0
Coastal County	1/9/2011	Coastal Flood	0	0	$5,000	$0
League City	5/12/2012	Flash Flood	0	0	$5,000	$0
Friendswood	10/31/2013	Flash Flood	0	0	$10,000	$0
League City-Arpt	9/18/2014	Flash Flood	0	0	$0	$0
League City-Arpt	4/17/2015	Flash Flood	0	0	$2,000	$0
League City	5/12/2015	Flash Flood	0	0	$0	$0
League City	6/13/2015	Flash Flood	0	0	$0	$0

Source: NCDC (1950-2014)

No losses of lives or injuries were reported for historical occurrences of flooding according to the National Climatic Data Center (NCDC). The approximate total amount of property damage was $1.73 million dollars.

6.5 Probability of Future Events

Although the intensity of a flood event can become lower as building codes and ordinances are made stronger or properties are "flood proofed," given the frequency of historical events, it is highly likely that the area will flood again. On average there is a flood event within each year.

6.6 Vulnerability Assessment

The building vulnerability assessment was conducted using a GIS mapping analysis process in which storm surge inundation GIS data was overlaid with local parcel data to determine the number of parcels that intersect these hazard zones. Data from the County's 2015 tax assessment was then used to determine the assessed value of these at-risk properties.

In making vulnerability determinations, it was decided that if any portion of structure was confirmed to be located within a storm surge inundation zone, then it was determined to be at risk to that flood hazard. While the GIS-based assessment does use specific attribute data tied to each property (i.e., year built and building value), it does not take into account certain unknown site-specific factors that may mitigate future flood losses on a building-by-building basis (such as finished floor elevations, surrounding topography, flood proofing measures, drainage, etc.). No further analysis of the potential vulnerability of structures to flooding was completed as part of this assessment.

Tables 6.2 through 6.6 show the potentially affected exposure for coastal flooding in Galveston County. Table 6.7 provides potential annualized losses due to coastal flooding, and Table 6.8 provides information on critical facilities and infrastructure potentially damaged due to coastal flooding.

Table 6.2: Estimated Exposure of People and Parcels by Jurisdiction (Category 1 Storm Surge)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (Category 1 Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,530	891	$164,088,970
Clear Lake Shores	1,069	1,051	$243,448,194	509	276	$64,142,744
Friendswood	26,364	10,853	$3,085,164,965	3,958	188	$47,767,140
Hitchcock	6,961	6,337	$460,075,283	1,505	564	$80,615,347
Jamaica Beach	983	1,590	$338,227,637	484	660	$169,399,172
Kemah	2,906	1,221	$294,986,165	947	96	$79,211,761
La Marque	14,543	8,972	$827,263,553	441	202	$40,218,160
League City	82,353	35,762	$8,164,064,546	10,196	1,256	$512,377,909
Santa Fe	12,814	6,457	$845,974,919	269	2	$267,000
Tiki Island	966	1,254	$445,402,231	933	778	$291,151,386
Unincorporated	40,244	34,756	$2,931,109,729	5,111	4,044	$408,179,054
Total	190,740	109,577	$17,860,872,212	25,883	8,957	$1,857,418,643

Table 6.3: Estimated Exposure of People and Parcels by Jurisdiction (Category 2 Storm Surge)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (Category 2 Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	1,035	$234,366,034
Friendswood	26,364	10,853	$3,085,164,965	5,822	408	$105,914,524
Hitchcock	6,961	6,337	$460,075,283	3,474	1,675	$160,331,192
Jamaica Beach	983	1,590	$338,227,637	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165	1,240	498	$162,042,541
La Marque	14,543	8,972	$827,263,553	1,409	982	$92,630,416
League City	82,353	35,762	$8,164,064,546	29,387	2,712	$1,023,852,238
Santa Fe	12,814	6,457	$845,974,919	976	5	$930,450
Tiki Island	966	1,254	$445,402,231	966	1,253	$445,380,771
Unincorporated	40,244	34,756	$2,931,109,729	11,155	18,253	$1,388,457,593
Total	190,740	109,577	$17,860,872,212	58,018	29,735	$4,177,288,386

Table 6.4: Estimated Exposure of People and Parcels by Jurisdiction (Category 3 Storm Surge)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (Category 3 Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	1,051	$243,448,194
Friendswood	26,364	10,853	$3,085,164,965	8,717	858	$244,692,012
Hitchcock	6,961	6,337	$460,075,283	6,849	5,946	$416,603,720
Jamaica Beach	983	1,590	$338,227,637	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165	2,906	1,217	$294,604,355
La Marque	14,543	8,972	$827,263,553	14,305	8,171	$665,852,808
League City	82,353	35,762	$8,164,064,546	65,964	19,061	$4,738,538,131
Santa Fe	12,814	6,457	$845,974,919	2,706	371	$51,274,960
Tiki Island	966	1,254	$445,402,231	966	1,254	$445,402,231
Unincorporated	40,244	34,756	$2,931,109,729	29,092	29,179	$2,272,739,367
Total	190,740	109,577	$17,860,872,212	135,094	70,022	$9,936,538,405

Table 6.5: Estimated Exposure of People and Parcels by Jurisdiction (Category 4 Storm Surge)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (Category 4 Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	1,051	$243,448,194
Friendswood	26,364	10,853	$3,085,164,965	19,539	4,435	$1,361,779,673
Hitchcock	6,961	6,337	$460,075,283	6,961	6,312	$457,397,363
Jamaica Beach	983	1,590	$338,227,637	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165	2,906	1,221	$294,986,165
La Marque	14,543	8,972	$827,263,553	14,543	8,969	$825,681,153
League City	82,353	35,762	$8,164,064,546	82,268	34,168	$7,809,891,714
Santa Fe	12,814	6,457	$845,974,919	10,241	4,444	$590,002,402
Tiki Island	966	1,254	$445,402,231	966	1,254	$445,402,231
Unincorporated	40,244	34,756	$2,931,109,729	38,071	32,805	$2,732,233,424
Total	190,740	109,577	$17,860,872,212	179,084	97,573	$15,324,204,946

Table 6.6: Estimated Exposure of People and Parcels by Jurisdiction (Category 5 Storm Surge)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (Category 5 Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	1,051	$243,448,194
Friendswood	26,364	10,853	$3,085,164,965	26,364	10,853	$3,085,164,865
Hitchcock	6,961	6,337	$460,075,283	6,961	6,337	$460,075,283
Jamaica Beach	983	1,590	$338,227,637	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165	2,906	1,221	$294,986,165
La Marque	14,543	8,972	$827,263,553	14,543	8,972	$827,263,553
League City	82,353	35,762	$8,164,064,546	82,353	35,762	$8,164,064,546
Santa Fe	12,814	6,457	$845,974,919	12,814	6,457	$845,974,919
Tiki Island	966	1,254	$445,402,231	966	1,254	$445,402,231
Unincorporated	40,244	34,756	$2,931,109,729	40,244	34,756	$2,931,109,729
Total	190,740	109,577	$17,860,872,212	190,740	109,577	$17,860,872,112

Table 6.7: Potential Annualized Losses Due to Storm Surge for Galveston County (Countywide)

Storm Events	Annualized Losses for Building Damage	Annualized Losses for Contents Damage	Annualized Losses for Inventory Loss	Annualized Percent Loss Ratio
Annualized	$702,705,416	$126,118,191	$936,078	1.9%

Table 6.8: Critical Facilities Exposed to Storm Surge in Galveston County(Countywide)

Storm Surge Based on Saffir Simpson Scale	Total Number and Value of Critical Facilities		Number and Value of Exposed Facilities	
	Number	Value	Number	Value
Category 1	263	$1,310,384,054	32	$53,919,000
Category 2			130	$509,699,012
Category 3			214	$1,005,940,037
Category 4			246	$1,154,987,049
Category 5			263	$1,310,384,054

In order to assess exposure to the flood hazard, digital flood hazard data was compared with census block data and parcel information provided by the county to determine the total estimated population, total estimated number of parcels, and total improved value of parcels intersecting three flood hazard areas. The three flood hazard areas analyzed consist of the 100-year inland flood hazard (based on mapped A/AE Zones), the 100-year coastal flood hazard (based on mapped V/VE Zones), and the 500- year flood hazard (based on mapped B Zones). Tables 6.9 to 6.11 show the results of each analysis by jurisdiction. Table 6.12 shows the potential impact on critical facilities.

Table 6.9: Estimated Exposure of People and Parcels by Jurisdiction (100-Year Flood—Inland)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (A/AE Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,470	1,099	$185,493,420
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	987	$240,705,924
Friendswood	26,364	10,853	$3,085,164,965	14,097	2,162	$663,350,938
Hitchcock	6,961	6,337	$460,075,283	6,629	4,632	$286,761,580
Jamaica Beach	983	1,590	$338,227,637	961	1,438	$294,440,652
Kemah	2,906	1,221	$294,986,165	1,592	898	$230,750,405
La Marque	14,543	8,972	$827,263,553	3,704	1,401	$172,940,454
League City	82,353	35,762	$8,164,064,546	37,231	8,460	$2,084,836,964
Santa Fe	12,814	6,457	$845,974,919	4,221	609	$96,352,765
Tiki Island	966	1,254	$445,402,231	147	90	$22,118,888
Unincorporated	40,244	34,756	$2,931,109,729	20,469	10,714	$842,121,362
Total	190,740	109,577	$17,860,872,212	91,590	32,490	$5,119,873,352

Table 6.10: Estimated Exposure of People and Parcels by Jurisdiction (100-Year Flood—Coastal)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (V/VE Zones)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,532	277	$49,006,030
Clear Lake Shores	1,069	1,051	$243,448,194	234	109	$23,213,493
Friendswood	26,364	10,853	$3,085,164,965	0	0	$0
Hitchcock	6,961	6,337	$460,075,283	281	728	$72,387,309
Jamaica Beach	983	1,590	$338,227,637	189	192	$60,784,015
Kemah	2,906	1,221	$294,986,165	169	110	$75,973,581
La Marque	14,543	8,972	$827,263,553	115	371	$4,234,692
League City	82,353	35,762	$8,164,064,546	2,560	110	$87,666,080
Santa Fe	12,814	6,457	$845,974,919	0	0	$0
Tiki Island	966	1,254	$445,402,231	966	1,211	$434,753,591
Unincorporated	40,244	34,756	$2,931,109,729	3,332	13,969	$1,217,475,012
Total	190,740	109,577	$17,860,872,212	9,378	17,077	$2,025,493,803

Table 6.11: Estimated Exposure of People and Parcels by Jurisdiction (500-Year Flood)

Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	At Risk (0.2 % Annual Chance)		
				Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	0	0	$0
Clear Lake Shores	1,069	1,051	$243,448,194	4	8	$22,789,590
Friendswood	26,364	10,853	$3,085,164,965	14,178	2,882	$954,702,397
Hitchcock	6,961	6,337	$460,075,283	4,705	1,779	$196,227,284
Jamaica Beach	983	1,590	$338,227,637	0	0	$0
Kemah	2,906	1,221	$294,986,165	2,494	471	$123,321,865
La Marque	14,543	8,972	$827,263,553	9,871	4,885	$516,860,254
League City	82,353	35,762	$8,164,064,546	49,569	11,365	$3,054,896,076
Santa Fe	12,814	6,457	$845,974,919	4,617	1,027	$142,152,322
Tiki Island	966	1,254	$445,402,231	0	0	$0
Unincorporated	40,244	34,756	$2,931,109,729	23,274	7,375	$706,082,824
Total	190,740	109,577	$17,860,872,212	108,712	29,792	$5,717,032,612

Table 6.12: Potential Impacts to Critical Facilities and Infrastructure

Jurisdiction	Critical Facilities and Infrastructure		
	Total Number	Number Inside the 100-year Floodplain	Percentage Susceptible to Flooding
Bayou Vista	0	0	0%
Clear Lake Shores	1	1	100%
Friendswood	14	0	0%
Hitchcock	11	4	36%
Jamaica Beach	1	1	100%
Kemah	3	2	67%
La Marque	13	0	0%
League City	28	2	7%
Santa Fe	9	1	11%
Tiki Island	2	2	100%
Unincorporated	14	5	36%
Total	96	18	19%

Source: HAZUS-MH

6.7 Impact

Based on the vulnerability assessment, a coastal flooding or storm surge event will have a greater impact on the area than an inland flood event. With a strong hurricane storm surge, the total value at risk is over $17 billion dollars compared to approximately $5 billion with an inland flooding event.

Based on the relative exposure and history of previous occurrences, the potential severity and impact of a major flood event are substantial. A major event or storm surge could result in multiple fatalities, a complete shutdown of facilities for 30 or more days, leaving more than half of all property destroyed or substantially damaged.

7.0 Extreme Heat

7.1 Description

Severe, excessive summer heat is characterized by a combination of exceptionally high temperatures and humidity. When these conditions persist over a period of time, it is called a heat wave. Many areas of the country are susceptible to heat waves, including the Texas Gulf Coast and Galveston County.

Major human risks associated with severe summer heat include heatstroke, heat exhaustion, and heat cramps. Most at risk are outdoor workers, the elderly, children, and people in poor physical health. The effects of severe summer heat are always more pronounced in urbanized areas than in rural areas. Within urbanized areas, pervasive heat is exacerbated by what is known as the heat island effect, in which concrete and metal infrastructure absorbs radiant heat energy from the sun during the day and emits that heat energy during the night. This cyclical process essentially traps the heat in urbanized areas and makes it as much as 10 degrees warmer than surrounding areas.

During summer months, Galveston County is frequently affected by severe heat hazards. Daily high temperatures range into the upper 90's and low 100's. Moderate to high relative humidity levels are prevalent in the county. The heat index can move into dangerous levels. A heat index of 105 degrees is where many people begin to experience extreme discomfort or physical distress.

Severe summer heat is an invisible killer. Although a heat wave does not happen with the spectacle of other hazards such as tornadoes and floods, the National Center for Environmental Health[1] reports that from 1999-2009, excessive heat exposure caused 7,233 deaths in the United States. Heat-related deaths were reported most frequently among males (69 percent) and 36 percent were adults aged 65 years and older. Ninety-four percent of heat-related deaths occurred during May–September, with the highest numbers reported during July (39 percent) and August (27 percent).

[1] http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6222a1.htm Kochanek K, Xu J, Murphy S, Minino A, Kung H. Deaths: final data for 2009. Natl Vital Stat Rep 2011;60(3).

7.2 Location

There is no distinct geographic boundary to excessive summer heat. Excessive heat can occur in every participating jurisdiction within Galveston County area as shown in Figure 7.1.

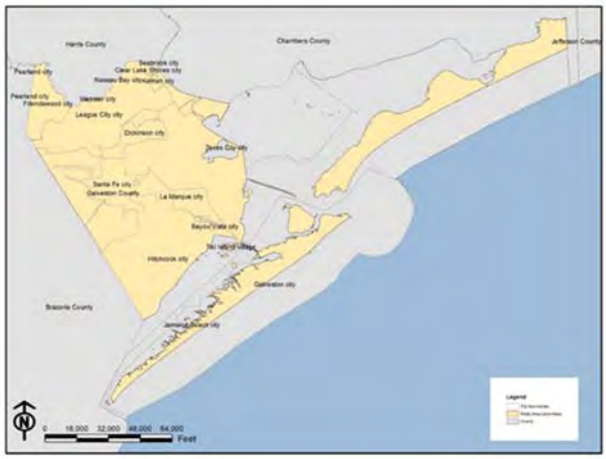


Figure 7.1: Galveston County and Participating Jurisdictions

7.3 Extent

Extreme summer heat is measured not only in terms of excessive high temperatures, but also on relative humidity with regard to temperature. Galveston County has experienced periods of extreme summer heat, which leads to injury and even death. Due to its location, the entire county also experiences high humidity along with high temperatures. Temperatures can often climb above 100 degrees during the summer months. This high heat combined with a high percentage of humidity increases the Heat Index as shown in Figure 7.2.

Figure 7.2: Extent Scale for Extreme Summer Heat

Relative Humidity (%)

Air Temperature °F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

Heat Index (Apparent Temperature)

With Prolonged Exposure and/or Physical Activity

Extreme Danger	Heat stroke or sunstroke highly likely
Danger	Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible
Caution	Fatigue possible

Based on the extent scale in Figure 7.2 an extreme summer heat event could occur with an air temperature as low as 80°F if the percentage of humidity was equal to or greater than 40 percent. Even though this temperature seems relatively low, given the high humidity, fatigue is possible. Citizens, especially children and the elderly should exercise caution by staying out of the heat for prolonged periods at this temperature and relative humidity. As the chart indicates, fatigue is possible, but can also occur with prolonged exposure or physical activity. Citizens who work outdoors should exercise caution even at the lower temperature if the humidity is at a high level. With prolonged exposure or physical activity, fatigue could result in causing dizziness, headaches or nausea.

Because Galveston County and all the participating jurisdictions within this plan update are affected seasonally by extreme summer heat, the extent scales provide a means for better targeting mitigation actions to protect lives. For example, it is important to note that heat stroke and associated fatigue are possible even when the temperature is not at a high peak. Using the extent scale in Figure 7.1 to combine heat and humidity allows officials to better predict events and more accurately warn citizens of danger.

Galveston County, Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island can expect the intensity of extreme heat to range from caution to extreme danger as noted in Figure 7.2.

Table 7.1 displays the National Weather Service's heat advisory and warning descriptions.

Table 7.1: Extreme Summer Heat Warnings

Intensity	Detailed Description
Heat Advisory	Extreme heat index making it feel hot, typically between 105 °F to 110 °F (41 °C to 43 °C) for 3 hours or more during the day and at or above 75 °F (24 °C) at night.
Excessive Heat Warning	Extreme heat index making it feel very hot, typically above 105 °F (41 °C) for 3 hours or more during the day and at or above 80 °F (27 °C) at night.

Source: National Weather Service

7.4 Historical Occurrences

In other parts of the country and the world, severe summer heat hazards have had devastating consequences. For instance, in 1995 a two-week-long heat wave hit Chicago and the heat index peaked at 119°F. There were 465 deaths directly attributable to the heat wave and more than half of the victims were 75 years of age or older.

In June 2013, scorching heat, caused by a dome of hot air trapped by a high pressure ridge, pushed temperatures above 100°F in parts of Texas, California, Arizona, Idaho, Colorado, Nevada, and Utah. This event claimed the life of one man in California and numerous illness/injuries throughout the impacted area.[2]

According to the National Climatic Data Center, a strong heat wave effected Texas in the summers of 1999 and 2000. This increases the importance of increased public awareness regarding the danger of extreme heat. Specific occurrences for Galveston County are listed in Table 7.2. These events are only captured on a countywide basis and are considered historical occurrences for all the participating jurisdictions within this plan update.

Table 7.2: Historical Excessive Heat Events in Galveston County

Event Date	Deaths	Injuries	Property Damage	Crop Damage
7/21/1995	2	200	0	0
6/26/1999	3	0	0	0
8/01/1999	6	0	0	0
7/06/2000	19	0	0	0
8/29/2000	3	0	0	0
9/01/2000	5	0	0	0
06/24/2009	0	0	0	0
07/09/2009	0	0	0	0

Source: Events from 1995 to 2000 were reported in the 2011-2016 Galveston County Hazard Mitigation Plan
Events from 2009 were reported on the NCDC database

[2] http://www.reuters.com/article/us-usa-weather-heat-idUSBRE95S0AS20130630

7.5 Probability of Future Events

The likelihood or future probability of occurrence of excessive summer heat in the Galveston County, including the all participating jurisdictions, is likely to occur within the next four to five years. Extreme drought conditions and above-average temperatures for 2009 have affected all of Central Texas as far southeast as Galveston County. In the past, multiple counties throughout the region have issued burn bans to prevent the occurrence of wildfires due to extreme heat and dry conditions.

7.6 Vulnerability Assessment

The elderly, disabled, and debilitated are especially susceptible to heat stroke. Therefore communities with substantial populations of elderly people could face a significant medical emergency during an extended period of excessive heat. Table 7.3 exhibits each jurisdictions percentage of elderly.

Table 7.3 Elderly Population by Jurisdiction

Jurisdiction	Total Population (2010 Census)	Population	
		Elderly (Over 65)	Elderly/Population
Bayou Vista	1,537	342	22%
Clear Lake Shores	1,063	164	15%
Friendswood	35,805	4,198	12%
Hitchcock	6,961	957	14%
Jamaica Beach	983	192	20%
Kemah	1,773	171	10%
La Marque	14,509	2,006	14%
League City	83,560	6,117	7%
Santa Fe	12,222	1,742	14%
Village of Tiki Island	968	243	25%
Galveston County	291,309	32,804	11%

Source: US Census 2010, Summary File, U.S Census ACS 5 year estimates 2009-2013

The dispersion of extreme heat is relatively uniform across the county although highly urbanized areas may exhibit heat island effects in which localized temperatures may be 3-5 degrees higher than surrounding areas.

Critical facilities are also susceptible to power failures and brown outs as energy supplies become stressed during an extended period of high heat.

7.7 Impact

The potential impact of excessive summer heat is considered minor, resulting in few, if any, injuries. However, the special needs population (children under five, the elderly, and those living below poverty level) may be more at risk to extreme heat conditions if access to air conditioning may be limited or unavailable and a potential for small children to be left unattended in vehicles. Table 7.4 expands the population data provided in subsection 7.6 to include the additional categories of population and the overall percentage of those potentially at risk by jurisdiction. The effect on property would be limited, with minimal disruption to quality of life. Any shutdown of facilities is temporary. In addition, each participating jurisdiction in this plan could be equally at risk for other areas concern such as the beach and outdoor shopping/recreational places.

Table 7.4 Special Needs Population by Jurisdiction

Jurisdiction	Total Population (2010 Census)	Children (Under 5)	Elderly (Over 65)	Below Poverty	Total Percent of Population
Bayou Vista	1,537	33	342	229	39%
Clear Lake Shores	1,063	37	164	237	41%
Friendswood	35,805	1,867	4,198	7,001	36%
Hitchcock	6,691	592	957	95	25%
Jamaica Beach	983	35	192	226	46%
Kemah	1,773	121	171	430	41%
La Marque	14,509	1,060	2,006	62	22%
League City	83,560	6,485	6,117	528	16%
Santa Fe	12,222	703	1,742	238	22%
Tiki Island	968	20	243	26	30%
Galveston County	291,309	19,979	32,804	38,856	31%

Source: US Census 2010, Summary File, U.S Census ACS 5 year estimates 2009-2013

8.0 Tornado

8.1 Description

Tornadoes are nature's most violent storms, spawned from powerful thunderstorms, causing fatalities and devastating properties in seconds. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can exceed one mile wide and 50 miles long. Some tornadoes are clearly visible while rain or nearby low-hanging clouds obscure others. Occasionally, tornadoes develop so rapidly little, if any, advance warning is possible. Before a tornado hits, the wind may die down, and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

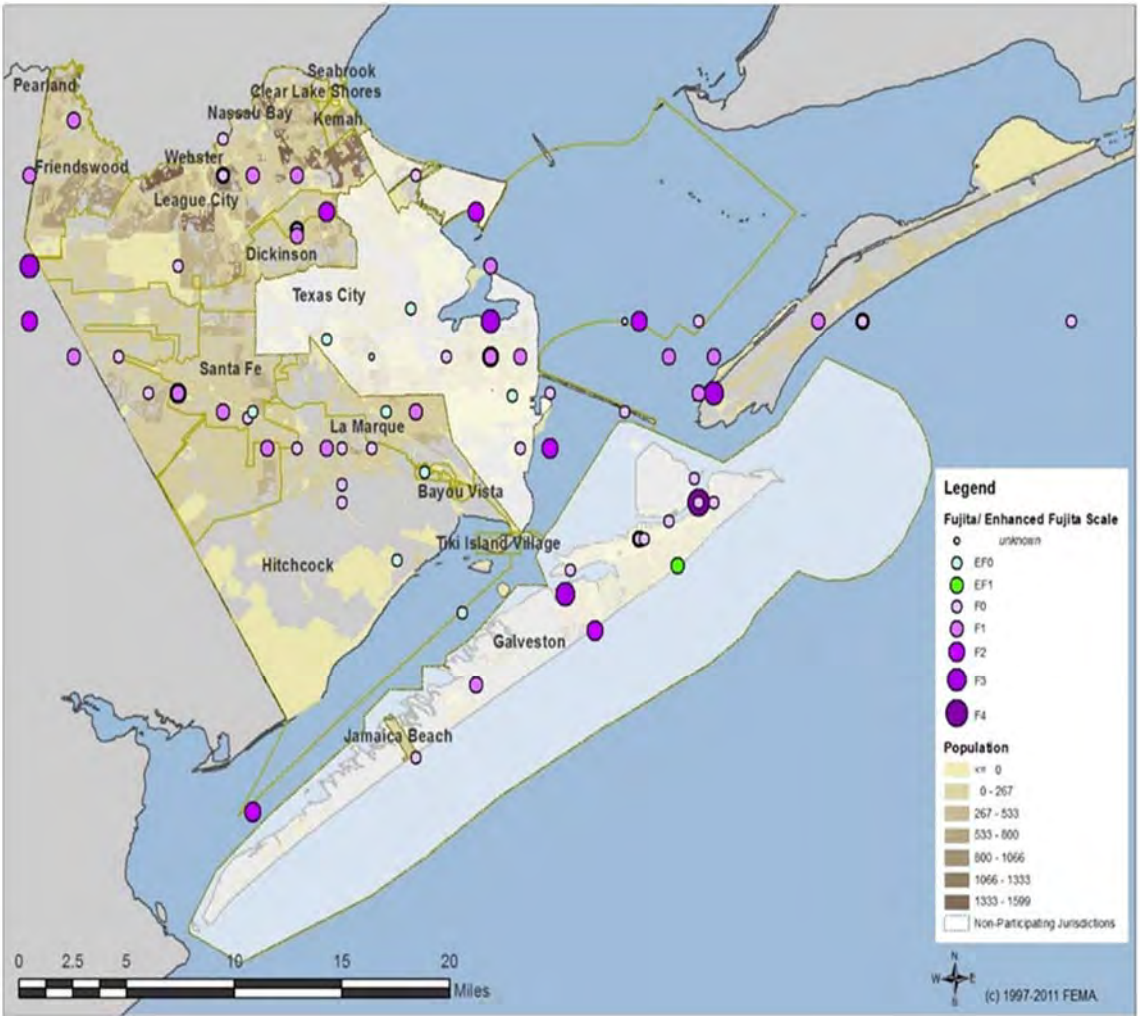
Galveston County Tornado September 5, 2014
Courtesy of KHUO-11 News

Galveston County, which borders the Texas Gulf Coast, is known for frequent severe weather and thunderstorms. In addition, tornadoes occasionally accompany tropical storms and hurricanes that move over land. Tornadoes are the most common to the right and front of the storm center path as it comes ashore.

8.2 Location

While historical tornado events in the Galveston County area total 92 from 1950 to 2015 (Figure 8.1), locations of these incidents are random and unpredictable. In fact, the historical evidence indicates that most of the area is vulnerable to the tornado hazard.

Figure 8.1: Location of Historical Tornado Events (NCDC)



8.3 Extent

The Enhanced Fujita Scale, or EF Scale (Table 8.1), is the current scale for rating the strength of tornadoes in the United States; magnitude is estimated via the damage left behind. Implemented in February 2007, it replaced the Fujita Scale. The scale has the same basic design as the original Fujita Scale, six categories from zero to five, representing increasing degrees of damage. The new scale takes into account how most structures are designed, and is thought to be more accurate representation of the surface wind speeds in the most violent tornadoes.

Table 8.1: Enhanced Fujita Scale

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	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.
EF4	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Source: NOAA

8.4 Historical Occurrences

The NCDC database was reviewed from 1950 through June 2014. Table 8-2 shows aggregated historical information by jurisdiction. The date range in Table 8.2 begins with the first occurrence recorded in the NCDC data base.

Historical evidence shows that most of the area is vulnerable to tornadic activity. This hazard can result from severe thunderstorm activity or may occur during a tropical storm or hurricane. Table 8.2 shows aggregated historical information by jurisdiction.

Table 8.2: Overall Historical Tornado Impact by Jurisdiction (March 1957-June 2014)

Jurisdiction	Property Damage	No. of Events	Magnitude (Fujita Scale)						Magnitude (Enhanced Fujita Scale)					
			F0	F1	F2	F3	F4	F5	EF0	EF1	EF2	EF3	EF4	EF5
Bayou Vista	$0	0												
Clear Lake Shores	$0	0												
Friendswood	$520,000	4	2	2										
Hitchcock	$72,000	2	1						1					
Jamaica Beach	$0	1	1											
Kemah	$0	0												
La Marque	$0	1							1					
League City	$120,000	2	1	1										
Santa Fe	$122,000	4	3						1					
Village of Tiki Island	$0	0												
Galveston County	$32,372,270	77	35	26	9	5	1		0	0	0	0	0	0
Total	**$33,206,270**	**91**	**43**	**29**	**9**	**5**	**1**		**3**	**0**	**1**	**0**	**0**	**0**

Source: National Climatic Data Center (note: two events in the County had unknown intensity)

8.5 Probability of Future Events

It is important to note that the range used to calculate the probability of future occurrence begins with the first occurrence recorded by the NCDC. Based on this historical average, tornadoes are highly likely. While some years have no recorded events, a tornado-to-year average indicates a tornado occurs every year (1.6 per year). Galveston County, Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island can expect the same probability of one tornado per year.

8.6 Vulnerability Assessment

Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be affected.

It is important to note that only reported tornadoes have been factored into this assessment and that the range used to calculate annualized expected property losses begins with the first occurrence recorded by the NCDC. Table 8.3 shows potential annualized property losses for each jurisdiction.

Table 8.3: Potential annualized losses by jurisdiction in the Galveston County area

Jurisdiction	Total Exposure*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Bayou Vista	$148,402,840	**Negligible	0.00%
Clear Lake Shores	$169,233,443	**Negligible	0.00%
Friendswood	$2,372,450,647	$9,070	0.00%
Hitchcock	$291,155,638	**Negligible	0.00%
Jamaica Beach	$253,449,835	**Negligible	0.00%
Kemah	$184,174,314	**Negligible	0.00%
La Marque	$616,967,900	**Negligible	0.00%
League City	$6,285,876,473	**Negligible	0.00%
Santa Fe	$633,204,508	**Negligible	0.00%
Tiki Island	$307,035,208	**Negligible	0.00%
Unincorporated	$1,738,099,508	$564,665	0.00%
Total	$13,000,049,864	$579,213	0.00%

Note: *Total Exposure is improved value of parcels in Galveston County

**Negligible is less than $5,000

The damage caused by strong tornadoes can be extensive for site-built homes as well as manufactured homes. But according to the National Weather Service, research of tornado sites has shown time and time again, that manufactured homes are more susceptible.

The enhanced Fujita scale identifies wind speeds that would completely destroy structures. For single-family site-built homes, it would take winds in excess of 170 miles per hour (EF-4). For a single wide manufactured home that drops to 127 miles per hour (EF2), and for a double wide manufactured home, 134 miles per hour (EF-2).

The highest number of manufactured homes within the planning area is in the unincorporated portion of the county, followed by League City and Santa Fe respectively. Table 8.4 lists the number of manufactured homes along with the ratio of manufactured homes as compared to the number of housing units in each jurisdiction.

Table 8.4: Manufactured Homes by Jurisdiction

Jurisdiction	Structures		
	Total Housing Units	Manufactured Homes	Manufactured Homes to Housing Ratio
Bayou Vista	1,252	0	0
Clear Lake Shores	617	0	0
Friendswood	13,593	72	.005
Hitchcock	3,273	353	.108
Jamaica Beach	1,213	0	0
Kemah	886	0	0
La Marque	6,341	182	.029
League City	33,098	435	.013
Santa Fe	5,261	396	.075
Tiki Island	964	0	0
Galveston County	136,160	5,486	.040

Source: US Census ACS 2010-2014; The ACS estimate of 10 was updated to reflect the specific number obtained in local counts. The updated information is within the margin of error of +/- 16 units of the ACS estimate.

8.7 Impact

Seasonal patterns are relevant to tornadoes. Thunderstorms form when warm, moist air collides with cooler, drier air. Since these masses tend to come together during the transition from summer to winter, most thunderstorms and resulting tornadoes occur during the spring (April through June) and fall (October through December). Warning time for tornadoes is minimal and ranges from no warning time to 30 minutes.

Based on the seasonal occurrence of tornadoes and the potential losses that could result, the impact can be substantial. They can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or sustain major damage.

Friendswood tornado, October 31, 2015 – Courtesy of onenewspage.com

9.0 Windstorm

9.1 Description

Thunderstorms are associated with frontal boundaries and surface heating of the earth. Every year approximately 100,000 thunderstorms occur in the United States. Though they are most likely in the spring and summer months and during the afternoon and evening, thunderstorms can occur year round and at any given hour. The strongest of these storms can cause damage to property and threaten lives with strong winds. The National Weather Service (NWS) wind speed threshold for a severe thunderstorm is a surface wind speed of 58 miles per hour (93 km/h) or greater.

Thunderstorm wind events fall into the following categories:

Straight-line wind is a term used to define any thunderstorm wind that is not associated with rotation, and is used mainly to differentiate from tornadic winds.

A downdraft is a small-scale column of air that rapidly sinks toward the ground.

A downburst is a result of a strong downdraft. A downburst is a strong downdraft with horizontal dimensions larger than 4 km (2.5 mi) resulting in an outward burst of damaging winds on or near the ground. (Imagine the way water comes out of a faucet and hits the bottom of the sink.) Downburst winds may begin as a microburst and spread out over a wider area, sometimes producing damage similar to a strong tornado. Although usually associated with thunderstorms, downbursts can occur with showers too weak to produce thunder.

Downburst – Courtesy of Jason Boggs, 2014

A microburst is a small concentrated downburst that produces an outward burst of damaging winds at the surface. Microbursts are generally small (less than 4km across) and short-lived, lasting only 5-10 minutes, with maximum wind speeds up to 168 mph. There are two kinds of microbursts: wet and dry. A wet microburst is accompanied by heavy precipitation at the surface. Dry microbursts, common in places like the high plains and the intermountain west, occur with little or no precipitation reaching the ground.

Microburst – Courtesy of Jason Boggs, 2014

A gust front is the leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Gust fronts are characterized by a wind shift, temperature drop, and gusty winds out ahead of a thunderstorm. Sometimes the winds push up the air above them, forming a shelf cloud or detached roll cloud.

A derecho is a widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. By definition, if the wind damage swath extends more than 240 miles (about 400 kilometers) and includes wind gusts of at least 58 mph (93 km/h) or greater along most of its length, then the event may be classified as a derecho.

Source: http://www.nssl.noaa.gov/education/svrwx101/wind/types/

In addition to windstorms directly related to thunderstorms, strong winds can also be produced by strong arctic cold fronts that plunge southward across the Plains from Canada. After the cold front has passed extreme differences in air pressure and temperature, they have a history of producing local winds at wind advisory levels with higher gusts. The NWS recognizes and defines three levels of wind-related advisories as follows:

- ***Wind Advisory*** – Sustained winds of 30 mph or more or gusts of 45 mph or greater for a duration for one hour or longer.
- ***High Winds*** – Sustained winds of 40 mph or greater for at least one hour, or frequent gusts of wind to 58 mph or greater.
- ***Extreme Wind Warnings*** – Sustained winds of 115 mph or greater during a land-falling hurricane.

Another potential source of local windstorms is a phenomenon known as a gravity wave. High winds from gravity waves are caused by rapid warming and drying on the back edge of a trailing region of rain usually associated with weakening thunderstorms. If conditions are right, this process can lead to falling pressure, which in turn may cause dramatic increases in wind speeds.

Visible Satellite Image of Gravity Wave Clouds off the Texas Coast (NOAA)

9.2 Location

Windstorms vary in terms of size, intensity, duration, and impacts. High winds associated with thunderstorms are frequent occurrences throughout Galveston County. Windstorms produced by arctic cold fronts and gravity waves are infrequent, however, they are often more expansive. It is assumed that all of the jurisdictions are uniformly exposed to windstorm events.

9.3 Extent

The strength of thunderstorm winds can vary from a light breeze to over 100 mph. Windstorms produced by cold fronts and gravity waves have been known to produce winds over 60 mph. The Beaufort wind scale exhibits the range in impacts of wind speeds as shown in Table 9.1. The Galveston County planning area is subject to all the World Meteorological Organization (WMO) classifications listed below.

Table 9.1: Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 ft.) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced	

Source: NOAA Storm Prediction Center

9.4 Historical Occurrences

The NCDC database was reviewed from 1950 through June 2014. Table 9.2 shows aggregated historical information on windstorm events by jurisdiction and Figure 9.1 on the subsequent page provides a graphic representation of these events. The date range in Table 9.2 begins with the first occurrence recorded in the NCDC data base.

Historical evidence shows countywide vulnerability to windstorms. Of the 116 windstorms identified, there was one gravity wave and one arctic cold front.

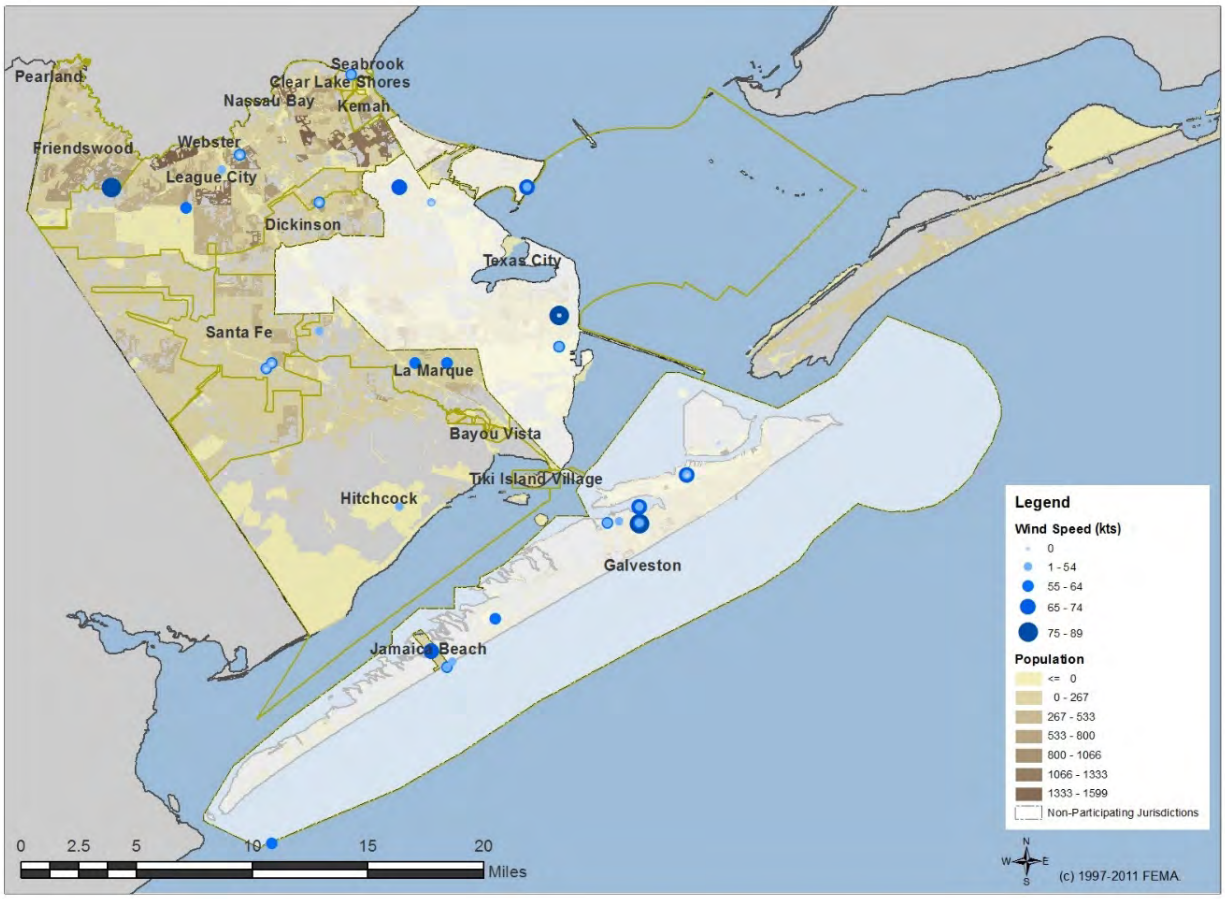
A strong cold front swept into the area on November 15, 2006 with estimated wind gusts of 55 kts and a gravity wave impacted the area on April 24, 2004 with a measured gust of 69 mph at Galveston Scholes Airport. Also, a severe thunderstorm occurred on May 2, 1993 which caused an estimated 50 million dollars in damages across the County. The geographic extent of these wind fields is unknown and for this study these three windstorms have been included with information for Unincorporated Galveston County.

Table 9.2: Historical Windstorm Events (April 1964-June 2014)

Jurisdiction	Number of Events	Maximum Wind (kt / mph)	Property Damage	Crop Damage
Bayou Vista	1	Unknown	$500	$0
Clear Lake Shores	2	55 / 63	$11,000	$0
*Friendswood	4	85 / 98	$118, 000	$0
Hitchcock	2	52 / 60	$56,000	$0
Jamaica Beach	6	70 / 81	$54,000	$0
Kemah	2	Unknown	$165,000	$0
La Marque	2	61 / 70	$15,000	$0
League City	15	62 / 71	$357,000	$0
Santa Fe	7	57 / 66	$156,000	$0
Village of Tiki Island	0	NA	$0	$0
Galveston County (Unincorporated)	75	89 /102	$50,040,000	$2,000
Total	116	62 / 71	$50,952,500	$2,000

Source: NCDC (*Note that one event recorded by the NCDC latitude longitude coordinates in Friendswood and listed under Galveston County was allocated to the Friendswood total)

Figure 9.1: Spatial Historical Wind Events (NCDC)



Note: Only wind events with latitude, longitude locations are plotted

9.5 Probability of Future Events

It is important to note that the range used to calculate the probability of future occurrence begins with the first occurrence recorded by the NCDC. Based on the historical analysis high wind events are highly likely. On average, windstorm events occur in the planning area 4 times per year. The NWS issues watches and warnings for severe thunderstorms and the lead times can vary from minutes to hours. However, the impacts of thunderstorm winds can occur with little to no warning.

9.6 Vulnerability Assessment

All existing and future buildings, facilities, and populations are considered to be exposed to windstorm hazards and could potentially be impacted. It is important to note that only reported thunderstorm-related events have been factored into this vulnerability assessment and that the range used to calculate annualized expected property losses begins with the first occurrence recorded by the NCDC.[1] Expected annualized losses are presented below in Table 9.3.

Table 9.3: Potential Annualized Losses (Windstorm)

Jurisdiction	Total Exposure*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Bayou Vista	$148,402,840	**Negligible	0.00%
Clear Lake Shores	$169,233,443	**Negligible	0.00%
Friendswood	$2,372,450,647	**Negligible	0.00%
Hitchcock	$291,155,638	**Negligible	0.00%
Jamaica Beach	$253,449,835	**Negligible	0.00%
Kemah	$184,174,314	$5,455	0.00%
La Marque	$616,967,900	**Negligible	0.00%
League City	$6,285,876,473	$11,802	0.00%
Santa Fe	$633,204,508	$5,157	0.00%
Tiki Island	$307,035,208	No damages recorded	0.00%
Unincorporated	$1,738,099,508	$1,654,215	0.00%
Total	$13,000,049,864	$1,684,380	0.00%

Source: National Climatic Data Center

Note: *Total Exposure is improved value of parcels in Galveston County
**Negligible is less than $5,000

The damage caused by strong winds can be extensive for site-built homes as well as manufactured homes. However, manufactured homes are far more susceptible to wind damage overall. According to National Weather Service guidance when wind gusts reach the 75-89 mph range manufactured homes may be pushed off foundations or overturned while most other homes will incur relatively minor damage to roofs, awnings, and siding and will not have the same significant structural failures (Source : NOAA Severe Weather Spotter Guidance).

[1] It is likely that additional thunderstorm events occurred that were not reported to the NCDC and are not accounted for in this analysis.

The highest number of manufactured homes within the planning area is in the unincorporated portion of the County, followed by League City, and Santa Fe respectively. Table 9.4 lists the number of manufactured homes along with the ratio of manufactured homes as compared to the number of housing units.

Table 9.4: Manufactured homes by jurisdiction

Jurisdiction	Structures		
	Total Housing Units	Manufactured Homes	Manufactured Homes to Housing Ratio
Bayou Vista	1,252	0	0
Clear Lake Shores	617	0	0
Friendswood	13,593	72	.005
Hitchcock	3,273	353	.108
Jamaica Beach	1,213	0	0
Kemah	886	0	0
La Marque	6,341	182	.029
League City	33,098	435	.013
Santa Fe	5,261	396	.075
Tiki Island	964	0	0
Galveston County	136,160	5,486	.040

Source: US Census ACS 2010-2014; The ACS estimate of 10 was updated to reflect the specific number obtained in local counts. The updated information is within the margin of error of +/- 16 units of the ACS estimate.

9.7 Impact

The impacts of windstorms are considered to be moderate. Minor injuries can be expected and are typically treatable with first aid. Damages to property can vary from minimal; shutting down critical facilities and services for 24 hours or less to significant in higher windstorm events.

Source: National Weather Service

10.0 Hailstorm

10.1 Description

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and subsequent cooling of the air mass. Frozen droplets gradually accumulate into ice crystals until they fall as precipitation that is round or irregularly shaped masses of ice. The size of hailstones is a direct result of the size and severity of the storm. High-velocity updraft winds are required to keep hail suspended where it can grow in size. The strength of the updraft is a byproduct of heating on the earth's surface. Higher temperature gradients above the earth's surface result in increased suspension time and hailstone size.

April 2, 2013 hailstorm in Galveston County near Hitchcock and Santa Fe
Courtesy of KHOU - Channel 11 Houston, Texas

10.2 Location

Hailstorms vary tremendously in terms of size, location, intensity, and duration but are considered frequent occurrences throughout Galveston County. It is assumed that all of the jurisdictions are uniformly exposed to hail events just as they are exposed to the thunderstorms that produce the hail events.

10.3 Extent

The severity of hail events ranges are based on the size of hail, winds, and structures in the path of a hail storm. A scale showing intensity categories was developed by the National Climatic Data Center (NCDC) and is included in Table 10.1.

Table 10.1: Hail Intensity and Magnitude

Size Code	Intensity Category	Size (diameter inches)	Descriptive Term	Typical Damage
H0	Hard Hail	up to 0.33	pea	no damage
H1	Potentially Damaging	0.33-0.60	marble	slight damage to plants and crops
H2	Potentially Damaging	0.60-0.80	dime	significant damage to plants and crops
H3	Severe	0.80-1.20	nickel	severe damage to plants and crops
H4	Severe	1.2-1.6	quarter	widespread glass and auto damage
H5	Destructive	1.6-2.0	half dollar	widespread destruction of glass, roofs, and risk of injuries
H6	Destructive	2.0-2.4	ping pong ball	aircraft bodywork dented and brick walls pitted
H7	Very Destructive	2.4-3.0	golf ball	severe roof damage and risk of serious injuries
H8	Very Destructive	3.0-3.5	hen egg	severe damage to all structures
H9	Super Hailstorms	3.5-4.0	tennis ball	extensive structural damage could cause fatal injuries
H10	Super Hailstorms	4.0 +	baseball	extensive structural damage could cause fatal injuries

Source: NCDC

10.4 Historical Occurrences

The NCDC database was reviewed from 1950 through June 2014. Figure 10.1 shows the aggregated historical information on hailstorms by jurisdiction. The date range in Table 10.2 begins with the first occurrence recorded in the NCDC data base.

Historical evidence shows county-wide vulnerability to hail events. Typically, hail results from severe thunderstorm activity. The largest hail recorded within the planning area fell in Hitchcock on April 2, 2013, and caused an estimated 1.1 million dollars in damages.

Figure 10.1: Historical Hail Events (NCDC, March 1957–June 2014)

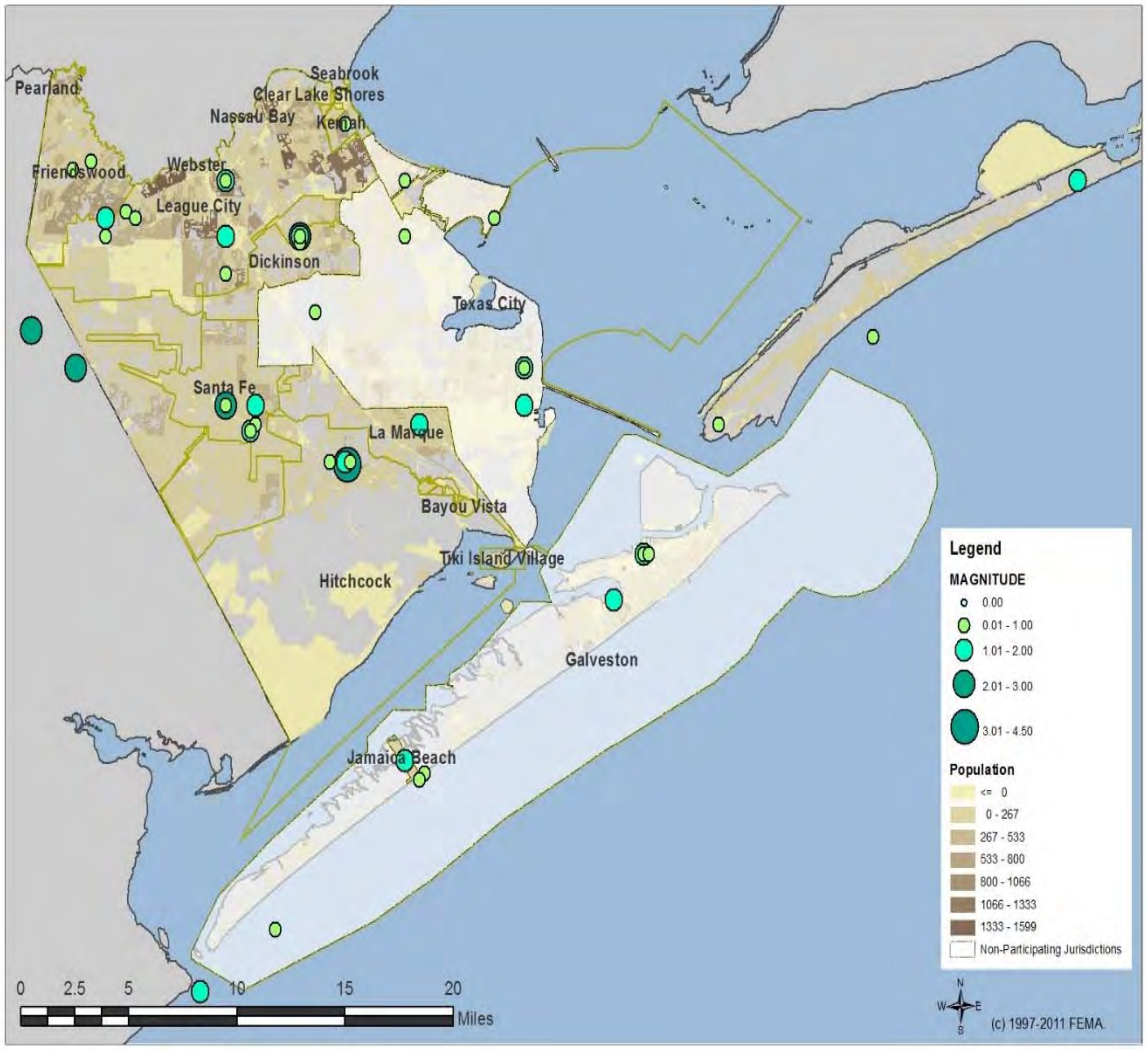


Table 10.2: Historical Hail Impact by Jurisdiction

Jurisdiction	Number of Events	Maximum hail size (inches)	Property Damage
Bayou Vista	1	1.75	$5,000
Clear Lake Shores	0	NA	$0
Friendswood	7	1.75	$500,000
Hitchcock	4	4.50	$1,112,000
Jamaica Beach	7	1.75	$61,000
Kemah	1	0.75	$3,000
La Marque	1	1.75	$3,000
League City	12	2.00	$80,000
Santa Fe	7	1.75	$39,000
Village of Tiki Island	0	NA	$0
Galveston County Unincorporated	30	2.75	$6,000
Total	70	2.08 *(Averaged)*	$1,809,000

Source: National Climatic Data Center

10.5 Probability of Future Events

Based on the historical occurrences of hailstorms for Galveston County; Bayou Vista; Clear Lake Shores; Friendswood; Hitchcock; Jamaica Beach; Kemah; La Marque; League City; Santa Fe; and Tiki Island, hail events are highly likely to occur on a yearly basis. On average an event occurs every 1.09 years. Most hailstorms occur during the spring (March, April, and May) and in the fall during the month of September. The warning time for a hailstorm is generally minimal, or there is no warning. The National Weather Service classifies a storm as severe if hail of 1 inch in diameter or greater occurs or is imminent based on observers or radar intensity.

10.6 Vulnerability Assessment

All existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be impacted. Unlike thunderstorm winds and tornadoes, there is no evidence to indicate any difference in the susceptibility of manufactured homes verses site built homes to hailstorms.

It is important to note that only reported hail events with geo-referenced point data have been factored into this vulnerability assessment.[1]

NOAA historical hail loss data was used to develop a stochastic model for averaged annualized losses (Table 10.3). Expected annualized losses were calculated through a non-linear regression of historical data.

Table 10.3: Potential Annualized Losses by Jurisdiction (Hail)

Jurisdiction	Total Exposure*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Bayou Vista	$148,402,840	**Negligible	0.00%
Clear Lake Shores	$169,233,443	No damages recorded	0.00%
Friendswood	$2,372,450,647	$8,721	0.00%
Hitchcock	$291,155,638	$19,397	0.00%
Jamaica Beach	$253,449,835	**Negligible	0.00%
Kemah	$184,174,314	**Negligible	0.00%
La Marque	$616,967,900	**Negligible	0.00%
League City	$6,285,876,473	**Negligible	0.00%
Santa Fe	$633,204,508	**Negligible	0.00%
Tiki Island	$307,035,208	No damages recorded	0.00%
Unincorporated	$1,738,099,508	**Negligible	0.00%
Total	$13,000,049,864	$31,554	0.00%

Note: *Total Exposure is improved value of parcels in Galveston County
**Negligible is less than $5,000

10.7 Impact

The severity of a hailstorm impact is considered to be limited since they generally result in injuries treatable with first aid, and less than ten percent of affected properties sustain major damage.

[1] It is possible that additional hail events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

11.0 Lightning

11.1 Description

Lightning is one of the top three storm-related killers in the United States. It is also one of the least understood weather phenomena. Below is a description of lightning and thunder as defined by NOAA:[1]

- ***Lightning*** is a giant spark of electricity in the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground; however, when the difference in charges become too great, the insulating capacity of the air breaks down, and there is a rapid discharge of electricity known as lightning.

  Lightning can occur between opposite charges within the thunderstorm cloud (Intra-Cloud Lightning) or between opposite charges in the cloud and on the ground (Cloud-To-Ground Lightning). Cloud-to-ground lightning is divided into two different types of flashes depending on the charge in the cloud where the lightning originates.

- ***Thunder*** is the sound made by a flash of lightning. As lightning passes through the air, it heats the air quickly. This causes the air to expand rapidly and creates the sound wave we hear as thunder. Normally, you can hear thunder about 10 miles from a lightning strike. Since lightning can strike outward 10 or more miles from a thunderstorm, if you hear thunder, you are likely within striking distance of a storm.

11.2 Location

Lightning strikes in association with thunderstorms vary in terms of size, intensity, duration, and impacts, but are considered frequent occurrences throughout Galveston County. It is assumed that all of the jurisdictions are uniformly exposed to thunderstorm events and the associated impact lightning. According to information calculated from the NOAA Severe Weather Data Inventory (SWDI), there were nearly 10,000 cloud-to-ground lightning strikes within the county between January 1986 and May 2013; this information indicates an average of 378 lightning strikes per year within the county. The dispersion of lightning strikes in Galveston County is assumed to be uniform across the planning area although elevation and local topography may play a role.

[1] http://www.lightningsafety.noaa.gov/science/science-overview.shtml

Figures 11.1 and 11.2 depict cloud to ground lightning strikes from 2005 to 2014.

Figure 11.1: Vaisala Flash Density 2005 to 2014

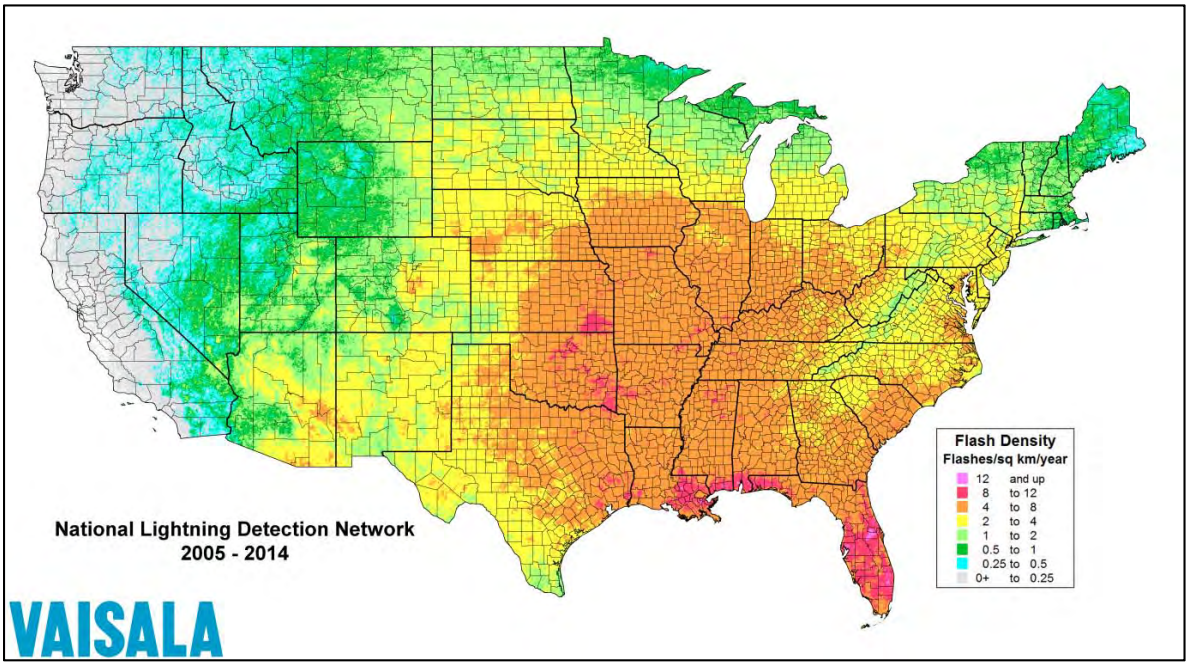
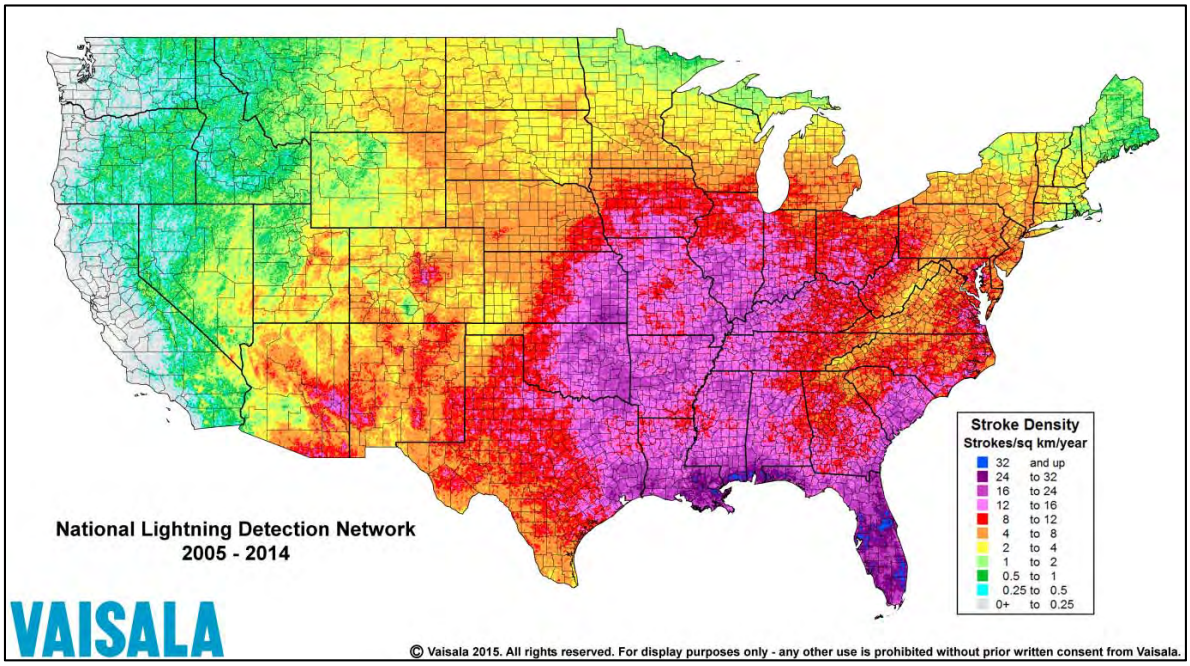


Figure 11.2: Vaisala Stroke Density 2005 to 2014



11.3 Extent

The extent for lightning can be expressed in terms of the number of strikes in an interval. NOAA utilizes lightning activity levels (LALs) on a scale from 1-6. LAL rankings reflect the frequency of cloud-to-ground lightning either forecast or observed as defined below in Table 11.1.

Table 11.1: NOAA Lightning Activity Levels (LAL)

LAL	Cloud and Storm Development	Lightning Strikes / 15 Minutes
1	No thunderstorm	0
2	Cumulus clouds are common but only a few reach the towering cumulus stage. A single thunderstorm must be confirmed in the observation area. The clouds produce mainly virga, but light rain will occasionally reach the ground. Lightning is very infrequent.	1-8
3	Towering cumulus covers less than two-tenths of the sky. Thunderstorms are few, but two to three must occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	9-15
4	Towering cumulus covers two to three-tenths of the sky. Thunderstorms are scattered and more than three must occur within the observation area. Moderate rain is common and lightning is frequent.	16-25
5	Towering cumulus and thunderstorms are numerous. They cover more than three-tenths and occasionally obscure the sky. Rain is moderate to heavy and lightning is frequent and intense.	>25
6	Dry lightning, similar to LAL 3 except thunderstorms are dry.	

The NCDC does not include the LAL for the historical lightning events included in Table 11.2. In order to determine the extent of lightning strikes, the yearly average of estimated number of lightning strikes within the county (378) and the comparison of the flash density of 4 to 8 per year and the stroke density of 12 to 24, indicates lightning strikes have a moderate frequency and will more than likely fall within the LAL range of 2 to 5. Therefore, Galveston County, Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island should expect the a range of 1 to 25 lightning strikes within 15 minutes at any given time.

11.4 Historical Occurrences

Historical evidence of lightning activity shows countywide vulnerability to lightning strikes. The NCDC database was reviewed from 1950 through June 2014; the date range below begins with the first recorded occurrence in the NCDC data base.

In a review of this information, there were no fatalities or injuries recorded. This information is passively collected; the actual coverage of detected strikes in Table 11.1 shows the extensive nature of the hazard, and Table 11.2 captures the reported occurrences with associated damages.

Table 11.2: Summary of Historical Events for Lightning (August 2007-June 2014)

Jurisdiction	Number of E vents	Property Damage
Bayou Vista	0	$0
Clear Lake Shores	0	$0
Friendswood*	7	$549,500
Hitchcock	0	$0
Jamaica Beach	1	$15,000
Kemah	1	$10,000
La Marque	0	$0
League City	1	$15,000
Santa Fe	0	$0
Village of Tiki Island	0	$0
Unincorporated	1	$250,000
Total	11	$578,500

Source: NCDC
Note: Data provided by Friendswood as" lightning fires", not documented as lightning on NCDC

11.5 Probability of Future Events

On average, several hundred strikes occur each year within the planning area. Based on historical occurrences of thunderstorms and associated impacts of lightning, lightning events are highly likely to occur on an annual basis.

The NCDC database only records reported events that resulted in fatalities, injury, and property damage and according to these records the planning area averages 1.6 events every year. Most thunderstorms occur during the spring (March, April, and May) and in the fall during the month of September. The NWS issues watches and warnings for severe thunderstorms; however, lightning is not criteria for issuance and the lead times can vary from minutes to hours. The impacts of

thunderstorms can occur with little to no warning and lightning strikes can occur as far as 10-15 miles away from a thunderstorm.

11.6 Vulnerability Assessment

All existing and future buildings, facilities, and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported lightning events have been factored into this vulnerability assessment and that the range used to calculate annualized expected property losses begins with the first occurrence recorded by the NCDC.[2] Lightning also interrupts communications and the supply of electricity to buildings and infrastructure. While no specific facilities have been identified as vulnerable to lightning, communications systems and power grids are vulnerable to disruption.

Table 11.3: Potential Annualized Losses - Lightning

Jurisdiction	Total Exposure*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Bayou Vista	$148,402,840	**Negligible	0.00%
Clear Lake Shores	$169,233,443	**Negligible	0.00%
Friendswood	$2,372,450,647	$79,408	0.00%
Hitchcock	$291,155,638	**Negligible	0.00%
Jamaica Beach	$253,449,835	**Negligible	0.00%
Kemah	$184,174,314	**Negligible	0.00%
La Marque	$616,967,900	**Negligible	0.00%
League City	$6,285,876,473	**Negligible	0.00%
Santa Fe	$633,204,508	**Negligible	0.00%
Tiki Island	$307,035,208	**Negligible	0.00%
Unincorporated	$1,738,099,508	$36,127	0.00%
Total	$13,000,049,864	$83,598	0.00%

Note: *Total Exposure is improved value of parcels in Galveston County
**Negligible is less than $5,000

11.7 Impact

The impact of lightning is considered to be moderate since it may result in injuries or deaths, shut down critical facilities and services for 24 hours or less, and affected properties may sustain damage and can be destroyed.

[2] It is likely that additional thunderstorm-related events occurred that were not reported to the NCDC and are not accounted for in this analysis.

12.0 Severe Winter Weather

12.1 Description

A severe winter storm event is identified as a storm with snow, ice, or freezing rain—all of which can cause significant problems for area residents. Although rare in southeast Texas, winter weather does occasionally occur. January is the month when snow, sleet, or freezing rain is most likely to be observed; yet, winter weather conditions can occur at any time during the winter and early spring months. The leading cause of death during winter storms is transportation accidents. Hypothermia and frost bite are other dangers from very cold winter temperatures.

The National Weather Service (NWS) defines a winter storm as having three factors: cold air, moisture, and lift. These three factors acting together create conditions suitable for a winter storm. Below is a listing of definitions for winter weather events that could impact the planning area:

- ***Snow Flurries -*** Intermittent light snowfall of short duration (generally light snow showers) with no measurable accumulation.
- ***Snow Showers -*** A snow shower is a short duration of moderate snowfall. Some accumulation is possible.
- ***Sleet -***Pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes.
- ***Freezing Rain -*** Rain that falls as a liquid but freezes into glaze upon contact with the ground.
- ***Wind Chill -*** The combination of wind and temperature that serves as an estimate of how cold it actually feels to exposed human skin. Wind chill values below -19 degrees are considered dangerous.

12.2 Location

Winter storms vary in location, intensity and duration but are considered rare occurrences in Galveston County and the upper Texas Gulf Coast. It is assumed all of the jurisdictions are equally susceptible to winter storm events; therefore, all areas of the county are equally affected. However, League City determined that severe winter weather is a rare event and would result in little to no discernable property damage. Therefore, severe winter weather is not recognized by League City in this plan update.

12.3 Extent

Figures 12.1 to 12.2 display scales/indices that factor the amount of snow recorded, wind (mph), estimated ice accumulations, and temperature to determine the extent of impact from severe winter weather events. The participating jurisdictions (except League City) should expect a Category One winter storm and an ice damage index range of 0 to 2.

Figure 12.1: Martin Winter Storm Category Scale

TheWeatherSpace.Com

WINTER STORM CATEGORY

MARTIN WINTER STORM CATEGORY SCALE ...

CATEGORY	SNOW	WIND	IMPACT
ONE	6-11"	15-24	MINIMAL
TWO	12-17"	25-38	MODERATE
THREE	18-23"	39-57	MAJOR
FOUR	24-29"	58-73	EXTENSIVE
FIVE	30"+	74+	CATASTROPHIC

Figure 12.2: Sperry–Piltz Ice Accumulation Index

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

Wind chill temperature is a measure of how cold the wind makes real air temperature feel to the human body, similar to the heat index for extreme heat (Figure 12.3). Since wind can dramatically accelerate heat loss from the body, a blustery 30° day would feel just as cold as a calm day with 0° temperatures.

Figure 12.3: Wind Chill Chart

Wind Chill Chart

Wind (mph)	Temperature (°F)																	
	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Countywide, Galveston County has never experienced a blizzard, but based on previous occurrences, the planning area has been subject to winter storm watches, warnings, freezing rain, sleet, snow and wind chill.

12.4 Historical Occurrences

The NCDC database was reviewed from 1950 through June 2014. This data was captured at a county level and includes the jurisdictions of Bayou Vista, Clear Lake Shores Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, Tiki Island, and the unincorporated areas of Galveston County for this analysis. During this period of time a severe ice storm occurred in 1997 and 2011, and one heavy snow fall occurred in 2004. The 1997 ice storm effected trees, powerlines and roadways. The weight of the ice caused trees and powerlines to snap and fall. Glazed roadways posed hazardous driving conditions. Schools were closed for two to three days to prevent additional traffic collisions. Over 1100 traffic accidents were reported in Southeast Texas which accounted for three deaths in 1997 and $800,000 in property damages. In 2004, snowfall totals ranged from 1-12 inches across the region. The heavier snowfall occurred over the coastal counties south of Houston because this area had more moisture in the atmosphere (being closer to the Gulf), and was also closer to the track of the upper level low. Table 13-2 depicts historical occurrences for the county.

Table 13-2: Historical Winter Storms (Galveston Countywide, January 1997- June 2014)

Date	Type	Deaths	Injuries	Property Damage	Description
Jan. 12-13, 1997	Ice Storm	3	0	$800,000	Trees, power lines and roadways were all affected by freezing rain and sleet. Glazed roadways posed hazardous driving conditions. Over 1,100 traffic accidents were reported in southeast Texas, causing 3 deaths.
Dec. 24-25, 2004	Heavy Snow	0	0	$0	A rare and record breaking snowfall occurred across southeast Texas. Snowfall totals ranged from 1-12 inches across the region. Approximately 4 inches fell on Galveston Island.
Feb. 3, 2011	Ice Storm	0	0	$0	A period of freezing rain and freezing drizzle led to icy roads, especially bridges and overpasses, and numerous accidents. Between one and two tenths of an inch of ice accumulated.

Source: National Climatic Data Center

Although not recorded in the NCDC, a cold core upper level low pressure system moved across southeast Texas on December 10, 2008. An inch of snow fell on Galveston Island with generally an

inch to two inches over the inland portions of county. This is the earliest accumulating snow that has affected southeast Texas and the planning area.

12.5 Probability of Future Events

It is important to note that the range used to calculate the probability of future occurrence begins with the first occurrence recorded by the NCDC. Based on the historical analysis a winter storm occurs once every 7-8 years. Significant winter weather events are likely to occur in the jurisdictions of Bayou Vista, Clear Lake Shores Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, Tiki Island, and the unincorporated areas of Galveston County equally.

12.6 Vulnerability Assessment

It is important to note that only reported winter storms have been factored into this vulnerability assessment.[1] To estimate losses due to winter storms, NCDC historical winter storm loss data was used. The vulnerability assessment for winter storm resulted in negligible annualized property losses and percent loss ratios for each individual jurisdiction and an average annualized loss ratio of $34,782 for the county and entire planning.

Most critical facilities are vulnerable to the effects of winter storms, due to potential disruption of services and transportation systems as well as possible structure failure due to heavy snow loads.

12.7 Impact

Winter storms often impact large areas and cross jurisdictional boundaries. All existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. A heavy accumulation of ice can break power and telephone lines, television towers, and trees. Highways become hazardous to travel on, and even stepping outdoors can be extremely risky. Utility disruptions from winter storms can severely impact the delivery of services. Water pipes can freeze and crack in sub-freezing temperatures, ice can build up on power lines and cause them to break under the weight, and ice accumulation on tree limbs can cause breakage and affect nearly power lines. These events can disrupt electric service for several days. Warning time for winter storms is generally six to twelve hours.

Therefore, the impact for the county is minor. It is likely that very few buildings in the jurisdictions of Bayou Vista, Clear Lake Shores Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, Tiki Island, and the unincorporated areas of Galveston County will be directly threatened or

[1] It is possible that additional winter storm events may have occurred since 1965 that were not reported to NCDC and are not accounted for in this analysis.

damaged by winter storms; in addition, any building damages directly attributable to winter storms would be considered negligible equally for the purposes of this risk assessment for the jurisdictions considered at risk to severe winter weather.

The potential impact of severe winter storm to people is considered minor, resulting in few, if any, injuries. However, the special needs population (children under five, the elderly, and those living below poverty level) may be more at risk to winter conditions if access to heating may be limited or unavailable and a potential for small children to be left unattended in vehicles. Table 12.3 provides a summary of special need population by jurisdiction and overall percentage of those potentially at risk by jurisdiction.

Table 12.3 Special Needs Population by Jurisdiction

Jurisdiction	Total Population (2010 Census)	Children (Under 5)	Elderly (Over 65)	Below Poverty	Total Percent of Population
Bayou Vista	1,537	33	342	229	39%
Clear Lake Shores	1,063	37	164	237	41%
Friendswood	35,805	1,867	4,198	7,001	36%
Hitchcock	6,691	592	957	95	25%
Jamaica Beach	983	35	192	226	46%
Kemah	1,773	121	171	430	41%
La Marque	14,509	1,060	2,006	62	22%
Santa Fe	12,222	703	1,742	238	22%
Tiki Island	968	20	243	26	30%
Galveston County	291,309	19,979	32,804	38,856	31%

Source: US Census 2010, Summary File, U.S Census ACS 5 year estimates 2009-2013

13.0 Drought

13.1 Description

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of all climatic regions, including areas with high and low average rainfall. Drought is the consequence of anticipated natural precipitation reduction over an extended period of time, usually a season or more in length. Drought can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 13-1 presents definitions for these different types of drought.

Drought is one of the most complex of all natural hazards as it is difficult to determine their precise beginning or end. In addition, drought can lead to other hazards such as extreme heat and wildfires. Their impact on wildlife and area farming is enormous, often killing crops, grazing land, edible plants and even in severe cases, trees. A secondary hazard to drought is wildfire because dying vegetation serves as a prime ignition source. Consequently, a heat wave combined with a drought is a very dangerous situation.

Table 13-1: Drought Classification Definitions

Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
Hydrologic Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops.
Socioeconomic Drought	The effect of demands for water exceeding the supply as a result of a weather-related supply shortfall.

Source: Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy, FEMA

13.2 Location

Drought occurs regularly in the Texas Gulf Basin and is a normal condition. However, they can vary greatly in their intensity and duration. On average, a year-long drought takes place somewhere in Texas once every three years and a major drought every 20 years. There is no distinct geographic boundary to drought; therefore, it can occur throughout the Galveston County area, including Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Tiki Island equally. For this plan update, League City does not consider drought as a risk and therefore is not included in the analysis provided in subsections 13.5 to 13.7.

13.3 Extent

The Palmer Drought Indices are used to measure the extent of drought. The Z Short-Term Conditions Index measures short-term drought on a weekly scale. The Meteorological Drought Index attempts to measure the duration and intensity of the long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. The Hydrological Drought Index in Table 13-2 is used to quantify the long term hydrological effects while Table 13-3 depicts magnitude of drought indices.

Table 13-2: Palmer Drought Classification Indices

	Drought Condition Classifications						
Drought Index	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z index	-2.75 and below	-2.00 to -2.74	-125 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.00	+3.00 to +3.00	+4.00 and above

Table 13-3: Palmer Drought Category Descriptions

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies	-5.0 or less

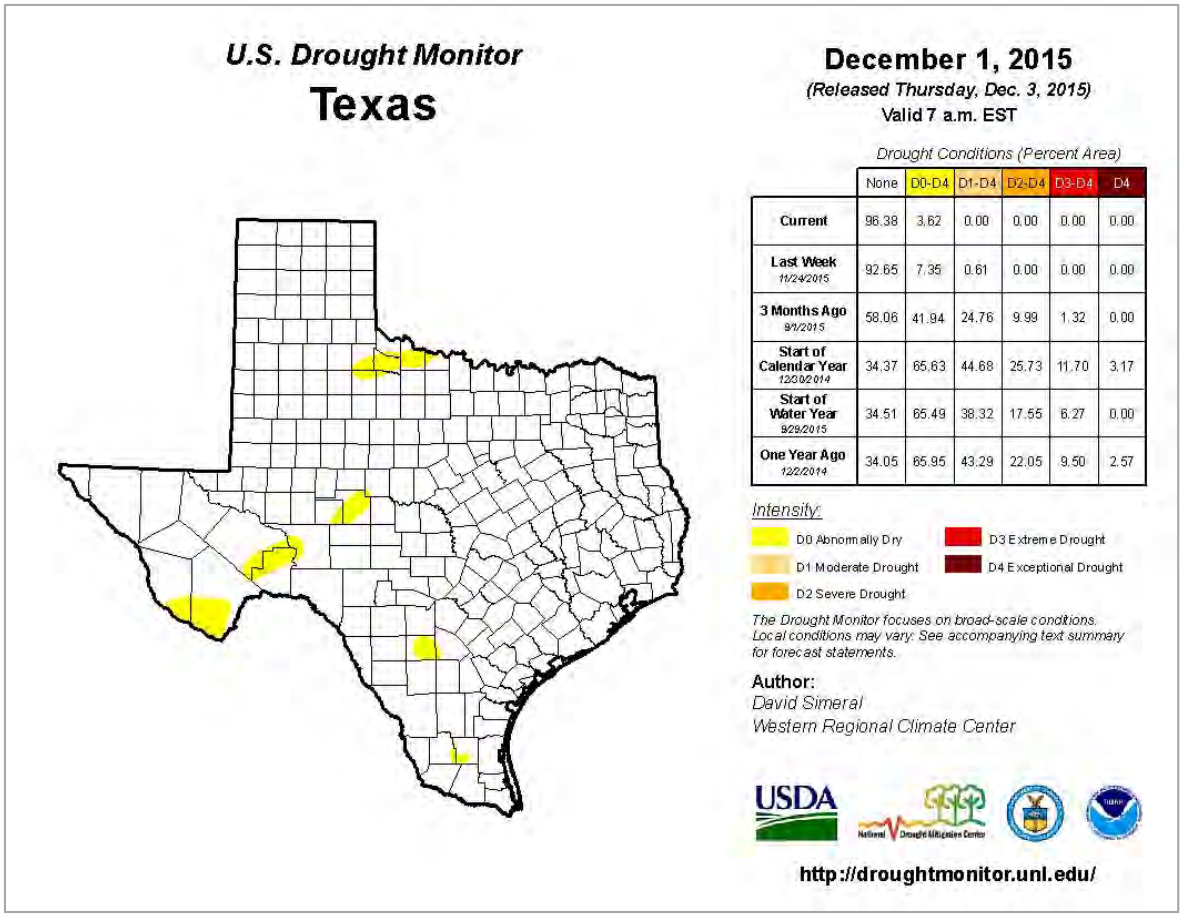
Source: National Drought Mitigation Center

Drought is a slow-onset hazards, but over time can have damaging effects on crops, municipal water supplies, recreation, and wildlife. If drought extends over a number of years, the direct and indirect economic impact can be significant.

Drought warnings are issued by the State Drought Preparedness Council, as directed by H.B. 2660, based upon input from NOAA, the Office of the State Climatologist, the U.S. Geological Service, the Texas Water Development Board, Texas Commission on Environmental Quality, and the Texas Agricultural Statistics Service. Warnings utilize five “levels of concern” and take into account assessments of climatology, agriculture, and water availability for each of 10 climatic regions of the state.

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. Indicators correspond to the intensity of drought. A snapshot of the region from December 2015 is included as Figure 13-1.

Figure 13-1: NCDC: U.S. Drought Monitor Indices, December 2015



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	96.38	3.62	0.00	0.00	0.00	0.00
Last Week 11/24/2015	92.65	7.35	0.61	0.00	0.00	0.00
3 Months Ago 9/1/2015	58.06	41.94	24.76	9.99	1.32	0.00
Start of Calendar Year 12/30/2014	34.37	65.63	44.68	25.73	11.70	3.17
Start of Water Year 9/29/2015	34.51	65.49	38.32	17.55	6.27	0.00
One Year Ago 12/2/2014	34.05	65.95	43.29	22.05	9.50	2.57

13.4 Historical Occurrences

Although the Galveston County area does not typically experience severe or extreme drought due to its proximity to the coast, it has been affected by key historic events. The NCDC collects drought data on a countywide level and therefore the summary of events provided below include Galveston County, Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Tiki Island followed by a summary of damages sustained in Table 13.4.

1996 Drought

From April to June of 1996, Southeast Texas, including Galveston County, experienced moderate to severe drought due to below normal precipitation that fell in the winter of 1995 to 1996. Some areas received only about 30 percent of their normal rainfall. Although exact county estimates are not available, total property damage across Southeast Texas reached $2 million with approximately $8 million in agricultural losses.

1998 Drought

Galveston County experienced another period of severe drought in 1998, beginning in May and ending in August. Rainfall levels were nine inches below normal, yet the area experienced temperatures at or above 96 degrees for months. Total crop and property damages reached $8.3 million for the county.

2000 Drought

High heat and dry conditions brought moderate to extreme drought to the area. Rainfall levels were down from 30 to 50 percent from their normal levels for the months of August and September. Wildfires broke out in neighboring counties, and the total crop damages for Southeast Texas were estimated at $102.3 million.

2005 Drought

Texas experienced record drought from 2005 to 2006 with a shortage of rainfall that lasted from May to December. Although the Galveston area was not affected as much as counties in North and Central Texas, it did experience abnormally dry conditions and moderate drought. The statewide drought losses from this event were estimated at $4.1 billion.

2009 Drought

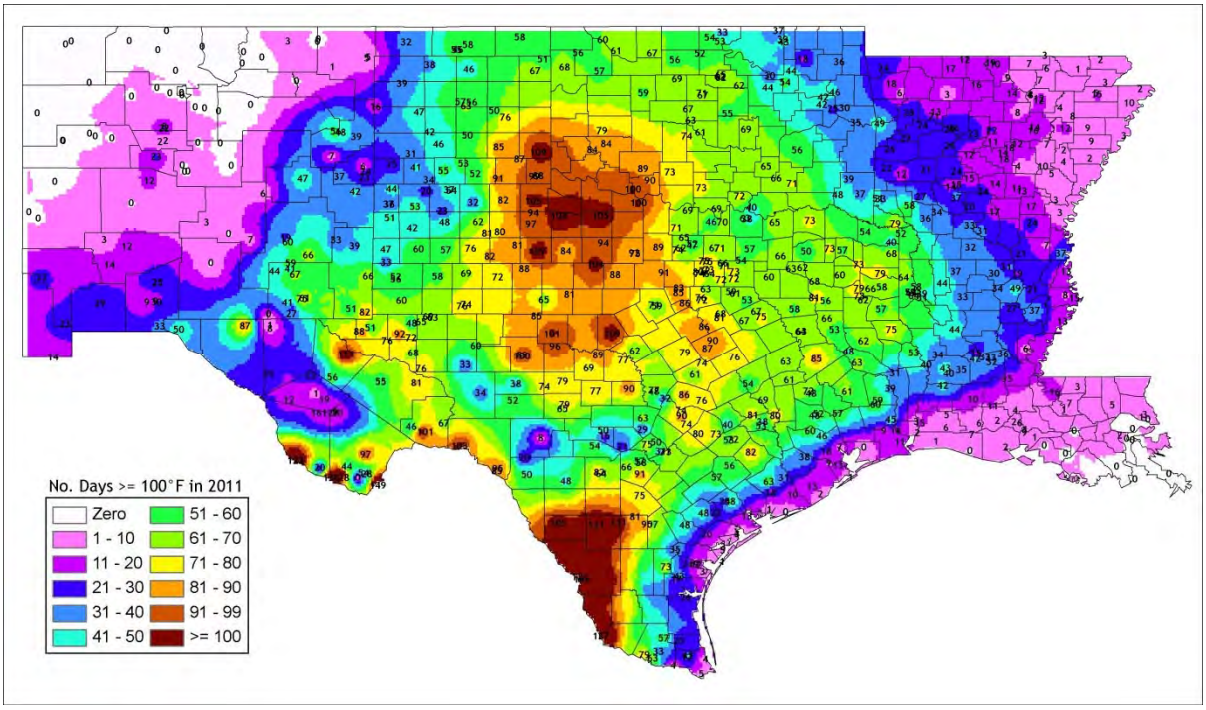
Like the 2005 drought, this period of high heat coupled with a lack of rainfall affected the entire state. The drought began in March and did not lessen in intensity until the fall months of 2009.

Galveston County experienced abnormally dry conditions, moderate and severe drought, with conditions improving in October of 2009.

2011 Drought

This drought was the most severe one-year drought on record for the State. Most of the State, including Galveston County, experienced D-4 Extreme Drought conditions. July of 2011 was the warmest month on record statewide; coastal portions of Galveston County did see some relief with slightly lower high temperatures due to the proximity to the Gulf of Mexico.

Figure13.2: Number of Days with Maximum Temperatures Equaling or Exceeding 100° in 2011 (through October 17, 2011)



Note: Graphic created by Brent McRoberts, Office of the State Climatologist, from Applied Climate Information System data in the 2011 Texas Drought Briefing Packet.

Table 13.4: Galveston Countywide Summary of Drought Events 1996 –June 2014

Date	Deaths	Injuries	Property Damage	Crop Damage
April 1, 1996	0	0	0	0
May 1, 1996	0	0	0	0
June 1, 1996	0	0	0	0
May 1, 1998	0	0	0	0
June 1, 1998	0	0	0	0
July 1, 1998	0	0	0	0
August 1, 1998	0	0	$1,000,000	$7,300,000
August 1, 2000	0	0	0	0
September 1, 2000	0	0	0	$102,300,000
Total	0	0	$1,000,000	$109,600,000

Source: NCDC

13.5 Probability of Future Events

Based on the historical frequency, it is likely that every 5 years the Galveston County area will experience at least one drought season with an average of 2 occurring every 6 years (1996-2014). Historical frequencies from 1895 to 1995 reveal that the entire Texas Gulf Coast Basin suffered drought conditions every 10 or 20 years and half of the basin suffered drought every five years.

13.6 Vulnerability Assessment

To estimate losses due to drought, NCDC historical drought loss data for Galveston County that includes the jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Tiki Island was also used.[1] Using this method based on historical losses annualized expected crop/livestock losses were approximately $6,060,274. For this analysis, Friendswood, Hitchcock, La Marque, Santa Fe, and the unincorporated areas of Galveston County are considered to have equal vulnerability for crop/livestock losses. Bayou Vista, Clear Lake Shores, Jamaica Beach, Kemah, and Tiki Island are not agricultural communities.

Drought impacts large areas and crosses jurisdictional boundaries. When droughts occur water supplies, live-stock, and crops are significantly impacted.

[1] Only drought events that have been reported have been factored into this vulnerability assessment. It is possible that additional drought events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Due to water restrictions and the drop in the water table crop losses are sometimes difficult to avoid. However, a significant water reservoir, fed by the San Jacinto River and located within the county, services the planning area. The reservoir storage capacity is approximately 7,360 acre feet and it is owned by the Gulf Coast Water Authority. This reservoir is the potable water source for the majority of the participating jurisdictions. Friendswood purchases their water from the City of Houston which is drawn from additional sources and locations.

13.7 Impact

The potential severity of impact of drought is substantial, especially taking into consideration the economic losses and interruption in water supplies that may result. If a drought extends over a number of years, the direct and indirect economic impact can be significant as they produce a complex web of impacts that spans many sectors of the economy and reach well beyond the area experiencing physical drought. This complexity exists because water is integral to our ability to produce goods and provide services.

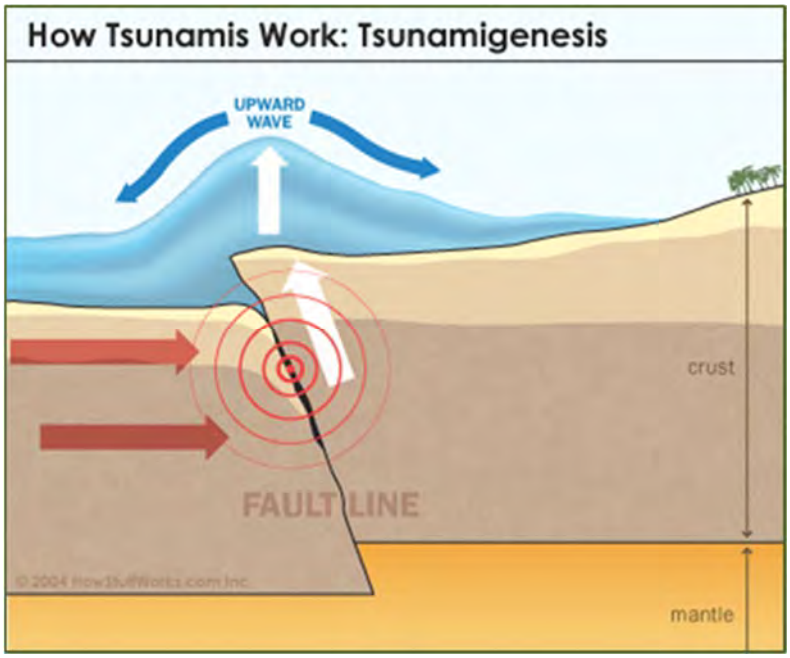
Based on the nine reported previous occurrences (1996 to 2000) and potential exposure for the drought, the potential severity of impacts of drought is limited with less than 10 percent of property destroyed. The average annualized loss over the 64-year period (1950 to 2014) for each participating jurisdiction is $44,615. Property losses could equally impact the unincorporated areas of Galveston County, Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Tiki Island.

14.0 Tsunami

14.1 Description

Tsunamis events can cause significant damage, injuries, and loss of life. The word tsunami is Japanese and means "harbor wave." A tsunami is a series of ocean waves generated by the sudden displacement of sea water most often caused by movement of the sea floor, landslides, or volcanic activity. Tsunami waves propagate outward from the area of the disturbance and can originate hundreds or even thousands of miles away from affected coastal areas.

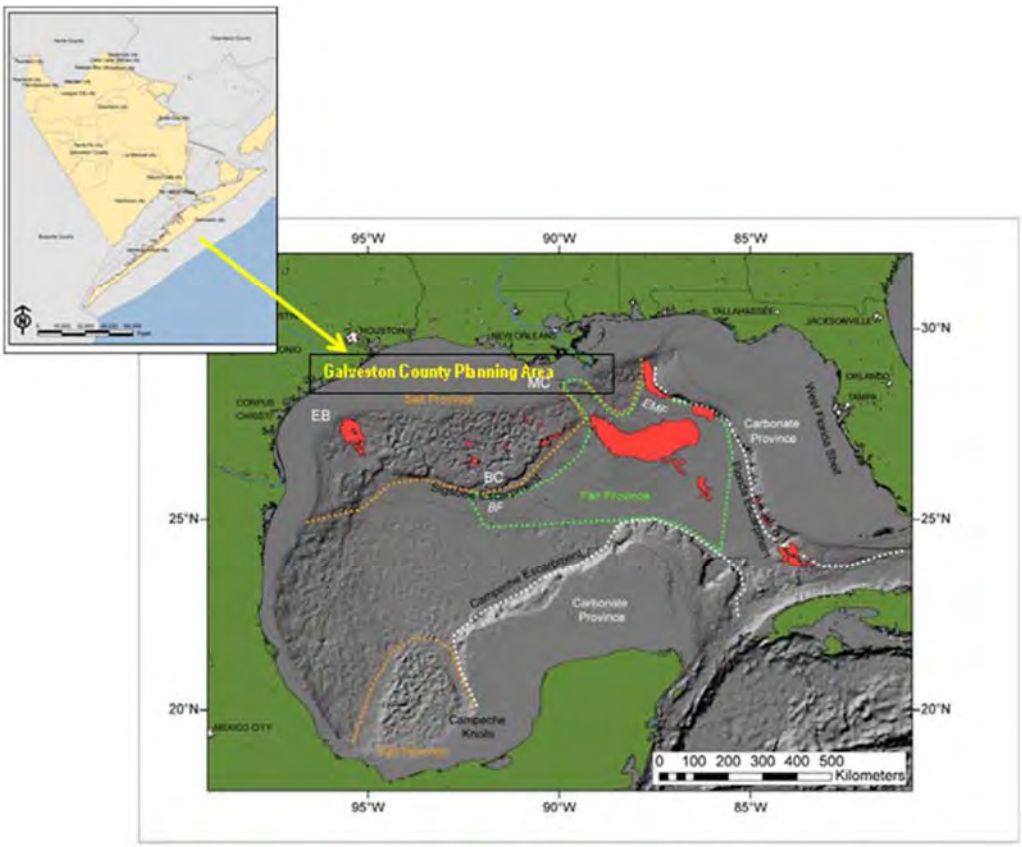
In the open ocean, tsunami waves travel at speeds of up to 600 miles per hour but are hidden in the deep water the wave travels in. The time between wave crests may range from five to 90 minutes. As the tsunami wave approaches shallow coastal waters, the wave slows down. The wave height becomes noticeable once it moves into shallower water. Waves can, without warning, rise to several feet or, in rare cases, tens of feet. Although the waves slow down as they enter shallow water, it is a negligible amount considering a 100-foot wave has been traveling at 600 miles per hour across the open ocean. In some extreme cases, a tsunami can throw several 100-foot tall waves onto the shore. The waves will come in sets. The first wave is almost never the largest; successive waves may be spaced tens of minutes apart and continue arriving for many hours.



14.2 Location

Galveston County is not at a high risk from tsunami due to the local rarity of the geologic events that most often generate these dangerous waves. However, according to the "Regional Assessment of Tsunami Potential in the Gulf of Mexico: US Geological Survey Administrative Report (2009)", there is sufficient evidence to consider submarine landslides in the Gulf of Mexico as a present-day tsunami hazard, as there are clear observations of large landslides along the continental margin of the Gulf. In this study hydrodynamic modeling of potential maximum tsunamis from landslide sources were conducted for the East Breaks (EB) slide (south Texas) and for hypothetical slides along the Florida/Campeche margin. Wave propagation yielded potential maximum tsunami run-up of approximately 4 meters or 13 feet (relative to mean sea level). Based on this information, Galveston County, Hitchcock, Jamaica Beach, Kemah, and Tiki Island are considered at risk from a tsunami event.

Figure 14.1: USGS Geological Provinces in the Gulf of Mexico – Galveston County Planning Area

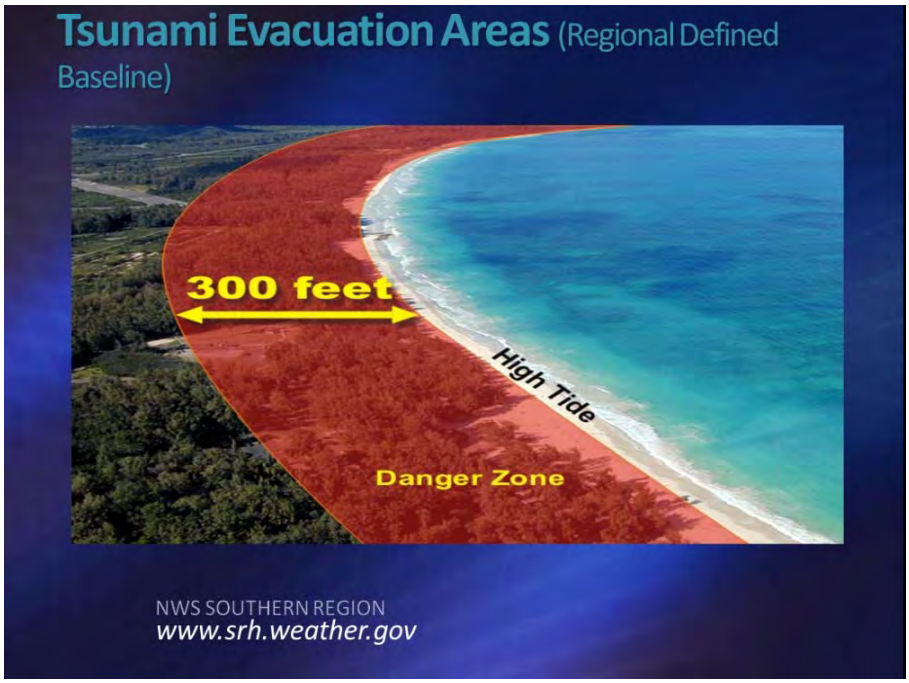


Source: Regional Assessment of Tsunami Potential in the Gulf of Mexico: U.S. Geological Survey Administration Report (2009)

Note: Landslide deposits are shaded in red

Primary impacts of a tsunami event would occur along the beachfront and island communities of the county, including Hitchcock, Jamaica Beach, and Kemah. The area of impact would likely be similar in coverage to a hurricane storm surge, affecting coastal areas. For planning purposes, NOAA suggests a 300-foot evacuation area.

Figure 14.2: Risk Areas



Source: NOAA

14.3 Extent

The severity of a tsunami depends on the amount of energy that propagates the wave, velocity of that wave, basin shape, population density, structures present, and warning time.

A modified Tsunami Intensity Scale was developed in 2001 by Gerassimos Papadopoulos and Fumihiko Imamura as is shown in Table 14.1. This 12-point scale of tsunami intensity is meant to correspond to current earthquake intensity scales and is arranged according to a tsunami's effects on: a) humans; b) objects including boats; and c) damage to buildings.

Taking note of the rare historical occurrences and the remote possibility for future events, Galveston County, Hitchcock, Jamaica Beach, Kemah, and Tiki Island could expect a potential tsunami event from a Level I to a Level X on the Tsunami Intensity Scale.

Table 14.1: Tsunami Intensity Scale

Level	Description
I	Not Felt
II	Scarcely Felt a. Felt by few people onboard small vessels. Not observed on the coast. b. No effect. c. No damage.
III	Weak a. Felt by most people on board small vessels. Observed by a few people on the coast. b. No effect. c. No damage.
IV	Largely Observed a. Felt by all onboard small vessels and by few people onboard large vessels. Observed by most people on the coast. b. Few small vessels move slightly onshore. c. No damage.
V	Strong (wave height 1 meter) a. Felt by all onboard large vessels and observed by all on the coast. Few people are frightened and run to higher ground. b. Many small vessels move strongly onshore, few of them crash into each other or overturn. Traces of sand layer are left behind on ground with favorable circumstances. Limited flooding of cultivated land. c. Limited flooding of outdoor facilities (such as gardens) of near-shore structures.
VI	Slightly damaging (2 m) a. Many people are frightened and run to higher ground. b. Most small vessels move violently onshore, crash strongly into each other, or overturn. c. Damage and flooding in a few wooden structures. Most masonry buildings withstand.
VII	Damaging (4 m) a. Many people are frightened and try to run to higher ground. b. Many small vessels damaged. Few large vessels oscillate violently. Objects of variable size and stability overturn and drift. Sand layer and accumulations of pebbles are left behind. Few aquaculture rafts washed away. c. Many wooden structures damaged, few are demolished or washed away. Damage of grade 1 and flooding in a few masonry buildings.
VIII	Heavily damaging (4 m) a. All people escape to higher ground; a few are washed away. b. Most of the small vessels are damaged; many are washed away. Few large vessels are moved ashore or crash into each other. Big objects are drifted away. Erosion and littering of the beach. Extensive flooding. Slight damage in tsunami-control forests and stop drifts. Many aquaculture rafts washed away, few partially damaged. c. Most wooden structures are washed away or demolished. Damage of grade 2 in a few masonry buildings. Most reinforced-concrete buildings sustain damage, in a few damage of grade 1 and flooding is observed.

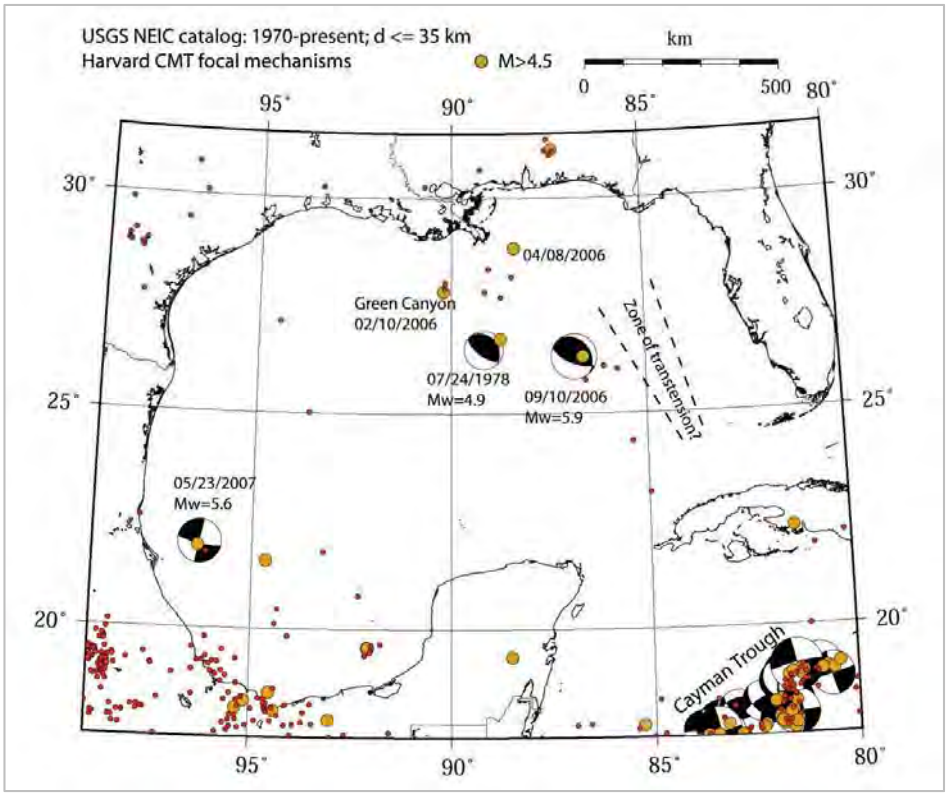
Level	Description
IX	Destructive (8 m) a. Many people are washed away. b. Most small vessels are destroyed or washed away. Many large vessels are moved violently ashore, few are destroyed. Extensive erosion and littering of the beach. Local ground subsidence. Partial destruction in tsunami-control forests and stop drifts. Most aquaculture rafts washed away, many partially damaged. c. Damage of grade 3 in many masonry buildings, few reinforced-concrete buildings suffer from damage grade 2.
X	Very destructive (8 m) a. General panic. Most people are washed away. b. Most large vessels are moved violently ashore, many are destroyed or collide with buildings. Small boulders from the sea bottom are moved inland. Cars overturned and drifted. Oil spills, fires start. Extensive ground subsidence. c. Damage of grade 4 in many masonry buildings, few reinforced-concrete buildings suffer from damage grade 3. Artificial embankments collapse, port breakwaters damaged.
XI	Devastating (16 m) b. Lifelines interrupted. Extensive fires. Water backwash drifts cars and other objects into the sea. Big boulders from sea bottom are moved inland. c. Damage of grade 5 in many masonry buildings. Few reinforced-concrete buildings suffer from damage grade 4, many suffer from damage grade 3.
XII	Completely devastating (32 m) Practically all masonry buildings demolished. Most reinforced-concrete buildings suffer from at least damage grade 3.

14.4 Historical Occurrences

According to the NCDC, a "definite" tsunami impacted Galveston, Texas, on October 24, 1918 around 3:45 a.m. The tsunami was generated by an earthquake that occurred in Puerto Rico. The observed wave run-up height was undetermined according to NOAA. A "questionable" tsunami impacted the same area on May 2, 1922 around 8:25 p.m. The cause for both events is believed to be earthquake activity originating near Puerto Rico. Galveston County is over 1,800 miles from the source of both events. There is no information available for either event concerning deaths, injuries or damages. The data provided by NCDC is on a countywide level, therefore the historical occurrences referenced include Hitchcock, Jamaica Beach, Kemah, Tiki Island, and the unincorporated areas of Galveston County.

Figure 14.3 displays the historical seismicity data for the Gulf of Mexico 1970 to 2009.

Figure 14.3: Gulf of Mexico Seismicity



Source: Regional Assessment of Tsunami Potential in the Gulf of Mexico: U.S. Geological Survey Administration Report (2009)

14.5 Probability of Future Events

An analysis of historical data indicates a very low risk for future occurrences of a tsunami for the Galveston County area. The probability of the future occurrence of a Tsunami is unlikely, with the last definite occurrence in 1918 nearly 100 years ago.

14.6 Vulnerability Assessment

The coastal areas of the county are those at greatest risk. Hitchcock, Jamaica Beach, Kemah, and Tiki Island and Galveston County are considered at risk. Tsunamis can cause great loss of life and property damage where they come ashore, and most deaths are the result of drowning. Associated risks include water pollution, damaged gas lines, and flooding.

If an intense tsunami of a Level X were to strike the area, wooden structures in the path of waves and those with pier-and- beam foundations could be destroyed. Waves can wash ships and shipping containers ashore, which become floating debris, causing extensive external damage. Critical infrastructure and commercial properties within the inundation area for a tsunami area would suffer major damage, with shutdowns for at least two weeks as critical infrastructure consists of low-rise, reinforced concrete buildings. It is expected that while the contents and non-structure components could be destroyed during an intense, Level X event, the outside structures for critical facilities and commercial properties could suffer major damage.

Scientific analysis of the tsunami threat is ongoing and modeling of local impacts may be forthcoming. However, for the purpose of this study, an analysis based on the evacuation area plus high tide was conducted (300ft plus 22 ft.). There were no critical facilities identified in the vulnerable area. Using a tidal surge buffer of 322 ft from the mapped shoreline, the following estimates shown in Table 14.2 were gathered to reflect the estimated number of parcels that could be impacted for Hitchcock, Jamaica Beach, Kemah, and the Unincorporated areas of Galveston County.

Table 14.2 Tidal Buffer Parcel Information

Total Value of Improvements	Hitchcock	Jamaica Beach	Kemah	Unincorporated
Count:	127	59	141	2
Maximum:	$919,090	$949,210	$1,474,440	$26,180
Sum:	$5,920,940	$8,227,181	$33,087,340	$26,180
Mean:	$46,622	$139,444	$234,662	$13,090

Tidal surge damage was not estimated for Tiki Island. The majority of homes and buildings are constructed along a man-made coastline. The total value of all 1,254 parcels, including two critical facilities, in the village is approximately $307 million. Figure 14.4 provides an overview of Tiki Island.

Figure 14.4 Village of Tiki Island

14.7 Impact

Even though the probability of a tsunami is low, the severity could be substantial. Records are unavailable to indicate the impact of the two suspected tsunamis for the area. However, several factors have changed since those events. The county and Hitchcock, Jamaica Beach, Kemah, and Tiki Island adhere to higher standards for building codes and the population density has increased substantially. However, it's expected that the impact on structures within the tidal surge buffer for Hitchcock, Jamaica Beach, Kemah, and the county would not be as devastating as the potential loss of life. Although Tiki Island is located outside the 300 ft. plus 22 ft. buffer, the Island could receive some damage to structures and potential loss of life.

15.0 Wildland Fire (Urban and Rural)

15.1 Description

Wildland fire is defined as any fire burning wildland vegetation-fuels; it includes prescribed fire, wildland fire use, and wildfire. Prescribed fires are planned fires started by land managers to accomplish specific natural resource objectives. Fires that occur from natural causes, such as lightning, that are then used to achieve management purposes under carefully controlled conditions with minimal suppression costs are known as wildland fire use (WFU).

Wildfires are unwanted and unplanned fires that result from natural ignition, unauthorized human-caused fire, escaped WFU, or escaped prescribed fire.

A **wildland-urban interface (WUI) fire** is a wildfire occurring in the wildland urban interface. The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfire.

Prescribed burning, also known as controlled burning, is the deliberate use of fire under specified and controlled conditions. Prescribed burning is used by forest management professionals and individual landowners to accomplish one or more of the following tasks:

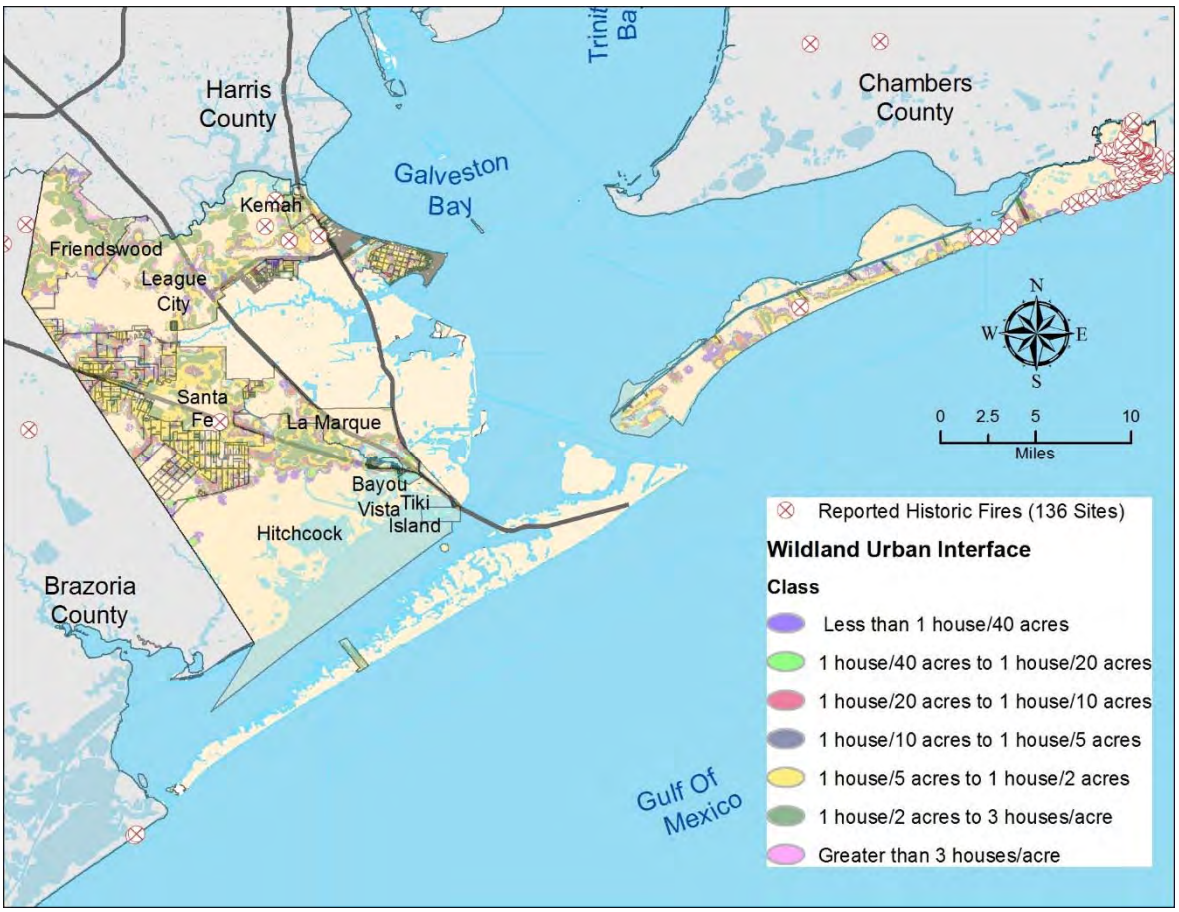
- ***Fuel Reduction*** – The reduction of accumulated grass, weeds, pine needles, and hardwood leaves. This type of vegetation can encourage wildfires in young stands and hinder regeneration of older stands.
- ***Hardwood Control*** – Prevents hardwood trees from competing with pines for nutrients and moisture; impeding visibility and access through the stands; and interfering with natural regeneration in areas better suited for growing pines.

The wildland interface problem has grown due to increases in population, urban expansion, land-management decisions, parks, greenbelts and the ever-present desire to intermingle with nature.

15.2 Location

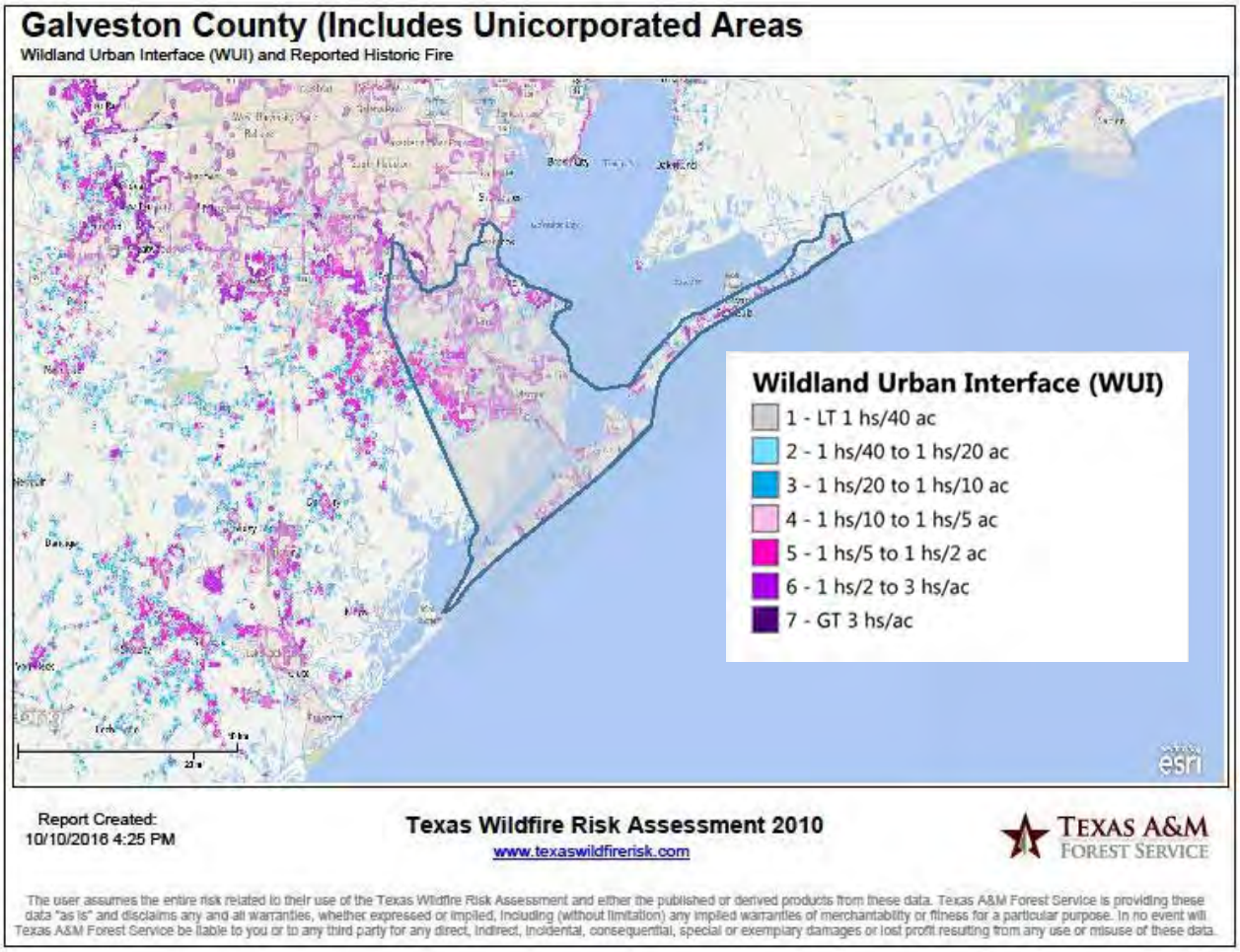
GIS data depicting historic wildfires and the wildland-urban interface from the Texas Forrest Service has been used to highlight areas of concern in the participating jurisdictions. Figure 15.1 graphically illustrates the wildfire hazard areas and provides an indication of where there is potential for damage to property and loss of life in the Galveston County study region. For this plan update, the jurisdictions of the unincorporated areas of Galveston County, Bayou Vista, Clear Lake Shores, Hitchcock, Kemah, La Marque, and Santa Fe consider Wildland fire a potential risk.

Figure 15.1: Wildland Urban Interface (WUI) Areas and Reported Historic Fires



Figures 15.2 to 15.8 depicts the Wildland Urban Interface as identified by the Texas A&M Wildfire Risk Assessment tool. The jurisdictional boundaries are shown by a dark line on each of the figures presented.

Figure 15.2: Galveston County Wildland Urban Interface (WUI) Areas and Reported Historic Fire



Source: Texas A&M http://www.texaswildfirerisk.com

Figure 15.3: Bayou Vista Wildland Urban Interface (WUI) Areas and Reported Historic Fire

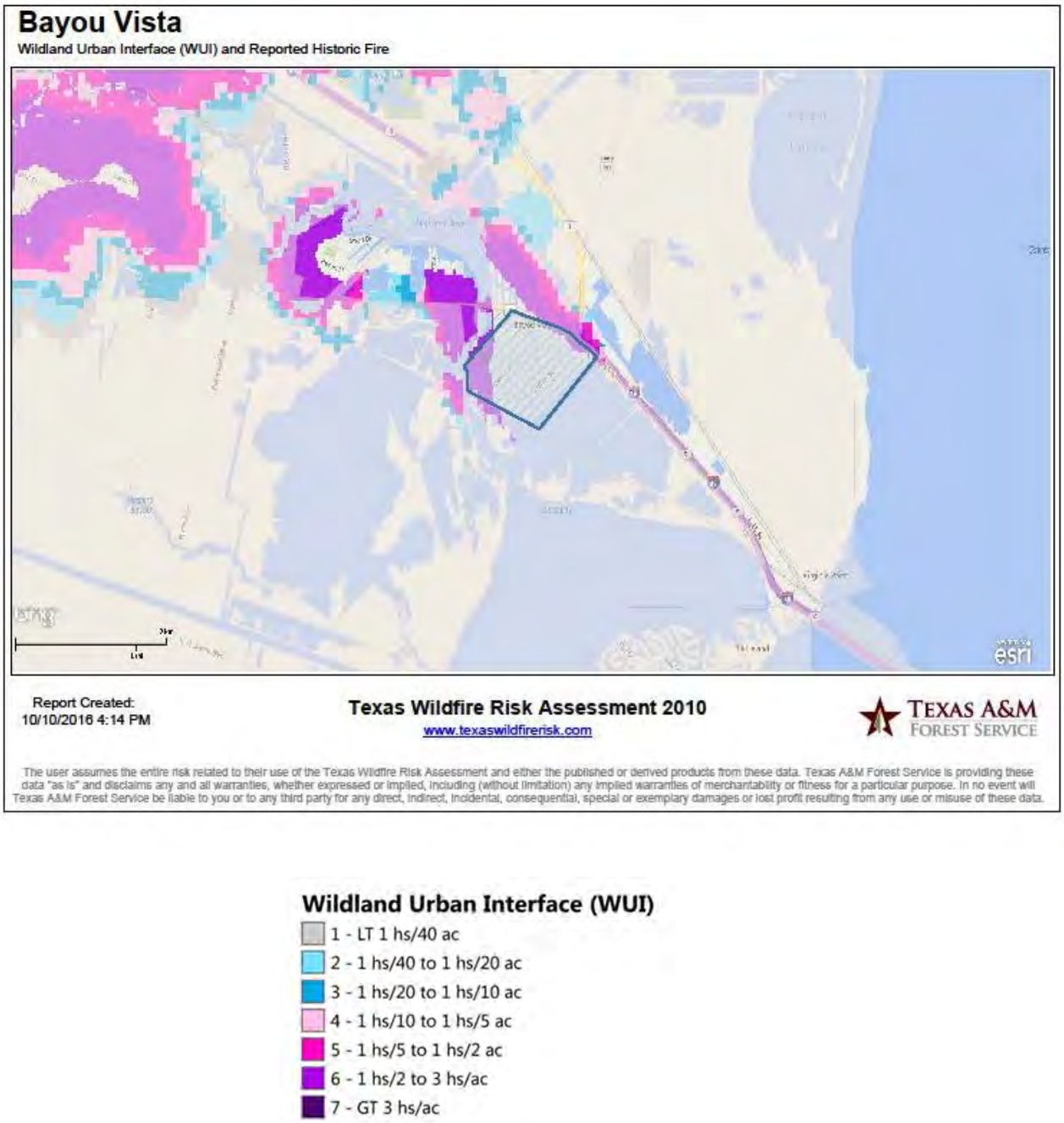
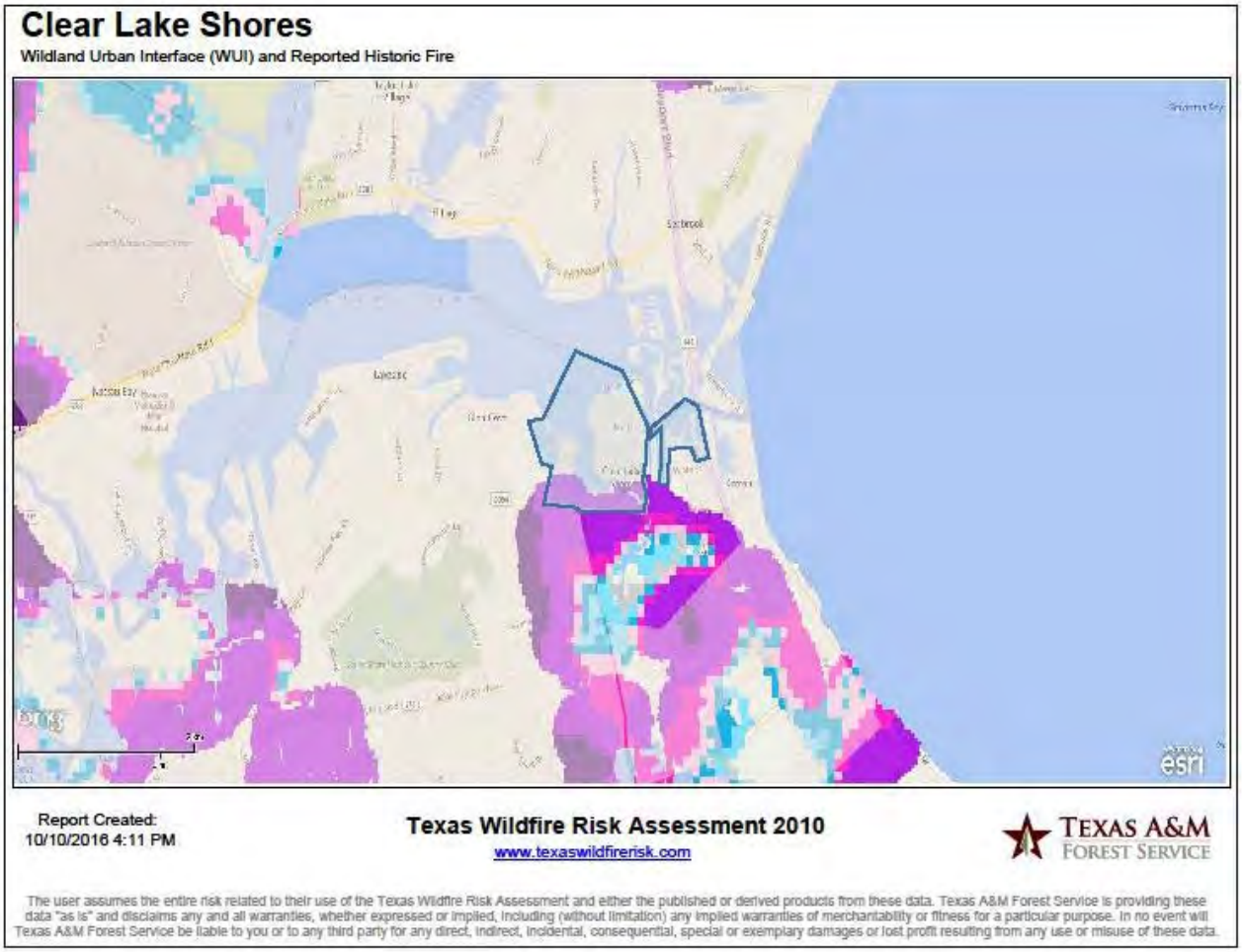


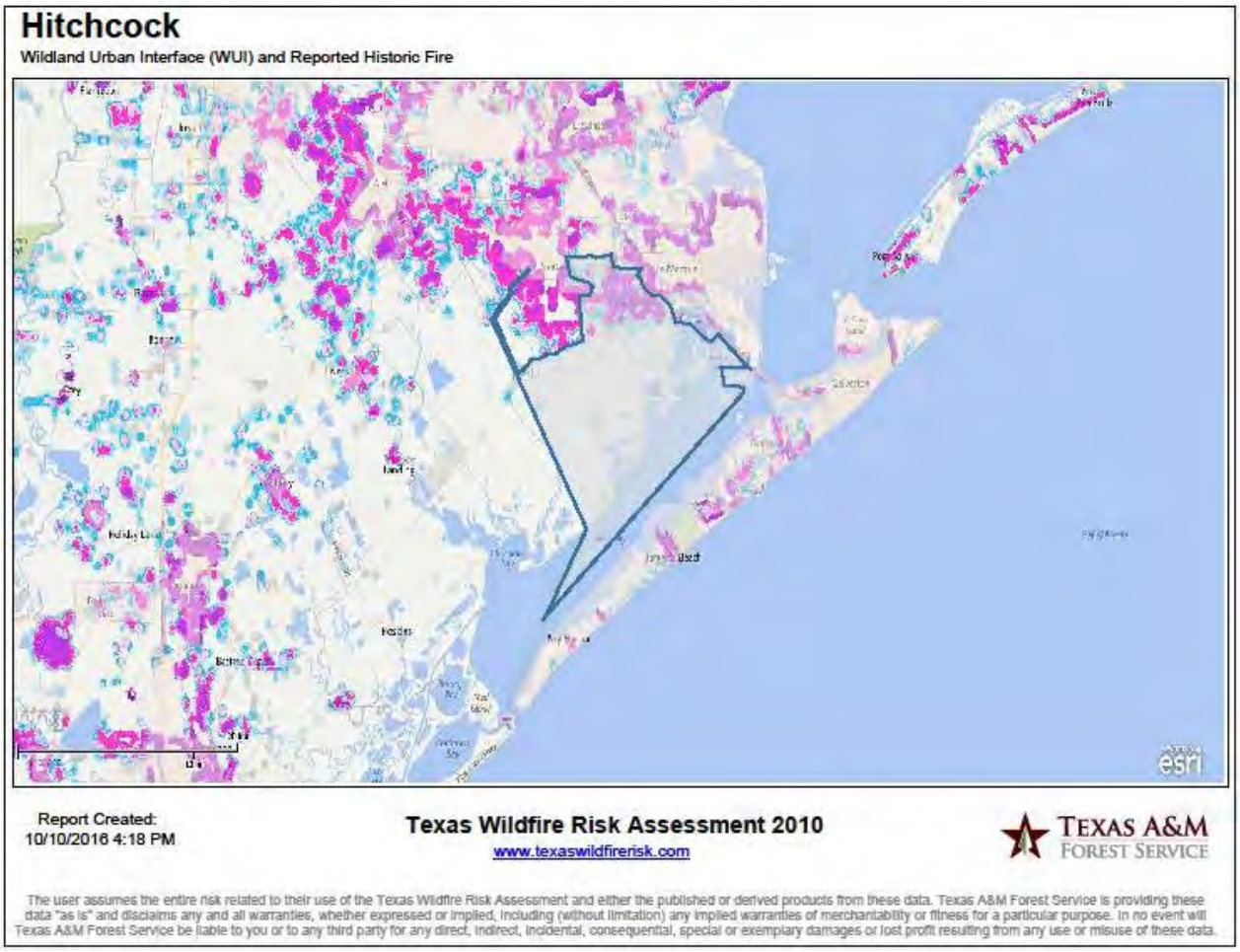
Figure 15.4: Clear Lake Shores Wildland Urban Interface (WUI) Areas and Reported Historic Fire



Wildland Urban Interface (WUI)

- 1 - LT 1 hs/40 ac
- 2 - 1 hs/40 to 1 hs/20 ac
- 3 - 1 hs/20 to 1 hs/10 ac
- 4 - 1 hs/10 to 1 hs/5 ac
- 5 - 1 hs/5 to 1 hs/2 ac
- 6 - 1 hs/2 to 3 hs/ac
- 7 - GT 3 hs/ac

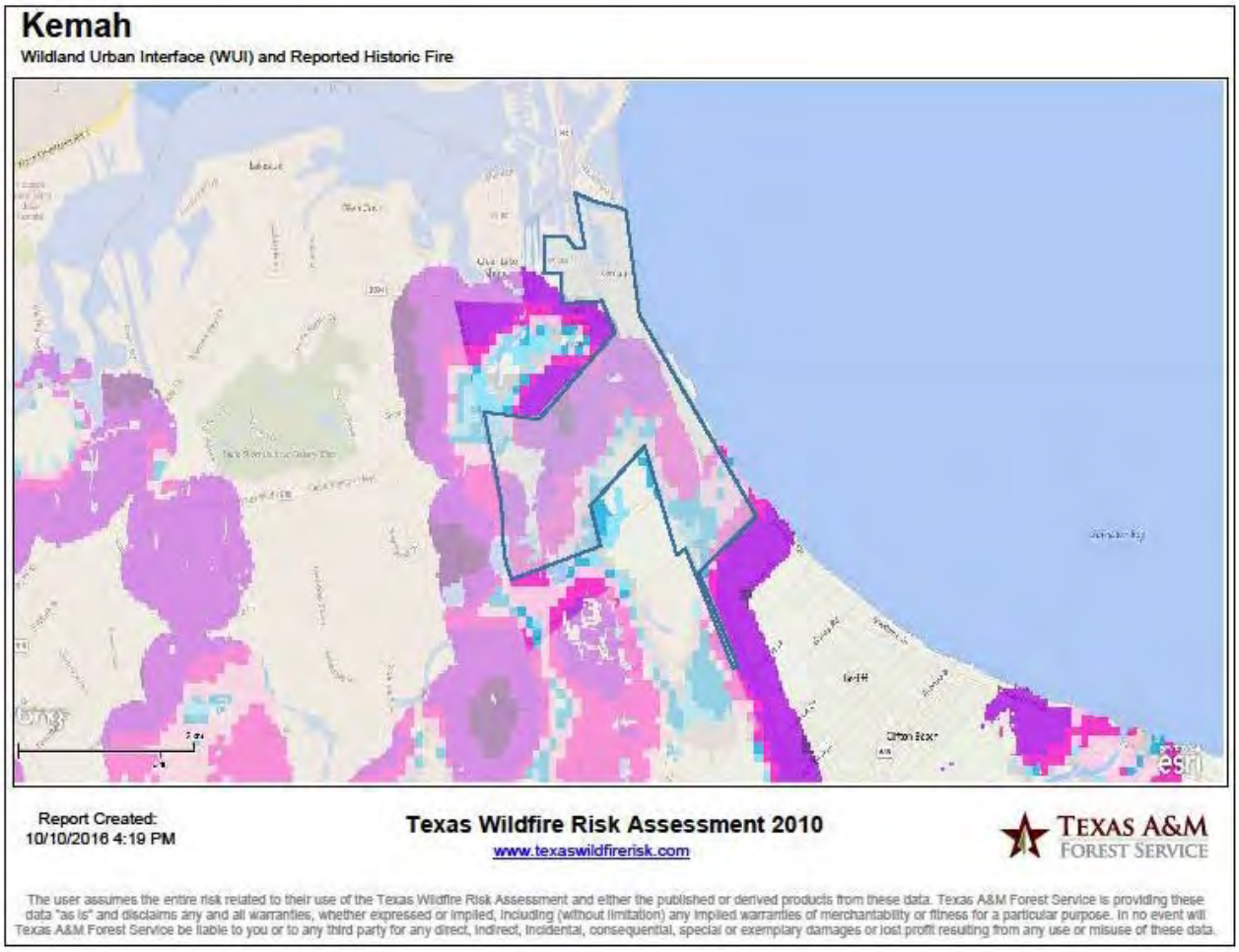
Figure 15.5: Hitchcock Wildland Urban Interface (WUI) Areas and Reported Historic Fire



Wildland Urban Interface (WUI)

- 1 - LT 1 hs/40 ac
- 2 - 1 hs/40 to 1 hs/20 ac
- 3 - 1 hs/20 to 1 hs/10 ac
- 4 - 1 hs/10 to 1 hs/5 ac
- 5 - 1 hs/5 to 1 hs/2 ac
- 6 - 1 hs/2 to 3 hs/ac
- 7 - GT 3 hs/ac

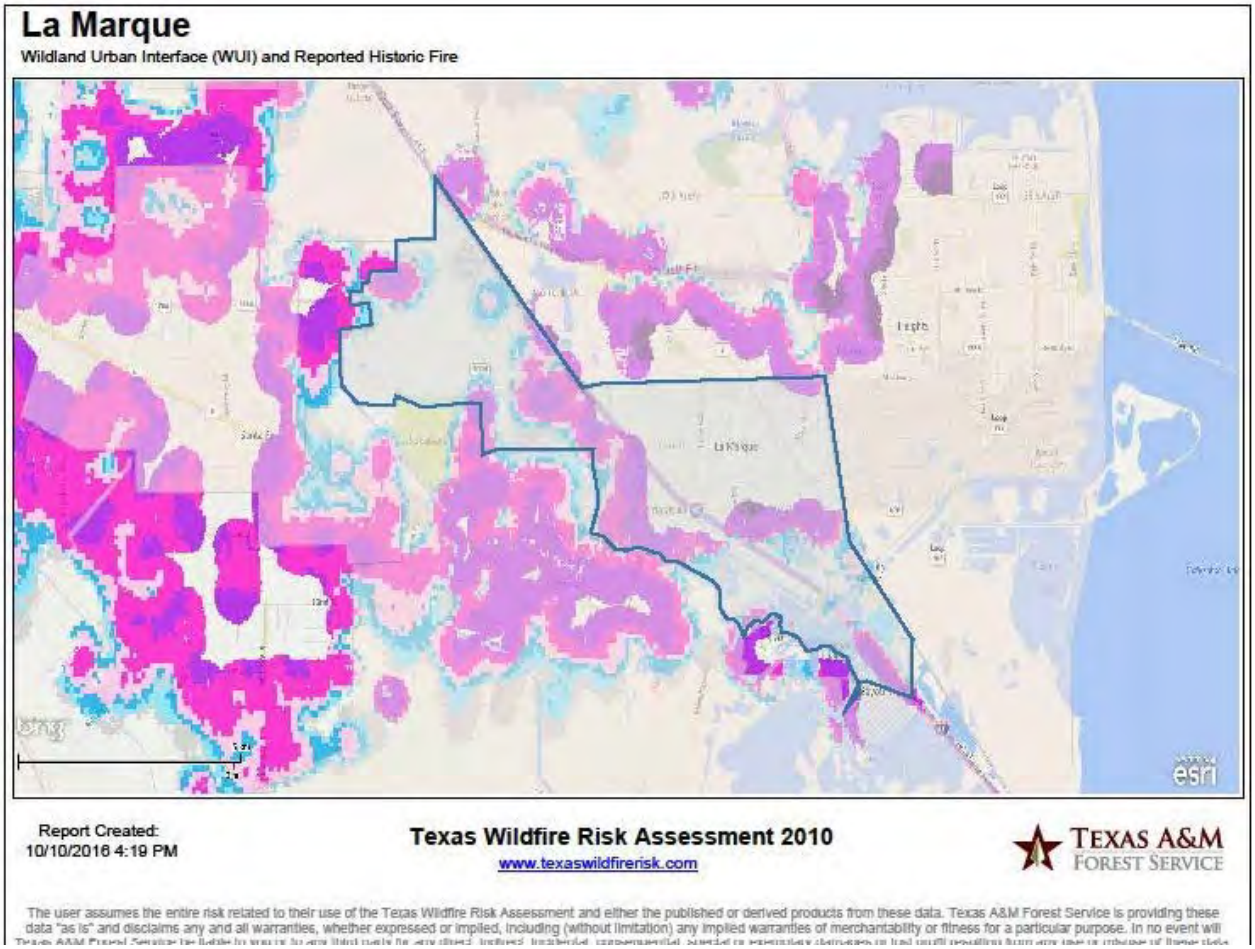
Figure 15.6: Kemah Wildland Urban Interface (WUI) Areas and Reported Historic Fire



Wildland Urban Interface (WUI)

- 1 - LT 1 hs/40 ac
- 2 - 1 hs/40 to 1 hs/20 ac
- 3 - 1 hs/20 to 1 hs/10 ac
- 4 - 1 hs/10 to 1 hs/5 ac
- 5 - 1 hs/5 to 1 hs/2 ac
- 6 - 1 hs/2 to 3 hs/ac
- 7 - GT 3 hs/ac

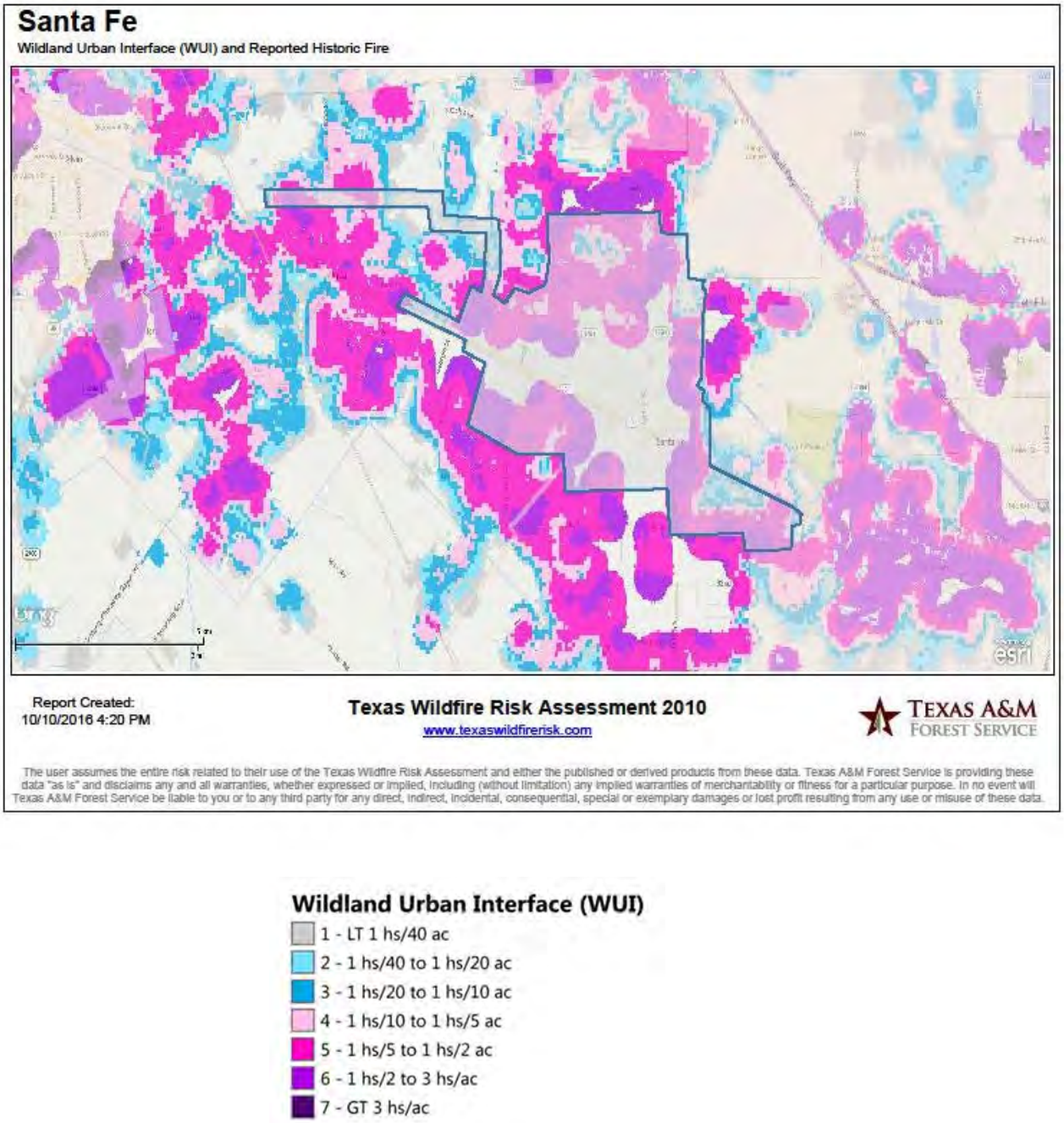
Figure 15.7: La Marque Wildland Urban Interface (WUI) Areas and Reported Historic Fire



Wildland Urban Interface (WUI)

- 1 - LT 1 hs/40 ac
- 2 - 1 hs/40 to 1 hs/20 ac
- 3 - 1 hs/20 to 1 hs/10 ac
- 4 - 1 hs/10 to 1 hs/5 ac
- 5 - 1 hs/5 to 1 hs/2 ac
- 6 - 1 hs/2 to 3 hs/ac
- 7 - GT 3 hs/ac

Figure 15.8: Santa Fe Wildland Urban Interface (WUI) Areas and Reported Historic Fire



15.3 Extent

Fire risk is measured in terms of magnitude and intensity using the Keetch-Byram Drought Index (KBDI), a mathematical system for relating current and recent weather conditions to potential or expected fire behavior. The KBDI determines forest fire potential based on a water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of 8 inches) and is expressed in hundredths of an inch of soil moisture depletion.

Figure 15.9 represents a current KBDI for the state of Texas with the drought index noted to correspond with the index range as shown in the legend. The drought index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, and an index of 800 represents absolutely dry conditions. Galveston County is within the 400 – 500 range. Table 15.1 provides the fire behavior categories for the four levels defined.

Figure 15.9: KBDI for the State of Texas (Galveston County Highlighted), 2016

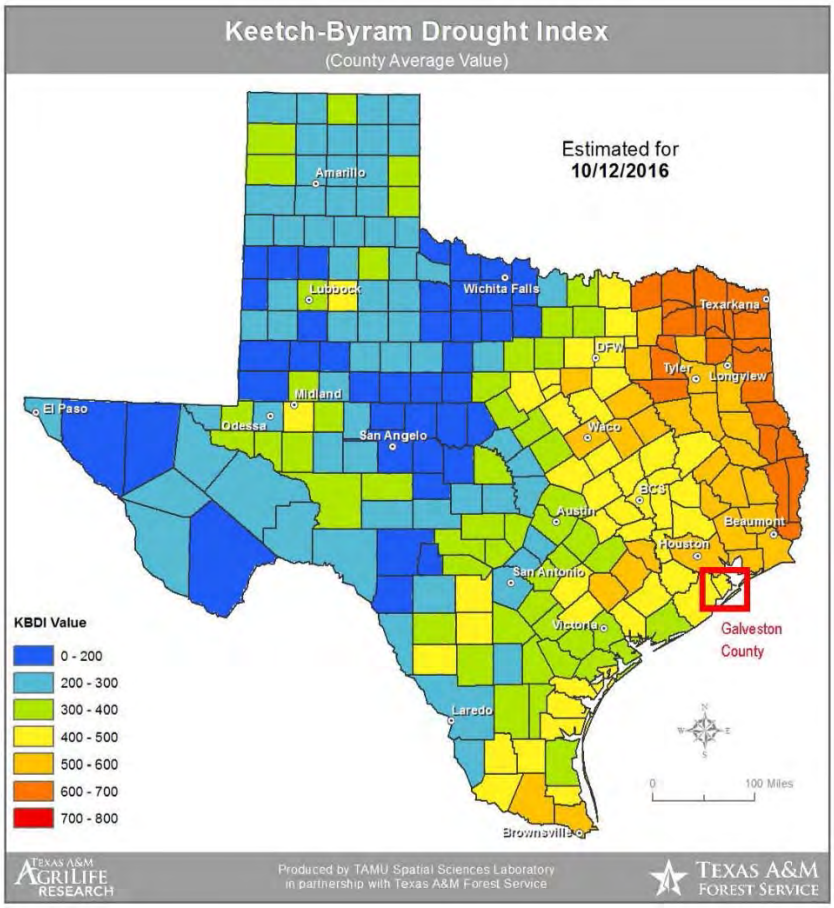


Table 15.1: Keetch-Byram Drought Index Values for Drought and Fire Potential

KBDI Values	Drought and Fire Potential Information
0 – 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation.
200 – 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity
400 – 600	Typical of late summer, early fall. Lower litter and duff layers contribute to fire intensity and will burn actively.
600 – 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep-burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

The jurisdictions at risk to potential wildland fires within the Galveston County planning area can expect a wildfire event that is in the range of 0 to 600 KBDI based on the amount of previous occurrences, the proximity to the Texas Gulf Coast and the amount of urban interface.

15.4 Historical Occurrences

Information gathered from the Wildfire data for the historic fires which were reported are provided as a summary in Figure 15.10 with details (location, date, acres burned, and cause) in Table 15.2. This data was carried over from the 2011-2016 Galveston County Hazard Mitigation Plan.

Figure 15.10: Summary of Galveston County Wildland Fires 2005-2009

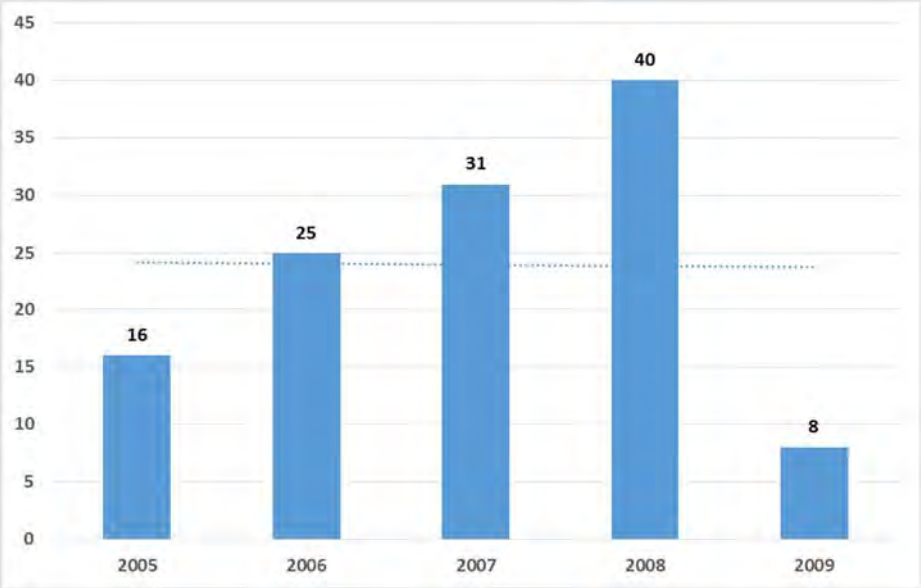


Table 15.2: Historical Wildfire Events

Responder Name	Start Date	Fire Name	Acres Burned	Cause
FWS	10/17/2009	No High Island Fire	0.5	Miscellaneous
	9/4/2008	Wf Two X Levee 2	5	Miscellaneous
	9/4/2008	Wf Two X Levee	15	Miscellaneous
	9/4/2008	Two X Levee 4	2	Miscellaneous
	9/4/2008	Two X Levee 3	6	Miscellaneous
	8/31/2008	No High Island North 08	2	Miscellaneous
	7/13/2008	Wf High Island Se	667	Miscellaneous
	3/2/2008	No Cade Estate Central	1	Miscellaneous
	2/27/2008	Wf Flow Line	0.7	Miscellaneous
	12/21/2007	Wf Cade Estate Small Ring Levee	25	Miscellaneous
	12/21/2007	Wf Cade Estate Cattle Pens	25	Miscellaneous
	12/5/2007	Wf Cade Estate West	100	Miscellaneous
	11/11/2007	No N. Ring Levee	11	Miscellaneous
	11/6/2007	No Sulfur Fire	2.6	Miscellaneous
	12/16/2006	No E. High Island Battery Tank	1.6	Miscellaneous
	10/15/2005	No Cade Estate	2	Miscellaneous
	7/20/2005	No Cattle Pen	19.2	Lightning
	5/17/2005	Giww Bridge Fa	5	Miscellaneous
High Island VFD	5/4/2009	Wildland fire	2	Incendiary
	4/8/2009	Wildland fire	20	Incendiary
	4/2/2009	Wildland fire	25	Incendiary
	4/2/2009	Wildland fire	1	Incendiary
	2/21/2009	Wildland fire	20	Debris burning
	12/28/2008	Wildland Fire	100	Incendiary
	12/11/2008	Wildland Fire	3	Incendiary
	12/6/2008	Brush fire	0.5	Debris burning
	11/29/2008	Brush fire	0.5	Debris burning
	11/14/2008	Wildland fire	50	Debris burning
	11/2/2008	Wildland fire	25	Incendiary
	10/20/2008	Wildland fire	4	Debris burning
	9/4/2008	Wildland fire	200	Incendiary
	8/3/2008	Wildland fire	100	Incendiary
	8/2/2008	Wildland fire	2	Campfire
	8/2/2008	Wildland fire	20	Incendiary

Responder Name	Start Date	Fire Name	Acres Burned	Cause
High Island VFD	7/26/2008	Brush fire	0.5	Debris burning
	7/20/2008	Wildland fire	100	Incendiary
	7/14/2008	Wildland fire	10	Incendiary
	7/13/2008	Wildland fire	2	Incendiary
	7/5/2008	Wildland fire	20	Incendiary
	4/28/2008	Grass fire	0.5	Debris burning
	4/17/2008	Wildland fire	5	Incendiary
	4/5/2008	Wildland fire	10	Incendiary
	3/31/2008	Wildland fire	0.5	Campfire
	3/17/2008	Wildland fire	0.5	Debris burning
	3/17/2008	Wildland fire	5	Incendiary
	3/15/2008	Wildland fire	0.5	Campfire
	3/15/2008	Wildland fire	3	Incendiary
	3/15/2008	Wildland fire	25	Incendiary
	3/2/2008	Wildland fire	4	Incendiary
	2/6/2008	Wildland fire	15	Incendiary
	1/13/2008	Wildland fire	2	Debris burning
	12/21/2007	Wildland Fire	60	Incendiary
	12/20/2007	Wildland Fire	50	Incendiary
	11/12/2007	Wildland Fire	1	Debris burning
	11/9/2007	Wildland Fire	20	Incendiary
	11/4/2007	Wildland Fire	10	Incendiary
	10/29/2007	Wildland Fire	25	Incendiary
	10/27/2007	Wildland Fire	10	Incendiary
	10/26/2007	Wildland Fire	5	Incendiary
	10/23/2007	Wildland Fire	1	Campfire
	10/23/2007	Wildland Fire	20	Incendiary
	8/27/2007	Wildland Fire	10	Incendiary
	8/27/2007	Wildland Fire	20	Incendiary
	8/15/2007	Wildland Fire	0.5	Incendiary
	7/29/2007	Wildland Fire	60	Debris burning
	6/28/2007	Wildland Fire	100	Incendiary
	5/24/2007	Wildland Fire	100	Incendiary
	5/24/2007	Wildland Fire	50	Incendiary
	5/17/2007	Wildland Fire	25	Incendiary
	5/16/2007	Wildland Fire	20	Incendiary

Responder Name	Start Date	Fire Name	Acres Burned	Cause
High Island VFD	5/14/2007	Wildland Fire	10	Incendiary
	4/16/2007	Wildland Fire	10	Debris burning
	3/30/2007	Wildland Fire	1	Campfire
	3/15/2007	Wildland Fire	0.5	Incendiary
	2/26/2007	Wildland Fire	10	Incendiary
	2/18/2007	Wildland Fire	1	Debris burning
	2/13/2007	Wildland Fire	0.5	Campfire
	12/31/2006	Wildland Fire	0.5	Incendiary
	12/31/2006	Wildland Fire	2	Incendiary
	11/18/2006	Wildland Fire	20	Incendiary
	9/21/2006	Grass Fire	0.05	Equipment use
	9/14/2006	Wildland Fire	10	Incendiary
	9/6/2006	Wildland Fire	25	Incendiary
	9/4/2006	Wildland Fire	20	Incendiary
	9/3/2006	Wildland Fire	1	Campfire
	9/1/2006	Wildland Fire	10	Incendiary
	8/26/2006	Wildland Fire	10	Lightning
	8/3/2006	Wildland Fire	5	Debris burning
	7/25/2006	Wildland Fire	10	Incendiary
	7/25/2006	Wildland Fire	5	Incendiary
	6/7/2006	Wildland Fire	15	Incendiary
	4/27/2006	Wildland Fire	2	Incendiary
	4/20/2006	Wildland fire	10	Debris burning
	4/15/2006	Wildland fire	2	Campfire
	3/11/2006	Wildland fire	2	Incendiary
	3/5/2006	wildland fire	5	Debris burning
	3/4/2006	wildland fire	10	Incendiary
	3/4/2006	wildland fire	30	Incendiary
	3/2/2006	wildland fire	10	Incendiary
	2/26/2006	wildland fire	20	Incendiary
	1/31/2006	Wildland fire	25	Incendiary
	10/20/2005	Grass Fire	2	Debris burning
	8/30/2005	Marsh fire	50	Incendiary
	8/22/2005	Grass Fire	10	Equipment use
	8/8/2005	Grass Fire	2	Equipment use
	7/6/2005	Grass Fire	1	Incendiary

Responder Name	Start Date	Fire Name	Acres Burned	Cause
High Island VFD	7/5/2005	Grass Fire	1	Incendiary
	7/4/2005	grass fire	5	Incendiary
	7/2/2005	Grass Fire	1	Campfire
	7/1/2005	Marsh Fire	20	Incendiary
	6/30/2005	Marsh Fire	25	Incendiary
	6/25/2005	Marsh Fire	100	Incendiary
	6/3/2005	Marsh Fire	20	Incendiary
	5/3/2005	Grass Fire	4	Miscellaneous
League City	1/30/2009	Bayridge	6	Equipment use
	1/13/2009	Sunset Ridge	20	Incendiary
	11/9/2008	State Highway 146	50	Incendiary
	1/12/2008	Leisure Lane	200	Debris burning
Santa Fe	1/11/2008	FM 1764	2	Debris burning

Source: Texas Forest Service, 2011-2016 Galveston County Hazard Mitigation Plan

The Texas Fire Incident Reporting System (TEXFIRS) captures fire incident reports voluntarily provided by fire departments within the planning area and is presented in Table 15.3. Clear Lake Shores receives fire protection from Kemah and the unincorporated areas of Galveston County are provided by High Island, Port Bolivar, and Bacliff. The numbers reported for these jurisdictions is inclusive.

Table 15.3: Types of Fires from 2010-2015 by Jurisdiction

Responder	Structure	Vehicle	Natural Vegetation	Outside Rubbish	Special Outside	Other	Crop	Total
Tiki Island F & R	3	7	6	2	2	0	0	20
Jamaica Beach FD	14	1	15	23	14	1	2	68
Clear Lake Shores/Kemah FD	15	23	13	6	10	15	0	82
Bayou Vista FD	12	11	17	16	5	1	2	62
Friendswood FD	105	42	68	79	22	5	3	324
Hitchcock VFD	81	31	42	59	4	1	0	218
Santa Fe F & R	29	9	51	29	8	5	0	131
La Marque FD	97	69	40	73	12	12	1	303
League City FD	206	119	113	170	27	0	2	637
High Island VFD (Unincorp.)	8	2	45	17	2	2	0	76
Port Bolivar VFD (Unincorp.)	8	2	18	24	3	10	0	65
Bacliff FD (Unincorp.)	24	11	17	30	7	13	0	102

Source: TEXFIRS (2010-2015)

15.5 Probability of Future Events

Climatic conditions such as severe freezes and drought can significantly increase the probability of wildland fires since these conditions kill vegetation, creating a prime fuel source for these types of fires. The intensity of fires and the rate at which they spread are directly related to wind speed, temperature, and relative humidity.

The threat of wildland fire changes with the season, but overall, the probability of future occurrence of a wildland fire is likely within in the next 4-5 years.

15.6 Vulnerability Assessment

Table 15.4 provides information on the number of persons potentially exposed to the wildfire hazard based upon mapped wildfire hazard areas previously shown, along with the estimated number of buildings at risk and total exposure for at-risk buildings.

Table 15.4: Estimated Exposure of People and Parcels by Jurisdiction

Jurisdiction	Total Est. Population	Total Est. No. of Parcels	Improved Value of Parcels	At Risk		
				No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,465	232	$36,501,220
Clear Lake Shores	1,069	1,051	$243,448,194	313	192	$78,888,441
Friendswood	26,364	10,853	$3,085,164,965	22,686	6,652	$1,964,292,327
Hitchcock	6,961	6,337	$460,075,283	6,906	5,009	$335,741,794
Jamaica Beach	983	1,590	$338,227,637	955	1,420	$277,279,567
Kemah	2,906	1,221	$294,986,165	2,604	718	$171,765,945
La Marque	14,543	8,972	$827,263,553	5,284	2,980	$401,180,580
League City	82,353	35,762	$8,164,064,546	58,404	16,296	$4,184,914,187
Santa Fe	12,814	6,457	$845,974,919	9,167	4,094	$548,588,359
Tiki Island	966	1,254	$445,402,231	29	6	$1,108,760
Galveston County Unincorporated	40,244	34,756	$2,931,109,729	31,014	22,280	$1,926,155,791
Total	190,740	109,577	$17,860,872,212	138,827	59,879	$9,926,416,971

15.7 Impact

Wildland fires are more likely to occur during periods of high wind and low humidity; warning time is minimal to none. Due to the humid climate of the Galveston County planning area, the amount of previous occurrences and the potential property at risk, the impact of an event would be minor with few injuries and less than 10 percent of property affected, damaged or destroyed.

16.0 Coastal Erosion and Retreat

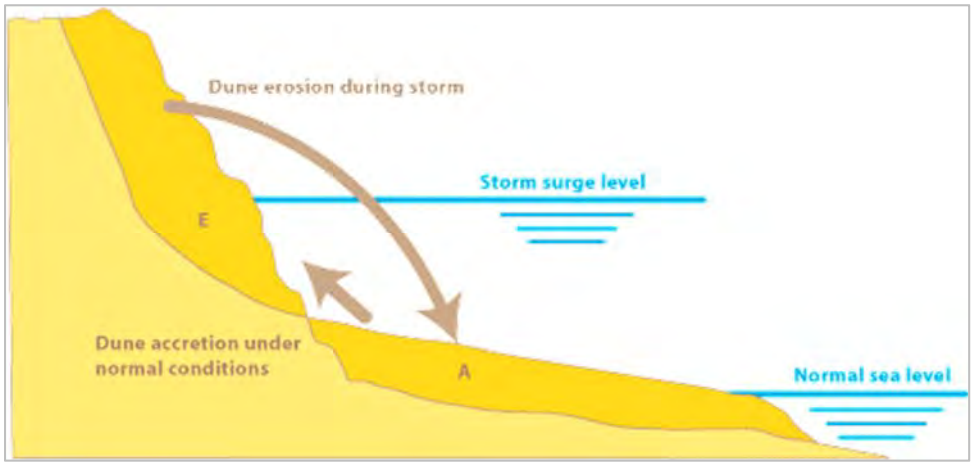
16.1 Description

As defined by NOAA, coastal erosion is a process whereby large storms, flooding, strong wave action, sea level rise, and human activities, such as inappropriate land use, alterations, and shore protection structures, erodes the beaches and bluffs along the U.S. ocean coasts. Erosion undermines and often destroys homes, businesses, and public infrastructure and can have long-term economic and social consequences. Figure 16.1 provides a graphic representation of the coastal erosion process.

Contributing processes to coastal erosion include tides, relative sea-level rise, subsidence, tropical and non-tropical low pressure centers. Model projections by the Intergovernmental Panel on Climate Change predict that global sea level rise will continue at an increase of as much as one meter during the next 100 years. Sea level rise measured by Texas Coastal Ocean Observation Network tide gauges in the Galveston area measured a current rise of about six millimeters per year. At this current rate of rise, local sea levels in the Galveston County area can be projected to be 0.6 meters (approximately two feet) by the year 2100.

A small rise in sea level can result in a significant shoreline retreat and an increased risk of inundation of wetlands, marshes, private property, and public infrastructure. Relative sea level rise increases the vulnerability of barrier islands and peninsulas to inundation from storm surge, wind driven waves, and tides from non-tropical weather systems.

Figure 16.1: Coastal Erosion Process



Source: http://www.conscience-eu.ne

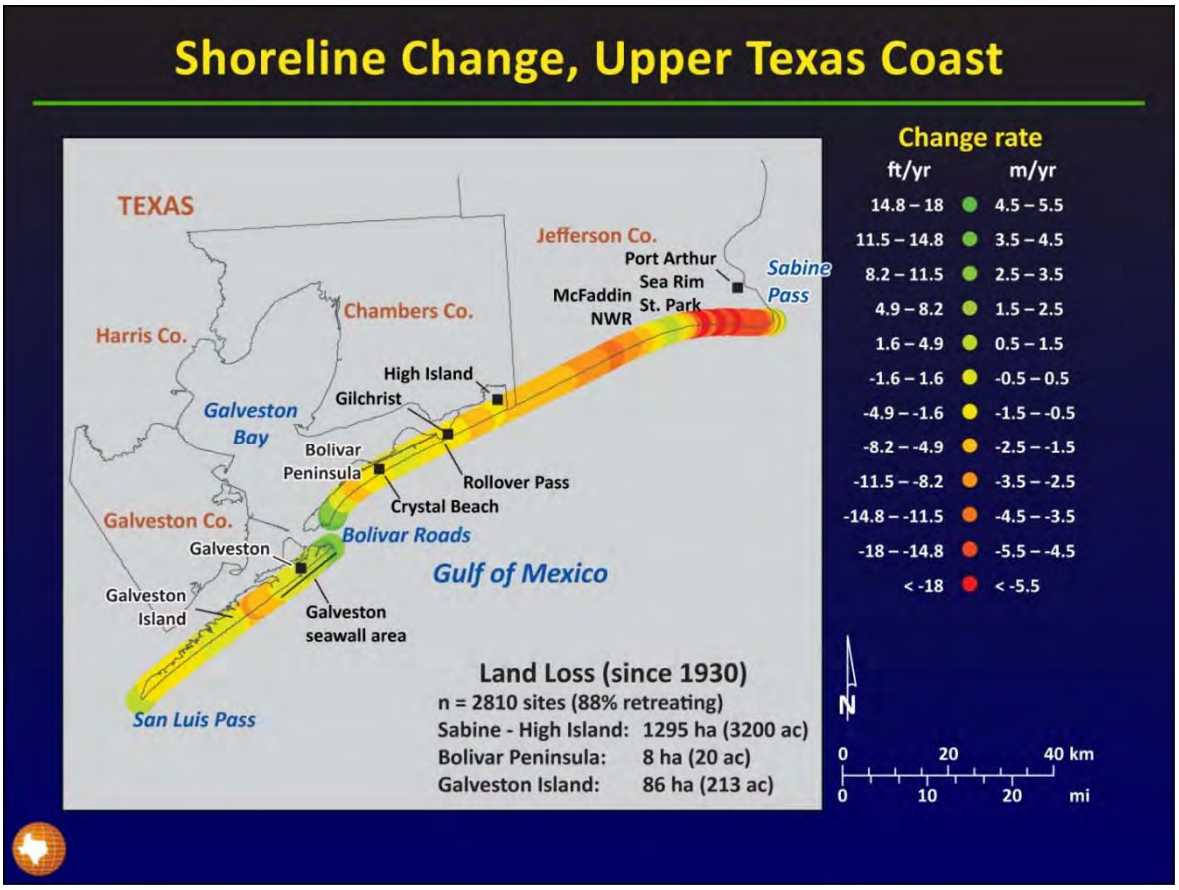
16.2 Location

Coastal erosion applies to the jurisdictions in Galveston County that border the Gulf or tidal waterway. These include Clear Lake Shores, Hitchcock, Jamaica Beach, Kemah, Tiki Island, and the unincorporated areas of Galveston County.

16.3 Extent

Galveston County has approximately 55 miles of Gulf shoreline and 291 miles of Bay shoreline. As shown in Figure 16.2, the jurisdictions located on the Gulf of Mexico have experienced substantial land loss along the shoreline. According to the Texas General Land Office, the average erosion rate for the 367 miles of Texas coast is 4.1 feet per year. For the tidal waterway communities (Clear Lake Shores, Kemah, and unincorporated Galveston County), estimated erosion rates were not available during this plan update. Therefore, the extent of erosion for this area can plan on less than 4.1 feet per year.

Figure 16.2: Land Loss Since 1930



The Gulf of Mexico is impacted by the development of oil, gas and mineral resources. The Gulf accounts for over 95 percent of the U.S.'s outer continental shelf oil and gas production, and the region processes over two-thirds of the nation's oil imports. Invasive species are a serious threat to native biota in many Gulf coast ecosystems, and aquatic nuisance species pose severe economic problems, interfering with transportation, energy production, reservoir capacity and recreational uses. The effect of oil breaches on coastal erosion is determined by how much oil reaches the coastal regions and how long it remains. Oiled plants can die, along with roots that bind and stabilize the soil, leading to erosion.

Loss of wetlands and marsh is another important concern, since wetlands may contribute to reducing storm surge associated with hurricanes. It is estimated coastal wetlands within the United States are being lost at a rate of approximately 59,000 acres per year (source NOAA).

16.4 Historical Occurrences

Coastal erosion is averaged on an annual basis and the Texas coastline average rate of erosion is about 1.2 meters per year (source: Bureau of Economic Geology, University of Texas, http://earthsky.org/earth/jeffrey-paine-retreating-shoreline-along-texas-gulf-coast). Tables 16.1 and 16.2 provides a summary of data collected by the Bureau of Economic Geology for the *Shoreline movement along the Texas Gulf Coast, 1930's to 2012* study. The data is presented on a countywide basis and includes the potential at risk communities of Clear Lake Shores, Hitchcock, Jamaica Beach, Kemah, Tiki Island, and the unincorporated areas of Galveston County.

Table 16.1: Locations of Critical Erosion for Galveston County using 2010 Data from the Texas General Land Office

Population*	Gulf Shoreline	Bay Shoreline	Critical Erosion (Gulf)	Erosion Rate (Gulf)
250,158	290,400 ft. (55 miles)	1,536,480 ft. (291 miles)	253.440 ft (48 miles)	-2 to -11 ft/yr

Source: State of Texas Mitigation Plan Update 2013
Note: *2000 Census

Table 16.2: Galveston County Land Area Changes

Time Frame	No. of Measurement Points	Net rate (m/yr)	Std. Dev (m/yr)	Range (m/yr)	Area Change Rate (ha/yr)	Area Change (ha)
1950 to 2012	1,740	-1.12	1.57	-3.6 to 6.3	-9.7	-555
2000 to 2012	1,740	-0.10	2.63	-10.5 to 24.9	-0.9	-11

Source: http://earthsky.org/earth/jeffrey-paine-retreating-shoreline-along-texas-gulf-coast

Natural hazards can shorten the renourishment time frame and coastal storms significantly erode the sand beach. In the past decade, the following storms had an impact on the sand beach area within the Galveston County planning area:

- High Surf (September 3, 2011) – high offshore winds associated with Tropical Storm Lee impacted areas of Galveston County
- High Winds (April 24, 2010) - A low pressure system combined with a gravity wave disturbance produced a period of strong winds mainly along the coast. Wind gusts were in excess of 69 mph.
- Hurricane Ike (September 12, 2008) - Ike produced damage due to high storm surge and high winds along Galveston Island, the Bolivar Peninsula, and along the Galveston Bay. Storm tides of 10 to 15 feet above mean sea level were observed in these areas.
- Tropical Storm Edouard (September 5, 2008) - 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.
- Hurricane Humberto (September 12, 2007) – Developed from a tropical depression into a hurricane within nineteen hours. Maximum rainfall totals from Humberto ranged from around two inches to over fourteen inches mainly along and east of a line from Freeport to the Hitchcock and Texas City area to around Winnie.
- High Winds (November 15, 2006) - A strong cold front moved through Southeast Texas in the morning. A tight surface pressure gradient behind the front produced winds at wind advisory levels with some higher gusts observed at Bacliff.
- Hurricane Rita (September 23, 2005) - In Galveston County, tropical storm force sustained winds with gusts to hurricane force were reported across the county, especially on the Bolivar Peninsula.
- Hurricane Claudette (July 14, 2003) – The highest recorded tide level, 7.56 ft. above mean low-lower water, was recorded at Pleasure Pier in Galveston.

16.5 Probability of Future Events

Given the localization of this hazard to those locations that border waterways, the collective rankings from participating jurisdictions was 1.5 on a scale of 1-10. This information indicates that coastal erosion is likely to occur within the Bay area communities of Clear Lake Shores, Kemah, and the unincorporated areas of Galveston County and the Gulf communities of Hitchcock, Jamaica Beach, and Tiki Island.

16.6 Vulnerability Assessment

While it is difficult to identify specific locations vulnerable to coastal erosion, large scale coastal erosion would increase the vulnerability of the coastal communities to hurricane surge events which are outlined in this plan in Section 5.

Another important aspect to the local vulnerability is the sea wall along the beach on Galveston Island. This sea wall is owned by the county and protects residents of the island, tourists and area business owners who rely on tourism.

16.7 Impact

Coastal erosion is a dynamic process and is often event driven and its consequences may be at least partially reversed during calmer periods. For the communities located on the Gulf (Hitchcock, Jamaica Beach, Tiki Island and Galveston County , the impact of coastal erosion and retreat have greater impact on economic losses due to the tourism the beaches provide. The Bay communities (Clear Lake Shores, Kemah, and Galveston County) also will suffer economic loss as well as infrastructure losses due to the close proximity of roads to the shoreline. Since coastal erosion and retreat is a somewhat slow process, these communities, through proper planning and enforcement of ordinances and regulations, can protect and/or minimize potential losses to structures.

17.0 Land Subsidence

17.1 Description

Land subsidence is the lowering of the ground as a result of water, oil, gas extraction, as well as other phenomena such as soil compaction, decomposition of organic material, and tectonic movement.

In the Houston-Galveston region, subsurface clay layers compact in response to ground-water withdrawals from the Chicot and Evangeline aquifers and oil and gas extraction. Other conditions contributing to subsidence with minor noticeable impacts currently include oil and gas extraction, and the existence of salt domes and fault scarps, small step-like changes in elevation caused by fault slip in the ground.[1 2 3] Ground-water pumping from aquifers is the leading cause of subsidence in the region.[4] Groundwater withdrawn from the regional aquifers was the primary source of water for municipal supply, industrial and commercial use, and irrigation.[5]

By the 1970's the effects of groundwater withdrawals on subsidence and resultant flooding were apparent. Extensometers were installed in 1973 in the region to measure the rate of compaction. In 1975, the Texas State Legislature authorized the establishment of the Harris-Galveston Subsidence District (HGSD) "for the purpose of ending subsidence which contributes to, or precipitates, flooding, inundation, and overflow of any area within the district including, without limitation, rising waters resulting from storms or hurricanes."[6] Regulatory plans and groundwater regulations were subsequently established to manage groundwater resources. By 1979, subsidence was measured at 10 feet in some areas of the Houston-Galveston region.[7] Subsidence in the greater Houston-Galveston Bay area has led to damage to industrial and transportation infrastructure, investments in levees, reservoirs, and surface-water distribution facilities, and substantial loss of wetland habitats.

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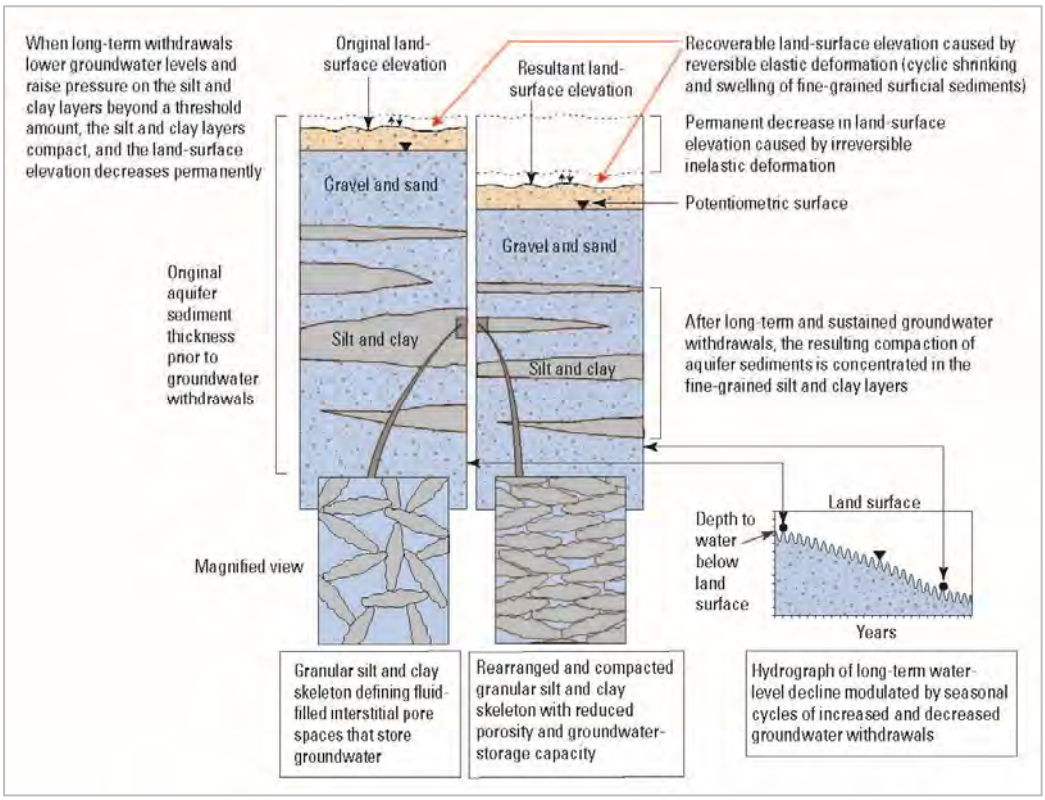
1 Department of Earth and Atmospheric Sciences, National Center for Airborne LiDAR Mapping. "Is There Deep-Seated Subsidence in the Houston-Galveston Area?" International Journal of Geophysics Volume 2014 (2014). Retrieved online January 2016: http://www.hindawi.com/journals/ijge/2014/942834/
2 Coplin, Laura. "Houston-Galveston, Texas: Managing Coastal Subsidence" USGS. 2007. Retrieved online January 2016: http://pubs.usgs.gov/circ/circ1182/pdf/07Houston.pdf
3 http://earthquake.usgs.gov/learn/glossary/?term=fault%20scarp
4 Coplin, Laura 2007
5 Kasmarek, M.C. "Groundwater withdrawals 1976, 1990, and 2000–10 and land-surface-elevation changes 2000–10 in Harris, Galveston, Fort Bend, Montgomery, and Brazoria Counties, Texas: U.S. Geological Survey Scientific Investigations Report 2013–5034" 2013 Retrieved online January 2016: http://pubs.usgs.gov/sir/2013/5034/
6 Chapter 8801 special districts code

Soils in the region can shrink and swell 15-20 ft. below the surface with large variations in soil moisture. As much as 0.2 to 0.3 ft. of vertical movement can occur within days as clay soils respond to seasonal variations in rainfall and temperature.[8] Subsidence or compaction will vary by measurement site due not only to groundwater withdrawal, but also to ratios of sand, silt, and clay beneath the surface and the tendency of each mixture to compress. [9]

However, once the water has been removed from the sediment, it cannot be replaced (Figure 17.1). Only about 5.3 million acre-feet of the total rainfall "recharge" Texas aquifers each year. In 1996, approximately 9.9 million acre-feet of groundwater were pumped resulting in a net loss of 4.6 million acre-feet of groundwater.[10] As a regional example, groundwater withdrawals contributed to water-level-altitude declines of as much as 300 to 350 ft. below datum in the Chicot and Evangeline Aquifers in Harris County by 1977 as measured by extensometers in the region.[11]

Figure 17.1: The Subsidence Process



[8] Zilkoski, David 2001
[9] Kasmarek, Mark C. 2013
[10] City of Friendswood Hazard Mitigation Plan 2015
[11] Kasmarek, Mark C. 2013

As the rate of groundwater withdrawal decreased in response to the establishment of the HGSD, the rates of compaction slowed and water levels in the aquifers began to rise and recover. Water levels in the Chicot and Evangeline aquifers rose as much as 200 and 240 ft. by 2015.[12] In 1976, about 27.4 Mgal/d were withdrawn from the aquifer system, and by 2000, withdrawals had decreased to about 4.12 Mgal/d, or about an 85-percent reduction since 1976. By 2010, withdrawals had decreased to about 0.626 Mgal/d, or about a 98-percent decrease since 1976.[13] (Figure 17.2)

Figure 17.2: Groundwater Withdrawals in Galveston County

[Groundwater withdrawal values are in million gallons per day]

Year	Harris County[1]	Galveston County[1]	Fort Bend County[2]	Montgomery County[2, 3]	Brazoria County[2]
1976	428.9	27.4	16.0	7.84	18.0
1990	363.4	4.56	62.6	24.9	15.4
2000	337.8	4.12	86.5	43.6	26.0
2001	289.6	1.63	74.6	40.3	21.7
2002	276.9	1.03	78.7	42.7	21.5
2003	276.5	1.01	80.5	47.0	21.7
2004	233.6	0.692	82.0	47.0	24.1
2005	295.8	0.820	100.5	58.8	24.8
2006	246.6	0.751	94.2	59.6	31.5
2007	213.8	0.630	79.1	54.0	34.6
2008	256.4	0.783	101.1	64.7	49.2
2009	246.9	1.21	111.3	64.1	43.2
2010	227.1	0.626	99.8	64.2	24.7

[1]Greg Lakey, Harris-Galveston Subsidence District, written commun., 2012.

[2]Bill Billingsley, Texas Water Development Board, written commun., 2012.

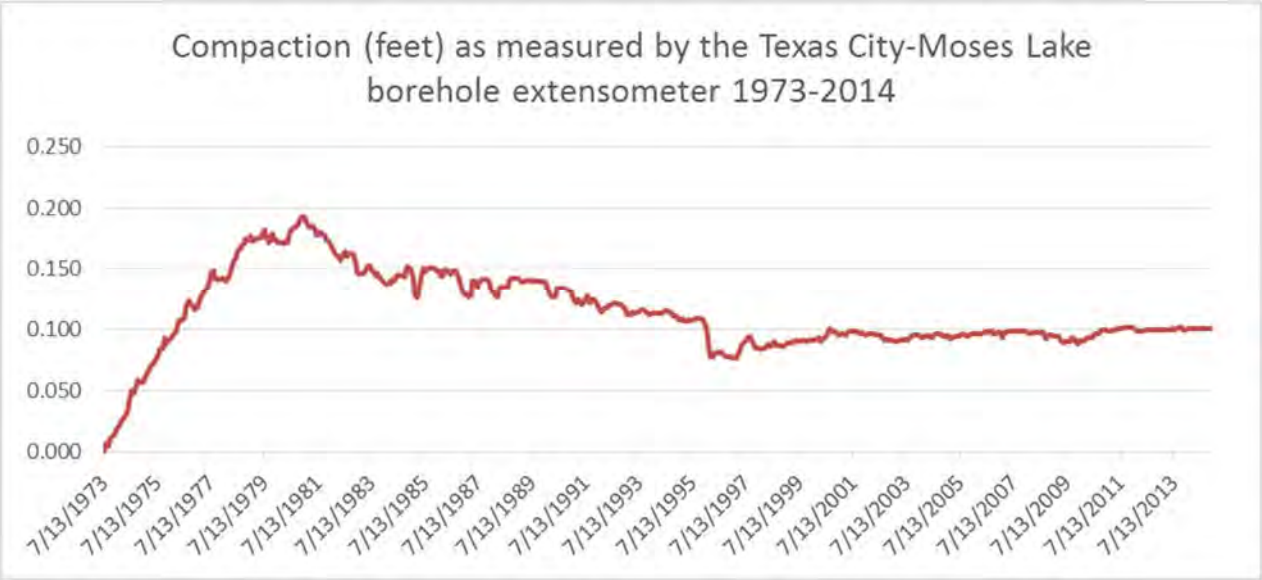
[3]Samantha Reiter, Lone Star Groundwater Conservation District, written commun., 2012.

[12] Kasmarak, Mark C. "Water-Level Altitudes 2015 and Water Level Changes in the Chicot, Evangeline, and Jasper Aquifers and Compaction 1973-2014 in the Chicot and Evangeline Aquifers, Houston Galveston Region, Texas." 2015. Retrieved online January 2016: https://pubs.er.usgs.gov/publication/sim3337

[13] Kasmarek, Mark C. 2013

Figure 17.3 illustrates that as groundwater withdrawals decreased in Galveston County, rates of compaction decreased. While Texas City is not one of the participating jurisdictions, it is proximal and the extensometer there was one of the first installed in 1973. This location offers a reasonable reference point with a rich amount of historical data. Compaction at this location increased to almost 0.2 ft. from 1973 to 1980 and has tapered to approximately 0.1 ft. in recent years.

Figure 17.3: Compaction



17.2 Location

Historical data is captured regionally from 1906 to 2000 and shows the greatest rates of subsidence in the eastern portion of the Harris-Galveston Subsidence District along the Houston Bay Ship Channel (Figure 17.4). This location is near Bayou Vista, Clear Lake Shores, Hitchcock Kemah, and unincorporated areas of Galveston County. Rates of subsidence after the implementation of the HGSD are decreasing in areas where groundwater withdrawals are regulated to the south and east of Houston and increasing in the north and west where businesses and residents still rely on groundwater (Figures 17.5 and 17.6). For this plan update, the unincorporated areas of Galveston County, Bayou Vista, Clear Lake Shores, Hitchcock, and Kemah consider land subsidence a potential risk. The near location of these communities are referenced on Figures 17.4 and 17.5. The unincorporated areas of Galveston County are located in various locations inland and along the Bay and Gulf.

Figure 17.4: Subsidence 1906-2000

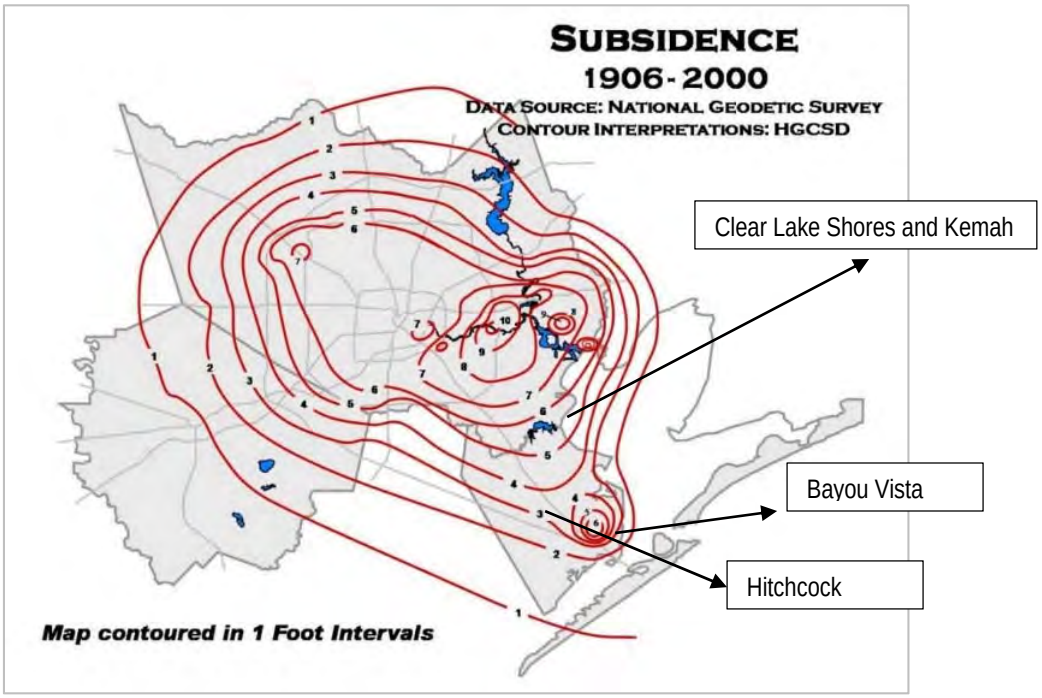


Figure 17.5: Subsidence in Feet 1978-2000

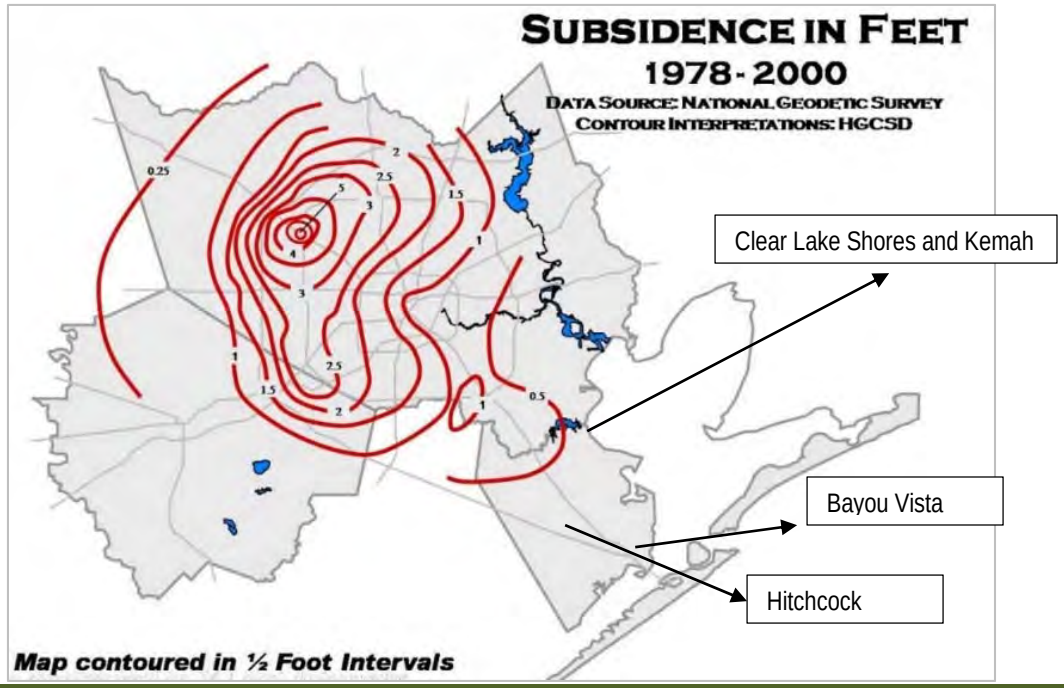
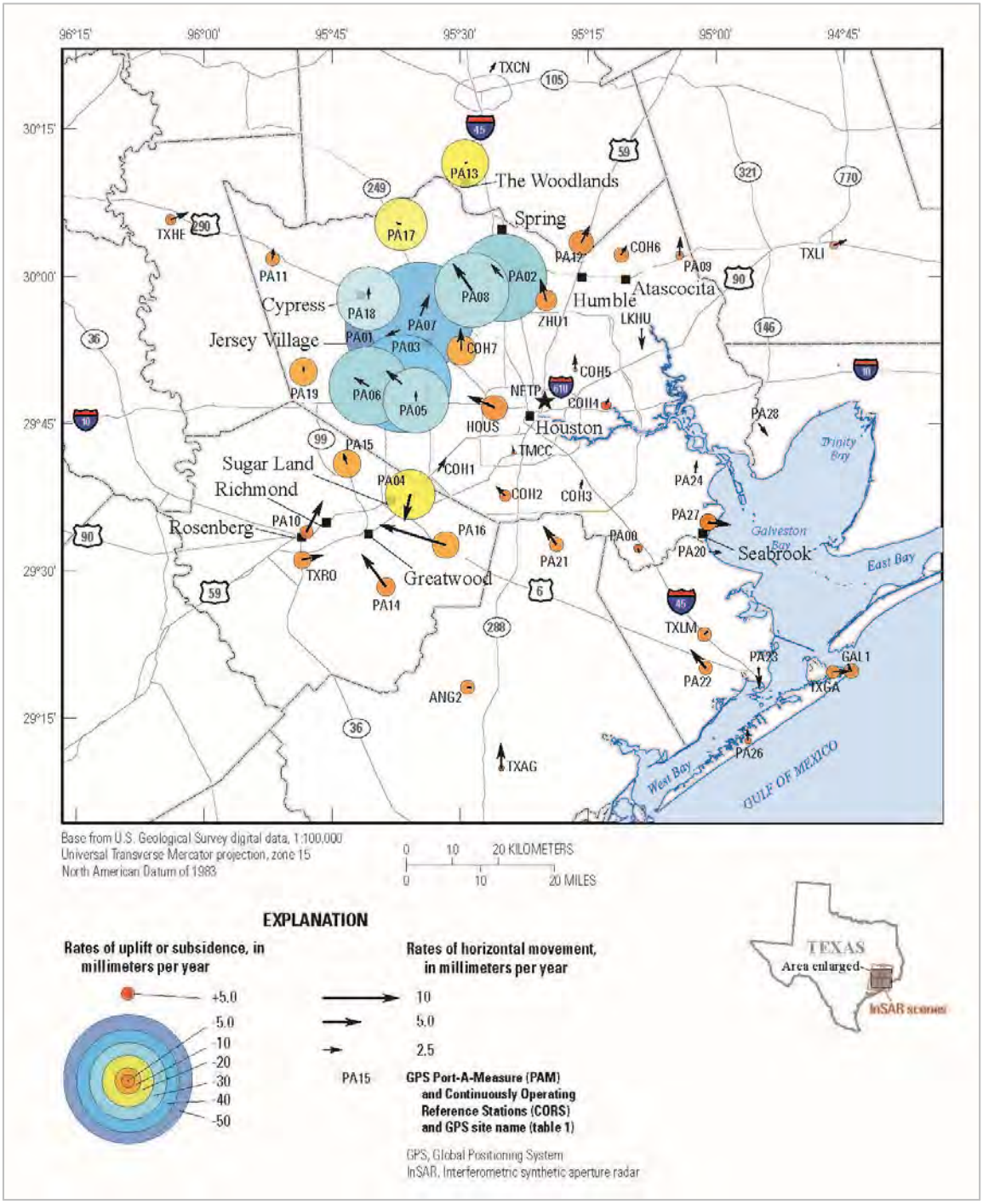


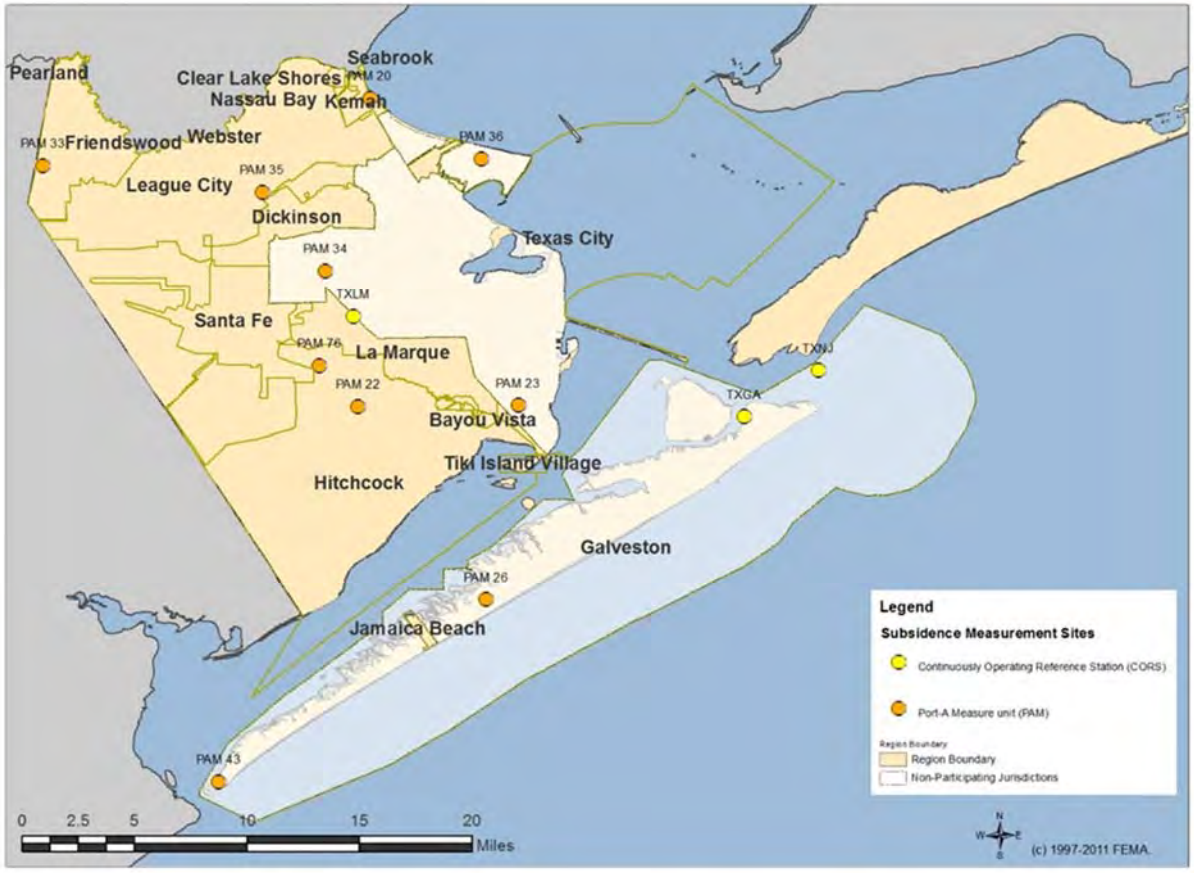
Figure 17.6: Subsidence 1993-2010



Source: 1993-2010 Galloway 1999 as modified by Kasmarek 2015

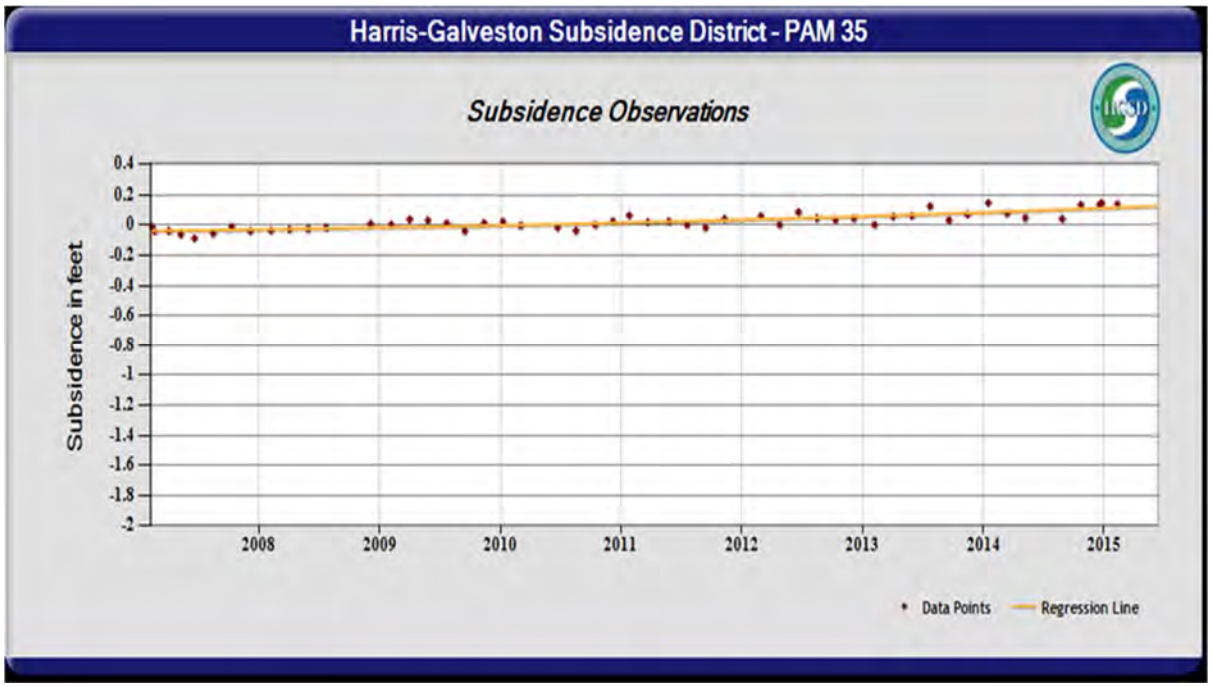
In addition to extensometers installed in 1973, Galveston County has 3 fixed GPS monitoring stations (CORS) and 10 portable measurement units (PAM) measuring subsidence. The location of these units is illustrated in Figure (17.7).[14] In review of 2014-2015 data from the Harris-Galveston Subsidence District (HGSD) the area subsidence rates recorded by local sensors ranged from a 0.5 inch increase (PAM 35-League City) to a one inch decrease (TXNJ-near Bolivar Peninsula). Figure 17.8 provides the charted data for these two sites.

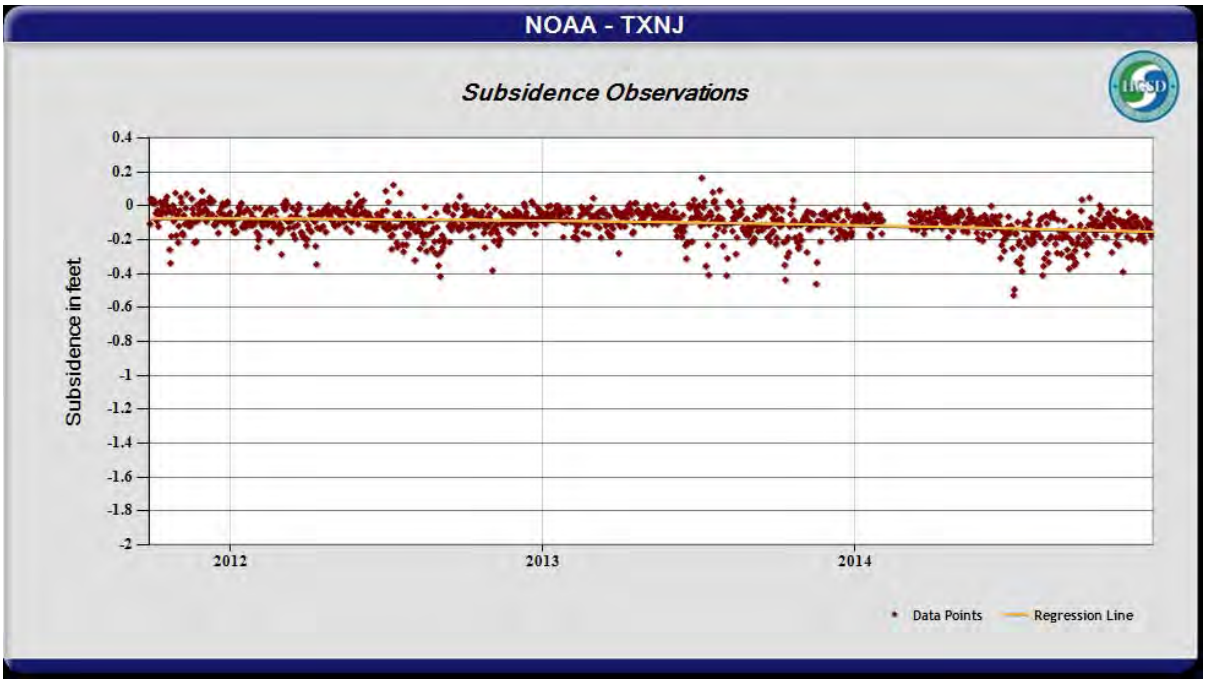
Figure 17.7: Subsidence Measure Sites



[14] Data retrieved online January 2016: http://hgsubsidence.org/subsidence-data/

Figure 17.8: Subsidence Observations- PAM 35 and TXNJ

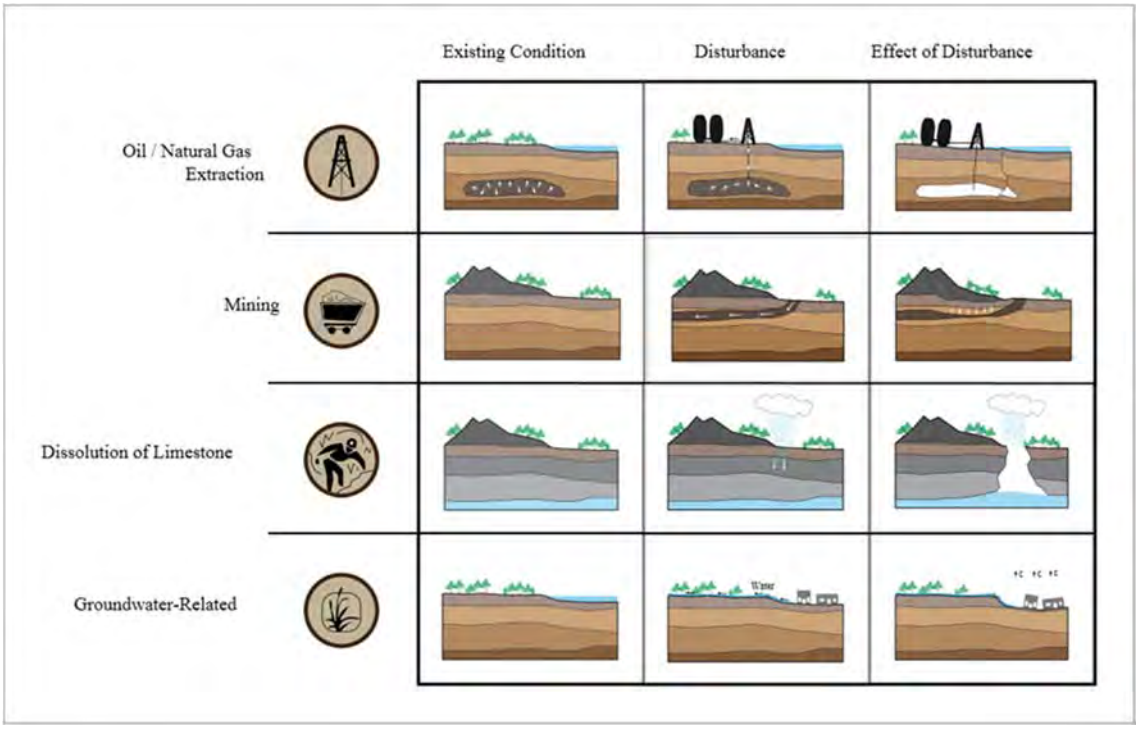




17.3 Extent

Land subsidence is measured by rates of elevation loss. The extent of land subsidence in the regional study area, which includes Bayou Vista, Clear Lake Shores, Hitchcock, Kemah, and the unincorporated areas of Galveston County, from 1906 to 2000 ranges from approximatley 1-6 feet within the Harris-Galveston Subsidence District. Clear Lake Shores, Kemah and Bayou Vista have experienced 3 to 6 ft. in decline and Hitchcock around 2 to 3 ft. The Unincorporated areas of Galveston County range from 1 to 5 ft (based on data from Figure 17.4). The types of ground subsidence is provided in Figure 17.9.

Figure 17.9: Types of Ground Subsidence



Source: http://en.wikipedia.org/wiki/File:Wiki_Image_Rev1.svg

17.4 Historical Occurrences

Subsidence is a continuous hazard, and its effects are intimately intertwined with those of other natural forces and episodic hazardous events. Rates of subsidence have decreased across Galveston County, but its effects continue to compound. There is one reported subsidence event dated June 2000 in the Houston-Galveston area but the exact location is not available. According to the State of Texas Hazard Mitigation Plan, 2013 update, early oil and gas production and a long history of

groundwater pumping in the Houston-Galveston area created severe and costly coastal flooding hazards and affected a critical environmental resource – the Galveston Bay estuary. This past impact would have included all the participating jurisdictions within this plan update due to the pipeline systems that meanders throughout the County.

17.5 Probability of Future Events

Rates of subsidence have decreased dramatically in line with the curtailing of water removal. The hazard is identified as unlikely (event possible in the next 10 years). Subsidence may continue to develop from other types of below ground withdrawals or from other natural processes.

17.6 Vulnerability Assessment

The decrease in land surface elevation contributes to: [15] [16] [17]

- Saltwater inundation of coastal areas;
- Increase in the frequency and extent of flooding;
- Damage to infrastructure including protrusion above land surface of wells and other fixed infrastructure, Gradient reversals resulting in ponding and/or backflow of sewage and storm water runoff;
- Activation or acceleration of the movement of geologic faults resulting in visible surface fracturing, surface offsets, and property damage;
- Exaggerated flooding by tidal surges and heavy rains attendant to hurricanes;
- Gradient change in open channels which can lead to channel erosion and sediment deposit;
- Conversion of emergent wetlands to open water and barren flats. This causes bay shorelines to become more susceptible to erosion by wave action;
- Significant loss of submerged aquatic vegetation.

Therefore, this hazard can amplify the impacts of flooding which is outlined in this plan with regards to specific areas of vulnerability within the planning area. Flood Loss data is provided in Tables 17.1 and 17.2 for Galveston County, Bayou Vista, Clear Lake Shores, Kemah, and Hitchcock.

Estimates of the financial impact of subsistence are vague. “Many millions of dollars” are spent reclaiming land submerged by tidal water, elevating structures such as buildings, wharves and roadways, constructing levees to protect against tidal inundation and to repair damage due to fault movement. An estimate of the average annual cost to property owners from 1969 to 1974 for the

15 Kasmarek, Mark C. 2015
16 Coplin, Laura 2007
17 Subsidence.org

HGSD was $31,000,000 (measured in 1975 dollars, present day $139,337,043). Due to the decrease in rates of subsidence, this cost may be much lower today. Costs to relocate or fortify industrial facilities would likely exceed those estimates. [18]

Table 17.1: Estimated Exposure of People and Parcels by Jurisdiction

100-Year Flood—Inland						
				At Risk (A/AE Zones)		
Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,470	1,099	$185,493,420
Clear Lake Shores	1,069	1,051	$243,448,194	1,069	987	$240,705,924
Hitchcock	6,961	6,337	$460,075,283	6,629	4,632	$286,761,580
Kemah	2,906	1,221	$294,986,165	1,592	898	$230,750,405
Unincorporated	40,244	34,756	$2,931,109,729	20,469	10,714	$842,121,362

100-Year Flood—Coastal						
				At Risk (V/VE Zones)		
Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	1,532	277	$49,006,030
Clear Lake Shores	1,069	1,051	$243,448,194	234	109	$23,213,493
Hitchcock	6,961	6,337	$460,075,283	281	728	$72,387,309
Kemah	2,906	1,221	$294,986,165	169	110	$75,973,581
Unincorporated	40,244	34,756	$2,931,109,729	3,332	13,969	$1,217,475,012

500-Year Flood						
				At Risk (0.2 % Annual Chance)		
Jurisdiction	Total Est. Population	Total Est. Number of Parcels	Improved Value of Parcels	Number of People at Risk	Number of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,324	$225,154,990	0	0	$0
Clear Lake Shores	1,069	1,051	$243,448,194	4	8	$22,789,590
Hitchcock	6,961	6,337	$460,075,283	4,705	1,779	$196,227,284
Kemah	2,906	1,221	$294,986,165	2,494	471	$123,321,865
Unincorporated	40,244	34,756	$2,931,109,729	23,274	7,375	$706,082,824

18 Coplin, Laura 2007

Table 17.2: Potential Impacts to Critical Facilities and Infrastructure

Jurisdiction	Critical Facilities and Infrastructure		
	Total Number	Number Inside the 100-year Floodplain	Percentage Susceptible to Flooding
Bayou Vista	0	0	0%
Clear Lake Shores	1	1	100%
Hitchcock	11	4	36%
Kemah	3	2	67%
Unincorporated	14	5	36%

Source: HAZUS-MH

17.7 Impact

The severity of subsidence impacts are considered to be unlikely in the short term since they generally result in no physical injuries and rarely shut down critical facilities and services. Financial impacts created by land subsidence for Galveston County, Bayou Vista, Clear Lake Shores, Hitchcock, and Kemah could occur to residential and commercial properties and critical facilities and infrastructure. Impacts to saltwater intrusion, flooding and storm surge, and loss of submerged aquatic vegetation can be expected for these jurisdictions as well.

18.0 Expansive Soils

18.1 Description

Expansive soils are soils that expand when water is added, and shrink when they dry out. This continuous change in soil volume can cause structures to move unevenly and crack and roads and sidewalks to buckle. Soils with a high clay content exhibit high expansive properties. Slab on grade construction is the most susceptible to damage from expansive clays.

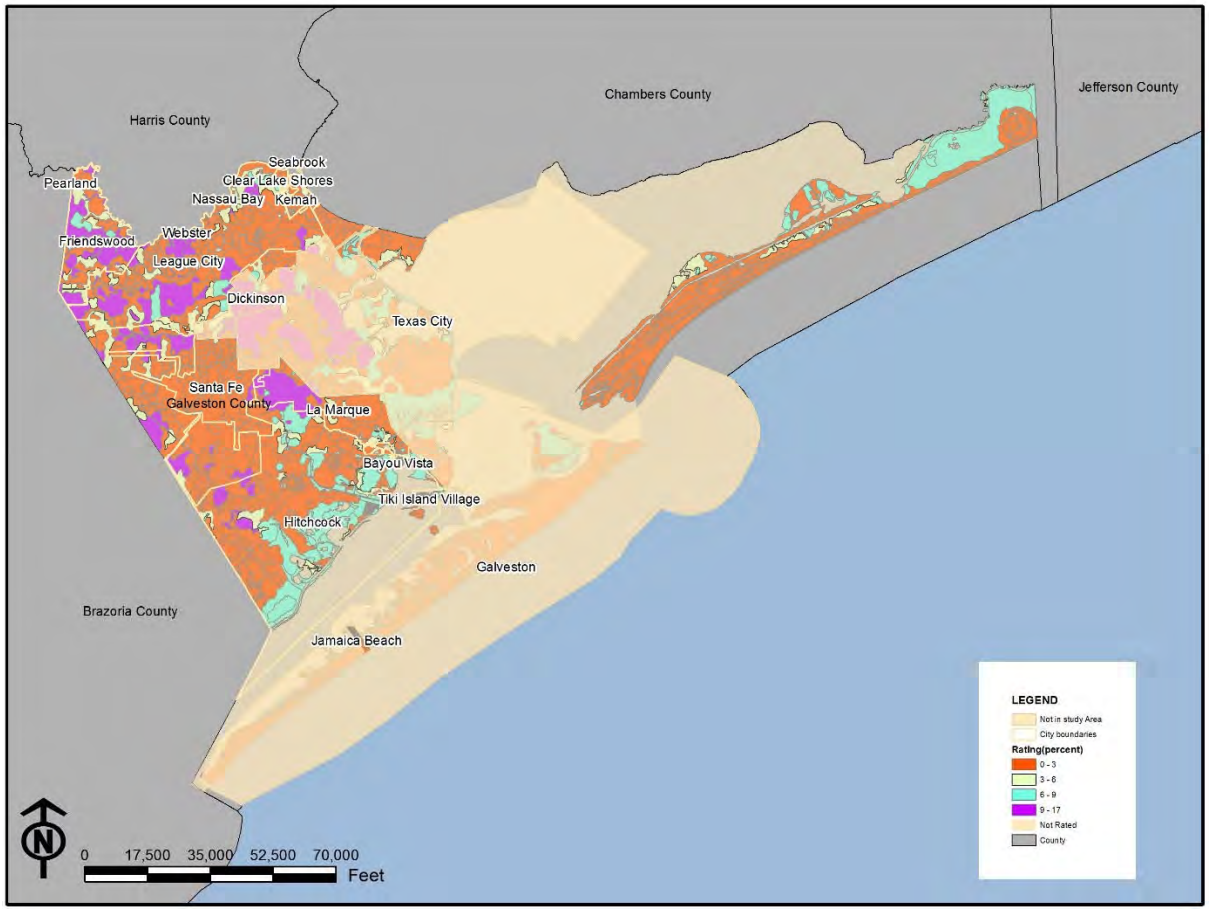
18.2 Location

Figure 18.1, on the subsequent page, provides the expansive soil ratings (in percent) as classified by the USGS. The low range, 0-3 percent, represents fine sand with little moisture content and thus low linear extensibility. The high range, 9-17 percent represents clay like soils and is found in areas of Galveston County, Friendswood, League City, and La Marque. Bayou Vista, Clear Lake Shores, Hitchcock, Jamaica Beach, Kemah, Santa Fe, and Tiki Island are located within the low to moderate areas.

18.3 Extent

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from moist to a dry state. It is an expression of the volume change as a percentage change for the soil. Soil extensibility ratings over 9 percent are considered to be very high. According to report data gathered from the USDA (Web Report v13, September 2015) the average linear extensibility rate for Galveston County is 3.5 percent which is just below the linear extensibility of clay loam. Areas along the Gulf have lower linear extensibility rates in general while areas along the shoreline east of Bayou Vista have higher linear extensibility rates. Inland soil extensibility rates vary greatly by location. One area with high linear extensibility rates begins to the east of Moses Lake near San Leon and extends to the Northeast (includes sections of the unincorporated areas of Galveston County, Friendswood, League City, and La Marque). For these areas, the extent of damages may include cracking foundations, shifting and/or disruption of underground utilities, and shifting of roadways.

Figure 18.1: Expansive Soil Ratings



Source: USDA Natural Resources Conservation Service

18.4 Historical Occurrences

There were no documented losses due to expansive soils for Galveston County, Friendswood, League City, or La Marque. Sources verified included the USGS, GCOEM, Texas General Land Office, and NCDC.

18.5 Probability of Future Events

Galveston County receives approximately 50 inches of rain annually. Given the high average annual rainfall and the areas propensity for drought, expansive soils will likely continue to impact the areas with a high expansive soil rating found in Galveston County, Friendswood, League City, and La Marque.

18.6 Vulnerability Assessment

According to the State of Texas 2013 Hazard Mitigation Plan, damages caused by expansive soils are higher on slab-on-grade foundations as opposed to pier and beam construction. For the unincorporated areas outside of the coastal zone, Friendswood, League City, and La Marque are at greater risk to cracking foundations. In addition to the potential impact to housing and building construction the vast network of oil and gas pipelines across the planning area are vulnerable to this hazard (Figure 18.2 and 18.3).

Figure 18.2: Gas Pipelines

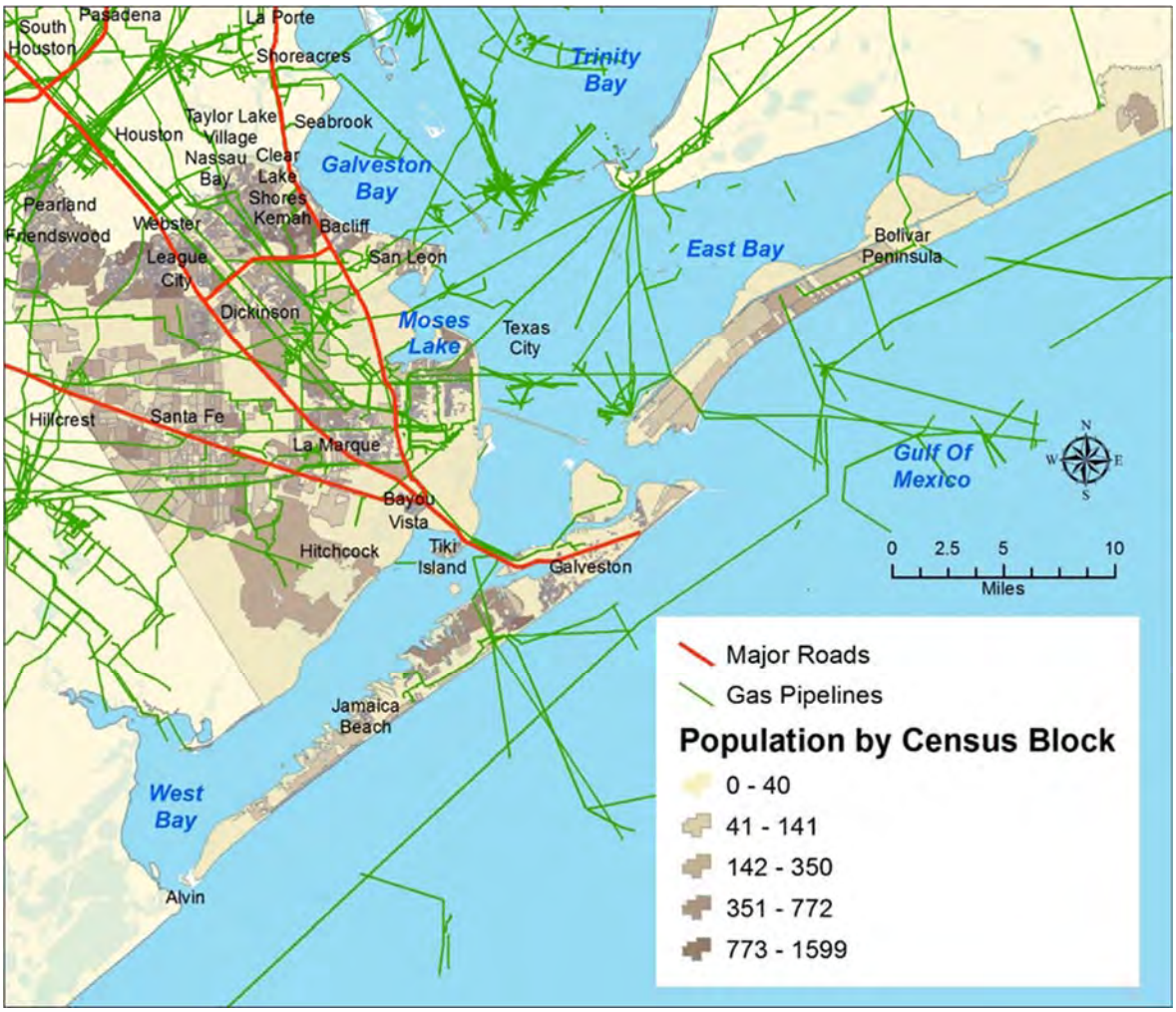
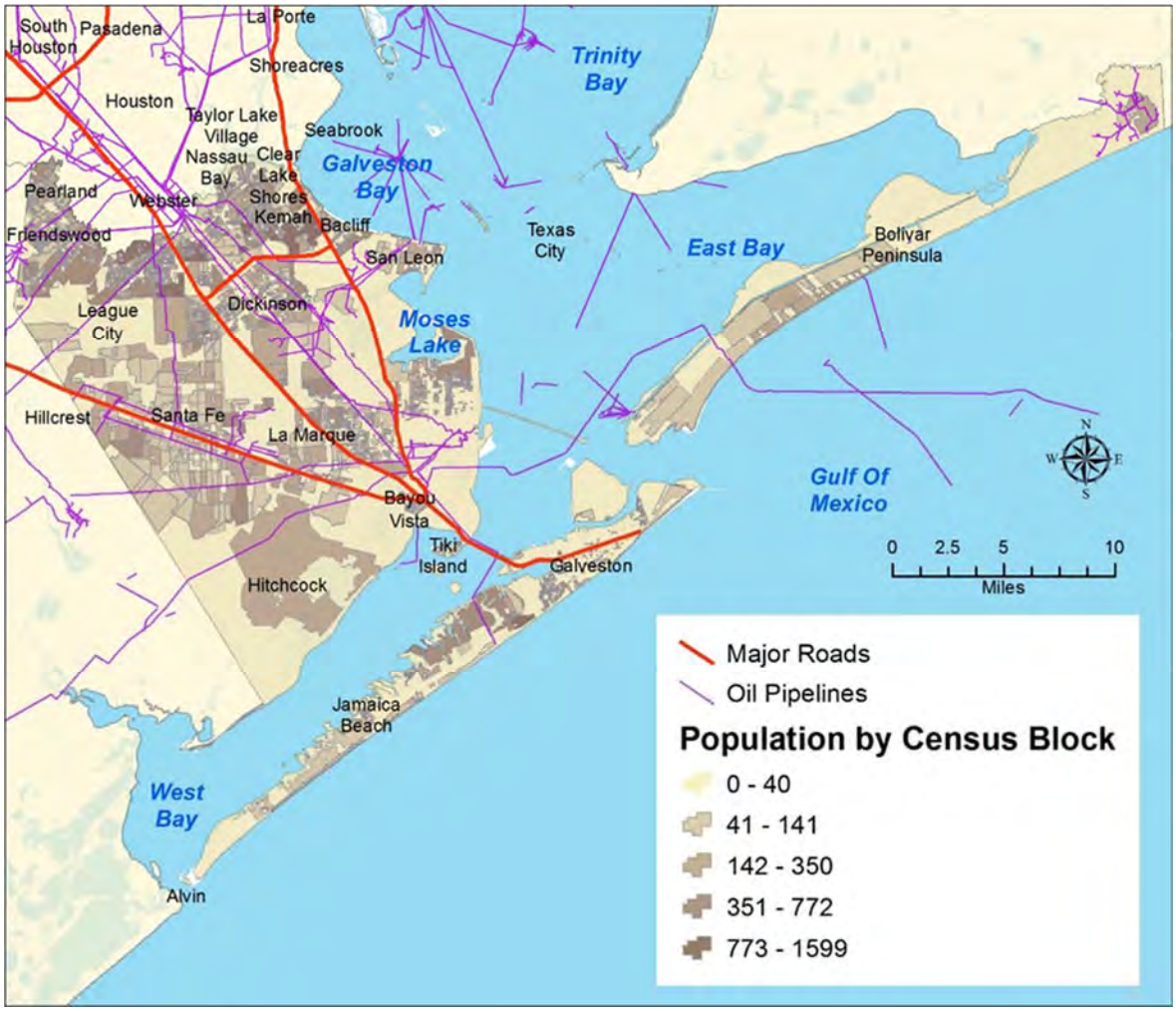


Figure 18.3 Oil Pipeline



18.7 Impact

The impact for expansive soils for Galveston County, Friendswood, League City and La Marque will vary from minor structural foundation repairs (residential and commercial) to potential breaches to the oil/gas pipeline system that could interrupt transmission of the products or create significant damage to due leakage in the systems. The impact for expansive soil is considered to be likely throughout the high expansive soil rating areas found in Galveston County, Friendswood, League City and La Marque.

19.0 Dam and Levee Failure

19.1 Description

Dam

Dams are water storage, control, or diversion structures that impound water upstream in reservoirs. Dam failure can take several forms, including a collapse of, or breach in, the structure. While most dams have storage volumes small enough that failures have few or no repercussions, dams storing large amounts can cause significant flooding downstream. Dam failures can result from any one, or a combination, of the following causes:

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Failure of upstream dams in the same drainage basin;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion; and
- Destructive acts of terrorism.

Benefits provided by dams include water supplies for drinking, irrigation and industrial uses; flood control; hydroelectric power; recreation; and navigation. At the same time, dams also represent a risk to public safety. Dams require ongoing maintenance, monitoring, safety inspections, and sometimes even rehabilitation to continue safe service.

In the event of a dam failure, the energy of the water stored behind the dam is capable of causing rapid and unexpected flooding downstream, resulting in loss of life and great property damage. A devastating effect on water supply and power generation could be expected as well. The terrorist attacks of September 11, 2001, generated increased focus on protecting the country's infrastructure, including the safety of dams.

Levee

Levees (also "floodwalls") are human-made structures designed to contain, control or deflect the flow of water to provide protection from temporary flooding. Levees usually protect from seasonal flooding, and may be subject to water loading for periods of only a few days or weeks each year.

Many of the nation's levees were first put in place by farmers to protect agricultural areas from frequent flooding. They date back as much as 150 years, but in that time, land use has changed and development has taken place where these farms were once located. Levees are earthen berms and/or concrete walls built to keep storm surge or other water from flooding the land behind it and can decay over time. Accurate mapping of the risks of flooding behind levees depends on knowing the condition and level of protection the levees provide.

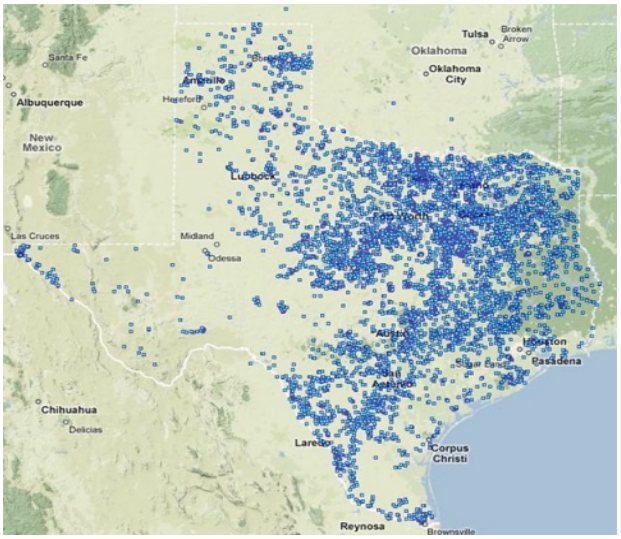
19.2 Location

Dam

The state of Texas currently lists 7,126 non-federal dams. According to the American Society of Civil Engineers-Texas Section Report Card (2012), there are 1,046 high hazard dams in Texas. The state of Texas has more dams than any other state in the Union (See Figure 19.1).

According to the National Inventory of Dams, there is one major dam in Galveston County, which is the Galveston County Water Reservoir Dam located at Dickinson Bayou in Texas City This dam, operated and maintained by the Gulf Coast Water Authority, is classified as a "High" hazard dam. Although Texas City is not part of this plan, the neighboring jurisdictions of Clear Lake Shores, Kemah, La Marque, and unincorporated areas of Galveston County could be impacted should this dam experience a breach. Figure 19.2 provides the location of the dam in relation to these communities.

Figure 19.1: Location of Texas Dams



Source: USACE

Data Deficiency: The US Army Corp of Engineers is developing a study to determine the potential location, extent, and impact of a breach from the Galveston County Water Reservoir Dam and levee system. This study is expected

to be completed in 2018 and will include a projected inundation area map. The location of the inundation area is not known at this time. Details regarding the data deficiency is provided on page 19-5.

Figure 19.2: Galveston County Water Reservoir Dam Area

National Geospatial-Intelligence Agency (NGA); Delta State University; Esri | scott.mcafee@fema.dhs.gov | Texas Parks & Wildlife, Esri, HERE, DeLorme, USGS, NGA, EPA, USDA, NPS

Levee

The Galveston County hurricane flood protection levee protects the cities of Texas City and La Marque and their more than 50,000 residents and almost $7.5 billion of property, which represents more than 40 percent of Galveston County's tax base.

The levee is comprised of 15.7 miles of an earthen berm and 1.3 miles of concrete wall, offering a total of 17 miles of protection. Hurricane flood protection efforts in the Texas City area began in

1928 when some 13,500 feet of earthen levees were constructed by Galveston County in the general area of the port and industrial section of Texas City. These levees reached an elevation of about 14.5 feet. In 1932, construction began on an additional 8,300-foot-long concrete wall and a 3,800-foot-long earthen levee. Both of these structures were built to an elevation of 12.5 feet. The Texas City/La Marque Hurricane Flood Protection Levee has numerous appurtenant structures. The project is designed to provide protection for about 36 square miles of residential and industrial development from tropical hurricanes of magnitudes up to and including a Standard Project Hurricane Tide of 15 feet. The location and potential impact for the levee are displayed in Figure 19.3.

Figure 19.3: Map of the Texas City/La Marque Hurricane Flood Protection Levee System

19.3 Extent

Data Deficiency

The US Army Corps of Engineers and URS Group, Inc. completed two Project Information Reports (PIR) on the Texas City Levee and Galveston Seawall following Hurricane Ike in Jan 2009. The PIRs examined the dam and levee damages from the storm and surge as well as the extent of flooding in the surrounding areas caused by the failure of the structures. When Hurricane Ike made landfall in Galveston County on September 13, 2008, it brought a storm surge of 15+ feet above mean sea level. The combined storm surge and wave action from Hurricane Ike caused costly damages to the dam and levee. The Corps of Engineers reported that failure to repair these prior to the next hurricane season would increase the risk of structural failure during a significant storm event and threaten the protected community and property. Although both structures needed (and received) repairs due to the hurricane, both served their purposes during the surge and protected the communities they were built to support. **While the dam and levee benefited the areas in close proximity to the structures since neither failed, the Corps is in the process of researching the location, extent, and impact if either the dam or levee completely fails and will release the information in 2018. They are unable to release the information during this plan update because it's still changing significantly but it will be reviewed and implemented as appropriate in accordance with mitigation actions GC-2016-11, CLS-2016-5, K-2016-6, and LM-2016-6 (see Section 21 for details).**

Best available data is presented below to describe the general observation of extent for dam/levee failure.

Dam

Effective January 1, 2009, the Texas Commission on Environmental Quality (TCEQ) adopted the revised dam classifications as shown in Table 19.1. The new classifications place a greater emphasis on high and significant hazard dams. Now a significant classification indicates a probable loss of life, whereas before no loss of life was expected in the event of dam failure. A High Hazard dam breach is now indicative of an expected loss of life of seven or more persons versus a probable chance in pre-2008 classifications.

The Galveston County Water Reservoir Dam is of a homogeneous earth-fill construction with a maximum height of 14 feet and a length of 25,281 feet. The reservoir has a maximum capacity of 11,368 acre feet. Normal storage is 7,360 acre feet with approximately 859 acres of water surface at the elevation of 18.2 feet above mean sea level. Based on the classifications provided in Table 19.1, the damages to Clear Lake Shores, Kemah, La Marque and Galveston County could result in

minor injuries with possible loss of life (although not expected). Economic losses could be considerable due to the effect a breach may have on the local water supply and the critical facilities located nearby.

Table 19.1: Dam Size and Hazard Classifications Effective January 1, 2009

Size Classification		
Category	Storage (acre-feet)	Height (feet)
Small	Less than 1,000	Less than 40
Intermediate	1,000 to 49,999	40-99
Large	50,000+	100+
Hazard Classification		
Category	Loss of Life	Economic Loss
Low	None expected	Minimal
Significant	Possible, but not expected	Appreciable
High	Expected	Excessive

Source: http://www.damsafety.org/media/Documents/PDF/TX.pdf

Levee

For levees in the federal system, FEMA relies on the expertise of the USACE and the levee inventory they are developing to determine the appropriate range of flood risk designation to use in re-mapping flood risk on the Flood Insurance Rate Map (FIRM). Information for the inventory is coordinated with the local community and levee owners. For levees not in the federal system, FEMA will coordinate with the impacted community and the levee owner.

While levees reduce the chance of flooding from certain designed events, no levee completely eliminates the risks associated with flooding as levees are designed to provide a specific level of protection and can be overtopped or fail during flood events that exceed the design storm. Table 19.2 depicts the range of protection that levees provide.

The Texas City levee is considered to be an Accredited Levee, designed to protect to the one percent flood event. Therefore, the levee can protect La Marque and unincorporated areas of Galveston County against a storm surge range up to 15 feet with waves reaching eight feet high.

Table 19.2: Levee Classifications/Range of Protection

Classification	Description	Area of Protection/Inundation
Accredited Levees	If a levee meets the criteria and the necessary data and documentation are provided to FEMA, the FIRM will show the area behind the levee as protected from the base flood and it will be mapped as a moderate-risk zone.	Area protected on FIRM/DFIRM – shaded Zone X (area of low to moderate risk)
Provisionally Accredited Levees	If community officials and levee owners reasonably believe a levee system provides protection from the base flood but documentation is not promptly available, this interim designation will allow up to two years for communities to submit documentation and levee certification to FEMA.	Area protected by levee on DFIRM will be mapped as shaded Zone X
Non-accredited	If the levee does not meet the regulatory protection criteria of 44 CFR Section 65.10, then the FIRM will show the area behind the levee as a high-risk zone, or SFHA.	The area of inundation will be shown as a Zone A or AE

19.4 Historical Occurrences

Due to the nature of their construction, both levees and dams are susceptible to decay and deterioration over time and require regular and proper maintenance. However, to date, there has been no historical occurrence of dam or levee failure in the area of Galveston County and La Marque nor reports of mis-operation of the flood gate located at the water reservoir dam to impact Clear Lake Shores, Kemah, or Galveston County. In fact, the Texas City/La Marque Hurricane Flood Protection Levee performed as expected and was not damaged during Hurricane Ike in 2008.

19.5 Probability of Future Occurrences

Based on the lack of historical incidents or previous occurrences of dam failure for the Galveston County Water Reservoir Dam (high hazard classification), the probability of a future occurrence of dam failure is unlikely within the next ten years for Clear Lake Shores, Kemah, La Marque and the unincorporated areas of Galveston County.

While Bolivar Peninsula was devastated during Hurricane Ike, the Hurricane and Flood Protection Levee in Galveston County held strong and fared well. Currently, the levee protects Texas City and La Marque from a 15-foot storm surge plus the additional height of waves on top of the surge. This is equivalent to a strong category 3 or low category 4 storm. The probability of a future occurrence of levee failure is unlikely within the next ten years for La Marque and the unincorporated areas of Galveston County.

19.6 Vulnerability Assessment

Dam and Levee System Failure

Although Texas City is not participating in this plan, La Marque would also be directly affected by flooding should the dam and levee system fail. The primary purpose of the levee is to protect the local area from a hurricane surge or extreme tidal event. The dam is the western side of the water reservoir, and it also prevents saltwater from entering through Dickinson Bayou on the northwestern side of the dam and levee system.

If the dam and levee system failed to retain the reservoir of fresh water La Marque and Texas City would be impacted by the freshwater release, and the cascading effect would be the loss of a local water supply for most jurisdictions and local business in the area. Friendswood and League City do receive water from the City of Houston which is derived from multiple other sources.

Should the flood gate at the water reservoir fail, Clear Lake Shores, Kemah, and Galveston County could suffer economic loss due to flooding in lower areas of these communities.

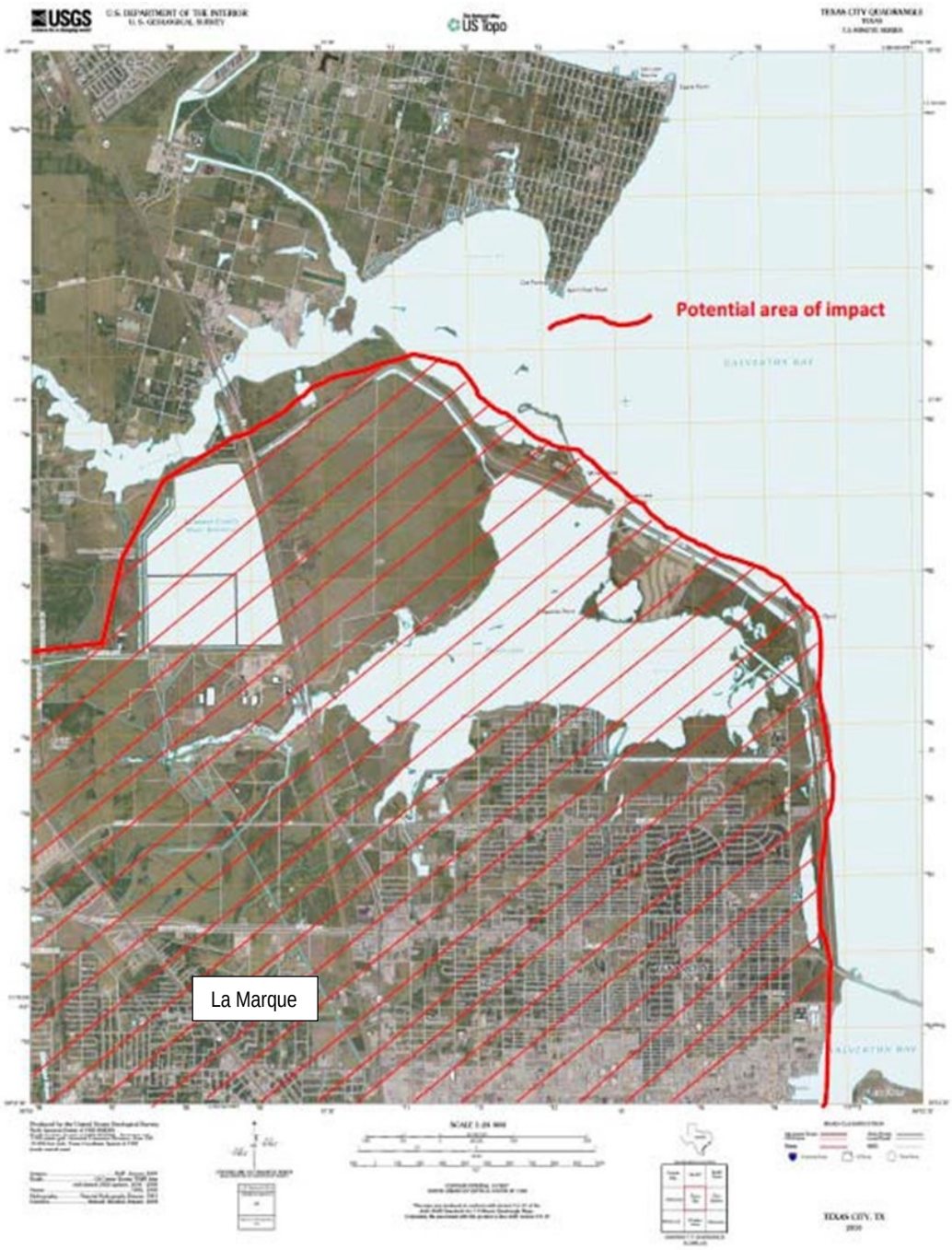
If the levee failed independent of the dam a saltwater intrusion of flood water would occur and inundate La Marque, Texas City, and the industrial complex within the area.

Particularized dollar losses in terms of annualized loss-estimates for dam and levee failures are not available. Therefore, a breakdown is not available for potential dollar losses of critical facilities, infrastructure, and lifelines, or hazardous-materials facilities.

Due to the importance of the area in the overall economy, particularly with regard to supplying our Nation with fuel, Galveston County and adjacent communities and partners are reconsidering whether they should be protected by a levee that will withstand a 20-foot storm surge.

For this plan update, best available mapping data is presented. A topographic map showing the general area of impact for dam and levee failure to La Marque is provided as Figure 19.5. An estimated inundation map for dam failure is provided as Figure 19.1 for Clear Lake Shores, Kemah, La Marque and Galveston County.

Figure 19.5: USGS Topographic Map – Area of Impact La Marque –Dam/Levee Failure



19.7 Impact

Dam Failure

Failure of the dam and levee system is an unlikely event. However, major industrial, commercial, and residential infrastructure and facilities are in the immediate area and immediately Southeast of the dam and inside of the overall dam and levee system. If a failure occurred at the dam in Texas City, the immediate impact on participating jurisdictions (Clear Lake Shores, Kemah, La Marque, and Galveston County) in this plan would be minor, meaning injuries or illness would not result in permanent disability, critical facilities could be shut down for more than a week, and more than ten percent of property could be destroyed or suffer major damage. However, the impact on the local water supply would be significant considering that only Friendswood and League City utilize water from other sources.

Levee Failure

Although there has not been a previous occurrence of a levee failure in the area, the potential impact would be major. Critical facilities could be shut down for weeks and more than 25 percent of property could be destroyed, including some of the nation's refineries. Area refineries have the capacity to satisfy more than 10 percent of the gasoline demand in the U.S. – enough to fully fuel 21 cars every second. The risk associated with levee failure would also affect other industrial companies behind the levee that produce electricity and steam for the Texas City complex. The Mainland Medical Center serves the industrial complex and remains particularly important when dealing with potential injuries resulting from the work with chemicals and volatile substances. All told, the impact from levee failure would affect over 50,000 residents, almost $7.5 billion in property, and roughly five percent of the nation's oil refining capacity. In addition to these figures, over 5,000 people are employed in the area including more than 2,000 independent contractors at any one time.

20.0 Capability Assessment

20.1 Overview

The purpose of conducting a capability assessment is to determine the ability of the participating jurisdictions to implement a mitigation strategy.[1] As in any planning process, it is important to determine what actions are feasible, based on an understanding of those departments tasked with their implementation. More specifically, the capability assessment helps to determine what mitigation actions are practical and likely to be implemented over time given the fiscal, technical, administrative and political framework of the community. It also provides an opportunity to assess existing plans, policies and processes in place. A careful analysis was conducted to detect any existing gaps, shortfalls or weaknesses within existing government activities that could exacerbate community vulnerability. The assessment also highlights positive measures already in place, which should continue to be supported through future mitigation efforts.

20.2 Conducting the Capability Assessment

Prior to the kickoff meeting, a detailed *Capability Assessment Survey* was distributed to each participating jurisdiction. The survey was based on the Disaster Mitigation Act of 2000 which requires that local governments review and incorporate, if appropriate, existing plans, studies, reports and technical information into their hazard mitigation plans. The survey provided a list of existing local plans, policies, programs or ordinances that typically contribute to and/or hinder the ability to implement hazard mitigation actions. Other indicators included information related to each jurisdiction's fiscal, administrative and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes.

Through the review process of the Galveston County 2011-2016 plan, the planning team saw an opportunity to expand the information presented in the assessment survey to allow for a comprehensive approach in capturing more levels of each jurisdiction's capabilities. Listed below is a summary of the additional information provided in the planning and regulatory category along with a list of the new categories introduced in this plan update. Details for each category are provided throughout this section. The survey results and scoring methodology are provided in section 20.3.

[1] While the Interim Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, we believe that it is it a critical step to develop a mitigation strategy that meets the needs of each jurisdiction while taking into account their own unique abilities. However, the Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c)(3)).

- Planning and Regulatory Capability - added land use plan, community wildfire protection plan, fire department rating, site plan review, and the community rating system (Tables 20-1 and 20-2)
- Administrative and Technical Capability – new to 2016-2020 update (Table 20-3)
- Fiscal Capability – new to 2016-2020 update (Table 20-4)
- Education and Outreach – new to 2016-2020 update (Table 20-5)

Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, ordinances and programs that demonstrate a local jurisdiction's commitment to guiding and managing growth, development and redevelopment in a responsible manner, while maintaining the general welfare of the community. It includes emergency response and mitigation planning, comprehensive land use planning and transportation planning, in addition to the enforcement of zoning or subdivision ordinances and building codes that regulate how land is developed and structures are built, as well as protecting environmental, historic and cultural resources in the community. These planning initiatives generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision making process.

This assessment is designed to provide a general overview of the key planning and regulatory tools or programs in place or under development, along with their potential effect on loss reduction. This information will help identify opportunities to address existing gaps, weaknesses or conflicts with other initiatives in addition to integrating the implementation of this Plan with existing planning mechanisms where appropriate. Tables 20.1 and 20.2 represent the capabilities of each participating jurisdiction. Planning and regulatory capabilities indicated with a bold "**X**" have been updated or developed since the previous plan.

Table 20.1: Planning Capabilities

Jurisdiction	General Planning							Hazard/Emergency Management Planning								Floodplain Management		
	Comprehensive / Master Plan	Land Use Plan	Economic Development Plan	Historic Preservation Plan	Natural Resource Plan	Open Space Plan	Capital Improvements Plan	Hazard Mitigation Plan	Community Wildfire Protection Plan	Drought Plan/Ordinance	Emergency Operations Plan	Post Disaster Plan	Disaster Recovery Plan	Continuity of Operations Plan	Evacuation Plan	Stormwater Management /Drainage Master Plan	Floodplain Management Plan	Flood Response Plan
Galveston County	X		X	X	X	X	X	X		X	X	X	X		X	X	X	X
Bayou Vista							X	X		X	X	X			X	X	X	X
Clear Lake Shores	X	X	X			X		X			X	X	X	X	X	X	X	X
Friendswood	X	X	X			X	X	X		X	X	X	X	X	X	X		
Hitchcock								X			X		X	X	X			
Jamaica Beach	X							X			X				X		X	
Kemah		X			X			X		X	X		X	X	X	X	X	X
La Marque	X		X			X	X	X	X	X	X	X	X		X	X	X	
League City	X	X	X	X		X	X	X		X	X		X		X	X	X	X
Santa Fe	X	X	X				X				X		X			X	X	
Tiki Island	X		X				X	X			X		X		X		X	

Table 20.2: Regulatory Capabilities

Jurisdiction	Building Codes (Year)	Fire Department ISO (Rating)	Site Plan Review	Zoning Ordinance	Subdivision Regulation	Flood Damage Prevention Ordinance	National Flood Insurance Program	Community Rating System (Rating)
Galveston County				X	X	X	X	
Bayou Vista	2012	7		X	X	X	X	
Clear Lake Shores	2012	4	X	X	X	X	X	
Friendswood	2009	3	X	X	X	X	X	5
Hitchcock	2003			X	X	X	X	
Jamaica Beach	2012	3		X	X	X	X	
Kemah	2009	4	X	X	X	X	X	5
La Marque	2003	3		X	X	X	X	
League City	2009	3	X	X	X	X	X	6
Santa Fe	2012	5	X	X	X	X	X	
Tiki Island	2009	6	X	X	X	X	X	8

General Planning

The implementation of hazard mitigation activities often involves stakeholders beyond the emergency management profession. Stakeholders may include local planners, public works officials, economic development specialists and others. As a result, the questions asked in the Local Capability Assessment Survey regarding general planning capabilities were designed to measure the degree to which mitigation is integrated into other planning efforts. Descriptions of the plans and regulatory programs listed in the survey are provided below.

Comprehensive Plan

A comprehensive plan establishes the overall vision for a community and helps to guide municipal decision making.

Land Use Plan

A land-use plan provides a vision for the future possibilities of development in neighborhoods, districts, cities, or any defined planning area.

Capital Improvements Plan

A capital improvement plan guides the scheduling of spending on public improvements. A capital improvement plan can serve as an important mechanism to guide future development away from identified hazard areas. Limiting public spending in hazardous areas is one of the most effective long- term mitigation actions available to local governments.

Economic Development Plan

An economic development plan serves as a road map for economic development decision making, based on the collection of statistical data, historical perspective, and human potential.

Historic Preservation Plan

A historic preservation plan is intended to preserve historic structures or districts within a community. An often overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards to include the identification of the most effective way to reduce future damages.[2] This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards or are within a historic district that cannot easily be relocated out of a hazard-prone area.

[2] See Protecting the Past from Natural Disasters. 1989. Nelson, Carl. National Trust for Historic Preservation: Washington, D.C.

Natural Resource Protection Plans

Natural Resource Protection plans provide recommendations for how to best protect the sustainability of natural resources.

Open Space Management Plans

Open Space Management plans describe a process and recommend strategies and solutions for handling open space issues for outdoor recreational or open habitat areas of land.

Hazard/ Emergency Management Plans

Hazard mitigation is widely recognized as one of the four primary "phases" of emergency management. Other phases include preparedness, response and recovery. In reality, each phase is interconnected with hazard mitigation as Figure 20.1 suggests. Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the *Local Capability Assessment Survey* asks several questions across a range of emergency management plans in order to assess the jurisdiction's willingness to plan and their level of technical proficiency.

Figure 20.1 – Emergency Management Cycle

Hazard Mitigation Plan

A hazard mitigation plan represents a community's blueprint for how they intend to reduce the impact of natural and human-caused hazards on people and the built environment. Elements of a hazard mitigation plan include a risk assessment, capability assessment and mitigation strategy.

For this plan update, the cities of Dickinson, Galveston, and Texas City opted not to participate in the county multi-jurisdictional plan update. Santa Fe has joined this planning initiative and apparently has not been included in any previous hazard mitigation plan.

Community Wildfire Protection Plan

The community wildfire protection plan is a strategic plan that identifies wild land fire issues facing the community and outlines prioritized mitigation actions. This plan is not applicable to the Galveston County planning area.

Drought Plan

A drought plan provides a framework for an integrated approach to minimize the impacts of drought on its people and resources. It outlines both long-term and short-term measures that can be used to prepare for, respond to, and mitigate the effects of drought.

Emergency Management or Operations Plan

An emergency operations plan outlines the responsibilities of those responding to an emergency or disaster and the means by which resources are deployed.

Disaster Recovery Plan

A disaster recovery plan serves to guide the physical, social, environmental and economic recovery of a community, including the physical reconstruction process following a disaster.

Continuity of Operation Plan (COOP)

A continuity of operation plan establishes a clear chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster.

Evacuation Plan

An evacuation plan provides a planned response to and support capabilities for population protection, which include coordination, public notification, resource management and the implementation of protection actions such as evacuation, shelter-in-place, and refuge of last resort. It identifies measures bused by the community to mitigate safety issues during evacuations and assist with the repopulation of areas affected by disaster.

Floodplain Management Capability

Flooding represents the greatest natural hazard facing the nation and Galveston County. At the same time, the tools available to reduce the impacts associated with flooding are among the most developed when compared to other hazard-specific mitigation techniques.

Stormwater Management Plan

A stormwater management plan is designed to address flooding associated with stormwater runoff. The stormwater management plan is typically focused on design and construction measures that are intended to reduce the impact of more frequently occurring minor urban flooding.

Floodplain Management Plan

A floodplain management plan provides a framework for action regarding the corrective and preventative measures in place to reduce flood-related impacts.

Flood Response Plan

A Flood Response plan addresses future flood events in terms of proactive remediation measures to minimize flood hardships and losses.

Regulatory Programs

Zoning Ordinances

Zoning represents the means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the public health, safety and welfare. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, it can serve as a powerful tool when applied in identified hazard areas.

Subdivision Ordinances

A subdivision ordinance is intended to regulate the development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development.

Building Codes, Permitting and Inspections

Building codes regulate construction standards. Decisions regarding the adoption of building codes, the type of permitting process required both before and after a disaster, and the enforcement of

inspection protocols all affect the level of hazard risk faced by a community. With the exception of the county, all jurisdictions reported the enforcement of building codes.[3]

Flood Damage Prevention Ordinance

A local Flood Damage Prevention Ordinance is a tool used by counties and municipalities to regulate the type of construction that occurs in the floodplain.

National Flood Insurance Program

The National Flood Insurance Program (NFIP) provides specific regulatory measures that enable officials to determine where and how growth occurs relevant to flood hazards. The NFIP is a voluntary program but is strongly encouraged by FEMA as a means to implement sustainable solutions.

Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary program under the NFIP. The goals of the CRS are to reduce flood damages to insurable property, strengthen and support the insurance aspects of the NFIP, and encourage a comprehensive approach to floodplain management.

It should be noted that four communities participate in the CRS program. In 2014, Santa Fe applied for the program but was not able to attain the minimum 500 points. Despite Friendswood's effort to improve their CRS rating, the grading criteria have made pursuing their goal costlier.

Administrative and Technical Capability

Administrative capability was evaluated by reviewing county and municipal staffing and the existing organizational structure found across local government to implement mitigation strategies.

Technical capability can be defined as possessing the skills and tools needed to improve decision-making, including the development of sound mitigation actions. Technical capability can be measured across three primary elements: 1) geographic information systems (GIS) and database management; 2) grants management; and 3) professional and knowledge-based staff.

The analysis of the responses to the capability assessment survey indicated that the administrative and technical capabilities for the majority of the jurisdictions are adequate.

Table 20.3 provides a summary of the Administrative and Technical capabilities.

[3] Counties do not have the authority to adopt building codes, unless needed for fire safety for certain public and commercial buildings (See Chapter 233, Section 233.032 of the Texas Local Government Code).

Table 20.3: Administrative and Technical Capabilities

Jurisdiction	Planning Commission	Participation in Emergency Management Committee (LEPC or other)	Maintenance program to reduce risk (i.e., tree trimming, clearing drainage systems)	Mutual Aid Compacts	Building Inspection Department	Floodplain Manager	Emergency Manager	Community Planner	Civil Engineer	GIS Coordinator	Warning Systems / Services (i.e., reverse 911 / outdoor warning systems)	Grant Writing Capabilities
Galveston County		X	X	X	X	X	X		X	X		X
Bayou Vista		X	X	X	X	X[1]	X		X[2]		X	X
Clear Lake Shores	X	X	X	X	X	X	X	X			X	X
Friendswood	X	X	X	X	X	X	X	X	X	X*	X	X*
Hitchcock					X	X	X					
Jamaica Beach	X			X	X	X	X				X	
Kemah		X	X	X	X	X[1]	X	X			X	X
La Marque	X	X	X	X	X	X	X	X	X*	X*	X	X*
League City	X	X	X	X	X	X	X	X	X	X	X	X
Santa Fe	X	X	X	X	X	X	X	X				
Tiki Island	X	X	X	X	X	X	X	X			X	

Note: [1]Provided by the Galveston County Floodplain Manager

[2]Contracted services

Fiscal Capability

The ability to take action is often closely associated with the amount of money available to implement policies and projects. This may take the form of grants received or state and locally based revenue. The cost associated with the mitigation policy and project implementation varies widely. In some cases, policies are tied primarily to staff time or administrative costs associated with the creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project, such as the acquisition of flood-prone homes, which can require a substantial commitment from local, state, and federal funding sources. A discussion of potential funding sources relevant to mitigation projects and activities are presented in Section 25 – Mitigation Strategies.

The analysis of the responses to the capability assessment survey indicated that there is a moderate fiscal capability at the county and larger municipal levels while smaller communities are limited financially.

Recommendation: When considering the effect of fiscal capability on the implementation of policies and projects, jurisdictions should ask themselves the following questions:

- Does this action require monetary commitment or staff resources?
- Can we combine resources with other counties, municipalities, or other agencies to address identified problems?
- Are we willing to commit local revenue on a sustained or a one-time basis action?

Table 20.4 provides a summary of the results of the Fiscal Capabilities.

Table 20.4: Fiscal Capabilities

Jurisdiction	Capital Improvements Project Funding	Authority to levy taxes for specific purposes	Fees for water, sewer, gas, or electric services	Impact fees for new development	Stormwater utility fee	Incur debt through general obligation bonds or tax bonds	Incur debt through private activities	Community Development Block Grant (CDBG)	Other federal funding programs	State funding programs
Galveston County		X	X		X			X	X	X
Bayou Vista	X	X							X	X
Clear Lake Shores	X					X		X	X	X
Friendswood	X	X	X	X		X			X	
Hitchcock			X					X		
Jamaica Beach						X		X		
Kemah										
La Marque	X	X	X			X		X	X	X
League City	X	X	X	X		X	X	X	X	X
Santa Fe	X	X				X		X		
Tiki Island						X		X	X	

Education and Outreach Capability

This type of local capability refers to education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard–related information. Examples include natural disaster or safety-related school programs, participation in community programs such as StormReady; and activities conducted as part of hazard awareness campaigns such as private/public partnership meetings to discuss disaster preparedness.

The analysis of the responses to the capability assessment survey indicated that there is a moderate fiscal capability at the county and larger municipal levels while the small communities are somewhat limited and tend to rely on the county to provide outreach and educational programs and timely information to their residents.

Table 20.5 provides a summary of the Education and Outreach Capabilities.

Table 20.5: Education and Outreach Capabilities

Jurisdiction	Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Ongoing public education or information programs (e.g. responsible water use, fire safety, household preparedness, environmental education)	Natural disaster or safety-related school programs	StormReady® Certification	Firewise Community Certification	Public / Private partnership initiatives addressing disaster-related issues
Galveston County	X	X	X	X		X
Bayou Vista	X	X				
Clear Lake Shores	X	X				X
Friendswood	X	X	X	X		X
Hitchcock						
Jamaica Beach		X		X		X
Kemah						
La Marque		X	X			
League City		X	X			X
Santa Fe						
Tiki Island	X	X				X

20.3 Conclusions

In order to form an assessment of local capabilities, a quantitative scoring methodology was designed and applied to the results of the assessment survey. A point system was established to provide an overall ranking of limited, moderate, and high. Each capability provided by the jurisdiction received a scoring value of 1 with an additional point given to community's whose building codes are 2008 and greater, fire department rating is greater than 6, and they participate in the CRS program.

Table 20.6 shows the results of the Capability Assessment using the designed scoring methodology based on a maximum point value of 57 as defined below.

- High – score of 57 to 38
- Moderate – score of 37 to 18
- Limited – score of 17 to 0

Table 20.6: Results of Capability Assessment by Jurisdiction

	Maximum Point Value					
	29	12	10	6	57	
Jurisdiction	Planning / Regulatory	Administrative / Technical	Fiscal	Education and Outreach	Overall Capability	Rating
Galveston County	22	9	6	5	42	High
Bayou Vista	16	9	4	2	31	Moderate
Clear Lake Shores	22	10	5	3	40	High
Friendswood	24	12	6	5	47	High
Hitchcock	9	3	2	0	14	Limited
Jamaica Beach	13	6	2	1	22	Moderate
Kemah	22	9	0	0	31	Moderate
La Marque	20	12	7	2	41	High
League City	25	12	9	3	49	High
Santa Fe	15	8	4	0	27	Moderate
Tiki Island	19	9	3	3	34	Moderate

20.4 Recommendations for Expanding and Improving on Existing Authorities, Policies, Programs, and Resources

As shown in Tables 20.1 to 20.5, each jurisdiction participating in this plan update provided a summary of their existing authorities, policies, programs, and resources in place. This information provides a quick reference of where each jurisdiction may be lacking in capabilities to assess how they can proactively implement or improve their abilities that may lend to the reduction/elimination of future impacts through enhanced standards, additional staff/resources, funding programs, etc.

Provided below is a listing recommendations suitable for each jurisdiction within this plan update to implement as appropriate. Galveston County is somewhat limited in creating and adopting rules and statutes under the Texas Constitution Article 9 - "Counties can exercise on the powers that the Constitution or statutes have conferred upon it". Galveston County will work with Texas legislature to further mitigate impacts to the unincorporated areas.

Planning and Regulatory Capabilities

- Jurisdictions should consider reviewing/updating all planning initiatives every five years to coincide with the update of the hazard mitigation plan. Integrating mitigation strategies and goals should be incorporated where appropriate to achieve reduction/elimination of risk to people and property.
- Galveston County will coordinate a review of each participating jurisdictions COOP to ensure procedures are developed to address all hazards prone to the planning area.
- Review current floodplain ordinances and consider modifying permitting and building codes.
- Review current building and zoning codes to improve the quality of construction and to control development as it pertains to mitigating future impacts from hazards prone to the jurisdiction.
- Establish a site plan review process for Bayou Vista, Hitchcock, Jamaica Beach, and La Marque.
- Bayou Vista, Clear Lake Shores, Hitchcock, Jamaica Beach, La Marque, Santa Fe, and Galveston County should annually evaluate their participation in the CRS program.

Administrative and Technical Capabilities

- Identify opportunities for increasing staff to administer/enforce regulatory and planning tasks and grant writing.
- Implement training opportunities to cross-train staff as a means to ensure continuity of operations and improve daily work performance through increased understanding of the jurisdiction's area of responsibility.
- Consider utilizing local high school and college students to augment city/county staff with data research and analysis.

Fiscal Capabilities

- Increase development of grant writer's capabilities through training programs and awareness of various funding programs and how they fit into the needs of the participating jurisdictions. This can increase the success of obtaining future grant awards and alleviating the limited budgets all jurisdictions are faced with.
- Explore opportunities to combine resources with other counties, municipalities, or other agencies to address common needs.
- Review fees and incentives for programs to fund future expansion projects.

Education and Outreach Capabilities

- Increase natural disaster and safety-related school programs by combining resources with all the participating jurisdictions to assist in the development and delivery of the programs.
- Establish/enhance local community groups or non-profit organizations. Provide training and informational materials.

21.0 Mitigation Strategy

The mitigation strategy section of the previously approved Galveston County 2011-2016 plan has been restructured to coordinate the information for mitigation goals, an update on the mitigation actions from previous planning cycle, and a listing of the current mitigation actions.

21.1 Update on 2011 to 2016 Mitigation Action Plans

Prior to the kick off meeting, a listing of the mitigation actions identified in the previous plans for each jurisdiction were sent to their designated GCHMC member to review the progress made with their respective officials. A project status category was selected based on the following definitions:

- Ongoing – Actions that are continually implemented as appropriate by the jurisdiction.
- In Progress – Actions that are currently being implemented but are not yet complete.
- Delayed – Actions that were not able to be implemented due to various issues such as funding constraints, lack of support, construction delays, etc.
- No longer required – Actions that cannot be implemented for various reasons such as outside of their capabilities, issues no longer relevant, etc.
- Completed – Actions that have been satisfied according to the description provided. The completion date is also noted.

The actions categorized as ongoing, in progress, and delayed are included with details in Section 21.3 Mitigation Action Plans - 2016 to 2020.

Tables 21.1 to 21.10 provide a summary by jurisdiction of the accomplishments made on the mitigation actions plans identified in the previous plan.

Previous Mitigation Action Table Reference

Jurisdiction	*Table Number*	*Page Number*
Galveston County	*21.1*	*21-2*
Bayou Vista	*21.2*	*21-5*
Clear Lake Shores	*21.3*	*21-7*
Friendswood	*21.4*	*21-9*
Hitchcock	*21.5*	*21-16*

Jurisdiction	*Table Number*	*Page Number*
Jamaica Beach	*21.6*	*21-19*
Kemah	*21.7*	*21-20*
La Marque	*21.8*	*21-22*
League City	*21.9*	*21-24*
Tiki Village	*21.10*	*21-26*

*Santa Fe was not a part of the previous Galveston County plan and therefore there are no previous mitigation actions to report on.

Table 21.1: Status of Galveston County 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
Galv. Co (Past Action) 3: Remove exposed concrete and rebar on 60 miles of public beach					X	2011	
Galv. Co (Past Action) 7: Implement aggressive beach nourishment program to address critical erosion areas				X			This action is outside of the authority of the County.
Galv. Co (Past Action) 8: Elevate coastal Roadway (Hwy. 87) to ease evacuation and reduce damages					X	2011	
Galv. Co (Past Action) 11: Develop Debris Management Plan					X	2014	
Galv. Co (Past Action) 12: Incorporate GIS System into emergency planning and operations	X						
Galv. Co (Past Action) 13: Join the Community Rating System (CRS)				X			Unable to fulfill the requirements for participating in the CRS program
Galv. Co (Past Action) 14: Evaluate areas with limited evacuation capacity and pursue improvements					X	2015	
Galv. Co-1: Develop a comprehensive drainage plan for unincorporated areas to mitigate flooding that occurs due to flat terrain					X	2012	
Galv. Co-2: Conduct dune restoration projects o Bolivar Peninsula for CBRA and non-CBRA areas				X			This action is outside of the authority of the County.
Galv. Co-3: Routinely clear debris including tree limbs from drainage and roadside ditches deposited by weather events such as hurricane, winter storm, flood and tornado - unincorporated areas of county	X						
Galv. Co 4: Determine locations of special needs population and develop an evacuation plan for urban fire. Once plan is approved notify affected facilities and the public of the plan process and procedures involving a disaster. unincorporated areas of county					X	2011	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
Galv. Co. 5: Develop procedures including chain of command and responsible parties to carry out NIMS guidelines on specific group/persons responsible for implementing alarm systems or specifying alternate shelter locations during a disaster. Document these guidelines in an emergency operations plan - unincorporated areas of county					X	2013	
Galv. Co 6: Disseminate information to the public on drought, extreme heat tornado Wildfire, and other safety and health issues. - unincorporated areas of county	X						
Galv. Co 7: Construct parallel break waters. Bolivar Peninsula in the non-CBRA zones				X			This action is outside of the authority and capability of the County.
Galv. Co 8: Meet National Weather Service (NWS) criteria and apply to be designated as Storm Ready County and Storm Ready Communities					X	2015	
Galv. Co 9: Design and construct a multi-purpose EMS facility for Crystal Beach and High Island area residents					X	2013	Crystal Beach EMS completed. New action developed for High Island Community Shelter
Galv. Co 10: Harden critical facilities by purchasing equipment and installing emergency backup power at Bayview Municipal Utility District lift stations, operations center, and wastewater treatment facility		X					Generators installed on lift stations 1 and 2 in 2013
Galv. Co 11: Determine locations of special needs population and develop an evacuation plan. Once plan is approved notify affected facilities and the public of the plan process and procedures involving a disaster.					X	2011	
Galv. Co 12: Disseminate information to the public on safety issues and health concerns for extreme heat as it affects the elderly and those that work outdoors.				X			Combined with Action GC-2011-6
Galv. Co 13: Disseminate information to the public on drought, water conservation tips during drought, and xeriscape landscaping plants.				X			Combined with Action GC-2011-6
Galv. Co. 14: Install emergency generator at Bayview Municipal Utility District lift stations, operations center, and wastewater treatment facility					X	2012	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
Galv. Co. 15: Routinely clear debris including tree limbs from drainage and roadside ditches deposited by weather events such as tornado.				X			Combined with action GC-2011-3
Galv. Co 16: Routinely clear debris including tree limbs from drainage and roadside ditches deposited by weather events such as hailstorm.				X			Combined with action GC-2011-3
Galv. Co 17: Develop procedures including chain of command and responsible parties to carry out NIMS guidelines on specific group/persons responsible for implementing alarm systems or specifying alternate shelter locations during a disaster. Document these guidelines in an emergency operations plan					X	2013	
Galv. Co 18: Routinely clear debris including tree limbs from drainage and roadside ditches deposited by weather events such as hurricane wind				X			Combined with action GC-2011-3
Galv. Co 19: Disseminate information to the public on drought, including ways to reduce and conserve water, protect pets, and landscaping for drought-resistant plants.				X			Combined with Action GC-2011-6
Galv. Co 20: Provide residents and business owners in vicinity of the existing levee system information regarding evacuation routes and procedures in the event of a levee breach				X			Galveston County maintains levee but cities notify their citizens on updates
Galv. Co 21: Initiate a new Corp of Engineers study of the Texas City Hurricane Flood Protection Project to improve the current levee system to provide protection from a Category 5 storm.		X					
Galv. Co 22: Provide residents and business owners in vicinity of the existing levee system information regarding the availability of NFIP flood insurance				X			This action is outside of the authority and capability of the County.
Galv. Co 23: Develop procedures for mass notification of citizens and merchants to development of winter storms possibilities					X	2012	
Galv. Co 24: Develop a drought contingency plan					X	2012	

Table 21.2: Status of Bayou Vista 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Relayed	No Longer Required	Completed	Completion Date	Comment
BV (Past Action) 1: Provide website information to citizens regarding weather alerts and departmental phone listings with personnel contact information	X						
BV (Past Action) 2: Conduct outreach efforts, including Hurricane and Disaster Awareness Booths at the city fair and other public events				X			Combined with BV-2006-1
BV (Past Action) 3: Conduct town meetings to inform citizens and city officials of the procedures for disaster preparedness, mitigation, and recovery.				X			Combined with BV-2006-1
BV 1: Purchase and install generators:18 KW (NG) Aluminum/Automatic Transfer Switch-(Guardian) to protect the submersible lift station pumps by elevating the lift station roof, electric control panels, and lift station well to 7 feet through the use of a generator secured above a higher flood level. At the following lift stations: Pompano, Bonita, Omega Bay, Lakeside, Bayou Vista					X	2009	
BV 2: Purchase and install Natural Gas Generators-3 Phase w/V10 engine 130 KW for Water Plant 3035 Highway 6					X	2009	
BV 3: Purchase and install Natural Gas Generators-3 Phase w/V10 engine 150 KW Wastewater Plant 3031 Highway 6					X	2009	
BV 4: Implement drainage improvement program to reduce standing water and runoff, and reduce minor flooding for residents located in District No.12			X				Pending funding
BV 5: Install fire danger rating/burn ban signs				X			Not applicable to the area. Uncertain why this was included in previous plan
BV 6: Implement Stormwater management plan to improve drainage during flood and other weather events; clean and repair storm sewer system			X				Pending funding
BV 7: Develop Master Drainage Plan to assist in reducing flooding through increased lowest finish floor requirements			X				Pending funding

Action	Ongoing	In Progress	Relayed	No Longer Required	Completed	Completion Date	Comment
BV 8: Reconstruct storm sewers system and upgrade existing storm sewer system			X				Pending funding
BV 9: Implement water conservation measures	X						
BV 10: Upgrade existing storm sewer construction projects to mitigate flood-related impacts such as tsunami				X			This action is included in BV-2011-8
BV 11: Implement best management practices for securing windblown debris in canals as part of an ongoing Canal Debris Management Plan.	X						
BV 12: Develop and implement a plan for canal dredging to reduce sediment deposited during storm events, reducing access in canals	X						
BV 13: Repair, upgrade or replace Water and Sewer infrastructure for 175 connections as needed in original Bayou Vista area	X						
BV 14: Construct new 12" -10" -8" water lines and 10 additional fire hydrants				X			Not feasible
BV 15: Implement water conservation awareness campaign for residents	X						
BV 16: Install a deflective shield over two (2) clarifiers Wastewater Treatment Plant 3031 Highway 6			X				Pending funding
BV 17: Implement a plan for shutting down water and sewer system during fire events Wastewater Treatment Plant 3031 Highway 6	X						
BV 18: Secure funding to construct a barn to house and protect tractors, and other large equipment and sewer machine Wastewater Treatment Plant 3031 Highway 6					X	2009	
BV 19: Implement a plan for the hardening the water system during freeze events Water Plant 3035 Highway 6	X						
BV 20: Implement a plan for minimizing damage due to pipeline breach or failure	X						
BV 21: Identify and implement all public buildings and critical facilities for floodproofing and hardening needs			X				Pending funding

Table 21.3: Status of Clear Lake Shores2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Relayed	No Longer Required	Completed	Completion Date	Comment
CLS (Past Action) 2: Implement stormwater management practices	X						
CLS 1: Promote awareness and implement mass notification system of dam flooding due to failure of flood gates to open - Harris County Flood Dam Gate in Seabrook, TX				X			Restructured under action CLS-2016-1.
CLS 2: Review drought plan with local water district WCID 12 and implement a plan to address drought	X						
CLS 3: Implement a program of mass notification in the event of a Wildfire through the City's website or telephone alert system.				X			Wildfires are not applicable to Clear Lake Shores
CLS 4: Educate and alert citizens on the dangers of flooding. Inform residents of the benefits of the National Flood Insurance Program and purchase of flood insurance	X						
CLS 5: Repair bridge footings - Clear Lake Road Bridge					X	2010	
CLS 6: Purchase Storm shutters for public buildings (community clubhouse)					X	2010	
CLS 7: Work with the National Weather Service to promote safety from weather related threats to local schools				X			There are no schools in Clear Lake Shores
CLS 8: Conduct mass notification for pipeline breach or release of hazardous materials emergencies related to in-place protection and/or evacuation	X						
CLS 9: Participate in pipeline group training pertaining to responding to pipeline emergencies, evacuation, in-place protection of residents	X						
CLS 10: Develop a wildfire contingency plan				X			Wildfires are not applicable to Clear Lake Shores
CLS 11: Adopt routine fire hydrant program to update or replace old or inoperable fire hydrants				X			Clear Lake Shores does not own any hydrants. These are maintained by Kemah Fire Dept.

Action	Ongoing	In Progress	Relayed	No Longer Required	Completed	Completion Date	Comment
CLS 12: Develop mass notification system to warn citizens of threat of a severe winters storm					X	UNK	Notification systems have been in place-date of implementation is not known. Restructured under action CLS-2016-1 to address notification procedures
CLS 13: Develop and implement the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) program to citizens, conduct meetings to explain voluntary position and sign up residents to become official observers					X	UNK	Notification systems have been in place-date of implementation is not known. Restructured under action CLS-2016-1 to address notification procedures
CLS 14: Apply for grant assistance in establishing an independent Building Inspector position					X	UNK	The city has had a building inspector – uncertain why this action was created.
CLS 15: Develop mutual aid agreement with Harris County Flood Control to strengthen the flood gate operation. Harris County Flood Control gate in Seabrook, Texas				X			Uncertain why this action was created – not applicable
CLS 16: Review current building codes and periodically review code and update accordingly					X	2016	2015 IBC adopted
CLS 17: Review drought plan with local water district WCID 12 and implement a plan to address water conservation measures	X						
CLS 18: Implement a public awareness plan to address extreme temperature with emphasis on health and safety issues for the elderly that may not have air conditioning and those that work outdoors				X			Restructured under action CLS-2016-1 to address notification procedures
CLS 19: Work with the National Weather Service to promote safety from weather related threats to local schools				X			No Schools in Clear Lake Shores

UNK = Unknown date

Table 21.4: Status of Friendswood2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
F-2009-1: COMMUNITY RATING SYSTEM RECERTIFICATION (2003 AND 2009 MITIGATION PLANS) FLOOD EVENTS – FLOOD PLAIN MANAGEMENT							
• Maintain current CRS Rating of 5	X						CRS Rating was downgraded in Summer of 2015 to a CRS Rating of 7.
• Conduct activities to obtain CRS Rating of 4	X						CRS Rating was downgraded in Summer of 2015 to a CRS Rating of 7.
• Review/Update city's floodplain regulations/ordinances as appropriate.	X						
• Review/update city's Regional Drainage Plan	X						
• Coordinate/cooperate with Harris County Flood Control District and USACE with regard to Clear Creek Federal Flood Protection Project.	X						
• Require elevation certificates on all construction plans submitted for development.	X						
• Maintain annual progress records of all repetitive loss properties.	X						All RL/SRL properties are maintained in a database in-house, and verified against NFIP/FEMA records on a routine basis.
• Continue adherence to the open space requirements	X						
• Continue annual outreach projects for structures located within the SFHA	X						
• Continue to implement the drainage system maintenance program.	X						
• Continue to encourage residents participate in the NFIP	X						
MASTER DRAINAGE PLAN (2003 AND 2009 MITIGATION PLANS) FLOOD EVENTS – FLOOD PLAIN MANAGEMENT							
• Sun Meadow Relief Storm Sewer, Phase I & II					X	2005	
• Mission Estates Outfall					X	2006	
• Melody Lane/Willowick Projects, Phase II					X	2006	Coordination with GCCDD (Wegner Ditch – Tributary 2)

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• Annalea/Whitehall/Kings Park Drainage – Phase I					X	2004	
• Clover Acres Drainage					X	2007	
• FM 518 Drainage, Phase I					X	2010	
• Glenshannon Drainage, Phase I					X	2008	
• West Shadow Bend/Woodlawn, Drainage Phase I					X	2004	
F-2009-2: ELEVATION, RELOCATION & ACQUISITION DATABASE MAINTENANCE (2003 & 2009 MITIGATION PLANS) FLOOD EVENTS – FLOOD PLAIN MANAGEMENT							
• Maintain Base Flood Elevations (BFE) on the remaining 181 properties	X						14 properties mitigated 2013-2014
• Research funding sources to assist property owners with elevation, relocation and/or buyout of repetitive loss properties	X						
F-2009-3: PUBLIC WARNING SYSTEM (2003 AND 2009 MITIGATION PLANS) SEVERE THUNDERSTORM/HAIL/LIGHTNING							
• First Call Notification System	X						
• Harris County Neighborhood Early Warning System (NEWS)	X						
• Friendswood Information Radio 1650 AM	X						
• KTRH 740 AM	X						
• TV – City of Friendswood PEG Channel 17	X						
• E-mail Alerts	X						
• Outdoor Warning Siren System	X						
• Storm Spotters	X						
UPGRADE PUBLIC WATER SYSTEM (2003 AND 2009 MITIGATION PLANS) SEVERE THUNDERSTORM/HAIL/LIGHTNING							
• WATER PLANT #1 – REHABILITATION ✓ Sandblasting & painting of both ground storage tanks ✓ Minor equipment repairs & replacement					X	2012	2009-2013 CIP

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• WATER PLANT #2 – REHABILITATION ✓ Replacement of control room, chemical room, conversion of pumps and ground storage tank ✓ Replace all vales and piping as necessary ✓ Replace fencing surrounding the tank	X						2009-2013 CIP
• WATER PLANT #5 – REHABILITATION ✓ Replaced elevated tank & ground storage tanks with concrete tanks ✓ Installed emergency generator ✓ Increase storage capacity					X	2013	2009-2013 CIP
• WATER PLANT #6 – REHABILITATION ✓ Installed 500,000-gallon steel water tank & new pump house ✓ Installed emergency generator					X	2014	2009-2013 CIP
• WATER WELL #7 -REHABILITATION ✓ Replacement of control room, chemical room, conversion of pumps and ground water storage ✓ Replace all values/piping as necessary ✓ Replace existing 210,000 tank with 500,000-gallon steel unit					X	2014	2009-2013 CIP
• Purchased additional 6 MGD surface water from City of Houston					X	2013	Cost $16,250,000
• Added 30 fire hydrants					X	2014	
• Installed PVC transmission lines to replace large sections of old water lines; strategic connections and increased certain line sizes to improve pressure and water quality					X	2009	
DEVELOP CONTINUITY OF OPERATIONS PLANS FOR CRITICAL FACILITIES SEVERE THUNDERSTORM/HAIL/LIGHTNING							

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• Lift Station #2 – Rehabilitation Project ✓ Replacement of control room, chemical room, conversion of pumps & probable replacement of ground storage tank. ✓ Replacement of valves & piping as necessary ✓ Replace existing fence					X	2009	2009-2013 CIP
• Surface Water Station #2 ✓ Auxiliary Power supply					X	2012	2009-2013 CIP
• Blackhawk Regional Treatment Plant rehabilitation and generator				X			Reorganization of authority
• Install/provide back-up generator to maintain operations at all city lift stations • Install/provide back-up generator to maintain operations of water wells					X	2012	• 35 lift stations and 8 surface water stations have natural gas back-up generators installed. • CDBG funding was utilized following Hurricane Ike, 2008
• Lift station #27 and Blackhawk Regional Treatment Plant Generators			X				Pending award of funding
CRITICAL FACILITIES PROTECTION (2003 AND 2009 MITIGATION PLANS) HURRICANE/TROPICAL STORM							
• Generator installation for auxiliary power at the Public Library, City Hall and Activities Building					X	2011	Homeland Security Disaster Recovery Grant funding utilized
• Protective Window Covering (Film) for City Hall, Public Safety Building, Library, Activities Building, 4 Fire Stations.					X	2011	CDBG grant funding was utilized
HURRICANE PUBLIC EDUCATION CAMPAIGN (2003 AND 2009 MITIGATION PLANS)							

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• Design/develop a hurricane guide to include ✓ evacuation procedures/routes & re-entry procedures utilizing the H-GAC zip-zone evacuation map ✓ preparing homes to withstand storm damage ✓ prepare a survival kit ✓ health safety guidelines ✓ power outages ✓ debris removal ✓ permitting process	X						• Public education programs are offered to all residents through area schools, nursing homes, elderly living centers, civic groups, homeowner's associations, etc. • Printed publications are made available at City Hall, Library, and Activities Building and homeowner's associations. • This will be carried over to the 2009 Mitigation Plan to ensure all new residents to the area have sufficient educational materials for self- protection. This action has been restructured under F-2016-18
SHELTER-IN-PLACE PUBLIC EDUCATION CAMPAIGN (2003 AND 2009 MITIGATION PLANS) TORNADO							
• Design/develop a public awareness flyer for shelter-in-place procedures • Schedule presentations with all critical and vulnerable facilities within the city (to include schools, day cares, nursing homes, elderly living facilities, etc.) • Distribute flyer to all residents within the city through "Focus on Friendswood" newsletter, utility billing, etc. • Post information in city PEG Channel • Pre-record messages for broadcast over Friendswood Information Radio 1650 AM • Post information on city's website	X						This action has been restructured under F-2016-18
CRITICAL FACILITIES PROTECTION (2003 AND 2009 MITIGATION PLANS) TORNADO							
• Auxiliary Power ✓ Fire Station #1 ✓ Fire Station #2 ✓ Fire Station #3 ✓ City Hall ✓ Library					X	2011	Homeland Security Disaster Recovery Grant funding utilized
F-2009-4: MAJOR THOROUGHFARE PLANNING (2003 AND 2009 MITIGATION PLANS) HAZARDOUS MATERIALS							

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
Brittany Bay Blvd (continuation of LC PKWY) – Phase I (east portion to SH 146)	X						Included in CIP for 2018 • $6.5 million
Brittany Bay Blvd (continuation of LC PKWY) – Phase II (west portion to Pearland PKWY)	X						Included in CIP for 2018 • $6.5 million
GIS MAPPING & HAZUS HAZARDOUS MATERIALS							
• Equipment (computers and plotters) • Staff (salaries, benefits, etc.)				X			Unable to obtain software and maintain capabilities to operate within the city's IT protocols
DEVELOP A DROUGHT CONTINGENCY PLAN							
• The main emphasis of this project is to conserve the available water supply and protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation and fire protection. • Protect and preserve public health, welfare and safety and minimize the adverse impacts of water supply shortages or other water supply emergency operations. • Conserve existing water supplies. • Protect integrity of water supply facilities. • Ensure continual water supply. • Provide sufficient supply of water for emergency response usage.					X	2010	
DEVELOP PUBLIC EDUCATION CAMPAIGN (2009 MITIGATION PLAN) DROUGHT PUBLIC SERVICE ANNOUNCEMENTS (PSA) Main emphasis of this project is to ensure that the citizens of Friendswood are informed of the potential danger of existing weather conditions, and to ensure they have information to protect themselves and their property.							

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• Ensure the public is aware of the potential dangers posed by drought conditions. • Ensure water conservation methodologies are available to all residential and commercial properties within the city. • Ensure articles are available for publication in local newspapers, "Focus on Friendswood", PEG Channel 17, at the beginning of the summer season, and during times of extended drought conditions. • Ensure residential and commercial populations are informed of drought conditions, solutions to conserve water and protect property and people. • Ensure the integrity of the city's water supplies are maintained on a consistent basis.	X						This action has been restructured under F-2016-18
SUBSIDENCE • The city purchases treated water from the City of Houston. • The city owns and operates 2 water booster stations and 6 ground water plants. • The purchased water provides the majority of the demand and averages over 90% of the usage.							
• The city has purchased 12 million gallons/day surface water from the City of Houston.					X	2014	At this capacity, this supply will serve up to 57,000 people. This capacity will sustain the city to total build-out status.
• Review and amend, if necessary, the Water Conservation Plan and the Storm Water Management Program.	X						This action has been restructured under F-2009-5
DEVELOP A PUBLIC EDUCATION CAMPAIGN (2009 MITIGATION PLAN) SUBSIDENCE • Promote community awareness of subsidence risks and effects by providing materials to property developers and home builders when building permit applications are made. • Ensure property owners are aware of changes to base flood elevations to enhance awareness to potential for flooding.							
• Develop informational pamphlets to be distributed to all property developers and home builders at the building application phase of the process	X						This action has been restructured under F-2016-18
• During the plan review process, ensure that all city building codes and floodplain management regulations are adhered to by the developer/builder.	X						

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comments
• Increase awareness of the history of subsidence in the area. • Increase awareness and knowledge of the necessity to changes in base flood elevation requirements. • Minimize effects from flooding hazards.	X						
WINTER STORM PUBLIC EDUCATION CAMPAIGN (2009 MITIGATION PLAN)							
• Develop informational materials for use on city's local PEG Channel to inform the public of predicted temperature fluctuations; the importance protecting outside pipes from cold temperatures; and the need to bring pets indoors out of the inclement weather.	X						This action has been restructured under F-2016-18
• Develop PSA to be utilized on the following modes of transmission ✓ 1650 AM Radio Station ✓ City's mass email system ✓ City's website ✓ Facebook ✓ Twitter	X						

Table 21.5: Status of Hitchcock 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
H (Past Action) 1: Purchase fire water truck (2500 gallon)					X	2015	
H (Past Action) 2: Address poor drainage on Lexington Drive			X				Delayed due to lack of funding
H (Past Action) 3: Address poor drainage on Concord Drive			X				Delayed due to lack of funding
H (Past Action) 4: Address poor drainage on Lincoln Drive			X				Delayed due to lack of funding
H (Past Action) 5: Address poor drainage on Willow Drive			X				Delayed due to lack of funding
H (Past Action) 6: Address poor drainage on Meadowplace Drive			X				Delayed due to lack of funding
H (Past Action) 7: Address poor drainage on Tacguard Drive			X				Delayed due to lack of funding
H (Past Action) 8: Address poor drainage on Barry Street			X				Delayed due to lack of funding
H (Past Action) 9: Address poor drainage on Woodacres Drive			X				Delayed due to lack of funding
H (Past Action) 10: Address poor drainage on Buins St		X					
H (Past Action) 11: Address poor drainage on Jay Road		X					
H (Past Action) 12: Address poor drainage on Hacker Rd			X				Delayed due to lack of funding
H (Past Action) 13: Address poor drainage on Gulf Street					X	2015	
H (Past Action) 14: Address poor drainage on Florida St					X	2015	
H (Past Action) 15: Address poor drainage on Washington Street					X	2015	
H (Past Action) 16: Address poor drainage on Stewart Road			X				Delayed due to lack of funding
H (Past Action) 17: Address poor drainage on Mills Street					X	2015	
H (Past Action) 18: Address poor drainage on Hawthorne Street			X				Delayed due to lack of funding
H (Past Action) 19: Address poor drainage on Smith Drive					X	2015	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
H (Past Action) 20: Address poor drainage on Belring Rd			X				Delayed due to lack of funding
H 1: Implement public awareness program to residents regarding mitigating flooding and drainage issues with various methods such as curbside planting, elevating structures, and disseminate NFIP information regarding purchase of flood insurance.	X						Program not implemented due to lack of understanding what is required. This action will be modified to address all hazards under action H-2011-1.
H 2: Develop and implement a program to routinely check and maintain fire hydrants	X						
H 3: Extend water and sewer lines to septic and well water customers not currently on City system, thus reducing high use of septic systems in use.	X						
H 4: Install gate valves and boxes on the water mains. Lines are susceptible to various hazards and extreme temperatures					X	UNK	Uncertain when the city completed the installation of gate values and boxes.
H 5: Provide and distribute safety procedures to builders and developers to require adequate building setbacks from natural gas pipelines				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.
H 6: Educate the public about hazardous materials and waste, pipeline dangers				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.
H 7: Remove downed trees and brush that pose increase fire risk throughout city.				X			Combine with Hitchcock 8 under action H-2011-8
H 8: Implement a tree trimming program that clears tree limbs from public right of ways.	X						
H 9: Purchase NOAA “all hazard” Radios for early warning and post-event weather information for residents				X			The city does not have the financial resources to purchase radios for their residents
H 10: Purchase and install emergency power generators and connections equipment at critical sanitary sewer lift station sites			X				Delayed due to lack of funding.
H 11: Implement storm sewer system improvement projects to mitigate flooding	X						

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
H 12: Educate residents regarding benefits of xerogardening and xeriscaping				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.
H 13: Upgrade water and sanitary sewer distribution and collection system infrastructure where needed, include backflow prevention valves where feasible	X						
H 14: Develop and implement a program to routinely check and maintain fire hydrants				X			Duplicate action – addressed under H-2011-2
H 15: Implement a tree trimming program that clears tree limbs from public right of ways				X			Duplicate action – addressed under H-2011-8
H 16: Purchase NOAA "all hazard" Radios for early warning and post-event weather information for residents				X			The city does not have the financial resources to purchase radios for their residents
H 17: Educate residents and businesses about benefits of xeriscaping through a public awareness campaign				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.
H 18: Increase native canopy by tree planting in public right of way to reduce urban heat levels				X			This action is not realistic for the community to complete
H 19: Evaluate, design, and implement hardening designs to protect critical facilities and critical infrastructure during disasters	X						
H 20: Conduct a fire safety and prevention program				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.
H 21: Implement a public outreach program designed to educate the public about availability and benefits of NFIP flood insurance				X			City does not have the expertise to provide information regarding this action. Appropriate education and outreach efforts for this action will be included under action H-2011-1.

UNK = Unknown

Table 21.6: Status of Jamaica Beach 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
JB (Past Action) 1: Implement beach and dune restoration program		X					
JB (Past Action) 3: Join the Community Rating System		X					
JB (Past Action) 4: Conduct annual hurricane town hall meeting	X						
JB 1: Conduct routine hydrant maintenance	X						
JB 2: Develop system to maintain records of Elevation Certificates		X					
JB 3: Become a National Weather Service (NWS) "Storm Ready" Community					X	2013	
JB 4: Establish pre-disaster debris management contracts					X	2015	
JB 5: Prepare a Drought and Extreme Heat Contingency Plan		X					
JB 6: Form Mutual Aid Agreement with the City of Texas City in the event of Pipeline Failure or Hazardous Material Release					X	2013	A Mutual Aid Agreement was executed with Galveston County rather than Texas City
JB 7: Construct a retaining wall around the sewer plant to protect the facility from surge during coastal flood events					X	2014	
JB 8: Provide NOAA Weather Radios for Police and Fire Departments					X	2013	
JB 9: Provide larger size generator for City Hall Building					X	2013	

Table 21.7: Status of Kemah 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
K (Past Action) 1: Initiate outreach campaign promoting the purchase of flood insurance and lightning arrestors		X					
K (Past Action) 2: Develop severe weather audio alert system.			X				Pending funding and support
K (Past Action) 3: Implement storm sewer system re-engineering and follow-up construction project to mitigate flood-related impacts.		X			X		
K (Past Action) 4: Develop city ordinance requiring the incorporation of wind resistant construction provisions and enforcement measures in the city building code.			X				Pending support to develop ordinance
K (Past Action) 5: Develop city ordinance establishing water use regulations during drought.					X		
K 1: Participate in National Weather Service tornado drills along with elementary school in jurisdiction		X			X		
K 2: Develop procedures for mass notification of citizens and merchants of winter storms possibilities					X	2013	
K 3: Develop procedures for making mass notifications to citizens and merchants in the event of a fuel pipeline breach or hazardous material spill or release from a transporter or fixed site						2013	
K 4: Participate in Pipeline Group training and annual community meetings						2015	
K 5: Review and revise existing building codes to include more stringent measures such as roof shingles that reduce the effect of hail greater than 1" in diameter; maintain and adopt updates from International Code Congress		X			X	2014	
K 6: Seek grant funding adding a full-time building inspector position to support stronger ordinances and building codes that are proposed				X			Unable to support
K 7: Develop procedures for making mass notifications to citizens and merchants during times of drought, conditions of extreme temperatures and urban and wildland fire. Post same information on City website at www.kemah-tx.gov					X	2013	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
K 8: Review, participate and implement any updates for drought contingency plans as developed by the WCID# 12							
K 9: Develop awareness of potential impact to community as result of failure of function of flood gates at Second Cut - 1900 Shipyard Drive (intersection of Highway 146 and Shipyard Drive)						2013	
K 10: Develop program to integrate with the Harris County Flood Control District for the purpose of optimizing the operation of the flood gates at second cut outlet - 1900 Shipyard Drive (intersection of Highway 146 and Shipyard Drive)			X		X		Pending support
K 11a: Review and update if necessary flood plain ordinance to ensure compliance with minimum standards of NFIP		X			X		
K 11b: Alert community about dangers of flooding, NFIP compliance, and importance of purchasing flood insurance to protect property						2013	
K 12: Seek Community Development Block Grant funding for repairs to, modification of, or relocation of flood water lift station destroyed by Hurricane Ike on September 13,2008 100 Second Street						2014	
K 13: Develop maintenance and flow testing program for fire hydrants in jurisdiction		X					
K 14: Develop and implement program for hardening existing public buildings from winter storm – 1401 State Hwy 146 (city hall), 800 Harris (community center) 602 Bradford (visitor center)		X			X		
K 15: Educate residents regarding benefits of xerogardening and xeriscaping		X					
K 16: Become a National Weather Service (NWS) “Storm Ready” Community						2014	

Table 21.8: Status of La Marque 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
LM (Past Action) 2: Implement drainage projects that support low maintenance and cleaning of drainage ditches.			X				Deferred pending funding
LM (Past Action) 4: Install new 12" – 10" and 8" water line and ten (10) additional fire hydrants					X	2013	
LM (Past Action) 6: Purchase a rescue pumper truck for Main Station					X	2011	
LM (Past Action) 7: Build new west side fire station				X			Duplicate action
LM 1: Purchase and install a freshwater supply backflow preventer for ground water system - The City of La Marque's main connection to the Gulf Coast Water Authority located at Orchid Drive and 5th Ave, Texas City					X	2012	
LM 2: Purchase and Install Storm Shutters for Fire Station Entry Way - 1109-A Bayou Road			X				Deferred pending funding
LM 3: Purchase new Fire Station Doors for Apparatus Bays - 1109-A Bayou Road			X				Deferred pending funding
LM 4: Purchase and install two 350 KV generators at the Sewer Treatment Plant. 2701B Woodland Drive					X	2012	
LM 5: Purchase new generator for Fire Station and City Hall					X	2012	
LM 6: Purchase New Rescue Pumper for Fire Station			X				Deferred due to lack of funding
LM 7: Build a Westside Public Safety Complex			X				Deferred pending funding
LM 8: Replace two generators at the fresh water well in order to support our emergency operations. 4319 Kirby, and 2102 Magnolia					X	2015	
LM 9: Purchase Generator for the Public Works Facility.			X				Deferred pending grant funding
LM 10: Update the City of La Marque's Emergency Communications System: Federal Mandated (700MHZ) System by 2020					X	2015	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
LM 11: Construct safe room shelter at emergency operations command center to house local residents; shelter could be used for multiple purposes during non-emergency events			X				Deferred pending grant funding
LM 12: Build new roads to accommodate evacuations and reduce congestion at the intersections cited - Off IH-45 Feeder Road on La Marque/Texas City line. Start road on city line and continue past Gulf Greyhound Park and tie into FM 2004			X				Deferred pending grant funding
LM 13: Install generators for Wastewater Lift stations located around the city		X					
LM 14: Construct a storm water retention area on the east side of the City - The location of this detention area is located in close proximity to FM 1765 and SH 146			X				Deferred pending funding
LM 15: Increase the height of the existing Levee wall system to withstand a Category 5 storm surge. The South side of La Marque and through Texas City			X				Deferred pending funding
LM 16: Purchase 100' Aluminum Aerial platform fire apparatus for residential and commercial structure fire rescues. Central fire station			X				Deferred pending grant or bond funding
LM 17: Build public service facility			X				Deferred pending grant or bond funding
LM 18: Remove downed trees and brush that pose increase fire risk throughout the City.	X						
LM 19: Disseminate Texas Forest Service and other information to the public on minimizing damage from drought by xeriscape landscaping plants, and fire buffers surrounding structures.	X						

Table 21.9: Status of League City 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
LC (Past Action)-1: Storm drainage improvement			X				Pending funding
LC (Past Action)- 2: Coryell Street drainage					X	2011	
LC (Past Action)-3: Highland Terrace drainage			X				Pending funding
LC (Past Action)-4: Kansas Street drainage			X				Pending funding
LC (Past Action)-5: Robinson Bayou Bank stabilization					X	2013	
LC (Past Action)-6: Shellside detention		X					
LC (Past Action)-7: Develop a stormwater and master drainage plan update					X	2011	
LC (Past Action)-8: Clear Creek Heights Drainage					X	2014	
LC (Past Action)-9: Develop and manage a repetitive flood loss database		X					
LC (Past Action)-10: Weather station with the capability to monitor creek levels					X	2013	
LC (Past Action)-11: Develop a floodplain management plan					X	2012	
LC (Past Action)-12: Critical facilities protection emergency backup power					X	2012	
LC (Past Action)-13: Emergency power Clear Creek Independent School District's kitchen facilities				X			League City no longer uses these schools as a shelter location
LC (Past Action)-14: Critical facilities protection window protection					X	2011	Protective film installed on 12 city buildings
LC (Past Action)-15: Public education campaign - tornado			X				Pending funding to develop program
LC (Past Action)-16: Public education campaign – lightning safety					X	2013	
LC (Past Action)-17: Critical Infrastructure Protection Install Lightning/Surge Protection Equipment at City Buildings		X					New public safety building is equipped with physical and electrical lightning and surge protection
LC (Past Action)-18: Public safety campaign – extreme heat					X	2013	

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
LC (Past Action)-19: Develop a cooling station location and implementation plan – extreme heat				X			Unnecessary as public buildings such as civic center are available during normal business hours
LC (Past Action)-20: Public education campaign water conservation					X	2012	
LC (Past Action)-21: Firefighting equipment – assist the fire department with pursing grants				X			This action is no longer a priority.
LC (Past Action)-22: Homeowner mitigation incentive campaign			X				Pending funding
LC (Past Action)-23: Update mitigation plan to include pipeline and hazardous material incidents		X					

Table 21.10: Status of Tiki Island 2011-2016 Mitigation Action Plan

Action	Ongoing	In Progress	Delayed	No Longer Required	Completed	Completion Date	Comment
TK 1: Plan and construct emergency water well for backup water supply. Construct necessary reverse osmosis equipment, delivery system, backup generator, switchgear, fuel supply, and security fencing. Well location: 400 Jones Lake Rd						2014	
TK 2: Implement water conservation awareness campaign (at Citywide Fourth of July picnic and other local activities.)	X						
TK 3: Expand and harden Public Safety building to: • Withstand 150 MPH hurricane winds • Provide public shelter for citizens in aftermath of disaster • Elevate storage above flood elevation • Store emergency supplies • Provide base of operations for recovery effort					X	2009	
TK 4: Purchase generator for backup power to Public Safety building					X	2012	
TK 5: Elevate 11 wastewater lift stations and provide backup power							
TK 6: Elevate Water Plant lab building and storage					X	2011	
TK 7: Elevate Water Plant lab building and storage					X	2010	
TK 8: Purchase new Emergency Notification System			X				Funding Needed
TK 9: Replace the Tiki Drive bridge with an improved, hardened bridge to withstand storm surge and debris. 300 to 400 Tiki Drive			X				CDBG funding needed
TK 10: Become a NOAA "Storm Ready" community			X				Funding needed
TK 11: Improve NFIP CRS rating above current class 8	X						
TK 12: Increase native canopy by tree planting in public right of way to reduce urban heat levels					X	2014	
TK 13: Implement a tree trimming program that clears tree limbs from public right of ways.			X				Funding needed
TK 14: Conduct a fire safety and prevention program			X				Funding needed

21.2 Mitigation Goals and Objectives

Goals and objectives from the previous FEMA-approved plans (Galveston County 2011-2016, Friendswood 2015, and League City 2009) were reviewed by each jurisdiction during planning sessions held the week of January 5-7, 2016 (see section 2 for details). In an effort to streamline the goals and objectives between the three planning initiatives, the planning consultants looked for common themes to develop proposed goals and objectives to meet the participating jurisdictions going forward. A detailed crosswalk of the previous goals and objectives and how they aligned to the approved multi-jurisdictional goals and objectives is provided in Appendix G. Each of the 2016-2020 mitigation actions references which of the mitigation goals and objectives they address. The following goals and objectives were adopted:

Goal 1: Minimize loss of life, injury, damage to property, the economy, and natural systems

- Objective 1.1: Protect the life, health and safety of residents
- Objective 1.2: Protect existing/new critical facilities and infrastructure
- Objective 1.3: Provide protection for future/existing developments
- Objective 1.4: Provide backup power to critical facilities/infrastructure
- Objective 1.5: Minimize impacts from all hazards

Goal 2: Maintain and enhance emergency management/mitigation capabilities

- Objective 2.1: Update/develop plans, studies, and mapping for all hazards
- Objective 2.2: Incorporate/improve hazard mitigation strategies into ordinances, plans and polices
- Objective 2.3: Conduct/develop drills/training for all hazards
- Objective 2.4: Implement and maintain the Galveston County Multi-Jurisdictional Hazard Mitigation Plan
- Objective 2.5: Participate in programs that promote hazard mitigation strategies
- Objective 2.6: Build, obtain, and maintain critical facilities and equipment

Goal 3: Maintain public education and awareness activities

- Objective 3.1: Expand Public Outreach Campaigns for all hazards
- Objective 3.2: Promote disaster preparedness planning for families

21.3 Mitigation Action Plans 2016 to 2020

Once the completed or no longer relevant actions were removed from each jurisdictions mitigation action plan, the planning team began working with the Steering Committee to document those actions moving forward with an analysis of the progress made over the past five years. Each jurisdiction also identified new actions based on their current capabilities and needs.

Establishing Priorities

As discussed in Section 2 (Planning Process), a mitigation strategy workshop was held with each jurisdiction the week of January 5-7, 2016 to finalize the 2016-2020 mitigation action plans. At these workshops, jurisdictions and stakeholders completed a final review of the actions and considered the cost benefit of each to determine if the project makes sense for the overall good of their community. At this point, the costs and benefits were analyzed on a general level and all projects were considered valuable, viable, and beneficial in consideration of the quantitative and qualitative mitigation benefits versus the cost. Actual and estimated costs are included in the individual mitigation action tables found in Tables 21.12 to 21.22. A full Benefit Cost Analysis (BCA) will be conducted as projects become eligible for funding.

The workshop participants confirmed no changes in their jurisdictions priorities for mitigation planning and their focus remains on reducing or eliminating losses from future impacts. They conducted a prioritization process based on FEMA's Mitigation Action Evaluation Worksheet 6.1 provided in the Local Mitigation Planning Handbook (March 2013) for each mitigation action moving forward in this plan update. The evaluation system utilized the following ranking scale for each of the criteria defined by FEMA.

Ranking Scale:

1 = Highly effective or feasible	0 = Neutral	-1 = Ineffective or not feasible

Evaluation Criteria:

Life Safety – How effective will the action be at protecting lives and preventing injuries?

Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?

Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

Political – Is there overall public support for the mitigation action? Is there the political will to support it?

Legal – Does the community have the authority to implement the action?

Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?

Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the actions' implementation?

Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

Scoring:

The total points scored on each mitigation action per the evaluation criteria listed above was then placed into a high, moderate, and low priority as defined below:

High Priority = 10 to 4	Moderate Priority = 3 to -3	Low Priority = -4 to -10

Defining Hazard Type and Mitigation Strategy Group

Each mitigation action was identified for the natural hazard it addresses, using multi-hazard approaches where practical, and determining which mitigation strategy group as defined below.

Prevention: Government, administrative, and regulatory actions or processes influencing the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

Property Protection: Actions involving the modification of existing buildings or infrastructure to protect them from a hazard or remove them from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter-resistant glass.

Public Education and Awareness: Actions that inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate these risks.

Actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

Natural Resource Protection: Actions that not only minimize hazard losses but also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

Emergency Services: Actions protecting people before, during, and after a hazard event. Administrative and emergency operations offices that provide critical and vital services, coordinate warnings, responses, and recovery from a disaster are identified. Actions include protection of warning system capabilities, protection or hardening of critical facilities, protection of infrastructure needed for emergency response and training.

Structural Projects: Actions involving the construction of structures to reduce the impact of a hazard include storm water controls (e.g. culverts, floodwalls, seawalls, retaining walls, and safe rooms).

Technical Assistant Projects: Actions that involve required support/education from federal, state and local agencies, data collection for GIS mapping, utilization of technology, and upgrades as products are developed.

Mitigation Action Plans - 2016 to 2020

As previously stated, the mitigation actions not completed from the previous plan were assessed against the current needs to reduce and/or eliminate risk, improve outreach efforts, and participation in various programs that promote mitigation strategies.

Through the development of this plan update, the planning team and officials in each participating jurisdiction assembled to discuss their known risks to determine a minimum of two mitigation actions for each hazard prone to them (Table 21.11).

Table 21.11: Hazards Selected by Jurisdictions to Develop Mitigation Actions

Hazard	Galveston County	Bayou Vista	Clear Lake Shores	Friendswood	Hitchcock	Jamaica Beach	Kemah	La Marque	League City	Santa Fe	Tiki Island
Hurricane/Tropical Storm	X	X	X	X	X	X	X	X	X	X	X
Flood (Coastal and Inland)	X	X	X	X	X	X	X	X	X	X	X

Hazard	Galveston County	Bayou Vista	Clear Lake Shores	Friendswood	Hitchcock	Jamaica Beach	Kemah	La Marque	League City	Santa Fe	Tiki Island
Extreme Heat	X	X	X	X	X	X	X	X	X	X	X
Tornado	X	X	X	X	X	X	X	X	X	X	X
Windstorm	X	X	X	X	X	X	X	X	X	X	X
Hailstorm	X	X	X	X	X	X	X	X	X	X	X
Lightning	X	X	X	X	X	X	X	X	X	X	X
Severe Winter Storm	X	X	X	X	X	X	X	X		X	X
Drought	X	X	X	X	X	X	X	X		X	X
Tsunami	X				X	X	X				X
Wildfire (Urban and Rural)	X	X	X		X		X	X		X	
Coastal Erosion and Retreat	X		X		X	X	X				X
Land Subsidence	X	X	X		X		X				
Expansive Soils	X			X				X	X		
Dam/Levee Failure	X		X				X	X			

A revised numbering system, which includes the plan year an action was identified, was also developed to improve tracking of the progress made on actions for years to come. In addition, the details for each mitigation action were reviewed and modified to reflect pertinent information that will assist the jurisdictions in tracking the progress of actions going forward. A multi-hazard approach was utilized to streamline public education/outreach and property protection strategies where appropriate.

Tables 21.12 to 20.22 are provided by jurisdiction for the mitigation actions they desire to implement as funding and opportunities arise.

2016 – 2020 Mitigation Action Table Reference

Jurisdiction	*Table Number*	*Page Number*
Galveston County	*21.12*	*21-33*
Bayou Vista	*21.13*	*21-41*
Clear Lake Shores	*21.14*	*21-52*
Friendswood	*21.15*	*21-55*
Hitchcock	*21.16*	*21-71*
Jamaica Beach	*21.17*	*21-81*

Jurisdiction	*Table Number*	*Page Number*
Kemah	*21.18*	*21-85*
La Marque	*21.19*	*21-92*
League City	*21.20*	*21-104*
Santa Fe	*21.21*	*21-113*
Tiki Village	*21.22*	*21-118*

Table 21.12: Galveston County 2016-2020 Mitigation Action Plan

GC 2006-12: Develop GIS System to record locations of vulnerable population and structures	
Mitigation Goal/Objective:	2/2.1
Site and Location:	Countywide
Background/Next Steps:	The County will identify areas prone to unstable soils, flooding, inundation areas of dam/levee breach, and erosion in a GIS database to monitor the use of mitigation techniques employed during construction, disturbance of ground activities, and previous mining or geologically unstable areas. The database will also identify vulnerable structures and populations affected by high wind, storm surge, severe storms, drought, and wildfire to improve awareness of county officials of areas in need of mitigation education and outreach programs.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence, Expansive Soils
Mitigation Strategy:	Technical Assistance
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Local General Funds, HMGP, PDM
Lead Agency/Department Responsible:	Office of Emergency Management
Timeframe for Completion:	Upon plan approval to 2020
Analysis	
2010 - This project will be deferred. The County recently hired GIS personnel and will continue to move forward with this initiative. County will continue to seek grant funding for this initiative.	
2016 - The County received GIS capabilities in 2014 and is in the process of incorporating GIS into applicable emergency management planning and operations.	

GC 2011-3: Implement tree and vegetation trimming/removal program	
Mitigation Goal/Objective:	1/1.5
Site and Location:	Unincorporated areas of County
Background/Next Steps:	Trees and other vegetation can encroach overhead power lines, drainage systems, and road ways. Keep areas of concern free of unnecessary debris.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tsunami, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Staff time
Potential Funding Sources:	General fund

Lead Agency/Department Responsible:	Road and Bridge
Timeframe for Completion:	2016-2020

GC 2011-6: Develop and provide public information and awareness for hazards	
Mitigation Goal/Objective:	3/3.1
Site and Location:	Unincorporated areas of the County
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, include potential subsidence in freeboard calculations in flood-prone areas, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence, Expansive Soils
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$110,000 annually
Potential Funding Sources:	Grants/General Fund
Lead Agency/Department Responsible:	GCOEM and applicable county departments, and state and federal agencies
Timeframe for Completion:	2016-2020

GC 2011-10: Harden critical utility facilities by purchasing equipment and installing emergency backup power (generator) at Public Works, MUD water plant and MUD wastewater treatment facility	
Mitigation Goal/Objective:	1/1.4
Site and Location	1. Public Works Operations Center, 309 Miles Rd. 2. Bay View MUD Water Plant, 3206 Hwy 146 3. Bay View MUD Waste Water Treatment, 3208 Hwy 146
Background/Next Steps:	Backup power allows the District to operate as normal and provide continuous utility service to all structures. The estimated cost of the project does not include the engineering fees for set up and installation of the equipment. The following units are needed: 1. 25 KW 1 phase unit

	2. Two 150 KW 3 phase units
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm, Wildfire (Urban and Rural), Dam/Levee Failure, Extreme Heat
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$1,140,000
Potential Funding Sources:	Grants/Emergency State funds
Lead Agency/Department Responsible:	Bayview MUD Board of Directors
Timeframe for Completion:	2016-2020

GC 2011-21: Implement the Corp of Engineers study of the Texas City Hurricane Flood Protection Project to improve the current levee system to provide protection from a Category 5 storm	
Mitigation Goal/Objective:	1/1.5
Site and Location:	Galveston County, Texas City and La Marque area levee
Background/Next Steps:	Reduce potential flooding of existing structures. The current levee is designed to protect residents and industrial structures only to Category 3 or 4 hurricanes which will not provide the best possible protection from storm surge. Inspections have been completed (2012) but specific projects will need to be prioritized, scoped, and funded before implementation can begin.
Hazard(s) Addressed:	Flooding, Tsunami, Dam/Levee Failure, Coastal Erosion and Retreat
Mitigation Strategy:	Structural
Priority:	Moderate
Estimated Cost:	Millions of dollars
Potential Funding Sources:	Funding source dependent on project scope
Lead Agency/Department Responsible:	Engineering
Timeframe for Completion:	Upon approval for funding to 2020
Analysis	
2016 - Inspection of the levee system was completed in 2012. Projects will be developed/scoped and implemented as funding becomes available.	

GC 2016-1: Install severe weather warning systems	
Mitigation Goal/Objective:	1/1.1
Site and Location:	Countywide
Background/Next Steps:	Weather warning systems complement the methods of warning already used by the County Emergency Operation Center and the National Weather Service. County will coordinate site locations within the county.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Dam/Levee Failure

Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$35,000 each
Potential Funding Sources:	HMGP, general fund
Lead Agency/Department Responsible:	GCOEM and applicable jurisdictions
Timeframe for Completion:	Upon approval for funding to 2020

GC 2016-2: Stormproof/retrofit critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	County-owned properties and unincorporated areas
Background/Next Steps:	New construction and existing critical facilities and infrastructure should include advanced mitigation techniques. Measures include, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, electrical surge protection, stabilization of soils, include potential subsidence in freeboard calculations in flood-prone areas, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm, Land Subsidence, Expansive Soils
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Unknown, dependent upon facility type
Potential Funding Sources:	HMGP, CDBG, General Funds
Lead Agency/Department Responsible:	County Administration
Timeframe for Completion:	Upon approval for funding to 2020

GC 2016-3: Build storm water detention ponds	
Mitigation Goal/Objective	1/1.5
Site and Location:	Unincorporated areas of the County
Background/Next Steps:	Detention ponds can be a solution for addressing flood impacts.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds, private funds
Lead Agency/Department Responsible:	Engineering coordinate with developers
Timeframe for Completion:	Upon approval to 2020

GC 2016-4: Secure generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.4
Site and Location:	Countywide
Background/Next Steps:	Generators are essential for providing continual operations in the event of a disaster. As funding becomes available, the county will apply for grants to install/upgrade generators to support existing or new facilities/infrastructure.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Extreme Heat, Severe Winter Storm, Dam/Levee Failure
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP, General Funds
Lead Agency/Department Responsible:	GCOEM
Timeframe for Completion:	Upon approval for funding to 2020

GC 2016-5: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Unincorporated areas of the county – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tsunami, Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	GEOEM
Timeframe for Completion:	Upon funding approval to 2020

GC 2016-6: Develop applicable plans and studies to address hazard mitigation	
Mitigation Goal/Objective	2/2.1
Site and Location:	Countywide
Background/Next Steps:	Preparing for all hazards requires planning and coordinating for preparedness, mitigation, response, and recovery procedures. Review planning needs annually to include, but not be limited to, CEMP, debris management, stormwater management, master plan, drainage, drought, GIS mapping, complete study to locate areas prone to expansive soils and land subsidence, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence, Expansive Soils
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds, Homeland Security, HMGP
Lead Agency/Department Responsible:	GCOEM
Timeframe for Completion:	2016 to 2020

GC 2016-7: Widen drainage systems and culverts	
Mitigation Goal/Objective	1/1.5
Site and Location:	Unincorporated areas of the county
Background/Next Steps:	The drainage systems and culverts throughout the county are frequently impacted by flood and severe weather events. Coordinate efforts with water district to widen drainage systems and increase culvert size to accommodate increased water flows.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tsunami, Tornado, Windstorm, Flooding, Coastal Erosion and Retreat. Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	CDBG, HMGP, Developers
Lead Agency/Department Responsible:	Engineering and applicable jurisdictions and water district
Timeframe for Completion:	Upon funding approval to 2020

GC 2016-8: Install lightning grounding systems and protection devices on critical facilities/infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	County-owned facilities and infrastructure
Background/Next Steps:	Lightning strikes can create outages to essential water and sewer services as well as invite unnecessary damage to critical facilities. Develop/implement a program to establish lightning grounding systems on critical water and sewer system elements and other facilities prone to strikes.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	Engineering
Timeframe for Completion:	2016-2026

GC 2016-9: Improve and enforce regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Site and Location:	Unincorporated areas of the county
Background/Next Steps:	Regulations and permit requirements are in place to guide the development and enforcement of construction standards and land uses. Update and/or develop as required to address all hazards prone to the area and include any changes in future development areas.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence, Expansive Soils
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	GCOEM and applicable departments
Timeframe for Completion:	2016-2020

GC 2016-10: Construct High Island Community Shelter	
Mitigation Goal/Objective:	1/1.2
Site and Location:	Unincorporated communities of Crystal Beach and High Island
Background/Next Steps:	High Island does not have a community shelter to provide residents with a safe place to go for protection against hazard events. The community shelter will serve as a cooling/heating station in the event of power outages, protection from severe storms, hurricane/tropical storms, flooding, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$3 million per structure
Potential Funding Sources:	Grants (CDBG, FEMA PA, HMGP)
Lead Agency/Department Responsible:	GCOEM
Timeframe for Completion:	2016 to 2017

GC 2016-11: Implement the Corp of Engineers study of the Galveston County Water Reservoir Dam and Levee system	
Mitigation Goal/Objective	1/1.1, 1.2, 1.3, 1.4, 1.5
Background/Next Steps:	Review the findings of a potential breach to the dam/levee system and develop/implement mitigation actions as applicable to address location, extent and impact.
Hazard(s) Addressed:	Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	GCOEM and applicable departments
Timeframe for Completion:	2018-2020

Table 21.13: Bayou Vista 2016-2020 Mitigation Action Plan

BV 2006-1: Develop and provide public information and awareness for hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Land Subsidence
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$5,000, Staff time and resources
Potential Funding Sources:	General funds, HMGP, Homeland Security
Lead Agency/Department Responsible:	City of Bayou Vista Administration
Timeframe for Completion:	2016-2020
Analysis	
2010-This project is currently underway and will be deferred	
2016- The city develops and provides information on hazard preparedness, mitigation, recovery, and response efforts on their website, at town meetings/events.	

BV-2011-4: Develop drainage improvement program to reduce standing water and runoff, and reduce minor flooding for residents located in District No.12	
Mitigation Goal/Objective:	1/1.5
Site and Location:	1. Bayou Vista 2. Omega Bay 3. Original Bayou Vista
Background/Next Steps:	Standing water in existing buildings could be reduced or eliminated if adequate drainage provisions are implemented. Improvements may include wider drainage systems and increased size in culverts, etc. Identify drainage areas in need of increased culverts or widening and set priorities for developing funding requests and implementation of construction.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tornado,

	Windstorm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Office of Rural Community Affairs, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program,406 Public Assistance Program(following federal disaster declaration), Us Army Corps of Engineers-Small Flood Control Projects, USDA Natural Resources Conservation Service-Emergency Watershed Protection Agency, Texas Water Development Board(Development Fund II)-Texas Water Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Nonpoint Source Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016 to 2020
Analysis	
2016 - Funding is required	

BV-2011-6: Implement stormwater management plan to improve drainage during flood and other weather events	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Routinely cleaning and repairing stormwater drains can help avoid unnoticed clogs that may hamper the efficiency of the stormwater system. Insuring that flow paths will have the capacity to convey storm- event flood water volumes will reduce damages.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tornado, Windstorm, Land Subsidence
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$25,000
Potential Funding Sources:	Office of Rural Community Affairs, HMGP, PDM Grant Program,406 Public Assistance Program (following federal disaster declaration), USACE-Small Flood Control Projects, USDA Natural Resources Conservation Service-Emergency Watershed Protection Agency, Texas Water Development Board(Development Fund II)-Texas Water Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Nonpoint Source Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020

BV-2011-7: Develop Master Drainage Plan to assist in reducing flooding through increased lowest finish floor requirements	
Mitigation Goal/Objective:	2/2.1
Site and Location	Citywide
Background/Next Steps:	A master drainage plan will be a comprehensive document that correlates future and existing land use and flood/storm water drainage needs into one plan. The plan will also identify projects needed to reduce flooding impacts and establish priorities for funding requests and implementation.
Hazard(s) Addressed:	Flooding, Dam/Levee Failure, Tornado, Windstorm, Hurricane/Tropical Storm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	General Funds, Office of Rural Community Affairs, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, Us Army Corps of Engineers-Small Flood Control Projects, USDA Natural Resources Conservation Service-Emergency Watershed Protection Agency, Texas Water Development Board(Development Fund II)-Texas Water Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Nonpoint Source Grant Program, Texas Water Development Board- Research and Planning Fund Grants, Pre Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Upon approval of funding to 2020
Analysis	
2016 - Funding is required	

BV-2011-8: Reconstruct/upgrade storm sewer systems to increase water flow	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Inadequate and damaged storm sewers are problematic during natural disasters and severe weather events and need to be upgraded. Repairing/upgrading storm sewers to accommodate increase in flow will reduce the risk of flooding to new and existing buildings. Improvements may include increasing drainage or absorption capacities with detention and retention basins, relief drains, re-routing or increasing capacity, etc.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$4,000,000
Potential Funding Sources:	Office of Rural Community Affairs, Local Funds, US Army Corps of

	Engineers-Small Flood Control Projects, USDA Natural Resources Conservation Service- Emergency Watershed Protection Agency, Texas Water Development Board-Clean Water State Revolving Fund, Texas Water Development Board (Development Fund II)-Texas Eater Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Non-point Source Grant Program, 406 Public Assistance Program (following federal disaster declaration), HMGP, PDM Grant Program (FEMA)
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020
Analysis	
2016 - Funding is required	

BV-2011-9: Implement water conservation measures	
Mitigation Goal/Objective:	1/1.1
Site and Location	Citywide
Background/Next Steps:	Although the county receives 50 inches of rain annually, long periods between rains can occur. Drought is not a great threat to the area; however, implementing water conservation measures will increase reserves. Extreme temperatures can occur in conjunction with drought thereby increasing the necessity of having an available reserve.
Hazard(s) Addressed:	Drought, Extreme Heat, Wildfire (Urban and Rural), Land Subsidence
Mitigation Strategy:	Prevention
Priority:	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local funds, Water Resources, Texas Commission on Environmental Quality-Texas Clean Rivers Program, Texas Water Development Board Research and Planning Fund-Research and Planning Fund Grants, USDA National Resource Conservation Service- Watershed Surveys and Planning, USDA National Resources Conservation Service-Watershed Protection and Flood Prevention Program, Army Corps of Engineers-Planning Assistance to States
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020

BV-2011-11: Implement best management practices for securing windblown debris in canals	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Debris is generated by many hazards if the level of intensity allows. Bayou Vista is a residential canal community. Debris in water breaks down physically and chemically and becomes pollution. Water is fluid and

	waterborne pollution will travel. Furthermore, oxygen is removed from water in the breakdown process thereby opening up the potential for mass fish kills in poorly circulated canal system. Human health is then put at risk. Implement plan to remove debris throughout the canal system.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm,
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$5,000 Administration Costs
Potential Funding Sources:	General funds, HMGP, PDM
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020

BV-2011-12: Develop and implement a plan for canal dredging to reduce sediment deposited during storm events, reducing access in canals	
Mitigation Goal/Objective:	2/2.1
Site and Location	Citywide
Background/Next Steps:	Sedimentation of manmade canals occurs with water low; water moving at higher velocities will have more sediment entrained than a slower mass of water. Sediment is deposited when and where the water slows. Flow is slowed in dead-end canals and sedimentation occurs. Sedimentation reduces the capacity for flood water and leaves an area more vulnerable to damage of high wind and rain during storm events. Develop and implement a canal dredging program.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$200,000
Potential Funding Sources:	Office of Rural Community Affairs, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program,406 Public Assistance Program(following federal disaster declaration), Us Army Corps of Engineers-Small Flood Control Projects, USDA Natural Resources Conservation Service-Emergency Watershed Protection Agency, Texas Water Development Board(Development Fund II)-Texas Water Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Non-point Source Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding is required	

BV-2011-13: Repair, upgrade or replace water and sewer infrastructure for 175 connections	
Mitigation Goal/Objective:	1/1.5
Site and Location	Original Bayou Vista area
Background/Next Steps:	In past disaster events, emergency repair of connections post- disaster was costly and delayed water and sewer repairs and service. Many connectors were in need of replacement, repair, or upgrade. Ensuring that all connections are in working order by repairing, upgrading, or replacing connection as needed prior to events will reduce damages such as sewage backflow and be cost effective by reducing manpower and emergency repairs post disaster.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Drought, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$750,000
Potential Funding Sources:	Office of Rural Community Affairs, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program,406 Public Assistance Program(following federal disaster declaration), Us Army Corps of Engineers-Small Flood Control Projects, USDA Natural Resources Conservation Service-Emergency Watershed Protection Agency, Texas Water Development Board(Development Fund II)-Texas Water Development Fund, USDA Natural Resources Conservation Service-Watershed Protection and Flood Prevention Program, EPA-Non-point Source Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020
Analysis	
2016. Funding is required	

BV-2011-15: Implement water conservation awareness campaign for residents	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Bayou Vista can experience drought albeit infrequent. Temperatures can exceed 100° F for consecutive days in the summer months. Provide mitigation techniques such as incorporating drought tolerant or xeriscape protection, use of permeable driveways and surfaces to reduce runoff and promote groundwater recharge, etc.
Hazard(s) Addressed:	Drought, Extreme Heat, Wildfire (Urban and Rural)
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$2,000 + Staff time

Potential Funding Sources:	General fund, Water Resources, Texas Water Development Board, Texas Commission on Environmental Quality
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	2016-2020

BV-2011-16: Purchase and install a deflective shield over two (2) clarifiers	
Mitigation Goal/Objective:	1/1.2
Site and Location	Wastewater Treatment Plant, 3031 Highway 6
Background/Next Steps:	Severe storms cause damages to components of wastewater treatment plant. Clarifier will protect mechanisms in treatment facilities, thus allowing continuation of operation and ongoing availability of utilities for customers.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$40,000
Potential Funding Sources:	Pre-Disaster Mitigation Grant Program, Hazard Mitigation Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Upon approved funding to 2020
Analysis	
2016 - Funding is required	

BV-2011-17: Implement a plan for shutting down water and sewer systems	
Mitigation Goal/Objective:	1/1.5
Site and Location	Wastewater Treatment Plant, 3031 Highway 6
Background/Next Steps:	Back flows and bacterial contamination occur due to system not being shut down during fire or other weather events. Continuous flushing is unnecessary and wasteful. Multiple hazards can make shutting the water and sewer system down necessary in order to avoid contamination of the system or a loss of pressure system wide from breakage at a distribution point.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Wildfire (Urban and Rural), Windstorm, Severe Winter Weather
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$1,000 + Operator Time
Potential Funding Sources:	General Funds, Hazard Mitigation Grant Program, Pre- Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Continuous action

BV-2011-19: Implement a plan for the hardening the water system during freeze events	
Mitigation Goal/Objective:	1/1.5
Site and Location	Wastewater Treatment Plant, 3031 Highway 6
Background/Next Steps:	Freeze events are problematic to the water treatment plan when extreme temperature and freezing occurs. Winterizing the water system will insure the city residents, schools, and businesses do not have to close due to frozen water systems.
Hazard(s) Addressed:	Severe Winter Storm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$5,000
Potential Funding Sources:	General funds, Pre-Disaster Mitigation Grant Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Continuous action

BV-2011-21: Retrofit public buildings and critical facilities/infrastructure for flood proofing and hardening needs	
Mitigation Goal/Objective:	1/1.2
Site and Location	Citywide
Background/Next Steps:	Implement dry Floodproofing techniques such as strengthening walls, sealing openings, use of waterproof compounds or plastic for protection. Elevate, retrofit structures and utilities, install stormwater pumping stations, bank stabilization techniques, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds, FEMA- Emergency Management Performance Grants, FEMA-All Hazards Operational Planning, F
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Upon funding approval to 2020
Analysis	
2016 - Funding is required	

BV 2016-1: Purchase and install severe weather warning systems	
Mitigation Goal/Objective:	1/1.1
Site and Location:	Citywide
Background/Next Steps:	Weather warning systems complement the methods of warning already used by the City, County Emergency Operation Center, and the National Weather Service. Coordinate the purchase and installation of additional warning systems throughout the city.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$35,000
Potential Funding Sources:	HMGP, general fund
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

BV 2016-2: Stormproof/retrofit critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	Municipal Building (includes city hall, police, fire, and administrative services)
Background/Next Steps:	New construction and existing critical facilities and infrastructure should include advanced mitigation techniques. Measures include, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, electrical surge protection, stabilization of soils, include potential subsidence in freeboard calculations in flood-prone areas, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Land Subsidence
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP, CDBG, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

BV 2016-3: Purchase and install generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.4
Site and Location:	2929 Highway 6 (City Hall, Police, and Fire) and potential new Municipal building, and Community Center (783c Marlin)
Background/Next Steps:	Generators are essential for providing continual operations in the event of a disaster. As funding becomes available, the city will apply for grants to install/upgrade generators to support existing or new facilities/infrastructure.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$400,000
Potential Funding Sources:	HMGP, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

BV 2016-4: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding becomes available.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

BV 2016-5: Purchase and install lightning grounding systems and protection devices on critical facilities/infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	City-owned facilities and infrastructure
Background/Next Steps:	Develop/implement a program to install lightning grounding systems on critical water and sewer system elements and other facilities prone to strikes.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	Engineering
Timeframe for Completion:	2016-2026

BC 2016-6: Update regulations and permit requirements to address enhanced hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Land Subsidence
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Implementation Schedule:	2016-2020

Table 21.14 - Clear Lake Shores 2016-2020 Mitigation Action Plan

CLS-2006-2: Implement stormwater management practices	
Mitigation Goal/Objective:	1/1.5
Site and Location:	Citywide
Background/Next Steps:	The Stormwater management plan is focused on six minimum measures regarding what is being done to prevent stormwater pollution. Annual reporting and renewals are required to ensure compliance is met.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storms, Windstorm, Hailstorm, Tornado, Dam/Levee Failure
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local funds
Lead Agency/Department Responsible:	City of Clear Lake Shores
Timeframe for Completion:	2016-2020
Analysis	
2010 - This action will be deferred as an ongoing activity	
2016 - Renewal of MS4 Permit has been completed.	

CLS 2011-2: Implement drought plan	
Mitigation Goal/Objective:	1/1.1
Site and Location:	Citywide
Background/Next Steps:	The drought plan identifies measures to prevent damage to existing structures through water conservation measures. While maintaining the plan is the responsibility of the WCID, Clear Lake Shores will contribute perspective and help to create awareness of water conservation measures and mitigation techniques with residents
Hazard(s) Addressed:	Drought, Extreme Heat, Wildfire (Urban and Rural)
Mitigation Strategy:	Prevention
Priority:	Moderate
Estimated Cost:	No additional cost
Potential Funding Sources:	No Funding Required
Lead Agency/Department Responsible:	WCID 12
Timeframe for Completion:	2016-2020

CLS 2016-1: Develop and provide public awareness campaigns for natural hazards	
Mitigation Goal/Objective:	3/3.1
Site and Location	Citywide

Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, etc.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Coastal Erosion and Retreat, Land Subsidence, Dam/Levee Failure, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	No cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Emergency Management and applicable departments/agencies
Implementation Schedule:	2016-2020

CLS 2016-2: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Apply for HMGP/FMA grants to implement mitigation options (elevate, reconstruct, acquisition, demolition, etc.) with qualified property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined by property
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

CLS 2016-3: Widen drainage systems and culverts	
Mitigation Goal/Objective	1/1.5
Site and Location:	Citywide
Background/Next Steps:	The drainage systems and culverts throughout the city are frequently

	impacted by flood and severe weather events. Coordinate efforts with water district to widen drainage systems and increase culvert size to accommodate increased water flows.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tornado, Windstorm, Flooding, Coastal Erosion and Retreat. Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	CDBG, HMGP, Developers, General Funds
Lead Agency/Department Responsible:	City Administration and applicable department and water district staff
Timeframe for Completion:	Upon funding approval to 2020

CLS 2016-4: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update/develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

CLS 2016-5: Implement the Corp of Engineers study of the Galveston County Water Reservoir Dam and Levee system	
Mitigation Goal/Objective	1/1.1, 1.2, 1.3, 1.4, 1.5
Background/Next Steps:	Review the findings of a potential breach to the dam/levee system and develop/implement mitigation actions as applicable to address location, extent and impact.
Hazard(s) Addressed:	Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2018-2020

Table 21.15: Friendswood 2016-2020 Mitigation Action Plan

F 2009-2: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	The Community Development Department maintains the RL/SRL property database for all flood events in the city, and is updated and reviewed as necessary. Staff seeks funding sources to assist property owners with elevation, relocation and/or buyout of RL/SRL properties.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Staff time
Potential Funding Sources:	General budget
Lead Agency/Department Responsible:	Community Development, Floodplain Manager, Office of Emergency Management and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020
Analysis	
2016- This action item was carried over from 2003 and 2009 mitigation plans titled NFIP Elevation, Relocation & Acquisition. • 112 properties were mitigated following TS Allison (buyout) • 14 properties were mitigated through an elevation program administered through Galveston County in 2013-2014	

F 2009-3: Maintain public notification and warning programs/systems	
Mitigation Goal/Objective	1/1.1
Site and Location:	Citywide
Background/Next Steps:	The city provides notifications to the public through the following programs/systems: • Friendswood Information Radio 1650 AM • KTRH 740 AM • TV-City of Friendswood PEG Channel 17 • E-mail alerts • Outdoor warning systems • Storm spotters • Code Red • Social media
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness

Priority:	High
Estimated Cost:	Staff time
Potential Funding Sources:	General budget
Lead Agency/Department Responsible:	Community Development, Floodplain Manager, Office of Emergency Management and applicable state and county agencies
Timeframe for Completion:	2016-2020
Analysis	
2016- This action item was carried over from 2003 and 2009 mitigation plans titled Public Warning System. • The city disseminates alert warnings as needed through the various media outlets listed	

F-2009-4: Construct and expand evacuation routes	
Mitigation Goal/Objective:	1/1.1
Site and Location:	Brittany Bay Blvd to Pearland Pkwy Blackhawk Blvd to FM 2351 and Beamer Road
Background/Next Steps:	Within Friendswood, there are limited east/west corridors to efficiently move traffic through northern Galveston County. Sunset Drive and Blackhawk Blvd both terminate at Farm-to-Market roadways (528 & 2351) which requires motorists to travel to FM 518 or I-45; both of which are heavily congested. The construction of Friendswood Parkway would greatly improve mobility and become a vital evacuation route in northern Galveston County. • Construct Friendswood Parkway in the northeaster portion of the city to connect with League City Pkwy (Brittany Bay Blvd) to provide additional evacuation route • Construct Blackhawk Blvd to connect FM 2351 with Beamer Road. • Within Friendswood, there are limited east/west corridors to efficiently move traffic. • Blackhawk Blvd currently terminates at Farm-to-Market roadways (528 & 2351), which requires motorist to travel to FM 518 or I-45; both of which are heavily congested.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding
Mitigation Strategy:	Structural, Emergency Services
Priority:	High
Estimated Cost:	$30,000,000
Potential Funding Sources:	Capital improvement funding, bond, grant acquisition
Lead Agency/Department Responsible:	• Public Works Department • Fire Marshal's Office
Timeframe for Completion:	Design, bid, and build bridge structure within the next 5 to 10 years

Analysis	
2016-This is an amended/updated mitigation item carried over from the 2003 and 2009 mitigation plans titled Major Thoroughfare Planning. This is a continuous action to be completed as CIP funding and/or grant funds are made available.	

F-2009-5: Monitor water supply and establish conservation regulations	
Mitigation Goal/Objective:	2/2.5
Background/Next Steps:	• Develop a regular schedule to monitor drought conditions; i.e., monthly or quarterly, through the U.S. Drought Monitor website. • Report drought conditions to Public Works Department. • Report drought conditions to Department Heads. • If necessary, implement the city's Drought Contingency Plan in coordination with the Decision Makers and Department Heads. • Notify public of status of the Drought Contingency Plan through PSAs.
Hazard(s) Addressed:	Drought, Extreme Heat
Mitigation Strategy:	Prevention, Property Protection, Natural Resource Protection, Emergency Services
Priority:	Moderate
Estimated Cost:	Minimal; can be absorbed by staff
Potential Funding Sources:	Annual budget
Lead Agency/Department Responsible:	Office of Emergency Management, Public Works Department, City Manager, Public Information Officer
Timeframe for Completion:	2016-2020
Analysis	
2016-This action was carried over from the 2009 mitigation plan. In 2014, the city purchased 12 million gallons/day surface water from the City of Houston. At this capacity, the supply will serve up to 57,000 people and will sustain the city to total build-out status. The City will continue to monitor water supply and update regulations as required.	

F-2016-1: Purchase and install warning equipment within the nine city parks to provide early warning of approaching storms	
Mitigation Goal/Objective:	1/1.1
Site and Location:	Locations: • Baker Road (17.60 acres) • Centennial Park (58.40 acres) • Friendswood Sports Park (19.85 acres) • Lake Friendswood (42.00 acres) • Leavesley Park (2.90 acres) • Old City Park (14.70 acres) • Renwick Sports Complex (16.48 acres) • 1776 Memorial Park (2.90 acres) • Stevenson Park (includes city swimming pool 27.00 acres)
Background/Next Steps:	Baker Road Park, 1776 Park & portions of Stevenson Park are located within a floodplain or the floodway. Renwick Park, Friendswood

	Sportspark, Centennial Park, Lake Friendswood, Old City Park & Leavesley Park are not located within a floodplain or floodway. Total Park (241.02 in acres)
Hazard(s) Addressed:	Tornado, Windstorm, Hailstorm, Lightning
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$86,900
Potential Funding Sources:	HMGP $65,175 City budget $21,725
Lead Agency/Department Responsible:	Office of Emergency Management/Fire Marshal's Office, Parks and Recreation Department
Timeframe for Completion:	2016-2020

F-2016-2: Purchase Tiger Dam Systems	
Mitigation Goal/Objective:	1/1.2 and 1.3
Site and Location:	Public Works Complex
Background/Next Steps:	The public works complex of approximately 3 acres floods on average once every 5-6 years. Access to the public works complex is inhibited during flood events. Elevation of current office, lunchroom, equipment, fueling station and other outbuildings is not feasible as access to entire complex is blocked during flood events. Because the entire facility is located in the floodway, the possibility of installation of a permanent backup generator is not feasible. Office portion of current facility is insured by TML and NFIP is mandatory. Tiger Dam System Information • The system consists of elongated flexible tubes which can be staked, joined end to end & filled with water (flood water, 2" pump, fire hydrant or garden hose. • Tubes can be stacked up to 32" high, and linked together seamlessly (triangular in shape) • They are flexible and can form any shape. • Water can be drained back into Clear Creek once the flood waters have subsided. • Reusable • Can possibly divert up to 70-100% of floodwaters. Tiger Dam vs. Facility Relocation • Estimated cost of relocating the Public Works Building, Parks & Recreation storage unit, and securing enough property to house all equipment is estimated to cost $5-6 million dollars (including property purchase). • Projected property size would be 3-5 acres.

	Location of property large enough to house such a facility is going to be an issue: • If located within the COD (Community Overlay District) where any portion of the property lies within 300' of the major thoroughfares; i.e., FM 518, FM 528, FM 2351, Bay Area Blvd, and Friendswood Lakes, the structures would have to include fenestrations which will increase cost of construction, etc. for the structures.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Property Protection
Effect on new/existing buildings:	Location of property large enough to house such a facility is going to be an issue: • If located within the COD (Community Overlay District) where any portion of the property lies within 300' of the major thoroughfares; i.e., FM 518, FM 528, FM 2351, Bay Area Blvd, and Friendswood Lakes, the structures would have to include fenestrations which will increase cost of construction, etc. for the structures. Estimated cost for property purchase and relocation for all facilities is estimated at $4-6 million.
Priority:	High
Estimated Cost:	Estimated cost $450,000 to Utilize Tiger Dams to protect the following buildings at their current location between 3 and 4 feet high (3 – 42" high tubes) • Public Works Facility (600'), Parks Facility (350'), & Public Works & Parks Department Fuel Station (200')
Potential Funding Sources:	Grant
Lead Agency/Department Responsible:	Public Works Department, Parks & Recreation Department, Office of Emergency Management
Timeframe for Completion:	2016-2020

F-2016-3: Retrofit Public Works Building and Community Services/Parks Facility to current codes	
Mitigation Goal/Objective:	1/1.2
Site and Location:	1306 and 1324 Dogwood
Background/Next Steps:	• The current facilities are located in Hurricane Category 4 Storm Surge Zone. • Current facility was built in 1978. • Current facility has approximately 2400 square feet, and is not sufficient to accommodate current office staff members (public works, engineering, projects and design). • Current facility needs to be improved to adhere to current codes, i.e., IBC, IFR, ADA, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning
Mitigation Strategy:	Property Protection

Priority:	High
Estimated Cost:	Projected cost is $1.4 million
Potential Funding Sources:	CIP or bond initiative
Lead Agency/Department Responsible:	Community Development, Public Works Department, Engineering Department, Capital Projects Department
Timeframe for Completion:	2016-2026

F-2016-4: Purchase and installation of a back-up natural gas generator at the Activity Center	
Mitigation Goal/Objective:	1/1.4
Site and Location:	416 Morning Side
Background/Next Steps:	• The current facility is being utilized as the city's activity center and offers numerous and various activities to the senior population. • The current facility has a diesel generator and would like to switch to natural gas due to current fuel issues. • During periods of extreme heat and/or power outages, with the addition of back-up power, the library could be utilized as a cooling station for residents lacing the ability to cool their homes. • The Activity Center has also been identified as a feeding station for the city staff members who are assigned as essential emergency staff prior to, during, and following a severe emergency event. • The Activity Center would also be capable of providing a source for shelter arrangements for the essential emergency staff members.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Severe Winter Storm, Extreme Heat
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$50,000-$80,000 for natural gas generator and installation.
Potential Funding Sources:	HMGP
Lead Agency/Department Responsible:	• Community Development Department o Capital Improvements • Fire Marshal's Office
Timeframe for Completion:	2016-2020

F-2016-5: Purchase and installation of back-up natural gas generator for Friendswood Animal Control Facility and Friendswood Public Library Expansion	
Mitigation Goal/Objective:	1/1.4
Site and Location:	3000 W. Parkwood (Animal Control) 416 S. Friendswood (Library)
Comments:	Purchase and installation of a back-up natural gas generator at the Friendswood Animal Control Facility • Wind events will likely cause damage to residential fences which will impede the ability to maintain and/or provide a safe environment for pets.

	• Flood events will displace wildlife and potentially force them into neighborhoods. Purchase and installation of a back-up natural gas generator at the New Expansion to Friendswood Public Library • November 2013 Tax Bond Proposition approved the 21,000 square foot expansion to the existing footprint of the Public Library. • Current facility has a natural gas back-up generator. • Projected 211 KW expected total load (current load is 138 KW)
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	Animal Control Facility • $50,000-$80,000 for generator and installation. Public Library • $80,000-$100,000 for generator and installation
Potential Funding Sources:	HMGP
Lead Agency/Department Responsible:	• Community Development Department o Capital Improvements • Fire Marshal's Office
Timeframe for Completion:	2016-2020, or when library expansion is completed

F-2016-6: Installation of a Fuel Station for City Vehicles	
Mitigation Goal/Objective:	2/2.6
Site and Location:	Feasible location would be at Public Safety Building -1400 Whitaker Drive
Background/Next Steps:	• Design and Install a compartmentalized fuel tank • Design a 12,000-gallon combination diesel and no-lead fuel tank. • This would be compartmentalized tank with the capacity to provide 8,000 gallons no-lead fuel and 4,000 gallons diesel fuel. • AST – Above ground storage tank • The design will include the storage tanks, dispensing pumps, card management system, and covered awning over tank and fueling area
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Severe Winter Storm
Mitigation Strategy;	Emergency Services
Priority:	Moderate
Estimated Cost:	$500,000 (generator, gas pumps, storage tanks, installation, and concrete pad)
Potential Funding Sources:	Grants and/or city operating funds
Lead Agency/Department Responsible:	Public Works, Community Development, Office of Emergency Management
Timeframe for Completion:	Upon approval for funding to 2020

F-2016-7: Purchase a portable reader board	
Mitigation Goal/Objective:	2/2.6
Background/Next Steps:	• Purchase and maintain a portable reader board mounted on a trailer that could be deployed during emergencies and other events within the City. • The reader board would be accessible to all of Friendswood emergency services as well as Public Works and Parks and Recreation. • This project would convey public information to the public during evacuations and other emergencies.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$40,000 (reader board and trailer)
Potential Funding Sources:	Grants and/or city operating funds
Lead Agency/Department Responsible:	• Police Department • Fire Marshal's Office
Timeframe for Completion:	Upon funding and approval, the equipment could be purchased and implemented within one year.

F-2016-8: Acquire portable lighting devices to be used at major intersections during power outages	
Mitigation Goal/Objective:	2/2.6
Background/Next Steps:	Purchase 4 portable light towers on trailers to be utilized at four (4) major intersections during extended power outages to protect residents while driving into and/or outside the city. • Intersection of FM 528 and FM 518 • Intersection of FM 518 & FM 2351 • Intersection of FM 528 and Moore Road • Intersection of FM 528 and Bay Area Boulevard
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	Per unit cost of $10,000 to $40,000 Minimum costs: $40,000 Maximum costs: $160,000
Potential Funding Sources:	Grant funding, annual city budgeting process
Lead Agency/Department Responsible:	Public Works, Office of Emergency Management
Timeframe for Completion:	2016-2020

F-2016-9: Upgrade drainage systems and culverts to accommodate increased flow	
Mitigation Goal/Objective:	1/1.5
Site and Location:	Several locations within the city
Background/Next Steps:	These projects are in areas that have already been built out and have experienced flooding in the past. These projects are designed to protect existing structures from future flooding losses. FM518 DRAINAGE IMPROVEMENTS – PHASE 2 o FM 2351 to Willowick o Convey the 100 year flows into Clear Creek o Component of the 2007 Master Drainage Plan Phase 2 Estimated cost $2.7 million ANNALEA/WHITEHALL/KINGS PARK DRAINAGE – DRAINAGE IMPROVEMENTS PHASE 2 o Initial phase of project completed in 2005 o Upsizing storm sewer system to reduce potential flooding Estimated cost $862,000 Shadowbend Drainage Improvements Phase 2 o Component of 1993 master Drainage Plan Phase 1 o Upsizing storm sewer system to reduce potential flooding Estimated cost $416,000 Sunmeadow Drainage Improvements Phase 2 o Component of 1993 Master Drainage Plan Phase 1 o Initial phase of project completed in 2005 o Upsizing storm sewer system to reduce potential flooding Estimated cost $3.1 million Tributary 2 Drainage/Outfall Improvements o Component of 2004 TxDOT study o First 3 segments of project have been completed o From FM2351 to Cowards Creek o Placement of 3,300 linear feet of box culverts o Possible partnership with Galveston County Consolidated Conservation District Estimated cost $3.6 million
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado, Severe Winter Weather
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$10.678 million
Potential Funding Sources:	Capital Improvements Budget & grant funding
Lead Agency/Department Responsible:	Community Development, Public Works-Engineering & Capital Projects
Timeframe for Completion:	• Capital improvements are an ongoing program within the city. • Projects are proposed and prioritized though City Council. • Project completion is dependent upon the securing of funding either through the general operating budget or other avenues; i.e., bonds, grants, loans, etc.

F-2016-10: Maintain drainage systems and culverts	
Mitigation Goal/Objective:	1/1.2, 1.3, 1.5
Site and Location:	Citywide
Comments:	Mitigate the Impact of Flooding to Safeguard against the Loss of Life and/or Damage to Structures • Funding available through Public Works operating budget to clean & recut drainage ditches, complete work orders related to conveyance systems, remedy localized ponding issues. • Pursue sub-regional drainage improvements in the built environment to reduce the impact of flooding in areas outside the designation of official capital projects
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado, Severe Winter Weather
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$1.4 million
Potential Funding Sources:	To be addressed in the annual budget process and capital improvements program
Lead Agency/Department Responsible:	• Public Works Department - Streets & Drainage and Engineering • Community Development - Floodplain Manager
Timeframe for Completion:	2016-2020

F-2016-11: Mary's Creek Bridge Elevation ("Devils Dip")	
Mitigation Goal/Objective:	1/1.5
Site and Location:	▪ Mary's Creek Bridge ▪ Alleviate and/or eliminate potential flooding of residential properties in Imperial Estates Section 2.
Background/Next Steps:	• Following TS Allison in 2001, 38 residential properties were mitigated (buyout) following the severe flooding. The city-owned properties have been included to the original footprint of 1776 Memorial Park expanding the park. The city has installed an outdoor Frisbee field for use by all city residents. • Replace the current pedestrian bridge across Mary's Creek connecting 1776 Park to Imperial Estates Section 2. The current bridge, which has been in place since 1962, was closed to vehicular traffic in the early 2000s. Its low profile acts as blockade to flow within Mary's Creek during heavy rain events. • Moreover, shortly following those extreme events, substantial effort is expended on the part of the Galveston County Consolidated Drainage District to remove natural debris that collects within the bridge's substructure further impacting the flow within the Creek and causing flooding of the surrounding properties. • This project has been included in the city's Master Park Plan.

Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Property Protection, Structural
Priority:	High
Estimated Cost:	$100,000 for the reconstruction of an elevated bridge which will not impede the flow of water and act as a "dam" when debris flows down Mary's Creek
Potential Funding Sources:	To be addressed in the annual budget process, capital improvement program, and cooperation with Galveston County Consolidated Drainage District
Lead Agency/Department Responsible:	• Public Works Department • Office of Emergency Management • Galveston County Consolidated Drainage District
Timeframe for Completion:	Design, bid, and build bridge structure within the next 5 years 2016-2020

F-2016-12: Bury Power Lines	
Mitigation Goal/Objective:	1/1.3 and 1.5
Site and Location:	Citywide
Background/Next Steps:	• The Community Development Department requires all potential developers to submit their potential plans and participate in a review process which includes Community Development, Fire Marshal's Office, Public Works and Engineering. • All future developments are required to bury power lines to prevent disruption by protecting said lines from wind and flying debris. • By requiring future developments to bury power lines, interruption of power can be minimized in more portions of the community.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	Developers, utility companies
Lead Agency/Department Responsible:	Community Development, Engineering, Fire Marshal's Office
Timeframe for Completion:	Begin and continue this program through the next five years.2016-2020

F-2016-13: Adopt higher codes and update ordinances and regulations to promote hazard mitigation strategies	
Mitigation Goal/Objective:	2/2.2
Background/Next Steps:	• Adopt the 2012 International Building Code to include3 ASCE-24-10 and the 2012 International Fire Code (IFC). The city currently operates under the 2009 IBC which includes the ASCE-24-05 Flood Resistant Design and Construction and the 2009 IFC. • Establish design standards for buildings located in areas susceptible to storm surge. • Adoption of these codes will require higher elevations in structures in

	inundation zones. • Require deep foundations in order to avoid erosion and scour. • Plans for future storm surge heights due to potential rise in sea levels. • Develop building construction ordinance to address expansive soil techniques in high risk areas. • Require road construction to use techniques to mitigation expansive soils
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Severe Winter Storm, Expansive Soils
Mitigation Strategy:	Prevention, Property Protection
Priority:	High
Estimated Cost:	• Cost to implement the adoption of these codes is limited to staff review time of the 2012 IBC and IFC, and submitting suggested amendments to City Council for approval. • Additional staff time would be required if it was recommended that the city adopt the 2015 IBC and IFC.
Potential Funding Sources:	Annual budget
Lead Agency/Department Responsible:	Community Development - Design Review Committee (DRC)
Timeframe for Completion:	This process could begin in Fiscal Year (FY) 2015 and be completed within a year.

F-2016-14: Update City Storm Surge Maps to Reflect the NWS Predictions	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	The updated maps will display potential storm surge by water depth based upon the NWS predicted storm surge and projected track for landfall. The new maps may more accurately display water depth in areas within the city. • The storm surge maps currently utilized to depict storm surge are based upon hurricane category wind speeds. • As indicated during Hurricane Ike (2008), the storm surge recorded at Bolivar Peninsula was 20', however, surge at Kemah (entrance of Clear Lake) was recorded at 10-12 feet, which did not affect any structures within the city. • Storm surge water depth is in direct relation to the path or track of the hurricane. • A hurricane making landfall nearer the west portion of Galveston Bay or west portion of Galveston County will affect the city more than a hurricane tracking over the east portion of Galveston Bay (as occurred during Hurricane Ike). • The updated maps will display potential storm surge by water depth based upon the NWS predicted storm surge and projected track for landfall. The new maps may more accurately display water depth in areas within the city.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Property Protection, Prevention

Priority:	High
Estimated Cost:	Projected cost is $5,000-10,000 (updated mapping provided by the current contracted engineering firm). .
Potential Funding Sources:	Projected costs could potentially be covered by annual budget funding through the city's annual budgeting process
Lead Agency/Department Responsible:	Community Development, Office of Emergency Management
Timeframe for Completion:	2016-2020

F-2016-15: Develop, initiate, and enhance public information campaigns and awareness programs for hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	Develop outreach initiatives to communicate hazard preparedness information to the general public; provide timely information and educational materials related to preparedness, mitigation, response & recovery to enhance the public's ability to become self-sufficient. SEVERE THUNDERSTORM/HAIL/LIGHTNING • Develop public information materials and conduct outreach programs which include information regarding thunderstorms/hail/lightning to include how they develop, precautionary measures to take to protect property and lives, and developing a disaster plan. o Protective measures which can be utilized to protect against thunderstorms, lightning and hail events ✓ Remove dead or rotting trees & branches which could fall and cause damage or injury; ideal planting conditions for fruit trees is 16', ash 32' and oak 59' from a building structure to prevent damage to foundations and/or structural damage from the canopy; go indoors after seeing lightning and remain inside for at least 30 minutes after hearing last clap of thunder; postpone outdoor activities; secure outdoor objects which may be blow around or cause further damage; avoid corded telephones – cordless & cellular phones are safe to use; unplug electrical appliances and other electrical items such as computers, TVs, radio, etc.; use NOAA Weather Radio for updates from local officials o Encourage the public to make a family disaster plan to include contacts and locations to reunite in the event they become separated o Assemble a 3-day disaster supply kit with food, water, medical supplies, battery powered NOAA radio, flashlights, batteries, extra clothing. • Gather important documents and store them in a fire and/or water-proof container. SEVERE WEATHER EVENTS, HURRICANES, TORNADOES & WIND • Minimize and/or eliminate tree vegetation within local utility ROWs o Remove dead or rotting trees & branches which could fall and cause damage or injury; ideal planting conditions for fruit trees is 16', ash 32' and oak 59' from a building structure to prevent damage to

	foundations and/or structural damage from the canopy o Work with Texas New Mexico Power Company to develop public information materials or a cooperative plan to encourage residents and/or business to trim and/or remove trees and other vegetation located within the utility easement and intermingling through the power lines which could potentially tear down power lines during severe thunderstorms with high winds. o Effect on existing buildings would be to minimize damage to power lines by the removal of trees or trimming of canopies away from the power lines. o Effect on future buildings would be to ensure that electrical utility lines are buried and not affected by tree canopies and/or vegetation. • Develop tornado awareness materials to educate the public as to how to protect themselves and property in the event a tornado would occur in the area. o Items to cover: if no concrete safe room is located in the residence, use an internal room with no windows; secure all items located outside the residence (patio furniture, flower pots, grilling accessories, etc.) so they do not become flying projectiles; encourage installation of impact-resistant windows; reinforce garage doors DROUGHT - WATER CONSERVATION • Develop public informational materials to educate the public regarding water conservation measures during periods of drought conditions. o Encourage recapturing of water with buckets when showering or bathing to be used on outside vegetation areas; educate public on restricted watering criteria; i.e., by house number/days of week; limiting watering of lawns to certain hours; establish only flower beds and gardens can be watered using only the end hose – no sprinklers; encourage xeriscaping property and lawns; encourage installation of permeable driveways and sidewalks in new subdivision developments to reduce runoff and promote groundwater recharge WINTER STORMS/SEVERE HEAT • Establish a warming center and/or cooling center at the Public Library and Activity Center for the general public and senior citizens o Develop public information materials for the general public regarding the location of a warming station at the Public Library. EXPANSIVE SOILS • Educate engineers, public works, and contractors on expansive soil construction techniques such as: o Application of calcium soil stabilizers in high soil rating areas o Installation of property perimeter drainage systems
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Severe Winter Storm, expansive soils
Mitigation Goal/Objective:	3/3.1
Priority:	High
Estimated Cost:	• Minimal; can be created and obtained by staff; annual budget • Obtain pre-printed materials through FEMA • Information can be disseminated through public service announcements

	(PSAs) via the city PEG channel, Twitter feed, Facebook, Focus on Friendswood newsletter, email messages, newspaper articles, and public presentations at civic organizations.
Potential Funding Sources:	Annual budget process
Lead Agency/Department Responsible:	Office of Emergency Management - Public Information Officer
Timeframe for Completion:	2016-2020

F-2016-16: Public information and warning mobile application for Android and Apple applications	
Mitigation Goal/Objective:	1/1.1 and 1.5
Background/Next Steps:	• Research and develop a mobile application to be available for citizens to download for IOS and Android operating systems • If cost is too prohibitive, research and promote applications already developed to encourage emergency preparedness • Promote the use of emergency preparedness apps currently available at the Apple Store.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness
Priority:	Moderate
Estimated Cost:	• Research has shown that costs associated with the development of an emergency management application – simple, table based app – for IOS systems range $500 to $4,000. All content & clear direction is provided by the organization. If GSP locators, social media integration, and additional add-ins are included, costs will rise accordingly. • If costs are maintained in the range of $5,000 to $10,000, proposals could be made during the budget development process to include this project in the annual operating budget.
Potential Funding Sources:	If this project is rejected by the governing body, research and application for grants could provide an alternative funding source
Lead Agency/Department Responsible:	Office of Emergency Management, IT Department
Timeframe for Completion:	If a funding source is secured, ideally development could be accomplished within 2-3 years.

F-2016-17: Develop a Comprehensive Flood Mitigation Plan	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	To attain a lower CRS rating and improve the city's approach for addressing RL/SRL properties, the city should consider developing a flood mitigation plan to meet the current NFIP standards. • Develop a Flood Mitigation Plan for the city and submit the plan to the Texas Water Development Board for guidance and review. • Strive to meet criteria necessary to achieve a lower CRS rating through this initiative. • Initiate and implement additional floodplain requirements that are above the minimum floodplain compliance. • Update the city's current floodplain map to coordinate with the currently proposed FEMA Flood Insurance Rate Map relative to all floodplains as proposed.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	General fund through annual budget process/apply for planning grant funding
Lead Agency/Department Responsible:	Community Development, Floodplain Manager, Office of Emergency Management
Timeframe for Completion:	2016-2020

Table 21.16: Hitchcock 2016-2020 Mitigation Action Plan

H-2006-2: Increase flow capacity to drainage system on Lexington Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 – Funding is required.	

H-2006-3: Increase flow capacity to drainage system on Concord Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-4: Increase flow capacity to drainage system on Lincoln Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown

Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-5: Increase flow capacity to drainage system on Willow Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-6: Increase flow capacity to drainage system on Meadowplace Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-7: Increase flow capacity to drainage system on Tacguard Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado

Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-8: Increase flow capacity to drainage system on Barry St.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-9: Increase flow capacity to drainage system Woodacres Dr.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-10: Increase flow capacity to drainage system on Buins St.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-11: Increase flow capacity to drainage system on Jay Rd.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-12: Increase flow capacity to drainage system on Hacker Rd.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock

Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-16: Increase flow capacity to drainage system on Steward Rd.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-18: Increase flow capacity to drainage system on Hawthorne St.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H-2006-20: Increase flow capacity to drainage system on Belring Rd.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Severe Winter Weather, Tornado
Mitigation Strategy:	Structural

Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	Unknown
Lead Agency/Department Responsible:	City of Hitchcock
Timeframe for Completion:	2016-2020
Analysis	
2010 – Action deferred due to lack of grant funding	
2016 - Funding is required.	

H 2011-1: Develop and provide public awareness materials and information at community events (food bank) and city website regarding hazards	
Mitigation Goal/Objective:	3/3.1
Site and Location	Citywide
History of Damages	Hitchcock is prone to natural and technological hazards
Comments	The Food bank provides the best opportunity to reach those residents who typically do not have the resources to understand the importance of personal and property protection measures. Information will also be developed for the city's website as opportunities for updating their site become available. Information provided includes the following mitigation techniques (elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Wildfire (urban and rural), Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Coastal Erosion and Retreat, Land Subsidence, Tsunami
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	Staff salary
Potential Funding Sources:	Budget
Lead Agency/Department Responsible:	Police and Fire Departments, Galveston County EMC
Timeframe for Completion:	2016-2020

H 2011-3: Extend water and sewer lines to septic and well water customers not currently on City system	
Mitigation Goal/Objective:	1/1.1
Site and Location	Citywide

Background/Next Steps:	Reducing the number of septic systems in use in the higher hazard areas will reduce contamination. Decreasing groundwater withdrawal will allow for maximum recharge and user participation in a managed system.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Drought, Extreme Heat, Severe Winter Storm, Land Subsidence
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	Office of Rural community affairs
Lead Agency/Department Responsible:	City departments
Timeframe for Completion:	2016-2020

H 2011-8: Implement a tree trimming/vegetation removal program from public right of ways	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Tree limbs and vegetation generated by storms or natural decay process can block access of streets from first responders, clog storm sewers, down power lines and damage buildings.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$50,000/year
Potential Funding Sources:	Budget
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

H 2011-10: Purchase and install emergency power generators and connections equipment to support critical facilities and infrastructure	
Mitigation Goal/Objective:	1/1.4
Site and Location	Citywide
Background/Next Steps:	Lift stations, water/wastewater and sewer facilities should be equipped for generator connections. City-owned facilities should also have fixed-unit generators in place.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Extreme Heat, Severe Winter Storm, Wildfire (urban and rural), Lightning, Tsunami
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$4,500,000
Potential Funding Sources:	Office of Rural Community Affairs, Grants

Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding is required.	

H 2011-11: Implement storm sewer system improvement projects to mitigate flooding	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Outdated storm sewers require updating and reconstruction to increase water flow. Reduce/prevent minor flooding from substandard storm sewer and clogged roadside ditches
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	Office of Rural Community Affairs, Grants
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding is required.	

H 2011-13: Upgrade water and sanitary sewer distribution and collection system infrastructure to include backflow prevention valves	
Mitigation Goal/Objective:	1/1.1
Site and Location	Citywide
Background/Next Steps:	Many lines within the city limits are old and in need of replacing or improving.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Drought
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$10,000,000
Potential Funding Sources:	Office of Rural Community Affairs, Grants
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding is required.	

H 2011-19: Evaluate, design, and implement hardening measures to protect existing critical facilities and critical infrastructure	
Mitigation Goal/Objective:	1/1.2
Site and Location	Citywide
History of Damages	Area prone to high wind and flooding events
Background/Next Steps:	Reduction of risk to existing buildings and properties, including lost services. Hardening measures may include, elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Severe Winter Storm, Land Subsidence, Coastal Erosion and Retreat, Tsunami
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	FEMA: HMGP, PDM, FMA, RFC, SRL; General Fund
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding is required.	

H 2016-1: Stormproof/retrofit new critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	Citywide
Background/Next Steps:	New construction and existing critical facilities and infrastructure should include advanced mitigation techniques. Measures include, elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Severe Winter Storm, Land Subsidence, Coastal Erosion and Retreat, Tsunami
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP, CDBG, General Funds

Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

H 2016-2: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

H 2016-3: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Coastal Erosion and Retreat, Land Subsidence, Tsunami
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

Table 21.17: Jamaica Beach 2016-2020 Mitigation Action Plan

JB 2006-1: Implement beach and dune restoration program	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tsunami, Coastal Erosion and Retreat
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$2,100,000
Potential Funding Sources:	Texas Coastal Coordination Council-Texas Coastal Management Program, Texas General Land Office, USACE, General Fund, 406 Public Assistance
Lead Agency/Department Responsible:	City staff and council
Timeframe for Completion:	2016-2020
Analysis	
2016 - Currently seeking easement forms from beach front property owners. Construction is scheduled for early 2016.	

JB 2006-4: Conduct annual hurricane town hall meetings	
Mitigation Goal/Objective:	3/3.1
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tsunami, Flooding
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$750
Potential Funding Sources:	Donations and the general fund
Lead Agency/Department Responsible:	City staff
Timeframe for Completion:	2016-2020

JB 2011-5: Prepare a Drought and Extreme Heat Contingency Plan	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	Jamaica Beach experiences drought and periods of extreme heat during the summer months. A contingency plan allows for water storage and monitoring procedures that can be engaged when needed.
Hazard(s) Addressed:	Drought, Extreme Heat
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$45,000
Potential Funding Sources:	Grants, general funds
Lead Agency/Department Responsible:	City Administrator
Timeframe for Completion:	2016-2020

JB 2016-1: Jamaica Cove Rd. Survey	
Mitigation Goal/Objective:	2/2.1
Site and Location	Jamaica Cove Rd.
Background/Next Steps:	Jamaica Cover Road is prone to flooding. Conduct a survey to determine if elevating the road would reduce future flooding impacts.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tsunami
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$3,500
Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	City Administrator
Timeframe for Completion:	2016-2018

JB 2016-2: Purchase and install generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective:	1/1.4
Site and Location:	Fire Station and others as identified
Background/Next Steps:	Generators are essential for providing continual operations in the event of a disaster. The fire station may be in need of a generator but other facilities may be needed over the next five years. As funding becomes available, the city will apply for grants to install/upgrade generators to support existing or new facilities/infrastructure.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Tsunami, Extreme Heat, Severe Winter Storm, Lightning
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$50,000
Potential Funding Sources:	HMGP, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon funding approval to 2020

JB 2016-3: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tsunami
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

JB 2016-4: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Severe Winter Storm, Coastal Erosion and Retreat
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

JB 2016-5: Develop and provide public awareness campaigns for natural hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Severe Winter Storm, Coastal Erosion and Retreat
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$1,000
Potential Funding Sources:	Local funds
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

Table 21.18: Kemah 2016-2020 Mitigation Action Plan

K 2006-1: Develop and provide public awareness campaigns for natural hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$1,000
Potential Funding Sources:	Local funds, National Weather Service, Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, FEMA – Emergency Operations Center Funding, FEMA – Emergency Management Performance Grant, USDA – Environmental Quality Incentives Program
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

K 2006-2: Develop severe weather audio alert system	
Mitigation Goal/Objective:	1/1.1
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$2,000
Potential Funding Sources:	General Fund, FEMA – Emergency Performance Grants, FEMA – All Hazards Operational Planning, FEMA – Fire Management Assistance Grants, USDA – Environmental Quality Incentives Program
Lead Agency/Department Responsible:	City Administration

Timeframe for Completion:	2016-2020
Analysis	
2010 - Action deferred due to lack of additional funding to support implementation	
2016 - Funding is required.	

K 2006-3: Implement storm sewer system re-engineering and follow-up construction project to mitigate flood related impacts.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Tsunami, Dam/Levee Failure
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$4,000,000
Potential Funding Sources:	US Army Corps of Engineers – Small Flood Control Projects, Hazard Mitigation Grant Program, Pre- Disaster Mitigation Grant Program, Texas Water Development Board – Clean Water State Revolving Fund, Texas Water Development Board (Development Fund II) – Texas Water Development Fund, USDA Natural Resources Conservation Service – Watershed Protection and Flood Prevention Program, EPA – Nonpoint Source Grant Program
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

K 2006-4: Develop city ordinance requiring the incorporation of wind resistant construction provisions and enforcement measures in the city building code.	
Mitigation Goal/Objective:	2/2.2
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tsunami, Tornado, Windstorm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	Staff time and resources
Potential Funding Sources:	Local commitment
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

K 2011-1: Conduct National Weather Service tornado drills along with elementary school in jurisdiction	
Mitigation Goal/Objective:	2/2.3
Site and Location	Citywide
Hazard(s) Addressed:	Flooding, Tornado, Windstorm, Hailstorm, Lightning
Mitigation Strategy:	Public Education and Awareness
Priority:	High

Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Emergency management
Timeframe for Completion:	2016-2020

K 2011-8: Implement any updates for drought contingency plans as developed by the WCID# 12	
Mitigation Goal/Objective:	2/2.1
Site and Location	Citywide
Background/Next Steps:	Jurisdiction experiences occasional drought conditions and days of extreme heat during the summer months which may also cause wildfires (Urban and Rural). City of Kemah does not provide water or waste water for its citizens. This service is provided by Water Control Improvement District #12 (WCID#12). Implementation ensures adequate water supply by lessening water usage
Hazard(s) Addressed:	Extreme Heat, Drought, Wildfire (Urban and Rural)
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	Staff time
Potential Funding Sources:	General Fund Municipal
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020

K 2011-10: Develop program to integrate with the Harris County Flood Control District for the purpose of optimizing the operation of the flood gates at second cut outlet	
Mitigation Goal/Objective:	2/2.1
Site and Location	1900 Shipyard Drive (intersection of Highway 146 and Shipyard Drive)
Background/Next Steps:	This structure is located outside the city of Kemah. However, the failure of this gate to function impacts structures within the jurisdiction of Kemah
Hazard(s) Addressed:	Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Staff Time
Potential Funding Sources:	General Fund
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020
Analysis	
2016 - Coordination is needed between the city and Harris County Flood Control District to develop a program.	

K 2011-11a: Update flood plain ordinance to ensure compliance with minimum standards of NFIP	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	A review of the city's floodplain ordinance will reveal where improvement and updating can allow the city to move beyond the minimum standards for development in the regulatory floodway.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$1,000
Potential Funding Sources:	General Fund Municipal
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020

K 2011-13: Develop maintenance and flow testing program for fire hydrants in jurisdiction	
Mitigation Goal/Objective:	2/2.1
Hazard(s) Addressed:	Wildfire (Urban and Rural)
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$20,000
Potential Funding Sources:	Grants
Lead Agency/Department Responsible:	Fire Department
Timeframe for Completion:	2016-2020

K 2011-14: Harden existing critical facilities and infrastructure to be more resistant to hazards	
Mitigation Goal/Objective:	1/1.2
Site and Location	1401 State Hwy 146—City Hall 800 Harris Community Center 602 Bradford-Visitor Center
Background/Next Steps:	Continuity of emergency services and general government operations is necessary to protect staff and city property. Existing facilities may be lacking protective measures and adequate building standards. Mitigation measures include: elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc. Potential hardening projects may include any municipal building and public infrastructure.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm, Coastal Erosion and Retreat,

	Land Subsidence
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	HMGP and Other Post Ike Funding
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2026
Analysis	
2016 - Funding is required.	

K-2016-1: Stormproof/retrofit critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	Fire Station
Background/Next Steps:	New construction and existing critical facilities and infrastructure should include advanced mitigation techniques. Measures include, elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm, Coastal Erosion and Retreat, Land Subsidence
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP, CDBG, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

K 2016-2: Purchase and install generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective	1/1.4
Site and Location:	Fire Station and others as needed
Background/Next Steps:	Generators are essential for providing continual operations in the event of a disaster. The city will apply for grants to install/upgrade generators to support existing or new facilities/infrastructure.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Tsunami, Severe Winter Storm
Mitigation Strategy:	Emergency Services

Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	HMGP, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon approval of funding to 2020

K-2016-3: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

K-2016-4: Widen drainage systems and culverts	
Mitigation Goal/Objective	1/1.5
Site and Location:	Citywide
Background/Next Steps:	The drainage systems and culverts throughout the county are frequently impacted by flood and severe weather events. Coordinate efforts with water district to widen drainage systems and increase culvert size to accommodate increased water flows.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tsunami, Tornado, Windstorm, Flooding, Coastal Erosion and Retreat. Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	CDBG, HMGP, General Funds
Lead Agency/Department Responsible:	City Administration and applicable department and water district staff
Timeframe for Completion:	Upon funding approval to 2020

K-2016-5: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm, Dam/Levee Failure, Coastal Erosion and Retreat, Land Subsidence
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

K 2016-6: Implement the Corp of Engineers study of the Galveston County Water Reservoir Dam and Levee system	
Mitigation Goal/Objective	1/1.1, 1.2, 1.3, 1.4, 1.5
Background/Next Steps:	Review the findings of a potential breach to the dam/levee system and develop/implement mitigation actions as applicable to address location, extent and impact.
Hazard(s) Addressed:	Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2018-2020

Table 21.19: La Marque 2016-2020 Mitigation Action Plan

LM 2006-2: Implement drainage projects that support low maintenance and cleaning of drainage ditches.	
Mitigation Goal/Objective:	1/1.5
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Dam/Levee Failure, Severe Winter Storm,
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General funds and FEMA grants
Lead Agency/Department Responsible:	Public Services
Timeframe for Completion:	2016-2020
Analysis	
2010 - Action deferred to solicit funds	
2016 - To date, 14,000 linear feet of ditches have been cleaned. Residents have also become proactive in keeping their property ditches cleaned – this is being monitored by Code Compliance Staff. The remaining drainage systems will be addressed as funding becomes available. Coordinating efforts with local Drainage District to accommodate outfall.	

LM 2011-2: Purchase and Install Storm Shutters for Fire Station Entryway	
Mitigation Goal/Objective:	1/1.2
Site and Location	La Marque Fire Rescue 1109-A Bayou Road La Marque, Texas 77568
Background/Next Steps:	This project addresses several hazards that could impact the City of La Marque. Protective shutters would reduce damage from flying debris and hail. The shutters could also be sandbagged when closed in order to keep flood water from entering the building. Entryway door was damaged during Hurricane Ike due to excessive winds. The Main door was bowed in the center and broke the system that closes it. By installing this storm shutter, we could minimize building damage in future events.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tornado, Windstorm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$3,750
Potential Funding Sources:	Grant / General Budget
Lead Agency/Department Responsible:	Fire Department
Timeframe for Completion:	2016-2020
Analysis	
2016 –Funding is required - will apply and/or seek General Fund appropriation during Fiscal Year - 2017.	

LM 2011-3: Purchase new Fire Station Doors for Apparatus Bays	
Mitigation Goal/Objective:	1/1.2
Site and Location	La Marque Fire Rescue 1109-A Bayou Road La Marque, Texas 77568
Background/Next Steps:	The existing bay doors do not meet local windstorm ratings. The doors had to be left open in past storms in order to keep them from being damaged. This allowed excessive up-loading to our building's roof system, winds damaged the interior resulting in repairs costing the citizens almost $300,000. The new doors will be rated for 165 mph wind and would most likely be able to provide protection from hail storms. Door rated for maximum wind resistance will keep Emergency Operation staff safe from storm debris.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tornado, Windstorm, Wildfire (Urban and Rual)
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$125,000
Potential Funding Sources:	Grant / General Budget
Lead Agency/Department Responsible:	Fire Department
Timeframe for Completion:	2017-2018
Analysis	
2016 – Funding required	

LM 2011-6: Purchase New Rescue Pumper for Fire Station	
Mitigation Goal/Objective:	2/2.6
Site and Location:	1109-A Bayou Road La Marque, Texas 77568 Lot 29.369629 Land -94.9717
Background/Next Steps:	A realistic 10 - 15-year fire apparatus replacement program must be instituted. Reserve Fire Apparatus currently in service are 20 and 23 years old. A Rescue Pumper is a support truck that can carry all equipment and compensate for a down sized staff. Continued growth and service calls has placed higher demand on the Fire Station personnel and trucks. Adding a new rescue pumper to the fleet will allow personnel to respond to more calls at the same time. Reliable Reserve Apparatus are essential to augment the fleet during disasters and multiple / major emergencies.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Wildfire (Urban and Rural)
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$800,000
Potential Funding Sources:	Grant / Bond
Lead Agency/Department Responsible:	Fire Department
Timeframe for Completion:	2017-2019

Analysis
2016 – Funding is required

LM 2011-7: Build Westside Public Safety Complex	
Mitigation Goal/Objective:	1/1.2
Site and location:	Westside of La Marque
Background/Next Steps:	This annex would consist of a 4-bay fire / emergency medical service station, police station complete with holding cells, EOC, Municipal Court, and multipurpose training facility. Currently departments are fragmented throughout the city. Departments that need to be involved in emergency response are housed in old buildings that were modified to serve the purpose and have since suffered damage in recent storms. The city is constantly spending money repairing buildings that do not provide sufficient space and safety. Make shift offices and rented buildings are being used until needed repairs are complete on some buildings.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$35,000,000
Potential Funding Sources:	Grants / Bonds / or EDC Funds
Lead Agency/Department Responsible:	City of La Marque Fire/Police Departments
Timeframe for Completion:	2017-2018
Analysis	
2010 - This project will be deferred with a current maximum estimated cost of $5,000,000	
2016 - The project scope has been modified to reflect a Westside Public Safety Complex inclusive of Westside Fire Station and Administrative Headquarters, new Police Station and Detention Facilities, Municipal Court Facilities, Multipurpose Training Facilities, and Emergency Operations Center. Estimated costs associated with this project include the acquisition of property in the vicinity of IH 45 and FM 1764 and/or FM 2004 in addition to site development, construction, furnishings, necessary equipment, and Fire / Emergency Medical Services apparatus based on the Houston / Galveston regional area development / construction costs, and market apparatus acquisition costs. The proposal provides for the inclusion of a modern Emergency Operations Center necessary to sustain effective city operations / services; improve emergency preparedness and provide technological support and telecommunication capabilities required for survivability and interoperability with surrounding jurisdictions during emergencies.	

LM 2011-9: Purchase and Install Generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective:	1/1.4
Site and Location	Public Services 1500 Municipal Drive, and Police Department, 431 Bayou

	Road, La Marque, Texas 77568 and other facilities as they are identified.
Background/Next Steps:	The Public Services main field office was totally inoperable during Hurricanes Ike and Rita due to no alternative generator equipment. It resulted in being unable to fuel our equipment or maintain water system operations. This project mitigates for damages from severe weather power outages. This facility powers fuel distribution and water system operation which is vital to any emergency response situation. Currently, there is no alternate power source. The Police Department's generator is more than 20 years old and in dire need of replacement. It not only powers the police department building, but also most of the City's internet connectivity and phone systems. Additional generators may be required in the future to support critical facilities and infrastructure throughout the city
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	Moderate
Estimated Cost:	$260,000
Potential Funding Sources:	Grant / General Budget
Lead Agency/Department Responsible:	Public Services / Police Department
Timeframe for Completion:	2016-2020
Analysis	
2016- Funding required. Every essential city facility requires a back-up power source and this is the last remaining city building without a generator. As funding becomes available, the city will apply for grants to install generators to support Public Services, Police Department, and other facilities as they are identified.	

LM 2011-11: Construct safe room community shelter	
Mitigation Goal/Objective:	1/1.1
Site and Location	1100 Block of Bayou Road La Marque, Texas 77568
Background/Next Steps:	No such multi-functional facility currently exists that can accommodate large numbers of people. Citizens have needed to be rescued in the past during small scale incidents. There was no shelter other than the fire station. La Marque is growing and emergency operation capabilities must grow with it. A community safe room shelter would provide a place for an emergency operations command center, emergency medical care area, and evacuation staging area, and/or a safe shelter for affected residents. No such facility currently exists. Shelter could be used for other public functions during non-emergency events.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Severe Winter Storm

Mitigation Strategy:	Structural
Priority:	Moderate
Estimated Cost:	$5,000,000
Potential Funding Sources:	Grant
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2022
Analysis	
2016 – Funding required.	

LM 2011-12: Build new roads to accommodate evacuations and reduce congestion at the intersections cited	
Mitigation Goal/Objective:	1/1.1
Site and Location	Off IH-45 Feeder Road on La Marque/Texas City line. Start road on city line and continue past Gulf Greyhound Park and tie into FM 2004.
Background/Next Steps:	Three roads meet at the IH 45 / Exit 15 intersection. During evacuations, this area becomes severely congested. Delays of up to several hours have occurred. Traffic flow, emergency services, and recovery operations are severely impeded. Building a new road to the new standards should help alleviate some of the traffic and flooding problems. An alternate evacuation route is crucial considering the hazardous materials that are transported through this intersection, the poor drainage of floodwater, and hurricane evacuations. The nearby Gulf Greyhound Park was used during Hurricane Ike recovery efforts to house the power utility (electric) companies that responded to assist with the recovery effort. An estimated 2,000 contractors with trucks and equipment moved in and out, 24 hours a day. Interstate 45 was congested to a standstill and several major accidents occurred. Had an additional roadway been built, traffic flow could have moved more safely and many accidents may have been avoided.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Dam/Levee Failure
Mitigation Strategy:	Structural
Priority:	Moderate
Estimated Cost:	$20,000,000
Potential Funding Sources:	Bond, or Grant
Lead Agency/Department Responsible:	TXDOT, Public Services to coordinate
Timeframe for Completion:	2018-2020
Analysis	
2016 –This project would need to be funded by an outside agency(ies), through a Texas Department of Transportation project as it pertains to state-owned roadways. The City of La Marque would participate as an interested party.	

LM 2011-13: Purchase and Install generators for wastewater lift stations located throughout the city.	
Mitigation Goal/Objective:	1/1.4
Site and Location	Wastewater lift stations require redundant power sources; this includes but may not be limited to the following locations: 2500 6th Ave 1810 Bayou 200 Main St 724 Shady Lane 901 First St 201 Bayou 301 Vauthier 4818 Delany 2502 Duroux 2995 FM 1764 2420 Jackson 1019 Walnut St 1024 Hathaway 604 Ross 728 Hwy 3 2813 Cedar 3905 McKinney 1111 Volney 6090 FM 1764
Background/Next Steps:	Hurricanes Ike, Rita, and others of the past have caused power outages lasting as long as 20 days. Some residents received a back flow of raw sewage into their homes. Back flow of raw sewage into a home is a direct threat to human health that could have been completely avoided if generators were available to support the continual operation of the city's lift stations.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Extreme Heat, Severe Winter Storm, Dam/Levee Failure
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$357,445
Potential Funding Sources:	Grant / General Budget
Lead Agency/Department Responsible:	Public Services
Timeframe for Completion:	2017-2018
Analysis	
2016 –Funding required for lift stations	

LM 2011-14: Construct a storm water detention area on the east side of the City	
Mitigation Goal/Objective:	1/1.5
Site and Location	The location of this detention area is located near FM 1765 and SH 146 Lat. 29.378173732237762 Long. -94.9524736404419
Background/Next Steps:	Areas east of town are prone to flooding during heavy rain events. Dow Chemical purchased several acres of land east of town for use as a greenbelt. The city of La Marque would like to build a detention pond in this area that will help alleviate flooding on the east side. Phase I will include a feasibility study and a drainage analysis of the new pond row acquisition and associated conveyance improvements on a part of 10 acres of land. Engineering of the pond will be based on results of the study and analysis. Construction of the pond will be the second phase.

Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	Moderate
Estimated Cost:	$3,868,150
Potential Funding Sources:	Grant / Bond / Corporate Sponsor
Lead Agency/Department Responsible:	Public Works
Timeframe for Completion:	2017-2020
Analysis	
2016 – Funding required	

LM 2011-15: Increase the height of the existing Levee wall system to withstand a Category 5 storm surge	
Mitigation Goal/Objective:	1/1.5
Site and Location	The South side of La Marque and through Texas City
Background/Next Steps:	Recent storms have brought the storm surge to within 1 foot of breaching the levy. This project addresses several issues that may impact the city of La Marque. The existing levee was built to protect our community from a category 3 hurricane tidal surge. Should we receive a storm surge greater than that of a category 3 storm, chances are this levee system will fail and cause catastrophic flooding throughout the community.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Dam/Levee Failure
Mitigation Strategy:	Structural
Priority:	Moderate
Estimated Cost:	$23,000,000
Potential Funding Sources:	Grant or Federal Funding
Lead Agency/Department Responsible:	US Army Corps of Engineers, Galveston County Drainage District
Timeframe for Completion:	2018-2020
Analysis	
2016 – Funding required. The levy, although within the city limits of La Marque, is owned/managed by the Corps of Engineers and the pumps are maintained by the Galveston County. The City of La Marque would participate in this project as an involved party, overseeing the city's interests.	

LM 2011-16: Purchase 100' Aluminum Aerial platform fire apparatus for residential and commercial structure fire rescues	
Mitigation Goal/Objective:	2/2.6
Site and Location	Central Fire Station 1109-A Bayou Road, La Marque, Texas 77568
Background/Next Steps:	An aerial ladder can be used in many rescue situations. The City responds to and has assisted in responding to refinery fires/explosions, major

	pipeline breaches, flood water rescues, and residential fires. The city has summoned aerial ladder support from outside jurisdictions six times in the past five years. Wait times for the ladder to arrive have exceeded 20 minutes and resulted in fatalities. One fire incident in an apartment complex within the city limits resulted in the deaths of two young children who were unable to escape a multi-story apartment complex while the city had to wait for a neighboring fire department to bring their aerial ladder to the scene to make the rescue. The city currently serves a population of 14,600 persons which includes a bay front community consisting of 275 two-story homes. The projected growth in La Marque is estimated to exceed 20,000 citizens by 2020. The aerial apparatus would also aid in swift water and coastal flooding emergencies. Additionally, the city has assisted with plant explosion rescues and major pipeline breach incidents. On several of these occasions a ladder was required to respond.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Lightning, Wildfire (Urban and Rural)
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$1,250,000
Potential Funding Sources:	Grant / General Budget
Lead Agency/Department Responsible:	Fire Department
Timeframe for Completion:	2017-2018
Analysis	
2016 – Funding required. Revised cost estimate from $1,000,000 to 1,250,000 due to continued inflation. Implementation schedule revised to address increasing risk factors. This acquisition is rapidly becoming increasingly critical to address increased commercial growth and construction of multi-story structures.	

LM 2011-17: Build Public Services Facility	
Mitigation Goal/Objective:	1/1.2
Site and Location	Western area of La Marque
Background/Next Steps:	Public Services building would house public works, development services, and code enforcement and should be located in the western area of the city.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$15,000,000
Potential Funding Sources:	Grant / General Budget / Bonds

Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2017-2021
Analysis	
2016 – Funding required. The City is in the infant stages of planning and has begun searching for suitable location options for this project. Phase 1 would include identifying a prospective location and working with an architect to determine the project specifications and cost. Phase II would identify funding for this project; Phase III would be implementation/completion.	

LM 2011-18: Remove downed trees and brush that pose increased fire risk throughout the City.	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Brush and debris create fuel for obstruction to drainage, and impedes vehicle movement. This action is provided through maintenance program.
Hazard(s) Addressed:	Wildfire (Urban and Rural), Severe Winter Weather, Hurricane/Tropical Storm, Tornado, Windstorm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$100,000
Potential Funding Sources:	Grants, City funds
Lead Agency/Department Responsible:	Fire Department/Public Services
Timeframe for Completion:	2016-2020

LM 2011-19: Develop and provide public awareness campaigns for natural hazards and Dam/Levee Failure	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Dam/Levee Failure: information provided includes advisory notifications of imminent or breached dam/levee for evacuation route/procedures. Mitigation techniques such as elevation of structures. Information provided includes the following mitigation techniques (elevation, floodproofing, electrical grounding devices, generators, insulating water pipes, xeriscaping, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, educate engineers, public works, and contractors on expansive soil construction techniques such as: apply calcium soil stabilizers in high soil rating areas and the installation of property perimeter drainage systems.

Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural Severe Winter Storm, Dam/Levee Failure, Expansive Soils
Mitigation Strategy:	Public Outreach and Awareness
Priority:	High
Estimated Cost:	$5,000 annually
Potential Funding Sources:	Grants/General fund
Lead Agency/Department Responsible:	GCOEM, Emergency Management, and applicable state/federal agencies
Timeframe for Completion:	2016-2020

LM-2016-1: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

LM 2016-2: Install lightning grounding systems and protection devices on critical facilities/infrastructure	
Mitigation Goal/Objective	1/1.2
Site and Location:	Citywide
Background/Next Steps:	Lightning strikes can create outages to essential water and sewer services as well as invite unnecessary damage to critical facilities. Develop/implement a program to establish lightning grounding systems on critical water and sewer system elements and other facilities prone to strikes.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	Moderate
Estimated Cost:	To be determined
Potential Funding Sources:	General funds

Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

LM 2016:3 Develop Critical Infrastructure and Key Resources database (CIKR)	
Mitigation Goal/Objective	2/2.1
Background/Next Steps:	A comprehensive database of critical facilities and infrastructure to build out a mapping system will further the planning area's preparedness and response abilities for all hazards. Develop a listing of properties to include, facility name, latitude/longitude, physical address, number of people based in facility, building and content value, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural Severe Winter Storm, Dam/Levee Failure
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

LM 2016-4: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices. Include building construction requirements to address areas with high expansive soils to include property perimeter drainage systems, subgrade irrigation systems, applying calcium soil stabilizers, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural Severe Winter Storm, Dam/Levee Failure, Expansive Soils
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2016-2020

LM 2016-5: Become a Certified NWS StormReady Community	
Mitigation Goal/Objective	2/2.4
Background/Next Steps:	StormReady helps arm America's communities with the communication and safety skills needed to save lives and property-before and during an event. StormReady helps leaders and emergency managers strengthen local safety programs. StormReady communities are better prepared to save lives from the onslaught of severe weather through advanced planning, education, and awareness. Contact NWS before applying, complete application, schedule verification meeting and receive approval.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Severe Winter Storm
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	Undetermined
Potential Funding Sources:	General Funds
Lead Agency/Department Responsible:	Emergency Manager
Timeframe for Completion:	2016-2020

LM 2016-6: Implement the Corp of Engineers study of the Galveston County Water Reservoir Dam and Levee system	
Mitigation Goal/Objective	1/1.1, 1.2, 1.3, 1.4, 1.5
Background/Next Steps:	Review the findings of a potential breach to the dam/levee system and develop/implement mitigation actions as applicable to address location, extent and impact.
Hazard(s) Addressed:	Dam/Levee Failure
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration and applicable departments
Timeframe for Completion:	2018-2020

Table 21.20: League City 2016-2020 Mitigation Action Plan

LC 2005-1: Stormwater Drainage Improvement	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	The project consists of proposed slope paving (concrete lining) improvements to the following drainage rights-of-way throughout the city: • Interurban Ditch, north from FM 518 (900 Feet, $312,000) – Designed but on hold due to costs associated with stream bank mitigation. Newport Ditch, north from FM 518, (900 Feet, $360,000) – pending funding, will be performed after Interurban Ditch • Bradshaw Road, southwest from SH 3 to the north line of CCISD's Elem. School # 25 (1,200 Feet, $390,000) – pending funding • Nottingham Ditch from Calder Road to the Old Interurban Right-of-Way (3,200 Feet, $1,335,000) – still in planning, consultant hired. Design complete and pending construction funding
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$2,397,000
Potential Funding Sources:	City Funds, FEMA Mitigation Grant Funds
Lead Agency/Department Responsible:	Public Works and Engineering
Timeframe for Completion:	Upon funding approval to 2020
Analysis	
2010 – Pending funding	
2016– Nottingham and Interurban are pending construction funding	

LC 2005-2: Highland Terrace Drainage	
Mitigation Goal/Objective:	1/1.5
Site and Location	FM 518, Highland Terrace Drive
Background/Next Steps:	The proposed project includes: • Slope paving a portion of the drainage ditch north of FM 518, with probable wetland mitigation. • Lowering the pavement section of Highland Terrace Drive, with attendant utility adjustments. This project will reduce the number of repetitive flood losses in the sub-watershed area. There are six repetitive loss structures on Highland Terrace Drive that would benefit from this project.

Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$4,000,000
Potential Funding Sources:	City Funds, FEMA Mitigation Grant Funds
Lead Agency/Department Responsible:	Public Works and Engineering
Timeframe for Completion:	Dependent upon funding
Analysis	
2010- Drainage study done, but no further action taken. Not in CIP due to drainage improvement in the Conoco-Phillip corridor (FY 2012). Studies have indicated that resolution should be within the FM518 and Wesley intersection at a higher cost. Project unfunded	
2016–No funding approval to date, continue to seek funding.	

LC 2005-3: Kansas Street Drainage	
Mitigation Goal/Objective:	1/1.5
Site and Location	Kansas Street
Background/Next Steps:	The purpose of this project is change the existing roadway section from a flexible based, open ditch rural pavement section to a 28-feet wide, concrete curb and gutter urban pavement section with enclosed conduit storm sewer system. It is proposed that the pavement section be lowered 12 to 18 inches, thereby providing a route for overland sheet flow in extreme rainfall events. In addition, staff proposes to provide irrigation along the street using treated grey-water from the Dallas Salmon Wastewater Treatment Plant and an 8-foot wide concrete trail along one side of the new roadway section. This project will reduce the number of repetitive flood losses in the neighborhood. There are approximately 10 undeveloped lots in this area whose future residents will benefit from this project.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm, Windstorm, Tornado
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$3,610,000
Potential Funding Sources:	City Funds, FEMA Mitigation Grant Funds
Lead Agency/Department Responsible:	Public Works and Engineering
Timeframe for Completion:	2019-2020
Analysis	

2010 - This project will provide extreme event overflow (such as the flooding that occurred on April 18, 2009) to a natural stream. Project unfunded.
2016 – Project remains unfunded, protected to be completed in FY 2019

LC 2005-4: Shellside Detention	
Mitigation Goal/Objective:	1/1.5
Site and Location	SH 96 to Shellside area and Tuscan Lakes Development Area
Background/Next Steps:	The proposed Robinson Gully – Profile 6E Drainage Extension is to extend approximately 1,500 linear feet of an earthen channel south from SH 96 to the Shellside area. The channel will have a 10-feet wide bottom and be approximately 9 feet deep, thereby providing a deep outfall for the area. This project will reduce repetitive flood losses (there is one SRL property in the area) and protect many lower-income residents, most of whom cannot afford flood insurance, from flooding. This project will provide drainage for the many new homes and businesses that are projected to be built in the Tuscan Lakes development area.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$500,000
Potential Funding Sources:	City Funds, FEMA Mitigation Grant Funds
Lead Agency/Department Responsible:	Public Works and Engineering
Timeframe for Completion:	2016-2020
Analysis	
2016 –Formally Robinson Gully Drainage	

LC 2005-6: Develop a Tornado Public Education Campaign	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	Develop a tornado public education campaign to provide tornado hazard information to the residents.
Hazard(s) Addressed:	Tornado, Windstorm
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	City Funds

Lead Agency/Department Responsible:	Office of Emergency Management in coordination with CCISD and local private schools
Timeframe for Completion:	2016-2020

LC 2005-7: Install Lightning/Surge Protection Equipment at City Buildings	
Mitigation Goal/Objective:	1/1.2
Background/Next Steps:	Provide external and/or internal lightening and surge protection equipment to city buildings and other critical infrastructure. Provides protection to electrical equipment housed within existing and future public buildings.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	City Funds
Lead Agency/Department Responsible:	Office of Emergency Management, Facilities Maintenance
Timeframe for Completion:	2016-2020
Analysis	
2010- Since the creation of this mitigation action the City has constructed a new public safety building. This building is equipped with physical and electrical lightning and surge protection.	
2016 - As future buildings are designed and constructed the city will continue to implement these protections.	

LC 2005-8: Homeowner Mitigation Incentive Campaign	
Mitigation Goal/Objective:	1/1.1
Background/Next Steps:	League City is prone to many natural hazards. Provide partial compensation to homeowners that mitigate their primary residence against hazards in an effort to reduce damage from future impacts. Potential projects could include: • installation of storm shutters or protective window film • upgrading roofs and garage doors to meet current wind codes • installation of electrical surge protection • installation of subgrade irrigation systems • application of calcium soil stabilizers • other projects as identified
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Extreme Heat, Expansive Soils
Mitigation Strategy:	Property Protection

Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	FEMA Mitigation Grant Funds, Other Grant Funds
Lead Agency/Department Responsible:	Office of Emergency Management, Buildings
Timeframe for Completion:	Upon funding approval to 2020
Analysis	
2010 – pending funding	
2016 – pending funding	

LC 2016-1: Clear Creek Federal Project - South Belt Detention aka MUD Gully Detention	
Mitigation Goal/Objective:	1/1.5
Site and Location	South Belt Detention aka Mud Gully Detention:
Background/Next Steps:	This project was identified in the Clear Creek Federal Project study as being effective for flood management but did not yield a high enough cost benefit ratio for Federal funding. Therefore, Harris and Galveston County have decided to fund this effort. Information for the Public will be available at http://www.hcfcd.org as the project progresses toward. This project is managed by Harris County Flood Control and monitored by the Clear Creek Watershed Steering Committee. Designed in 2012 and 2013. Phase1 Construction started in 2014. Reduces or maintains BFE upstream and downstream thereby reducing the 1% flood zone
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$10,000,000
Potential Funding Sources:	Harris and Galveston County
Lead Agency/Department Responsible:	Engineering
Timeframe for Completion:	2016-2020

LC 2016-2: Elevate Homes in RL and SRL Properties	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Flooding is prone to the area and has caused damage to the properties involved in the program. Existing structures will be elevated above floodplain (BFE) on a voluntary basis. - Elevating homes from the floodplain will reduce long-term, repetitive

	loss. - Elevating homes from in the floodplain will contribute towards Activity 530 (Flood Protection) in the CRS program.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$4,600,000
Potential Funding Sources:	HMGP/FMA, federal and state grants
Lead Agency/Department Responsible:	Building Department
Timeframe for Completion:	Upon funding approval to 2020

LC 2016-3: Increased Freeboard - Update City ordinance to require 24" of freeboard in the floodplain.	
Mitigation Goal/Objective:	2/2.2
Site and Location	Citywide
Background/Next Steps:	Increasing freeboard will reduce an individual structure's vulnerability to floodwaters. Increasing freeboard will contribute towards Activity 430 (Higher regulatory standards) in the CRS program and will generate points toward improving the City's CRS rating. Homeowners in the floodplain will see a reduction in their flood insurance premiums if the City's CRS rating improves. Homeowners with 24" of freeboard will enjoy reduced flood insurance premiums relative to homeowners whose houses are elevated to the current standard of 18" of freeboard. Substantially improved/damaged existing structures that need to be brought into compliance with code will have to elevate to a higher design flood elevation.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	Building Department
Timeframe for Completion:	2016-2020

LC 2016-4: Acquisition and Relocation	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide

Background/Next Steps:	Buying and removing property from the floodplain will reduce long-term, repetitive flood loss. The open space created by the removal of insured property will facilitate drainage and allow for the creation of recreation areas. Buying and removing property from the floodplain will contribute towards Activity 520 (Acquisition and relocation of buildings) in the CRS program.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$300,000,000
Potential Funding Sources:	City Funds, Federal and State Grants
Lead Agency/Department Responsible:	Building Department
Timeframe for Completion:	Upon funding approval to 2020

LC 2016-5: Lightning Monitoring	
Mitigation Goal/Objective:	1/1.2
Site and Location	Citywide
Background/Next Steps:	The mobile units will provide early detection capabilities at city events and park facilities. Install a permanent lightning detection system at the fire department drill field. Also purchase 3 portable detectors to be placed in fire department response vehicles.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$5,000
Potential Funding Sources:	City funds
Lead Agency/Department Responsible:	Fire Department, Emergency Management
Timeframe for Completion:	2017-2020

LC 2016-6: Develop and Provide Public Outreach and Education	
Mitigation Goal/Objective:	3/3.1
Site and Location	Citywide
Background/Next Steps:	Design a new outreach program that will take into account new storm surge graphics and warnings from the National Weather Service. Offer more accurate mapping of the hazard to citizens via the city's website, social media and physical maps to be distributed at outreach events, provide information on mitigation techniques such as roof and foundation

	supports, shatter proof and high wind doors and windows, shutters, elevation, floodproofing, electrical grounding devices, generators, insulating water pipes, xeriscaping, create defensible space around power and gas lines, cover electrical/mechanical systems, encourage purchase/use of weather radios, seek covered shelter in the event of severe weather events (lightning, hail, high wind) etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Extreme Heat, Expansive Soils
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$10,000
Potential Funding Sources:	City Funds and available grants
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020

LC 2016-7: Planting of Trees	
Mitigation Goal/Objective:	1/1.1
Site and Location	Citywide
Background/Next Steps:	Increase tree plantings around public buildings and right of ways to reduce the urban heat island effect.
Hazard(s) Addressed:	Extreme Heat
Mitigation Strategy:	Prevention
Priority:	Low
Estimated Cost:	$50,000
Potential Funding Sources:	City funds
Lead Agency/Department Responsible:	Planning and Zoning
Timeframe for Completion:	Dependent on funding approval to 2020

LC 2016-8: Safe Rooms/Community Shelters	
Mitigation Goal/Objective:	1/1.1
Site and Location	Citywide
Comments	The area is prone to tornado and high wind events. Encourage construction and use of safe rooms in existing and new structures. Allow citizens to install safe rooms at a significant discount in preexisting homes. Provide homeowners and developers with funds to assist in installing a safe room in new homes.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	Unknown
Potential Funding Sources:	FEMA HMGP
Lead Agency/Department Responsible:	Emergency Management, Planning and Zoning and Building
Timeframe for Completion:	Dependent on funding approval to 2020

Table 21.21: Santa Fe 2016-2020 Mitigation Action Plan

SF 2016-1: Stormproof / retrofit new critical facilities and infrastructure	
Mitigation Goal/Objective:	1/1.2
Site and Location	Citywide
Background/Next Steps:	New construction and existing critical facilities and infrastructure should include advanced mitigation techniques. Measures include, elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Severe Winter Weather, Wildfire (Urban and Rural), Drought
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General fund, HMGP, PDM, CDBG
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon funding approval to 2020

SF 2016-2: Harden existing critical facilities and infrastructure to be more resistant to hazards	
Mitigation Goal/Objective:	1/1.2
Site and Location	City Hall, Maintenance Building, Library, and Community Center
Background/Next Steps:	Continuity of emergency services and general governmental operations is necessary to protect staff and county property. Existing facilities may be lacking protective measures and adequate building standards. Mitigation options may include the provision of elevation, Nema enclosures, elevation, floodproofing, stabilization of soils in construction, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc. Potential hardening projects may include any municipal building and public infrastructure. The following improvements have been noted: • City hall – windows and doors • Maintenance building, Library, and Community Center – roof, windows and doors
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Severe Winter Weather, Wildfire (Urban and Rural), Drought
Mitigation Strategy:	Property Protection
Priority:	Moderate

Estimated Cost:	$2,000,000
Potential Funding Sources:	HMGP, PDM, General Fund, CDBG
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon funding approval to 2020

SF 2016-3: Build storm water detention ponds when appropriate	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Detention ponds/basins could be a solution for addressing flood impacts.
Hazard(s) Addressed:	Flooding, Hurricane/Tropical Storm
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	Developers, general fund
Lead Agency/Department Responsible:	City administration
Timeframe for Completion:	Upon funding approval to 2020

SF 2016- 4: Purchase and install generators for existing and new critical facilities and infrastructure	
Mitigation Goal/Objective:	
Site and Location	City Hall and Street Department
Background/Next Steps:	Generators are essential for providing continual operations in the event of a disaster. As funding becomes available, the city will apply for grants to install generators to support existing or new facilities/infrastructure. At this time, City Hall and the Street Department are in need of a generator
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Severe Winter Weather, Extreme Heat
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$500,000
Potential Funding Sources:	HMGP, PDM, General funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon funding approval to 2020

SF 2016-5: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide - see Section 22 and Appendix E for listing of non-mitigated properties

Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP, FMA, General Funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	Upon funding approval to 2020

SF 2016-6: Widen drainage systems and culverts	
Mitigation Goal/Objective	1/1.5
Site and Location:	Citywide
Background/Next Steps:	The drainage systems and culverts throughout the county are frequently impacted by flood and severe weather events. Coordinate efforts with water district to widen drainage systems and increase culvert size to accommodate increased water flows.
Hazard(s) Addressed:	Flooding, Severe Winter Weather, Hurricane/Tropical Storm, Tornado, Windstorm, Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	CDBG, HMGP, General Funds
Lead Agency/Department Responsible:	City Administration and applicable department and water district staff
Timeframe for Completion:	Upon funding approval to 2020

SF 2016-7: Purchase and install lightning grounding systems and protection devices on sewer and water systems and municipal buildings	
Mitigation Goal/Objective	1/1.2
Site and Location:	Citywide
Background/Next Steps:	Lightning strikes can create outages to essential water and sewer services as well as invite unnecessary damage to critical facilities. Develop/implement a program to establish lightning grounding systems on critical water and sewer system elements and other facilities prone to strikes.
Hazard(s) Addressed:	Lightning
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$50,000

Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2026

SF 2016-8: Implement / maintain tree /vegetation trimming/removal near, infrastructure, drainage systems and roadside areas	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Trees and other vegetation can encroach overhead power line, drainage systems and road ways potentially causing loss of service and/or accidents during and after various weather events Keep areas of concern free of unnecessary debris as needed.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$5,000
Potential Funding Sources:	General funds
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

SF 2016-9: Develop Critical Infrastructure and Key Resources database (CIKR)	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	A comprehensive database of critical facilities and infrastructure to build out a mapping system will further the planning area's preparedness and response abilities for all hazards. Develop listing of properties to include, facility name, latitude/longitude, physical address, number of people based in facility, building and content value, etc.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No Cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

SF 2016-10: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective:	2/2.2
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	No cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

SF 2016-11: Develop and provide public information and awareness for natural hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, electrical grounding devices, generators, insulating water pipes, xeriscaping, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Drought, Extreme Heat, Wildfire (Urban and Rural), Severe Winter Storm
Mitigation Strategy:	Education and Awareness
Priority:	High
Estimated Cost:	No cost
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration in coordination with county and state officials
Timeframe for Completion:	2016-2020

Table 21.22: Tiki Island 2016-2020 Mitigation Action Plan

TI 2011-2: Implement water conservation awareness campaign (at Citywide Fourth of July picnic and other local activities.)	
Mitigation Goal/Objective:	3/3.1
Site and Location	Citywide
Background/Next Steps:	Past damages include post-Hurricane Ike water shortages, early 2009 Brazos watershed drought, numerous summer heat waves causing high water consumption and low water pressure. Publish information citywide; attend functions where citizens gather such as 4th of July at public park-man booth to promote program and answer questions
Hazard(s) Addressed:	Drought, Extreme Heat
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	$2,000
Potential Funding Sources:	General Fund, TCEQ, TWDB
Lead Agency/Department Responsible:	Water District
Timeframe for Completion:	2016-2020

TI 2011-5: Elevate 11 wastewater lift stations and provide backup power	
Mitigation Goal/Objective:	1/1.2
Site and Location	Numerous locations within city of Tiki Island
Background/Next Steps:	Electronic panels will be elevated above base flood elevations, requiring OSHA complaint work platforms. Quick connect backup power connections will be added, and two trailer based portable generators will be rotated among lift stations as needed.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Tsunami, Flooding, Tornado, Windstorm, Lightning, Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$950,000
Potential Funding Sources:	CDBG, HMGP, General Fund
Lead Agency/Department Responsible:	Water District
Timeframe for Completion:	2016-2020 (dependent on funding)
Analysis	
2016 – Funding Required	

TI 2011-8: Purchase new Emergency Notification System (ENS).	
Mitigation Goal/Objective:	1/1.1
Site and Location	802 Tiki Drive
Background/Next Steps:	In the aftermath of Hurricane Ike, City officials were unable to communicate with displaced citizens. The emergency notification system will be capable of easily registering citizens' cell phones, email, and VOIP lines. The system will be tested to insure completeness and accuracy of data. Prompt communication to inform residents when they can safely return to their homes and businesses will reduce looting and vandalism.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Tsunami, Severe Winter Storm
Mitigation Strategy:	Emergency Services
Priority:	High
Estimated Cost:	$5000
Potential Funding Sources:	General fund
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020 (dependent on funding)
Analysis	
2016 – Funding Required	

TI 2011-9: Replace the Tiki Drive bridge with an improved, hardened bridge to withstand storm surge and debris.	
Mitigation Goal/Objective:	1/1.2
Site and Location	300 to 400 Tiki Drive
Background/Next Steps:	This bridge is the only access to the City of Tiki Island. Hurricane Ike caused some damage to bridge and an unknown degree of scouring. Improving the bridge decking to withstand higher storm surge will insure that the ingress/egress is available for emergency evacuation and operations. Replace three section spans with single span, eliminating potential failure of current bridge supports in channel.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tsunami
Mitigation Strategy:	Structural
Priority:	High
Estimated Cost:	$4.8 million
Potential Funding Sources:	CDBG, County road & Bridge
Lead Agency/Department Responsible:	TXDOT, mayor
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding Required	

TI 2011-10: Become a NOAA "Storm Ready" community	
Mitigation Goal/Objective:	1/1.1
History of Damages	Emergency Services
Background/Next Steps:	Recent storms have shown the vulnerabilities of this coastal community. To be officially StormReady, a community must: • Establish a 24-hour warning point and emergency operation center • Have more than one way to receive severe weather warnings and forecasts and to alert the public • Create a system that monitors weather conditions locally • Promote the importance of public readiness through community seminars • Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises Next Steps: Pursue requirements to become a StormReady community. Download and complete application from http://www.stormready.noaa.gov/apply.htm.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Severe Winter Storm
Mitigation Strategy:	N/A
Priority:	High
Estimated Cost:	$150,000
Potential Funding Sources:	Unknown at this time
Lead Agency/Department Responsible:	Emergency Management
Timeframe for Completion:	2016-2020
Analysis	
2016 – Funding required.	

TI 2011-13: Implement a tree trimming program that clears tree limbs from public right of ways	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Tree limbs and brush that falls during extreme temperature events block access of streets from first responders, clog storm sewers, down power lines and prevent road access. Minimizing falling tree limbs protects structures from damage during extreme temperature and weather events
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Tsunami, Severe Winter Storm
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	$50,000/year

Potential Funding Sources:	Grants, City Funds
Lead Agency/Department Responsible:	City Dept.
Timeframe for Completion:	2016-2020

TI 2011-14: Develop and conduct a fire safety and prevention program	
Mitigation Goal/Objective:	3/3.1
Site and Location	Citywide
Background/Next Steps:	Due to extreme heat, drought, and lightning strikes during storms, the City is susceptible to fire hazard incidents. Develop and provide residents and business owners with mitigation techniques to reduce or eliminate future impacts such as creating defensible spaces, xeriscape, permeable driveways and surfaces, etc.
Hazard(s) Addressed:	Lightning, Extreme Heat, Drought
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	General Funds, Federal and State Grants
Lead Agency/Department Responsible:	Public Safety/Fire Marshal
Timeframe for Completion:	2016-2020

TI-2016-1: Mitigate (elevate, reconstruct, acquisition, demolition) Repetitive Flood Claim / Severe Repetitive Loss (RFC/SRL) properties	
Mitigation Goal/Objective	2/2.5
Site and Location:	Citywide – see Section 22 and Appendix E for listing of non-mitigated properties
Background/Next Steps:	Grant funding through the HMGP (Flood Mitigation Assistance) may be used to mitigate RFC and SRL properties. Mitigation options (elevate, reconstruct, acquisition, demolition, etc.) will be implemented with property owners as funding and opportunities arise.
Hazard(s) Addressed:	Flooding
Mitigation Strategy:	Property Protection
Priority:	High
Estimated Cost:	To be determined
Potential Funding Sources:	HMGP/FMA
Lead Agency/Department Responsible:	City Administration and applicable state and county agencies
Timeframe for Completion:	Upon funding approval to 2020

TI 2016-2: Improve regulations and permit requirements to promote hazard mitigation strategies	
Mitigation Goal/Objective:	2/2.2
Site and Location	Citywide
Background/Next Steps:	Update and/or develop regulations and permits to address hazards prone to the area and include any changes in future development areas. Develop regulation restricting development in areas with soil considered poor or unsuitable for development and installation of electrical grounding devices.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Severe Winter Storm, Coastal Erosion and Retreat
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	N/A
Potential Funding Sources:	Budget
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

TI 2016-3: Develop and provide public information and awareness for natural hazards	
Mitigation Goal/Objective:	3/3.1
Background/Next Steps:	The planning area has several outreach initiatives to communicate hazard preparedness information to the general public and visitors to the area. Providing timely information and educational information related to preparedness, mitigation, response, and recovery to the public fosters their ability to become self-sufficient. Information provided includes the following mitigation techniques (elevation, floodproofing, electrical grounding devices, generators, insulating water pipes, xeriscaping, open foundations to minimize scour, roof and foundation supports, shutters, shatter-proof and high wind doors and windows, create defensible space around power lines, oil/gas lines, etc.); evacuation routes/procedures; workshop/training programs; alert systems, and the like.
Hazard(s) Addressed:	Hurricane/Tropical Storm, Flooding, Tornado, Windstorm, Hailstorm, Lightning, Tsunami, Drought, Extreme Heat, Severe Winter Storm, Coastal Erosion and Retreat
Mitigation Strategy:	Public Education and Awareness
Priority:	High
Estimated Cost:	N/A
Potential Funding Sources:	N/A
Lead Agency/Department Responsible:	City Administration
Timeframe for Completion:	2016-2020

22.0 Repetitive Flood Properties

22.1 National Flood Insurance Program (NFIP) Participation

Flood insurance offered through the National Flood Insurance Program (NFIP) is the best way for home and business owners to protect themselves financially against the ravages of flooding. All jurisdictions in this plan update participate in the NFIP.

Community Rating System (CRS) Participation

The NFIP's Community Rating System (CRS) is a voluntary incentive program that recognizes jurisdictions for implementing floodplain management practices that exceed the minimum federal requirements of the NFIP to provide protection from flooding.

In exchange for a community's proactive efforts to reduce flood risk, policyholders can receive reduced flood insurance premiums for buildings in the community. These reduced premiums reflect the reduced flood risk resulting from community efforts toward achieving the three CRS goals:

1. Reduce flood damage to insurable property
2. Strengthen and support the insurance aspects of the NFIP
3. Encourage a comprehensive approach to floodplain management

Participation in the CRS is voluntary. By participating, jurisdictions earn credit points that determine classifications. There are 10 CRS Classes: Class 1 requires the most credit points and provides the largest flood insurance premium reduction (45 percent) while Class 10 means the community does not participate in the CRS or has not earned the minimum required credit points, and residents receive no premium reduction. The CRS Classes are based on completion of 19 creditable activities organized into four categories:

CRS Class	Premium Discount	CRS Class	Premium Discount
1	45%	6	20%
2	40%	7	15%
3	35%	8	10%
4	30%	9	5%
5	25%	10	----

1. Public Information
2. Mapping and Regulations
3. Flood Damage Reduction
4. Warning and Response

Table 22.1 provides an overview of each community's participation in the NFIP and CRS as of September 2014. As indicated, four jurisdictions are currently participating in the CRS program. Each jurisdiction will continue to seek opportunities to improve or join the CRS program.

Table 22-1: NFIP Participation as of September 2014

CID	Community	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Regular / Emergency Date	CRS Rating
481589	Bayou Vista				04/09/71	
485461	Clear Lake Shores	10/23/70	10/23/70	04/04/83	10/23/70	
485468	Friendswood	06/05/70	03/03/72	09/22/99	03/03/72	7[1]
485470	Galveston County		04/09/71	12/06/02	04/09/71	
485479	Hitchcock	11/17/70	11/13/70	04/04/83	11/13/70	
481271	Jamaica Beach		04/08/71	12/06/02	04/08/71	
485481	Kemah	06/05/70	10/16/70	04/04/83	10/16/70	8[1]
485486	La Marque	05/26/70	10/16/70	02/16/83	10/16/70	
485488	League City	06/05/70	06/05/70	09/22/99	11/20/70	6
481562	Santa Fe	09/02/80	04/08/71	10/18/83	04/09/71	
481585	Tiki Island	04/09/71	04/09/71	11/01/85	04/15/83	8

Source: FEMA Community Status Book Report 01/19/16 http://www.fema.gov/cis/TX.html
Community Rating System Communities 06/01/14 www.fema.gov/media-library/assets/documents/15846

Note: [1]Reflects current CRS rating for Friendswood and Kemah.

22.2 Repetitive Loss and Severe Repetitive Loss Properties

A high priority in Texas and nationwide is the reduction of structures with repetitive losses. These structures strain NFIP. They increase the NFIP's annual losses and the need for borrowing and, more importantly, they drain resources needed to prepare for catastrophic events. The NFIP defines a repetitive loss property (RL) as "any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period since 1978. At least, two of the claims must be more than 10-days apart."

The Flood Insurance Reform Act of 2004 identified another category of repetitive loss. Severe repetitive loss (SRL) is defined as "a single family property (consisting of one-to-four residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which four or more separate claim payments (building and contents) have been paid under flood insurance coverage with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least two separate claim payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the reported value of the property."

The planning team reviewed the list of RL/SRL properties received from the Galveston County Housing and Economic Development (Report date September 2014) to determine how many properties that remain unmitigated are in the program compared to how many have been mitigated (Appendix H provides a property listing by jurisdiction, excluding addresses).

Table 22-2 provides a summary by occupancy type and reflects the total number of properties reported as mitigated to date. Additional details regarding insurance status and the number of flood claims and total amounts paid from 1978 to September 2014 are provided in Table 22-3.

Table 22-2: Summary of Repetitive Flood Properties by Occupancy Type and Number of Properties Mitigated

Community	2-4 Family	Assmd. Condo	Non-Resident	Other Resident	Single Family	Total RF Properties	No. of Mitigated Properties
Bayou Vista	0	0	0	0	45	45	9
Clear Lake Shores	1	2	13	1	86	103	53
Friendswood	1	4	5	2	295	307	129
Hitchcock	0	1	4	0	100	105	34
Jamaica Beach	0	1	0	0	44	45	4
Kemah	2	3	30	3	74	112	79
La Marque	0	1	5	0	69	75	6
League City	1	3	7	2	220	233	111
Santa Fe	0	0	7	1	114	122	11
Tiki Island	0	0	0	0	2	2	0
Galveston County-Unincorporated							
Alta Loma	0	0	1	0	4	5	3
Arcadia	0	0	0	0	1	1	0
Bacliff	1		6		60	67	4
Caplen	0	0	0	0	2	2	2
Crystal Beach	0	1	3	0	55	59	46
Gilchrist	1	1	4	0	68	74	72
High Island	0	0	0	0	2	2	1
Port Bolivar	0	0	4	0	63	67	46
San Leon	1	0	2	0	29	32	10
Seabrook	0	0	1	0	0	1	1
Total	8	17	92	9	1,333	1,459	621

Table 22-3: Summary of Repetitive Flood Properties Flood Claims and Total Payments Received 1978 to 2014

Community	No. of RF Properties	No. of Insured Properties			Flood Claims	Total Payments ($)
		No	Yes	SDF[1]		
Bayou Vista	45	29	5	11	196	4,901,778
Clear Lake Shores	103	61	36	6	408	9,838,341
Friendswood[2]	307	184	95	28	1177	48,719,984
Hitchcock	105	75	23	7	339	5,554,124
Jamaica Beach	45	31	12	2	133	3,173,088
Kemah	112	76	31	5	455	12,637,778
La Marque	75	66	7	2	274	1,887,720
League City[2]	233	130	88	15	728	17,383,753
Santa Fe	121	96	18	7	406	4,450,361
Tiki Island	2	1	1	0	6	33,624
Galveston County-Unincorporated:						
Alta Loma	5	5	0	0	16	156,890
Arcadia	1	1	0	0	2	48,108
Bacliff	67	42	22	3	228	3,259,796
Caplen	2	2	0	0	4	248,242
Crystal Beach	59	49	10	0	127	8,406,900
Gilchrist	74	70	4	0	191	9,491,736
High Island	2	2	0	0	4	84,493
Port Bolivar	67	58	7	2	189	6,250,562
San Leon	32	19	13	0	81	3,204,189
Seabrook	1	1	0	0	11	184,628
Total	1,458	998	372	88	4,975	$139,916,095

Source: Galveston County Housing and Economic Development, September 2014

Note: [1]Special Direct Facility–NFIP Insurance is obtained directly from FEMA/NFIP and not through local insurance brokers.
[2] Friendswood and League City have a few properties located in Harris County. Data for these properties is included in this table.

The NFIP also provides updates as to the total amounts paid on losses and policies in place. Table 22.4 provides a summary of these reports for the participating jurisdictions from 1978 to 2015.

Table 22-4: Summary of Loss and Policy Statistics 1978 to November 30, 2015

Community	Loss Statistics					Policy Statistics		
	No. Losses	Closed Losses	Open Losses	CWOP Losses	Total Payments	Policies In-Force	Insurance In-Force	Written Premium In-Force
Bayou Vista	27	27	0	0	$687,312	12	$2,326,700	$17,161
Clear Lake Shores	1,075	956	4	115	$24,307,538	534	$127,452,200	$367,874
Crystal Beach	660	484	0	176	$2,036,238	Included in Galveston County		
Friendswood	3,339	2,785	2	552	$86,475,320	6,845	$2,128,862,500	$2,884,981
Hitchcock	1,162	984	1	177	$17,226,974	812	$171,425,600	$512,197
Jamaica Beach	1,536	1,280	3	253	$22,293,349	915	$224,032,900	$1,211,719
Kemah	1,340	1,142	3	195	$40,886,780	532	$150,009,800	$443,487
La Marque	1,299	1,004	0	295	$11,992,475	1,551	$398,246,500	$788,355
League City	3,106	2,310	3	793	$42,388,008	14,568	$4,509,262,500	$5,934,617
Santa Fe	172	108	0	64	$1,322,706	1,080	$300,290,100	$431,887
Tiki Island	621	470	1	150	$6,299,524	568	$144,400,100	$2,089,404
Galveston County (Unincorporated)	16,448	14,125	37	2,286	$580,784,193	8,756	$2,258,675,700	$10,909,581

Source: Loss Statistics http://bsa.nfipstat.fema.gov/reports/1040.htm#48
Policy Statistics http://bsa.nfipstat.fema.gov/reports/1011.htm#TXT

Total losses - All losses submitted regardless of the status.
Closed losses - Losses that have been paid.
Open losses - Losses that have not been paid in full.
CWOP losses - Losses that have been closed without payment.
Total Payments - Total amount paid on losses.
Policies In Force - Policies in force on the "as of" date of the report.
Insurance In Force - The coverage amount for policies in force.
Written Premium In Force - The premium paid for policies in force

Progress Made on Repetitive Flood Properties

The largest SRL grant ever awarded in the nation went to Galveston County in 2011. More than $34 million was allocated to elevate 224 homes of which FEMA's SRL program covered 90 percent or $31 million. The properties were selected based on their SRL status and homeowner interest (source: fema.gov/news-release/2011/10/04).

Galveston County presented a voluntary buyout program through HMGP to property owners located on Bolivar Peninsula (Port Bolivar, Crystal Beach, Caplen, and Gilchrist), and Jamaica Beach, and Hitchcock (Freddiesville). As a result, Galveston County was able to purchase 550 properties (10 each in Jamaica Beach and Hitchcock, and 530 Bolivar Peninsula.

<u>Galveston County:</u>

- 2014 SRL program – 130 properties (101 completed or in progress and 29 pending)
- FMA Award – Texas City (4 reconstruction and 1 elevation)
- 2015 FMA Application Submitted – 40 elevation projects
- Housing Program – Round 1
    - 600 homes built
    - 8 demolition of slum/blighted properties
    - 59 single family rentals
- Housing Program – Round 2
    - 617 homes built
    - 31 veteran homes
    - 37 demolition of slum/blighted properties
    - 35 single family rentals
- Multi-family rental project
    - 2 projects with 51 single-family units
    - 1 rehabilitation project

Friendswood:

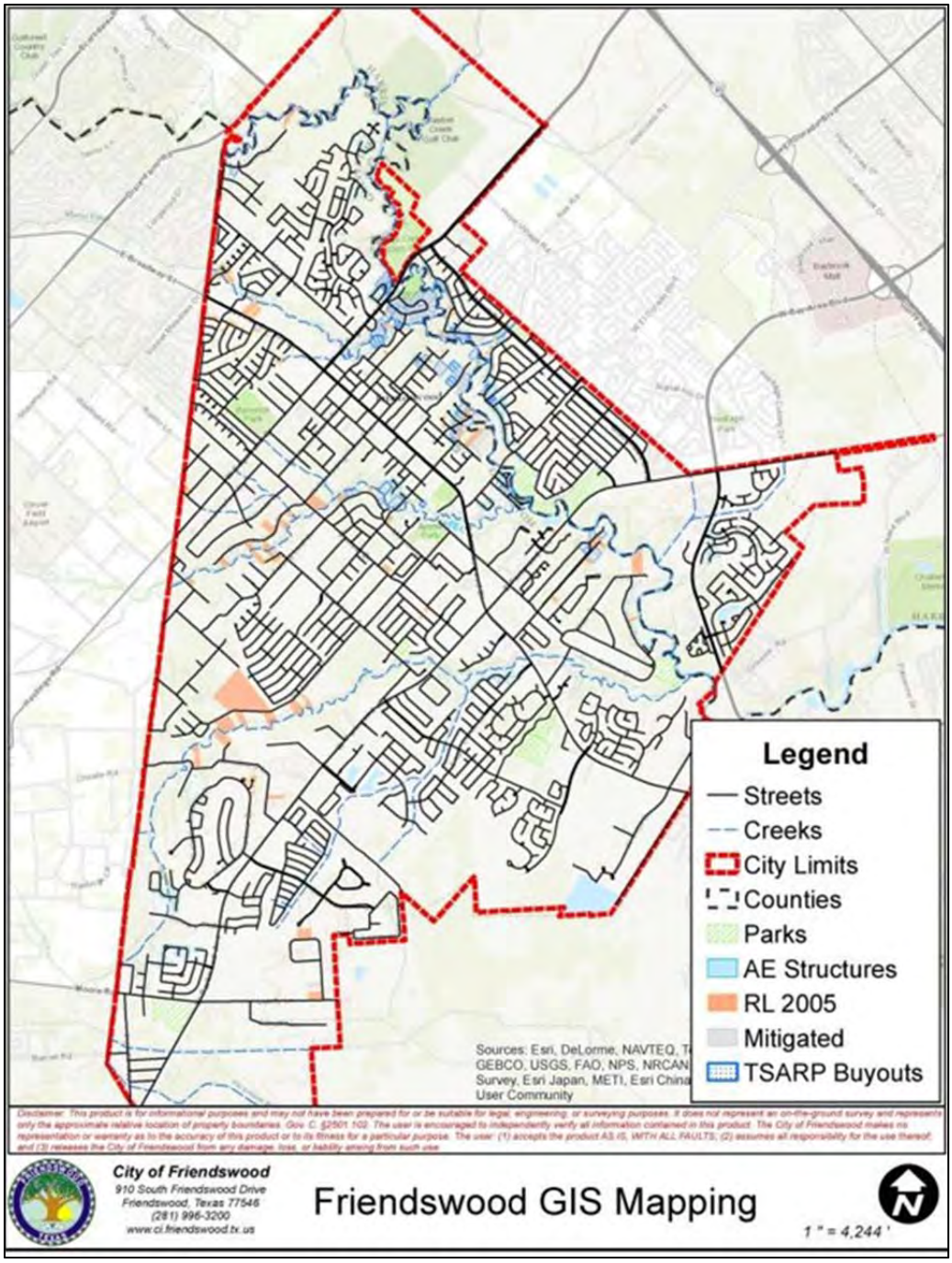
- 2013 HMA Grant Assistance program through the County (2011 SRL Award)
    - 14 contracts executed (90/10 funding)
        - four qualified for ICC (Increased Cost of Compliance) through private insurance carriers which went towards their 10 percent match
- 2001 Tropical Storm Allison Buyout Program
    - 112 properties removed

League City:

- 20 properties elevated at a cost of $4,064,272 (completed 2012-2014)
- 2 properties in progress at a cost of $508,962 (completion 2016)

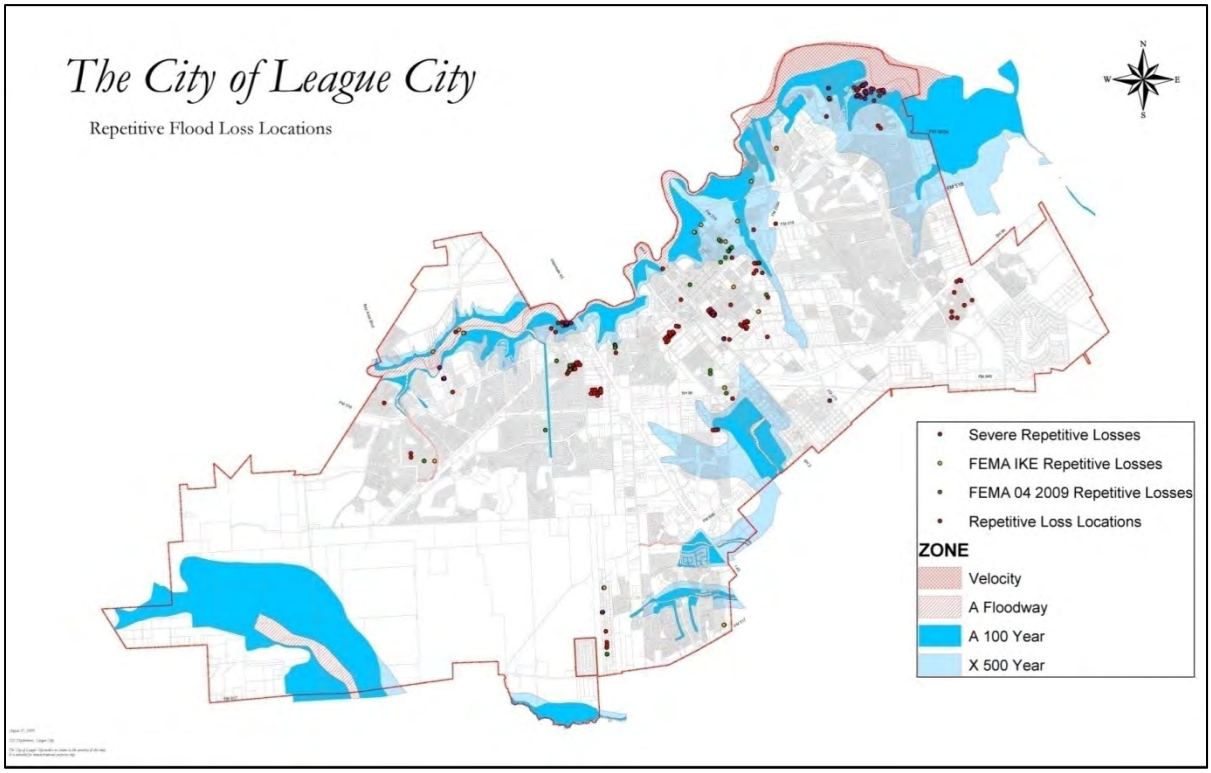
Figures 22.1 to 22.2 provide the general location of the repetitive flood properties that have been mapped by GIS for Friendswood and League City. The other jurisdictions are encouraged to develop GIS maps when feasible to further enhance their NFIP program.

Figure 22.1: Friendswood Repetitive Flood Properties



Source: City of Friendswood

Figure 22.2: League City Repetitive Flood Loss and Severe Repetitive Flood Loss Properties



Source: City of League City

Mitigating Repetitive Flood Properties

FEMA's Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (HMA) provide funding to assist jurisdictions in mitigating properties prone to flooding. Table 22.5 provides a listing of eligible activities typically funded through these programs.

Table No. 22.5: Eligible Activities by Program

Eligible Activities	HMGP	PDM	FMA
Property Acquisition and Structure Demolition The voluntary acquisition of an existing at-risk structure and, typically, the underlying land, and conversion of the land to open space through demolition of the structure. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions. For property acquisition and structure demolition projects, see Addendum A.	X	X	X
Property Acquisition and Structure Relocation The voluntary physical relocation of an existing structure to an area outside of a hazard-prone area, such as the Special Flood Hazard Area (SFHA) or a regulatory erosion zone and, typically, the acquisition of the underlying land. Relocation must conform to all applicable State and local regulations. The property must be deed-restricted in perpetuity to open space uses to restore and/or conserve the natural floodplain functions. For property acquisition and structure relocation projects, see Addendum, Part A.	X	X	X
Structure Evaluation Physically raising and/or retrofitting an existing structure to the Base Flood Elevation (BFE) or higher if required by FEMA or local ordinance. Elevation may be achieved through a variety of methods, including elevating on continuous foundation walls; elevating on open foundations, such as piles, piers, posts, or columns; and elevating on fill. Foundations must be designed to address properly all loads and be appropriately connected to the floor structure above, and utilities must be properly elevated as well. FEMA encourages Applicants and sub-applicants to design all structure elevation projects in accordance with the American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI) 24-05, Flood Resistant Design, and Construction. For additional information about structure elevation projects, see Addendum, Part E.	X	X	X
Mitigation Reconstruction The construction of an improved, elevated building on the same site where an existing building and/or foundation has been partially or completely demolished or destroyed. Mitigation reconstruction is only permitted for structures outside of the regulatory floodway or coastal high hazard area (Zone V) as identified by the existing best available flood hazard data. Activities that result in the construction of new living space at or above the BFE will only be considered when consistent with the mitigation reconstruction requirements.			X

Eligible Activities	HMGP	PDM	FMA
Dry Floodproofing Techniques applied to keep structures dry by sealing the structure to keep floodwaters out. For all dry floodproofing activities, FEMA encourages applicants and sub-applicants to design all dry floodproofing projects in accordance with ASCE/SEI 24-14. Dry Floodproofing is not permitted in the Coastal V Zone.			
- Dry Floodproofing of Historic Residential Structures Permissible only when other techniques that would mitigate to the BFE causing the structure to lose its status as a Historic Structure, as defined in 44 CFR Section 59.1.	X	X	X
- Dry Floodproofing of Non-Residential Structures Must be performed in accordance with NFIP Technical Bulletin (TB) 3-93, *Non-Residential Floodproofing—Requirements and Certification*, and the requirements pertaining to dry floodproofing of non-residential structures found in 44 CFR Sections 60.3(b)(5) and (c)(4).	X	X	X
Localized Flood Reduction Projects Projects to lessen the frequency or severity of flooding and decrease predicted flood damages, such as the installation or modification of culverts, and stormwater management activities, such as creating retention and detention basins. These projects must not duplicate the flood prevention activities of other Federal agencies and may not constitute a section of a larger flood control system.	X	X	X

Source: FEMA Hazard Mitigation Assistance Guidance, February 27, 2015, and Addendum to the Hazard Mitigation Assistance Guidance, February 27, 2015

22.3 Continued Compliance in the NFIP

Section 21 includes a mitigation action to mitigate (elevate, reconstruct, acquire, demolition) repetitive flood claim/severe repetitive loss properties for each participating jurisdiction. Table 22.6 provides a list of improvement/maintenance strategies designed to further strength the jurisdictions participation and compliance in the NFIP and CRS programs; thus reducing the cost of flood insurance to residents.

Table No. 22.6: NFIP/CRS Program Strategies

Jurisdiction	Strategy	Priority	Mitigation Goal/Objective	Responsible Agency
Galveston County	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	GCOEM
Bayou Vista	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	City Administration
Clear Lake Shores	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	City Administration

Jurisdiction	Strategy	Priority	Mitigation Goal/Objective	Responsible Agency
	Educate citizens on the dangers of flooding. Inform residents of the benefits of purchasing flood insurance	High	3 / 3.1	Emergency Management
Friendswood	Improve participation in the NFIP and CRS Programs	High	2 / 2.2	Community Development, Floodplain Manager, Office of Emergency Management
	Develop a RLAA (Repetitive Loss Area Analysis) to satisfy CRS rating through the ISO	High	2 / 2.1	Community Development – Floodplain Manager, Office of Emergency Management/Fire Marshal's Office, Assistance from Hazard Mitigation Committee
	Database Development & Maintenance for RL/SRL Properties - Elevation, Relocation & Acquisition	High	2 / 2.5	Floodplain Manager, Community Development, Parks & Recreation Department, Office of Emergency Management
Hitchcock	Improve participation in the NFIP and CRS Programs	High	2 / 2.2	City Administration
Jamaica Beach	Improve participation in the NFIP and CRS Programs	High	2 / 2.2	City Administration
	Develop system to maintain records of elevation certificate	High	2 / 2.2	City Administration
Kemah	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	City administration and applicable departments
La Marque	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	City administration and applicable departments
League City	Develop and Manage Repetitive Flood Loss Database	High	2 / 2.1	Building Department
Santa Fe	Improve participation in the NFIP and CRS Programs	High	2 / 2.5	City administration and applicable departments
Tiki Island	Improve participation in the NFIP and CRS Programs	High	2 / 2.1	Mayor with Building Inspector

In addition to the strategies outlined in Table 22.6, each participating jurisdiction is encouraged to work alongside the Galveston County Housing and Economic Development Office and the State NFIP Coordinator to accomplish the following tasks:

- Increase awareness among residents and business owners about NFIP insurance
- Schedule a community Assistance Visit (CAV) to ensure continued compliance with NFIP regulations
- Review status of the properties identified on the Repetitive and Severe Repetitive Flood Claim Properties list and report properties that have been mitigated
- Encourage local officials in Bayou Vista and Kemah to become Certified Floodplain Managers
- Develop GIS maps of the location of RF and SRL properties
- Participate in NFIP training workshops
- Continued enforcement of flood damage prevention ordinances and site plan reviews
- Update Stormwater Management/Drainage Master Plans, Floodplain Management Plans, and Flood Response Plans as warranted

Appendix A

Introduction

Appendix A-1

FEMA Approval Letter and Local Mitigation Plan Review Tool

U.S. Department of Homeland Security
Region VI
800 N. Loop 288
Denton, TX 76209-3698

FEMA

February 16, 2017

Ms. Sandra Fulenwider
State of Texas
Texas Division of Emergency Management
P.O. Box 4087
Austin, TX 78773-0220

RE: Approvable Pending Adoption of the Galveston County, Texas Multi-Jurisdiction Hazard Mitigation Plan.

Dear Ms. Fulenwider:

This office has concluded its review of the referenced plan, in conformance with the Final Rule on Mitigation Planning (44 CFR Part 201.6). Formal approval of this plan is contingent upon the adoption by resolution by the participants on Enclosure A, as well as the receipt of a CD containing all components of this plan.

Adopting resolutions must be submitted to this agency for review and approval no later than 90 days from the date of this letter. Failure to submit these resolutions in a timely manner could lead to a required update of the plan prior to FEMA approval.

Once this final requirement has been met, a letter of official approval will be generated. The Local Hazard Mitigation Planning Tool, with the reviewer's comments has been enclosed to further assist the jurisdictions in complying with planning requirements.

If you have any questions, please contact Jamie Leigh Price, HM Community Planner, at (940) 898-5440.

Sincerely,

Ronald C. Wanhanen
Chief, Risk Analysis Branch

Enclosure

cc: Marty Chester, R6-MT-HM
Connie Dill, R6-MT-HM

Enclosure A

Galveston County, Texas
Multi-Jurisdiction
Hazard Mitigation Plan Participants

Attached is the list of approved participating governments included in the February 09, 2017 review of the referenced Hazard Mitigation plan.

Community Name
1) Bayou Vista city
2) Clear Lake Shores city
3) Friendswood city
4) Galveston County
5) Hitchcock city
6) Jamaica Beach city
7) Kemah city
8) La Marque city
9) League City city
10) Santa Fe city
11) Tiki Island village

Adoption Submittal (Final)

Region 6 recommends that all jurisdictions refrain from adopting a plan until it has received an Approvable Pending Adoption status from FEMA. Following the issuance of Approvable Pending Adoption letter, all participants are provided 90 days to adopt the plan and submit it through the state to FEMA. For multi-jurisdictional plans, multiple adoptions should be submitted as a complete package as outlined below.

- Include a state transmittal letter containing:
  - Plan name, sub-grantee, FEMA funding source, grant or disaster number, and project number, as applicable.
  - Information on enclosed adoptions.
- Include an electronic (CD) version containing the final plan formatted as a single document, and all signed resolutions as an additional single document on the disk.
  - Track changes, strikethroughs, highlights must be removed from the final plan.
  - A bound paper copy of the plan is not required for this submittal.
  - Plan must be dated to final adoption month and year.
- E-mail submittals will not be accepted.
- Submittals which do not conform to the above requirements will be returned to the State for resubmission.

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Galveston County, TX	**Title of Plan:** Galveston County Multi-Jurisdictional Hazard Mitigation Plan 2016 to 2020	**Date of Plan:** August 2016
Local Point of Contact: Meaghan Kenney	**Address:** 1353 FM 646 Rd. West Suite 201 Dickinson, TX 77539	
Title: Deputy Emergency Management Coordinator		
Agency: Galveston County		
Phone Number: 281-309-5001	**E-Mail:** Meaghan.kenney@galvestoncountytx.gov	

State Reviewer: Raymond Mejia Alexander Straker	**Title:** Mitigation Planner Mitigation Planner	**Date:** 28JUN2016 01AUG2016

FEMA Reviewer: Mary Lover	**Title:** HM Community Planner	**Date:** 11/30/2016
Date Received in FEMA Region 6	11/18/2016	
Plan Not Approved	12/2/2016	
Plan Approvable Pending Adoption		
Plan Approved		

LOCAL MITIGATION PLAN REVIEW TOOL

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pg. 1-2; 2-2	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Pg. 2-7 to 2-11; 486-487	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pg. 2-7 to 2-11	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Pg. 2-12	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 2-18	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pg. 2-1; 2-15 to 2-18	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Pgs. 19-3 to 19-3 Pg. 19.5		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Pg. 5-9 Pg. 10-4 Pg. 12-5 Pg. 15-16 Pg. 19-7	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))		X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Pg. 22-1 to 22-4	X	

ELEMENT B: REQUIRED REVISIONS

B1. Corrections did not meet the requirements.

Location:

- **Dam failure** – The plan still does not provide the inundation areas for each of the jurisdictions at risk. Pg. 19-3 is not sufficient, as dam waters do not flow in an oval pattern around the dam.

  *Correct the discrepancies of who is at risk and if using maps, provide inundation areas for all participating jurisdictions that could be affected should there be a dam or levee failure. A topographical map can be used and an estimated inundation area can be identified. If a map is not used, provide a detailed description of the inundation areas, to include how far and wide the inundation is expected (feet, blocks, miles, etc.). If there is a data deficiency, then the plan needs to **clearly** state there is a data deficiency.*

  Revised narrative under location and Figure 19.2 (pgs. 19-2 and 19-3) – noting data deficiency

Extent:

- **Dam Failure –** The dam classifications on pg. 19-5 do not provide extent for dam failure, additionally, the "extent of impact" is in fact impact and not extent.

  Extent means the strength and magnitude of the hazard. For example extent could be described in terms of the specific measurement of an occurrence on a scientific scale, flood depth grids, and/or speed of onset. For dam failure, the most commonly provided method of extent is flood depth in inches and/or feet. Provide a range of flood depth that could impact those jurisdictions that would be affected by a dam failure.

  Revised narrative to include data deficiency on pg. 19-5 and enhanced wording
  Added mitigation actions GC-2016-11 (pg. 21-40), CLS 2016-5 (pg. 21-54), K-2016-6 (pg. 21-91, and LM-2016-6 (pg. 21-103) to review pending study by the US Army Corp of Engineers and develop/implement appropriate mitigation actions to address the location, extent and impact of a potential breach to the dam/levee system.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 20	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pg. 22-11 to 22-13	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Pg. 21-28	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Pg. 21-33 to 21-122 Pg. 21-32 Pgs. 21-65 to 68 Pgs. 21-100 to 103 Pg. 21-107-108 Pgs. 21-110-111	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Pg. 21-29 to 21-30; 21-33 to 21-122	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pg. 2-13 to 2-15	X	
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Pg. 3-21 to 3-25		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Pg. 21-2 to 21-27	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Pg. 21-29	X	
ELEMENT D: REQUIRED REVISIONS **D1. Corrections did not meet the requirements.** The plan is still discussing future development for the jurisdictions. It does not discuss each jurisdiction's development in hazard prone areas or if their vulnerability has increased or decreased **Since the last approved plan dated August 23, 2011.** Additionally, Section 3 stops with pg. 3-21. There is no Table 3-14 or pages 3-22 to 3-25. *Describe each participating jurisdiction's changes in development (residential, commercial, industrial, governmental, etc.) from **August 23, 2011 to present**, and whether the jurisdictions vulnerability has increased or decreased.* **Added Table 3-14 on pgs. 3-21 to 25 – Not included in the plan** **Table added on pgs. 3-21 to 3-25.**			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			X
ELEMENT E: REQUIRED REVISIONS **E2.** After receiving the approvable pending adoption letter from FEMA, at least one jurisdiction must formally adopt the plan and provide adequate documentation in order to obtain approval of the plan.			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (optional for State reviewers only; not to be completed by FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISION			

SECTION 2:
PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

LOCAL MITIGATION PLAN REVIEW TOOL

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

A2. While the plan identifies that the stakeholders were notified in various ways, it appears that they were primarily invited via word of mouth or through public notices. Stakeholders are not the same as the general public and should not be invited through word of mouth, press releases or Facebook pages, etc. A stakeholder is someone who has specific expertise that is needed during the planning process, but not they are not required to attend every meeting. Because of their specific expertise, Stakeholders should be invited through individual invitations, such as emails, letters and/or phone calls. There are a list of names and emails on pages 486 and 487.

Element B: Hazard Identification and Risk Assessment

Element C: Mitigation Strategy

Element D: Plan Update, Evaluation, and Implementation (Plan Updates Only)

B. Resources for Implementing Your Approved Plan

This section provides examples of possible resources plan implementation.

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?
- What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?
- What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?
- Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?
- What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?

FEMA Mitigation grants are available to eligible applicants. Search grants.gov for additional resources for implementing mitigation actions.

SECTION 3:
MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

MULTI-JURISDICTION SUMMARY SHEET												
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Require-ments
1	Galveston Co	County										
2	Bayou Vista	City										
3	Clear Lake Shores	City										
4	Friendswood	City										
5	Hitchcock	City										
6	Jamaica Beach	City										
7	Kemah	City										
8	La Marque	City										
9	League City	City										
10	Santa Fe	City										
11	Tiki Island	Village										

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Galveston County, TX	**Title of Plan:** Galveston County Multi-Jurisdictional Hazard Mitigation Plan 2016 to 2020	**Date of Plan:** August 2016
Local Point of Contact: Meaghan Kenney	**Address:** 1353 FM 646 Rd. West Suite 201 Dickinson, TX 77539	
Title: Deputy Emergency Management Coordinator		
Agency: Galveston County		
Phone Number: 281-309-5001	**E-Mail:** Meaghan.kenney@galvestoncountytx.gov	

State Reviewer: Raymond Mejia Alexander Straker	**Title:** Mitigation Planner Mitigation Planner	**Date:** 28JUN2016 01AUG2016

FEMA Reviewer: Mary Lover	**Title:** HM Community Planner	**Date:** 10/7/2016
Date Received in FEMA Region 6	08/30/2016	
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

LOCAL MITIGATION PLAN REVIEW TOOL

SECTION 1:
REGULATION CHECKLIST

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1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pg. 1-2; 2-2	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Pg. 2-7 to 2-11; 486-487	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pg. 2-7 to 2-11	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Pg. 2-12	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 2-18	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pg. 2-1; 2-15 to 2-18	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Pg. 18.1 Pgs. 19-1 to 19-2 Pg. 19.5 Pg. 21-107		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Pg. 5-9 Pg. 10-4 Pg. 12-5 Pg. 15-16 Pg. 19-7		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))		X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Pg. 22-1 to 22-4	X	

ELEMENT B: REQUIRED REVISIONS

B1. Corrections did not meet the requirements.

Location:

- **Drought, Winter Storm and Dam/Levee Failure** – The plan states that League City does not consider drought, winter storms and dam/levee failure as a risk. However, pg. 21-32 League City shows 1 action (LC2005-8, pg. 21-107) for drought, winter storm and dam/levee failure. *– Correct discrepancy.*
  Updated hazards addressed under LC2005-8 (pg. 21-107) by removing drought, winter storm, and dam/levee failure to correspond with chart shown on pg. 21-32.
- **Expansive Soils** – The plan now states that Friendswood, League City, and La Marque have some areas of high end risk (9-17), they have elected not to profile expansive soils in this plan update but will evaluate the effects of expansive soils in their communities and determine suitable mitigation strategies for inclusion in the 2020 plan update." *– The communities not profiling expansive soil need to provide justification for why they feel they are not at risk of expansive soils. Not "electing to profile" is not sufficient. If they are at risk, they need to provide actions for expansive soils.*
  Updated the location to include profiling expansive soils for Friendswood, League City, La Marque and Galveston County on pg. 18-1.
- **Dam/Levee failure** – Location for dam/levee failure, it is not the dam/levee itself, but the inundation area should there be a breach, either with a map or a detailed discussion of the inundation area. While the plan states that Clear Lake Shores, Kemah and La Marque have concerns (pg. 19-3), it then states that Clear Lake, Kemah and Galveston County are considering dam failure, but not La Marque. The plan still does not provide an inundation area for each of the jurisdictions as risk. Pg. 19-8 only shows the inundation area for La Marque and not the other jurisdictions at risk. Additionally, Bayou Vista (pg. 21-43) and League City (pg. 21-107) show actions for dam failure, but are not identified as having a risk. *– Correct the discrepancies of who is at risk and if using maps, provide inundation areas for all participating jurisdictions that could be affected should there be a dam or levee failure **or** provide a detailed description of the inundation areas. If there is a data deficiency, then the plan needs to clearly state the deficiency.*
  Updated narrative to further define at risk communities (pg. 19-2) and replaced Figure 19.1 (pg. 19-3) with estimated inundation area map.

Extent:

- **Dam Failure –** The dam classifications on pgs. 19-5 do not provide extent for dam failure. *Provide a range of flooding depth that could impact those jurisdictions that would be affected by a dam failure.*
  Updated description for extent for dam failure on pg. 19-5

B2. Corrections did not meet the requirement.

Probability:

- **Hurricane/Tropical Storm** – The new information in the plan states, "Taking into account the previous occurrences and return period, a hurricane event for Galveston County, Bayou Vista Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island is **likely**, meaning an event is **probable** within the next five years. The plan uses two different terms for probability and "probable" is not defined. *Correct the discrepancy.*
  Removed reference to "probable' on pg. 5-9
- **Hail -** The new information in the plan states, "Based on the historical occurrences of hailstorms for Galveston County, Bayou Vista Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island, hail events are **highly likely**, meaning an event is **probable** on a yearly basis…. The plan uses two different terms for probability and "probable" is not defined. *Correct the discrepancy.*
  Removed reference to "probable' on pg. 10-4
- **Severe Winter Weather –** Pg. 12-5 states events are possible, but then states they are considered occasional. Table 4.8 on pg. 4-15 only defines Unlikely, Likely and Highly Likely. It does not define possible or occasional. Additionally, probability is provided in general terms and does not include all participating jurisdictions. *Define the terms possible or occasional or use the terms already defined and provide probability for all participating jurisdictions.*
  Removed reference to "possible and occasional" on pg. 12-5
- **Wildfire -** Pg. 15-9 states wildfires are **likely** and events are **possible**. Table 4.8 on pg. 4-15 only defines Unlikely, Likely and Highly Likely. It does not define possible. Additionally, probability is provided in general terms and is not specific to the participating jurisdictions at risk. *– Define the terms possible or use the terms already defined and provide probability for all participating jurisdictions.*
  Removed reference to "possible"" on pg. 15-16
- **Dam/Levee Failure –** Pg. 19-7 only discusses levee failure and not dam failure. *Provide probability for dam failure for all participating jurisdictions at risk.*
  Updated probability statement on pg. 19-7.

1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 20	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pg. 22-11 to 22-13	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Pg. 21-28	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement	Pg. 21-33 to 21-122 Pg. 21-32 Pgs. 21-65 to 68 Pgs. 21-100 to 103		

§201.6(c)(3)(ii))	Pg. 21-107-108 Pgs. 21-110-111		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Pg. 21-29 to 21-30; 21-33 to 21-122	**X**	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pg. 2-13 to 2-15	**X**	

ELEMENT C: REQUIRED REVISIONS

C4. Corrections did not meet the requirements.

The plan has some conflicting information regarding the hazards that affect jurisdictions and actions.

- **Friendswood**– Pgs. 4-8 and 17-4 do not identify Friendswood as having a risk to **land subsidence**, but shows a public education action (pg. 21-67-68) for several hazards and includes subsidence in the "Background" section (68). *Correct discrepancy.*
  Removed reference to Land Subsidence on Action F-2016-15 (pg. 21-67)
- **League City –** the plan does not identify League City as having a risk to **dam/levee failure, drought**, and **winter storms**, yet pg. 21-107 shows a homeowner incentive campaign (public education) to include each of those hazards. *If League City is at risk of dam/levee failure, drought and/or winter storm, they must provide an additional action for each hazard. Otherwise, correct discrepancy.*
  Updated hazards addressed under LC2005-8 (pg. 21-107) by removing drought, winter storm, and dam/levee failure to correspond with chart shown on pg. 21-32.
- **League City –** Still need one action for **extreme heat** and **hail**. Action LC-2005-8 and LC-2016-6 are duplicate actions. Other than these two actions, there are no other actions for hail. Action LC-2016-7 is acceptable for drought, but does not mitigate extreme heat. *Provide one additional action for extreme heat and hail.*
  Action LC-2016-7 removed action for "Rainwater collection Incentive" and replaced with "Planting of Trees" to address mitigating the hazard extreme heat. (pg. 21-111). Action LC-2016-6 included outreach measure for hail (pg. 21-111)
- **Expansive Soils –** It was not clearly stated as to whether Friendswood, La Marque and League City were at risk of expansive soils. *If they are at risk, they each need to provide two actions for expansive soils. Otherwise, correct discrepancy.*
  Updated Table 21.11 to include Friendswood, League City and La Marque under Expansive Soil (pg. 21-32)
  Friendswood: Updated Action F-2016-13 (pg. 21-65 to 66), Update Action F-2016-15 (pg. 21-67 to 68)
  La Marque: Updated Action LM-2011-19 (pgs. 21-100 to 101) LM-2016-4 (pgs. 21-102 to 103)
  League City: Updated Action LC-2005-8 (pgs. 21-107 to 108), LM-2016-1 (pgs. 21-110 to 111)
  The table below identifies the number of actions still needed to satisfy the comprehensive range of actions. The darker blue cells are those jurisdictions shown not to have risk to those specific hazards.

# of additional actions needed	Hurricane/ Tropical Storm	Flooding	Ext. Heat	Tornado	Wind	Hail	Lightning	Winter Storm	Drought	Tsunami	Wildfire	Coastal Erosion	Land Subsidence	Exp. Soils	Dam/Levee Failure
Galveston County	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bayou Vista	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Clear Lake Shores	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Friendswood	---	---	---	---	---	---	---	---	---	---	---	---	**1**	2	---
Hitchcock	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Jamaica Beach	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Kemah	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
La Marque	---	---	---	---	---	---	---	---	---	---	---	---	---	2	---
League City	---	---	**1**	---	---	**1**	---	**1**	**1**	---	---	---	---	2	**1**
Santa Fe	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tiki Island	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Pg. 3-21 to 3-25		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Pg. 21-2 to 21-27	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Pg. 21-29	X	

ELEMENT D: REQUIRED REVISIONS

D1. Corrections did not meet the requirements.

While the plan discusses current and future development for the jurisdictions, it does not discuss each jurisdiction's development in hazard prone areas or if their vulnerability has increased or decreased **since the last approved plan dated August 23, 2011.**

Describe each participating jurisdiction's changes in development (residential, commercial, industrial, governmental, etc.) from August 23, 2011 to present, and whether the jurisdictions vulnerability has increased or decreased.

Added Table 3-14 on pgs. 3-21 to 25

ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			X

ELEMENT E: REQUIRED REVISIONS

E2.

After receiving the approvable pending adoption letter from FEMA, at least one jurisdiction must formally adopt the plan and provide adequate documentation in order to obtain approval of the plan.

ELEMENT F. ADDITIONAL STATE REQUIREMENTS (optional for State reviewers only; not to be completed by FEMA)			
F1.			
F2.			

ELEMENT F: REQUIRED REVISION

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Galveston County, TX	**Title of Plan:** Galveston County Multi-Jurisdictional Hazard Mitigation Plan 2016 to 2020	**Date of Plan:** August 2016
Local Point of Contact: Meaghan Kenney	**Address:** 1353 FM 646 Rd. West Suite 201 Dickinson, TX 77539	
Title: Deputy Emergency Management Coordinator		
Agency: Galveston County		
Phone Number: 281-309-5001	**E-Mail:** Meaghan.kenney@galvestoncountytx.gov	

State Reviewer: Raymond Mejia Alexander Straker	**Title:** Mitigation Planner Mitigation Planner	**Date:** 28JUN2016 01AUG2016

FEMA Reviewer: Mary Lover	**Title:** HM Community Planner	**Date:** 10/7/2016
Date Received in FEMA Region 6	08/30/2016	
Plan Not Approved	10/7/2016	
Plan Approvable Pending Adoption		
Plan Approved		

LOCAL MITIGATION PLAN REVIEW TOOL

SECTION 1:
REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pg. 1-2; 2-2	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Pg. 2-7 to 2-11; 486-487	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pg. 2-7 to 2-11	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Pg. 2-12	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 2-18	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pg. 2-1; 2-15 to 2-18	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Sections 5 to 19 Pages: 5-1 to 5-6 6-1 to 6-15 7-1 to 7-3 8-1 to 8-3 9-1 to 9-4 10-1 to 10-2 11-1 to 11-3 12-1 to 12-3 13-1 to 13-4 14-1 to 14-5 15-1 to 15-10 16-1 to 16-3 17-1 to 17-9 18-1 to 18-1 19-1 to 19-6		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Sections 5 to 19 Pages: 5-6 to 5-9 6-18 to 6-19 7-4 to 7-5 8-4 to 8-5 9-5 to 9-6 10-3 to 10-4 11-4 12-4 to 12-5 13-5 to 13-7 14-5 to 14-6 15-11 to 15-16 16-3 to 16-5 17-9 to 17-10 18-2 19-7 to 19-7		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Sections 5 to 19 Pages: 5-9 to 5-11 6-21 to 6-27 7-5 to 7-6 8-5 to 8-7 9-7 to 9-8 10-4 to 10-5 11-5 12-5 13-7 to 13-8		

	14-7 to 14-8 15-16 to 15-17 16-5 17-12 18-3 to 18-4 19-7 to 19-9		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Pg. 22-1 to 22-4	**X**	

ELEMENT B: REQUIRED REVISIONS

The plan discusses the County specifically in most instances regarding probability. With this being a multi-jurisdictional plan, it must include information for all the participating jurisdictions and not just the county.

B1.
Location:

- **Flooding** - City of Santa Fe map is difficult to read. The roads are such, that they cover the flood zones and make it illegible. *Provide a clear map of Santa Fe (similar to the other communities).*
  Replaced Figure 6.11 on pg. 6-13 for Santa Fe
- **Earthquakes** – The plan eliminates earthquake. However, Pg. 4-8, Figure 4.3, provides a seismicity map for earthquakes, which highlights the DFW area and not the Galveston County planning area, so is not clear how the map is eliminating earthquake from the plan. *Either provide a seismicity map specific to the planning area or a detailed discussion of why the planning area is not susceptible to earthquakes.*
  Removed Figure 4.3 and revised narrative to support why earthquake is not included in plan.
- **Severe Winter Storm –** Pg. 12-1 states that all participating jurisdictions are equally affected by severe winter storms. Yet, on pg. 21-32 League City is not providing actions for severe winter storms. *Correct discrepancy.*
  Added narrative regarding the exclusion of severe winter weather by League City.
- **Drought** - Pg. 13-1 states that all participating jurisdictions are equally affected by drought. Yet, on pg. 21-32 League City is not developing actions for drought, but then shows 2 actions. *Correct discrepancy.*
  Added list of participating jurisdictions and noted League City does not consider drought a risk for this plan update
- **Tsunami -** Pg. 4-8 states that only Bayou Village, Clear Lake, Jamaica Beach, Kemah, Tiki Island and Galveston County could be impacted by a tsunami. Yet, pg. 14-3 states that the county and participating jurisdictions would have the same extent, but is not clear if that is all participating jurisdictions or just the ones identified on pg. 4-8. Additionally, pg. 21-32 only shows Galveston County, Hitchcock, Jamaica Beach, Kemah and Tiki Island developing actions. Yet, in the actions, only Galveston County, Jamaica Beach, Kemah and Tiki Island have actions. Bayou Vista, Clear Lake and Hitchcock do not have actions. *Correct the discrepancies.*
  Bayou Vista and Clear Lake Shores are not considered at risk to Tsunami and they have been removed from Table 12-11 on pg. 4-8 and Hitchcock was added. Actions have also been added for Hitchcock and are noted under Element C-4. Enhanced statement on pgs. 14-2 to 14-3 to note those jurisdictions considered at risk.
- **Wildfire –** maps do not identify the city boundaries and is difficult to determine where the WUI is located for those communities and whether all communities are susceptible to wildfire. *When using maps include base information (major roadways and city boundaries), to accurately identify each participating jurisdiction's risk, or provide a detailed description of the location(s).*
  Added list of participating jurisdictions on pg. 15-2 and inserted individual maps for those participating jurisdictions in Figures 15.2 to 15.8 on pgs. 15-3 to 15-9

- **Coastal Erosion** – the plan is not clear as to which jurisdictions are affected by coastal erosion. Pg. 4-7 identifies Clear Lake, Hitchcock, Jamaica Bay, Kemah, Tiki Island and Galveston County. However, the map on pg. 16-2 only identifies areas on Galveston Island and not for those communities located on the bay side of the county and does not provide where coastal erosion occurs for the other jurisdictions. *Provide a map that shows coastal erosion locations for all jurisdictions affected, or provided a detailed description of where coastal erosion occurs.*
  Added list of participating jurisdictions on pg. 16-2.
- **Land Subsidence** – the plan is not clear as to where land subsidence occurs. Pg. 4-8 states that Bayou Vista, Clear Lake, Hitchcock, Kemah and Galveston County are susceptible to land subsidence. Pg. 17-4 discusses south and east of Houston. Pg. 17-7 identifies sensors in League City and Bolivar Peninsula, pg. 17-9 provides extent for participating jurisdictions, but is not clear if that is all jurisdictions or the ones listed on pg. 4-8. *Clarify which jurisdictions are at risk of land subsidence.*
  Added list of participating jurisdictions on pg. 17-4 and added location markers on Figures 17.4 and 17.5.
- **Expansive Soils** – the map on pg. 18-1 shows the entire state and is not clear where expansive soils occur in the planning area. Additionally, pg. 21-32 only shows that the county is developing actions for expansive soils. However, Jamaica Beach in an action for drought is discussing cracking foundations, which would occur from expansive soils and not drought. *Either provide map showing where expansive soils occur in the planning area or provide a detailed description of where they occur.*
  Changed map (Figure 18.1) from USGS showing planning area and expansive soil ratings. Clarified Galveston County as at risk and profiled and notation regarding other jurisdictions. Jamaica Beach action JB 2011-5 was updated to exclude reference to cracking foundations. Also added a statement on pg 4.8 regarding the planning area for this hazard
- **Dam/Levee failure** – It is unclear who is at risk or where the inundation areas are located. The map provided on Pg. 19-8 does not identify any communities or the inundation areas should there be a dam/levee failure. Pg. 4-7 states that Clear Lake, Kemah and La Marque are at risk of dam/levee failure. Yet, pg. 19-6 states that a levee failure is non-existent or minimal to all participating jurisdictions, except for La Marque. Additionally, pg. 21-32 shows Galveston County, La Marque developing actions. Yet, Galveston County, Clear Lake Shores, Kemah, La Marque and League City all have actions for dam and levee failure. League City was never identified as having a risk. – *Correct the discrepancies of who is at risk and if using maps, provide inundation areas for all participating jurisdictions that could be affected should there be a dam or levee failure or provide a detailed description of the inundation areas.*
  Added notation of Clear Lake Shores, Kemah, and Galveston County of potential risk on pg. 19-3 to the flood gate that operates the water reservoir dam due to a misoperation of the flood gate. Added notation of La Marque on Figure 19.5 (pg. 19.8). League City removed reference to dam/levee failure on mitigation action LC 2005-8 pg. 21-107.

Extent:

- **Flooding** – Flood zone descriptions are not an acceptable scale for flooding extent. While the scale provides information on the areas it will flood, it does not provide the depth range of flooding that each jurisdiction can expect. *Provide a flood depth range (X inches to X feet, etc.) for each jurisdiction that could be impacted by a flood event. If based on previous occurrences, then the plan must state that.*
  Added average rainfall event statistics from NWS from 1981 to 2015 and Hurricane Ike inundation map (Figure 6.13) on pgs 6-16 and 6-17
- **Extreme Heat** – pg. 7-2 to 7-3 provides a generalized statement and is not specific to the jurisdictions. *Provide extent for each participating jurisdiction. If all jurisdictions can expect the same extent, the plan must state that.*
  Enhanced the statement on pgs. 7-2 to 7-3
- **Lightning** – pg. 11-3 states that the Galveston County area events range from infrequent to intense frequency. However, infrequent or intense frequency is not defined. *Define the terms or provide a range from Table 11.1. If based on previous occurrences, then the plan must state that.*

Enhanced the statement on pg. 11-3 and identified the LAL range that can be expected for all jurisdictions

- **Severe Winter Weather** – Alert definitions are not acceptable for extent. It only describes the types of watches/warnings *Provide a range in inches of accumulations for ice and snow that would impact each of the participating communities. If based on previous occurrences, then the plan must state that.*
  Replaced Table 12.1 with Figures 12.1 and 12.2 and narrative to more adequately define extent on pg. 12-2.
- **Tsunami –** Pg. 4-8 states that only Bayou Village, Clear Lake, Jamaica Beach, Kemah, Tiki Island and Galveston County could expect a tsunami. Yet, pg. 14-3 states that the county and participating jurisdictions would have the same extent. *Correct the discrepancy.*
  Enhanced statement on pg. 14-3 to include Hitchcock, Jamaica Beach, Kemah, Tiki Island. Bayou Vista and Clear Lake Shores are not considered at risk to Tsunami and they have been removed from Table 12-11 on pg. 4-8.
- **Wildfire** – Table 15.1 provides contributing factors to a wildfire and not define what low, medium and high intensity means.
  Modified the approach for extent for wildfire by inserting information related to the KBDI intensity scale. Added Figure 15.10 to support and defined the range for extent for the jurisdictions considered at risk. Pgs. 15-10 to 15-11.
- **Coastal Erosion –** the plan does not provide an expected range of land loss for each of the jurisdictions that are susceptible to coastal erosion. The map on pg. 16-2 is a historical map and does not include all jurisdictions that could be impacted by coastal erosion (Clear Lake, Kemah, Tiki Island, Hitchcock or Galveston County (bay side) according to pg. 4-7. *Provide an expected range of land loss for each of the jurisdictions that are susceptible to coastal erosion. If based on previous occurrences, then the plan must state that.*
  Added a range of land loss and included a list of participating jurisdictions on pg. 16-2.
- **Land Subsidence -** Pg. 4-8 states that Bayou Vista, Clear Lake, Hitchcock, Kemah and Galveston County are susceptible to land subsidence. Pg. 17-9 provides extent for participating jurisdictions, but is not clear if that is all jurisdictions or the ones listed on pg. 4-8. Additionally, pg. 17-9 shows historically that the extent has been from 1-6 feet. Then states that the extent of land subsidence is considered minimal, yet does not define what minimal is. *Clarify which jurisdictions are at risk of land subsidence and either provide the range of loss of land or define minimal. If based on previous occurrences, then the plan must state that.*
  Added list of jurisdictions considered at risk on pg. 17-9 and noted an range of loss for each.
- **Dam/Levee Failure –** The dam/levee classifications on pgs. 19-5 and 19-6 do not provide extent for dam or levee failure. *Provide a range of flooding depth that could impact those jurisdictions that would be affected.*
  Added information from the USACE regarding the extent for dam/levee failure on pg.

B2.
Previous Occurrences:

- **Hurricane/tropical storm** – pgs. 5-6 to 5-9 do not include previous occurrences for all participating jurisdictions.
  Noted all participating jurisdictions are included in countywide information on pg. 5-7
- **Flooding** – does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted all participating jurisdictions are included in countywide information on pg. 6-18
- **Extreme Heat -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted all participating jurisdictions are included in countywide information on pg. 7-4
- **Severe Winter Weather -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted all participating jurisdictions are included in countywide information on pg. 12-4

- **Drought -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted all participating jurisdictions are included in countywide information on pg. 13-5
- **Tsunami -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Added sentence on pg. 14-5
- **Wildfire** – the plan does not provide previous occurrences for Clear Lake or Galveston County.
  Added notation on pg. 15-15 on which fire departments serve the Clear Lake and Galveston County jurisdictions.
- **Coastal Erosion -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted all participating jurisdictions are included in countywide information on pg. 16-3
- **Land Subsidence** – the plan only provides previous occurrence information for Harris and Galveston Counties only and does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted the participating jurisdictions are included in the regional information on pg. 17-9
- **Expansive Soils -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Noted there is no documented evidence of damages caused by expansive soils for Galveston County pg. 18-2
- **Dam/Levee Failure -** does not include previous occurrences for all participating jurisdictions. If the participating jurisdictions are included in the county information, the plan must say that.
  Added notation for Galveston County and La Marque.

  Provide previous occurrences for <u>each</u> participating jurisdictions. Participating jurisdictions can be included in the county data, however, the plan must state that they are included. Additionally, for some hazards where NDCD data is not available, it may be necessary to reach out to other sources, such as national weather service, local news, libraries, etc. to obtain the information.

Probability:

- **Hurricane/Tropical Storm** – probability is for the county only and does not include all participating jurisdictions. If the same probability applies to all participating jurisdictions, the plan must state that, or state each participating jurisdiction's probability.
  Enhanced statement to include list of participating jurisdictions
- **Extreme Heat -** probability is for the county only and does not include all participating jurisdictions. If the same probability applies to all participating jurisdictions, the plan must state that, or state each participating jurisdiction's probability.
  Noted all participating jurisdictions on pg. 7-5
- **Tornado -** probability is provided in general terms and does not include all participating jurisdictions. If the same probability applies to all participating jurisdictions, the plan must state that, or state each participating jurisdiction's probability.
  Added a statement on pg. 8-5 that all participating jurisdictions have same probability.
- **Hail -** probability is provided in general terms and does not include all participating jurisdictions. If the same probability applies to all participating jurisdictions, the plan must state that, or state each participating jurisdiction's probability.
  Noted all participating jurisdictions on pg. 10-4
- **Severe Winter Weather –** Pg. 12-5 states events are possible, but then states they are considered occasional. Table 4.8 on pg. 4-15 only defines Unlikely, Likely and Highly Likely. It does not define possible or occasional. Additionally, probability is provided in general terms and does not include all participating jurisdictions. *Define the terms possible or occasional or use the terms already defined.*
  Corrected reference from possible to likely on pg. 12.5 to correspond with terms used in table 4.8.
  Noted equal probability for each jurisdictions who consider this hazard as a potential risk.

- **Wildfire -** Pg. 15-9 states events are possible. Table 4.8 on pg. 4-15 only defines Unlikely, Likely and Highly Likely. It does not define possible. Additionally, probability is provided in general terms and does not include all participating jurisdictions. *Define the terms possible or use the terms already defined.*
  Corrected reference on pg. 15-16 from possible to likely to correspond with the terms used in Table 4.8.
- **Coastal Erosion –** It is not clear if probability is for all participating jurisdictions or just those identified on pg. 4-7. *Clarify probability for each of the jurisdictions.*
  Noted all participating jurisdictions on pg. 16-5
- **Dam/Levee Failure –** pg. 19-6 includes probability for dam only and not levee failure as well. *Provide the probability for levee failure for those participating jurisdictions that could be affected.*
  Added notation for probability of levee failure on pg. 19-7
  The requirement is "Does the plan include information on previous hazard events and on the probability of future hazard events for each jurisdiction."

  Provide probability for each of the participating jurisdictions that are affected by the hazard. If the same probability applies to all participating jurisdictions, then the plan must state that, or must state each participating jurisdiction's probability.

B3.
Vulnerability

- **Tsunami** – provides vulnerability for the county only and not for each of the participating jurisdictions that could be affected.
  Enhanced statement on pg. 14-7
- **Land Subsidence –** pg. 17-10 does not discuss what is vulnerable in those communities that could be affected by land subsidence. The plan discusses the impacts, but not what is actually vulnerable.
  Added Tables 17.1 and 17.2 with estimated losses by jurisdiction pgs. 17-10 to 17-12
  Provide what is vulnerable in each participating jurisdiction for the above hazards.

Impact

- **Extreme Heat –** the plan provides general statements that could be any jurisdiction and is not clear if it is related to the participating jurisdictions. *Discuss how each participating jurisdiction would be impacted by extreme heat.*
  Added Table 7.4 and enhanced statement on pg. 7-6.
- **Severe Winter Weather –** the plan discusses Galveston County only. *Discuss how each participating jurisdiction would be impacted by severe winter weather.*
  Added at risk jurisdiction information and included impacts to population pg. 12-5 to 12-6
- **Drought –** Pg. 13-7 discusses annualized losses for the county, but not for each participating jurisdiction. Additionally, pg. 13-8 discusses impact in general terms and not specific to the planning area. *Discuss how each participating jurisdiction would be impacted by drought. If the annualized losses include the participating jurisdictions, then the plan needs to state that.*
  Added statement regarding each participating jurisdiction on pg. 13.7 and 13.8
- **Tsunami –** Pg. 14-7 provides impact, but in general terms and not specific to the planning area. *Discuss how each participating jurisdiction would be impacted by a tsunami.*
  Enhanced statement on pg. 14-8
- **Coastal Erosion** – Pg. 16-5 discusses the communities will be impacted, but does not explain what those impacts will be. *Discuss how each participating jurisdiction would be impacted by coastal erosion.*
  Enhanced statement on pg. 16-5
- **Land Subsidence –** Pg. 17-10 discusses impact, but is not clear if those impacts could affect the participating jurisdictions. *Discuss how each participating jurisdiction would be impacted by land subsidence.*
  Enhanced statement on pg. 17-12

- **Expansive Soils –** Pg. 18-4 states per the Texas State Mitigation plan "…damages are higher on slab-on-grade foundations….and there a potential impact to housing and building construction and oil and gas pipelines….", but does not describe the impact or whether each of the participating jurisdictions would experience the same impact. Pg. 18-4 states the impact is limited, but does not define what limited means. *Describe the impact each jurisdiction could experience or define the term "limited".*
  Enhanced statements on pgs. 18-3 and 18.4

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 20	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pg. 22-11 to 22-13		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Pg. 21-28	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Pg. 21-33 to 21-122		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Pg. 21-29 to 21-30; 21-33 to 21-122	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pg. 2-13 to 2-15		

ELEMENT C: REQUIRED REVISIONS

C2.

The plan identifies that each jurisdiction participates in the NFIP and how they will continue to comply. However, in the capabilities section (pg. 20-3) shows that Hitchcock does not have a flood damage prevention ordinance. Additionally, pg. 20-9 shows that Bayou Vista and Kemah do not have a floodplain manager. These are requirements to participate in the NFIP.

Correct the discrepancy.

Corrected Table 20.2 on pg. 20-3 Hitchcock does have a flood damage prevention ordinance. Corrected Table 20.3 on pg. 20-9 Bayou Vista and Kemah utilize the services of the Galveston County Floodplain Manager and added a note to the table to document. Updated Table 20.6 on pg. 20-12to reflect the additional points for Hitchcock, Bayou Vista and Kemah.

C4.

The plan has some conflicting information regarding the hazards that affect jurisdictions and actions.

- **Expansive Soils** - the map on pg. 18-1 shows the entire state and is not clear where expansive soils occur in the planning area. Additionally, pg. 21-32 only shows that the county is developing actions for expansive

soils. However, Jamaica Beach in an action for drought is discussing cracking foundations, which would occur from expansive soils and not drought. *Clarify who is at risk of expansive soils and provide 2 actions for each jurisdiction at risk.*
Changed map (Figure 18.1) from USGS showing planning area and expansive soil ratings. Clarified Galveston County as at risk and profiled and notation regarding other jurisdictions. Jamaica Beach action JB 2011-5 was updated to exclude reference to cracking foundations.

- **Dam/Levee Failure** – pg. 4-7 states that La Marque, Kemah, Clear Lake Shore and Galveston County are at risk from dam or levee failure. However, pg. 21-32 on show Galveston County, La Marque developing actions. Yet, Galveston County, Clear Lake Shores, Kemah, La Marque and League City all have actions for dam and levee failure. League City was never identified as having a risk. *Clarify discrepancy of who's at risk and, if League City is at risk, provide an additional action for dam/levee failure.*
  League City, Action LC 2005-8 pg. 21-107 removed reference to Dam/Levee
  Updated Table 21-11 on pg. 21-32 to reflect Kemah and Clear Lake Shore are at risk for Dam/Levee risk
- **Tsunami** - Pg. 4-8 states that only Bayou Vista, Clear Lake, Jamaica Beach, Kemah, Tiki Island and Galveston County could be impacted by a tsunami. Yet, pg. 14-3 states that the county and participating jurisdictions would have the same extent, but is not clear if that is all participating jurisdictions or just the ones identified on pg. 4-8. Additionally, pg. 21-32 shows Galveston County, Hitchcock, Jamaica Beach, Kemah and Tiki Island will be developing mitigation actions for tsunami. Yet, in the actions, only Galveston County, Jamaica Beach, Kemah and Tiki Island have actions. Bayou Vista, Clear Lake and Hitchcock do not have actions. *Clarify who is at risk and provide 2 actions for those jurisdictions at risk.*
  Removed reference to Bayou Vista and Clear Lake Shores on pg. 4-8 and added Hitchcock.
- **Severe Winter Storm –** Pg. 12-1 states that all participating jurisdictions are equally affected by severe winter storms. Yet, on pg. 21-32 League City is not developing actions for severe winter storms, but they did provide actions. *Correct discrepancy.*
  League City, Actions LC 2005-1, LC 2005-2, LC 2005-3 (pgs. 21-104 to 21-105); LC 2005-8 (pg. 21-107) and LC 2016-6 (pg. 21-110) removed reference to Severe Winter Storm
- **Drought** - Pg. 13-1 states that all participating jurisdictions are equally affected by drought. Yet, on pg. 21-32 League City is not developing actions for drought, but then shows 2 actions. *Correct discrepancy.*
  League City, Actions LC 2005-8 (pg. 21-107), LC 2016-6 and LC 2016-7 (pg. 21-110 to 21-111) removed reference to Drought

The table below identifies the number of actions still needed to satisfy the comprehensive range of actions.
La Marque updated Action LM 2011-19 (pg. 21-100 to 21-101) to include Dam/Levee Failure and updated Action LM 2011-14 to include Dam/Levee Failure
Bayou Vista and Clear Lake Shores are not at risk for Tsunami
Hitchcock updated Action H 2011-1, H 2011-10, H 2011-19, H 2016-1, and H 2016-3 to include Tsunami
Galveston County is the only jurisdiction who is considering expansive soils as a risk in this plan update.

# of additional actions needed	Hurricane/ Tropical Storm	Flooding	Ext. Heat	Tornado	Wind	Hail	Lightning	Winter Storm	Drought	Tsunami	Wildfire	Coastal Erosion	Land Subsidence	Exp. Soils	Dam/Levee Failure
Galveston County	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bayou Vista	---	---	---	---	---	---	---	---	---	**2**	---	---	---	**2**	---
Clear Lake Shores	---	---	---	---	---	---	---	---	---	**2**	---	---	---	**2**	---
Friendswood	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	---
Hitchcock	---	---	---	---	---	---	---	---	---	**2**	---	---	---	**2**	---
Jamaica Beach	---	---	---	---	---	---	---	---	---	---	---	---	---	**1**	---
Kemah	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	---

La Marque	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	**1**
League City	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	---
Santa Fe	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	---
Tiki Island	---	---	---	---	---	---	---	---	---	---	---	---	---	**2**	---

C6.
Pg. 2-13 to 2-14 of the plan discusses other planning mechanisms and that the mitigation actions will be incorporated into those other planning mechanisms. However, it does not describe each jurisdictions process for integrating the mitigation plan into those other planning mechanisms. For example, who is responsible for updating those other plans, is there a timeframe the other mechanisms are updated (annually, every 3 or 5 years, etc.), do they (and who) present the plans for approval or denial to city council, county commissioners, mayor, city administrator, etc.?
Updated Table 2.2 and narrative on pgs. 2-13 to 2-15
Provide the process that each jurisdiction follows when updating their other planning mechanisms. There could be a different process for each type of planning mechanism. Additionally, each community could have a different process as well.

1. REGULATION CHECKLIST **Regulation (44 CFR 201.6 Local Mitigation Plans)**	**Location in Plan (section and/or page number)**	**Met**	**Not Met**
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Pg. 3-19 to 3-21		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Pg. 21-2 to 21-27	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Pg. 21-29	X	

ELEMENT D: REQUIRED REVISIONS

D1.
While the plan discusses current and future development for the jurisdictions, it does not discuss each jurisdiction's development in hazard prone areas or if their vulnerability has increased or decreased since the last approved plan.
Enhanced the development trend section located on pg. 3-21
Provide whether each jurisdiction has had any changes in development (residential, commercial, industrial, governmental, etc.) and whether the jurisdictions vulnerability has increased or decreased.

ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			X

ELEMENT E: REQUIRED REVISIONS

E2.
After receiving the approvable pending adoption letter from FEMA, at least one jurisdiction must formally adopt the plan and provide adequate documentation in order to obtain approval of the plan.

ELEMENT F. ADDITIONAL STATE REQUIREMENTS (optional for State reviewers only; not to be completed by FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISION			

Appendix A-2

Adoption Resolutions

Appendix B

Planning Process and Plan Maintenance

Appendix B-1

GCHMC Meeting Documentation

Hazard Mitigation Planning Committee Meeting
Agenda

October 19, 2015
3:00 to 5:00 p.m.
Doyle Center
2010 5th Avenue North, Texas City

I. Introduction
   A. Planning Team
   B. Meeting Objectives
   C. Committee Structure

II. Plan Update Overview

III. Community Report
   A. Challenges
   B. Opportunities

IV. Hazard Identification and Risk Assessment
   A. Review hazards
   B. Discussion of additional hazards

V. Mitigation Strategies
   A. Review Goals and Objectives
   B. Mitigation Ideas Handbook

VI. Schedule

VII. Questions and Dismissal

Rebecca Boone

From: Kenney, Meaghan <Meaghan.Kenney@co.galveston.tx.us>
Sent: Thursday, October 15, 2015 8:36 AM
To: John Hamm; Charlene Todaro; Lucy Dieringer; amatranga@cityofhitchcock.org; Rebecca Boone; reldridge@cityoflamarque.org; b.hocking@cityoflamarque.org; c.buttler@cityoflamarque.org; Young, Alyssa; Foskit, Garret; Terry Byrd (tbyrd@friendswood.com); Cora Crews ; Steven Simmons; Brian Mansfield; Kenny Cook; cstrout@clearlakeshores.tx.gov; Vern Johnson; Bryan Springer (b@bryanspringer.com); John Brick; Larry Whittington; mayor@bayouvistatx.us; citysecretary@bayouvista.com; Kenneth Campbell; jtambrella@ci.sante-fe.tx.us; janet@ci.sante-fe.tx.us; Brent Hahn; broberts@kemah-tx.com; mayorjoiner@kemah-tx.com; Edghill, Ryan; Henry, Mark; Drummond, Tyler; Rainville, Brittany; Lambert, Michael; Nicholson, Connie; Jason Dobronz; Derek Duckette - Texas City OEM (dduckett@texas-city-tx.org); Charlie Kelly; Rosana Pratt; DEPT. HEADS; ml.jones@dps.texas.gov; Posta@tamug.edu; Mastrangelo, Mike; Trish Mcintosh ; grikard@kemah.tx.com; Achapa@ci.jamaicabeach.tx.us; jw1801 @comcast.net; gorum@gcwater.org; Ryan Williams; Kingsley McCallum
Subject: Emergency Management's Hazard Mitigation Plan
Attachments: RELEASE_mitigation plan.pdf

RE: Galveston County Multi-Jurisdictional Hazard Mitigation Plan Update
Including the Jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Village of Tiki Island

Thank you for your partnership in updating the Hazardous Mitigation Plan. The plan must be updated this year for the county and participating cities to remain eligible for federal grants and reimbursements, which are essential if we have a disaster.

Our stakeholder meeting will be held *Monday, October 19, 2015, from 3:00 p.m. to 5:00 p.m.*, at the Doyle Center located at 2010 5th Avenue N., Texas City. If you are part of the plan but unable to attend, please send representatives from your jurisdiction that can discuss your city's hazards and reactions. Also, please invite county or city employees who have working knowledge of the community (i.e. CFM, engineer, public works, administrators, etc) if they were not included.

The stakeholder meeting will be followed by a public meeting from 5pm-6pm that is open to all citizens (public release from the Judge's office is attached). True North Emergency Management LLC has been hired to oversee the planning process. Jason Dobronz is the Project Manager and can be reached at (561) 459-0493 or by email at jdobronz@truenorthem.com if you have questions.

Thank You,

Meaghan Kenney
Deputy Emergency Management Coordinator
Galveston County
O: 281-309-5001 C: 409-539-0021
Meaghan.Kenney@galvestoncountytx.gov

Galveston County
Multi-Jurisdiction Hazard Mitigation Plan

Bayou Vista
Clear Lake Shores
Friendswood
Galveston County
Hitchcock
Jamaica Beach
Kemah
La Marque
Santa Fe
Village of Tiki Island

TRUE NORTH EMERGENCY MANAGEMENT

Introductions

- Planning Team
  - True North Emergency Management /Neel-Schaffer
    - Jason Dobronz FPEM, MS, Project Manager
    - Rebecca Boone, Senior Planner
    - Ryan Williams, Planner
    - Kingsley McCallum
- TDEM
  - Provide technical assistance
- Galveston County
  - Provide planning team coordination with the jurisdictions

TRUE NORTH EMERGENCY MANAGEMENT

Meeting Objectives

- Define the planning process
- Identify hazards for inclusion in plan update
- Introduce/review mitigation goals
- Hear from you!

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Committee Structure

- Steering Committee Members
  - Representative from each jurisdiction who provide guidance to planning team, set priorities, assist with data collection and verification, and provide/coordinate review of draft plan.
- Mitigation Committee Members
  - Representative(s) from each jurisdiction who have a working knowledge of their area in the way of potential new mitigation actions (projects), policy/regulation needs, identification of vulnerable risk areas and population, etc.

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Plan Update Overview

- Principles for Plan Development
  - Focus on the mitigation strategy
  - Process is as important as the plan itself
  - This is your community's plan
- Why is this plan important to your Community?
  - Funding for eligible projects
  - Integration with future planning initiatives
- How can you help?
  - Tell us what your needs/concerns are
  - Provide timely feedback
  - Attend meetings
  - Spread the word

TRUE NORTH EMERGENCY MANAGEMENT

Multi-Jurisdictional Plan Requirements

- For FEMA approval, requirements found in 44 CFR §201.6 must be met along with the following items:
  - The risk assessment must assess each jurisdiction's risk where they may vary from the risks facing the entire planning area. (44 CFR §201.6(c)(2)(iii))
  - There must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan. (44 CFR §201.6(c)(3)(iv))
  - Each jurisdiction requesting approval of the plan must document that is has been formally adopted. (44 CFR 201.6(c)(5))

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Planning Tools

- Local Mitigation Planning Handbook
- Mitigation Ideas
- Integrating Hazard Mitigation into Local Planning
- Local Mitigation Plan Review Guide
- 2013 State of Texas Hazard Mitigation Plan
- 2011-2015 Galveston County Hazard Mitigation Plan
- 2015 Friendswood Hazard Mitigation Plan
- Other applicable plans

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Community Report

- Open discussion
  - What are your mitigation challenge(s)?
    - Funding
    - Enforcement or development of policy/regulations
    - Support from public and/or officials
    - Lack of understanding/training in the HMA program
    - Etc.
  - What are your opportunities to reduce/eliminate future impacts?
    - Update/develop plans to address mitigation
    - Improve education/outreach efforts
    - Mitigation AFC/SRL properties
    - Improve drainage
    - Retrofit critical facilities/infrastructure
    - Etc.

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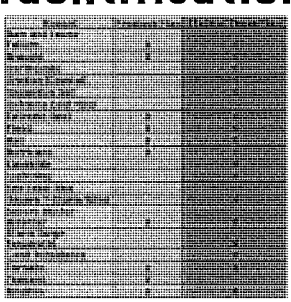
Natural Hazard Identification



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Hazard Risk Ranking

(previous plan)

Table 4-8. Hazard Risk Ranking by Jurisdiction

Jurisdiction	Coastal Flood*	Inland Flood**	Tropical Storm*	Drought**	Hail*	Hurricane*	Tornado*	Wildfire*	Winter Storm**	Tsunami
Bayou Vista	H	H	H	L	L	VL	M	H	H	L	VL
Clear Lake Shores	H	H	H	L	L	VL	H	H	H	L	VL
Dickinson	M	M	M	L	L	VL	H	H	H	L	VL
Galveston	H	H	H	L	L	L	H	M	M	L	VL
Hitchcock	H	H	H	L	L	VL	H	H	H	L	VL
Jamaica Beach	H	H	H	L	L	VL	N/A	VL	H	L	VL
Kemah	H	M	H	L	L	VL	H	H	H	L	VL
La Marque	H	M	H	L	L	VL	H	H	M	L	VL
Texas City	H	L	H	L	L	VL	M	M	M	L	VL
Unincorporated	H	M	H	L	L	VL	H	H	M	L	VL

*NCR used for ranking.
** Exposure used for ranking.
***Potential impact used for ranking

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Other Hazards

- Non-natural hazard concerns included in previous plan:
  - Hazardous Materials
  - Pipeline Failure

Note: these hazards are not covered under FEMA's HMA program.

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Additional Hazard Discussion

- Risks not included in previous plan:
  - Coastal Erosion - wearing away of land and loss of beach, shoreline or dune material because of natural coastal processes or manmade influences. According to state plan, erosion rates are -2 to -11 ft./yr. frequency is highly likely.
  - Land Subsidence - loss of surface elevation due to the removal of subsurface support. Galveston is listed as high risk in the state plan. However, the frequency is unlikely.
  - Expansive Soils - Soils and soft rock that tend to swell or shrink to changes in moisture content. Documentation is limited and frequency is unlikely and catastrophic damage is not expected.
  - Lightning

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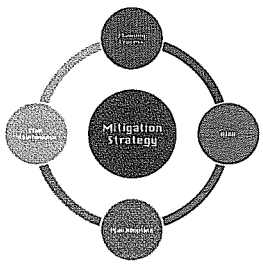
Mitigation Strategy

- All requirements in the plan lead to and support the mitigation strategies identified



TRUE NORTH EMERGENCY MANAGEMENT

Goals and Objectives

- Goals are general guidelines that describe what you want to achieve in the long run
  - Based on risk and capability assessments
    - Protect
    - Improve
    - Educate
- Objectives define strategies or steps to achieve goals. They are more specific and narrower in scope than goals
  - Minimize Losses (specific focus *i.e.* flood)
  - Retrofit/Relocate facilities/infrastructure
  - Enforcement
  - Develop/maintain programs/procedures

TRUE NORTH EMERGENCY MANAGEMENT

Goal and Objective Review

- ***Goal 1*** – Improve education and outreach efforts regarding preparedness. Develop mitigation actions that can be implemented by citizens, businesses and county and municipal government officials in preparing for disasters.
  - ***Objective 1.1*** – Heighten public awareness of the full range of natural and man-made hazards they face.
  - ***Objective 1.2*** – Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.

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- ***Goal 2*** – Develop hazard mitigation policies and programs designed to reduce the impact of natural and human-caused hazards on people and property.
  - ***Objective 2.1*** – Reduce repetitive losses to the National Flood Insurance Program.
  - ***Objective 2.2*** – Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.

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- ***Goal 3*** – Conduct studies and implement planning processes to increase the understanding of local hazard vulnerability.
  - ***Objective 3.1*** – Build and support local partnerships to continuously become less vulnerable to hazards.
  - ***Objective 3.2*** – Build hazard mitigation concerns into planning and budgeting processes.

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- ***Goal 4*** – Identify and implement hazard mitigation projects to reduce the impact of hazard events and disasters.
  - ***Objective 4.1*** – Incorporate hazard mitigation into the long-range planning and development activities.
  - ***Objective 4.2*** – Utilize regulatory approaches to prevent creation of future hazards to life and property

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- ***Goal 5*** **- Improve evacuation procedures for natural and human-caused hazards.**
  - ***Objective 5.1*** - Maximize participation of property owners in protecting their properties.
  - ***Objective 5.2*** - Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.

TRUE NORTH EMERGENCY MANAGEMENT

Friendswood Goals

- Ensure that critical infrastructure sites are protected from all hazards
- Reduce the vulnerability from flooding of existing residential and business structures
- Maintain previous mitigation projects to ensure continuity of services
- Continue to enforce existing zoning and building regulations
- Educate the public regarding zoning and building regulations which affect new construction, demolition, and flood hazard
- Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities, such as flooding
- Continue to develop capital improvement projects which address hazards identified in the mitigation plan
- Maintain the city's ability to respond to all types of hazards
- Develop, maintain, and update a viable public information network to ensure that residents and commercial interests are aware of the various sources of information regarding impending emergency and/or disaster events (i.e. Facebook, Twitter, E-mail, city website, FirstCall Network, radio, etc.)

TRUE NORTH EMERGENCY MANAGEMENT

League City Goals/Objectives

- **Goal 1 - Public Awareness**
  - Increase public awareness to the risks that are associated with the area's hazards, through information dissemination and outreach programs
  - Provide information on funding resources, partnership opportunities and tools to assist in the implementation of mitigation activities
  - Develop educational training programs and materials residents can utilize to protect property against hazards.

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- **Goal 2 - Partnerships and Implementation**
  - Conduct studies and implement planning processes to increase the resident's understanding of the city's hazard vulnerability
  - Strengthen communication and coordinate participation among and within public agencies, residents, non-profit organizations, business, and industry to gain a vested interest in implementation
  - Encourage leadership within public and private section organizations to prioritize and implement local, county, and regional hazard mitigation activities
- **Goal 3 - Emergency Services**
  - Maintain and improve where possible the city's ability to respond to all types of hazards
  - Coordinate and integrate hazard mitigation activities, where appropriate, with emergency plans and procedures

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- **Goal 4 - Mitigation Planning**
  - Improve hazard assessment: propose recommendations for mitigating new development and encourage preventative measures for existing development in areas vulnerable to natural hazards
  - Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions
  - Evaluate and update the City of League City's Local Hazard mitigation Plan on an annual basis
- **Goal 5 - Public Works and Capital Improvement Projects**
  - Prioritize drainage projects identified in the Capital Improvements Program according to the number of repetitive loss properties they will benefit
  - Ensure that critical infrastructure sites are protected from hazards

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Goal/Objective Discussion

- Changes/additions

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Mitigation Ideas

- Mitigation Ideas Handbook
  - http://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf
- HMA Unified Guidance
  - http://www.fema.gov/media-library-data/15463cb34a2267a900bde4774c3f42e4/FINAL_Guidance_081213_508.pdf

TRUE NORTH EMERGENCY MANAGEMENT

Previous Plan Homework Review

- Capability Assessment
- Mitigation Actions
- Grant
- Toxic Site and Critical Facilities

TRUE NORTH EMERGENCY MANAGEMENT

Stakeholder / Public Input

- Public Input Meeting October 19
  - Input on hazards that are of concern
  - Mitigation needs
  - Online survey
- Interview process for Stakeholders
  - City/County department leaders
  - Large employers/Essential Service Providers
  - Medical facilities

TRUE NORTH EMERGENCY MANAGEMENT

Meeting Schedules

- Tentative Steering and Working Committee Meeting
  - November 17 (rank hazards, community profile, capability assessment, mitigation actions, public input update)
  - January 7 (mitigation actions and ranking)
  - January 27 (hazard overview and mitigation strategy)
- Draft Plan Review - online process
  - February 1
- Public Meeting Draft Plan Review
  - February 9
- State Plan Review
  - February 12

TRUE NORTH EMERGENCY MANAGEMENT

Contact Information	
Jason Debraez	jason.debraez@truenorthem.com 501-459-8491
Rebecca Boone	rebecca.boone@neel-schaffer.com 601-906-1041
Ryan Williams	arwilliams@truenorthem.com 386-679-8959
Kingsley McCallum	kingsley.mccallum@neel-schaffer.com 985-788-2204

TRUE NORTH EMERGENCY MANAGEMENT

Hazard Mitigation Planning Committee Meeting - Sign In

Monday, October 19, 2015
3:00 p.m. – 5:00 p.m.
Doyle Center - 2010 5th Avenue North, Texas City

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Kenny Cook	Chief of Police EMC	Clear Lake Shores	(832) 309-5868	kcook@clearlakeshores-tx.gov	✓	✓
Ryan Edghill	League City EMC	—	979 450 6857	ryan.edghill@leaguecitytx.gov	✓	✓
Peri Bluemel	CHRO Gal Cty	Gal Cty	409 770 5350	peri.bluemel@co.galveston.tx.us	X	
Karen Hearring	Alderman	Tiki Island	409-457-3528	hearring@sbcglobal.net	✓	
Carol Buttler	City Mgr	La Marque	409. 761. 1138	c.buttler@cityoflamarque.org.	✓	
Amber Karshner	Fire Admin/EM Specialist	La Marque	409-938-9264	a.karshner@cityoflamarque.org	✓	
Gerald Grimm	Fire Chief	La Marque	409-938 9261	g.grimm@cityoflamarque.org	✓	
Suzy Kou	Finance Director	La Marque	(409) 938-9205	financedirector@cityoflamarque.org	✓	

Hazard Mitigation Planning Committee Meeting - Sign In

Monday, October 19, 2015
3:00 p.m. – 5:00 p.m.
Doyle Center - 2010 5th Avenue North, Texas City

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Charlene Warren	EMC	LaMarque	409-938-9283	c.tudor@cityofLamarque.org	✓	
John Brick	City Admin EMC	Jamaica Beach	409-737 1142	jbrick@ci.jamaicabeach.tx.us	✓	
John Bertolino	Fire Marshal	Hitchcock	409 502 0761			
John Hamm	Chief of Police EMC	Hitchcock	409.986.5559	jhamm@hitchcockPD.com	✓	
Kirk Jackson	Chief	LMPD	409-938-9220	K.jackson@cityofLamarque.org	✓	
Cora Crews	Deputy EMC	Friendswood	281 996 3335	ccrews@friendswood.com	✓	
Jerry Byrd	EMC	✓	✓	tbyrd@friendswood.com	✓	
Charles Kelly	Galveston EMC	GALV	409 765-3710	KellyChas@Galvestonc.org		

Hazard Mitigation Planning Committee Meeting - Sign In

Monday, October 19, 2015
3:00 p.m. – 5:00 p.m.
Doyle Center - 2010 5th Avenue North, Texas City

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Allen Post	EMC TAMUG	TAMUG	409 740-4477	postea@tamug.edu	✓	✓
Philip Meadows	Captain SFPD	Santa Fe	409 925-2000	Philip@ci.santa-fe.tx.us	✓	
Connie Nicholson	Director Contract Services	Galv Co	409-770-5543	connie.nicholson@co.galveston.tx.us	✓	
Chaise Cary	Superintendent	La Marque	409-938-9213	c.cary@cityofLamarque.org	✓	
Meaghan Kenney	Deputy EMC	Galveston County	409-539-0021	meaghan.kenney@co.galveston.tx.us	✓	✓
Kathy Girndt	Acct Mgr	City of La Marque	409 938 9215	K.girndt@cityofLamarque.org	✓	
Myrna Remgord	Attorney	Galveston county	409 770 5564	myrna.remgord@co.galveston.tx.us	✓	✓
Rebecca Boone	Consultant	Neel-Schaffer	601 906 1041	rebecca.boone@neel-schaffer.com		

Hazard Mitigation Planning Committee Meeting - Sign In

Monday, October 19, 2015
3:00 p.m. – 5:00 p.m.
Doyle Center - 2010 5th Avenue North, Texas City

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Les Rumburg	Dir. Pub. Svcs.	LaMarque	4099389257	l.rumburg@cityoflamarque.org	✓	
Patricia McIntosh	EMC	College of the Mainland	409.933 8267	pmcintosh@com.edu	✓	
Robert Michetich	City Council Dist C LaMarque	LaMarque	409-692 4545	r.michetich@cityoflamarque.org		✓
Brittany Rainville	PIO Galv Co OEM	Galveston County	409978 0242	brittany.rainville@galvestoncountytx.gov	✓	
Michael Lambert	GCOEM	Galveston County	409-682-3140	michael.lambert@co.galveston.tx.us	✓	
Mike Mastrangelo	Program Director	UTMB	512 705 8112	mimastra@utmb.edu	✓	
Ryan Williams	Consultant	True North	386 679-8989	Rwilliams@truenorthem.com		

Hazard Mitigation Planning Committee Meeting
Homework Assignments

Jurisdiction	Capability Assessment	Mitigation Action Implementation Worksheet	Grant Summary	Appendix C-Toxic Sites	Appendix D- Critical Facility
Galveston County	X	X	X		
Bayou Vista					
Clear Lake Shores	X	X			
Friendswood	X	X	X	X	X
Hitchcock	X				
Jamaica Beach	X	X			
Kemah					
La Marque	X	X	X	X	X
League City	X				X
Santa Fe					
Tiki Island					

Capability Assessment:

- Jamaica Beach and Clear Lake Shores
    - Building code year
    - Fire Department ISO (rating)

Mitigation Action Implementation Worksheet:

- Jamaica Beach-follow up questions
- Clear Lake Shores-follow up questions
- Santa Fe – Do you have a list of actions
- Friendswood and League city – Under review by planning team

Grant Summary:

Provide a list of mitigation grants received over the past five years

Appendix C and D-Toxic Sites and Critical Facilities:

The planning team is reviewing the data in the previous plan and HAZUS list. We will follow up with each community after assessment is made.

Steering and Mitigation Committee Meeting Summary

Meeting Date: October 19, 2015

Location: Doyle Center, 2010 5th Ave. N, Texas City, TX

Time: 3-5:00 p.m.

Attendance: 31

Introduction

Meaghan Kennedy, Deputy EMC, Galveston County welcomed the meeting participants to the Galveston County Multi-jurisdictional hazard mitigation plan kick-off meeting and introduced True North Emergency Management as the consultant hired to update the county, and participating jurisdictions, 2010-2015 hazard mitigation plan.

Rebecca Boone, representing True North, opened the meeting with introductions from the planning team, and defined the roles and responsibility of the following committees who will guide the True North team throughout planning process:

- TDEM – technical advisors to ensure the plan is developed according to the State of Texas and FEMA's regulations.
- Galveston County – coordinator between the True North team and the participating jurisdictions
- Steering Committee – guide the planning team, set priorities, assist with data collection and verification, and provide/coordinate review of draft plan
- Mitigation Committee – provide input on potential new mitigation actions (projects), policy/regulation needs, identification of vulnerable risk areas and population, etc.

The meeting objectives were stated as follows:

- Define the planning process
- Identify hazards for inclusion in plan update
- Introduce/review mitigation goals
- Receive input on each jurisdiction's mitigation opportunities and challenges

A brief overview of what this mitigation plan entails and the importance of working together to develop an updated plan that will meet the participating community's needs for the next five years was discussed. A definition of mitigation planning and the plan was presented. The plan is a living document. It must be updated every five years. Projects in the plan and mitigation efforts outlined in the plan will assist with grant applications and funding. There will be three more meetings along with emails during this planning update. This is a multi-jurisdictional plan and will include community risk assessments, and the plan will need to be formally adopted by each jurisdiction.

Rebecca invited represented jurisdiction to share what their community's mitigation opportunities and challenges are. In general, funding and improving drainage have been a challenge for the majority of the planning area. Opportunities noted included enhancing outreach to the public (social media and reaching non-English speaking communities); continuance of elevation and buyout programs, having support of officials and the public have led to many successes.

Greatest Mitigation Challenges:

- La Marque-drainage, the City is educating the Public and keeping ditches clean. They also need an EOC. Discussion took place regarding FEMA rehabbing old buildings.
- League City-drainage, the City has done some education and some elevation projects.
- Galveston-drainage, there are four creeks going through the City. Galveston Flood Control District also has a mitigation plan.
- Santa Fe-funding, and some minor drainage issues. The public may not understand what mitigation is.
- Tiki Village-funding, the City is fairly high, and flooding and drainage may not be as critical.
- Bayou Vista-not present.
- Clear Lakes Shores-In good shape.
- Hitchcock-flooding, it is an older community (elderly) and is engaged actively in food banks. The City is currently working on Facebook and social media initiatives.
- Jamaica Beach-drainage is good, and they have raised several electronic switch boxes and clean ditches regularly. The City is also looking into the CRS program.

HIRA

Ryan Williams, True North, reviewed the list of hazards profiled in the current hazard mitigation plan as compared to the current State of Texas plan, and FEMA guidance. There are four hazards in the State plan that was brought forward: coastal erosion, land subsidence, expansive soils, and lightning. In group discussion the following was recorded and summarizes the HIRA conversations:

- True North will continue to research the dams and levee systems, along with all of the hazards in the previous plan to ensure they are covered appropriately
- The group will be briefed up at the November 17th meeting concerning the hazard profiles and the recommendations for formatting etc. as a result of the conversations held at the kick-off and the research in progress
- Initial findings from the group point to several possible actions: may include urban interface with wildfire or at least include a description of where this is relevant in the planning area; may bundle coastal retreat, coastal erosion, land subsidence together as a profile; may include

lightning as part of a bundle with severe weather thunderstorms; may include extreme cold as part of a bundle with extreme winter weather

Mitigation Strategy

Next the meeting participants received an overview of the mitigation strategy section of the plan and a list of the mitigation goals and objectives identified by the participating jurisdictions in their previous plans. The planning team will further review the goals outlined in the Friendswood and League City plans to find opportunities to link with the established county goals. This information will be presented at the next meeting for review and approval by the steering committee.

Rebecca requested the representatives download and review the following FEMA planning guides to help them identifying new mitigation actions for inclusion in the plan update. The planning team will work with each jurisdiction over the course of the next two months to determine changes and additions to their mitigation strategy section of the plan.

- Mitigation Ideas Handbook http://www.fema.gov/media-library-data/20130726-1904-25045-0186/fema_mitigation_ideas_final508.pdf
- HMA Unified Guidance http://www.fema.gov/media-library-data/15463cb34a2267a900bde4774c3f42e4/FINAL_Guidance_081213_508.pdf

In closing, the planning team presented the following tentative meeting schedule so representatives can plan their tasks and schedules accordingly. Meeting materials and information will be sent to the representatives before each meeting.

- Tentative Steering and Working Committee Meeting
    - November 17 (rank hazards, community profile, capability assessment, mitigation actions, public input update)
    - January 7 (mitigation actions and ranking)
    - January 27 (hazard overview and mitigation strategy)
- Draft Plan Review – online process
    - February 1
- Public Meeting Draft Plan Review
    - February 9
- State Plan Review
    - February 12

Next Steps and Comments:

- The mitigation goals will need to be coordinated and consolidated.
- The planning team will meld the three hazard mitigation plans (Galveston County, Friendswood, and League City) into this plan update.
- One-on-one interviews may need to be conducted by the planning team with critical facilities to ensure their needs are identified in this plan update.
- The selected hazards profiled in this plan update will be ranked (high, moderate, low) during the November 17th meeting.
- Information gathered, and draft sections under development will be presented during the November 17th meeting. This may include the community profile, capability assessment, previous mitigation actions, and update on the public on-line survey.
- A request was made to research past mitigation funding allocations including how much money has been allocated and who received it? The planning team will discuss this request with Galveston County.
- Additional questions were raised about the CRS program and the loss of points due to Mitigation Plans being under review and outside of their previously validated period.

Steering Committee Meeting

Meeting Date: November 17, 2015

Time: 2-3:30p.m.

Location: Doyle Center, 2010 5th Ave N, Texas City, TX 77590

I. Introduction

II. Approval of Previous Meeting Minutes

III. Plan Update Status

IV. Review of Capability Assessment

V. Public On-line Survey Results

VI. Hazard List and Summarize Findings

VII. Hazard Ranking

VIII. Next Steps

Rebecca Boone

Subject:	Hazardous Mitigation Plan
Location:	Doyle Center
Start:	Tue 11/17/2015 2:00 PM
End:	Tue 11/17/2015 3:30 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Declined
Organizer:	Kenney, Meaghan

Friendly Reminder: Our Hazardous Mitigation Plan stakeholder meeting will be held *tomorrow, November 17, 2015, from 2:00 p.m. to 3:30 p.m.*, at the Doyle Center located at 2010 5th Avenue N., Texas City. If you are part of the plan but unable to attend, please send representatives from your jurisdiction that can discuss your city's hazards and reactions. Also, please invite county or city employees who have working knowledge of the community (i.e. CFM, engineer, public works, administrators, etc) if they were not included. The agenda and updated minutes are attached.

Thank you, Meaghan

RE: Galveston County Multi-Jurisdictional Hazard Mitigation Plan Update
Including the Jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe, and Village of Tiki Island

Thank you for your partnership in updating the Hazardous Mitigation Plan. The plan must be updated this year for the county and participating cities to remain eligible for federal grants and reimbursements, which are essential if we have a disaster.

Our stakeholder meeting will be held *Monday, October 19, 2015, from 3:00 p.m. to 5:00 p.m.*, at the Doyle Center located at 2010 5th Avenue N., Texas City. If you are part of the plan but unable to attend, please send representatives from your jurisdiction that can discuss your city's hazards and reactions. Also, please invite county or city employees who have working knowledge of the community (i.e. CFM, engineer, public works, administrators, etc) if they were not included.

The stakeholder meeting will be followed by a public meeting from 5pm-6pm that is open to all citizens (public release from the Judge's office is attached). True North Emergency Management LLC has been hired to oversee the planning process. Jason Dobronz is the Project Manager and can be reached at (561) 459-0493 or by email at jdobronz@truenorthem.com if you have questions.

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Mtg_10-19-15...

Planning Committee Meeting
November 17, 2015

Galveston County
Multi-Jurisdiction Hazard Mitigation Plan

Bayou Vista
Clear Lake Shores
Friendswood
Galveston County
Hitchcock
Jamaica Beach
Kemah
La Marque
League City
Santa Fe
Tiki Island

TRUE NORTH EMERGENCY MANAGEMENT

Meeting Objectives

- Approve Previous Meeting Minutes
- Outline Current Planning Status
- Capability Assessment Overview
- Public Survey Results
- Present Hazard List and Summarize Findings
- Hazard Ranking
- Next Steps

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Previous Meeting Minutes

- Please let us know if anyone has any comments and/or revisions for the minutes

TRUE NORTH EMERGENCY MANAGEMENT

Plan Update Overview

Section	Target Completion Date	Draft Completed
1 - Introduction	11-9-15	
2 - Planning Process	02-18-16	
3 - Community Profiles	11-13-15	√
18 - Capability Assessment	11-13-15	√
19 - Mitigation Strategy	12-30-15	
20 - Repetitive Loss Properties and NFIP Compliance	11-30-15	

TRUE NORTH EMERGENCY MANAGEMENT

HIRA Section Overview

Section	Target Completion Date	Completed
4 - HIRA Overview	01-22-16	
5 - Hurricane Wind	01-22-16	
6 - Coastal and Inland Flood	01-22-16	
7 - Tornado	01-22-16	
8 - Severe Weather (Hail/Lightning/Thunderstorm)	01-22-16	
9 - Tsunami	01-22-16	
10 - Drought	01-22-16	
11 - Extreme Heat	01-22-16	
12 - Urban and Wildfire	01-22-16	
13 - Winter Storm (Extreme Cold)	01-22-16	
14 - Dam/Levee Failure	01-22-16	
15 - Coastal Erosion/Coastal Retreat/Land Subsidence	01-22-16	

TRUE NORTH EMERGENCY MANAGEMENT

Man-Made/Technological Section Overview

Section	Target Completion Date	Completed
16 - Pipeline Failure	01-22-16	
17 - Hazardous Materials	01-22-16	

TRUE NORTH EMERGENCY MANAGEMENT

Capability Assessment

The following areas were surveyed to identify each jurisdictions existing plans, programs, resources, etc. in place:

- Planning and Regulatory
- Administrative and Technical
- Fiscal
- Education and Outreach

TRUE NORTH EMERGENCY MANAGEMENT

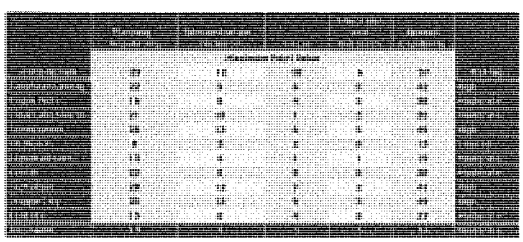
Scoring Methodology

Each capability provided by the jurisdiction received a scoring value of 1 with an additional point given to community's whose building codes are 2008 and greater, fire department rating is greater than 6, and they participate in the CRS program.

- Scoring:
  - High - score of 57 to 38
  - Moderate - score of 37 to 18
  - Limited - score of 17 to 0

TRUE NORTH EMERGENCY MANAGEMENT

Results



TRUE NORTH EMERGENCY MANAGEMENT

Public Survey Results

- 282 entries have been made in the Survey
- The Survey will be kept open until November 22nd and the total report will be provided to the Planning Group shortly thereafter
- Over 90% of respondents were home owners, in single family homes
- SO, what does the Public think about local hazards?

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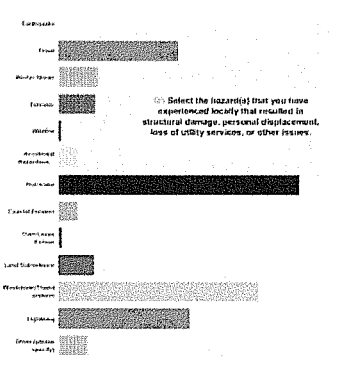

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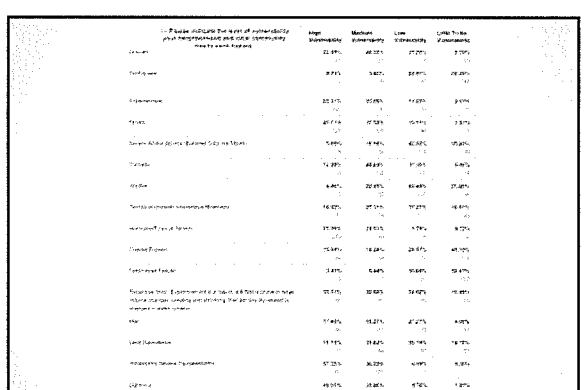

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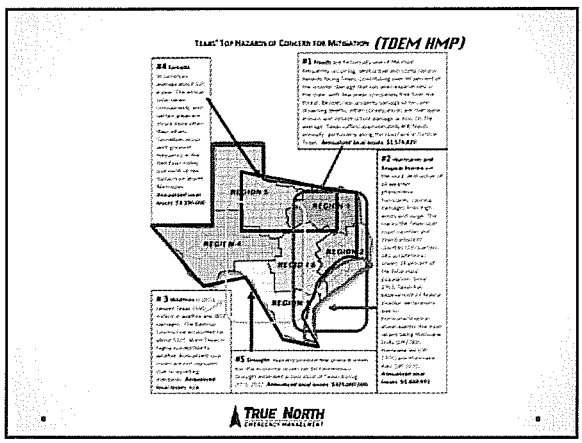
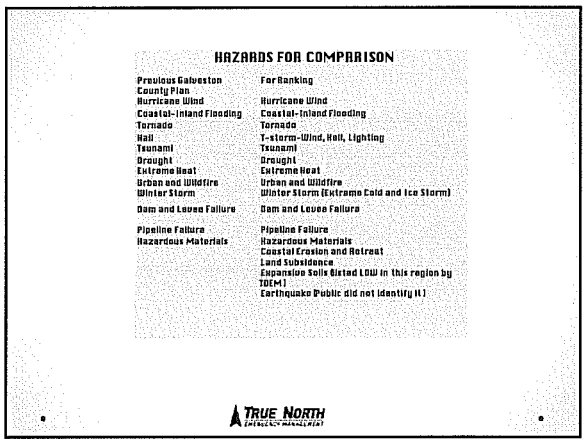




Hazards List

For Ranking

- Hurricane Wind
- Coastal-Inland Flooding
- Tornado
- T-storm-Wind, Hail, Lighting
- Tsunami
- Drought
- Extreme Heat
- Urban and Wildfire
- Winter Storm (Extreme Cold and Ice Storm)
- Dam and Levee Failure
- Pipeline Failure
- Hazardous Materials
- Coastal Erosion and Retreat
- Land Subsidence
- Expansive Soils (listed LOW in this region by TDEM)
- Earthquake (Public did not identify it)

TRUE NORTH EMERGENCY MANAGEMENT

Next Steps

- The following draft sections are ready for review:
  - Community Profile
  - Capability Assessment

Note: An email will be sent following this meeting with a link to download the draft sections and instructions on how to provide comments.

TRUE NORTH EMERGENCY MANAGEMENT

Next Steps

- Previous Mitigation Action Review
  - Status:
    - Galveston County - completed
    - Bayou Vista - in process
    - Clear Lake Shores - pending response to comments
    - Friendswood - in process
    - Hitchcock - in process
    - Jamaica Beach - completed
    - Kemah - completed
    - La Marque - completed
    - League City - in process
    - Tiki Island - completed

Note: Rebecca is working with each community to complete this process.

TRUE NORTH EMERGENCY MANAGEMENT

Meeting Schedules

- Tentative Steering and Working Committee Meeting
  - January 7 (mitigation actions and ranking) ***Possibly combining to one***
  - January 27 (hazard overview and mitigation strategy)
- Draft Plan Review - online process
  - February 1
- Public Meeting Draft Plan Review
  - February 9
- State Plan Review
  - February 12

TRUE NORTH EMERGENCY MANAGEMENT

Contact Information	
Jason Dobronz	jason.dobronz@truenorthem.com 561-459-0493
Rebecca Boone	rebecca.boone@neel-schaffer.com 601-906-1041
Ryan Williams	arwilliams@truenorthem.com 386-679-8959
Kingsley McCallum	kingsley.mccallum@neel-schaffer.com 985-788-2204

TRUE NORTH
EMERGENCY MANAGEMENT

Hazard Mitigation Planning Committee Meeting - Sign In

November 17, 2017
2:00 to 3:30 p.m.
Doyle Center, 2010 5th Ave. N., Texas City, TX

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Connie Nicholson	Director Contract Services		409-770-5543	connie.nicholson@co.galveston.tx.us	✓	
Meaghan Kenney	Deputy EMC	Galveston County	409-4581 0021	meaghan.kenney@co.galveston.tx.us	✓	✓
Ryan Edgill	Interim EMC	League City	979 450 5857	ryan.edgille leagrecity.com	X	X
Charlene Warren	EMC	La Marque	409-457-7511	c.todaro@ city of lamarque.org	✓	
Les Rumburg	Dir Public Svcs	La Marque	409 938 9287	l.rumburg@ cityof lamarque.org	✓	
Greg Rikard	Chief	Kemah	281 334 5414	grikard@ Kemah-tx.com	✓	
Amy Miller	Library Dir	La Marque	409.938 9272	a.miller@ cityoflamarque.org	✓	
NANCY BAHERE	ASST. COUNTY ENGINEER	GALVESTON COUNTY	409 770 5556	NANCY.BAHERE@CO.GALVESTON.TX.US	✓	

[redacted]

Hazard Mitigation Planning Committee Meeting - Sign In

November 17, 2017
2:00 to 3:30 p.m.
Doyle Center, 2010 5th Ave. N., Texas City, TX

Name	Title/Position	Community	Telephone Number	Email	Communication Preference	
					Email	Telephone
Amber Kershner	Fire admin/ Em specialist	La Marque	713-704 9770	a.kershner@cityofla[illegible]	✓	✓
Carol Buttler	City Mgr	La Marque		c.buttler@cityofla[illegible]	✓	
Cora Crews	Deputy EMC	Friendswood		ccrews@friendswood.com	✓	
Philip Mendows	Captain City of S.F.	Santa Fe				
Larry Williamson	Chief	Bayou Vista				
Brittany Rainville	PIO GCOEM	Galv County	409478 0242	brittany.rainville@galvcounty.tx.gov	✓	
Garret Foster	GCOEM	Galv County	409 6024031			✓
A. RYAN WILLIAMS	TMEM, Planner					

[redacted]

Steering and Mitigation Committee Meeting Summary

Meeting Date: November 17, 2015
Location: Doyle Center, 2010 5th Ave. N, Texas City, TX
Time: 2-3:30 p.m.
Attendance: 16

Introduction
Meaghan Kennedy, Deputy EMC, Galveston County welcomed the meeting participants to the Galveston County Multi-jurisdictional hazard mitigation plan kick-off meeting and introduced True North Emergency Management and participating jurisdictions.
Ryan Williams, representing True North, opened the presentation.

Approval of Previous Meeting Minutes-The group agreed to the previous meeting minutes with no comments or revisions.

Plan Update Status-The group was presented with the present time line for completion of the planning sections and was informed that two sections, Community Profiles, and Capability Assessments were under a final Q/C review for delivery to the client and the group. They were also told that these documents will be shared upon Q/C completion for any final input.

Review of Capability Assessment-The results of the Capability Assessment update were presented and no comments were received.

Public On-line Survey Results-The results of the public survey questions #4 and #5 were presented along with two hazard graphics from the TDEM HMP to help the group understand the public views of the hazards as well as the overall view from the Texas Division of Emergency Management.

Hazard List-The list of hazards from the previous plan correlated to the expanded list was presented. Some brief discussion from the participants about the urban and wildfire hazards took place. The outcome of the discussion was that the group would like the definitions of these hazards to be explicitly expressed in the plan.

Hazard Ranking-The group discussed qualitative and quantitative hazard analysis and were then tasked with hazard rankings specific to their jurisdictions. This task consumed a great deal of the meeting time and participation was energetic and interactive.

Next Steps-The group was presented information regarding the next meeting which is TBD in January. The public survey link will remain open through the month of November and those jurisdictions that were unable attend this meeting will be provided with guidance and the documents to complete their hazard rankings.

Mitigation Strategy Workshop

Meeting Dates: January 5-7, 2016

I. Review Mitigation Goals and Objectives

II. Review Previous Mitigation Action Tables

III. Review and Prioritize 2016 Mitigation Action Tables

IV. Identify Additional Mitigation Actions

V. Review Critical Facility/Infrastructure

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 5, 2016 **Time:** 9:00 a.m. to 11:00 a.m.

Location: 1111 Bayou Rd., La Marque **Community(s) Invited:** La Marque

Name	Title/Position	Community	Telephone Number	Email
Kyle Hunter	IT Analyst / Asst. EMC	La Marque	4099389862	k.hunter@cityofla marque.org
Charlene Warren	EMC	LaMarque	409.938.9225	c.todaro@cityoflamarque.org
Carol Buttler	City Manager	LaMarque	409.938.9202	c.buttler@cityoflamarque.org
Les Rumburg	Pub. Svc. Director	LaMarque	409.938.9282	l.rumburg@cityof lamarque.org
Rebecca Boone	Planner/Consultant		601-9061041	rebecca.boone@neel-schaffer.com

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 5, 2016 **Time:** 1:00 p.m. to 3:00 p.m.

Location: 3650 FM 646 North, Santa Fe **Community(s) Invited:** Santa Fe

Name	Title/Position	Community	Telephone Number	Email
Diana Steelquist	Director Community Services	Santa Fe	409/ 925-6412	diana@ci.santa-fe.tx.us
Chris Beanland	Street Supt.	Santa Fe	409-925-8933	
James Newman	WCID #8	Santa Fe	409-750-2445	WCID8@Comcastinet.
Kenneth Campbell	Chief	Santa Fe	409 925 4806	Kenneth@ci.santa-fe.tx.us
Philip Meadows	Captain	Santa Fe	409-925-2000	Philip@ci.santa-fe.tx.us
Joe Dickson	City Manager	Santa Fe	409 925-6412	Joe@ci.santa-fe.tx.us
Rebecca Boone	Planner/Consultant		601 906-1041	rebecca.boone@neel-schaffer.com

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 5, 2016 **Time:** 3:45 p.m. to 5:00 p.m.

Location: 1600 Whitaker Drive, Friendswood **Community(s) Invited:** Friendswood

Name	Title/Position	Community	Telephone Number	Email
Steven Simmons	Deputy Fire Marshal	Friendswood	281 996-3335	ssimmons@friendswood.com
Brian Mansfield	Deputy Chief	FWD	" "	bmansfield@friendswood.com
Terry Byrd	EMC	Friendswood	281 996-3335	tbyrd@friendswood.com
Corey Crews	Deputy EMC	FWD	✓	ccrews@friendswood.com
Rebecca Boone	Planner/ Consultant		601 9061041	rebecca.boone@neel-schaffer.com

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 6, 2016 **Time:** 8:30 a.m. to 10:30 a.m.

Location: 783c Marlin, Bayou Vista **Community(s) Invited:** Bayou Vista, Hitchcock, Jamaica Beach, Tiki Island

Name	Title/Position	Community	Telephone Number	Email
LARRY WHITTINGTON	CHIEF OF POLICE	BAYOU VISTA	409 935.0449	chiefwhittington@gmail.com
JOHN BRICK	City Admin	Jam. Bch	409 737-1142	jbrick@ci.jamaica beach.tx.us
Rebecca. Boone	Planner/consultant		601 906-1041	rebecca.Boone@neelschaffer.com

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 6, 2016 **Time:** 3:00 p.m. to 5:00 p.m.

Location: 555 W. Walker, League City **Community(s) Invited:** League City, Kemah, Clear Lake Shores

Name	Title/Position	Community	Telephone Number	Email
Ryan Edghill	Asst. EMC	League City	281-554-1302	ryan.edghill@leaguecity.co
Alex Noel	CFM	League City	281-554-1302	alex.noel@leaguecity.com
George Jones	City Admin.	Clear Lake Shores	281-334-2179	gjones@clearlakeshores-tx.gov
Kenneth Cook	EMC	Clear Lake Shores	281-334-1034	kcook@clearlakeshores-tx.gov
Gary Rikard	Police chief	Kemah	281-334-5414	grikard@kemah-tx.com
Brent Hahn	Asst EMC	Kemah	281-538-5727	brent.hahn@kemahfire.com
Rebecca Boone	Planner/Consultant		601 906-1041	rebecca.boone@neel-schaffer.co

Mitigation Action Plan Workshop Meeting - Sign In

Date: January 7, 2016 **Time:** 10:00 a.m. to 11:00 a.m.

Location: 1301 FM 646 Rd W, Dickinson **Community(s) Invited:** Galveston County

Name	Title/Position	Community	Telephone Number	Email
Meaghan Kenney	Deputy EMC	Galveston	409-539-0021	meaghan.kenney@co.galveston.tx.us
Connie Nicholson	Director Contract Services	Galveston Co	409-770-5543	connie.nicholson@co.galveston.tx.us
Garnet Foskit	EMC	Galv. Co	281 309 5003	garnet.foskit@co.galveston.tx.us
Rebecca Boone	Planner/Consultant		401 906 1041	rebecca.boone@neel-schaffer.c

Rebecca Boone

Subject:	santa fe
Location:	3650 FM 646 North, 77510
Start:	Tue 1/5/2016 1:00 PM
End:	Tue 1/5/2016 3:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Rebecca Boone
Required Attendees:	philip@ci.santa-fe.tx.us; kenneth@ci.santa-fe.tx.us

Gentlemen:

I am preparing for our meeting on January 6th from 1-3:00 p.m. and wanted to send you a meeting reminder with a list of items we will need to work through to get your community rolled into the Galveston County Hazard Mitigation Plan. Feel free to invite anyone else from your community (i.e. CFM, engineer, public works, administrators, planning/zoning, etc.) that can lend to providing feedback/input on mitigation actions, knowledge of facility/infrastructure needs, vulnerable areas, etc.

During this meeting, we will discuss the following topics:

- Identify vulnerable areas within your jurisdiction that are prone to impacts from natural hazards
- Outreach and education programs regarding hazards
- Repetitive flood loss properties
- Discuss critical facility and infrastructure improvement needs (generators, hardening measures, etc.)
- List of critical facilities and infrastructure
- Identify mitigation actions and establish priority ranking

Below are two attachments that I sent in previous emails we will need to work through:

- Santa Fe critical facilities – emailed this document to you on December 15th. If you have this completed, please return it to me via email.
- Mitigation Action Ideas 2016 – emailed this document to you on December 22nd. This is the main topic for our meeting. we will need to select actions that are suited to your community that lend to improving your vulnerability to natural hazards. Since this is your first plan, I recommend we go with a short and general listing to get you started.

Santa Fe Critical facilities a... Mitigation Action Ideas_2016.d...

Please let me know if you have any questions! To help me prepare for this meeting, please indicate your participation in the "respond" options at the top of this invitation or at least email me how many will be meeting with me.

Thanks,
Rebecca
Cell 601-906-1041

Rebecca Boone

Subject:	hazard mitigation plan workshop
Location:	Your office
Start:	Tue 1/5/2016 3:45 PM
End:	Tue 1/5/2016 5:15 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Rebecca Boone
Required Attendees:	tbyrd@ci.friendswood.tx.us; ccrews@friendswood.com
Optional Attendees:	Cora Crews

I will be in your area the first week of January and would like to schedule a workshop to go over the final pieces of your mitigation action plan, goals/objectives (see attached), and priority rankings. Following our meeting, I would like to treat you both to dinner as a thank you for helping me mesh your previous plan into this multi-jurisdiction plan approach!

Goal and objective Cross...

Meeting Date: Tuesday, January 5
Time: 3:45 to 5:00
Location: Your place? Please send me the address!

Please let me know if this date and time work for you so we can lock it down. Feel free to invite other officials/stakeholders to participate in our meeting from 3:30 to 5:30 – such as CFM, public works, administration, etc.

Thanks,
Rebecca Boone
Cell: 601-906-1041
Direct line: 601-351-2702

Rebecca Boone

Subject:	Hazard mitigation plan workshop
Location:	783c marlin bayou vista tx
Start:	Wed 1/6/2016 8:30 AM
End:	Wed 1/6/2016 10:30 AM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Rebecca Boone
Required Attendees:	jbrick@ci.jamaicabeach.tx.us; jhamm@hitchcockpd.com; hearring@sbcglobal.net; Bryan Springer (b@bryanspringer.com); chiefwhittington@gmail.com

I am preparing for our meeting next week and would like to get an idea of how many from your communities will be participating in our discussion. Please indicate your availability by selecting your option in the "respond" box at the top of this meeting invitation.
Also attached is a copy of some new mitigation action ideas (2016) that were previously emailed to you. We will walk through these to see if any should be added to your action plan and establish your priority rankings for the next five years.
Please let me know if you have any questions!
Thanks,
Rebecca

Mitigation Action Ideas_2016.d...

Good afternoon!

I will be in town the first week of January and would like to meet with you all to go over a few items for the hazard mitigation plan update specific to your community. Feel free to invite anyone else from your community (i.e. CFM, engineer, public works, administrators, etc.) that can lend to providing feedback/input on mitigation actions, knowledge of facility/infrastructure needs, vulnerable areas, etc.
During this meeting we will make sure we have a sound approach to your mitigation action plan, review the revised mitigation goals and objectives (see attached document), and verify the priority ranking of your actions.

Goal and objective Cross...

Meeting Information:

Date:	January 6 (Wednesday)
Time:	8:30 am to 10:30 am
Location:	783c Marlin, Bayou Vista (across from Bayou Vista Police station)

I appreciate all your help in gathering the data we need to present to FEMA and TDEM regarding your vulnerabilities to natural hazards!
Please let me know if you have any questions or conflicts that would prevent participation in this meeting by at least one member from your community.

Thanks,

Rebecca Boone

Subject:	Hazard mitigation plan workshop
Location:	555 W. Walker League City (Public Safety Bldg.)
Start:	Wed 1/6/2016 3:00 PM
End:	Wed 1/6/2016 5:00 PM
Recurrence:	(none)
Meeting Status:	Meeting organizer
Organizer:	Rebecca Boone
Required Attendees:	Rebecca Boone; ryan.edghill@leaguecity.com; bkerber@kemah-tx.com; brent.hahn@kemahfire.com; gjones@clearlakeshores-tx.gov; vernjohnson08 @gmail.com; kcook@clearlakeshores-tx.gov
Optional Attendees:	Noel, Alex; Carpenter, Kris

Good morning!

I will be in town the first week of January and would like to meet with you all to go over a few items for the hazard mitigation plan update specific to your community. Feel free to forward this invitation to anyone else from your community (i.e. CFM, engineer, public works, administrators, etc.) that can lend to providing feedback/input on mitigation actions, knowledge of facility/infrastructure needs, vulnerable areas, etc. Please indicate your participating for this meeting by selecting the appropriate "RESPOND" option.

During this meeting we will make sure we have a sound approach to your mitigation action plan, review the revised mitigation goals and objectives (see attached document), and verify the priority ranking of your actions.

Goal and objective Cross...

Meeting Information:

Date:	January 6 (Wednesday)
Time:	3:00 p.m. to 5:00 p.m.
Location:	555 W. Walker, League City (Public Safety Building)

I appreciate all your help in gathering the data we need to present to FEMA and TDEM regarding your vulnerabilities to natural hazards!

Please let me know if you have any questions or conflicts that would prevent participation in this meeting by at least one member from your community.

Rebecca Boone,
Cell 601-906-1041
Email: Rebecca.boone@neel-schaffer.com

Rebecca Boone

From: Rebecca Boone
Sent: Wednesday, December 16, 2015 3:34 PM
To: 'c.todaro@cityoflamarque.org'
Subject: Galveston County Hazard Mitigation Plan - Meeting to Review Mitigation Actions
Attachments: La Marque list of critical facilities and infrastructure.docx; LaMarque mitigation action review.docx

Charlene:

I will be in your area January 5-6 and would like to schedule a meeting with you and appropriate city officials to identifying/review mitigation actions for inclusion in the Galveston County Hazard Mitigation Plan Update.

- January 5: 9-11:00 am or 1-3:00 p.m.
- January 6: 2:30-4:30 pm

The meeting should take no more than two hours and would be great if we can have representation from the following departments:

- City Manager
- Building Department/Public Works
- Planning/Zoning
- Floodplain Manager
- Emergency Manager

I have attached a couple of documents that you can begin to work on – critical facilities/infrastructure and mitigation action review. If you have time, it would be very helpful if you can try to complete the information needed and return to me prior to my arrival. That way, I can see what we need to focus on so we can move quickly through our meeting.

Let me know if you want to talk through these documents – I will be off tomorrow (going to try to get my Christmas shopping done without the weekend crowds!) but back in my saddle on Friday. I will also be here until 4:30 this afternoon. Also, please let me know what date and time will best for me to meet with you.

Thanks,
Rebecca

Rebecca Boone
Neel-Schaffer
125 S. Congress Street, Suite 1100
Jackson, MS 39201
Main Telephone: 601-948-3071
Direct Telelphone: 601-351-2702
Cell: 601-906-1041

"If we do not change our direction, we are likely to end up where we are headed." **Ancient Chinese proverb**

Steering Committee Meeting

Meeting Date: January 20, 2016

Time: 10:00 a.m. to 12:00p.m.

Location: Bayou Vista Community Center
783c Marlin, Bayou Vista, TX

I. Welcome

II. Approval of Previous Meeting Minutes

III. Plan Update Status

IV. Review Hazard Analysis

V. Review Repetitive Flood Loss

VI. Next Steps

Rebecca Boone

Subject:	Reminder: Hazard Mitigation Plan
Location:	783c Marlin, Bayou Vista
Start:	Wed 1/20/2016 10:00 AM
End:	Wed 1/20/2016 12:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Declined
Organizer:	Kenney, Meaghan

maryNotes_Comm Mtg_11-...

January 20, 2015

Hazard Mitigation Plan: We are wrapping up the Hazard Mitigation Plan and will be meeting on *January 20, 2016, from 10:00 a.m. to 12:00 p.m.*, at 783c Marlin, Bayou Vista (across from the Bayou Vista Police Station). If you are part of the plan but unable to attend, please send representatives from your jurisdiction that can discuss your city's hazards and reactions. Also, please invite county or city employees who have working knowledge of the community (i.e. CFM, engineer, public works, administrators, etc) if they were not included.

The minutes from our last meeting (Nov 17th) are attached.

ATT17523 1.jpg

Planning Committee Meeting
January 20, 2015

Galveston County
Multi-Jurisdiction Hazard Mitigation Plan

Bayou Vista
Clear Lake Shores
Friendswood
Galveston County
Hitchcock
Jamaica Beach
Kemah
La Marque
League City
Santa Fe
Tiki Island

TRUE NORTH EMERGENCY MANAGEMENT

Meeting Objectives

- Approve Previous Meeting Minutes
- Planning Update, Status
- Review of Hazard Ranking Results
- Review of Hazard Analysis Data
- Final Ranking
- Repetitive Flood Loss Update
- Next Steps

TRUE NORTH EMERGENCY MANAGEMENT

Previous Meeting Minutes

- Please let us know if anyone has any comments and/or revisions for the minutes

TRUE NORTH EMERGENCY MANAGEMENT

Plan Update Overview

Section	Status	Next Step
1-Introduction	Under County Review	Send to Communities for Review
2-Planning Process	In Progress	Draft ready prior to Public Draft Plan review Meeting
3-Community Profiles	Under County Review	Send to Communities for Review
18-Capability Assessment	Under County Review	Send to Communities for Review
19-Mitigation Strategy	Meetings held Jan. 5-7	Rankings Pending: Hitchcock, Tiki Island due by 1-21-16
20-Repetitive Loss Properties	County returned with comments	Draft 2 to be completed by 1-21-16

TRUE NORTH EMERGENCY MANAGEMENT

HIRA Section Overview

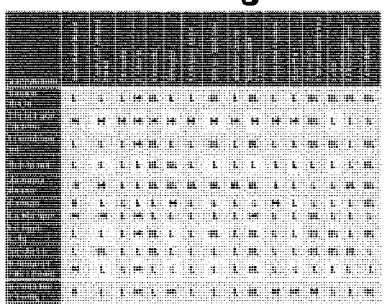
Section	Target Completion Date	Completed
4 - HIRA Overview	01-22-16	
5 - Hurricane (Wind)	01-22-16	
6 - Coastal-Issues Focus (Flash Flooding, & Surge)	01-22-16	
7- Tornado	01-22-16	
8 - Thunderstorm, Hailstorm, Lightning	01-22-16	
9 - Tsunami	01-22-16	
10 - Drought	01-22-16	
11 - Extreme Heat	01-22-16	
12 - Urban and Interior	01-22-16	
13 - Winter Storm (Extreme Cold)	01-22-16	
14 - Dam/Levee Failure	01-22-16	
15 - *Coastal Erosion/Coastal Retreat/Land Subsidence*	01-22-16	

Man-Made/Technological Section Overview

Section	Target Completion Date	Completed
16 - Pipeline Failure	01-22-16	
17 - Hazardous Materials	01-22-16	

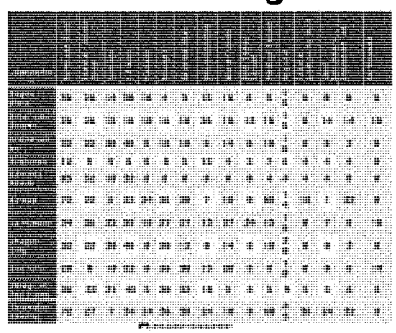
TRUE NORTH EMERGENCY MANAGEMENT

Hazard Rankings (VL-H)



TRUE NORTH EMERGENCY MANAGEMENT

Hazard Rankings (#s)



Natural Hazards Data Review

Everyone ranked Hurricane Wind as the number one hazard for the area

TRUE NORTH EMERGENCY MANAGEMENT

Flash Flooding ($1,580,000)

- 52 Flash Flood incidents according to the NCDC data
- Average loss per event-$29,259
- Fatalities-0
- Injuries-0
- NOTE this is a component of Coastal-Inland Flooding, which also includes surge

TRUE NORTH EMERGENCY MANAGEMENT

Tornado ($33,202,270)

- 92 Tornado according to the NCDC data
- Average loss per event-$360,894
- Fatalities-9
- Injuries-242

TRUE NORTH EMERGENCY MANAGEMENT

Wind/Hail/Lightning-storms ($53,241,000)

- 188 Thunderstorm events related to hail, wind, and lightning
- Average loss per event-$283,197, <u>most</u> damage was from wind events (over $51 million)
- Fatalities-0
- Injuries-0

TRUE NORTH EMERGENCY MANAGEMENT

Drought ($110,600,000)

- 3 events according to the NCDC data
- Average loss per event-$3.68 million

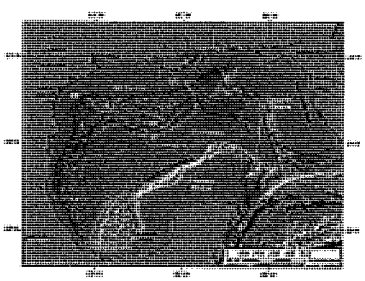
TRUE NORTH EMERGENCY MANAGEMENT

Extreme Heat ($0)

- 6 events according to the NCDC data
- Average loss per event-$0
- Fatalities-38
- Injuries-200

TRUE NORTH EMERGENCY MANAGEMENT

Tsunami



TRUE NORTH EMERGENCY MANAGEMENT

*Winter Storm ($800,000)

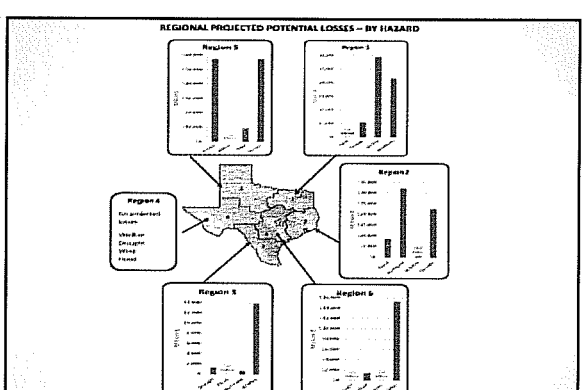
Date	Type	Deaths	Injuries	Property Damage (10/06 Dollars)	Description
1/12-13/1997	Ice Storm-Freezing Rain and Sleet	3	0	$800,000	Trees, power lines and roadways were all affected by freezing rain and sleet. Glazed roadways posed hazardous driving conditions. Over 1,100 traffic accidents were reported in southeast Texas, causing 3 deaths.
12/24-25/2004	Heavy Snow	0	0	$0	A rare and record breaking snowfall occurred across southeast Texas. Snowfall totals ranged from 5-13 inches across the region. Approximately 4 inches fell on Galveston Island.
02/03-4/2011	Ice Storm-Freezing Rain	0	0	$0	A period of freezing rain and freezing drizzle led to icy roads, ice on bridges and overpasses, and numerous accidents. Between one and two tenths of an inch of ice accumulated.

TRUE NORTH EMERGENCY MANAGEMENT

We are revisiting rankings

- Refer to your handouts (your old numbers are still there if you want to transpose)
- We will distribute ranking sheets ONE PER jurisdiction

TRUE NORTH EMERGENCY MANAGEMENT



TRUE NORTH EMERGENCY MANAGEMENT

Repetitive Loss Update

Rebecca will send a draft of the repetitive flood section to each jurisdiction to review their data no later than January 22nd

TRUE NORTH EMERGENCY MANAGEMENT

QUESTIONS?

TRUE NORTH EMERGENCY MANAGEMENT

Contact Information

Rebecca Boone	rebecca.boone@neel-schaffer.com 601-981-1941
Ryan Williams	rwilliams@truenorthem.com 386-679-5959

TRUE NORTH EMERGENCY MANAGEMENT

Hazard Mitigation Planning Committee Meeting - Sign In
Date: January 20, 2016
Time: 10am-Noon
Location: 783c Marlin, Bayou Vista

Name	Title/Position	Community	Telephone Number	Email
Meaghan Kenney	GC Deputy EMC	Galveston County	409-539-0021	meaghan.kenney@co.galveston.tx.us
BRIAN SPRINGER	EMC	Tiki	409 692-6880	bc@brianspringer.com
LARRY M. WHITTINGTON	EMC / CHIEF OF POLICE	BAYOU VISTA	409. 935.0449	chiefwhittington@gmail.com
Brian Marsfield	Deputy Dir EMC	Friendswood	281 996.5335	bmarshall@friendswood.com
CORA CREWS	Asst. EMC	Friendswood	281 996-3335	ccrews@friendswood.com
Carol Buttler	City Mgr	LaMarque	409-938-9225	c.buttler@cityflamarque.org
George Jones	City Admin	Clearlake Shores	281-334-2799	gjones@clearlakeshores-tx.go
John Brick	City Admin	Jamaica Beach	409 737-7142	jbrick@cityjamaicabeach.tx.us

Hazard Mitigation Planning Committee Meeting - Sign In
Date: January 20, 2016
Time: 10am-Noon
Location: 783c Marlin, Bayou Vista

Name	Title/Position	Community	Telephone Number	Email
Ryan Edgill	EMC	League City	281 554 1302	ryan.edgill@leaguecity.com
Alex Noel	Flood Plain	League City	281-554-1429	alex.noel@leaguecity.com
Rosana Pratt	Deputy EMC	Galveston		prattros@cityofgalveston.org
Charlie Kelly	EMC	Galveston		Kellycha@cityofgalveston.org
Charlene Warren	EMC	LaMarque	409-938-9225	c.todaro@cityofLamarque.org
Kenny Cook	Chief, EMC	Clear Lake Shores	(832) 309-5868	kcook@clearlakeshores-tx.gov
Brent Hatch	Fire Chief EMC	Kemah	281-709-7614	Brent.Hatch@KemahFire.com
Sean Welsh	Floodplain	Galveston County	409-770-5552	Sean.Welsh@co.galveston.tx.us

Hazard Mitigation Planning Committee Meeting - Sign In
Date: January 20, 2016
Time: 10am-Noon
Location: 783c Marlin, Bayou Vista

Name	Title/Position	Community	Telephone Number	Email
Les Rumburg	Director, Dev. Services	La Marque	409-935-9287	L.rumburg@cityofla marque.org
Amber Karshner	EM Specialist	La Marque	409-938-9264	a.karshner@cityof lamarque.org
Gerald Grimm	Fire chief	La Marque	409-938-9261	g.grimm@cityof lamarque.org
Brittany Rainville	PIO -	Galv County	409.978-0242	brittany.rainville@galvestoncounty tx.gov
Philip Meadows	Captain	Santa Fe	409 925-2000	Philip@ci.santa-fe.tx.us
[illegible]	Chief of Police	Hitchcock	409.986.5559	jhasam@hitchcockPD.com

Steering and Mitigation Committee Meeting Summary

Meeting Date: January 20, 2016
Location: 783c Marlin Street, Bayou Vista
Time: 10am-Noon
Attendance: 22

Introduction

Meaghan Kennedy, Deputy EMC, Galveston County welcomed the meeting participants to the Galveston County Multi-jurisdictional hazard mitigation plan and introduced Ryan Williams, True North Emergency Management. Subsequently, attendees introduced themselves by name, agency, and jurisdiction.

Approval of Previous Meeting Minutes

The group agreed to the previous meeting minutes with no comments or revisions, a deadline of COB Friday January 22nd was agreed upon as a final date for revisions via email.

Plan Update Status

The group was presented with the present time line for completion of the planning sections. They were also told that these documents will be shared upon Q/C completion for final input.

Review of Hazard Analysis

The natural hazards data from the NCDC was presented. Participating jurisdictions were asked to review their previous rankings and ensure that they were in final form. Minor revisions to the hazard list including the breakout of Lightning, Hailstorm, and Windstorm as stand-alone hazards in alignment with the TDEM plan occurred.

Repetitive Flood Loss

Participants were informed that the repetitive flood loss information is under final review and incorporation of the latest information is under way. A final analysis of this information will occur through email with particpating jurisdictions.

Appendix B-2

Public/Stakeholder Meeting Documentation and Online Survey Results

Public Input Meeting - Sign In
Monday, October 19, 2015
5:00 p.m. – 6:00 p.m.
Doyle Center - 2010 5th Avenue North, Texas City

Name/Title (if applicable)	Community
Connie Nicholson Director Contract Services	Galveston Co.
Brittany Rainville PIO Galv. Co. OEM	Galveston Co.
Ryan Edgell EMC	League City
Jerry Byal Fire Marshal/EMC	Friendswood
Gerald Grimm Fire Chief	La Marque
Kirk Jackson	League City
Michael Lambert Homeland Security Planner	GCOEM
Charlene Warren / EMC	La Marque
Carol Buttler - City Mgr	La Marque
Cora Crews - Dep EMC	Friendswood
Meaghan Kenney Deputy EMC	Galveston Co.
Rebecca Bane, consultant	
Ryan Williams, consultant	

Public Input Meeting - Sign In
Wednesday, January 6, 2016
12:00 a.m. to 2:00 p.m.
Lowe's - 3620 Emmett F. Lowry Expressway, Texas City

Name/Title (if applicable)	Community
Meaghan Kenney, Deputy EMC Galveston County	Galveston County
Rebecca Boone, Consultant True North	
AL CHANDLER CITIZEN	LA MARQUE
[illegible]	Texas City
ALYSHA JOHNSON LICOEM	LA MARQUE
C.B. Rathbone	League City
Cathy Catching - resident	Texas City
Michael D. Griffith	Clear Lake
JAMES HARVEY	Santa Fe
George Milburn	Bolivar Pen.
Johnny Smith	Texas City
Robert Smith	Kemah
Steve McMontgomery	Texas City
Danny Sanders	Texas City

Mark Henry

County Judge
County of Galveston

Galveston County Courthouse
722 Moody Avenue, Galveston, Texas 77550

PUBLIC INVITED TO GALVESTON COUNTY MULTI-JURISIDCTIONAL HAZARD MITIGATION OPEN HOUSE

October 7, 2015

GALVESTON COUNTY, TX – The Galveston County Office of Emergency Management (OEM) invites the public to participate in the development of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan. The meeting will take place on Monday, Oct. 19 from 5 p.m. - 6 p.m. at the Doyle Center, 2010 5th Avenue N., Texas City 77590.

The purpose of the open house meeting, hosted by the Galveston County OEM in conjunction with the Galveston County Commissioners Court and local city officials, is to develop a plan with input from the general public.

"The goal in developing a multi-jurisdictional hazard mitigation plan is to reduce loss of life and property during a hazard," County Judge Mark Henry said. "By planning and communicating with each other prior to an emergency, we will be better prepared to address the next natural disaster when it occurs."

During the open house, citizens will be given an opportunity to provide their input regarding hazard concerns and projects. This information will then be used in the development of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan which includes the jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe and Village of Tiki Island.

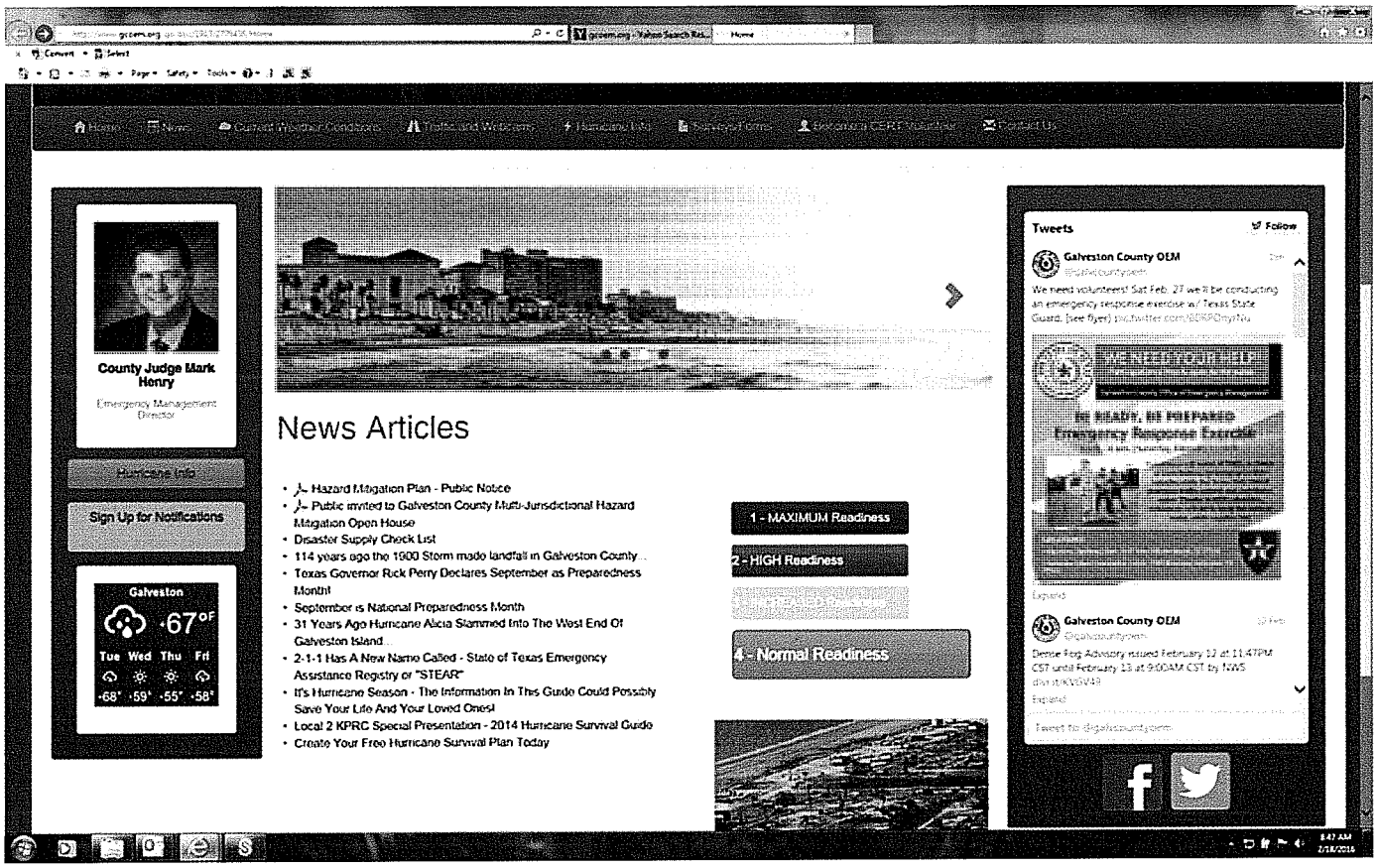
"We have all learned valuable lessons from disasters that have impacted our communities," Henry said. "This exchange of information will benefit community leaders and the general public as they learn to be more self-sufficient in preparing for and recovering from natural disasters."

If anyone is unable to attend the meeting, they may provide their input regarding natural hazards by completing an online survey from Oct. 19 to Nov. 20, 2015 at:

https://www.surveymonkey.com/r/6SBHZF9

Media Contact:
Brittany Rainville
brittany.rainville@galvestoncountytx.gov
O: 409-770-5457 • C: 409-978-0242 • Fax 409-765-2915

www.gcoem.org: Announcement of public meetings October 19, 2015 and January 20



City of Friendswood Texas

Hazard Mitigation Plan Survey

The City of Friendswood is participating as a stakeholder with Galveston County in the review and update of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

The first stakeholder meeting, along with a public meeting, were held on Monday, October 19.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

True North Emergency Management LLC has been contracted to oversee the planning process.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

As part of the on-going hazard mitigation process, a survey has been developed and all residents of the City are encouraged to participate.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

Your input will help in the identification of the vulnerabilities to natural disasters faced and to develop proposed mitigation action items to reduce or eliminate future impacts from such hazards.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

Your input will help improve local public-private coordination, mitigation, and risk reduction efforts.

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

The survey can be found at:
https://www.surveymonkey.com/r/6SBHZF9

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

City of Friendswood Texas

Hazard Mitigation Plan Survey

The survey can be found at:
https://www.surveymonkey.com/r/6SBHZF9

Friendswood on TRAQ
TRUST RESPECT ACCOUNTABILITY QUALITY

October 22, 2015
As posted on the City of Friendswood's Website

http://www.ci.friendswood.tx.us/

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October 2015

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Friendswood News

Hazard Mitigation Plan Survey
Oct 22 2015
The City of Friendswood is participating as a stakeholder with Galveston County in the review and up... details

Veterans Day program and lunch
Oct 15 2015
Everyone is invited to honor veterans and active military at the 6th Annual Veterans Day program and... details

Fall Haul
Oct 14 2015
It's time to prepare for the Fall Haul. Friendswood's city-wide clean-up and garage sale, is Satur... details

FHS Homecoming Parade street closures
Oct 14 2015
A portion of FM 518 (Friendswood Drive) will be closed on Thursday night, October 22 for the Friends... details

2015 Flapjack Fun Run sponsorships available
Oct 8 2015
This year's Flapjack Fun Run is Saturday, December 5 in Stevenson Park. Last year, more tha... details

Financial Achievement Award
Oct 8 2015
For the 27th consecutive year, the City of Friendswood has received the Certificate of Achievement i... details

View All

Friendswood Events

Traffic Control Plan "Friendswood High School Homecoming Parade"
Oct 22 2015
Printable pdf Traffic Control Plan Friendswood High School Homecoming Parade ... details

Keep Friendswood Beautiful Meeting
Oct 27 2015
MEETING OF KEEP FRIENDSWOOD BEAUTIFUL Agenda October 27, 2015 NOTICE IS HEREBY GIVEN ... details

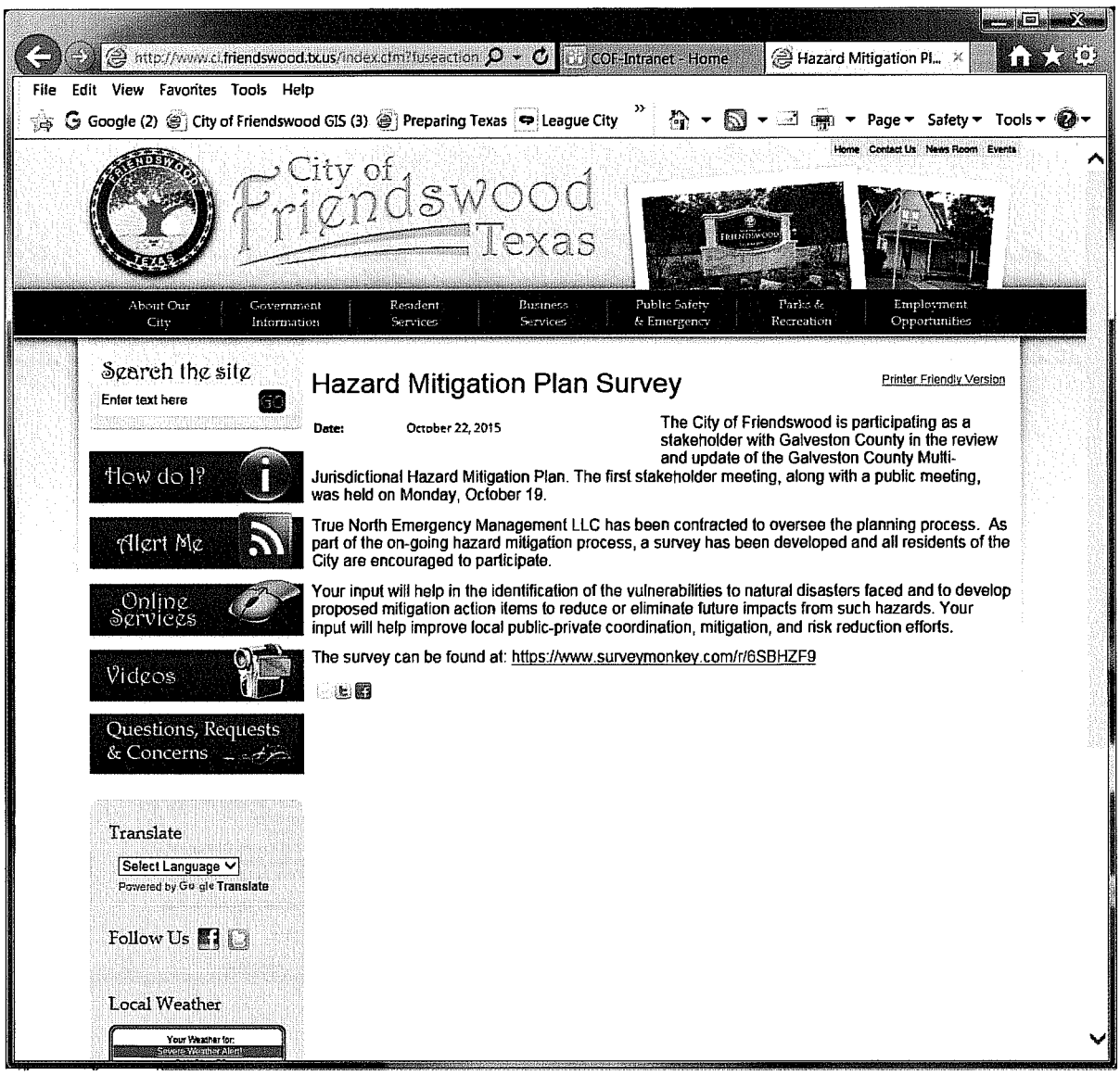
Zoning Board of Adjustment Meeting
Oct 27 2015
NOTICE IS HEREBY GIVEN OF A REGULAR MEETING OF THE FRIENDSWOOD ZONING BOARD OF ADJUSTMENT ... details

Animal Shelter Advisory Committee Meeting
Nov 3 2015
NOTICE IS HEREBY GIVEN OF A MEETING OF THE FRIENDSWOOD ANIMAL SHELTER ADVISORY COMMITTEE TO BE ... details

Fall Haul City-wide Cleanup and Garage Sale
Nov 14 2015
Fall Haul City-wide Cleanup and Garage Sale Saturday, November 14, 2015 8 a.m. to 2 p.m. Ce... details

2nd Annual Flapjack 5K Fun Run
Dec 5 2015

October 22, 2015
Once link is opened on main city webpage, this is how it is displayed.



October 22, 2015
As posted on the City of Friendswood's Facebook Page

This is a copy of the email sent out on the City of Friendswood's mass email system to all residents who have signed up to receive all general notifications from the city.

October 22, 2015

From: City of Friendswood [mailto:do_not_reply@friendswood.com]
Sent: Thursday, October 22, 2015 3:03 PM
Subject: Hazard Mitigation Plan Survey

The City of Friendswood is participating as a stakeholder with Galveston County in the review and update of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan. The first stakeholder meeting, along with a public meeting, was held on Monday, October 19.

True North Emergency Management LLC has been contracted to oversee the planning process. As part of the on-going hazard mitigation process, a survey has been developed and all residents of the City are encouraged to participate.

Your input will help in the identification of the vulnerabilities to natural disasters faced and to develop proposed mitigation action items to reduce or eliminate future impacts from such hazards. Your input will help improve local public-private coordination, mitigation, and risk reduction efforts.

The survey can be found at:
https://www.surveymonkey.com/r/6SBHZF9

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NEWS RELEASE
City of Friendswood

HEADLINE: Hazard Mitigation Survey

STORY: The City of Friendswood is participating as a stakeholder with Galveston County in the review and update of the Galveston County Multi-Jurisdictional Hazard Mitigation Plan. The first stakeholder meeting, along with a public meeting, were held on Monday, October 19.

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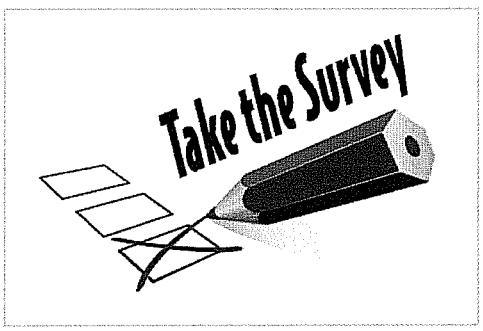
Your input will help improve local public-private coordination, mitigation, and risk reduction efforts. The survey can be found at: https://www.surveymonkey.com/r/6SBHZF9
--30—
Jeff Newpher
Communications Specialist, City of Friendswood
910 S. Friendswood Drive, Friendswood, TX 77546 (281) 996-3294
jnewpher@friendswood.com www.friendswood.com

Emergency Management

Posted on: October 28, 2015

Hazard Mitigation Plan Survey



Take The Survey

The City of La Marque in conjunction with the County and surrounding cities are updating our Hazard Mitigation Plans and your input is important to OUR Plan. Please fill out the survey (https://goo.gl/9NtLy0) and let us know what is important to you. The survey will close on November 20, 2015

Click here for the survey

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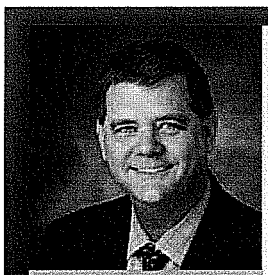

County Judge Mark Henry
Emergency Management Director

About Hurricanes
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Evacuation Considerations
How to Prepare
Pets and Hurricanes

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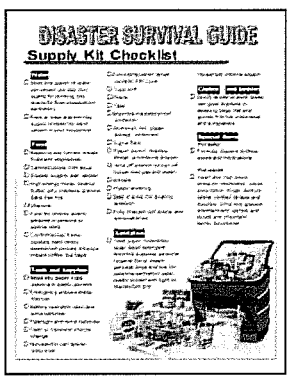
Galveston County Office of Emergency Management
1353 FM 646W, Suite 201
Dickinson, Texas 77539
http://www.gcoem.org/
281-309-50
FAX 888-534-56
Toll-Free/24-Hour On-Call 888-384-20

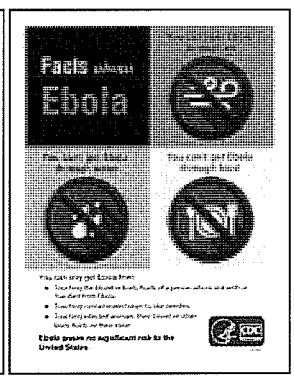
Public invited to Galveston County Multi-Jurisdictional Hazard Mitigation Open House

Document Link

Disaster Supply Check List

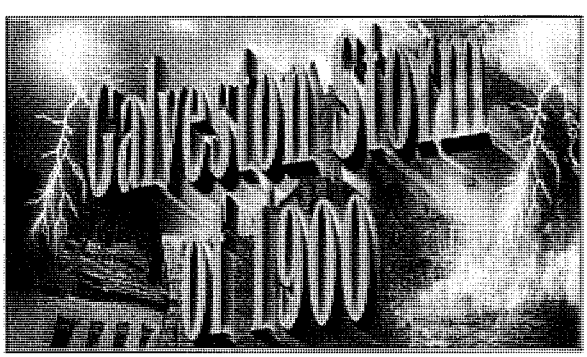
Click here or on image for larger view: *Click here for EBOLA facts:*





CLICK HERE FOR UPDATES ON EBOLA INFORMATION:
Document Link

114 years ago the 1900 Storm made landfall in Galveston County...



On Saturday, September 8, 1900, a hurricane of almost unimaginable force smashed into the Texas coast at Galveston. Winds reached as high as 120 miles per hour. The storm surge inundated the city and the county to a depth of 15 feet, and the great amount of debris in the water acted as a battering ram against the city and the county as the waves rose and fell. Two-thirds of the buildings were destroyed, and between 6000 and 8000 people killed in Galveston County. It was the worst natural disaster in United States history. Scenes of unbelievable horror and suffering followed for weeks after the disaster.

We will never forget the lessons of the 1900 storm. Be prepared, have a plan and for more information on Hurricane and disaster preparedness visit www.gcoem.org.

Telegraph from J.H.W. Stele to Gov. Sayers

Sept 11, 1900

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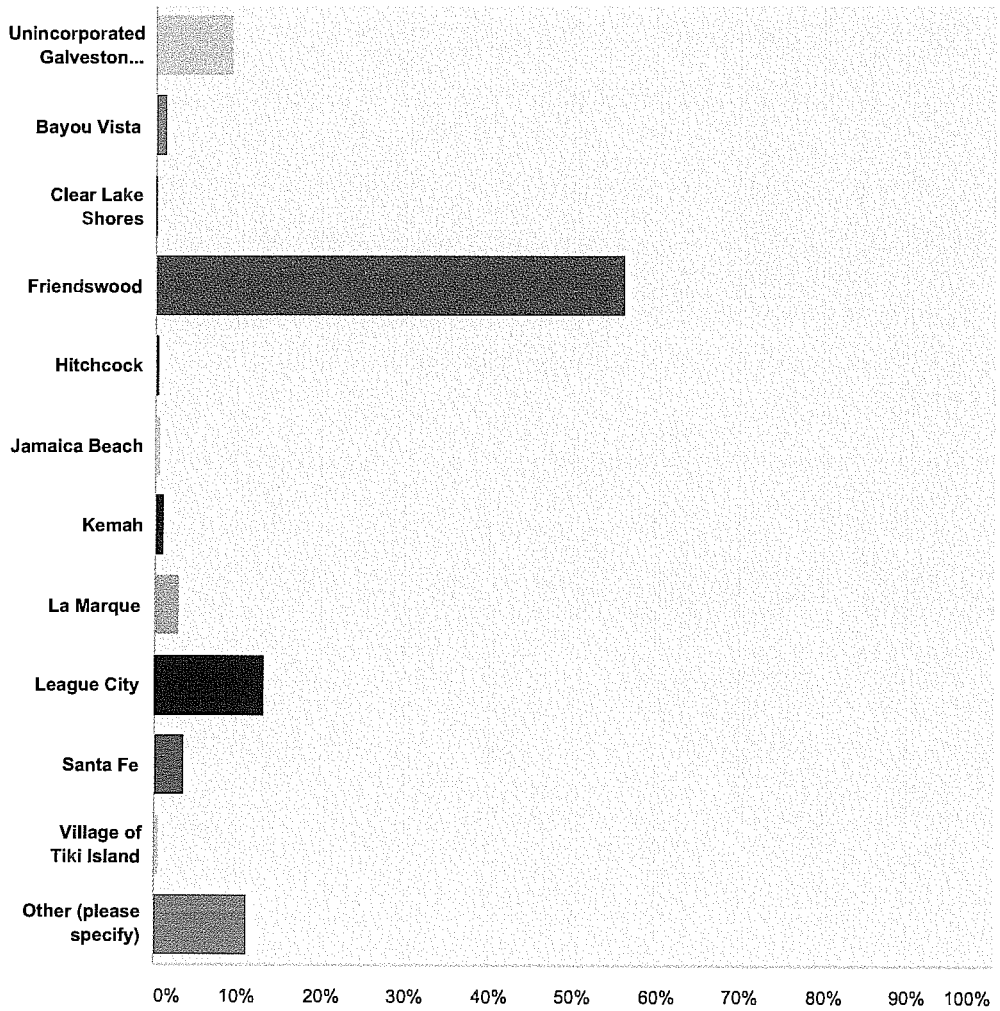
Q1 Where do you live?

Answered: 314 Skipped: 1

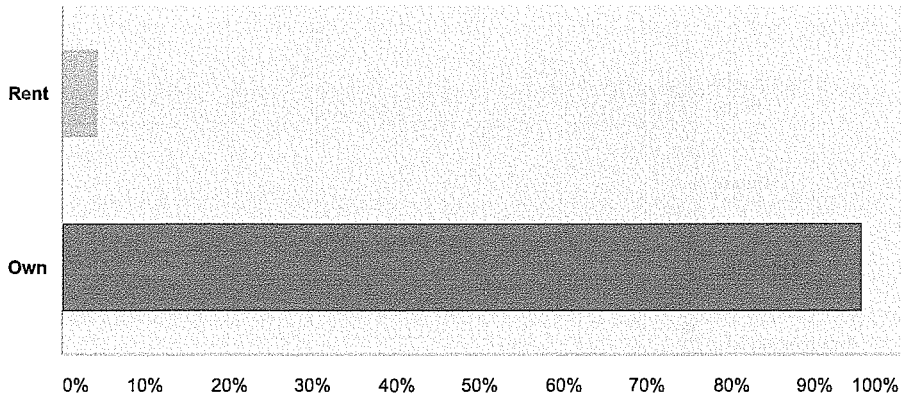


Answer Choices	Responses	
Unincorporated Galveston County	9.24%	29
Bayou Vista	1.27%	4
Clear Lake Shores	0.32%	1
Friendswood	56.05%	176
Hitchcock	0.32%	1
Jamaica Beach	0.64%	2
Kemah	0.96%	3
La Marque	2.87%	9
League City	13.06%	41
Santa Fe	3.50%	11

Village of Tiki Island	**0.64%**	2
Other (please specify)	**11.15%**	35
Total		**314**

Q2 Do you rent or own the place you live?

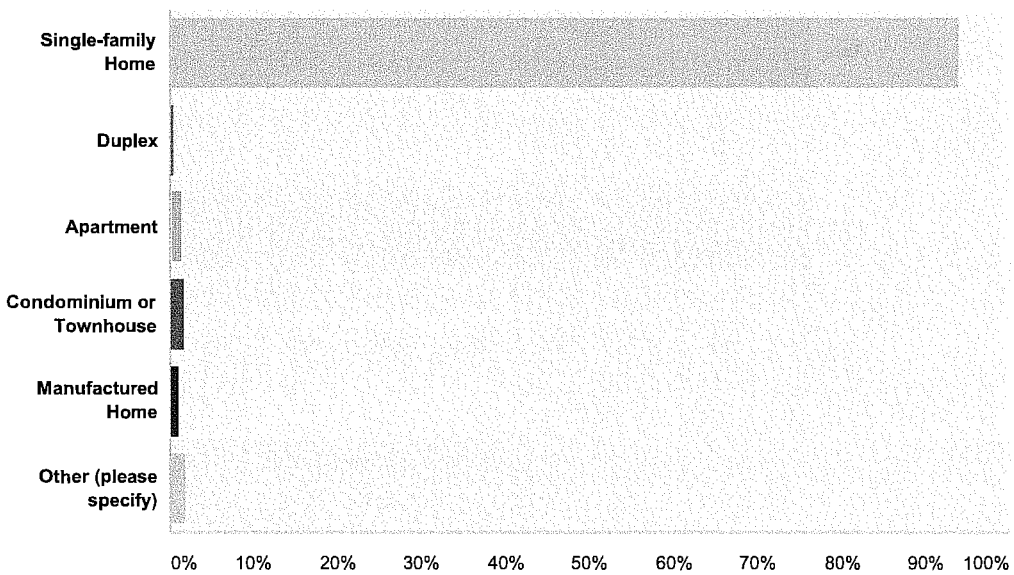
Answered: 313 Skipped: 2



Answer Choices	Responses	
Rent	**4.47%**	14
Own	**95.53%**	299
Total		**313**

Q3 Please select the housing type that best describes your dwelling.

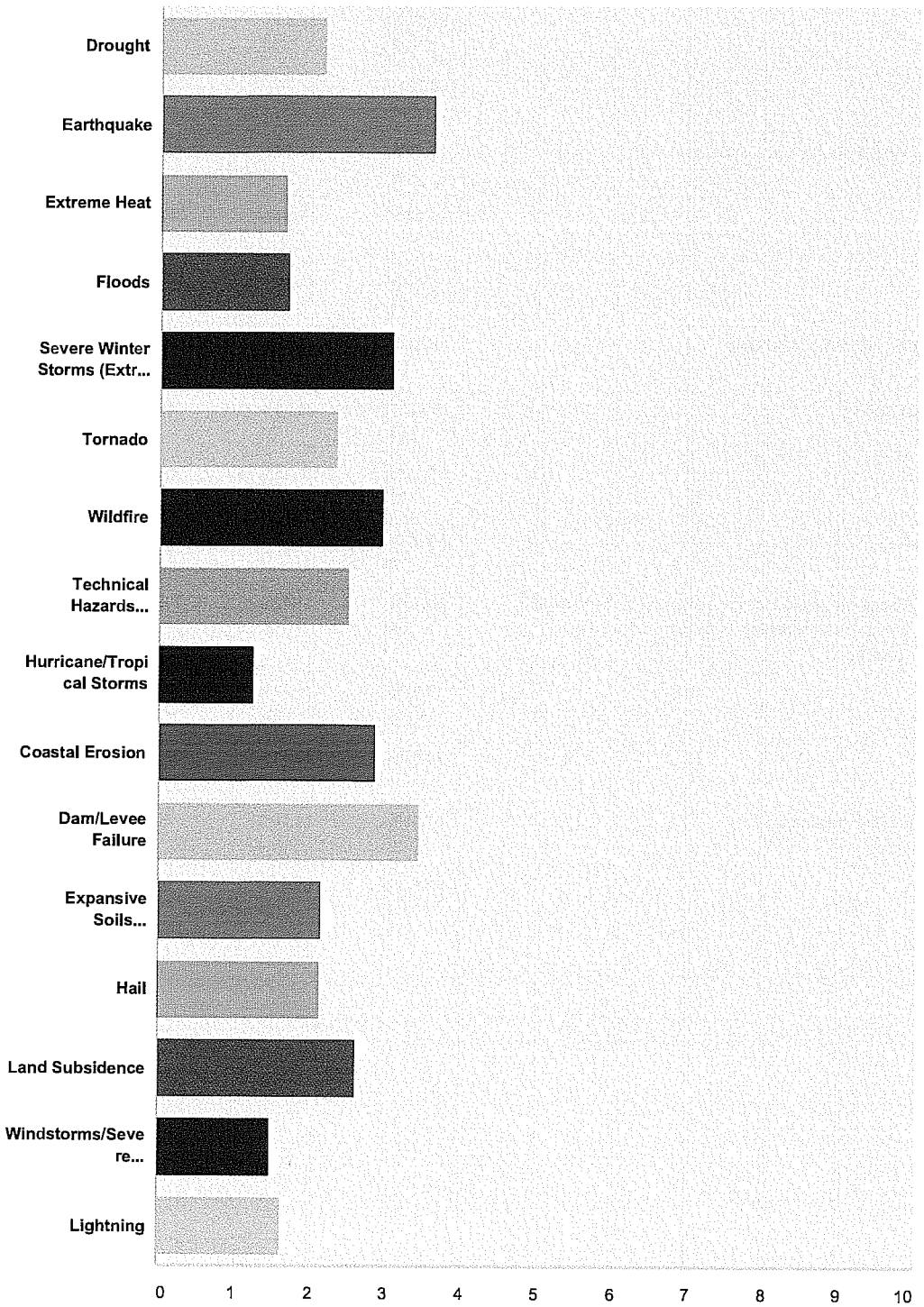
Answered: 315 Skipped: 0



Answer Choices	Responses	
Single-family Home	93.97%	296
Duplex	0.32%	1
Apartment	1.27%	4
Condominium or Townhouse	1.59%	5
Manufactured Home	0.95%	3
Other (please specify)	1.90%	6
Total		**315**

Q4 Please indicate the level of vulnerability your neighborhood and local community has to each hazard.

Answered: 314 Skipped: 1

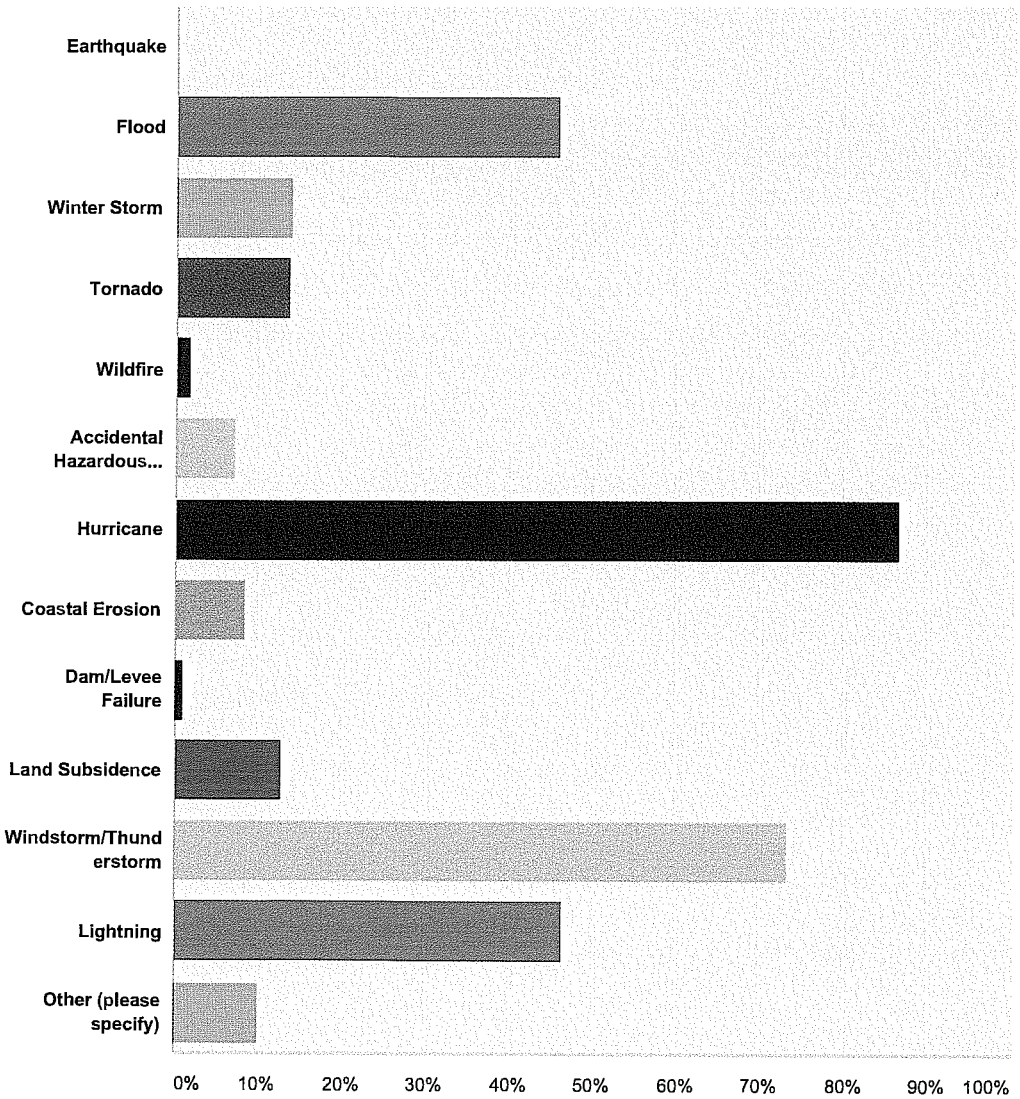


Galveston County Hazard Mitigation Plan Public Outreach Survey

	High Vulnerability	Medium Vulnerability	Low Vulnerability	Little To No Vulnerability	Total	Weighted Average
Drought	**21.90%** 67	**47.06%** 144	**23.20%** 71	**7.84%** 24	306	2.17
Earthquake	**0.66%** 2	**5.98%** 18	**24.25%** 73	**69.10%** 208	301	3.62
Extreme Heat	**51.97%** 158	**32.89%** 100	**11.84%** 36	**3.29%** 10	304	1.66
Floods	**46.79%** 146	**37.50%** 117	**14.74%** 46	**0.96%** 3	312	1.70
Severe Winter Storms (Extreme Cold, Ice Storm)	**6.25%** 19	**16.78%** 51	**42.11%** 128	**34.87%** 106	304	3.06
Tornado	**13.44%** 41	**44.92%** 137	**35.41%** 108	**6.23%** 19	305	2.34
Wildfire	**4.32%** 13	**21.26%** 64	**49.17%** 148	**25.25%** 76	301	2.95
Technical Hazards (Hazardous Materials)	**18.81%** 57	**28.38%** 86	**36.96%** 112	**15.84%** 48	303	2.50
Hurricane/Tropical Storms	**77.42%** 240	**20.32%** 63	**1.61%** 5	**0.65%** 2	310	1.25
Coastal Erosion	**17.16%** 52	**18.15%** 55	**25.08%** 76	**39.60%** 120	303	2.87
Dam/Levee Failure	**3.38%** 10	**7.77%** 23	**29.73%** 88	**59.12%** 175	296	3.45
Expansive Soils (Expansive soil is a clay or soil that is prone to large volume changes, swelling and shrinking, that are directly related to changes in water content.)	**33.45%** 99	**31.08%** 92	**23.65%** 70	**11.82%** 35	296	2.14
Hail	**17.92%** 55	**51.47%** 158	**27.04%** 83	**3.58%** 11	307	2.16
Land Subsidence	**11.60%** 34	**33.11%** 97	**37.20%** 109	**18.09%** 53	293	2.62
Windstorms/Severe Thunderstorms	**57.56%** 179	**36.66%** 114	**5.47%** 17	**0.32%** 1	311	1.49
Lightning	**49.84%** 153	**39.41%** 121	**9.12%** 28	**1.63%** 5	307	1.63

Q5 Select the hazard(s) that you have experienced locally that resulted in structural damage, personal displacement, loss of utility services, or other issues.

Answered: 300 Skipped: 15

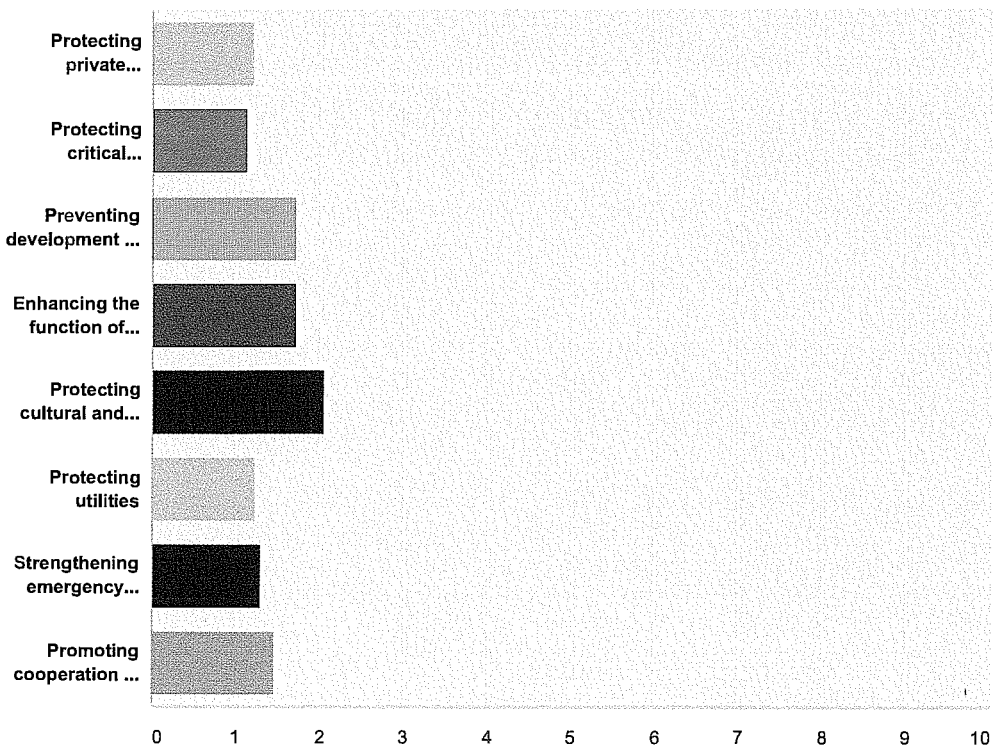


Answer Choices	Responses	
Earthquake	0.00%	0
Flood	45.67%	137
Winter Storm	14.00%	42
Tornado	13.67%	41
Wildfire	1.67%	5

Accidental Hazardous Material Release	**7.00%**	21
Hurricane	**86.33%**	259
Coastal Erosion	**8.33%**	25
Dam/Levee Failure	**1.00%**	3
Land Subsidence	**12.67%**	38
Windstorm/Thunderstorm	**73.33%**	220
Lightning	**46.33%**	139
Other (please specify)	**10.33%**	31
Total Respondents: 300		

Q6 Natural hazards can have significant impacts, but planning for these events can help mitigate them. The following statements will help determine citizen priorities regarding planning for natural hazards. Please tell us how important each of the following are to you.

Answered: 314 Skipped: 1

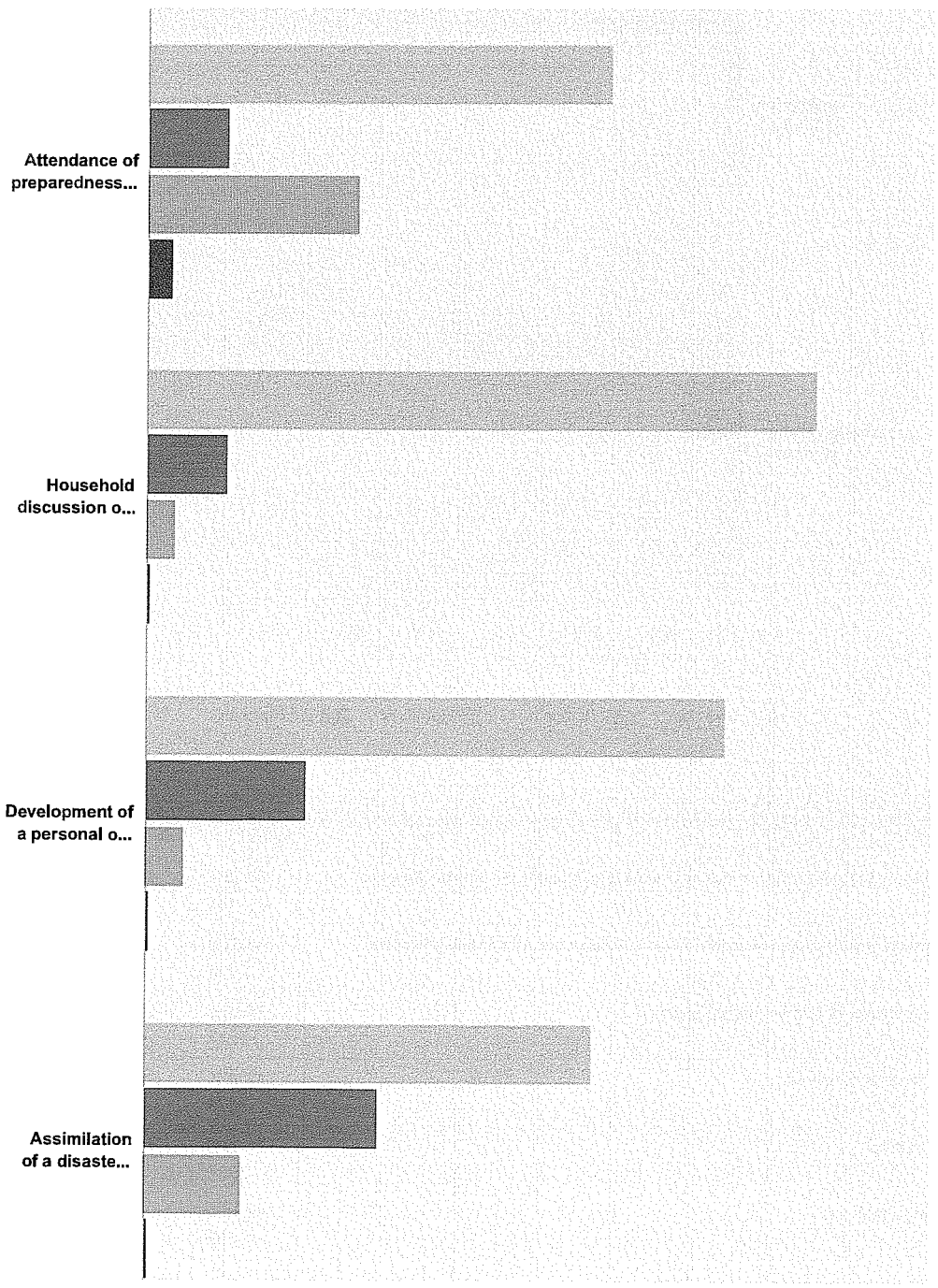


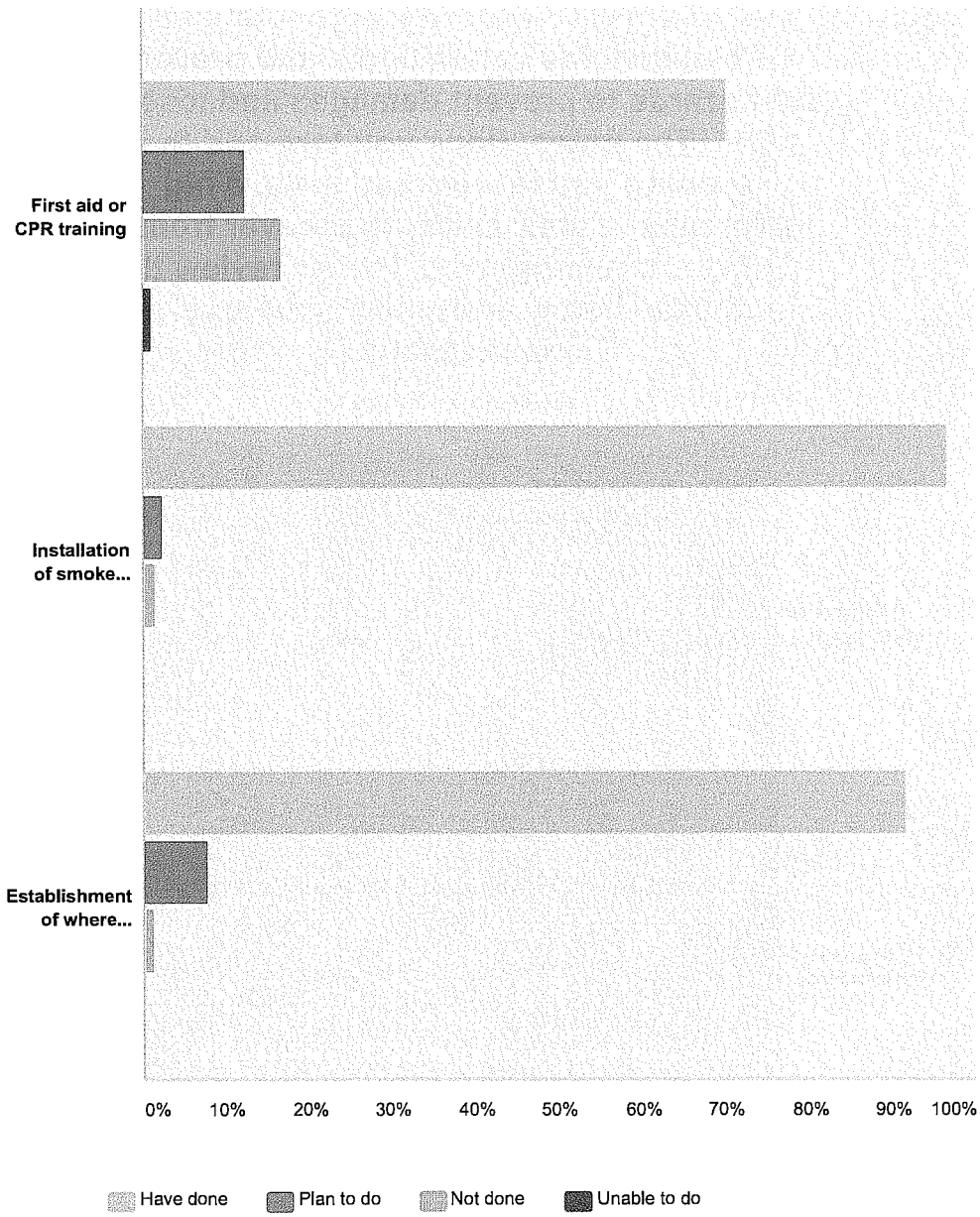
	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important	Total	Weighted Average
Protecting private property	82.52% 255	14.56% 45	1.94% 6	0.65% 2	0.32% 1	309	1.22
Protecting critical infrastructure (i.e. hospitals, transportation, fire stations)	91.00% 283	7.07% 22	1.29% 4	0.64% 2	0.00% 0	311	1.12
Preventing development in hazard prone areas	50.00% 155	30.32% 94	16.13% 50	2.58% 8	0.97% 3	310	1.74
Enhancing the function of natural features (streams, wetlands)	50.80% 158	31.51% 98	14.47% 45	2.57% 8	0.64% 2	311	1.71
Protecting cultural and historical landmarks	31.39% 97	41.75% 129	19.42% 60	5.50% 17	1.94% 6	309	2.05
Protecting utilities	81.15% 254	15.34% 48	3.19% 10	0.32% 1	0.00% 0	313	1.23

Strengthening emergency services	**75.88%** 236	**20.26%** 63	**3.54%** 11	**0.00%** 0	**0.32%** 1	311	1.29
Promoting cooperation on planning and hazard awareness among all stakeholders (whole community)	**64.42%** 201	**25.32%** 79	**9.94%** 31	**0.00%** 0	**0.32%** 1	312	1.46

Q7 Households can mitigate and prepare for hazards to prevent damages and loss of life. The precautions you take and the training you receive can make a big difference in your ability to recover from a disaster or emergency. Please review the activities below and select your level of participation.

Answered: 313 Skipped: 2



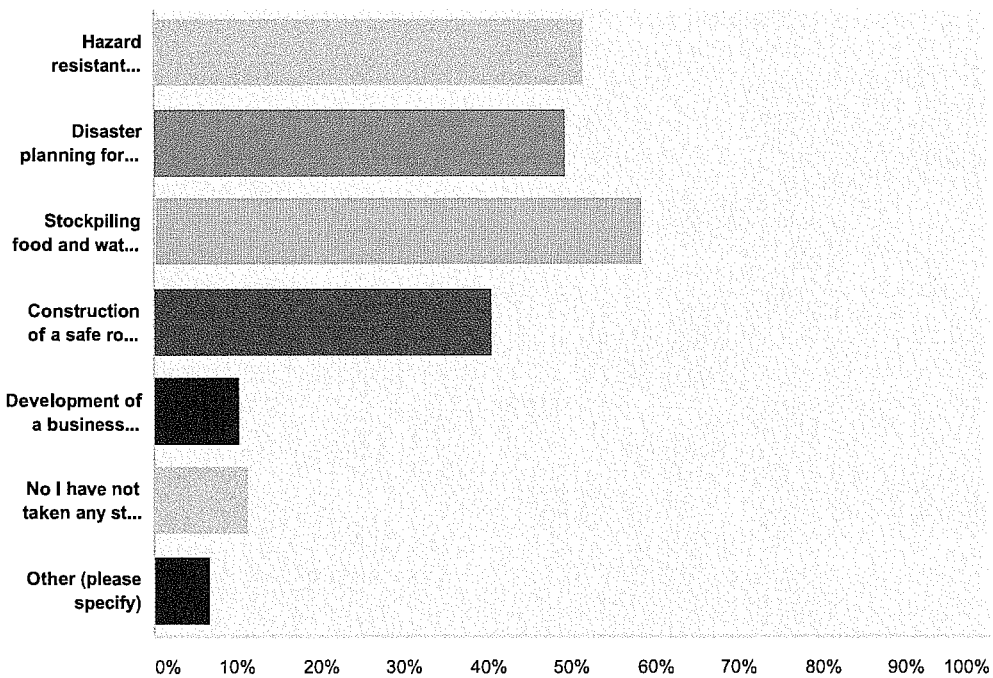


	Have done	Plan to do	Not done	Unable to do	Total
Attendance of preparedness meetings or review of written information on local hazards and disasters	**59.29%** 185	**10.26%** 32	**27.24%** 85	**3.21%** 10	312
Household discussion of your course of action should a disaster occur or threaten to occur	**85.53%** 266	**10.29%** 32	**3.86%** 12	**0.32%** 1	311
Development of a personal or family emergency plan	**74.12%** 232	**20.45%** 64	**5.11%** 16	**0.32%** 1	313
Assimilation of a disaster supply kit	**57.23%** 178	**29.90%** 93	**12.54%** 39	**0.32%** 1	311
First aid or CPR training	**70.23%** 217	**12.30%** 38	**16.50%** 51	**0.97%** 3	309
Installation of smoke detectors	**96.49%** 302	**2.24%** 7	**1.28%** 4	**0.00%** 0	313

Establishment of where utility shut off locations are (ie water main and circuit breaker box)	**91.37%** 286	**7.67%** 24	**0.96%** 3	**0.00%** 0	313

Q8 What steps have you taken to mitigate your home, business and family from disaster impacts?

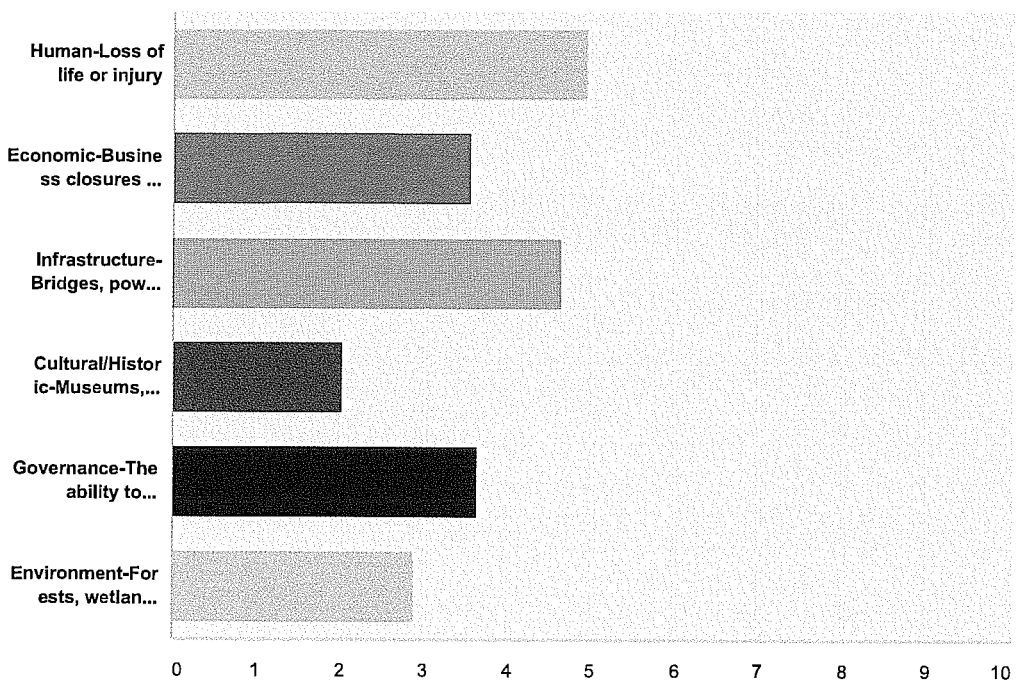
Answered: 311 Skipped: 4



Answer Choices	Responses	
Hazard resistant building codes and materials were used in a recent home renovation or new construction	**51.45%**	160
Disaster planning for household pets	**49.20%**	153
Stockpiling food and water for a disaster supply kit	**58.20%**	181
Construction of a safe room or designation of the safest location	**40.51%**	126
Development of a business continuity or business disaster plan	**10.29%**	32
No I have not taken any steps to mitigate disaster impacts	**11.25%**	35
Other (please specify)	**6.75%**	21
Total Respondents: 311		

Q9 In order to assess community risk, we need to understand vulnerabilities in your community. Vulnerable assets are community features, characteristics, or resources that may be impacted by natural hazards (i.e. populations with functional needs, economic components, environmental resources). Below is a list of community assets. Please rank the following 1-6 in order of vulnerability, with 1 being the most vulnerable and 6 being the least.

Answered: 304 Skipped: 11

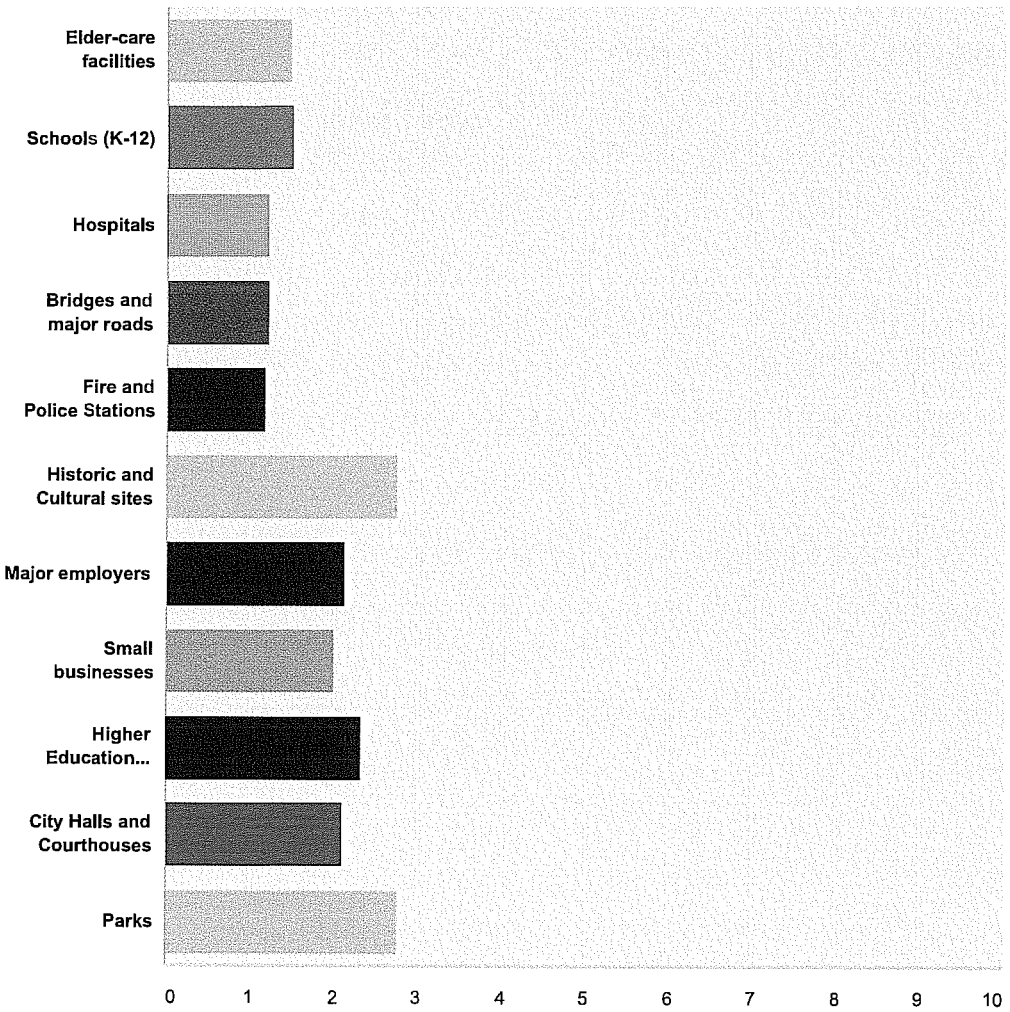


	1	2	3	4	5	6	Total	Score
Human-Loss of life or injury	61.94% 153	8.50% 21	10.93% 27	6.48% 16	4.45% 11	7.69% 19	247	4.94
Economic-Business closures and interruptions	5.44% 13	20.08% 48	20.92% 50	33.89% 81	15.48% 37	4.18% 10	239	3.54
Infrastructure-Bridges, power and water utilities, roads, and communications hardware or equipment	23.05% 59	38.67% 99	25.00% 64	7.81% 20	4.69% 12	0.78% 2	256	4.65
Cultural/Historic-Museums, historic structures and locations	3.00% 8	4.49% 12	4.87% 13	16.48% 44	22.10% 59	49.06% 131	267	2.03
Governance-The ability to maintain order and provide public services and amenities	7.58% 21	22.74% 63	28.16% 78	18.77% 52	12.64% 35	10.11% 28	277	3.64

Environment-Forests, wetlands, streams and rivers	**9.90%** 29	**7.51%** 22	**14.33%** 42	**17.06%** 50	**32.42%** 95	**18.77%** 55	293	2.89

Q10 Please select the importance of the following community assets.

Answered: 314 Skipped: 1



	Very Important	Somewhat Important	Neutral	Not very important	Not important	Total	Weighted Average
Elder-care facilities	63.58% 199	25.56% 80	10.54% 33	0.32% 1	0.00% 0	313	1.48
Schools (K-12)	61.86% 193	28.21% 88	7.69% 24	1.60% 5	0.64% 2	312	1.51
Hospitals	83.65% 261	11.54% 36	3.85% 12	0.00% 0	0.96% 3	312	1.23
Bridges and major roads	82.96% 258	14.47% 45	1.61% 5	0.96% 3	0.00% 0	311	1.21
Fire and Police Stations	87.22% 273	10.54% 33	1.28% 4	0.96% 3	0.00% 0	313	1.16
Historic and Cultural sites	8.97% 28	33.01% 103	38.78% 121	11.86% 37	7.37% 23	312	2.76

Major employers	**26.92%** 84	**42.31%** 132	**25.00%** 78	**3.85%** 12	**1.92%** 6	312	2.12
Small businesses	**30.03%** 94	**44.41%** 139	**21.09%** 66	**3.19%** 10	**1.28%** 4	313	2.01
Higher Education Institutions (Colleges and Universities)	**23.96%** 75	**34.82%** 109	**28.75%** 90	**9.27%** 29	**3.19%** 10	313	2.33
City Halls and Courthouses	**30.03%** 94	**41.21%** 129	**19.81%** 62	**7.03%** 22	**1.92%** 6	313	2.10
Parks	**13.87%** 43	**28.39%** 88	**32.58%** 101	**17.42%** 54	**7.74%** 24	310	2.77

Q11 In the space below please identify any issues related to hazardous materials events that should be considered for planning purposes.

Answered: 73 Skipped: 242

Public Meeting – Draft Plan Review - Sign In
Monday, February 29, 2016
3:00 p.m. to 6:00 p.m.
Galveston County Courthouse, 722 21st Street, Galveston, TX

Name/Title (if applicable)	Community
Leonard Gonzales	Galveston
David Smith	Galveston
Kathy Lubel	Tiki Island
Mike Lubel	Tiki Island
Catherine Morgan	Galveston
Victor Oswaldo Hernandez	Galveston
Hugh Putman	Friendswood
JOHN BRICK	JAMAICA BEACH
JEFF SANDRIDGE	Friendswood
WILL SINGLETON	CRYSTAL BEACH
David Vanderburg	Galveston
Garret Foster	League City
LYMAN M. DABNEY II	LA MARQUE
Meaghan Kenney	Galveston Co.
Rebecca Boone	consultant

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County invites public to hazard mitigation planning process

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Posted: Thursday, December 31, 2015 12:00 am

By JOSEPH BAUCUM The Daily News

County officials will lay out the county's multi-jurisdictional hazard mitigation plan at a meeting on Jan. 6, County Deputy Emergency Management Coordinator Meaghan Kenney said in a news release. The meeting will start at noon at the Lowe's Home Improvement store at 3620 Emmett F. Lowry Expressway in Texas City.

In addition to the county, the plan pertains to the communities of Bayou Vista, Clear Lake Shores, League City, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, Santa Fe and Tiki Island.

The county has invited the public to participate in the meeting. The purpose of the plan is to identify and assess natural hazard risks and determine how to best minimize and manage those risks, Kenney said.

For more information contact Kenney at 281-309-5001.

-Joseph Baucum

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We're always interested in hearing about news in our community. Let us know what's going on!

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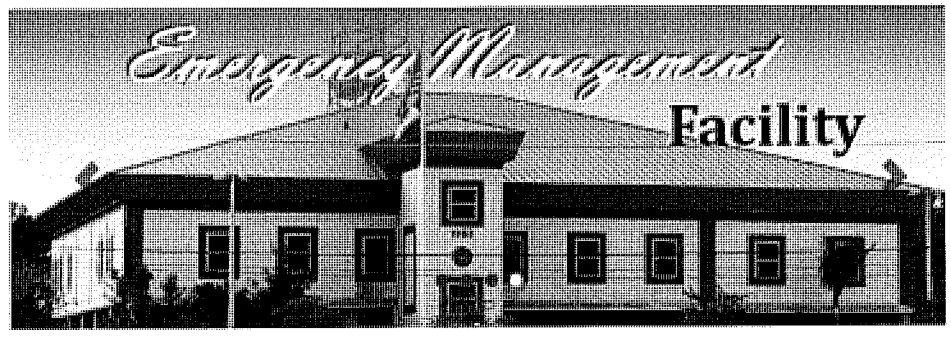

News Articles

- Galveston County 2016 Hazarad Mitigation Plan Survey
- Galveston County 2016 Hazard Mitigation Plan
- Hazard Mitigation Plan - Public Notice
- Public invited to Galveston County Multi-Jurisdictional Hazard Mitigation Open House
- Disaster Supply Check List
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- Texas Governor Rick Perry Declares September as Preparedness Month!
- nal Preparedness Month
- ricane Alicia Slammed Into The West End Of
- d...
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- istry or "STEAR"
- eason - The Information In This Guide Could Possibly
- And Your Loved Ones!
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1 - MAXIMUM Readiness

2 - HIGH Readiness

3 - ELEVATED Readiness

4 - Normal Readiness

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Hazard Mitigation Plan developers will answer questions during public meeting TODAY at the Galveston County Courthouse from 3-6 pm @GalvNews
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Galveston County OEM @galvcountyoem 23 Feb
Wind Advisory issued February 23 at 5:23PM CST until February 24 at 6:00AM CST by NWS dlvr.it/KbP9sm
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Galveston County OEM @galvcountyoem 23 Feb

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Galveston County, Texas
Just now

Attention Galveston County residents! This is your last chance to provide input to the county's hazard mitigation plan. Click the link below to view the plan and participate in the survey.

Plan developers will also be on hand to answer any questions during a public meeting TODAY at the Galveston County Courthouse from 3:00 to 6:00 p.m.

This plan, once approved by the public, TDEM and FEMA, will allow the participating jurisdictions to remain eligible for federal assistance should a disaster impact our community.

Galveston County Hazard Mitigation draft plan | Galveston County News Center

Galveston County and the jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock,...

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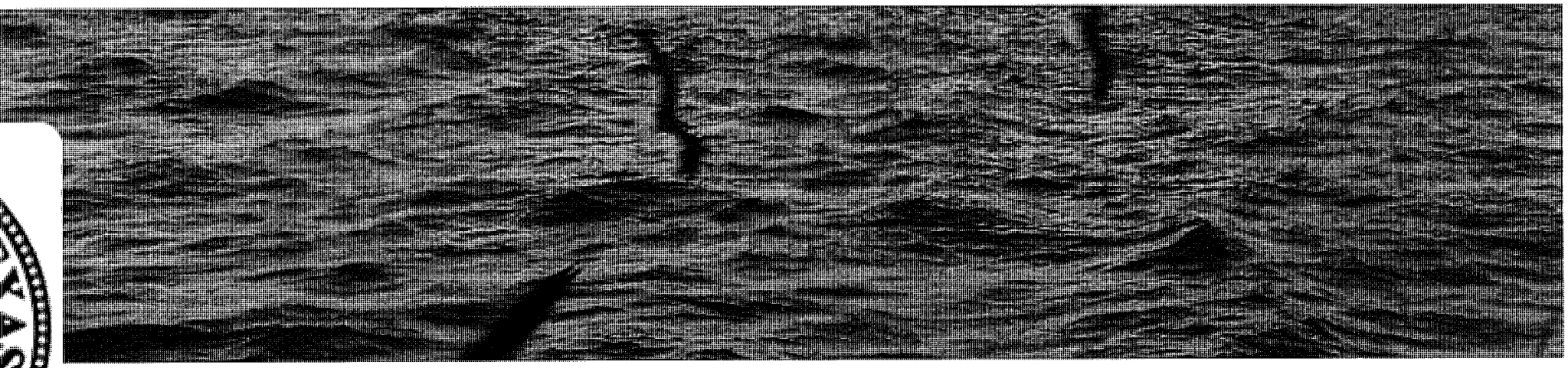

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Galveston County OEM @galvcountyoem · 4h

Last chance to provide input to the county's hazard mitigation plan. Click to view plan & take survey galvconews.com/#!Galveston-Co...

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Draft Plan Review

Galveston County Multi-Jurisdictional Hazard Mitigation Plan

Galveston County and the jurisdictions of: Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Island

Monday, February 29th
3 pm to 6 pm

Galveston County Courthouse

722 21st Street
Galveston, TX 77550

We Need Your Input!

Being prepared for all types of natural hazards and disasters is the first step in reducing negative effects. Mitigation planning is the best way to be prepared.

Please join us to review and make comments on the draft Galveston County Multi-Jurisdictional Hazard Mitigation Plan.

This meeting is for all residents, stakeholders, and business owners in Galveston County.

If you are unable to attend the meeting in person, you may view the plan online at www.gcoem.org and provide your comments from February 29 to March 6, 2016.

Mitigation Planning Is... a process for identifying actions that reduce or eliminate long-term risk to people and their property from natural hazards

For more information, contact:

Rebecca Boone, Senior Project Manager

E-mail: rebecca.boone@neel-schaffer.com
Telephone : 601-948-3071

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2016 Hazard Mitigation Draft Plan Review

Galveston County and the jurisdictions of Bayou Vista, Clear Lake Shores, Friendswood, Hitchcock, Jamaica Beach, Kemah, La Marque, League City, Santa Fe, and Tiki Village are finalizing their Hazard Mitigation Plan. The purpose of this Plan is to identify and assess their community's natural hazard risks and determine how to best minimize or manage those risks. Your participation is important to us!

This survey provides an opportunity to share your opinions of the draft plan.

* 1. Where do you live?

- ◯ Bayou Vista
- ◯ Clear Lake Shores
- ◯ Friendswood
- ◯ Galveston County (unincorporated)
- ◯ Hitchcock
- ◯ Jamaica Beach
- ◯ Kemah
- ◯ La Marque
- ◯ League City
- ◯ Santa Fe
- ◯ Tiki Village
- ◯ Other (list community)

2. Do you approve the Galveston County Multi-Jurisdictional Hazard Mitigation Plan?

- ◯ Yes
- ◯ No
- ◯ Unsure

3. If you do not approve this plan, please state your reason

4. If you think changes/corrections should be made, please reference the page and line number and provide a comment to support your suggestion

5. How do you rate this plan?

- Excellent
- Good
- Average
- Poor

6. If you need additional information on this plan, please provide your contact information below and a plan developer will contact you.

Invited Stakeholders			
Name	**Organization/Title**	**Email**	**Phone**
Beanland, Chris	Street Superintendent, Santa Fe	none available	409-925-8933
Brick, John	Jamaica Beach, EMC	jbrick@ci.jamaicabeach.tx.us	409-737-1142
Buttler, Carol	City Manager, City of La Marque	c.buttler@cityoflamarque.org	409-761-1138
Byrd, Terry	Friendswood, EMC	tbyrd@ci.friendswood.tx.us	281-996-3335
Campbell, Kenneth	Santa Fe, EMC	kenneth@ci.santa-fe.tx.us	409-925-3092
Cook, Kenny	Clear Lake Shores, EMC	kcook@clearlakeshores-tx.gov	281-334-1034
Crews, Cora	Friendswood, assistant	ccrews@friendswood.com	281-996-3335
Davis, Peter	Galveston Beach Patrol, Chief/EMC	pdavis@galvestonparkboard.org	(409) 763-4769
Derek, Duckett	Texas City, EMC	dduckett@texas-city-tx.org	(409) 739-4799
Dickson, Joe	City Manager, Santa Fe	joe@ci.stanta-fe.tx.us	409-925-6412
Edghill, Ryan	League City, EMC	ryan.edghill@leaguecity.com	281-554-1302
Foskit , Garret	Galveston County, EMC	Garret.foskit@co.galveston.tx.us	281-309-5003
Frankovich, Trey	Galveston County Health District, Emergency Medical Services Director	tfrankovich@gchd.org	
Fuller, Greg	Texas City, Deputy EMC	gfuller@texas-city-tx.org	409-682-4699
Gentile, James	Galveston County Housing & Economic Development, Floodplain Mngr	james.gentile@co.galveston.tx.us	409-770-5369
Grimm, Gerald	Fire Chief, City of La Marque	g.grimm@cityoflamarque.org	409-938-9261
Hahn, Trent	Kemah, EMC	brent.hahn@kemahfire.com	281-538-5727
Hallisey,Pat	League City, Mayor	pat.hallisey@leaguecity.com	(281) 910-0182
Hamm, John	Hitchcock, EMC	jhamm@hitchcockpd.com	409-986-5559
Hanks, Trisa	Friendswood ISD, Superintendent	tlocklear@fisdk12.net	281-482-1267
Hart,Corky	Tiki Island, EMC	harmonhart@yahoo.com	(409) 935-1427
Henry, April	Mainland Center, EMC	april.henry@hcahealthcare.com	(409) 938-5505
Hocking, Bobby	La Marque, Mayor	b.hocking@ci.la-marque.tx.us	409-938-9259
Holland, Kevin	Friendswood, Mayor	fwdcity@ci.friendswood.tx.us	281-996-3200
Johnson, Vern	Clear Lake Shores, Mayor	vern.johnson08@gmail.com	281-334-2799
Joiner, Carl	Kemah, Mayor	mayorjoiner@kemah-tx.com	281-334-1611
Jones, Mike	TDEM, DDC	M.L.Jones@dps.texas.gov	409-933-1125
Jones, George	Clear Lake Shores City Manager	gjones@clearlakeshores-tx.gov	281-334-2799
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Kou, Suzy	Finance Director, City of La Marque	financedirector@cityoflamarque.org	409-938-9205
Krone, Steve	Dickinson, Manager	skrone@wcid1.com	281-337-6308
Lambert, Michael	Homeland Security Planner, GCOEM	michael.lambert@co.galveston.tx.us	409-682-3140
Mansfield, Brian	Deputy Chief Fire Marshall, Friendswood	bmansfield@friendswood.com	281-996-3335
Mares, Deidra	ISO Community Hazard Mitigation	dmares@iso.com	830-832-3506
Mastrangelo, Mike	UTMB,Program Director	mimastran@utmb.edu	512-705-8112
Matranga, Anthony	Hitchcock, Mayor	amatranga@cityofhitchcock.org	(409) 986-5591
Mcintosh, Trish	College of the Mainland, EMC	pmcintosh@com.edu	409-933-8267
McLean, Denise	La Marque ISD, Superintendent	dmclean@lmisd.net	409.938.4251
Meadows, Philip	Santa Fe, EMC	philip@ci.santa-fe@tx.us	409-925-3092

Mejia, Raymond	TDEM, Hazard Mitigation Planner	Raymond.Mejia@dps.texas.gov	512-438-6519
Miller, Amy	Library Director, City of La Marque	a.miller@cityoflamarque.org	409-938-9272
Morales, Ron	Dickinson, Chief	rmorales@ci.dickinson.tx.us	281-337-0476
Newman, James	Utility Foreman, WCID #8	wcib8@comcast.net	409-750-2445
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Noel, Alex	CFM, League City	alex.noel@leaguecity.com	281-554-1302
Popoff, David	Dickinson, EMC	dpopoff@ci.dickinson.tx.us	281-337-4700
Post, Allan	TAMUG, EMC	posta@tamug.edu	409.740.4477
Pratt, Rosana	Deputy EMC, City of Galveston	prattros@cityofgalveston.org	409-765-3710
Rainsville, Brittany	Galveston County OEM	Brittany.Rainville@co.galveston.tx.us	281-309-5002
Rikard, Gary	Police Chief, League City	grikard@kemah-tx.com	281-334-5414
Rumburg, Les	Public Works Director, City of La Marque	lrumburg@cityoflamarque.org	409-938-9257
Simmons, Steven	Deputy Fire Marshall, Friendswood	ssimmons@friendswood.com	281-996-3335
Smith, Greg	Clear Creek ISD Superintendent	grsmith@ccisd.net	281-284-0000
Spicer, Steve	Jamaica Beach, Mayor	cityadmin@ci.jamaicabeach.tx.us	409.737.1142
Springer, Bryan	Tiki Island, EMC	b@bryanspringer.com	409-692-6880
Steelquist, Diana	Community Services Director, Santa Fe	diana@ci.santa-fe.tx.us	409-925-6412
Tambrella, Jeff	Santa Fe, Mayor	jtambrella@ci.santa-fe.tx.us	409-925-6412
Telschick, Vernon "Goldie"	Tiki Island, Mayor	tikiisland@comcast.net	409-935-1427
Trantham, Greg	Dickinson, EMC	trantham@ci.dickinson.tx.us	281-337-4700
Wall, Leigh	Santa Fe ISD Superintendant	Leigh.wall@sfisd.org	409-925-9093
Warren, Charlene	La Marque, EMC	c.todaro@cityoflamarque.org	409.938.9229
Welsh, Sean	CFM, Galveston County	sean.welsh@co.galveston.tx.us	409-770-5852
Wheeler, Bill	Deputy EMC, Harrison County OEM	bill.wheeler@oem.hctx.net	(713) 881-3083
Whitehead, Jim	Port of Texas City, EMC	jwhitehead@ptcsc.org	(409) 641-6162
Whittington, Sr., Larry	Bayou Vista, EMC	chiefwhittington@gmail.com	409-935-0449
Young, Alyssa	Galveston County, Office Manager	Alyssa.Young@co.galveston.tx.us	281-309-5002

Appendix B-3

Plan Maintenance Tools

GCHMC Meetings and Public Involvement Activities

Date	Event	Comments

Plan Evaluation Checklist

Goal/Objective	Address Current Needs?	
	Yes	No
Goal 1: Minimize loss of life, injury, damage to property, the economy, and natural systems		
• Objective 1.1: Protect the life, health and safety of residents		
• Objective 1.2: Protect existing/new critical facilities and infrastructure		
• Objective 1.3: Provide protection for future/existing developments		
• Objective 1.4: Provide backup power to critical facilities/infrastructure		
• Objective 1.5: Minimize impacts from all hazards		
Goal 2: Maintain and enhance emergency management/mitigation capabilities		
• Objective 2.1: Update/develop plans, studies, and mapping for all hazards		
• Objective 2.2: Incorporate/improve hazard mitigation strategies into ordinances, plans and polices		
• Objective 2.3: Conduct/develop drills/training for all hazards		
• Objective 2.4: Implement and maintain the Galveston County Multi-Jurisdictional Hazard Mitigation Plan		
• Objective 2.5: Participate in programs that promote hazard mitigation strategies		
• Objective 2.6: Build, obtain, and maintain critical facilities and equipment		
Goal 3: Maintain public education and awareness activities		
• Objective 3.1: Expand Public Outreach Campaigns for all hazards		
• Objective 3.2: Promote disaster preparedness planning for families		

Planning Considerations	Address Current Needs?	
	Yes	No
Have the nature or magnitude of the risks identified in the plan changed? If yes, comment below.		
Are the resources adequate for implementing the plan? If no, comment below.		
Have there been any implementation problems such as technical, political, legal or coordination issues with other agencies for the mitigation actions identified? If yes, reference action by selecting "Delayed" on the Project Implementation worksheet with a comment describing issue in implementation.		
Should personnel/agency changes be made to the Galveston County Multi-Jurisdictional Hazard Mitigation Committee? If yes, complete the mitigation planning team worksheet.		
Have there been changes to the participating communities' capabilities that improve or impair the progress of the mitigation strategies identified in the plan? If yes, please comment below.		

Mitigation Planning Team Worksheet

Use this worksheet to identify partner organizations to invite to participate on the planning team. Some organizations do not need to be involved in every decision of the planning process but are stakeholders that require outreach and involvement during the planning process. Revise the list of general partners below to reflect the organizations in your community. Mark which organizations will be invited to participate on the planning team and which will be involved through stakeholder outreach activities.

Planning Team – The core group responsible for making decisions, guiding the planning process, and agreeing upon the final contents of the plan

Stakeholders – Individuals or groups that affect or can be affected by a mitigation action or policy

Partner Organization	Planning Team	Stakeholder	Notes
Local Agencies			
Building Code Enforcement			
City Management/County Administration			
Emergency Management			
Fire Department/District			
Floodplain Administration			
Geographic Information Systems			
Parks and Recreation			
Planning/Community Development			
Public Works			
Stormwater Management			
Transportation (Roads and Bridges)			
City Council/Board of Commissioners			
Planning Commission			
Planning/Community Development			
Regional/Metropolitan Planning Organization(s)			
City/County Attorney's Office			
Economic Development Agency			
Local Emergency Planning Committee			
Police/Sheriff's Department			
Sanitation Department			
Tax Assessor's Office			
Special Districts and Authorities			
Airport, Seaport Authorities			
Fire Control District			
Flood Control District			
School District(s)			
Transit Authority			
Utility Districts			

Worksheet 2.1

Mitigation Planning Team Worksheet

Partner Organization	Planning Team	Stakeholder	Notes
Non-Governmental Organizations			
American Red Cross			
Chamber of Commerce			
Community/Faith-Based Organizations			
Environmental Organizations			
Homeowners Associations			
Neighborhood/Community Organizations			
Utility Companies			
State Agencies			
State Emergency Management Agency			
State Dam Safety			
State Department of Transportation			
State Fire and Forestry Agency			
State Geological Survey			
State Water Resources Agency			
State National Flood Insurance Program Coordinator			
State Planning Office			
Federal Agencies			
Federal Emergency Management Agency			
Land Management Agencies (USFS/NPS/BLM)			
National Weather Service			
US Army Corps of Engineers			
US Department of Housing and Urban Development			
US Department of Transportation			
US Environmental Protection Agency			
US Geological Survey			
Other			
Tribal Officials			
Colleges/Universities			
Land Developers and Real Estate Agencies			
Major Employers and Businesses			
Professional Associations			
Neighboring Jurisdictions			

Note: Multi-jurisdictional planning teams require at least one representative for each participating jurisdiction. This worksheet can be used by each jurisdiction to identify their local sub-team.

Mitigation Action Implementation Worksheet

Jurisdiction Name: Date:

Reference Mitigation Action Number	In Progress	Delayed*	No Longer Required	Completed	Completion Date	Comment

Appendix C

Hazard Identification and Risk Assessment Results of Ranking Process

Hazard Ranking Worksheet - Galveston County

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	2	2	2	1	1	8	3	24
Hurricane/Tropical Storm	4	4	4	4	4	20	3	60
Tsunami	4	4	4	4	4	20	1	20
Tornado	2	2	1	1	1	7	1	7
Windstorm	4	2	4	3	4	17	4	68
Hailstorm	2	2	4	1	4	13	2	26
Lightning	2	1	1	1	1	6	4	24
Winter storm	3	2	1	1	1	8	2	16
Drought	4	2	2	2	1	11	3	33
Extreme Heat	4	2	1	1	1	9	3	27
Wildfire (Urban and Rural)	2	2	1	1	1	7	3	21
Coast Erosion and Retreat	3	0	2	1	2	8	4	32
Land Subsidence	2	0	1	1	1	5	4	20
Earthquake	0	0	0	0	0	0	1	0
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	3	0	2	1	1	7	4	28
Pipeline Failure	4	4	2	4	3	17	3	51
Hazardous Material Incents	3	3	2	3	2	13	3	39

Hazard Ranking Worksheet - Bayou Vista

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	3	4	4	4	19	5	95
Hurricane/Tropical Storm	4	4	4	4	4	20	5	100
Tsunami	4	4	4	4	4	20	1	20
Tornado	4	4	4	4	4	20	5	100
Windstorm	4	3	3	3	3	16	5	80
Hailstorm	4	2	3	3	2	14	5	70
Lightning	3	3	2	2	2	12	3	36
Winter storm	2	3	3	4	3	15	2	30
Drought	2	2	0	1	2	7	2	14
Extreme Heat	2	4	1	2	3	12	4	48
Wildfire (Urban and Rural)	2	3	2	4	4	15	2	30
Coast Erosion and Retreat	4	3	2	4	2	15	2	30
Land Subsidence	4	2	2	3	2	13	2	26
Earthquake	2	4	4	4	4	18	1	18
Dam/Levee Failure	3	3	3	3	4	16	2	32
Expansive Soils	3	2	3	3	3	14	2	28
Pipeline Failure	4	4	4	4	4	20	2	40
Hazardous Material Incents	4	4	2	4	3	17	2	34

Hazard Ranking Worksheet - Clear Lake Shores

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	2	3	2	2	13	2	26
Hurricane/Tropical Storm	4	2	4	2	4	16	3	48
Tsunami	4	2	2	2	2	12	1	12
Tornado	2	3	4	3	3	15	1	15
Windstorm	4	3	2	3	3	15	2	30
Hailstorm	1	2	1	2	2	8	1	8
Lightning	1	2	1	2	1	7	2	14
Winter storm	4	2	1	2	2	11	1	11
Drought	4	2	1	2	1	10	1	10
Extreme Heat	4	2	1	0	1	8	2	16
Wildfire (Urban and Rural)	4	2	2	3	2	13	1	13
Coast Erosion and Retreat	4	0	1	2	1	8	1	8
Land Subsidence	4	0	1	2	1	8	1	8
Earthquake	4	2	2	3	4	15	1	15
Dam/Levee Failure	4	2	2	2	2	12	1	12
Expansive Soils	4	0	1	2	1	8	1	8
Pipeline Failure	4	4	1	0	1	10	1	10
Hazardous Material Incents	4	4	1	2	2	13	1	13

Hazard Ranking Worksheet - Friendswood

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	2	4	3	3	16	5	80
Hurricane/Tropical Storm	4	2	2	3	2	13	2	26
Tsunami	0	0	0	0	0	0	1	0
Tornado	1	2	2	2	1	8	2	16
Windstorm	2	2	1	2	1	8	3	24
Hailstorm	2	2	2	2	1	9	3	27
Lightning	1	2	1	3	2	9	5	45
Winter storm	4	2	0	0	1	7	2	14
Drought	4	2	2	0	1	9	2	18
Extreme Heat	4	2	0	0	0	6	2	12
Wildfire (Urban and Rural)	0	0	0	0	0	0	0	0
Coast Erosion and Retreat	0	0	0	0	0	0	1	0
Land Subsidence	0	0	0	0	0	0	1	0
Earthquake	0	0	0	0	0	0	1	0
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	0	0	0	0	0	0	1	0
Pipeline Failure	3	4	3	2	3	15	1	15
Hazardous Material Incents	0	0	0	0	0	0	1	0

Hazard Ranking Worksheet - Hitchcock

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	3	2	1	2	1	9	1	9
Hurricane/Tropical Storm	4	4	3	2	2	15	2	30
Tsunami	0	0	0	0	0	0	1	0
Tornado	2	2	2	2	1	9	1	9
Windstorm	4	2	2	2	2	12	3	36
Hailstorm	4	2	2	2	2	12	3	36
Lightning	2	0	0	0	2	4	2	8
Winter storm	1	2	1	0	0	4	1	4
Drought	0	0	1	2	0	3	1	3
Extreme Heat	1	2	1	1	0	5	1	5
Wildfire (Urban and Rural)	1	2	1	2	0	6	2	12
Coast Erosion and Retreat	1	0	1	2	0	4	1	4
Land Subsidence	1	2	1	0	0	4	1	4
Earthquake	0	0	0	0	0	0	1	0
Dam/Levee Failure	1	0	1	0	0	2	1	2
Expansive Soils	1	0	1	1	1	4	1	4
Pipeline Failure	1	2	1	2	1	7	1	7
Hazardous Material Incents	1	2	1	2	0	6	1	6

Hazard Ranking Worksheet - Jamaica Beach

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	2	2	2	3	13	4	52
Hurricane/Tropical Storm	4	2	4	3	4	17	5	85
Tsunami	0	0	0	0	0	0	1	0
Tornado	2	2	2	2	2	10	1	10
Windstorm	4	2	2	2	1	11	3	33
Hailstorm	4	2	2	2	1	11	1	11
Lightning	4	2	2	2	1	11	2	22
Winter storm	0	0	0	0	0	0	1	0
Drought	0	0	0	0	0	0	1	0
Extreme Heat	0	0	0	0	0	0	1	0
Wildfire (Urban and Rural)	0	0	0	0	0	0	1	0
Coast Erosion and Retreat	1	2	1	0	0	4	1	4
Land Subsidence	1	0	1	2	0	4	1	4
Earthquake	0	0	0	0	0	0	1	0
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	0	0	0	0	0	0	1	0
Pipeline Failure	1	2	1	0	0	4	1	4
Hazardous Material Incents	1	2	1	0	0	4	1	4

Hazard Ranking Worksheet - La Marque

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	2	2	2	2	4	12	3	36
Hurricane/Tropical Storm	4	2	4	3	4	17	2	34
Tsunami	1	4	4	3	3	15	1	15
Tornado	1	3	3	2	2	11	2	22
Windstorm	4	3	4	2	3	16	5	80
Hailstorm	4	2	4	2	2	14	4	56
Lightning	4	3	4	2	3	16	5	80
Winter storm	3	2	1	2	1	9	3	27
Drought	3	2	1	2	1	9	3	27
Extreme Heat	4	3	0	2	0	9	3	27
Wildfire (Urban and Rural)	2	2	3	3	3	13	1	13
Coast Erosion and Retreat	0	0	0	0	0	0	1	0
Land Subsidence	1	2	1	2	1	7	1	7
Earthquake	4	3	4	3	4	18	1	18
Dam/Levee Failure	3	3	4	3	4	17	2	34
Expansive Soils	1	0	0	2	1	4	2	8
Pipeline Failure	1	3	1	3	1	9	5	45
Hazardous Material Incents	1	3	1	3	1	9	4	36

Hazard Ranking Worksheet - Kemah

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	4	4	4	4	20	5	100
Hurricane/Tropical Storm	4	4	4	3	4	19	5	95
Tsunami	4	4	4	4	4	20	1	20
Tornado	4	4	4	3	4	19	4	76
Windstorm	4	4	4	3	4	19	5	95
Hailstorm	4	4	4	3	4	19	5	95
Lightning	4	4	4	3	4	19	5	95
Winter storm	4	4	4	4	4	20	3	60
Drought	4	4	4	4	4	20	5	100
Extreme Heat	4	4	4	4	4	20	5	100
Wildfire (Urban and Rural)	4	4	4	4	4	20	3	60
Coast Erosion and Retreat	4	3	4	4	4	19	4	76
Land Subsidence	4	3	4	3	4	18	3	54
Earthquake	4	3	4	4	4	19	2	38
Dam/Levee Failure	4	4	4	4	4	20	3	60
Expansive Soils	4	3	4	3	4	18	3	54
Pipeline Failure	4	4	4	4	4	20	5	100
Hazardous Material Incents	4	4	4	4	4	20	5	100

Hazard Ranking Worksheet - League City

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	2	3	2	3	3	13	3	39
Hurricane/Tropical Storm	4	3	2	3	4	16	2	32
Tsunami	0	0	0	0	0	0	1	0
Tornado	4	3	2	2	4	15	2	30
Windstorm	4	2	2	3	2	13	3	39
Hailstorm	4	2	2	2	2	12	3	36
Lightning	4	2	1	2	2	11	2	22
Winter storm	1	2	1	2	1	7	2	14
Drought	4	2	1	2	1	10	2	20
Extreme Heat	1	3	0	2	0	6	2	12
Wildfire (Urban and Rural)	0	0	0	0	0	0	1	0
Coast Erosion and Retreat	0	0	0	0	0	0	1	0
Land Subsidence	0	0	0	0	0	0	1	0
Earthquake	0	0	0	0	0	0	1	0
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	1	0	1	0	1	3	1	3
Pipeline Failure	1	3	1	3	2	10	1	10
Hazardous Material Incents	1	3	1	3	2	10	2	20

Hazard Ranking Worksheet - Santa Fe

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	0	0	0	0	0	0	1	0
Hurricane/Tropical Storm	4	2	2	2	2	12	2	24
Tsunami	0	0	0	0	0	0	1	0
Tornado	1	2	2	2	2	9	2	18
Windstorm	4	2	2	2	0	10	2	20
Hailstorm	4	2	2	2	0	10	3	30
Lightning	4	2	2	2	0	10	3	30
Winter storm	4	3	1	2	4	14	2	28
Drought	4	2	2	3	2	13	2	26
Extreme Heat	4	2	1	2	1	10	3	30
Wildfire (Urban and Rural)	2	2	4	3	4	15	1	15
Coast Erosion and Retreat	0	0	0	0	0	0	1	0
Land Subsidence	0	0	0	0	0	0	1	0
Earthquake	4	4	4	3	4	19	1	19
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	0	0	0	0	0	0	1	0
Pipeline Failure	1	3	1	2	2	9	1	9
Hazardous Material Incents	1	3	1	2	2	9	2	18

Hazard Ranking Worksheet - Tiki Island

Hazard	Area Impacted (0-4)	Health & Safety (0, 2, 3, 4)	Property Damage (0-4)	Environmental Damage (0-4)	Economic Damage/Disruption (0-4)	Total	Probability (1-5)	Risk
Flood (Coastal and Inland)	4	2	4	4	4	18	5	90
Hurricane/Tropical Storm	4	2	4	4	4	18	5	90
Tsunami	4	3	4	3	4	18	1	18
Tornado	2	2	3	2	2	11	5	55
Windstorm	4	2	3	2	2	13	5	65
Hailstorm	4	2	2	2	2	12	5	60
Lightning	4	2	1	2	2	11	5	55
Winter storm	4	0	1	1	1	7	1	7
Drought	4	2	1	1	1	9	1	9
Extreme Heat	4	2	1	1	1	9	1	9
Wildfire (Urban and Rural)	0	0	0	1	1	2	1	2
Coast Erosion and Retreat	2	0	1	1	1	5	2	10
Land Subsidence	4	0	1	1	1	7	2	14
Earthquake	4	2	1	1	3	11	1	11
Dam/Levee Failure	0	0	0	0	0	0	1	0
Expansive Soils	4	0	1	1	1	7	2	14
Pipeline Failure	3	2	1	3	4	13	1	13
Hazardous Material Incents	3	2	2	3	4	14	1	14

Appendix D

Mitigation Strategy

Appendix D-1

Revised Mitigation Goals and Objectives Crosswalk

Revised Mitigation Goal Crosswalk

	Goal 1: Minimize loss of life, injury, damage to property, the economy, and natural systems	Goal 2: Maintain and enhance emergency management/mitigation capabilities	Goal 3: Maintain public education and awareness activities
Galveston County Goals Previous Plan	2. Develop hazard mitigation policies and programs designed to reduce the impact of natural and human-caused hazards on people and property. 4. Identify and implement hazard mitigation projects to reduce the impact of hazard events and disasters.	3. Conduct studies and implement planning processes to increase the understanding of local hazard vulnerability. 5. Improve evacuation procedures for natural and human-caused hazards.	1. Improve education and outreach efforts regarding preparedness. Develop mitigation actions that can be implemented by citizens, businesses and county and municipal government officials in preparing for disasters.
Friendswood Goals Previous Plan	1. Ensure that critical infrastructure sites are protected from all hazards. 2. Reduce the vulnerability from flooding of existing residential and business structures. 4. Continue to enforce existing zoning and building regulations. 7. Continue to develop capital improvement projects which address hazards identified in the mitigation plan.	3. Maintain previous mitigation projects to ensure continuity of services. 6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities, such as flooding. 8. Maintain the city's ability to respond to all types of hazards.	5. Educate the public regarding zoning and building regulations which affect new construction, demolition, and flood hazards. 9. Develop, maintain, and update a viable public information network to ensure that residents and commercial interests are aware of the various sources of information regarding impending emergency and/or disaster events (i.e., Facebook, Twitter, E-mail, City Website, CodeRed, Radio, etc.)
League City Goals Previous Plan	5. Public Works and Capital Improvement Projects 6. Floodplain Management	2. Partnerships and Implementation 3. Emergency Services 4. Mitigation Planning	1. Public Awareness

Revised Mitigation Objectives Crosswalk

	Goal 1 - Minimize loss of life, injury, damage to property, the economy, and natural systems					
	Objective 1.1: Protect the life, health and safety of residents	**Objective 1.2: Protect existing/new critical facilities and infrastructure**	**Objective 1.3: Provide protection for future / existing developments**	**Objective 1.4: Provide backup power to critical facilities/infrastructure**	**Objective 1.5: Minimize impacts from all hazards**	
Galveston County Objectives Previous Plan	4.2 Utilize regulatory approaches to prevent the creation of future hazards to life and property.	2.2 Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties. 4.1 Incorporate hazard mitigation into the long-range planning and development activities. 4.2 Utilize regulatory approaches to prevent creation of future hazards to life and property	2.2 Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties. 4.1 Incorporate hazard mitigation into the long-range planning and development activities. 4.2 Utilize regulatory approaches to prevent creation of future hazards to life and property		2.1 Reduce repetitive losses to the National Flood Insurance Program.	
League City Objectives Previous Plan		Prioritize drainage projects identified in the Capital Improvements Program according to the number of Repetitive Loss Properties they will benefit. Ensure that critical infrastructure sites are protected from hazards.	Prioritize drainage projects identified in the Capital Improvements Program according to the number of Repetitive Loss Properties they will benefit. Encourage preventative measures for existing development in areas vulnerable to natural hazards.		Prioritize drainage projects identified in the Capital Improvements Program according to the number of Repetitive Loss Properties they will benefit. Preserve, rehabilitate, and enhance natural systems to serve natural hazard mitigation functions.	

	Goal 2 - Maintain and enhance emergency management / mitigation capabilities.					
	Objective 2.1: Update / develop plans, studies, and mapping for all hazards	**Objective 2.2: Incorporate / improve hazard mitigation strategies into ordinances, plans and policies**	**Objective 2.3: Conduct / develop drills / training for all hazards**	**Objective 2.4: Implement and maintain the Galveston County Multi-Jurisdictional Hazard Mitigation Plan**	**Objective 2.5: Participate in programs that promote hazard mitigation strategies**	**Objective 2.6: Build, obtain, and maintain critical facilities and equipment**
Galveston County Objectives Previous Plan	3.2 Build hazard mitigation concerns into planning and budgeting processes.	3.2 Build hazard mitigation concerns into planning and budgeting processes.	5.2 Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.		3.1 Build and support local partnerships to continuously become less vulnerable to hazards. 5.1 Maximize participation of property owners in protecting their properties.	
League City Objectives Previous Plan	Conduct studies and implement planning processes to increase the resident's understanding of the city's hazard vulnerability	Coordinate and integrate hazard mitigation activities, where appropriate, with emergency operations plans and procedures.	Maintain and improve where possible the city's ability to respond to all types of hazards.	Evaluate and update the City of League City's Local Mitigation Plan on an annual basis.	Strengthen communication and coordinate participation among and within public agencies, residents, non-profit organizations, business, and industry to gain a vested interest in implementation. Encourage leadership within public and private sector organizations to prioritize and implement local, county, and regional hazard mitigation activities.	

	Goal 3 - Maintain public education and awareness activities				
	Objective 3.1: Expand Public Outreach Campaigns for all hazards	**Objective 3.2: Promote disaster preparedness planning for families and area businesses**			
Galveston County Objectives Previous Plan	1.1 Heighten public awareness of the full range of natural and man-made hazards they face.	1.2 Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.			
League City Objectives Previous Plan	Increase public awareness to the risks that are associated with the area's hazards, through information dissemination and outreach programs.	Provide information on funding resources, partnership opportunities and tools to assist in the implementation of mitigation activities. Develop educational training programs and materials residents can utilize to protect property against hazards.			

Appendix D-2

Mitigation Action Ranking Methodology and Worksheets

Mitigation Ranking Methodology

Ranking Scale:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

The maximum points an action can achieve is 10 and the lowest a -10.

Evaluation Criteria:

Life Safety – How effective will the action be at protecting lives and preventing injuries?

Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?

Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

Political – Is there overall public support for the mitigation action? Is there the political will to support it?

Legal – Does the community have the authority to implement the action?

Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?

Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the actions' implementation?

Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

As a result of the mitigation action workshop discussion and evaluation process, an overall priority was based on the total points scored on each mitigation action as a high, medium, and low priority as defined below:

- High Priority = 10 to 4
- Medium Priority = 3 to -3
- Low Priority = -4 to -10

Galveston County - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
GC 2006-12	1	1	0	0	0	1	1	1	0	0	5
GC 2011-3	1	1	0	1	1	1	0	0	0	0	5
GC 2011-6	1	1	1	1	0	0	1	0	0	0	5
GC 2011-9	1	0	1	1	1	0	1	1	1	1	8
GC 2011-10	1	1	1	1	1	1	0	0	1	0	7
GC 2011-21	0	0	1	1	1	0	0	0	0	0	3
GC 2016-1	1	0	1	1	1	0	1	0	0	0	5
GC 2016-2	1	1	1	1	1	0	1	0	0	0	6
GC 2016-3	0	1	1	1	1	1	0	0	0	0	5
GC 2016-4	1	0	1	0	0	0	0	0	0	1	3
GC 2016-5	0	1	1	1	1	0	0	0	0	0	4
GC 2016-6	1	1	1	1	1	1	1	1	1	1	10
GC 2016-7	1	1	1	1	1	1	1	0	0	1	8
GC 2016-8	1	1	1	1	0	0	0	0	0	0	4
GC 2016-9	1	1	1	1	1	1	1	1	1	1	10
GC 2016-10	1	1	1	1	1	1	1	1	1	1	10

Bayou Vista - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2006-1	1	0	1	1	1	0	0	1	1	1	7
2011-4	1	1	1	1	-1	1	0	1	1	1	7
2011-6	1	1	1	1	-1	1	0	1	1	1	7
2011-7	1	1	1	1	-1	1	0	1	1	1	7
2011-8	1	1	1	1	-1	1	0	1	1	1	7
2011-9	1	1	1	1	-1	1	0	1	1	1	7
2011-11	1	1	1	1	-1	1	0	1	1	1	7
2011-12	1	1	1	1	-1	1	0	1	1	1	7
2011-13	1	1	1	1	-1	1	0	1	1	1	7
2011-15	1	0	1	1	-1	1	0	1	1	1	6
2011-16	1	1	1	1	-1	1	0	1	1	1	7
2011-17	1	1	1	1	-1	1	1	1	1	1	8
2011-19	1	1	1	1	0	1	0	1	1	1	8
2011-20	1	1	1	1	0	1	0	1	1	1	8
2011-21	1	1	1	1	1	1	0	1	1	1	9
2016-1	1	1	1	1	1	1	0	1	1	1	9
2016-2	1	0	1	1	1	1	1	1	1	0	8
2016-3	1	1	1	1	0	1	0	1	1	1	8
2016-4	1	1	1	1	0	1	0	1	1	1	8
2016-5	1	1	1	1	0	1	0	1	1	1	8
2016-6	1	1	1	1	1	1	0	1	1	1	9

Clear Lakes Shores - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2006-2	0	1	1	0	1	1	0	1	0	0	5
2011-2	0	0	1	0	1	-1	0	1	0	1	3
2016-1	1	1	1	1	1	0	0	1	1	1	8
2016-2	1	1	0	0	1	1	-1	0	0	0	3
2016-3	0	1	1	0	1	1	0	0	0	0	4
2016-4	1	0	1	1	1	1	0	0	0	0	5

Friendswood - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2009-2	0	1	1	0	1	0	0	1	0	1	5
2009-3	1	1	1	1	1	0	0	1	1	1	8
2009-4	1	0	1	1	1	0	0	1	1	1	7
2009-5	0	0	1	0	1	0	0	1	0	0	3
2016-1	0	1	1	1	1	0	0	1	1	0	6
2016-2	1	1	1	1	1	0	0	1	1	1	8
2016-3	0	0	1	1	1	0	0	1	1	0	5
2016-4	0	1	1	1	1	0	0	1	1	0	6
2016-5	0	0	1	1	1	0	0	1	0	0	4
2016-6	1	0	0	0	1	0	0	1	0	0	3
2016-7	0	0	1	1	1	0	0	1	0	0	4
2016-8	1	0	1	1	1	0	0	1	1	1	7
2016-9	0	1	1	1	1	0	0	1	1	0	6
2016-10	0	1	1	1	1	0	0	1	1	0	6
2016-11	0	1	1	1	1	1	0	1	1	1	8
2016-12	0	1	1	1	1	1	0	0	0	1	6
2016-13	1	1	1	1	1	0	0	1	1	0	7
2016-14	0	0	1	0	1	0	0	1	1	0	4
2016-15	0	0	1	0	1	0	0	1	1	0	4
2016-16	1	1	1	0	1	0	0	1	0	0	5
2016-17	1	1	0	1	1	0	1	1	1	0	7
2016-18	1	0	0	0	1	0	0	1	0	0	3
2016-19	0	1	1	1	1	1	0	0	0	1	6

Hitchcock - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
H-2006-2	0	1	1	1	1	1	0	1	1	1	8
H-2006-3	0	1	1	1	1	1	0	1	1	1	8
H-2006-4	0	1	1	1	1	1	0	1	1	1	8
H-2006-5	0	1	1	1	1	1	0	1	1	1	8
H-2006-6	0	1	1	1	1	1	0	1	1	1	8
H-2006-7	0	1	1	1	1	1	0	1	1	1	8
H-2006-8	0	1	1	1	1	1	0	1	1	1	8
H-2006-9	0	1	1	1	1	1	0	1	1	1	8
H-2006-10	0	1	1	1	1	1	0	1	1	1	8
H-2006-11	0	1	1	1	1	1	0	1	1	1	8
H-2006-12	0	1	1	1	1	1	0	1	1	1	8
H-2006-16	0	1	1	1	1	1	0	1	1	1	8
H-2006-18	0	1	1	1	1	1	0	1	1	1	8
H-2006-20	0	1	1	1	1	1	0	1	1	1	8
H-2011-1	1	1	1	1	1	0	0	1	1	1	8
H-2011-2	1	1	1	1	1	0	0	1	1	1	8
H-2011-3	1	0	1	1	1	1	0	1	1	1	8
H-2011-8	1	1	1	1	1	0	0	1	1	1	8
H-2011-10	1	1	1	1	1	0	0	1	1	1	8
H-2011-11	0	1	1	1	1	1	0	1	1	1	8
H-2011-13	1	1	1	1	1	0	0	1	1	1	8
H-2011-19	1	1	1	1	1	0	0	1	1	1	8
H-2016-1	1	1	1	1	1	0	0	1	1	1	8
H-2016-2	1	1	1	-1	0	1	-1	1	1	1	5
H-2016-3	1	1	1	1	1	1	0	1	1	1	9

Jamaica Beach - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2006-1	0	1	1	0	1	1	1	1	1	1	8
2006-4	1	1	1	1	1	0	0	1	1	1	8
2011-5	1	0	1	0	1	1	0	1	0	0	5
2016-1	1	1	1	1	1	0	0	1	0	1	7
2016-2	1	1	1	0	1	0	0	1	1	1	7
2016-3	1	1	1	0	1	1	0	1	0	1	7
2016-4	1	1	0	0	1	1	0	1	0	0	5
2016-5	1	1	1	1	1	0	0	1	0	0	6

Kemah - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2006-1	1	1	1	1	1	1	0	1	1	1	9
2006-2	1	1	1	1	1	0	0	1	1	1	8
2006-3	1	1	1	1	1	1	1	1	1	1	10
2006-4	1	1	1	1	1	1	0	1	1	1	9
2011-1	1	1	1	1	1	0	0	1	1	1	8
2011-8	1	1	1	1	1	1	0	1	1	1	9
2011-10	1	1	1	1	1	1	1	1	1	1	10
2011-11a	1	1	1	1	1	1	1	1	1	1	10
2011-13	1	1	1	1	1	1	1	1	1	1	10
2011-14	1	1	1	1	1	0	0	1	1	1	8
2016-1	1	1	1	1	1	0	0	1	1	1	8
2016-2	1	1	1	1	1	0	0	1	1	1	8
2016-3	1	1	1	1	1	1	1	1	1	1	10
2016-4	1	1	1	1	1	1	1	1	1	1	10
2016-5	1	1	1	1	1	0	1	1	1	1	9

La Marque - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
LM 2006-2	0	1	0	1	1	1	0	0	0	1	5
LM 2011-2	0	1	0	0	1	0	0	1	1	0	4
LM 2011-3	0	1	0	0	1	0	0	1	1	0	4
LM 2011-6	1	1	0	1	1	0	0	1	1	1	7
LM 2011-7	1	1	1	1	1	0	1	1	1	1	9
LM 2011-9	0	0	1	0	1	0	0	1	0	0	3
LM 2011-11	1	0	-1	0	1	0	1	-1	0	0	1
LM 2011-12	1	0	1	1	-1	1	0	-1	0	0	2
LM 2011-13	1	1	1	1	1	0	0	1	0	1	7
LM 2011-14	0	1	0	1	1	1	0	-1	0	0	3
LM 2011-15	1	1	0	1	-1	1	0	-1	0	1	3
LM 2011-16	1	1	1	1	1	0	0	1	1	1	8
LM 2011-17	0	1	1	1	1	0	0	1	1	1	7
LM 2011-18	1	1	0	0	1	1	0	1	0	1	6
LM 2011-19	1	1	1	1	1	0	1	1	0	0	7
LM 2016-1	0	1	1	1	1	1	0	-1	0	1	5
LM 2016-2	0	0	1	0	1	0	0	1	0	0	3
LM 2016-3	0	1	1	0	1	0	0	1	1	1	6
LM 2016-4	0	1	1	1	1	0	0	1	0	1	6
LM 2016-5	0	0	1	1	1	0	0	1	1	1	6

League City - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2005-1	1	1	1	1	1	1	0	1	1	1	9
2005-2	1	1	1	1	1	1	0	1	0	1	8
2005-3	0	1	1	1	1	1	-1	1	1	1	7
2005-4	1	1	1	1	1	1	1	1	1	1	10
2005-5	0	1	1	0	1	1	0	1	0	1	6
2005-6	1	0	1	1	1	0	1	0	1	1	7
2005-7	0	1	1	0	1	0	0	1	0	1	5
2005-8	1	1	1	1	1	0	1	0	1	1	8
2005-9	1	1	1	1	1	1	0	0	0	0	6
2016-1	1	1	1	1	1	1	0	1	1	1	9
2016-2	1	1	1	1	1	1	1	1	1	1	10
2016-3	1	1	1	1	1	0	1	1	0	1	8
2016-4	1	1	1	-1	1	1	0	0	0	1	5
2016-5	1	0	1	0	1	0	0	1	0	1	5
2016-6	1	1	1	1	1	1	1	0	1	1	9
2016-7	0	1	1	1	1	1	1	1	1	1	9
2016-8	1	0	1	1	1	0	1	0	0	0	5

Santa Fe - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
SF2016-1	0	1	1	0	1	0	0	1	1	1	6
SF2016-2	1	1	-1	-1	1	0	0	1	0	0	2
SF2016-3	1	1	1	1	1	1	0	1	1	1	9
SF2016-4	1	0	1	1	1	0	0	1	1	1	7
SF2016-5	1	1	1	1	1	1	0	1	1	1	9
SF2016-6	1	1	-1	1	1	0	-1	1	0	1	4
SF2016-7	1	1	1	0	1	0	0	1	0	0	5
SF2016-8	1	1	1	1	1	0	1	1	0	0	7
SF2016-9	1	1	1	1	1	0	0	1	1	1	8
SF2016-10	1	1	1	1	1	1	0	1	1	1	9
SF2016-11	1	1	0	0	1	0	0	1	1	1	6

Tiki Island - Mitigation Action Ranking Worksheet

Action	Life Safety	Property Protection	Technical	Political	Legal	Environment	Social	Administrative	Local Champion	Other Community Objectives	Total Score
2011-2	1	1	1	1	1	1	0	1	1	1	9
2011-5	1	1	1	1	1	1	0	1	1	1	9
2011-8	1	0	1	1	1	0	0	1	1	1	7
2011-9	1	1	1	1	-1	1	0	-1	1	1	5
2011-10	1	1	1	1	1	0	0	1	1	1	8
2011-11	0	1	1	1	1	0	0	1	1	1	7
2011-13	1	1	1	1	1	1	0	1	1	1	9
2011-14	1	1	1	1	1	1	0	1	1	1	9
2016-1	1	1	1	1	1	1	0	1	1	1	9
2016-2	1	1	1	1	1	0	0	1	1	1	8
2016-3	1	1	1	1	1	1	0	1	1	1	9

Appendix E

RFC Repetitive Flood Properties Database

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	3	$49,305.40
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	2	$11,673.25
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$154,211.21
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	6	$230,950.07
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$118,267.56
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$222,227.50
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	3	$98,195.57
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$70,509.91
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	2	$8,846.89
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A13	4	$55,214.45
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	5	$228,833.96
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	C	9	$87,096.05
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A12	3	$86,580.88
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	5	$123,774.43
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	5	$83,387.80
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	6	$116,105.74
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	6	$117,486.53
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	6	$149,659.57
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$86,947.59
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$271,007.93
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$59,688.52
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$48,780.69
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	9	$158,778.07
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$51,806.41
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$100,971.00
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	3	$104,032.32
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	2	$55,248.31
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$79,828.94
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	8	$96,994.27
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$118,431.15
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	2	$88,436.27
NO	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	3	$63,213.82
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A12	2	$18,608.40
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A12	2	$17,375.46
NO	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	2	$37,135.07
NO	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	4	$82,335.32
YES	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	4	$62,319.59
YES	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	6	$82,471.09
YES	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	VE	3	$21,460.43
YES	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	X	5	$154,080.80
YES	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	AE	5	$219,799.40
YES	YES	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	7	$194,362.72
YES	NO	[redacted]	BAYOU VISTA	SINGLE FMLY	A12	3	$44,718.90
YES	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	12	$334,120.81
YES	SDF	[redacted]	BAYOU VISTA	SINGLE FMLY	A14	7	$236,498.06

9	**No. of Mitigated Properties**
36	**No. of Non-Mitigated Properties**
45	**Total RF Properties**
196	**No. of Losses**
$4,901,778	**Total Paid (building and contents)**

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	CLEAR LAKE SHORES	2-4 FAMILY	A14	2	$9,850.22
NO	SDF	[redacted]	CLEAR LAKE SHORES	ASSMD CONDO	AE	11	$509,835.22
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	A14	3	$85,345.27
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	A14	2	$54,199.00
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	4	$44,047.35
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	5	$579,578.09
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	4	$46,875.21
NO	SDF	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	A13	4	$69,106.00
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	A14	3	$11,371.70
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	7	$149,753.12
NO	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	3	$11,805.89
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$44,528.53
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$20,523.60
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$28,717.99
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$15,151.60
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$11,158.66
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY		3	$23,842.14
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$23,649.22
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$19,606.03
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$21,895.29
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$60,877.85
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$47,386.80
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	8	$50,299.66
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$83,220.98
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$31,117.62
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$17,721.91
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$10,922.82
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$218,115.63
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$44,510.09
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$60,989.53
NO	SDF	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	4	$174,344.98
NO	SDF	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	7	$264,074.95
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$141,118.77
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	2	$56,446.26
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$48,626.67
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$42,762.47
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$69,213.16
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$41,622.00
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$61,930.87
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$13,205.48
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$25,584.57
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$61,737.24
NO	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$37,705.04
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$2,634.68
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$5,937.05
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	4	$32,487.54
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$3,105.00
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$30,881.51
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$37,379.31
NO	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	7	$71,493.04
YES	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$15,448.53
YES	NO	[redacted]	CLEAR LAKE SHORES	NON RESIDNT	AE	2	$12,149.39
YES	NO	[redacted]	CLEAR LAKE SHORES	OTHER RESID	A13	6	$53,823.09
YES	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$33,018.68
YES	NO	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$45,007.28
YES	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$178,075.39
YES	YES	[redacted]	CLEAR LAKE SHORES	SINGLE FMLY	AE	6	$61,671.51

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$70,338.46
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$88,906.97
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$88,163.92
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$16,178.74
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$190,355.36
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$136,022.72
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$123,815.24
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$217,603.04
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	2	$16,151.68
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	12	$195,129.72
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$58,235.69
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	6	$60,218.41
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$11,163.16
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$19,882.66
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$3,882.00
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	3	$28,255.75
YES	NO		CLEAR LAKE SHORES	ASSMD CONDO	AE	5	$160,707.91
YES	NO		CLEAR LAKE SHORES	NON RESIDNT	AE	10	$458,158.14
YES	NO		CLEAR LAKE SHORES	NON RESIDNT	A14	2	$31,232.31
YES	NO		CLEAR LAKE SHORES	NON RESIDNT	A14	2	$7,123.25
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	1	$90,471.97
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$69,809.72
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$32,135.88
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	AE	4	$89,370.92
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	2	$85,791.41
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$11,855.62
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	2	$9,720.50
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	9	$59,818.96
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	AE	5	$365,431.16
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A14	5	$233,040.55
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$246,199.15
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	9	$167,173.52
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	6	$203,960.07
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	6	$200,485.60
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$263,505.51
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	6	$201,411.19
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	5	$142,562.61
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	7	$212,318.79
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	4	$26,626.36
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A14	2	$13,277.73
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A14	4	$51,259.23
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	11	$124,750.79
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$148,807.46
YES	NO		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$193,574.77
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	AE	3	$326,676.35
YES	YES		CLEAR LAKE SHORES	SINGLE FMLY	A13	3	$309,436.81

103	Total RF Properties
50	No. of Non-Mitigated Properties
53	No. of Mitigated Properties
408	No. of Losses
$9,838,341	Total Paid (building and contents)

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	FRIENDSWOOD	2-4 FAMILY	AE	4	297,992.15
NO	NO	[redacted]	FRIENDSWOOD	ASSMD CONDO	C	3	22,478.17
YES	NO	[redacted]	FRIENDSWOOD	ASSMD CONDO	AE	3	115,448.36
NO	YES	[redacted]	FRIENDSWOOD	ASSMD CONDO	B	2	199,719.46
NO	YES	[redacted]	FRIENDSWOOD	ASSMD CONDO	A	4	77,133.78
NO	NO	[redacted]	FRIENDSWOOD	NON RESIDNT	A06	3	71,687.14
NO	NO	[redacted]	FRIENDSWOOD	NON RESIDNT	C	2	79,642.95
NO	NO	[redacted]	FRIENDSWOOD	NON RESIDNT	A03	2	55,876.04
NO	NO	[redacted]	FRIENDSWOOD	NON RESIDNT	A	2	14,450.00
YES	NO	[redacted]	FRIENDSWOOD	NON RESIDNT	B	2	7,023.78
NO	NO	[redacted]	FRIENDSWOOD	OTHER RESID	C	2	105,629.85
NO	NO	[redacted]	FRIENDSWOOD	OTHER RESID	X	3	113,460.70
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	3,935.18
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	15,852.71
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	109,368.61
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	7,266.15
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	3,667.09
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	23,454.70
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	3	23,005.55
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	36,628.79
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	26,116.08
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	6,069.09
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	12,008.39
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	13,693.22
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	53,967.38
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	58,598.11
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	233,401.29
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	26,955.64
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	92,210.41
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	33,371.65
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	7	86,454.45
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	2	27,400.00
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	123,468.59
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	22,086.59
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	139,198.97
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	46,687.05
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	82,577.00
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	40,827.55
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	24,161.90
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	10,766.90
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	33,566.06
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	5	49,536.80
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	161,529.96
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	7	333,803.11
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	10	289,911.09
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	2	21,909.43
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	29,732.78
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	48,806.63
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	6	106,612.00
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	27,851.00
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	120,977.51
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	226,400.94
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	145,255.49
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	51,333.46
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	5	76,055.89
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	2	81,355.64
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	48,569.76

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	15,565.41
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	28,999.46
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	9,153.34
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	38,372.09
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	29,592.61
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A01	4	39,797.13
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	72,571.81
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	8,954.51
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	135,067.24
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	11,847.12
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	100,604.38
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	30,832.43
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	198,975.73
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	10	177,655.39
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	3,770.42
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	463,445.99
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	176,895.26
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	123,305.84
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	265,240.26
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	76,542.84
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	59,099.58
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	4	29,328.71
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	4	121,999.89
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	5	134,090.38
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	177,297.97
NO	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	47,739.32
YES	NO	[redacted]	HOUSTON	SINGLE FMLY	A08	2	128,102.15
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	107,174.95
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	4	151,089.46
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	161,476.70
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	553,887.40
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	366,601.44
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	319,630.59
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	550,886.60
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	675,133.46
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	468,280.51
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	156,319.83
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	9	745,006.75
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	5	137,886.72
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	136,484.99
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	148,774.77
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	106,768.10
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	104,758.99
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	49,772.83
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A06	5	201,692.18
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	212,566.19
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	312,183.63
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	204,194.19
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	4	170,386.41
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	275,052.46
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	244,140.80
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	48,000.00
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	263,611.54
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	243,785.50
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A06	3	186,082.15
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	4	679,889.63
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	184,213.37

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	186,537.85
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	5	238,030.45
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	231,789.89
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	300,622.32
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	7	476,400.74
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	250,831.70
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	463,629.07
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	325,403.51
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	515,401.33
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	452,435.59
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	564,340.12
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	297,373.99
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	459,820.07
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	482,072.56
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	180,966.58
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	404,800.47
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	86,618.47
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	306,647.19
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	4	122,578.03
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	563,562.05
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	6	302,576.94
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	451,958.64
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	7	664,775.73
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	435,460.92
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	400,028.23
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	290,160.38
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	529,851.87
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	250,507.31
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	280,496.99
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	6	513,328.45
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	206,972.17
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	324,867.01
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	259,142.66
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	307,517.41
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	5	197,989.50
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	104,962.19
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	346,455.69
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	362,041.30
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	156,087.06
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	325,046.58
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	71,409.21
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	15	225,877.63
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	13	374,022.01
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	202,855.17
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	504,605.27
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	275,485.12
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	310,674.45
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	230,520.42
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	2	44,088.00
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	5	277,997.69
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AO	3	245,079.16
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	70,886.48
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	172,635.97
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	9	184,103.84
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	8	204,389.37
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	138,450.22
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	81,482.55

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	146,739.60
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	7	472,150.95
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	189,568.61
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	8	287,520.66
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	180,744.09
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A15	4	78,488.96
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A06	10	181,190.87
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	132,860.87
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	216,083.16
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	295,637.47
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	225,529.77
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	209,360.16
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	183,077.19
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	368,996.03
YES	NO	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	4	220,534.83
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	80,004.33
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	317,866.70
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	255,473.03
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	A04	4	139,217.64
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	3	24,983.56
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	7	54,411.93
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	183,723.86
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	145,673.73
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	147,955.85
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	A05	4	211,670.61
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	146,639.30
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	198,641.87
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	5	434,508.30
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	147,397.08
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	239,777.89
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	139,077.79
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	4	106,119.84
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	178,720.14
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	4	101,051.12
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	82,724.41
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	6	162,242.21
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	149,208.73
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	5	321,052.18
NO	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	5	328,403.39
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	188,833.40
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	9	170,044.57
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	8	267,780.34
YES	SDF	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	4	140,954.33
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	66,429.93
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	27,654.58
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A06	2	20,405.87
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	26,231.59
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	56,524.37
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	78,530.24
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	16,187.13
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	4	27,512.00
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	30,864.90
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A06	3	13,251.64
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	13,156.80
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	121,351.97
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	155,006.67
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	86,636.25

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	93,485.68
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	4	321,241.12
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	59,534.04
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	51,000.86
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	142,880.78
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	18,723.19
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	2	82,193.88
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	15,560.75
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	19,261.17
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	25,614.55
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	89,053.74
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	56,930.68
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	2	8,807.13
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	3	17,760.80
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	21,707.22
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	157,901.12
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	104,471.13
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	11,265.51
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	60,985.02
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	152,645.57
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	66,275.41
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	39,382.23
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	63,344.79
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	43,095.70
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	17,669.06
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	36,461.26
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	3	178,357.53
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	23,118.99
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	44,386.55
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	98,330.75
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	157,231.40
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	31,304.23
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	11,525.35
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	147,865.53
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	14,889.48
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	5	34,515.30
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	77,648.52
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	69,375.64
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A08	3	40,651.41
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A07	2	17,420.55
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	154,244.46
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	101,666.74
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	95,178.97
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	78,276.99
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	47,471.64
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	5,824.32
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	21,620.50
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	3	19,930.67
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	8,559.70
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	2	36,621.69
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	3	128,608.44
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	35,359.67
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	28,624.30
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	10,580.18
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	392,543.66
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	2	29,556.92
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	11,701.08

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014
Source: City of Friendswood

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	C	2	26,838.76
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	2	76,422.26
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	127,743.01
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	3	139,883.24
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	4	142,820.73
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	42,604.69
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	2	13,459.92
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	10	593,809.86
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	9	595,297.39
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	41,946.32
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	3	85,472.87
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	35,520.71
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	B	2	34,589.25
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A03	2	16,479.72
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	9,482.78
NO	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	4	146,107.50
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	251,974.27
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	6	286,658.78
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	5	190,500.55
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	X	2	30,716.50
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	A	2	28,892.39
YES	YES	[redacted]	FRIENDSWOOD	SINGLE FMLY	AE	5	177,953.66

307	**Total RF Properties**
178	**No. of non-mitigated properties**
129	**No. of mitigated properties**
1177	**No. of losses**
$48,719,984	**Total Paid**

Properties highlighted in yellow are located in Harris County
Properties highlighted in green were mitigated after this report was generated (source Galveston Co. Housing Eco Dev)

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO		HITCHCOCK	ASSMD CONDO	B	8	$168,292.35
NO	NO		HITCHCOCK	NON RESIDNT	X	3	$218,746.89
NO	YES		HITCHCOCK	SINGLE FMLY	A14	2	$135,267.49
NO	NO		HITCHCOCK	SINGLE FMLY	AE	3	$29,533.84
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$19,525.72
NO	NO		HITCHCOCK	SINGLE FMLY	V12	2	$26,671.73
NO	NO		HITCHCOCK	SINGLE FMLY	A17	2	$11,171.19
NO	NO		HITCHCOCK	SINGLE FMLY	A17	2	$10,251.53
NO	NO		HITCHCOCK	SINGLE FMLY	V12	4	$35,581.41
NO	NO		HITCHCOCK	SINGLE FMLY	C	2	$5,752.00
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$106,539.87
NO	NO		HITCHCOCK	SINGLE FMLY	A14	4	$55,093.43
NO	NO		HITCHCOCK	SINGLE FMLY	AE	2	$36,678.57
NO	NO		HITCHCOCK	SINGLE FMLY	C	2	$3,799.87
NO	NO		HITCHCOCK	SINGLE FMLY	C	4	$44,787.49
NO	NO		HITCHCOCK	SINGLE FMLY	A11	3	$30,555.60
NO	NO		HITCHCOCK	SINGLE FMLY	A12	4	$96,257.23
NO	NO		HITCHCOCK	SINGLE FMLY	C	8	$63,436.34
NO	NO		HITCHCOCK	SINGLE FMLY	A11	2	$24,544.71
NO	NO		HITCHCOCK	SINGLE FMLY	A14	6	$104,139.23
NO	YES		HITCHCOCK	SINGLE FMLY	A14	3	$39,619.49
NO	YES		HITCHCOCK	SINGLE FMLY	V20	3	$25,975.28
NO	NO		HITCHCOCK	SINGLE FMLY	AE	4	$20,064.65
NO	YES		HITCHCOCK	SINGLE FMLY	A14	3	$103,061.13
NO	YES		HITCHCOCK	SINGLE FMLY	A14	3	$161,493.99
NO	NO		HITCHCOCK	SINGLE FMLY	A14	6	$41,927.45
NO	SDF		HITCHCOCK	SINGLE FMLY	A14	5	$169,844.98
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$21,669.24
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$15,621.53
NO	NO		HITCHCOCK	SINGLE FMLY	A12	2	$11,651.56
NO	NO		HITCHCOCK	SINGLE FMLY	A12	3	$13,823.02
NO	NO		HITCHCOCK	SINGLE FMLY	C	2	$17,975.17
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$3,057.89
NO	NO		HITCHCOCK	SINGLE FMLY	B	4	$41,320.71
NO	YES		HITCHCOCK	SINGLE FMLY	A14	2	$23,534.91
NO	NO		HITCHCOCK	SINGLE FMLY	A14	3	$74,819.49
NO	YES		HITCHCOCK	SINGLE FMLY	A14	3	$47,826.88
NO	NO		HITCHCOCK	SINGLE FMLY	B	5	$15,169.85
NO	YES		HITCHCOCK	SINGLE FMLY	A08	3	$81,638.33
NO	YES		HITCHCOCK	SINGLE FMLY	A12	2	$7,670.15
NO	NO		HITCHCOCK	SINGLE FMLY	X	3	$76,364.97
NO	NO		HITCHCOCK	SINGLE FMLY	A12	3	$44,198.48
NO	NO		HITCHCOCK	SINGLE FMLY	A11	7	$77,646.41
NO	NO		HITCHCOCK	SINGLE FMLY	A12	2	$3,749.03
NO	YES		HITCHCOCK	SINGLE FMLY	A12	4	$52,080.66
NO	YES		HITCHCOCK	SINGLE FMLY	C	2	$26,793.29
NO	NO		HITCHCOCK	SINGLE FMLY	A12	3	$24,498.67
NO	NO		HITCHCOCK	SINGLE FMLY	A14	7	$85,200.94
NO	SDF		HITCHCOCK	SINGLE FMLY	A08	5	$89,576.23
NO	YES		HITCHCOCK	SINGLE FMLY	A14	6	$92,495.13
NO	NO		HITCHCOCK	SINGLE FMLY	A14	6	$79,505.74
NO	NO		HITCHCOCK	SINGLE FMLY	A12	4	$19,160.99
NO	NO		HITCHCOCK	SINGLE FMLY	A12	2	$19,653.86
NO	NO		HITCHCOCK	SINGLE FMLY	A12	6	$50,826.31
NO	YES		HITCHCOCK	SINGLE FMLY	A14	2	$79,734.72
NO	NO		HITCHCOCK	SINGLE FMLY	A14	2	$37,302.82
NO	NO		HITCHCOCK	SINGLE FMLY	C	2	$30,918.05

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY		2	$13,087.28
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	C	4	$31,776.34
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$23,906.87
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	3	$32,250.11
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A11	3	$27,933.49
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	X	5	$15,365.75
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$5,492.84
NO	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$20,567.94
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY		2	$9,289.01
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A12	2	$8,251.41
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	C	2	$11,726.18
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	B	3	$17,432.65
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	C	2	$31,630.25
NO	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A11	2	$24,973.50
YES	NO	[redacted]	HITCHCOCK	NON RESIDNT	A14	5	$24,164.90
YES	NO	[redacted]	HITCHCOCK	NON RESIDNT	A12	4	$32,925.53
YES	NO	[redacted]	HITCHCOCK	NON RESIDNT	A12	3	$15,512.38
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	8	$114,884.06
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	3	$51,649.99
YES	SDF	[redacted]	HITCHCOCK	SINGLE FMLY	A14	4	$132,370.85
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	4	$184,868.63
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A11	2	$9,341.48
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$13,605.98
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	AE	4	$195,256.74
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	B	3	$9,049.36
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	B	3	$53,175.61
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A17	3	$34,457.21
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A12	2	$26,930.00
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$33,897.82
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$29,807.86
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A12	2	$36,413.43
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$22,957.06
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$37,685.34
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$15,415.97
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A12	2	$17,130.96
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$24,194.62
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A17	2	$31,659.89
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	2	$40,003.56
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	C	2	$39,453.48
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	B	5	$33,982.25
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	B	3	$16,208.61
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	AE	2	$11,588.38
YES	YES	[redacted]	HITCHCOCK	SINGLE FMLY	A14	3	$162,282.46
YES	SDF	[redacted]	HITCHCOCK	SINGLE FMLY	A14	5	$263,480.00
YES	SDF	[redacted]	HITCHCOCK	SINGLE FMLY	A	3	$90,171.24
YES	NO	[redacted]	HITCHCOCK	SINGLE FMLY	A14	4	$137,895.43
YES	SDF	[redacted]	HITCHCOCK	SINGLE FMLY	V12	5	$111,090.17
YES	SDF	[redacted]	HITCHCOCK	SINGLE FMLY	A14	6	$172,830.32

105	**Total RF Properties**
71	**No. of Non-Mitigated Properties**
34	**No. of Mitigated Properties**
339	**No. of Losses**
$5,554,124	**Total Paid (building and contents)**

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	YES	[redacted]	JAIMACA BEACH	ASSMD CONDO	A17	2	$41,604.37
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V12	3	$28,154.18
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	2	$13,385.90
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$10,732.92
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$8,709.90
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$7,001.16
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	VE	2	$9,386.56
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	2	$19,445.95
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	4	$17,044.20
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V12	2	$58,309.81
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V12	4	$31,959.87
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	4	$101,563.69
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	3	$41,453.94
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	VE	3	$55,908.01
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$29,488.78
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	2	$7,914.87
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$31,563.90
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$103,872.86
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	3	$305,411.11
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	4	$137,373.99
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	3	$144,872.45
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A11	3	$48,081.33
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A11	2	$30,939.22
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	VE	4	$192,477.70
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	5	$154,904.36
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$116,687.80
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	3	$73,463.94
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$167,532.32
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	VE	4	$81,207.91
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	3	$80,505.56
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$94,787.93
NO	SDF	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	6	$64,075.17
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$75,389.61
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	7	$110,134.81
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$23,441.51
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$38,135.14
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$36,267.96
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	2	$13,106.28
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	3	$35,906.90
NO	YES	[redacted]	JAMAICA BEACH	SINGLE FMLY	AE	2	$6,504.40
NO	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	VE	2	$10,076.68
YES	SDF	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	3	$191,898.83
YES	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V20	3	$43,345.11
YES	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	V12	3	$254,770.19
YES	NO	[redacted]	JAMAICA BEACH	SINGLE FMLY	A17	3	$24,288.72

45	**Total RF Properties**
41	**No. of Non-Mitigated Properties**
4	**No. of Mitigated Properties**
133	**No. of Losses**
$3,173,088	**Total Paid (building and contents)**

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	SDF	[redacted]	KEMAH	SINGLE FMLY	X	5	$106,119.46
NO	NO	[redacted]	KEMAH	SINGLE FMLY	B	5	$20,461.47
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A14	2	$81,889.93
NO	YES	[redacted]	KEMAH	SINGLE FMLY	C	2	$17,902.57
NO	YES	[redacted]	KEMAH	SINGLE FMLY	AE	6	$60,103.31
NO	NO	[redacted]	KEMAH	SINGLE FMLY	B	4	$50,733.01
NO	YES	[redacted]	KEMAH	SINGLE FMLY	AE	2	$71,268.59
NO	NO	[redacted]	KEMAH	NON RESIDNT	B	2	$610,228.22
NO	NO	[redacted]	KEMAH	SINGLE FMLY	A	4	$32,350.40
NO	YES	[redacted]	KEMAH	NON RESIDNT	B	2	$275,940.65
NO	NO	[redacted]	KEMAH	SINGLE FMLY	C	2	$3,771.30
NO	YES	[redacted]	KEMAH	NON RESIDNT	A13	3	$69,176.47
NO	NO	[redacted]	KEMAH	SINGLE FMLY	X	8	$219,152.41
NO	NO	[redacted]	KEMAH	NON RESIDNT	A13	5	$126,480.82
NO	NO	[redacted]	KEMAH	ASSMD CONDO	AE	7	$1,535,235.27
NO	YES	[redacted]	KEMAH	NON RESIDNT	A13	5	$61,477.21
NO	NO	[redacted]	KEMAH	NON RESIDNT	A13	12	$318,363.91
NO	YES	[redacted]	KEMAH	SINGLE FMLY	C	3	$56,646.22
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$103,217.55
NO	YES	[redacted]	KEMAH	SINGLE FMLY	C	2	$86,812.76
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$131,967.41
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	2	$119,738.11
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A14	3	$100,694.63
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	2	$133,374.77
NO	YES	[redacted]	KEMAH	NON RESIDNT	A13	3	$91,526.48
NO	SDF	[redacted]	KEMAH	NON RESIDNT	A13	6	$97,244.49
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$58,226.15
NO	NO	[redacted]	KEMAH	SINGLE FMLY	B	2	$27,620.96
NO	SDF	[redacted]	KEMAH	NON RESIDNT	A13	7	$226,322.37
NO	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$41,832.28
NO	NO	[redacted]	KEMAH	SINGLE FMLY	A11	2	$21,584.29
NO	NO	[redacted]	KEMAH	OTHER RESID	AE	2	$70,551.15
NO	YES	[redacted]	KEMAH	SINGLE FMLY	A13	2	$175,827.85
YES	YES	[redacted]	KEMAH	SINGLE FMLY	B	3	$75,342.21
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	4	$13,982.67
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$6,124.84
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A15	3	$205,615.76
YES	NO	[redacted]	KEMAH	SINGLE FMLY	AE	2	$30,267.69
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	3	$117,209.38
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A15	3	$366,571.99
YES	NO	[redacted]	KEMAH	NON RESIDNT	A13	5	$113,043.30
YES	NO	[redacted]	KEMAH	SINGLE FMLY	AE	3	$64,995.04
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$60,508.17
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$37,413.89
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	5	$47,222.89
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$31,235.12
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	4	$14,275.39
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	6	$46,162.90
YES	NO	[redacted]	KEMAH	SINGLE FMLY	X	11	$169,204.60
YES	NO	[redacted]	KEMAH	SINGLE FMLY	C	3	$65,483.79
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$19,079.13
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A14	3	$24,484.99
YES	NO	[redacted]	KEMAH	OTHER RESID	A14	7	$250,825.78
YES	NO	[redacted]	KEMAH	OTHER RESID	A14	6	$141,473.95
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	5	$151,206.02
YES	YES	[redacted]	KEMAH	2-4 FAMILY	A13	9	$145,610.84
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	5	$84,516.35

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	2	$48,143.98
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$19,685.53
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	3	$49,704.79
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	9	$363,716.07
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$37,213.12
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	8	$104,674.16
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$34,571.62
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$5,894.82
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	4	$36,989.34
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	4	$63,988.60
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	5	$57,706.13
YES	NO	[redacted]	KEMAH	SINGLE FMLY	AE	4	$21,143.80
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$12,549.00
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	4	$25,339.00
YES	NO	[redacted]	KEMAH	SINGLE FMLY	B	8	$42,905.38
YES	YES	[redacted]	KEMAH	ASSMD CONDO	AE	4	$91,260.95
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	6	$37,276.02
YES	NO	[redacted]	KEMAH	ASSMD CONDO	A14	8	$308,804.67
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	2	$8,292.70
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	4	$571,398.67
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	2	$5,411.62
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	10	$334,121.74
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	13	$388,868.37
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$21,535.43
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	3	$15,219.20
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	5	$161,899.68
YES	NO	[redacted]	KEMAH	SINGLE FMLY	C	2	$19,134.88
YES	NO	[redacted]	KEMAH	SINGLE FMLY	X	3	$16,375.69
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	2	$15,049.97
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	8	$53,171.55
YES	NO	[redacted]	KEMAH	2-4 FAMILY	A14	2	$18,678.77
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	2	$11,436.50
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	8	$38,987.93
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$9,934.90
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	10	$394,264.62
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	3	$49,733.86
YES	NO	[redacted]	KEMAH	SINGLE FMLY	C	8	$75,917.81
YES	NO	[redacted]	KEMAH	NON RESIDNT	AE	2	$11,719.14
YES	NO	[redacted]	KEMAH	SINGLE FMLY	AE	3	$72,089.80
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$163,996.02
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	6	$45,073.99
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$14,987.98
YES	YES	[redacted]	KEMAH	SINGLE FMLY	AE	2	$21,859.82
YES	YES	[redacted]	KEMAH	SINGLE FMLY	C	2	$26,222.82
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$66,036.03
YES	YES	[redacted]	KEMAH	SINGLE FMLY	X	3	$22,036.52
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	2	$139,556.33
YES	YES	[redacted]	KEMAH	SINGLE FMLY	C	2	$13,732.76
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	4	$60,028.30
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A14	2	$13,317.99

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	KEMAH	NON RESIDNT	A14	3	$16,773.40
YES	YES	[redacted]	KEMAH	SINGLE FMLY	A13	3	$162,723.62
YES	SPF	[redacted]	KEMAH	SINGLE FMLY	A13	3	$26,438.16
YES	NO	[redacted]	KEMAH	SINGLE FMLY	A13	3	$6,424.27
YES	SP	[redacted]	KEMAH	SINGLE FMLY	A13	6	$287,153.55

112	Total RF Properties
33	No. of Non-Mitigated Properties
79	No. of Mitigated Properties
455	No. of Losses
$12,637,778	Total Paid (building and contents)

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	SDF	[redacted]	LA MARQUE	SINGLE FMLY	X	14	$176,943.32
NO	SDF	[redacted]	LA MARQUE	SINGLE FMLY	X	11	$142,254.02
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	14	$75,673.38
NO	NO	[redacted]	LA MARQUE	NON RESIDNT	X	10	$50,804.03
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	4	$5,854.56
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$6,755.75
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$17,310.75
NO	NO	[redacted]	LA MARQUE	ASSMD CONDO	A99	3	$52,933.31
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	2	$5,074.27
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$5,202.23
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$10,535.77
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$11,080.06
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	X	5	$53,851.31
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$6,002.63
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	X	4	$34,968.09
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$6,388.00
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	2	$10,686.13
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$4,724.69
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	2	$17,367.60
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	4	$23,757.09
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	3	$7,559.45
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	B	4	$31,197.61
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$5,068.66
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$2,685.02
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$6,252.88
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	2	$2,050.13
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	3	$40,561.33
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	4	$55,791.43
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	C	4	$65,169.96
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	2	$10,204.94
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	3	$15,698.44
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	4	$17,133.74
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$5,858.98
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$36,320.97
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$4,346.04
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	4	$25,539.98
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$4,758.07
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	3	$8,812.70
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	2	$2,936.56
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	2	$9,690.35
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	5	$50,139.27
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A99	2	$4,303.14
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$29,434.20
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	2	$10,160.04
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	2	$22,555.83
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	2	$3,369.00
NO	NO	[redacted]	LA MARQUE	NON RESIDNT	B	4	$17,238.54
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$21,133.27
NO	YES	[redacted]	LA MARQUE	SINGLE FMLY	X	3	$57,555.66
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A14	2	$8,583.37
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	5	$20,828.69
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	11	$72,490.90
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	8	$64,029.44
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	4	$23,657.36
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	B	3	$3,733.31
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$6,793.83
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A99	2	$14,618.99

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	3	$20,713.85
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	3	$16,519.11
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$12,171.59
NO	NO	[redacted]	LA MARQUE	NON RESIDNT	X	4	$21,987.29
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	2	$11,336.16
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	3	$19,863.12
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	A13	2	$19,304.82
NO	NO	[redacted]	LA MARQUE	NON RESIDNT	C	3	$18,258.59
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$6,195.91
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$8,443.63
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$8,624.14
NO	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$2,314.01
YES	NO	[redacted]	LA MARQUE	SINGLE FMLY	X	10	$119,152.54
YES	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	2	$4,551.26
YES	NO	[redacted]	LA MARQUE	SINGLE FMLY	A99	2	$4,391.45
YES	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$46,067.51
YES	NO	[redacted]	LA MARQUE	SINGLE FMLY	C	3	$5,427.71
YES	NO	[redacted]	LA MARQUE	NON RESIDNT	B	7	$35,968.48

75	**Total RF Properties**
69	**No. of Non-Mitigated Properties**
6	**No. of Mitigated Properties**
274	**No. of Losses**
$1,887,720	**Total Paid (building and contents)**

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$16,133.97
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$64,385.01
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$21,997.73
NO	YES	[redacted]	LEAGUE CITY	NON RESIDNT	X	2	$25,049.38
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$51,012.27
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$16,386.72
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$5,874.64
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$128,930.06
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$84,049.41
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$149,320.13
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$76,299.38
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$111,900.38
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	9	$136,348.66
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$59,237.63
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$43,228.08
NO	NO	[redacted]	LEAGUE CITY	NON RESIDNT	A14	2	$54,947.24
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$133,107.15
NO	**NO**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**C**	**4**	**$256,864.82**
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	3	$86,265.18
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$49,153.09
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$60,892.66
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$49,511.59
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	4	$57,927.98
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$15,981.21
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	4	$28,884.51
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	4	$12,797.22
NO	NO	[redacted]	LEAGUE CITY	NON RESIDNT	X	4	$70,311.20
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$17,550.09
NO	**NO**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**AE**	**6**	**$372,324.93**
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$21,595.88
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$18,298.09
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$24,178.75
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	3	$123,685.02
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$49,215.16
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	3	$76,778.15
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	4	$95,803.30
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A13	3	$57,788.06
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	3	$41,897.93
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$40,634.92
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$64,710.18
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	3	$13,632.76
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$61,748.44
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$44,069.49
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	6	$64,777.56
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	3	$46,660.74
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$58,900.89
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$5,004.70
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$53,788.97
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$40,995.10
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A	2	$13,719.15

Properties in bold face are SRL Properties
Properties highlighted in green have been mitigated since this report was generated.

Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$19,047.94
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	7	$89,952.88
NO	**NO**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**A14**	**13**	**$176,749.37**
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	EMG	2	$26,813.91
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	4	$89,800.21
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$97,286.49
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	5	$39,611.97
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$12,680.83
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A14	3	$19,595.28
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$8,241.15
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	3	$18,799.91
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$104,932.87
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$19,185.95
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$8,220.80
NO	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**A14**	**6**	**$117,949.66**
NO	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**A14**	**5**	**$86,386.84**
NO	NO	[redacted]	LEAGUE CITY	ASSMD CONDO	C	2	$18,482.16
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	3	$40,816.17
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$13,876.76
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A14	4	$9,284.51
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$86,744.56
NO	NO	[redacted]	LEAGUE CITY	NON RESIDNT	X	2	$43,384.89
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$26,663.52
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$34,902.17
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$84,988.57
NO	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**X**	**8**	**$226,174.23**
NO	NO	[redacted]	LEAGUE CITY	OTHER RESID	B	2	$368,501.27
NO	**NO**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**C**	**6**	**$353,169.64**
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	4	$39,438.64
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$28,477.90
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	3	$190,618.41
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	2	$56,967.91
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	13	$488,327.77
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$3,379.84
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$45,599.10
NO	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**AE**	**9**	**$149,856.20**
NO	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	4	$180,496.34
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	5	$39,802.05
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$9,205.16
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$10,822.26
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$6,084.00
NO	YES	[redacted]	LEAGUE CITY	NON RESIDNT	C	3	$1,024,645.87
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A14	2	$3,564.00
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	3	$18,200.28
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	6	$173,967.73
NO	YES	[redacted]	LEAGUE CITY	OTHER RESID	X	2	$48,737.37
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	5	$38,008.94
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$34,783.22
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$58,696.14
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$36,870.28

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Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	LEAGUE CITY	2-4 FAMILY	A14	4	$90,581.93
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$101,418.68
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$17,293.49
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$44,107.44
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$88,952.83
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$7,293.94
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$7,021.85
NO	NO	[redacted]	LEAGUE CITY	ASSMD CONDO	X	2	$183,740.07
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$55,548.94
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	3	$80,479.23
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$105,140.82
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$51,051.81
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$17,139.84
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$56,882.84
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$94,325.36
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$46,259.37
NO	YES	[redacted]	LEAGUE CITY	NON RESIDNT	X	2	$116,098.52
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$54,481.20
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$116,539.90
NO	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	7	$77,732.37
NO	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$52,845.87
NO	NO	[redacted]	LEAGUE CITY	NON RESIDNT	X	4	$162,908.98
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$8,770.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$59,814.76
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$16,846.90
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$39,519.87
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$64,853.52
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	2	$8,753.33
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$8,130.17
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$15,268.32
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$24,839.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$19,229.53
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$12,364.45
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	4	$43,832.70
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$42,560.24
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$14,478.55
YES	NO	[redacted]	LEAGUE CITY	ASSMD CONDO	C	2	$21,764.89
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$4,630.90
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$13,984.37
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	5	$396,804.79
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$12,184.09
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A14	3	$214,513.35
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$13,941.58
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$9,017.85
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A14	4	$121,878.44
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$33,187.59
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$12,373.58
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$12,703.20
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	4	$244,688.27
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$35,039.74

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Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$47,368.26
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$54,648.04
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	B	3	$13,133.62
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$9,853.58
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	2	$29,399.90
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$19,509.49
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$54,046.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$27,305.24
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$12,799.14
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$34,339.97
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$42,158.87
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$45,658.94
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$10,329.03
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	A13	3	$79,686.16
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	7	$51,280.48
YES	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**A14**	**6**	**$139,666.88**
YES	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**A14**	**6**	**$123,387.08**
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$6,938.73
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$29,015.99
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$46,948.55
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	X	10	$172,000.11
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$32,467.74
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$52,823.79
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$41,243.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$18,840.70
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	4	$114,264.51
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$11,126.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$19,925.99
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$44,465.83
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$17,922.39
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$17,755.49
YES	**YES**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**AE**	**5**	**$168,998.57**
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$31,839.71
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$8,836.61
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$19,384.49
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$32,022.81
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$11,963.94
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$20,562.62
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$29,978.45
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$82,418.55
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	5	$176,787.15
YES	**SDF**	[redacted]	**LEAGUE CITY**	**SINGLE FMLY**	**AE**	**5**	**$296,450.03**
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$16,627.63
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	6	$388,199.81
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$28,542.78
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$3,438.70
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A06	6	$498,135.11
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	6	$262,286.79
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	AE	8	$467,324.81
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$4,496.31

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Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$20,350.18
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	A15	6	$305,316.08
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$52,899.43
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$34,311.72
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$18,355.10
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$47,179.77
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$65,996.04
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$21,508.39
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	5	$52,984.18
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	4	$64,038.67
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	X	5	$173,538.32
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$39,570.48
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	5	$61,226.40
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	C	6	$125,552.00
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	C	8	$127,403.55
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$18,925.19
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$27,778.49
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$13,516.92
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$8,886.53
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$27,589.06
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$39,575.97
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	B	2	$22,026.74
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$81,992.56
YES	SDF	[redacted]	LEAGUE CITY	SINGLE FMLY	C	5	$137,616.41
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$47,765.19
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$44,668.77
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$14,040.32
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$20,378.01
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	4	$73,560.90
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$59,631.21
YES	NO	[redacted]	LEAGUE CITY	SINGLE FMLY	X	3	$75,765.82
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	3	$89,129.38
YES	YES	[redacted]	LEAGUE CITY	SINGLE FMLY	C	2	$44,899.79

233	**Total RF Properties**
122	**No. of non-mitigated properties**
111	**No. of mitigated properties**
728	**No. of losses**
$17,383,753	**Total Paid**

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Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$106,723.50
NO	SDF	[redacted]	SANTA FE	SINGLE FMLY	C	7	$86,607.70
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$30,432.38
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$24,484.71
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$11,723.18
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$8,508.91
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$12,621.13
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$23,189.56
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	4	$37,359.18
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$13,810.32
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$43,112.93
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	6	$93,912.57
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$39,916.32
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	3	$17,409.11
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$21,532.28
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$19,921.00
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	5	$26,647.52
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	7	$89,350.61
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$4,113.31
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$20,666.81
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	A14	2	$17,276.56
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$32,806.26
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$40,761.32
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	7	$36,345.50
NO	NO	[redacted]	SANTA FE	NON RESIDNT	C	4	$24,611.78
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	B	2	$8,721.88
NO	SDF	[redacted]	SANTA FE	SINGLE FMLY	X	7	$97,068.79
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$7,156.00
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	7	$66,539.27
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$62,832.01
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	A11	2	$27,719.57
NO	SDF	[redacted]	SANTA FE	SINGLE FMLY	C	7	$218,446.23
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$11,316.69
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	B	4	$32,227.03
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	B	10	$96,239.23
NO	NO	[redacted]	SANTA FE	NON RESIDNT	C	2	$10,807.51
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	A10	2	$8,744.00
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$45,585.32
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$32,995.04
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$16,409.40
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$48,077.94
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$36,940.94
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	5	$26,488.02
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$7,748.72
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	V13	2	$15,498.22
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$37,737.99
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	X	4	$221,305.39
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	4	$99,127.01
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$53,818.52
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	8	$109,341.70
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$58,256.26
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$54,628.89
NO	SDF	[redacted]	SANTA FE	NON RESIDNT	C	3	$86,739.92
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	4	$58,946.74
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$20,302.05
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$45,176.00
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$35,914.43

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	4	$33,838.05
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$42,086.89
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	5	$47,664.51
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$39,024.11
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	X	6	$28,423.75
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$32,670.09
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	3	$21,554.50
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$23,624.94
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$22,302.94
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$22,892.76
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	A11	2	$12,679.31
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$33,990.87
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	5	$37,246.51
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$29,080.48
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$27,004.70
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$11,742.39
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$37,409.42
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$16,390.00
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$22,335.94
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	4	$19,534.72
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$41,823.65
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$28,471.33
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$2,593.45
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$26,547.79
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	3	$22,381.67
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$19,016.71
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$6,809.36
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	3	$13,513.42
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	3	$22,900.68
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$7,826.77
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$19,045.88
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$15,751.43
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$22,890.77
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	3	$15,028.41
NO	NO	[redacted]	SANTA FE	OTHER RESID	C	2	$6,242.66
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$13,651.77
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$13,303.98
NO	NO	[redacted]	SANTA FE	NON RESIDNT	C	2	$18,931.02
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	X	3	$6,937.36
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$6,690.22
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$26,341.23
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$4,729.18
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$8,118.60
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	V13	2	$8,564.24
NO	NO	[redacted]	SANTA FE	NON RESIDNT	C	4	$16,352.37
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	6	$22,754.38
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$5,905.19
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$9,909.56
NO	YES	[redacted]	SANTA FE	SINGLE FMLY	C	2	$4,169.35
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$6,173.15
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$2,597.27
NO	YES	[redacted]	SANTA FE	NON RESIDNT	C	2	$4,040.23
NO	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$7,508.68
YES	NO	[redacted]	SANTA FE	NON RESIDNT	C	4	$52,159.34
YES	NO	[redacted]	SANTA FE	SINGLE FMLY	C	3	$10,618.91
YES	YES	[redacted]	SANTA FE	SINGLE FMLY	C	4	$13,428.36
YES	NO	[redacted]	SANTA FE	SINGLE FMLY	C	2	$25,458.60

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	SANTA FE	SINGLE FMLY	C	4	$16,394.25
YES	YES	[redacted]	SANTA FE	SINGLE FMLY	C	6	$[illegible]
YES	SDF	[redacted]	SANTA FE	SINGLE FMLY	C	10	$[illegible]
YES	YES	[redacted]	SANTA FE	SINGLE FMLY	X	8	$[illegible]
YES	PDF	[redacted]	SANTA FE	SINGLE FMLY	C	6	$[illegible]
YES	YES	[redacted]	SANTA FE	SINGLE FMLY	C	5	$[illegible]
YES	SDF	[redacted]	SANTA FE	SINGLE FMLY	X	4	$[illegible]

121	Total RF Properties
110	No. of Non-Mitigated Properties
11	No. of Mitigated Properties
406	No. of Losses
$4,450,361	Total Paid (building and contents)

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	TIKI ISLAND	SINGLE FMLY	V20	3	$15,466.20
NO	YES	[redacted]	TIKI ISLAND	SINGLE FMLY	VE	3	$18,157.51

2	**Total RF Properties**
2	**No. of Non-Mitigated Properties**
0	**No. of Mitigated Properties**
6	**No. of Losses**
33624	Total Paid (building and contents)

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO		ALTA LOMA	SINGLE FMLY	C	7	$75,187.77
NO	NO		ALTA LOMA	SINGLE FMLY	C	2	$54,180.28
YES	NO		ALTA LOMA	SINGLE FMLY	A11	2	$10,883.49
YES	NO		ALTA LOMA	NON RESIDNT	C	2	$11,474.65
YES	NO		ALTA LOMA	SINGLE FMLY	C	3	$5,163.85
NO	NO		ARCADIA	SINGLE FMLY	C	2	$48,108.29
NO	NO		BACLIFF	SINGLE FMLY	C	2	$19,007.53
NO	YES		BACLIFF	SINGLE FMLY	C	4	$38,522.89
NO	SDF		BACLIFF	SINGLE FMLY	C	12	$164,520.14
NO	SDF		BACLIFF	NON RESIDNT	X	5	$166,104.70
NO	NO		BACLIFF	SINGLE FMLY	X	2	$26,616.77
NO	NO		BACLIFF	SINGLE FMLY	C	3	$53,001.99
NO	YES		BACLIFF	SINGLE FMLY	X	2	$15,568.03
NO	NO		BACLIFF	SINGLE FMLY	X	6	$19,660.25
NO	YES		BACLIFF	2-4 FAMILY	C	5	$30,546.88
NO	NO		BACLIFF	SINGLE FMLY	X	4	$33,444.99
NO	NO		BACLIFF	SINGLE FMLY	X	2	$33,193.22
NO	YES		BACLIFF	SINGLE FMLY	X	2	$50,681.36
NO	NO		BACLIFF	SINGLE FMLY	X	3	$129,935.27
NO	NO		BACLIFF	SINGLE FMLY	C	5	$18,731.62
NO	NO		BACLIFF	SINGLE FMLY	C	2	$6,935.18
NO	NO		BACLIFF	SINGLE FMLY	C	3	$378,483.17
NO	NO		BACLIFF	SINGLE FMLY	X	3	$24,495.60
NO	NO		BACLIFF	NON RESIDNT	X	5	$115,846.08
NO	NO		BACLIFF	SINGLE FMLY	X	2	$38,530.86
NO	NO		BACLIFF	SINGLE FMLY	C	3	$5,387.07
NO	NO		BACLIFF	SINGLE FMLY	C	8	$95,419.04
NO	NO		BACLIFF	SINGLE FMLY	C	2	$29,619.97
NO	NO		BACLIFF	NON RESIDNT	X	3	$9,705.33
NO	NO		BACLIFF	NON RESIDNT	X	2	$13,551.21
NO	NO		BACLIFF	SINGLE FMLY	C	2	$8,269.88
NO	YES		BACLIFF	SINGLE FMLY	X	3	$95,104.79
NO	NO		BACLIFF	SINGLE FMLY	X	3	$60,911.66
NO	NO		BACLIFF	SINGLE FMLY	C	3	$40,067.84
NO	NO		BACLIFF	SINGLE FMLY	X	5	$78,364.05
NO	NO		BACLIFF	SINGLE FMLY	X	5	$44,794.46
NO	NO		BACLIFF	SINGLE FMLY	X	5	$83,883.62
NO	NO		BACLIFF	SINGLE FMLY	X	5	$46,370.08
NO	YES		BACLIFF	SINGLE FMLY	C	3	$126,277.51
NO	NO		BACLIFF	SINGLE FMLY	C	2	$33,705.71
NO	NO		BACLIFF	SINGLE FMLY	C	2	$38,787.75
NO	NO		BACLIFF	SINGLE FMLY	X	5	$26,370.38
NO	YES		BACLIFF	SINGLE FMLY	X	4	$158,553.72
NO	YES		BACLIFF	SINGLE FMLY	X	2	$44,581.22
NO	NO		BACLIFF	SINGLE FMLY	X	7	$75,926.76
NO	NO		BACLIFF	SINGLE FMLY	X	2	$46,041.59
NO	NO		BACLIFF	SINGLE FMLY	X	2	$19,764.51
NO	NO		BACLIFF	SINGLE FMLY	X	5	$32,477.07
NO	YES		BACLIFF	SINGLE FMLY	C	3	$21,225.96
NO	NO		BACLIFF	SINGLE FMLY	X	2	$50,276.32
NO	YES		BACLIFF	SINGLE FMLY	X	2	$14,820.22
NO	YES		BACLIFF	SINGLE FMLY	X	3	$27,199.58
NO	YES		BACLIFF	SINGLE FMLY	C	3	$7,469.18
NO	YES		BACLIFF	NON RESIDNT	C	3	$83,144.45
NO	YES		BACLIFF	SINGLE FMLY	X	3	$42,851.88

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	X	4	$25,275.24
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	C	2	$30,778.50
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	X	5	$39,329.76
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	X	2	$29,828.49
NO	YES	[redacted]	BACLIFF	SINGLE FMLY	C	2	$8,643.21
NO	YES	[redacted]	BACLIFF	SINGLE FMLY	X	4	$39,148.72
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	C	2	$16,987.41
NO	YES	[redacted]	BACLIFF	SINGLE FMLY	C	2	$17,973.39
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	C	2	$18,317.42
NO	YES	[redacted]	BACLIFF	SINGLE FMLY	C	2	$10,893.45
NO	NO	[redacted]	BACLIFF	SINGLE FMLY	C	2	$11,503.40
NO	YES	[redacted]	BACLIFF	SINGLE FMLY	A14	2	$12,137.72
NO	YES	[redacted]	BACLIFF	NON RESIDNT	X	4	$32,269.77
NO	NO	[redacted]	BAYCLIFF	SINGLE FMLY	X	2	$4,958.90
YES	YES	[redacted]	BACLIFF	SINGLE FMLY	X	3	$20,806.34
YES	YES	[redacted]	BACLIFF	SINGLE FMLY	X	5	$53,476.22
YES	NO	[redacted]	BACLIFF	SINGLE FMLY	C	4	$9,409.89
YES	SDF	[redacted]	BACLIFF	SINGLE FMLY	C	5	$53,308.86
YES	NO	[redacted]	CAPLEN	SINGLE FMLY	A11	2	$73,212.89
YES	NO	[redacted]	CAPLEN	SINGLE FMLY	A15	2	$175,029.36
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A	2	$315,282.41
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$77,121.34
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$97,409.38
NO	YES	[redacted]	CRYSTAL BEACH	NON RESIDNT	V12	2	$116,073.14
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$267,470.42
NO	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$367,629.11
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$86,255.72
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$101,811.93
NO	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$95,786.30
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	3	$140,590.46
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A	2	$126,923.33
NO	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$71,348.41
NO	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$187,569.55
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	VE	2	$127,696.18
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$199,575.35
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	AE	2	$149,340.45
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	VE	4	$20,292.79
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$79,925.59
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V12	2	$13,074.18
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V12	2	$5,927.00
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V12	2	$12,531.57
YES	NO	[redacted]	CRYSTAL BEACH	NON RESIDNT	VE	2	$197,145.31
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$80,466.17
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$230,180.54
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$168,832.67
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$200,813.17
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$141,800.33
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$45,362.86
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$114,244.48
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V17	5	$115,121.73
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$131,739.36
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$96,639.05
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$164,004.08
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A11	2	$196,848.89
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$168,777.26

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$86,560.92
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$194,254.36
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A	2	$148,829.47
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$55,326.98
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$184,282.24
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A	2	$102,027.24
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$329,703.18
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$55,914.54
YES	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$225,119.58
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$91,712.50
YES	YES	[redacted]	CRYSTAL BEACH	ASSMD CONDO	VE	3	$308,412.17
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A15	2	$149,919.51
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A11	2	$165,809.51
YES	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$138,444.22
YES	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A16	3	$127,267.21
YES	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$189,839.24
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$65,772.60
YES	YES	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$130,394.87
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A01	2	$65,523.67
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$178,202.04
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	3	$257,962.72
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	V19	2	$87,882.94
YES	NO	[redacted]	CRYSTAL BEACH	NON RESIDNT	A16	2	$186,739.67
YES	NO	[redacted]	CRYSTAL BEACH	SINGLE FMLY	A16	2	$169,388.22
NO	NO	[redacted]	GILCHRIST	SINGLE FMLY	A15	3	$307,438.76
NO	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$165,258.48
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$293,837.44
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A15	3	$117,118.31
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$300,084.01
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	VE	4	$31,079.42
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$76,938.60
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	AE	3	$42,935.85
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	4	$158,782.03
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	AE	3	$32,546.88
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$11,202.95
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$268,723.19
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	2	$5,507.53
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	3	$230,534.49
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$280,005.53
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$90,392.34
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$68,845.61
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$238,926.42
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A13	2	$8,199.83
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$83,050.49
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$33,047.76
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	3	$171,121.26
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	2	$93,044.31
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$57,134.88
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$88,472.59
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V14	6	$93,052.31
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	5	$316,876.10
YES	NO	[redacted]	GILCHRIST	ASSMD CONDO	A11	4	$516,730.15
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	AE	5	$32,910.57
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$37,947.13
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	2	$175,840.08
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	VE	2	$53,028.20

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$163,669.91
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$108,890.63
YES	NO	[redacted]	GILCHRIST	NON RESIDNT	V19	2	$129,334.76
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$180,602.10
YES	NO	[redacted]	GILCHRIST	2-4 FAMILY	VE	2	$15,795.00
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$76,176.46
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	VE	2	$50,927.06
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$78,400.00
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V10	2	$4,687.30
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$69,957.24
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	VE	2	$50,620.82
YES	NO	[redacted]	GILCHRIST	NON RESIDNT	V19	2	$33,389.73
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$110,345.70
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$107,589.05
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A01	2	$69,201.58
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$146,169.87
YES	YES	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$69,675.03
YES	YES	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$140,610.00
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$27,790.69
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	2	$198,439.96
YES	YES	[redacted]	GILCHRIST	SINGLE FMLY	A02	3	$184,481.05
YES	NO	[redacted]	GILCHRIST	NON RESIDNT	V12	2	$34,592.39
YES	YES	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$94,640.44
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$79,860.44
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$300,099.25
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$63,528.44
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A15	3	$52,105.18
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	3	$148,875.92
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	AE	4	$198,443.91
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	4	$117,684.78
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$139,025.09
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A15	2	$112,141.19
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A16	3	$135,120.93
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$90,177.23
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A15	2	$10,753.75
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A11	2	$21,737.96
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	V19	2	$232,286.40
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A12	5	$66,151.82
YES	NO	[redacted]	GILCHRIST	SINGLE FMLY	A	2	$341,663.48
YES	NO	[redacted]	GILCREST	SINGLE FMLY	A01	4	$338,165.22
YES	NO	[redacted]	GILCREST	SINGLE FMLY	V19	2	$108,821.20
YES	NO	[redacted]	GILCREST	NON RESIDNT	A11	4	$308,493.18
YES	NO	[redacted]	HIGH ISLAND	SINGLE FMLY	C	2	$23,811.60
NO	NO	[redacted]	HIGH ISLAND	SINGLE FMLY	V19	2	$60,681.53
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	2	$8,127.70
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	2	$143,901.12
NO	NO	[redacted]	PORT BOLIVAR	NON RESIDNT	A15	4	$266,219.30
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V18	2	$62,409.72
NO	NO	[redacted]	PORT BOLIVAR	NON RESIDNT	VE	2	$356,191.27
NO	NO	[redacted]	PORT BOLIVAR	NON RESIDNT	VE	4	$281,391.03
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	3	$150,906.33
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A11	2	$3,723.00
NO	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	3	$71,686.27
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A01	2	$71,389.11
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	2	$22,006.70

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014

Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	PORT BOLIVAR	NON RESIDNT	A01	4	$300,278.16
NO	SDF	[redacted]	PORT BOLIVAR	SINGLE FMLY	V18	4	$93,276.28
NO	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	A	2	$106,840.85
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	8	$78,807.63
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V16	2	$41,757.83
NO	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	V18	2	$96,730.99
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	3	$43,689.12
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A11	2	$8,164.00
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	3	$12,473.18
NO	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	2	$4,719.64
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$7,843.92
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A01	5	$202,997.79
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	4	$41,896.62
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	5	$159,584.18
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	EMG	2	$28,752.92
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A14	2	$19,188.91
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$56,810.29
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$8,800.88
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A01	2	$87,231.84
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A11	3	$234,265.47
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A11	2	$3,282.09
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	2	$2,863.32
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	3	$127,123.88
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	3	$64,059.08
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	2	$21,933.36
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	3	$11,802.62
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$11,938.24
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	2	$12,387.60
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	3	$54,599.41
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V18	5	$314,738.22
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	6	$230,280.32
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A16	5	$172,143.91
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V10	2	$9,317.70
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$20,564.46
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	2	$8,540.10
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY		3	$81,242.80
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$6,377.47
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	2	$7,864.28
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A16	4	$117,627.06
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	3	$219,284.78
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	2	$115,489.02
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	3	$315,456.24
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A01	3	$116,071.93
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	2	$4,558.70
YES	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	A	3	$123,155.00
YES	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	3	$160,693.90
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	3	$221,048.81
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V12	2	$5,458.85
YES	YES	[redacted]	PORT BOLIVAR	SINGLE FMLY	AE	3	$69,976.71
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	A01	3	$147,130.46
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	VE	2	$11,889.24
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$5,910.66
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$11,513.56
YES	NO	[redacted]	PORT BOLIVAR	SINGLE FMLY	V19	2	$88,916.71
YES	SDF	[redacted]	PORT BOLIVAR	SINGLE FMLY	A15	4	$86,678.70
YES	YES	[redacted]	PT BOLIVAR	SINGLE FMLY	A11	3	$196,580.34
		[redacted]					

Properties highlighted in green were mitigated after this report was generated.

Repetitive Flood Properties - September 2014
Source: Galveston County Housing and Economic Development

Mitigated?	Insured?	Address Line 2	City	Occupancy	Zone	Losses	Total Paid
NO	NO	[redacted]	SAN LEON	NON RESIDNT	A12	2	$91,244.77
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$77,383.44
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	V18	3	$90,467.69
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$16,662.81
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	X	6	$160,205.86
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$73,550.77
NO	YES	[redacted]	SAN LEON	2-4 FAMILY	A12	2	$89,068.78
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	B	2	$200,510.71
NO	NO	[redacted]	SAN LEON	NON RESIDNT	X	5	$146,294.71
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	B	2	$70,938.83
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	A	2	$103,818.64
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$121,538.31
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$16,897.71
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	B	2	$44,364.73
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$50,895.45
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	B	2	$189,284.99
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$150,036.14
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$60,287.11
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	X	2	$170,728.38
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	B	3	$98,855.11
NO	NO	[redacted]	SAN LEON	SINGLE FMLY	B	2	$182,835.00
NO	YES	[redacted]	SAN LEON	SINGLE FMLY	X	2	$45,820.37
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$146,623.69
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	C	3	$74,990.54
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	4	$39,687.36
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	X	4	$134,672.28
YES	YES	[redacted]	SAN LEON	SINGLE FMLY	V18	4	$151,913.45
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	A12	2	$16,048.46
YES	NO	[redacted]	SAN LEON	SINGLE FMLY	A05	2	$76,428.99
YES	YES	[redacted]	SAN LEON	SINGLE FMLY	A12	3	$175,361.17
YES	YES	[redacted]	SAN LEON	SINGLE FMLY	V12	2	$105,884.14
YES	YES	[redacted]	SAN LEON	SINGLE FMLY	AE	2	$30,888.43
YES	NO	[redacted]	SEABROOK	NON RESIDNT	A14	11	$184,628.39

Community	No. RF Properties	No. of Non-Mitigated Properties	No. of Mitigated Properties	No. of Losses	Total Paid (building and	Total
Alta Loma	5	2	3	16	$156,890	$156,916
Arcadia	1	1	0	2	$48,108	$48,112
Bacliff	67	63	4	228	$3,259,796	$3,260,158
Caplen	2	0	2	4	$248,242	$248,250
Crystal Beach	59	13	46	127	$8,406,900	$8,407,145
Gilchrist	74	2	72	191	$9,491,736	$9,492,075
High Island	2	1	1	4	$84,493	$84,501
Port Bolivar	67	21	46	189	$62,505,612	$62,505,935
San Leon	32	22	10	81	$3,204,189	$3,204,334
Seabrook	1	0	1	11	$184,628	$184,641

Properties highlighted in green were mitigated after this report was generated.

Appendix F

Critical Facilities and Infrastructure

Critical Infrastructure and Key Resources

Galveston County				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
County Buildings:				
Galveston County Annex	174 Calder Rd.	C	50	173,200
Galveston County Office of Emergency Management	1353 FM 646, Dickinson, TX	C	40	1,667,760
West Galveston County Sheriff	11730 Highway 6, Santa Fe		20	1,246.00
Bacliff VFD	600 Grand Ave., Bacliff	C	10	
Port Bolivar VFD	1806 Broadway, Port Bolivar	V	25	
San Leon VFD	337 Twelfth ST, San Leon	A	30	
Crystal Beach Fire Rescue	930 Noble Carl Dr, Galveston	A	20	
High Island Fire Department	2041 7th St, High Island	C	10	
Educational:				
Kenneth E Little Elementary	622 Oklahoma St, Bacliff		804	11,489.79
High Island Elementary	2113 6th St, High Island		71	644.13
High Island Middle	2113 6th St, High Island		51	555.22
High Island High	2113 6th St, High Island		114	1,447.93
Crenshaw Elementary and Middle	406 Hwy 87, Port Bolivar		192	1,741.87
San Leon Elementary	2655 Broadway San Leon			

Medical Facilities			
Facility Type / Name	**Address**	**Potential Population At Risk**	**Value $**
Shriners Hospitals For Children	815 Market Street, Galveston	30	5,872.19
Jennie Sealy Hospital	301 University Boulevard, Galveston	776	151,893.93

Bayou Vista	
Facility Type / Name	**Address**
City Buildings	
Bayou Vista City Hall, Police Department	2929 Highway 6 (Hitchcock)
Bayou Vista VFD	
Community Center	783-C Marlin
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.	
Water Plant	3035 Highway 6
Well	3035 Highway 6
Wastewater Plant	3031 Highway 6
Pompano Lift Station	3021 Highway 6
Bonita Lift Station	856 Bonita
Lakeside Lift Station	49 ½ Lakeside (Hitchcock)
Original Bayou Vista Lift Station	105 ½ Bayou Vista Dr. (Hitchcock)
Omega Bay Lift Station	15 S. Omega (La Marque)
MUD #12 Office Building	2929 Highway 6

Clear Lake Shores		
Facility Type / Name	**Address**	**Value $**
City Buildings		
Clear Lake Shores Police Department	1006 S. Shore Dr.	580,000
Community Clubhouse	931 Cedar Rd.	440,000

Friendswood				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
City Buildings:				
City Hall	910 S. Friendswood Dr.	UNX	56	
Public Library	416 S. Friendswood Dr.	UNX	400±	
Public Safety Building(Police/FMO-OEM)	1600 Whitaker	UNX	308	
Animal Control Facility	3000 W. Parkwood	UNX	7-10	
Activity Center	416 Morning Side	UNX	100	
Public Works	1306 Deepwood	AE	38	
Community Services/Parks Facility	1324 Deepwood	AE	7	
Leavesley Park Hangar	905 Buckingham	UNX	300	
Girl Scout Building	112 E. Spreading Oaks	UNX	20	
Swimming Pool Facility	900 S. Friendswood Dr.	X	150	
Fire Station#1*(EMS)*	1000 S. Friendswood Dr.	UNX	6	
Fire Station #2	2605 W. Parkwood	UNX	5	
Fire Station #3	4302 Laura Leigh	UNX	6	
Fire Station #4	111 Woodlawn	UNX	6	
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)				
Blackhawk Regional Waste Water Treatment Plant (1)	3902 W. Bay Area Blvd.	AE	7	
Lift Station #0 *(no generator/newinstall)*	1325 West Blvd.	UNX	2	
Lift Station #1	159 Imperial Drive	AE	2	
Lift Station #2	1306 Deepwood	AE	2	
Lift Station #3	410 North Friendswood Dr.	UNX	2	
Lift Station #4	2510 Airline	A	2	
Lift Station #5	1901 Eagles Cove	A	2	
Lift Station #6	901 Buckingham Drive	UNX	2	
Lift Station #7	900½ Layfair Place	UNX	2	
Lift Station #8	1511 Sun Meadow Drive	UNX	2	
Lift Station #9	507 Old Course	UNX	2	
Lift Station #10	516 Belmont	UNX	2	
Lift Station #11	506 E. Castle Harbour Dr.	UNX	2	
Lift Station #12	115 Estate Drive	UNX	2	
Lift Station #13	2501 S. Friendswood Dr.	UNX	2	
Lift Station #14	2605 S. Friendswood Dr.	UNX	2	
Lift Station #15 *(no generator-serves a few safe homes)*	909½ Greenbriar	UNX	2	

Friendswood				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
Lift Station #16	1120 W. Castlewood	UNX	2	
Lift Station #17	5403 FM 2351	AE/X	2	
Lift Station #18	5140 Whittier Oaks Drive	AE/X	2	
Lift Station #19	411 Friendswood-Link Rd.	A	2	
Lift Station #20	1800 San Joaquin Parkway	UNX	2	
Lift Station #21	1000 Middlecreek Street	UNX	2	
Lift Station #22	4444 FM 528	X	2	
Lift Station #23	2101 S. Friendswood Dr.	UNX	2	
Lift Station #24	108 Eagle Lakes Drive	AE	2	
Lift Station #25	114 Oak Drive	AE	2	
Lift Station #26	3890 West Parkwood Ave.	UNX	2	
Lift Station #27	3202 Bay Area Blvd.	UNX	2	
Lift Station #28	503 Woodland Trail Drive	UNX	2	
Lift Station #29	1110 Falling Leaf	UNX	2	
Lift Station #30	1800 Sandy Lakes Drive	A	2	
Lift Station #31	213 Del Monte Drive	UNX	2	
Lift Station #32	701 Baker Road	UNX	2	
Lift Station #33	199 Hunters Lane	UNX	2	
Lift Station #34	3403 W. Bay Area Blvd.	UNX	2	
Lift Station #35	2311 John Street	AE/X	2	
Lift Station #36 (no generator/new install)	1901 Wilderness Trails	X	2	
Lift Station #37	4428A FM2351 @ SW#2	UNX	2	
Surface Water Station #1	17160 Blackhawk	UNX	0	
Surface Water Station #2	3324 FM 2351	UNX	0	
Well #2	401 Castlewood	AE	0	
Well #3	605 Stoneledge	UNX	0	
Well #4	500 W. Castle Harbour Dr.	UNX	0	
Well #5	1100 Colt Road	UNX	0	
Well #6	5006 Pennystone Way	UNX	0	
Well #7	16605 Bougainvilla Lane	UNX	0	
Elevated Tank	FM 528 & Moore Road	UNX	0	
Utilities:				
CenterPoint Power Control Center	FM 528	UNX	2	
AT&T Central Office	N. Friendswood Drive	UNX	10	
TX-New Mexico Power Control	1207 W. Parkwood Ave.	UNX	36	

Friendswood				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
Center				
Medical and Assisted Living:				
Emeritus at Friendswood (Assisted Living)	1310 S. Friendswood Dr.	UNX	120 beds=120	
Friendship Haven Health Care & Rehabilitation	1500 Sunset Drive	AE/SHX	150 Units=300	
Friendswood Health Care Center	213 East Heritage Dr.		86 units=172	
Educational:				
Bales Intermediate School	211 Stadium Lane	UNX	622	8,945.21[2]
Brookside Intermediate School	3535 East Parkwood	UNX	1200	13,116.62[2]
Cline Elementary	505 Briarmeadow Ave.	UNX	689	11,440.25[2]
Friendswood Administration Building	302 Laurel	UNX	60	
Friendswood High School	800 Greenbriar Dr.	UNX	1708	36,175[2]
Friendswood ISD Annex/Technology	400 Laurel	UNX	50	
Friendswood Junior High School *(Grades 6-8)*	1000 Manison Parkway	UNX	871	16,090.49[2]
The Goddard School (Private School)	1650 Friendswood Lakes Blvd.	UNX	162	
Wedgewood Elementary School	4000 Friendswood Link	UNX	915	
Westwood Elementary School	506 W. Edgewood Ave.	UNX	787	11,093.51[2]
Windsong Intermediate School	2100 West Parkwood	UNX	627	9,364.35[2]

Note: [1]Gulf Coast Waste Disposal Authority
[2]Value provided by HAZUS (previous

Hitchcock				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
City Buildings:				
Hitchcock Police Dept	6815 2nd St			1,246.00[2]
Hitchcock VFD	7005 Second ST			
Educational:				
Crosby Middle	7801 Neville		334	3,636.15
Hitchcock High	6625 FM 2004		361	4,585.10
Stewart Elementary	7013 Stewart St		445	5,562.18
Galveston Co J J A E P	8117 HWY 6		3	38.1
Kids First Head Start Texas City S	8117 HWY 6		538	7,097.74
Hitchcock Headstart	5701 FM 2004		122	1,549.54
Our Lady Of Lourdes School	10114 HWY 6		104	943.51

Jamaica Beach				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
City Buildings:				
Police Department	16628 Termini San Luis Pass Rd			
City Hall	16628 Termini San Luis Pass Rd			
VFD/EMA	16628 Termini San Luis Pass Rd			
Water/Sewer Dept.	16628 Termini San Luis Pass Rd			
Municipal County	16628 Termini San Luis Pass Rd			
City Park & Pavilion	16721 Jolly Roger			
City Swimming Pool	16721 Jolly Roger			
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)				
Sewer Plant	16611 Marina Dr.			
Lift Station A	16708 San Luis Pass Rd			
Lift Station B	16730 Ponce De Leon			
Lift Station C	16730 Flamingo Way			
Lift Station D	4834 Jamaica Cove			
Lift Station E	4455 Jolly Roger			
Lift Station F	4221 ½ Jolly Roger			
Lift Station G	4115 W. Bayside			

Kemah				
Facility Type / Name	**Address**	**Flood Zone**	**Potential Population At Risk**	**Value $**
City Buildings:				
Kemah Police Dept.	1401 Highway 146			$2,000,000
Clear Lake Shores Police Dept.	931 Cedar Rd			$2,000,000
Kemah VFD	905 Hwy 146			$5,000,000
Kemah Community Center	800 Harris			$5,000,000
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)				
Water Treatment Plant	524 Cien			$12,000,000
Kipp Road Lift Station	1100 Kipp Road			$1,000,000
2094 Lift Station	100 FM 2094			$1,000,000
Texas Avenue Lift Station	200 Texas			$2,000,000
FM 518 Lift Station	100 FM 518			$1,000,000
Educational:				
Lavace Stewart Elementary	330 Hwy 2094			$8,000,000

La Marque			
Facility Type / Name	**Address**	**Potential Population At Risk**	**Value $**
City Buildings			
La Marque Police Department	431 Bayou Rd	43	1,446,691
La Marque Fire Department #1	1109A Bayou Rd	20	1,741,206
La Marque City Hall	1111 Bayou Rd	19	1,142,100
La Marque Public Services	1500 Municipal Dr.	35	100,000
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)			
Pump Station	2506 6th St		200,000
Booster Pump Station	10750 FM 1764		300,000
Water Control Bldg,/Well/Tank	Magnolia Dr		1,247,000
Lift Station/Control Panel	1801 IH 45		7,900
Sewer Plant Bldgs. A/B/C/D	2701-B Woodland		1,108,200
500K Gallon Elevated Water Tank	1004 FM 2004		1,824,200
300K Gallon Ground Water Tank	2518 Stonewall		367,200
300K Gallon Elevated Water Tank	2518 Stonewall		1,425,200
400K Gallon Elevated Water Tank	Kirby St		1,637,700
200K Gallon Ground Water Tank	Kirby St		294,300
500K Gallon Ground Water Tank	10750 FM 1764		539,100
Medical and Assisted Living			
Bayou Pines Nursing Care Center	4905 Fleming	150	2,658,360
Doll House Enterprise	1031 Laurel	15	90,560
Laurel House	1109 Holly	20	129,995
Mildred House	1515 4th Ave	13	124,980
Educational			
Premier Learning Academy	4916 FM 1765	400	1,098,110
La Marque Elementary/Early Childhood Learning	100 Lake Rd	1,060	2,438,220
La Marque Intermediate	1431 Bayou Rd	346	7,283,070
Galveston Co JJAEP	1727 Bayou Rd	4	6,520
Renaissance Academy	1217 Vauthier Rd	187	1,137,320
La Marque Jr. High/High	300 Vauthier Rd	700	14,330,010
Mainland Preparatory	319 Newman Rd	610	2,746,630

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
City Buildings					
	City Hall	300 W. Walker Street	UNX	56	5,459,700
	Library	100 W. Walker Street	UNX	500	11,277,900
	Municipal Court	200 W. Walker Street	UNX	15	1,054,900
	Civic Center	400 W. Walker Street	UNX	10	1,797,400
	Public Safety Annex	600 W. Walker Street	UNX	15	699,400
	Police Station	500 W. Walker Street	UNX	40	5,268,400
	Public Safety Bldg	555 W. Walker Street	UNX	177	30,000,000
	Amegy Building	305 E. Main Street (contents value only)	UNX	53	
	Animal Shelter	821 Kansas Avenue	UNX	5	314,800
	Recreation Center	408 & 410 W. Walker Street	UNX	2	1,932,770
	EMS	260 FM 270	UNX	5	2,050,000
	EMS	409 Newport Boulevard	UNX	2	155,930
	FD Training Facility	911 & 921 Kansas Avenue	UNX	0	388,600
	Fire Station #1	601 2nd Street	UNX	1	976,250
	Fire Station #2	2120 Hobbs Road	UNX	0	1,192,200
	Fire Station #3	3575 FM 518	UNX	0	1,213,100
	Fire Station #4	175 N. Bay Area Boulevard	UNX	0	1,121,200
	Fire Station #5	2898 Bay Creek Drive	UNX	0	923,400
	Fuel Shed	1535 Dickinson Avenue	UNX	1	94,000
	Line Repair	1505 Dickinson Avenue	UNX	35	735,000
	Public Works Bldg	1535 Dickinson Avenue	UNX	52	1,111,100
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)					
	Lift Station	2798½ Austin	UNX	2	41,000
	Lift Station	405 W. FM 646	UNX	2	37,000
	Lift Station	2661½ Woodcock	UNX	2	44,500
	Lift Station	2106½ Pebble Beach Drive	UNX	2	39,500
	Lift Station	2150½ Bay Area Blvd (Magnolia South)	UNX	2	59,000
	Lift Station	500½ East Pear	UNX	2	44,500
	Lift Station	2321½ Isla Vista Circle	UNX	2	46,000

League City					
	Facility Type / Name	Address	Flood Zone	Potential Population At Risk	Value $
	Lift Station	402 Bent Creek Lane	UNX	2	34,500
	Lift Station	2501½ Brittany Lakes Boulevard	UNX	2	37,000
	Lift Station	5684 Main Street	UNX	2	52,000
	Lift Station	4122 Brittany Bay Blvd. (Magnolia)	UNX	2	37,000
	Lift Station	2150 Bay Area Boulevard	UNX	2	41,000
	Lift Station	308½ Lighthouse Blvd. (Marina Palms)	UNX	2	21,000
	Lift Station	2600 Masters Drive	UNX	2	37,000
	Lift Station	815½ Centerpointe Drive	UNX	2	25,000
	Lift Station	2935 Calder Drive	UNX	2	37,000
	Lift Station	1116 Hickory Terrace (Autumn Lakes)	UNX	2	46,000
	Lift Station	2111½ Hewitt (Tuscan Lakes #1)	UNX	2	25,000
	Lift Station	2551½ Hewitt (Tuscan Lakes #2)	UNX	2	145,000
	Lift Station	2800½ Calder Drive	UNX	2	36,000
	Lift Station	1151½ Big League Dreams Pkwy	UNX	2	91,000
	Lift Station	309½ Brandy Ridge lane	UNX	2	95,000
	Lift Station	2822½ Cross Colony Drive	UNX	2	20,000
	Lift Station	2102½ W. FM 646	UNX	2	31,000
	Lift Station	3250½ Cross Colony Drive	UNX	2	30,000
	Lift Station	660½ Hawkins Hill Lane	UNX	2	45,000
	Lift Station	1400½ Link Road	UNX	2	37,000
	Lift Station	331½ Calder Drive	UNX	2	37,000
	Lift Station	2627½ Quivera Trace (Coronado)	UNX	2	41,000
	Lift Station	100 Alderwood Street (Countryside)	UNX	2	9,500
	Lift Station	7605½ South Shore Blvd. (Bay Ridge)	UNX	2	91,000
	Lift Station	2304 W. Nasa Rd	UNX	2	54,000
	Lift Station #12	1002 Summer Place Court	UNX	2	50,000
	Lift Station #13	1002 Countryside Drive	UNX	2	17,850
	Lift Station #14	6125 Bay Area Boulevard	UNX	2	524,200
	Lift Station #15	2516 Jeb Stuart Drive	UNX	2	68,500

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
	Lift Station #16	450 Landing Boulevard	UNX	2	30,000
	Lift Station #18	100 Wesley Drive	UNX	2	11,500
	Lift Station #19	1220 Butler Avenue	UNX	2	148,500
	Lift Station #20	2935 Calder Drive	UNX	2	12,500
	Lift Station #21 & 33	1700½ Claiborne	X	2	86,730
	Lift Station #22	298 Wesley Drive	UNX	2	46,000
	Lift Station #23	2998½ W. Main Street	UNX	2	79,000
	Lift Station #24	3203 Blue Wing Drive	AFW	2	24,000
	Lift Station #27	623 Alabama Avenue	X	2	4,500
	Lift Station #28	1500 State Highway 3	X	2	24,000
	Lift Station #29	2850 FM 518	UNX	2	80,500
	Lift Station #31	499 Davis Road	X	2	42,000
	Lift Station #32	2651 FM 2094	UNX	2	151,000
	Lift Station #34	2227½ FM 2094	X	2	20,000
	Lift Station #35	793 Davis Road	X	2	46,000
	Lift Station #37	839 Constellation Boulevard	VE	2	33,500
	Lift Station #38	1599 Enterprise Avenue	X	2	18,500
	Lift Station #39	217 Meadow Parkway	UNX	2	66,000
	Lift Station #42	2106½ Pebble Beach Drive	UNX	2	39,500
	Lift Station #43	2742 Masters Drive	UNX	2	39,000
	Lift Station #44	2015 Harbour Park	X	2	46,000
	Lift Station #45	506 Seminole	A	2	114,000
	Lift Station #46	790 Waterford Way	A	2	21,500
	Lift Station #47	210 Admiralty Way	A	2	33,500
	Lift Station #48	424 Baycrest Drive	UNX	2	8,925
	Lift Station #51	600 W. Walker Street	UNX	2	6,500
	Lift Station (Sewer)	3029 Keva Glen Drive	UNX	2	93,000
	Lift Station (Sewer)	2102½ Barrington Pointe Drive	X	2	20,000
	Lift Station (Sewer)	4700 Masters Drive	UNX	2	38,500
	Lift Station (Sewer)	2203½ Shore Point Drive	X	2	20,000

League City					
	Facility Type / Name	Address	Flood Zone	Potential Population At Risk	Value $
	Lift Station (Sewer)	1502½ FM 646	UNX	2	191,500
	Lift Station	3420 Mary Lane	UNX	2	12,500
	Pump & Lift Station	3852 FM 518	UNX	2	25,000
	Pump & Lift Station	880 Glen Cove Street	A	2	15,658
	Pump & Lift Station	380 Amber Lane	A	2	10,200
	Pump & Lift Station	1633 Webster	UNX	2	13,500
	Pump & Lift Station	3613 Dove Meadows Drive	UNX	2	24,000
	Pump & Lift Station	2281½ W Walker St. (Centerpointe S)	UNX	2	37,000
	Pump & Lift Station	6997½ Calder Road (Bay Colony West)	UNX	2	41,000
	Pump & Lift Station	5551½ FM 646	UNX	2	94,500
	Pump House & Ground Water	2050 Dickinson Avenue	UNX	2	285,799
	Pump House & Ground Water	5929 FM 518 (Countryside)	UNX	2	445,501
	Pump House & Ground Water	2819 Wood Hollow Drive	UNX	2	441,235
	Pump House & Ground Water	18530 State Highway 3	X	2	872,821
	Pump House & Ground Water	2600 FM 518	UNX	2	1,727,221
	Sewer Treat. Plant Bayridge	404 Baycrest Drive	UNX	2	8,925
	Pump House & Ground Water	2690 Calder Drive	UNX	2	1,389,684
	Booster Pump station Ground storage and Well	4200 Grissom Rd	UNX	2	2,000,000
	Waste Water Plant & Office	701 & 703 Wisconsin	X	2	3,603,331
	Waste Water Pump Station	6500½ South Shore Boulevard	UNX	2	59,000
	Waste Water Treatment Plant	1553 ½ Maple Leaf Dr.	UNX	2	4,500,000

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
	Waste Water Pump Station	5401½ Brittany Bay Boulevard	UNX	2	45,500
	Water Tank	514 3rd Street	UNX	2	543,215
	Water Tank	2415 Calder Drive	UNX	2	335,000
	Water Tank – 125k gallon	1251 Link Road	UNX	2	56,800
	Elevated Water Tower	624 Alabama Avenue	X	2	1,091,330
	Brittany Bay Water Tower	5123½ Candlewood	UNX	2	2,945,700
Utilities					
	Verizon Central Office 1	125 W. Galveston Street	UNX	N/A	354,200
	Verizon Central Office 2	1701 League City Parkway	UNX	N/A	1,172,090
	Verizon Central Office 3	106 Countryside Dr.	UNX	N/A	114,840
	Verizon Central Office 4	2018 FM 2094	A	N/A	333,080
Medical and Assisted Living					
	Baywind Convalescent Center	411 Alabama	X	105	2,266,000
	Devereux	1150 Devereux Dr.	UNX	108	9,301,000
	Harborview Care Center	300 Enterprise	X	217	4,098,780
	Regal Estates	500 Enterprise	X	131	5,964,610
	Maplewood Crossing Sr. Living	600 Hobbs Rd.	UNX	100	522,020
	Regency Home Health	404 Newport Blvd.	UNX	In home care	49,000
	Regent Care Facility	2620 W. Walker	X	70	991,950
	UTMB Complex	I45 northbound feeder (just N 646)	UNX	Facility not complete	
	Lake Haven Sr. Living	1051 FM 1266 Rd	UNX	100	4,321,240
	Cottages at Clear Lake I & II	450 Landing Blvd.	UNX	31	948,380
Educational					

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
	5+2 Child Learning Center @ Creekside	4440 FM 518 W	UNX	110	128,640
	5 + 2 Child Learning Center	102 E. Walker	UNX	120	150,000
	A Child's Place	2755 FM 646 West	X	200	114,000
	A Kids World	110 McKibben	UNX	100	24,380
	Bright Years Day Care	805 Clear Creek Ave.	UNX	10	4,500
	CCISD Transportation Day Care	2748 Deke Slayton Hwy.	UNX	10	59,500
	Children's Lighthouse Mag CrK	4496 League City Pkwy	UNX	300	41,970
	Country Kingdom	919 Texas Ave.	UNX	100	150,110
	Happy Harbour	3459 FM 518 E.	UNX	197	114,000
	Just for Kids	1001 FM 270, St. 104	UNX	46	114,000
	Kandiland Day School	3052 S. Shore Blvd.	UNX	100	114,000
	Kid City Day Care	303 Spruce	UNX	185	198,000
	Kid City II Day Care	333 Spruce	X	185	21,000
	Kiddie Academy	2010 E. League City Pkwy.	UNX	130	326,700
	Kids R Kids	450 Constellation	UNX	284	69,950
	Kids R Kids #29	170 W. Bay Area Blvd.	UNX	346	73,100
	Kindercare	106 Meadow Pkwy.	UNX	117	52,700
	La Petite Academy	2205 W. Main	UNX	78	273,455
	Lighthouse Learning	3705 Columbia Memorial	UNX	145	698,210
	Lil' Texas Learning Center	3516 W. Main	UNX	100	20,000
	Metro City Kid	107 Landing Blvd., Ste. J	UNX	75	114,000
	Ms. Janet's Children of the Future	3007 Invincible Dr.	UNX	100	45,700
	Primrose School of S. Shore	3025 S. Shore Blvd.	UNX	170	54,460
	Secret Playhouse	218 Egret Bay Blvd. S.	A	35	114,000
	Self Defense America	3151 FM 518 E.	A	25	288,460
	South Shore Country Day School	2450 E. Main	A	90	22,600

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
	South Shore Montessori	201 S. Shore Blvd.	UNX	100	440,460
	St. Mary's Catholic School	1612 E. Walker	UNX	280	114,000
	The School Zone	1860 W. Main	UNX	76	150,770
	Treehouse Learning Center	1314 2nd Street	UNX	185	149,485
	Bauerschlag Elementary	2051 League City Pkwy	UNX	700	5,471,383
	Ferguson Elementary	1910 Compass Rose Blvd.	UNX	700	6,625,250
	Gilmore Elementary	3552 League City Parkway	UNX	900	5,471,383
	Goforth Elementary	2610 Webster Rd.	UNX	600	5,241,260
	Walter Hall Elementary	5931 Meadowside	UNX	700	3,202,870
	Hyde Elementary	3700 FM 518 E.	X	600	6,941,210
	League City Elementary	709 E. Wilkins	UNX	650	3,188,040
	Mossman Elementary	4050 Village Way	UNX	700	17,000,000
	Parr Elementary	1315 Hwy. 3 S.	UNX	700	5,471,383
	Ross Elementary	2401 W. Main St.	UNX	700	5,079.250
	Bayside Intermediate	4430 Village Way	UNX	700	35,000,000
	Clear Creek Intermediate	2451 E. Main St.	UNX	780	5,471,383
	Creekside Intermediate	4310 W. Main St.	UNX	800	5,471,383
	League City Intermediate	2588 Webster St.	UNX	740	10,305,330
	Victory Lakes Intermediate	2880 W. Walker	UNX	1000	12,099,040
	Clear Creek High School	2305 E. Main St.	UNX	2400	5,471,383
	Clear Falls High School	4380 Village Way - Education Village	UNX	1200	88,000,000
	Clear Springs High School	501 Palomino Lane	UNX	2500	434,030
	Clear Path Alternative School	400 S. Kansas	UNX	10	1,597,150

League City					
Facility Type / Name		Address	Flood Zone	Potential Population At Risk	Value $
	Education Village	4050 Village Way	UNX	220	114,000
	Clear Creek Education Building	2425 E. Main St.	UNX	220	5,471,383

	League City Key Assets	Address	Flood Zone	Value
Transportation Systems				
	Interstate 45 – North and South		N/A	N/A
	State Highway 146		N/A	N/A
	Farm to Market Road 96 (League City Parkway)		N/A	N/A
	Farm to Market Road 646		N/A	N/A
	Farm to Market Road 518 (Main Street)		N/A	N/A
	Farm to Market Road 270 (Egret Bay Blvd.)		N/A	N/A
	State Highway 3		N/A	N/A
	Union Pacific Railway System		N/A	N/A
Lifeline Utility Systems				
	Water Tank – 125k gallon	1251 Link Road	UNX	24,800
	Elevated Water Tower	624 Alabama	UNX	581,400
	Water Tank	514 3rd Street	UNX	221,750
	Water Tank	2415 Calder Rd.	UNX	335,000
	Water Tank	1401 Turner	UNX	335,000
	Water Tower	6060 South Shore Blvd.	UNX	5,022,600
	Brittany Bay West Side Water Tower	5123½ Candlewood	UNX	2,200
Communications Systems				
	City Hall – City Television, Channel 16	300 W. Walker	UNX	N/A
	Police Department – Radio and data sys.	500 W. Walker	UNX	N/A
	Anico Building (Backup communications)	2094 at South Shore Blvd.	UNX	N/A
	City Hall – Radio, Data and Telephone Sys.	300 W. Walker	UNX	N/A
	T1 Line – Phonoscope	600 W. Walker	UNX	N/A
Hazardous Material Facilities				
	Ammonia Building & Pump House	307 Windward	UNX	235,100
	Ammonia Building & Pump House	5950 FM 518	UNX	201,901
	Ammonia Building & Pump House	700 Walker	UNX	369,379
	Ammonia Building/Pump House (League Park)	721 Main	UNX	180,000
	Pump House, Chlorine Bldg./Ground H20 Tank	2600 FM 518	UNX	335,000
	Pump House, Chlorine Bldg.	Highway 3 at NASA Bypass	A	335,000
Historical and Cultural Facilities				
	Butler Longhorn Museum	1220 Coryell	A	938,500
	West Bay Common School Children's Museum	210 N. Kansas Avenue	UNX	42,350
	League Park	512 2nd Street	UNX	561,614
	Walter Hall Park	807 Highway 3 North	UNX	4,542,219

Santa Fe		
Facility Type /Name	**Address**	**Value $**
City Buildings		
Police Department	3650 FM 646	
City Hall	12002 State Hwy. 6	776,056
Thelma Webber Community Center	14304 Beriton	531,152
Mae S. Bruce Library	13302 6th St	889,762
Storage (Maintenance, Police, Parks_	1702 11th St.	112,493
Gazebo, Marque, and Fiber Optic (City Hall)	12002 Hwy 6	48,695
Joe A. Tambrella Park	13302 6th St	161,051
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)		
Sent request to James		
Educational		
Roy J Wollam Elementary	3400 Ave S	11,093.51
Santa Fe High	16000 Hwy 6	26,105
Santa Fe Intermediate	4135 Warpath Ave	9,504.06
Santa Fe Junior High	4132 Warpath Ave	10,901.18
Santa Fe Elementary South	4133 Warpath Ave	3,527.28
Galveston Co J J A E P	13304 Hwy 6	50.8
Santa Fe Elementary North	4131 Warpath	8,864.47

Source: Santa Fe (Real and Property Schedule, October 2015)

Tiki Village				
Facility Type /Name	Address	Flood Zone	Potential Population At Risk	Value $
City Buildings				
Police Station & Public Safety Bldg. (With Back-Up Generators)	747 Tiki Dr.	V20	500 YR FLOOD PLAIN	$878,500.
Water Resources (lift and pump stations, wastewater treatment plants, water tanks, etc.)				
Lift & Pump Station	1401, 1516 ½, 1827, 1777, 1621, & 503 Tiki Dr. ($10,252. each)	V20	500 YR FLOOD PLAIN	$61,512.
Lift & Pump Station	1347 ½ Lei Lani Dr.	V20	500 YR FLOOD PLAIN	10,252.
Lift & Pump Station	208 Tamana Dr.	V20	500 YR FLOOD PLAIN	10,252.
Lift Station & Water Treatment Plant	401 Jones Lake Rd.	V20	500 YR FLOOD PLAIN	679,986.
Office Bldg & Fence For Water Administration & Blower Bldg. , Waste Water Treatment Plant Lab, Storage Bldg, Pun Wastewater & Lift Station	802 Tiki Dr.	V20	500 YR FLOOD PLAIN	527,238.
2 Reverse Osmosis Systems & 2 Water Wells	401 Jones Rd.	V20	500 YR FLOOD PLAIN	2,300,000

Pipeline Failure

Description

Fuel pipeline breach or pipeline failure addresses the rare, but serious hazard of an oil or natural gas pipeline. Natural gas pipelines transport natural gas, and oil or liquid petroleum pipelines transport crude oil and refined products from crude oils, such as gasoline, home heating oil, jet fuel and kerosene in addition to liquefied propane, ethylene, butane and some petrochemical products. Sometimes oil pipelines are also used to transport liquefied gasses, such as carbon dioxide.

Pipeline failure is a rare occurrence but has the potential to cause extensive property damage and loss of life. Pipelines have caused fires and explosions that killed more than 200 people and injured more than 1,000 people nationwide and 50 people in Texas in the last decade.

Location

The locations of gas and oil pipelines throughout Galveston County are shown in Figures G.1 and G.2. It is important to note that due to scale, some pipelines cannot be seen on maps where one pipeline runs directly over another or where pipelines appear too close together to be visible on the map.

If any of these energy pipelines were to rupture, such an event could endanger property and lives in the immediate area. Immediate impacts can occur within a half mile area and secondary impacts within a mile of the incident. Therefore, due to the location of both oil and gas pipelines in the county, each participating jurisdiction faces a moderate to high risk, except Jamaica Beach.

Figure G.1: Location of Gas Pipelines in Galveston County

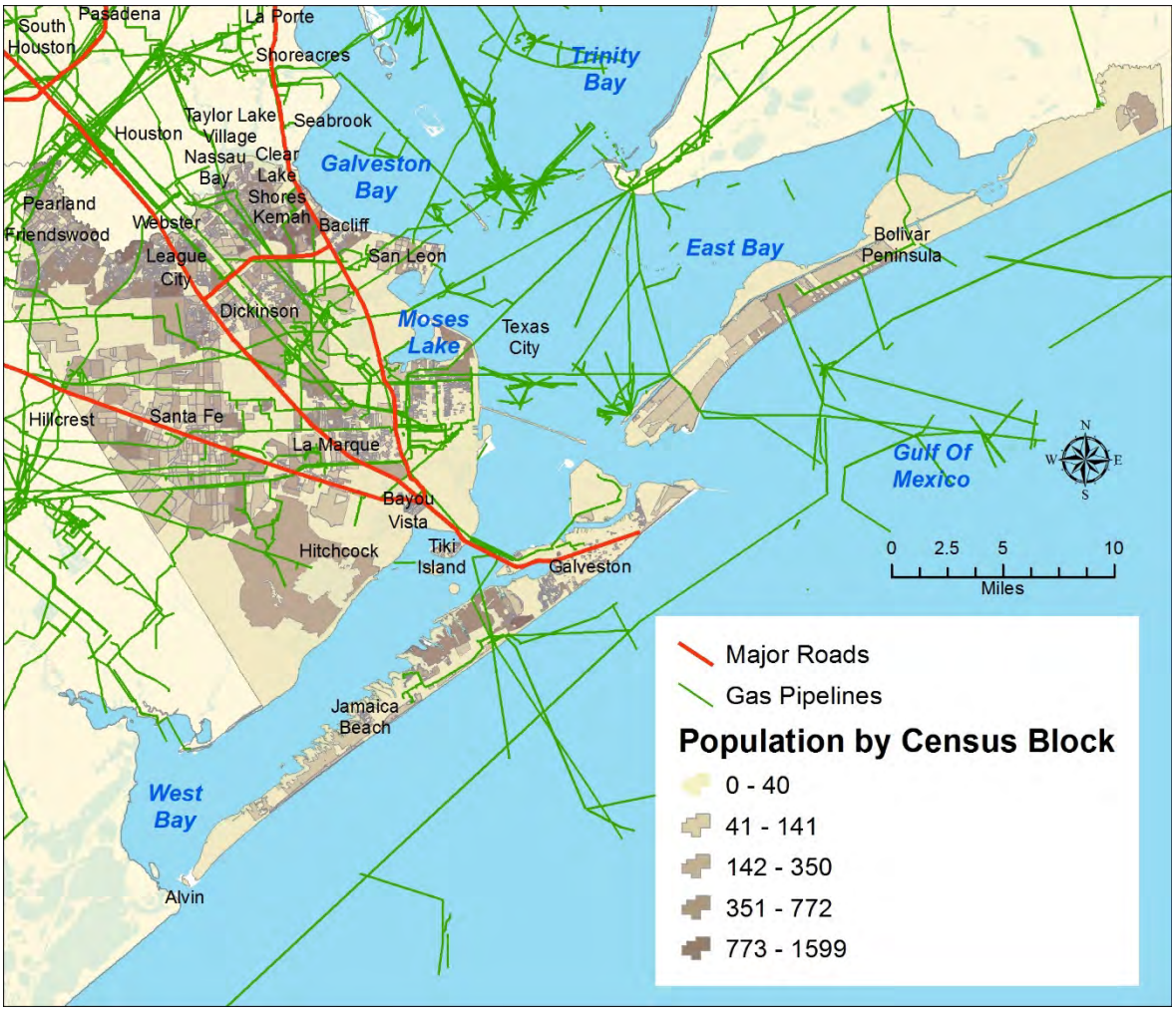
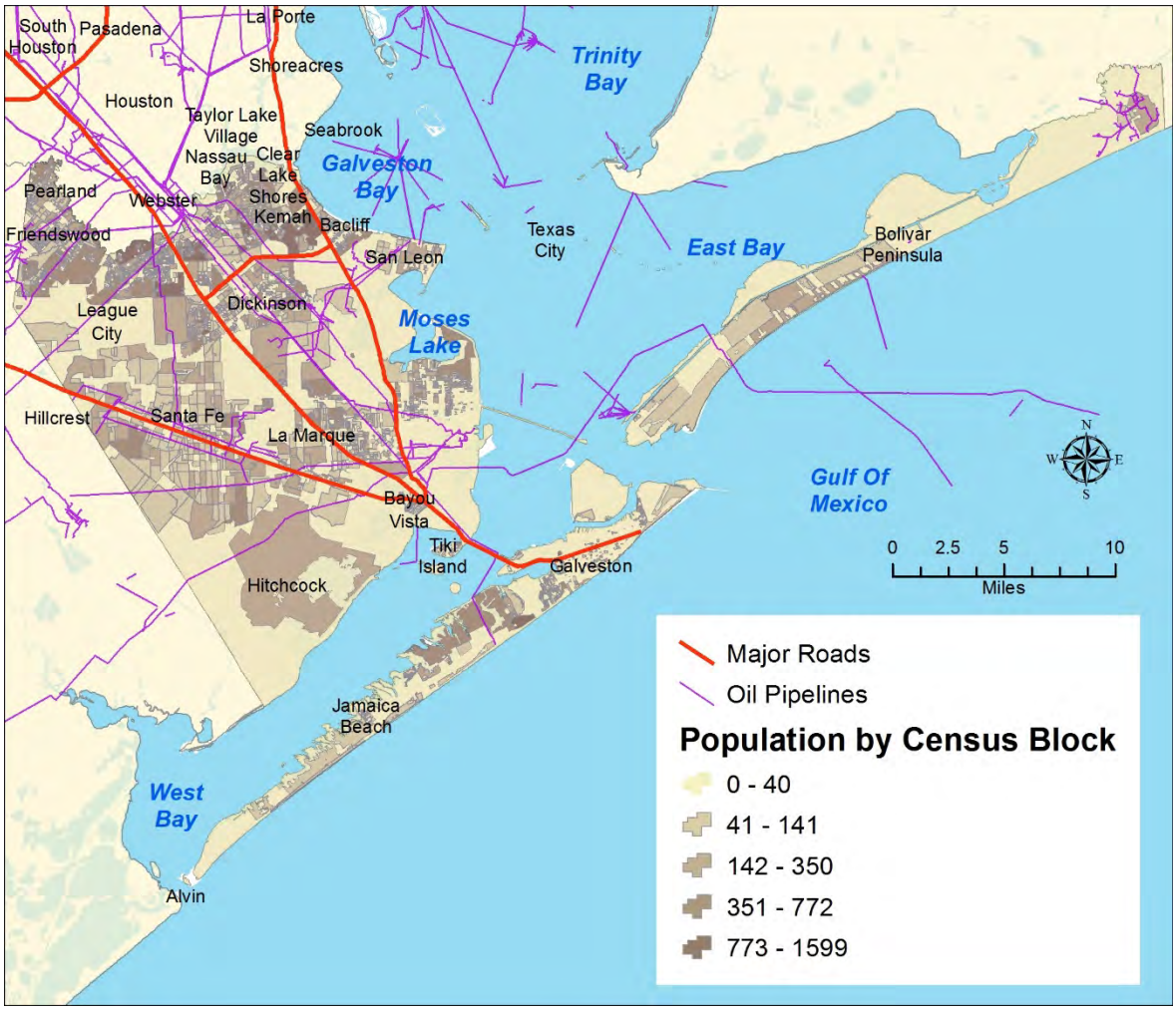


Figure G.2: Location of Oil Pipelines in Galveston County



Historical Occurrences

The causes of pipeline failure can range from internal issues such as corrosion or material defects to outside forces such as natural hazards and intentional destruction by humans. A records request was issued to the State of Texas Railroad Commission by the county for reported incidents from June 2008 to current with no results provided. Since no reported additional incidents were made available to the planning team, the data provided in the previous plan for the participating jurisdictions within this plan update are being brought forward in Table G.1.

Table G.1: Historical Pipeline Accidents (Gas and Oil Combined) (2003-2008)

Nearest Jurisdiction	Incident Date	Operator	Death	Injury	$ Operator Property Damage
Bacliff	01/09/2004	Centerpoint Energy Entex	0	0	$5,024
Hitchcock	08/29/2005	Centerpoint Energy Entex	0	0	0
San Leon	05/17/2006	Unknown O&G	0	0	0
San Leon	05/17/2006	National Onshore, LP	0	0	0
Santa Fe	10/26/2006	Hunt Petroleum	0	0	0
Smith Point*	01/06/2007	Tekoil & Gas Gulf Coast, LLC	0	0	0
Bolivar	03/11/2007	Masters Resources	0	0	0
Clear Lake*	05/15/2007	Buckeye Gulf Coast Pipelines, LP	0	0	$950
Kemah	11/26/2007	Centerpoint Energy Entex	0	0	0
Kemah	12/01/2007	Centerpoint Energy Entex	0	0	0
Offshore (Kemah)	02/17/2008	Tekoil And Gas Gulf Coast, LLC	0	0	0
Port Bolivar	04/15/2008	Tekoil And Gas Gulf Coast, LLC	0	0	0
Port Bolivar	05/29/2008	Tekoil And Gas Gulf Coast, LLC	0	0	0
Total			0	0	$5,974

Source: 2011-2016 Galveston County Hazard Mitigation Plan (State of Texas Railroad Commission)
Note: *Smith Point and Clear Lake are included in the planning area.

Vulnerability Assessment

Table G.2 below provides the estimated population, number of parcels, and improved value of parcels for the participating jurisdictions. This data was used to determine the number of people, buildings, and value of exposure at risk from gas and oil pipelines, respectively as shown in Tables G.3 and G.4. However, many pipelines run through less densely populated areas, reducing risk, unlike pipelines that run through heavily populated areas. The content analysis for gas pipelines consists of liquid petroleum gas and natural gas and the content analysis for oil pipelines consists of crude oil and natural gas liquids. The primary area of impact for both types of pipeline incident is a 0.5-mile buffer, and the secondary area of impact is a one-mile buffer.

Table G.2: Participating Jurisdictions Population and Parcel Data

Jurisdiction	Total Estimated Population	Total Estimated Number of Parcels	Improved Value of Parcels
Bayou Vista	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194
Friendswood	26,364	10,853	$3,085,164,965
Hitchcock	6,961	6,337	$460,075,283
Jamaica Beach	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165
La Marque	14,543	8,972	$827,263,553
League City	82,353	35,762	$8,164,064,546
Santa Fe	12,814	6,457	$845,974,919
Tiki Island	966	1,254	$445,402,231
Galveston county Unincorporated	40,244	34,756	$2,931,109,729
Total	190,740	109,577	$17,860,872,212

Source: State of Texas Railroad Commission GIS Analysis

Table G.3: Potential Impact Due to Gas Pipeline Accidents by Jurisdiction

Jurisdiction	Immediate Impact (1/2 Mile Buffer)			Immediate Impact (1 Mile Buffer)		
	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	887	$146,189,210	1,537	1,324	$225,154,990
Clear Lake Shores	0	30	$59,849,930	798	645	$161,619,404
Friendswood	15,429	5,296	$1,400,395,655	19,165	6,895	$1,826,862,524
Hitchcock	6,873	5,203	$356,355,861	6,961	6,078	$447,346,263
Jamaica Beach	0	0	0	0	0	0
Kemah	2,855	1,025	$232,444,023	2,906	1,221	$294,986,165
La Marque	12,455	7,599	$698,068,626	14,543	8,972	$827,263,553
League City	12,455	7,599	$698,068,626	76,237	31,186	$7,122,124,061
Santa Fe	12,458	5,561	$781,439,894	12,814	6,457	$845,974,919
Tiki Island	147	100	$19,812,460	654	622	$220,244,388
Galveston County Unincorporated	32,871	20,885	$1,845,773,633	39,505	28,362	$2,508,817,097
Total	143,544	67,384	$10,258,022,029	175,120	91,762	$14,480,393,364

Source: State of Texas Railroad Commission GIS Analysis

Table G.4: Potential Impact Due to Oil Pipeline Accidents by Jurisdiction

Jurisdiction	Immediate Impact (1/2 Mile Buffer)			Immediate Impact (1 Mile Buffer)		
	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	550	20	$1,765,500	1,537	1,276	$218,096,26
Clear Lake Shores	416	332	$71,534,113	1,069	1,033	$215,796,274
Friendswood	20,995	7,007	$1,991,112,967	25,974	10,053	$2,853,377,850
Hitchcock	5,236	2,987	$215,393,808	6,691	5,897	$406,097,877
Jamaica Beach	0	0	0	0	0	0
Kemah	114	225	$61,302,390	1,324	488	$155,216,580
La Marque	9,377	5,266	$395,565,887	13,629	7,776	$669,998,361
League City	54,932	18,755	$3,883,029,144	70,331	27,656	$6,047,921,952
Santa Fe	11,405	5,112	$659,829,283	12,164	5,835	$757,794,134
Tiki Island	147	123	$27,084,788	716	746	$265,865,318
Galveston County Unincorporated	24,361	11,705	$1,061,589,974	32,106	20,919	$1,939,414,820
Total	127,533	51,532	$8,368,207,854	165,811	81,679	$13,528,979,426

Source: State of Texas Railroad Commission GIS Analysis

Hazardous Material Incidents

Description

A hazardous material is any biological, chemical, or physical agent with the potential to cause harm to the environment or humans on its own or when combined with other factors or materials. Hazardous materials are monitored and recorded by the Environmental Protection Agency (EPA) through the Toxics Release Inventory (TRI), which is a publicly available database that contains information on toxic chemical releases and other waste management activities reported annually by certain covered industry groups as well as federal facilities. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990.

Each year, facilities that meet certain activity thresholds must report their releases and other waste management activities for listed toxic chemicals to the EPA and their state or tribal entity. A facility must report these activities if it meets the following three criteria:

- The facility falls within one of the following industrial categories: manufacturing; metal mining; coal mining; electric generating facilities that combust coal and/or oil; chemical wholesale distributors; petroleum terminals and bulk storage facilities; Resource Conservation and Recovery Act (RCRA) Subtitle C Treatment, Storage, and Disposal (TSD) facilities; and solvent recovery services;
- Has 10 or more full-time employee equivalents; and
- Manufactures or processes more than 25,000 pounds or uses more than 10,000 pounds of any listed chemical during the calendar year. Persistent, bioaccumulative, and toxic (PBT) chemicals are subject to different thresholds of 10 pounds, 100 pounds or 0.1 grams depending on the chemical.

Tier 2 data is a publicly available database from the Texas Department of State Health Services Tier 2 Chemical Reporting Program. Under the community right-to-know program laws upheld at the state and federal level, all facilities that store significant quantities of hazardous chemicals must share this information with state and local emergency responders and planners. Facilities in Texas share this information by filing annual hazardous chemical inventories with the state, Local Emergency Planning Committees (LEPCs), and local fire departments. The Texas Tier 2 Reports contain facility identification information and detailed chemical data about hazardous chemicals stored at the facility.

A facility must report chemicals if it meets the following criteria:

- Any company using chemicals that could present a physical or health hazard must report them, according to Tier 2 requirements.
- If an industry has an Occupational Safety and Health Administration (OSHA) deemed hazardous chemical that exceeds the appropriate threshold at any point in time, then the chemical must be reported. These chemicals may be on the list of 356 Extremely Hazardous Substances (EHS) or one of the 650,000 reportable hazardous substances (not on the EHS list). This reporting format is for a "snapshot in time". EHS chemicals have to be reported if the quantity is either greater than 500 pounds, or if the Threshold Planning Quantity (TPQ) amount is less than 500 pounds.

Location

Figure G.3 shows the locations of TRI and Tier 2 sites in the Galveston County study region, and Figures G.4through G.13 provides jurisdictional-level locations of the TRI and Tier 2. [1]

For fixed-site analysis, only locations with geo-referenced data available were analyzed. Circular buffers are drawn around each hazardous material site to delineate the areas of impact. Two sizes of buffers, 500 and 2,500 meters, are assumed in respect to the different levels of effect--primary and secondary. For mobile analysis, the major roads (Interstate Highway, US Highway, State Highway) and railroads are chosen to be routes where hazardous material is allowed. The buffer along the roads is drawn with the same size as fixed site analysis. Census block data was used to estimate exposure.

[1] Of the 249 Tier 2 sites available for analysis, 40 do not have latitude and longitude coordinates; this means that approximately 16% of the Tier 2 sites in Galveston County are not reflected in the GIS analysis or in the maps provided in this section.

Figure G.3: Galveston County TRI and Tier 2 Facilities

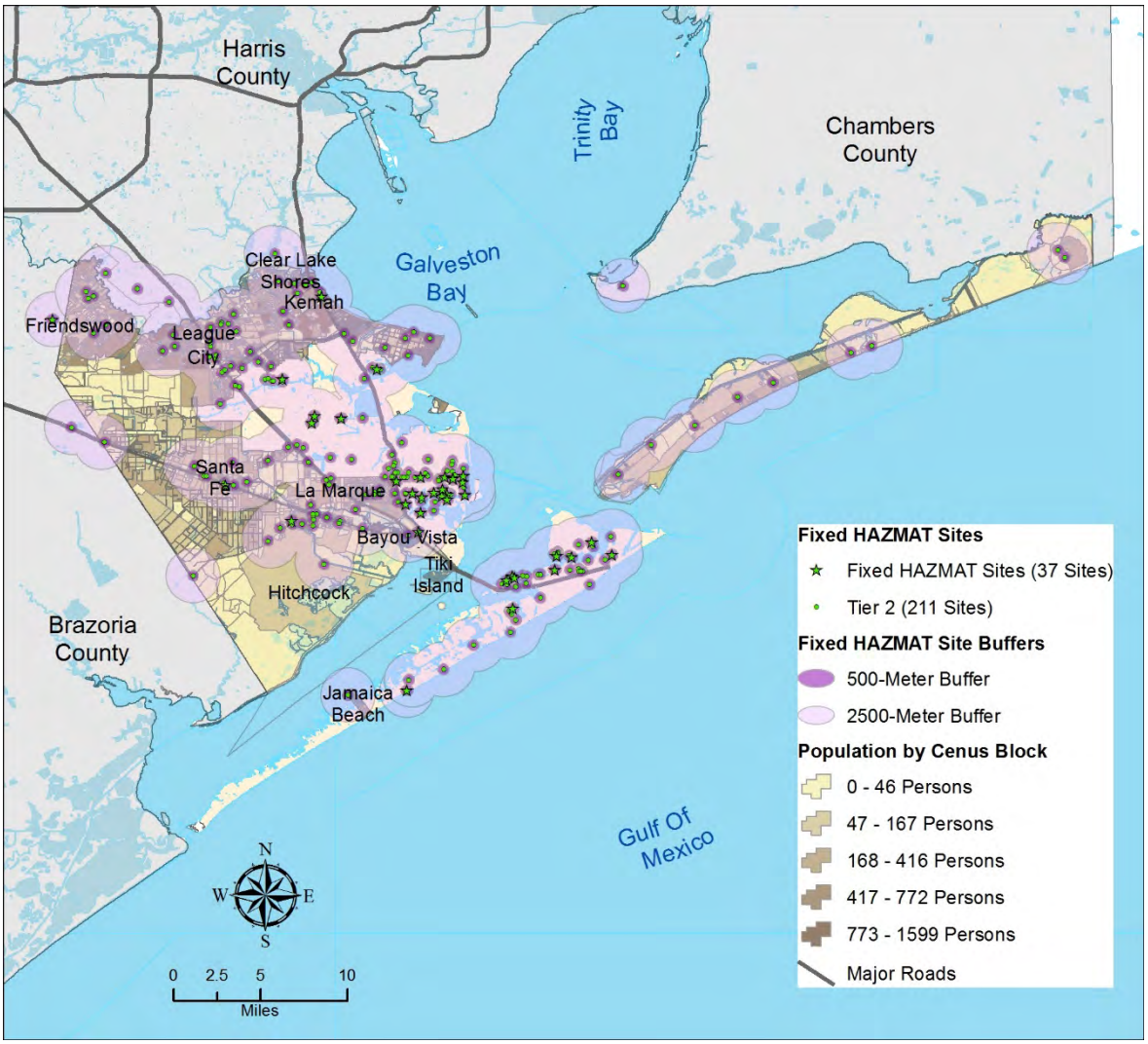


Figure G.4: Bayou Vista TRI and Tier 2 Facilities with Hazard Area Buffers

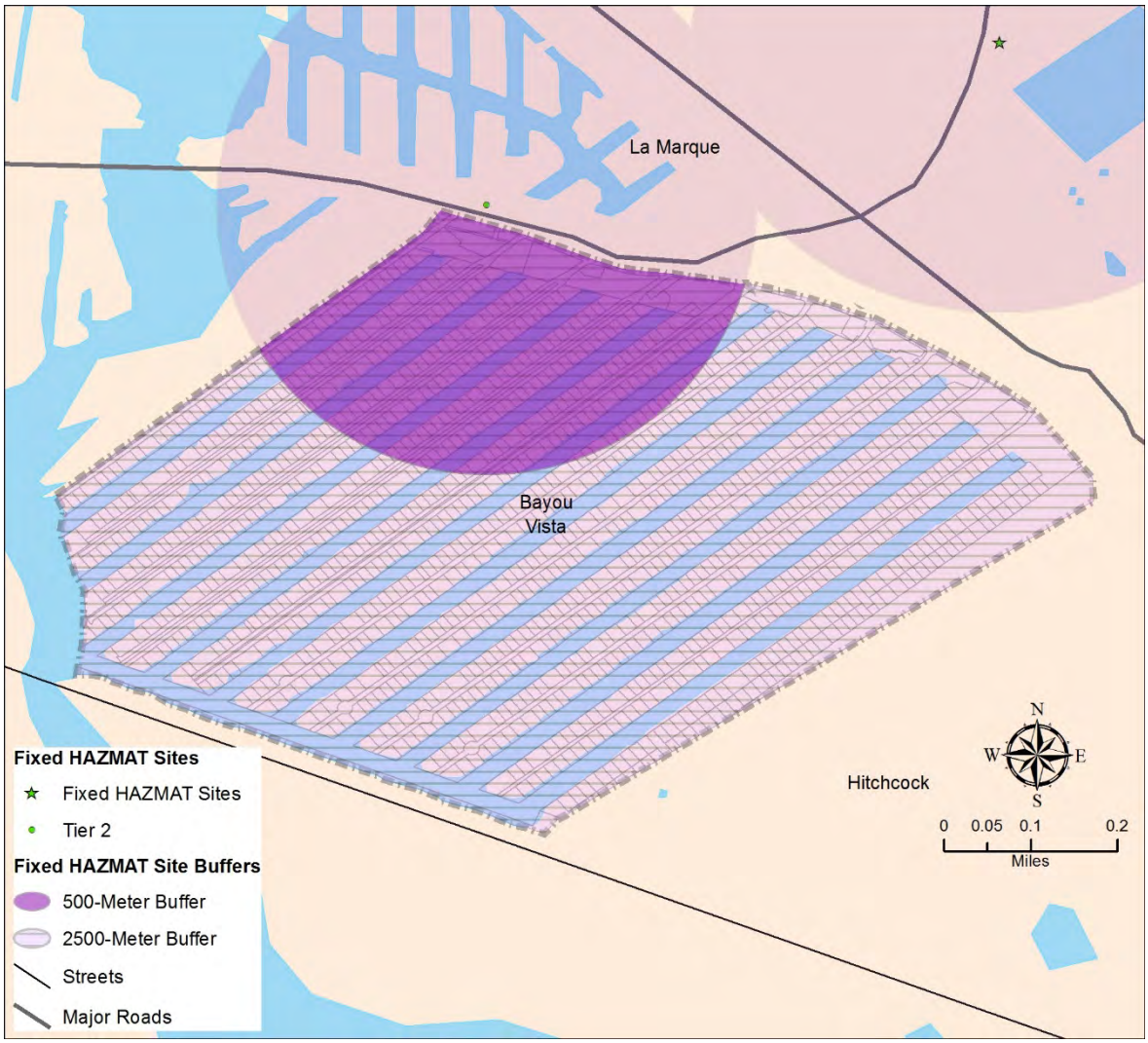


Figure G.5: Clear Lake Shores TRI and Tier 2 Facilities with Hazard Area Buffers

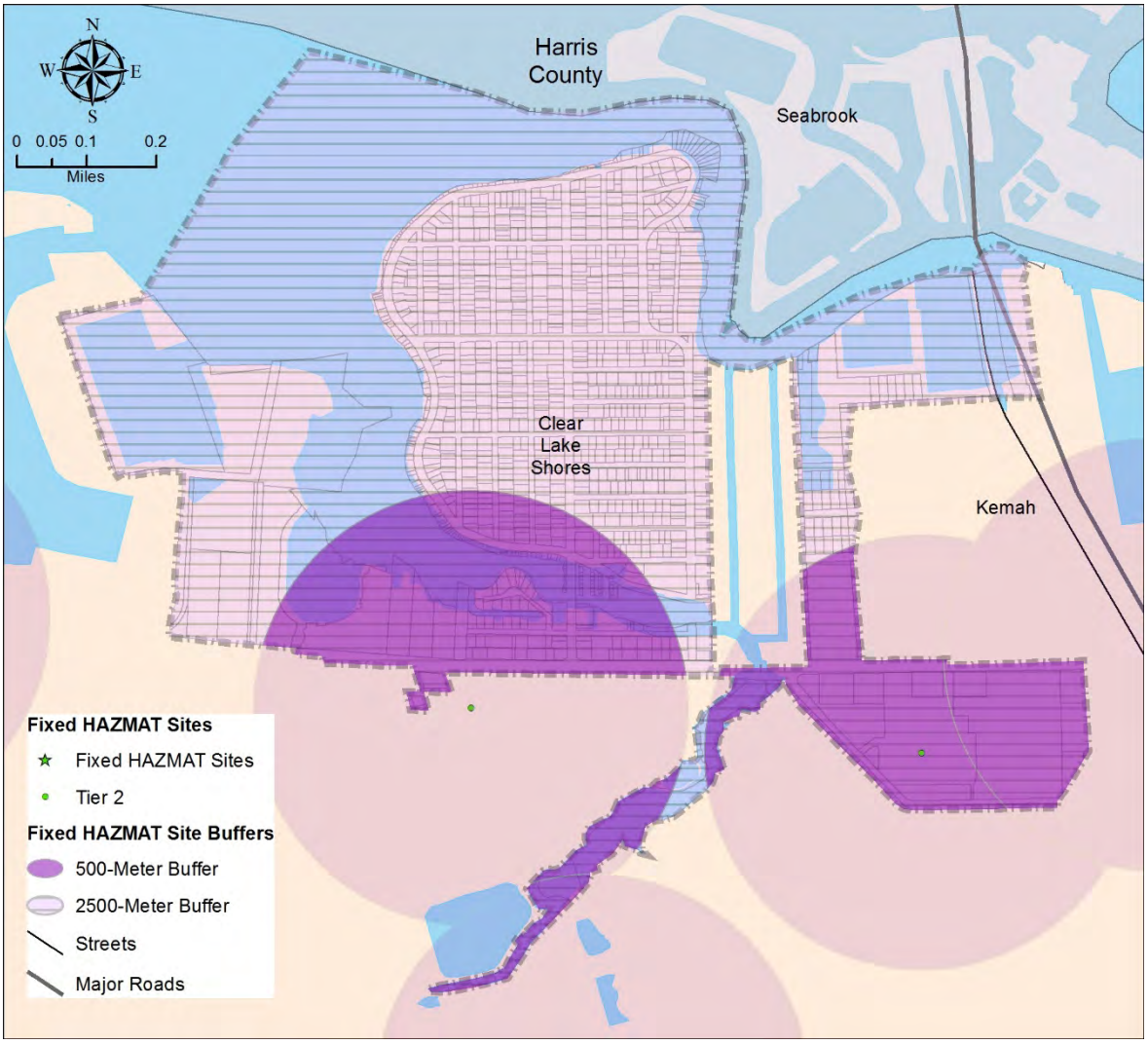


Figure G.6: Friendswood TRI and Tier 2 Facilities with Hazard Area Buffers

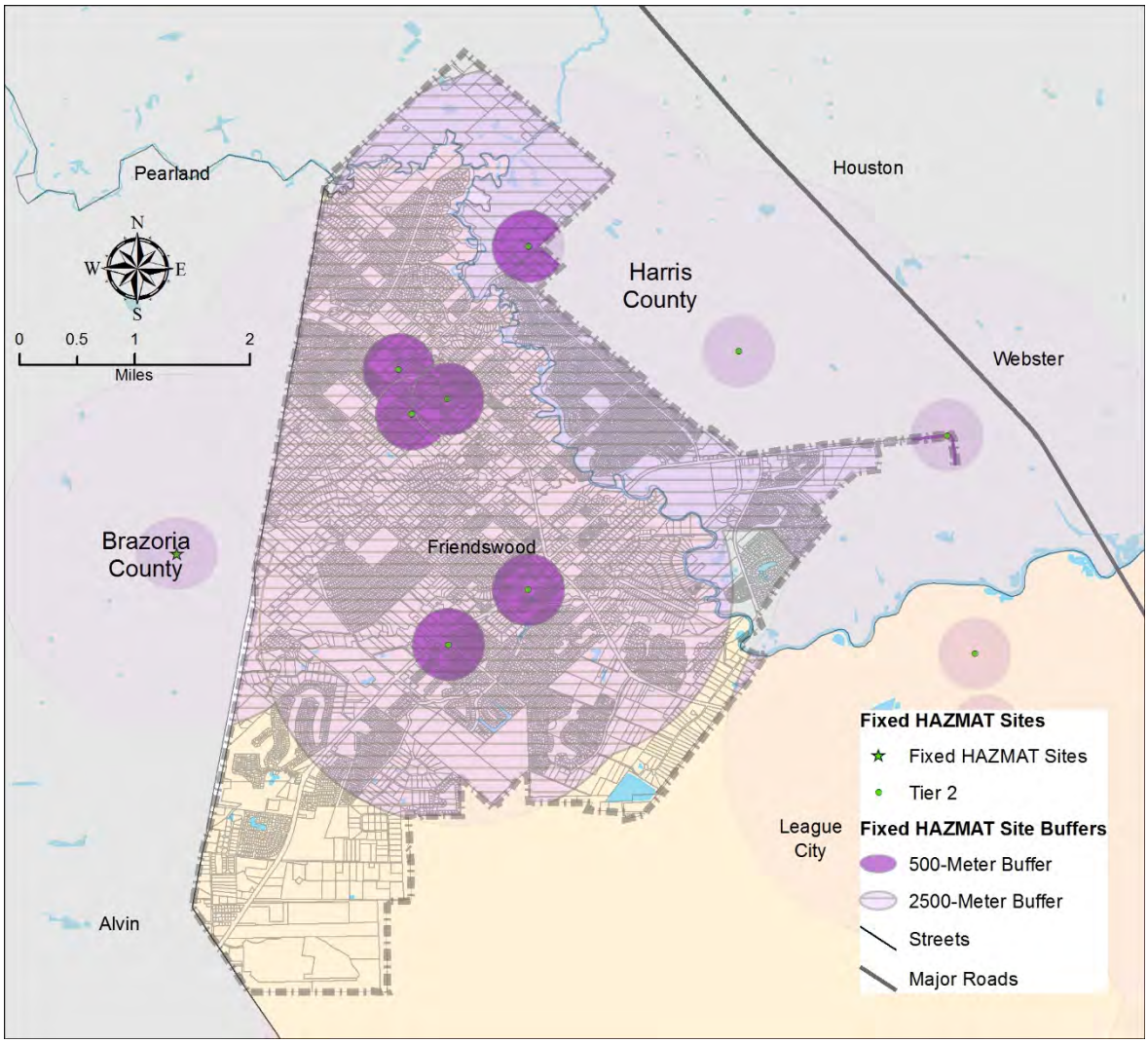


Figure G.7: Hitchcock TRI and Tier 2 Facilities with Hazard Area Buffers

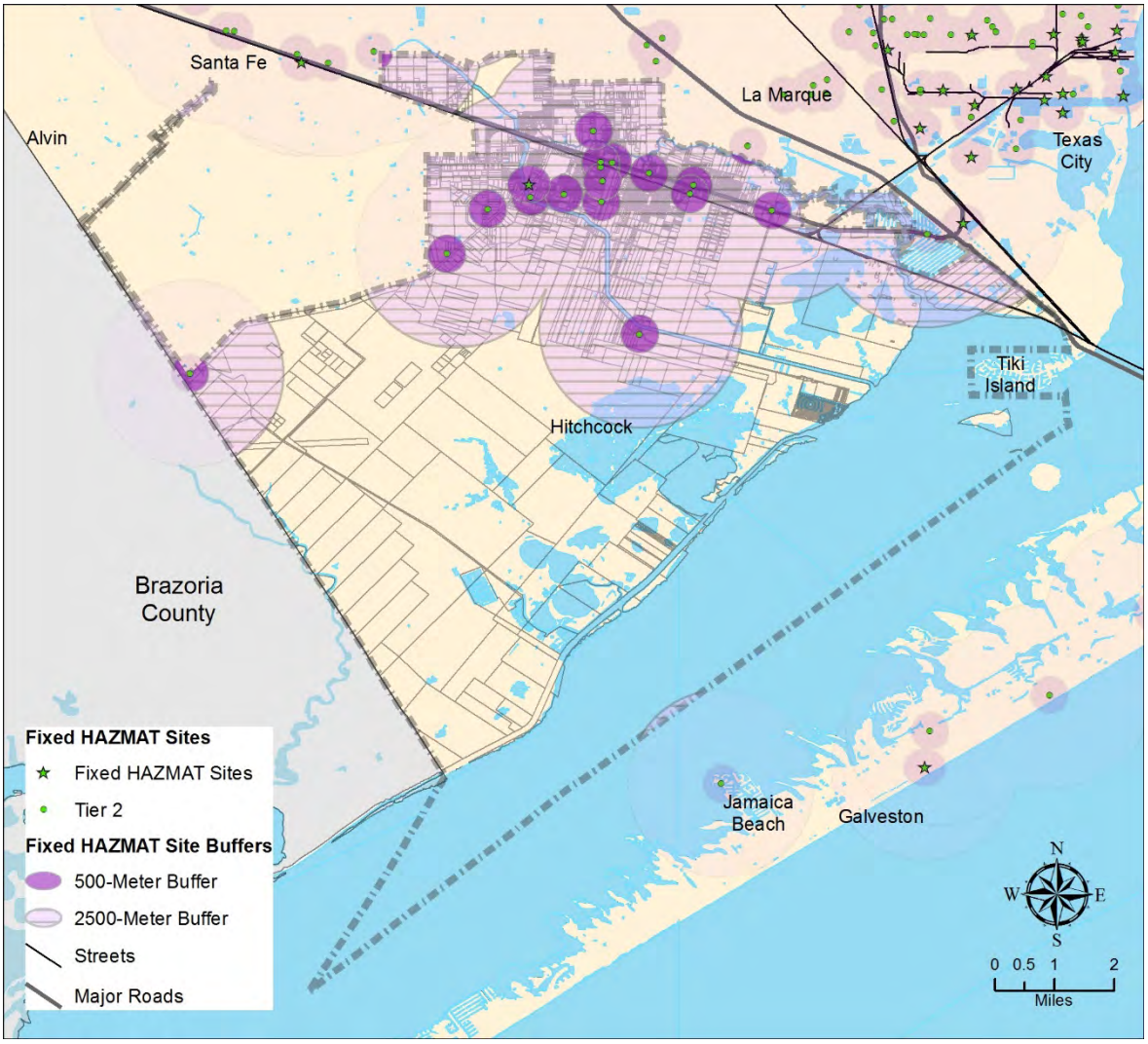


Figure G.8: Jamaica Beach TRI and Tier 2 Facilities with Hazard Area Buffers

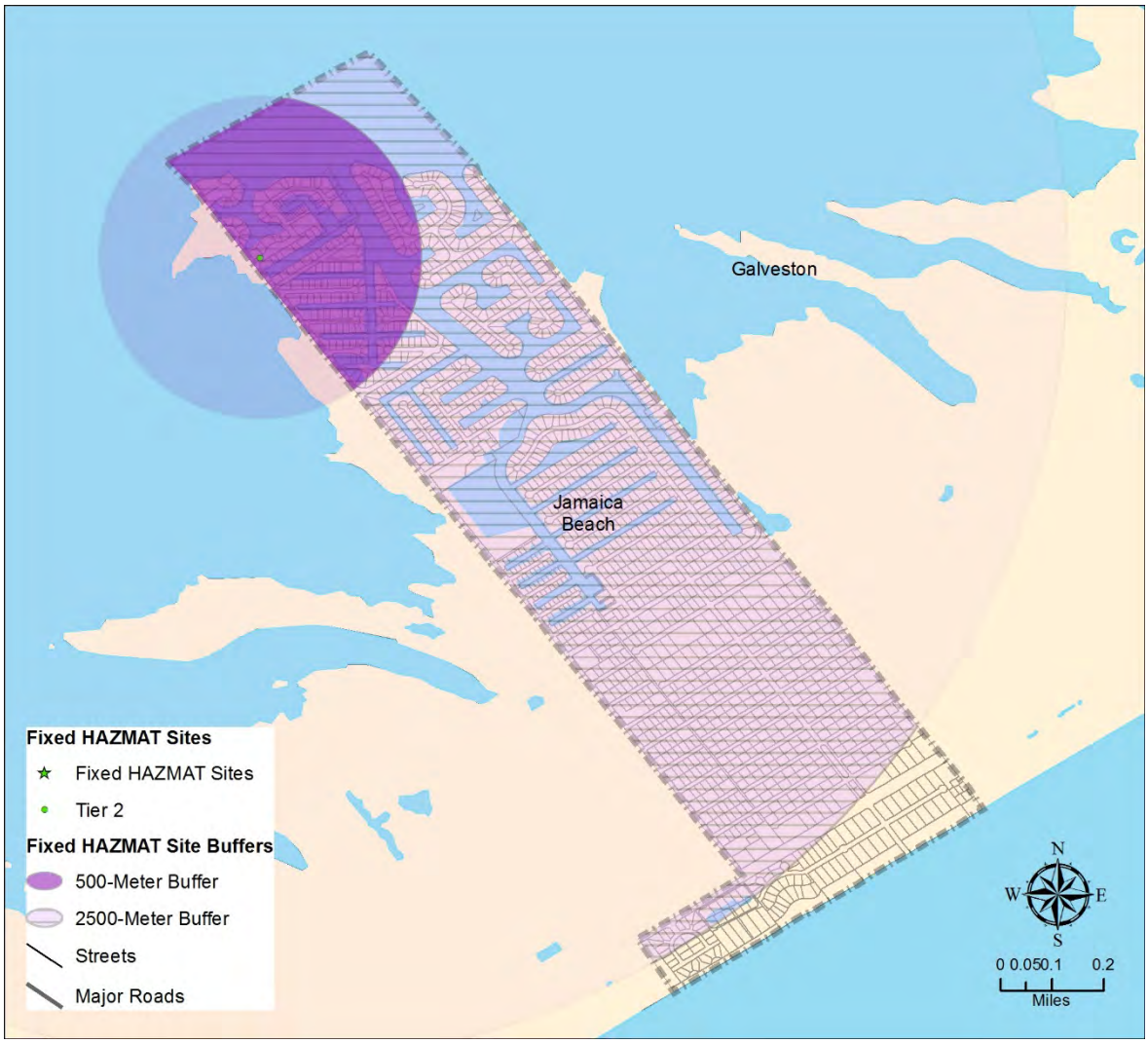


Figure G.9: Kemah TRI and Tier 2 Facilities with Hazard Area Buffers

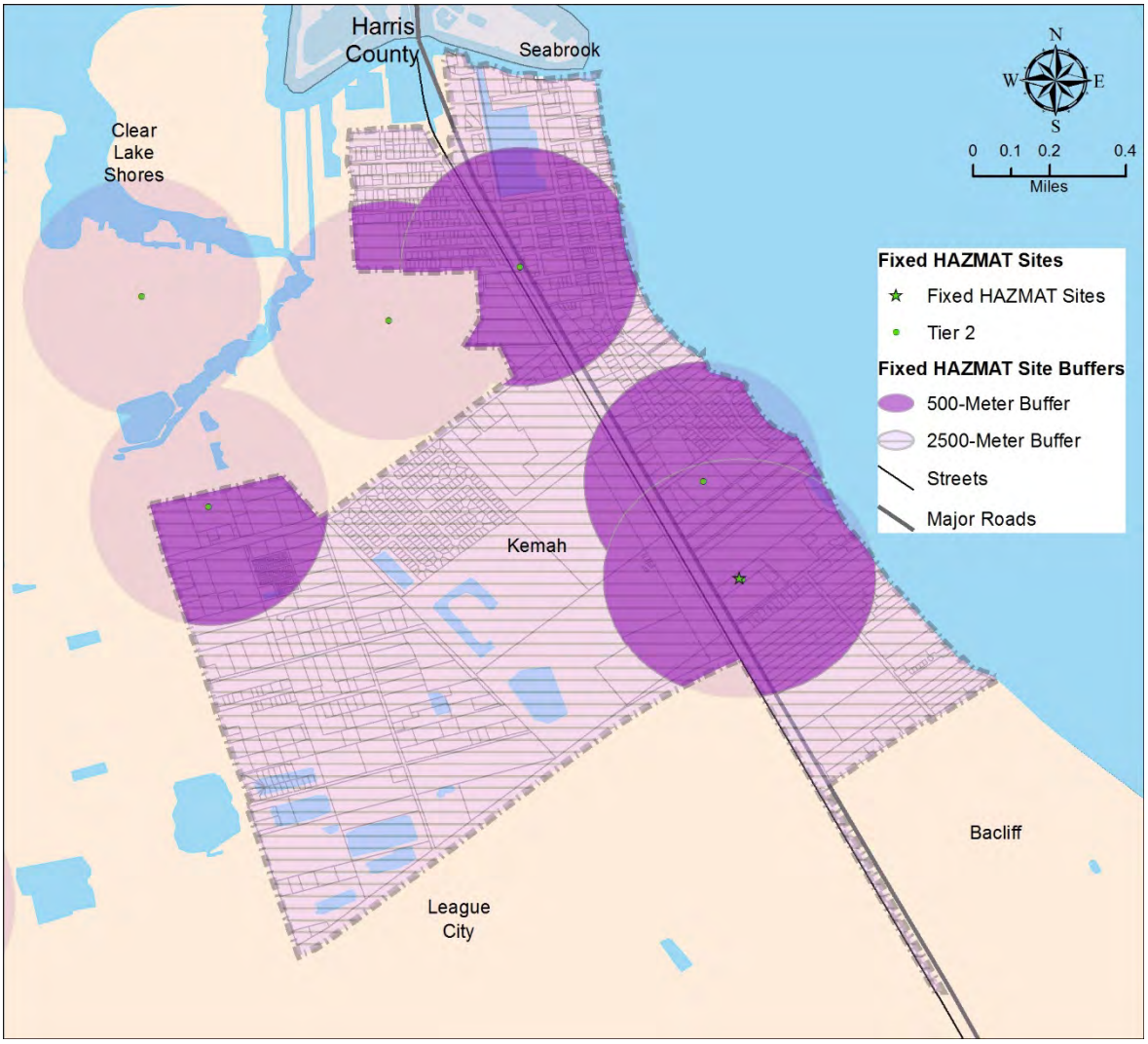


Figure G.10: La Marque TRI and Tier 2 Facilities with Hazard Area Buffer

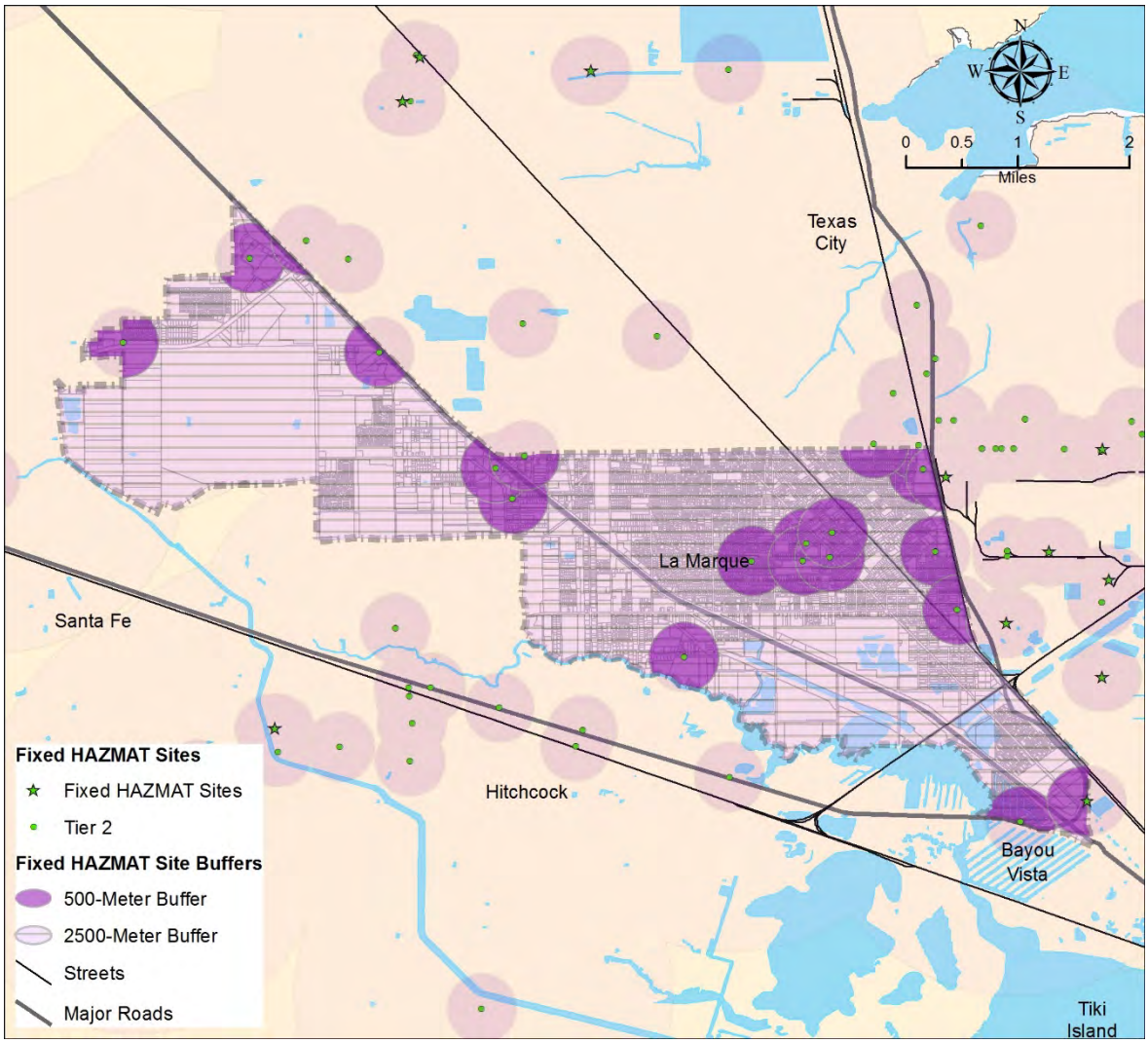


Figure G.11: League City TRI and Tier 2 Facilities with Hazard Area Buffers

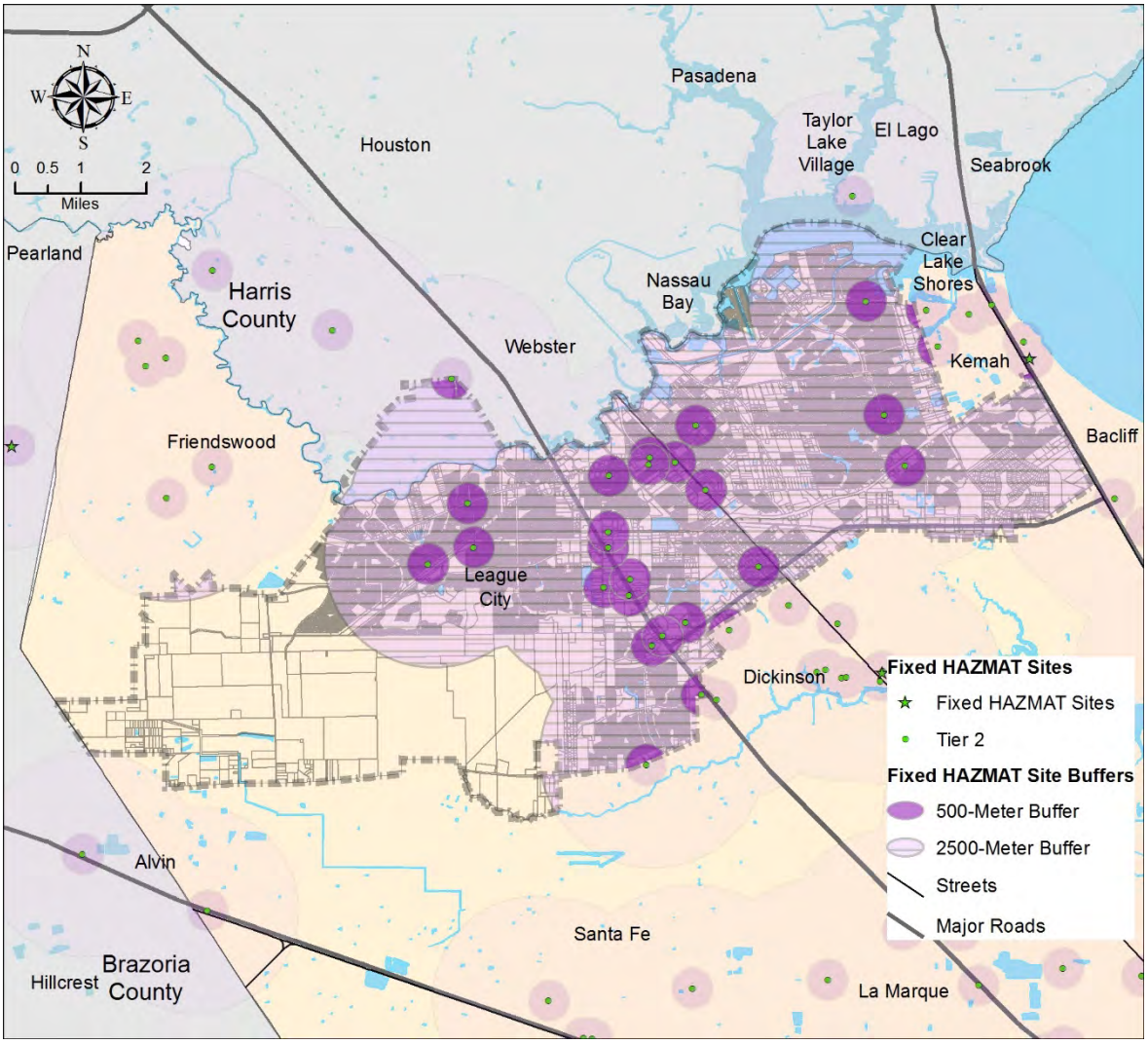


Figure G.12: Santa Fe TRI and Tier 2 Facilities with Hazard Area Buffers

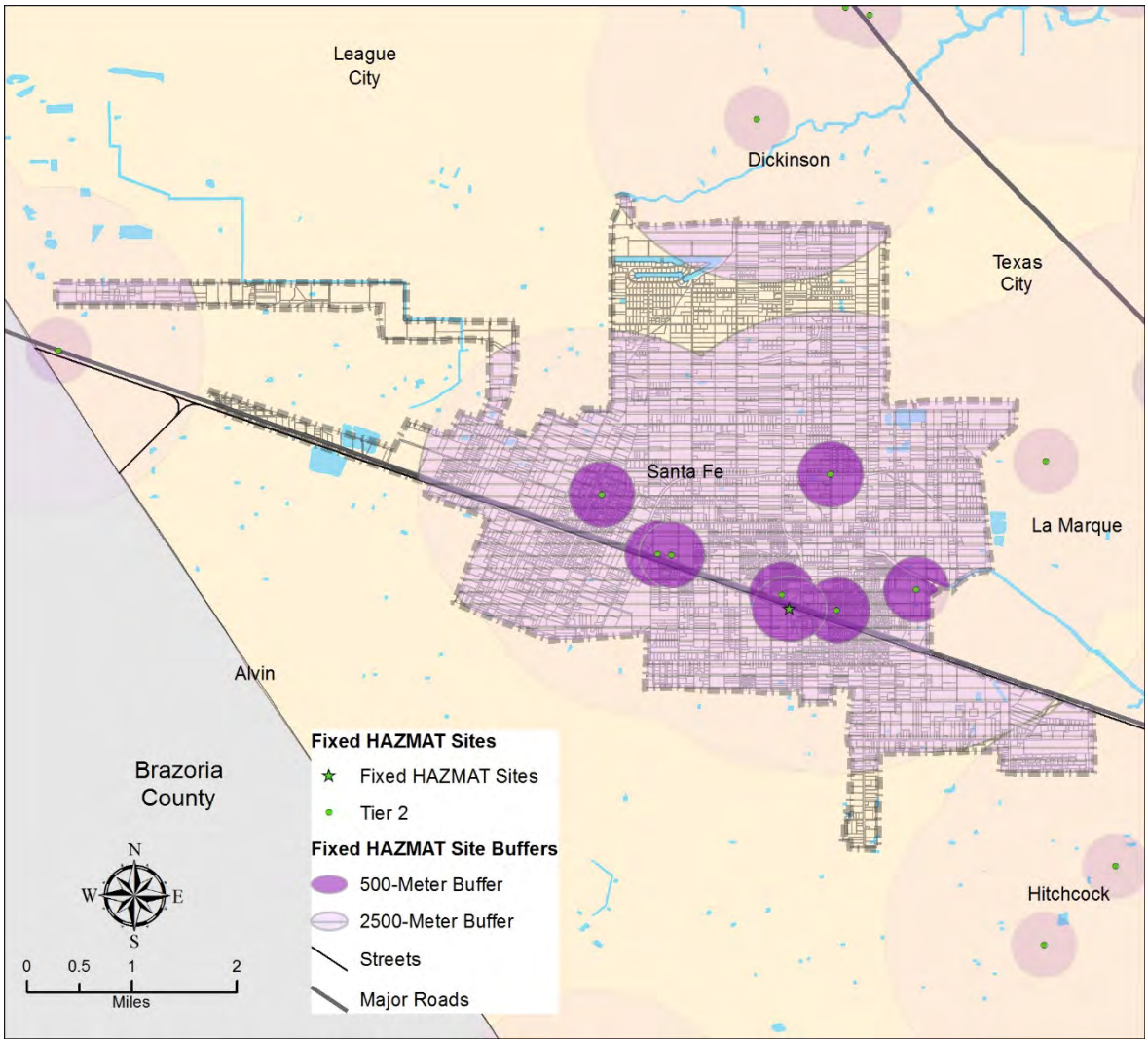
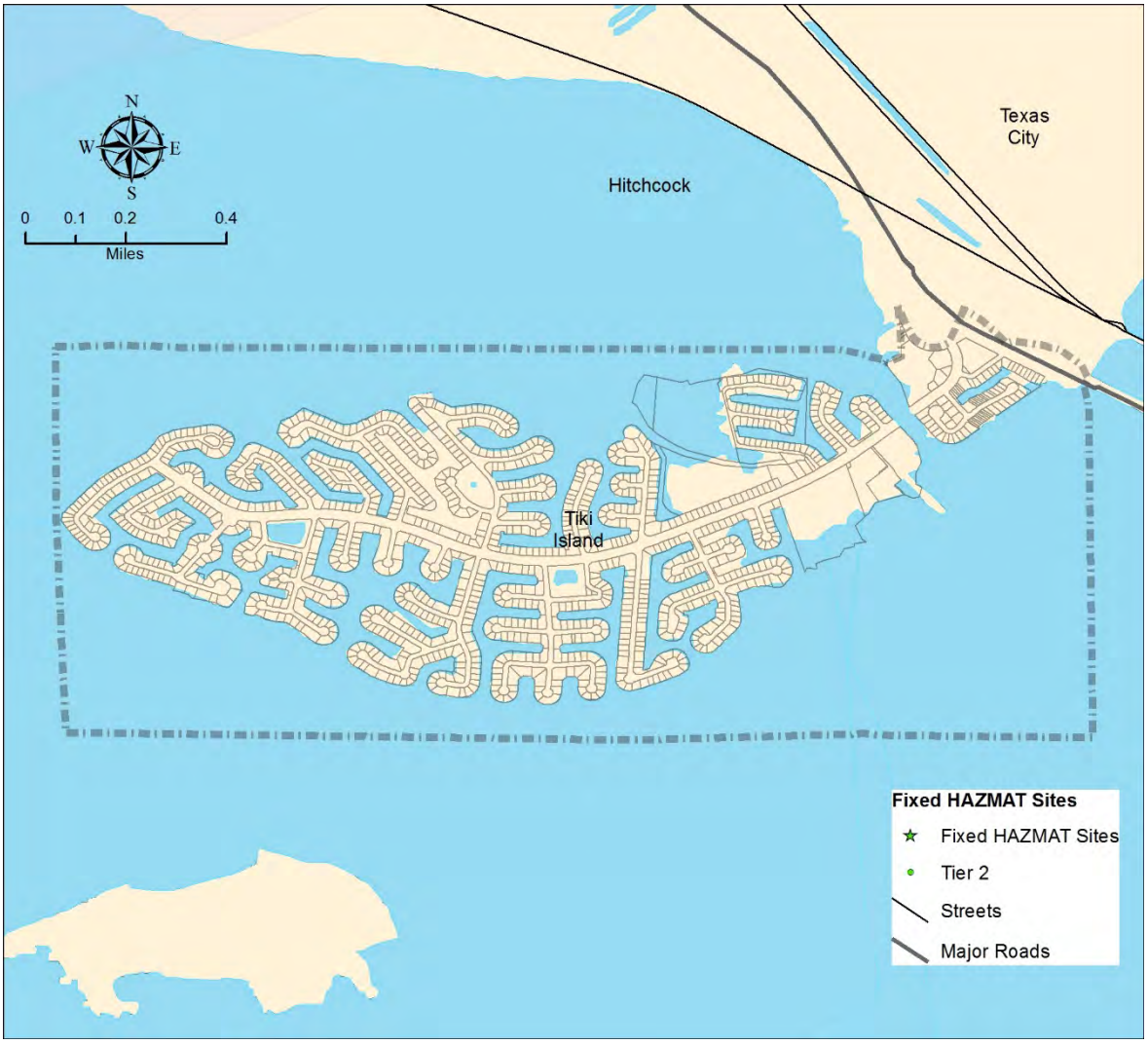


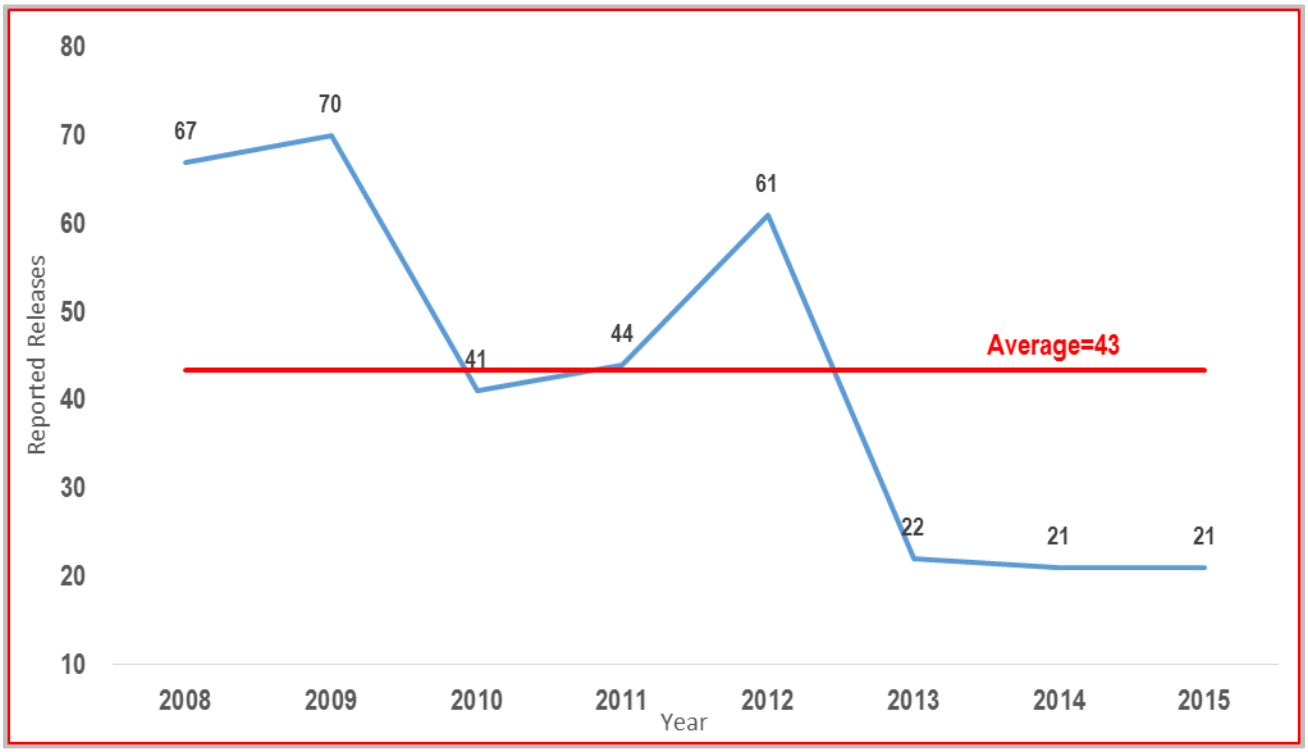
Figure G.13: Village of Tiki Island TRI and Tier 2 Facilities



Historical Occurrences

Figure G.14 illustrates the historical toxic release accidents in Galveston County as reported by the Texas Commission on Environmental Quality (TCEQ).

Figure G.14: Toxic Release Accidents (2008-2015)



Source: TCEQ Reported Releases

Extent and Impact

Hazardous materials or toxic releases can have a substantial impact on communities. Such events can cause multiple deaths, completely shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. In a hazardous materials incident, solid, liquid and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions would directly affect how the hazard develops. The micro-meteorological effects on buildings and terrain can alter travel patterns and duration of agents. Shielding in the form of permanent shelter can protect people from harmful effects. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment

features can substantially increase damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

Vulnerability Assessment

Table G.5 below provides the estimated population, number of parcels, and improved value of parcels for the participating jurisdictions. This data was used to estimate the toxic release exposure of people and parcels by jurisdiction for fixed sites using census block data and is shown in Table G.6. Refer to Figures G.3 to G.13 for a graphic representation of the buffer zones by jurisdiction.

Table G.5: Estimated Exposure of People and Parcels by Jurisdiction
Fixed Site Toxic Release

Jurisdiction	Total Estimated Population	Total Estimated No. of Parcels	Improved Value of Parcels
Bayou Vista	1,537	1,324	$225,154,990
Clear Lake Shores	1,069	1,051	$243,448,194
Friendswood	26,364	10,853	$3,085,164,965
Hitchcock	6,961	6,337	$460,075,283
Jamaica Beach	983	1,590	$338,227,637
Kemah	2,906	1,221	$294,986,165
La Marque	14,543	8,972	$827,263,553
League City	82,353	35,762	$8,164,064,546
Santa Fe	12,814	6,457	$845,974,919
Tiki Island	966	1,254	$445,402,231
Galveston County Unincorporated	40,244	34,756	$2,931,109,729
Total	190,740	109,577	$17,860,872,212

Table G.6: Estimated Exposure of People and Parcels by Jurisdiction – Highway and Rail Fixed Site Toxic Release

Jurisdiction	Immediate Impact (500 meter Buffer)			Secondary Impact (2,500 meter Buffer)		
	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	700	345	$51,759,650	1,537	1,324	$225,154,990
Clear Lake Shores	473	278	$88,570,561	1,069	1,051	$243,448,194
Friendswood	5,810	1,265	$398,315,589	25,000	10,096	$2,883,865,929
Hitchcock	4,741	2,121	$154,898,690	6,909	5,681	$362,575,698
Jamaica Beach	143	248	$85,488,362	979	1,583	$337,880,487
Kemah	2,719	669	$177,170,746	2,906	1,221	$294,986,165
La Marque	7,335	2,649	$332,783,125	14,543	8,972	$827,263,553
League City	32,395	5,982	$1,466,018,317	82,279	34,578	$7,979,752,638
Santa Fe	4,783	1,196	$169,798,020	12,027	5,825	$751,192,664
Tiki Island	0	0	$0	0	0	$0
Galveston County Unincorporated	13,187	5,692	$433,664,694	35,282	27,227	$2,313,411,254
Total	72,286	20,445	$3,358,467,754	182,531	97,558	$16,219,531,572

Source: GIS Analysis

Figures G.15 and G.16 illustrate the 500-meter and 2,500-meter buffers for the two components that comprise the mobile site toxic release hazard: highway and rail. While Table G.7 shows combined results for both highway and rail, it is meaningful to map the two separately due to the proximity of the rail lines with three of the four main highways present in the study area. Primary and secondary impact distances were selected based on guidance from FEMA Publication 426 and engineering judgment. Because many sites containing hazardous materials are located in densely populated areas, there are population and structures that could be susceptible to a release from more than one site.

Figure G.15: Mobile HAZMAT Analysis Buffers - Highway

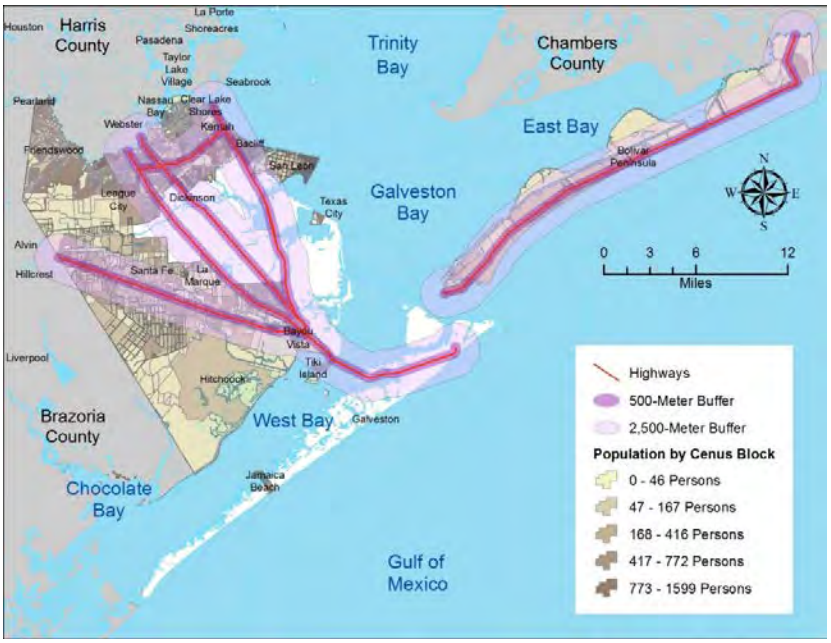


Figure G.16: Mobile HAZMAT Analysis Buffers - Rail

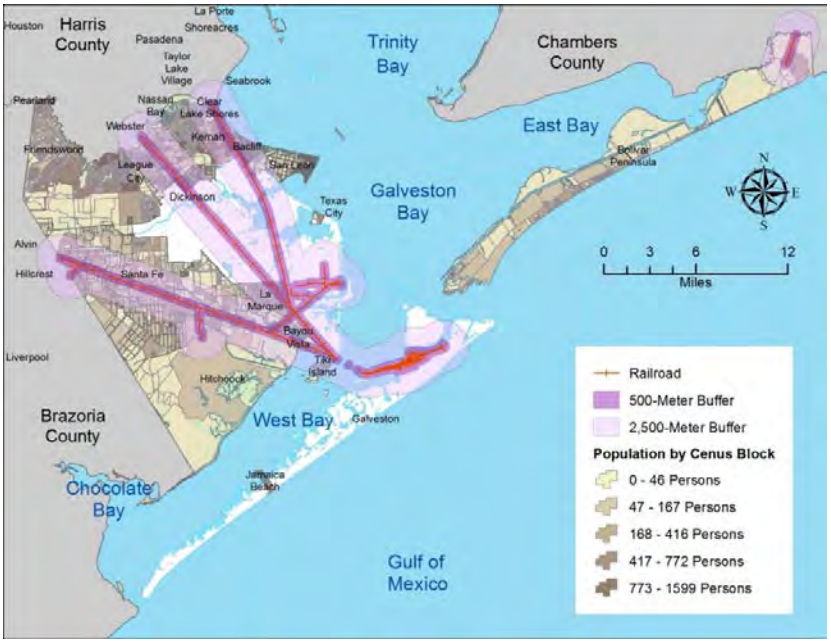


Table G.7: Estimated Exposure of People and Parcels by Jurisdiction – Highway and Rail Mobile Toxic Release

Jurisdiction	Immediate Impact (500 meter Buffer)			Secondary Impact (2,500 meter Buffer)		
	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	1,537	1,232	$208,384,140	1,537	1,324	$225,154,990
Clear Lake Shores	42	79	$45,077,153	1,069	1,051	$243,448,194
Friendswood	0	0	$0	0	0	$0
Hitchcock	5,511	3,234	$191,425,729	6,905	5,517	$353,574,278
Jamaica Beach	0	0	$0	0	0	$0
Kemah	2,745	747	$218,752,635	2,906	1,221	$294,986,165
La Marque	8,646	4,364	$401,481,123	14,543	8,933	$825,903,743
League City	21,945	6,288	$1,634,230,356	64,213	25,119	$5,672,253,097
Santa Fe	6,776	2,060	$278,065,546	11,546	5,297	$666,302,718
Tiki Island	180	138	$32,695,768	966	1,254	$445,402,231
Galveston County Unincorporated	14,950	12,522	$933,500,405	31,120	26,537	$2,236,772,263
Total	62,332	30,664	$3,943,612,855	134,805	76,253	$10,963,797,679

Source: GIS Analysis

Figure G.17 illustrates the areas that could be affected by a toxic release in the Gulf Intracoastal Waterway. The data provided in Table G.8 provides the estimated exposure of people and parcels by jurisdiction for the immediate and secondary impact areas.

Figure G.17: Mobile HAZMAT Analysis Buffers - Gulf Intracoastal Waterway

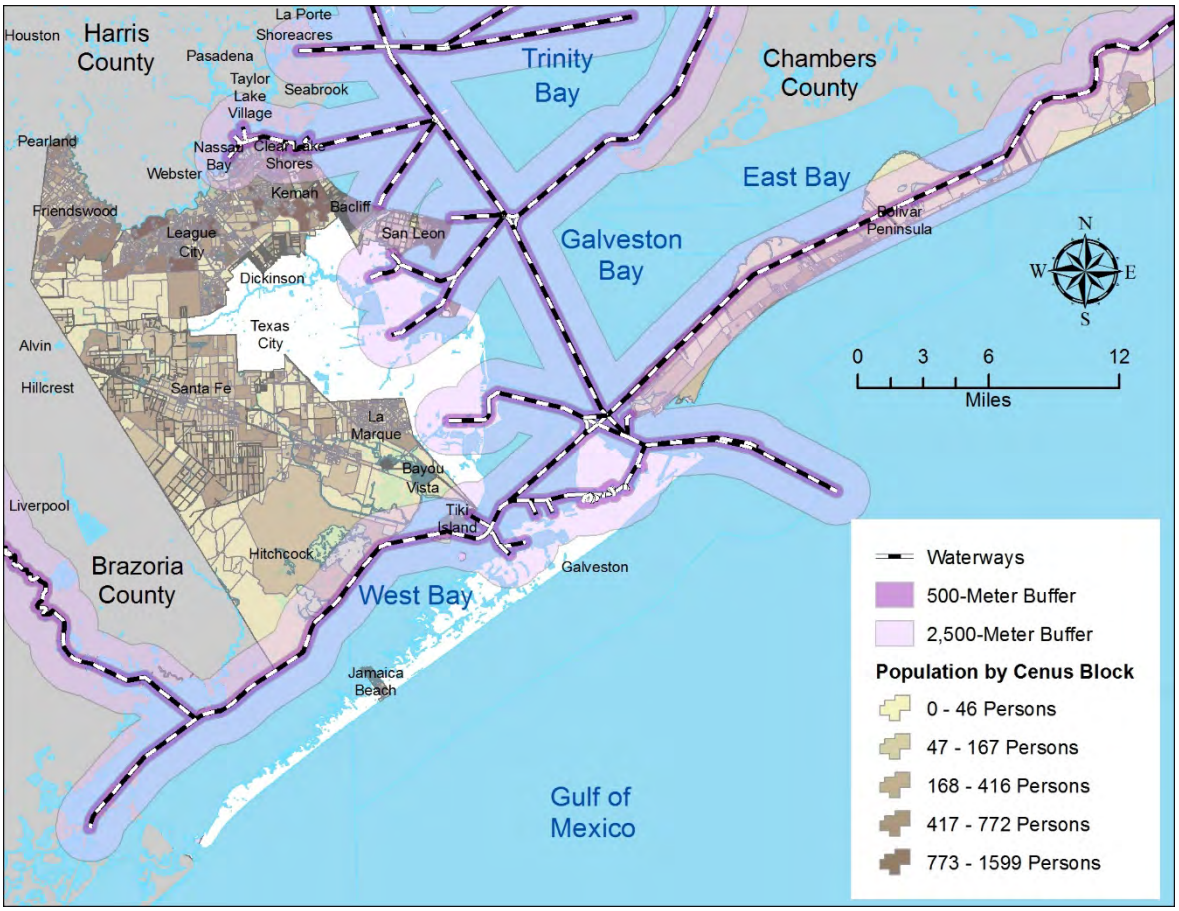


Table G.8: Estimated Exposure of People and Parcels by Jurisdiction - Gulf Intracoastal Waterway Mobile Site Toxic Release

Jurisdiction	Immediate Impact (500 meter Buffer)			Secondary Impact (2,500 meter Buffer)		
	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk	No. of People at Risk	No. of Parcels at Risk	Value of Parcels at Risk
Bayou Vista	0	0	$0	0	0	$0
Clear Lake Shores	874	760	$154,145,703	1,069	1,051	$243,448,194
Friendswood	0	0	$0	0	0	$0
Hitchcock	153	141	$18,390,196	186	566	$90,851,331
Jamaica Beach	0	0	$0	0	0	$0
Kemah	86	165	$53,352,660	1,736	1,091	$275,293,646
La Marque	0	0	$0	0	0	$0
League City	3,351	728	$262,310,986	15,912	5,605	$1,608,185,198
Santa Fe	0	0	$0	0	0	$0
Tiki Island	220	195	$44,654,678	966	1,254	$445,402,231
Galveston County Unincorporated	2,579	2,821	$190,696,497	13,768	23,606	$1,843,423,723
Total	7,263	4,810	$723,550,720	33,637	33,173	$4,506,604,323

Source: GIS Analysis

Mitigation Strategies

Below is a list of actions identified by Bayou Vista, Friendswood, and League City to address pipeline failure and hazardous material incidents. Since these hazards are not a requirement by FEMA in hazard mitigation planning, they are included as additional information to supplement this plan. Officials will use this information to support their preparedness, mitigation, response, and recovery efforts.

BV-2011-20: Implement a plan for minimizing damage due to pipeline breach or failure	
Mitigation Goal/Objective:	1/1.5
Site and Location	Citywide
Background/Next Steps:	Galveston county is one of the top areas in the nation for oil and gas refining. Multiple miles of fuel pipelines traverse residential neighborhoods underground in Galveston county. A community that has a response plan in place will suffer less damage and fewer or no lies will be lost to damages from a fuel pipeline breach.
Hazard(s) Addressed:	Land Subsidence
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$4,000
Potential Funding Sources:	General funds, FEMA- Emergency Management Performance Grants, FEMA-All Hazards Operational Planning, USDA-Environmental Quality Incentives Program
Lead Agency/Department Responsible:	Galveston County MUD #12
Timeframe for Completion:	Continuous action

F-2016-17: Continue to participate in maintaining the Pipeline Integrity Management Resource Reporting in High Consequence Areas (HCA) through the National Pipeline Mapping System (NPMS)	
Mitigation Goal/Objective:	2/2.5
Background/Next Steps:	• The Pipeline and Hazardous Materials Safety Administration (PHMSA) of the US Department of Transportation (DOT) has a rule requiring pipeline operators to develop an integrity management program for gas transmission lines where a leak or rupture could impact a HCA. • Pipeline operators are also required to identify the location of any "Identified Sites" located near their pipelines. • "Identified Site" o Outside area or open structure that is occupied by 20 or more persons on at least 50 days in any 12 month period (i.e., playgrounds, recreational facilities, camp grounds, outdoor theaters, stadiums, etc.) o A building that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12 month period (i.e., religious facilities, office buildings, community centers, general stores, etc.) o A facility occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate (i.e., hospitals, schools, day-care facilities, nursing homes, retirement facilities or assisted living facilities) • Every six months access the PHMSA site and verify the location of all "Identified Sites", and include any new facilities which meet the defined criteria.
Hazard(s) Addressed:	Pipeline Failure, Hazardous Materials
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	Staff time utilized to annually verify and update the HCAs for the NPMAS
Potential Funding Sources:	Annual budget
Lead Agency/Department Responsible:	Office of Emergency Management
Timeframe for Completion:	Continuous action

LC 2005-9: Update Local Mitigation Plan to include Pipeline and Hazardous Materials Incidents	
Mitigation Goal/Objective:	2/2.1
Background/Next Steps:	Pipelines and hazardous material industries are located within the planning area. Research and include the following information in the LMP: • Locate all pipelines • Create/update map • ID owner/lessee • ID product • ID evacuation zones for release and fire/explosion • Develop training programs
Hazard(s) Addressed:	Pipeline Failure, Hazardous Materials
Mitigation Strategy:	Prevention
Priority:	High
Estimated Cost:	$10,000
Potential Funding Sources:	City Funds, FEMA Mitigation Grant Funds
Lead Agency/Department Responsible:	Office of Emergency Management
Timeframe for Completion:	2016-2020

Appendix H

Completed Plan Maintenance Documents

(Jurisdictions to insert plan maintenance tools provided in Appendix B-3 as completed)