CHAPTER 7
FLOOD RESPONSE INFORMATION AND ACTIVITIES

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Texas Water Development Board

DRAFT CHAPTER 7 2023 REGIONAL FLOOD PLAN REGION 6 SAN JACINTO

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PREPARED FOR THE **SAN JACINTO REGIONAL FLOOD PLANNING GROUP**

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Task 7. Flood Response Information and Activities

The San Jacinto River Basin experiences a variety of flooding types as well as approach to responding to flooding events. This chapter summarizes the activities within the region to prepare for, respond to, and recover from flooding disasters. Information in this section was collected from survey responses, previous studies and plans, and discussion with agencies within the region.

There are several types of flooding that impact residents and communities within the San Jacinto region including tropical cyclones from the Gulf of Mexico to frontal thunderstorms from northern Texas.

- Coastal flooding occurs whenever there is a occurence such as waves, tide, storm surge, or heavy rainfall from tropical storms. Coastal flooding tends to be the most extreme when the storm surge is high. Storm surge is an abnormal rise of water generated by the pressure and wind of a large storm, over and above the predicted astronomical tides. Notable coastal events within recent years include Tropical Storm Imelda (2019), Hurricane Harvey (2017), Hurricane Ike (2008), and Tropical Storm Allison (2001).
- Riverine floods occur when excess rainfall within a watershed causes an overtopping of the riverbank. This rainfall can be caused by both frontal thunderstorms as well as effects from coastal events. This overtopping then spills the water onto adjacent land.
- Pluvial floods happen when there is flooding independent from a river due to excessive rainfall on internal drainage systems such as storm sewers, ditches, or overland sheet flow. The most common example of this is when the drainage system is overwhelmed, and the excess water floods into the streets.
- Flash floods are floods caused by heavy rainfall over relatively short period. The flood water can be very powerful making it extremely dangerous.

Emergency preparedness is necessary for each of these flooding scenarios to assist communities and people in disaster response. For flooding, there are four phases in emergency management[1] shown in Figure 7-1.

Figure 1: The Four Phases of Emergency Management

- **Flood Mitigation:** The implementation of both structural and non-structural solutions, to reduce flood risk and protect against the loss of life and property.
- **Flood Preparedness:** Actions, aside from mitigation, that are taken before flood events to prepare for flood response.
- **Flood Response:** Actions taken during and in the immediate aftermath of a flood event.

[1] Federal Emergency Management Agency, 1998, IS-010 Emergency Management Institute: Animals In Disaster, Module A: Awareness and Preparedness, Washington, DC, 185pp. Accessed on 2/24/2021 at https://training.fema.gov/emiweb/downloads/is10comp.pd

- **Flood Recovery:** Actions taken after a flood event involving repairs or other actions necessary to return to pre-event conditions.

Flood mitigation is the most important step to flood plan development and efforts to identify potential flood mitigation strategies, evaluations, and projects for the San Jacinto Region are described in Chapters 4 and 5. When implemented, these studies and projects will reduce flood risk for the region while improving communication of the risk to the public. Flood preparedness, response, and recovery are the focus of this chapter.

Task 7.A. Summary of Emergency Management for San Jacinto Region

Entities throughout the region have differing approaches to emergency response based on their existing capabilities and responsibilities as well as individual community needs. Each entity has methods of communicating flood preparedness awareness to the public, responding to flood emergencies, and coordinating recovery activities. Existing flood response information was collected through the survey, discussions with local entities, emergency action plans, and available studies.

7.A.1. Preparation

Preparation includes actions taken by both citizens and the government to prepare for a flood disaster. Preparation may occur minutes, days, or years prior to an event and ranges from emergency plan development to public education. The list below summarizes various preparations within the San Jacinto Region:

- Agencies perform tabletop exercises which are informal discussion-based sessions where teams practice roles and responsibilities during an emergency by walking through example scenarios. Most agencies conduct flood response scenarios with various departments present on an annual basis.
- Agencies identify critical infrastructure prior to disaster events and the potential level of inundation that may occur. The information is used to prepare staff as well as emergency responders of the flooding potential.
- Varying agencies have a documented emergency action plan that provides the process for responding to flooding disasters. The plan specifies relevant roles and responsibilities as well as action items for the agency personnel. Figure 7-2 depicts the operational plan prepared by the Galveston County Health District.

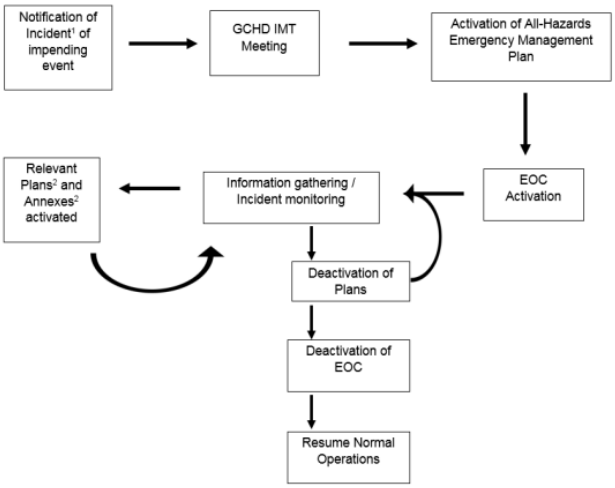

Figure 2: Galveston County Health District EAP

- Some communities have designated shelters during flood disasters and will train both volunteers and staff designated to each shelter on how to both respond to the event.
- Agencies develop and store pre-scripted messages that can be used during flood events to alert and inform the public.
- Communities provide public education and outreach on emergency preparedness and local warning systems such as the Galveston County Disaster Guide. These documents will provide local government contact information, steps for evacuation, and guides for developing an individual disaster plan.

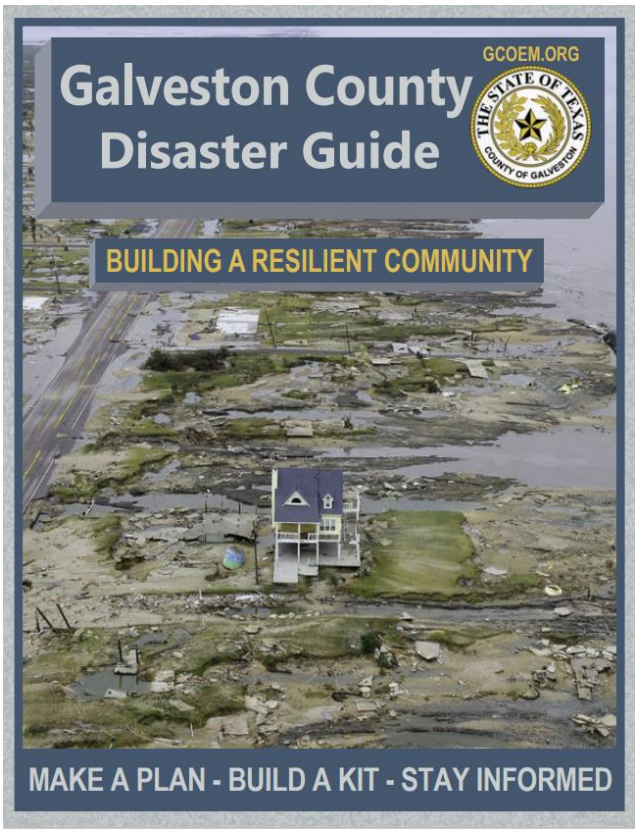

Figure 3: Galveston County Disaster Guide

- Communities identify areas of known flood risk when preparing for disasters to monitor during storm events and stage evacuations and rescue as needed. These are located through available flood mapping as well as historical accounts. Communities will also locate areas and individuals with functional needs that may need additional assistance.
- Communities are required to perform damage assessments post-disaster and will train local staff on the assessment process so that personnel are ready to be deployed following the event.
- Cities and agencies procure debris removal contracts and have them on-call for when they are needed. Debris in roads affects mobility for emergency crews and the public returning to their homes after the disaster.
- Agencies develop public listservs that will distribute information regarding the disaster to individuals that sign up for the information.
- Communites will educate the public regarding the importance of purchasing flood insurance from the NFIP.
- Some communities have purchased high water rescue vehicles that are used in disaster response efforts.

- The Houston-Galveston Area Council (H-GAC) has prepared a hurricane evacuation route map that the varying emergency managers use. The map also shows evacuation corridors and connections as well as the four zones used for mass evacuation by zip code.

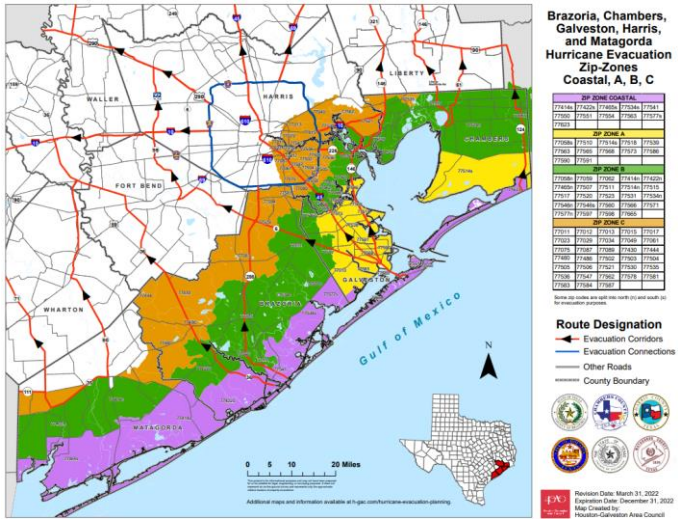

Figure 4: HGAC Hurricane Evacuation Routes and Zones

7.A.2. Response

Flood response actions occur during and after the storm event as floodwaters rise and fall within the region. Response actions require cooperation among the various agencies along with the residents of the region for successful coordination. Actions include public and interagency communication, alerts, and agency response. The list below summarizes various flood response actions within the San Jacinto Region:

7.A.2.a. Public Communication

Public communication activities are the most commonly activities undertaken by the agencies within the region. Various public communication activities include:

- Reverse 911 notifications are used by various entities to send alerts directly to citizen's phones based on a geographic area. These alerts can include information regarding weather watches and warnings as well as flooded areas to avoid.
- Many entities use social media posts on platforms including Facebook, Twitter, YouTube, and LinkedIn.
- Local news media is used to communicate critical information quickly and effectively to residents throughout the region.
- Agencies update their website to provide the status of current conditions and how to request assistance.
- Radio stations KTRH 740 AM and KUHF 88.7 FM serve as the Emergency Alert Systems (EAS) and will send out weather and flooding alerts as requested by the National Weather Service and other agencies.
- CodeRED Community Emergency Alert system is used by communities to alert residents and business of critical situations. The system is geographically based and sends out messages to anyone defined in the region via text messages, phone calls, and emails.
- Some agencies use a direct hotline for the public to call and receive information.
- Press releases are developed, distributed to news agencies, and posted on social media regarding status of current infrastructure.

7.A.2.b. Interagency Coordination

In addition to communicating with members of the public, communication between agencies is critical during flood events. There are many ways that interagency coordination is performed by agencies within the region, including:

- Emergency coordinators contact each other via cell phones or radio to communicate information regarding infrastructure status and flood related issues. They also use this communication to request for additional assistance when needed.
- City departments such as police and fire use radio systems as they are more reliable than cell towers during major events.
- Emergency Operating Centers (EOC) are established and include personnel from various jurisdictions for direct communication and coordination. The graphic below shows the Harris County EOC.

Figure 5: Harris County Emergency Operation Center

- Agencies use WebEOC® which is a software designed to bring real-time crisis information management to local, state and federal EOCs. Agencies can log on and coordinate with each other through this network.
- County Sheriffs offices are used for information dissemination to the public and for coordinating evacuations
- Agencies and communities participate in regional coordination calls with federal agencies such as the National Weather Service, National Hurricane Center, and FEMA.
- Agencies coordinate with critical care facilities such as hospitals and nursing homes to alert of potential flooding in the area and coordinate assistance.
- Agencies and communities conduct news conferences to inform the public.

7.A.2.c. Flood Alerts

Flood Alerts are more direct ways of disseminating critical information to the public and affected agencies during a flood event. Alert methods vary across agencies but include:

- Emergency management personnel monitor and alert agencies responsible for flooded roadways which are closed as needed. Staff is also assigned to monitor roadways that typically flood.

- Communities and agencies monitor National Weather Service broadcasts and react to information accordingly.
- Some agencies monitor River Forecast Center flow and stage predictions. The predictions indicate potential peak river stages and the agencies make decisions regarding evacuations as well as public alerts based on the information provided. The graphic below shows a forecast of stage and flow predictions for Peach Creek.

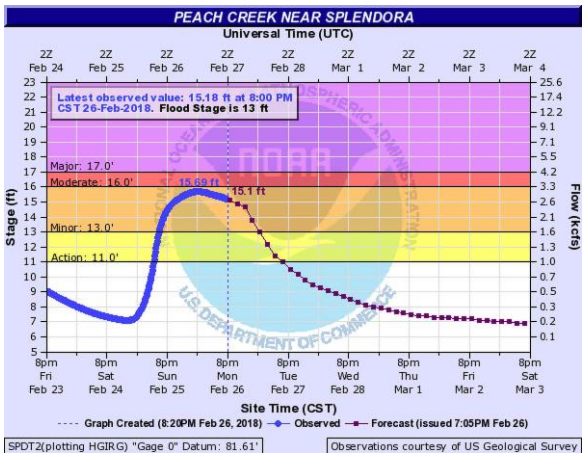

Figure 6: Peach Creek River Forecast Center Stage and Flow Predictions

- Many rural agencies communicate with TxDOT regarding status of state-maintained roadways and alert the public of potential route closures due to flooding.
- Local school district bus drivers provide valuable information regarding flooded roadways to the school district and local entities which can be used to re-route traffic and close roads.
- Communities have purchased proprietary subscription services that provides detailed weather forecasting information for the community.
- Communities will review the Houston Transtar (https://www.houstontranstar.org/) webpage for information regarding weather, alerts, and traffic conditions.

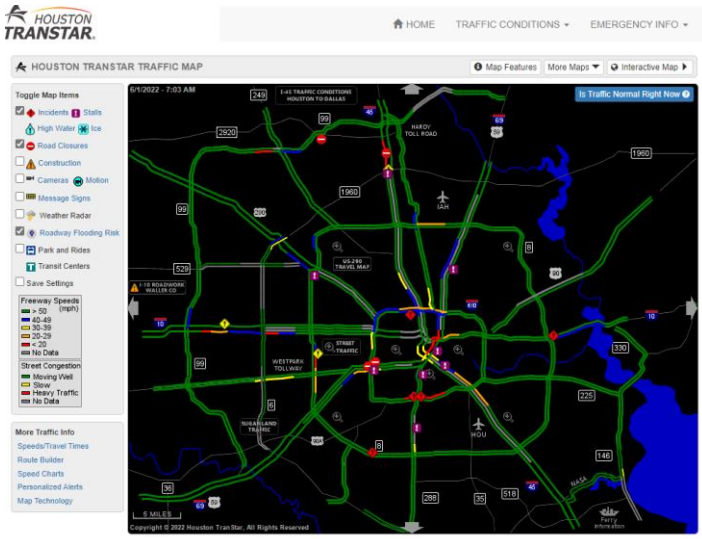

Figure 7: Houston Transtar Webmap

- The Harris County Flood Warning system (harriscountyfws.org) includes real time information regarding rainfall, stage, and potential inundation for Harris County. The website also offers text notifications regarding flood gage status that the public can sign up for to receive real time alerts as to potential flooding in the area.

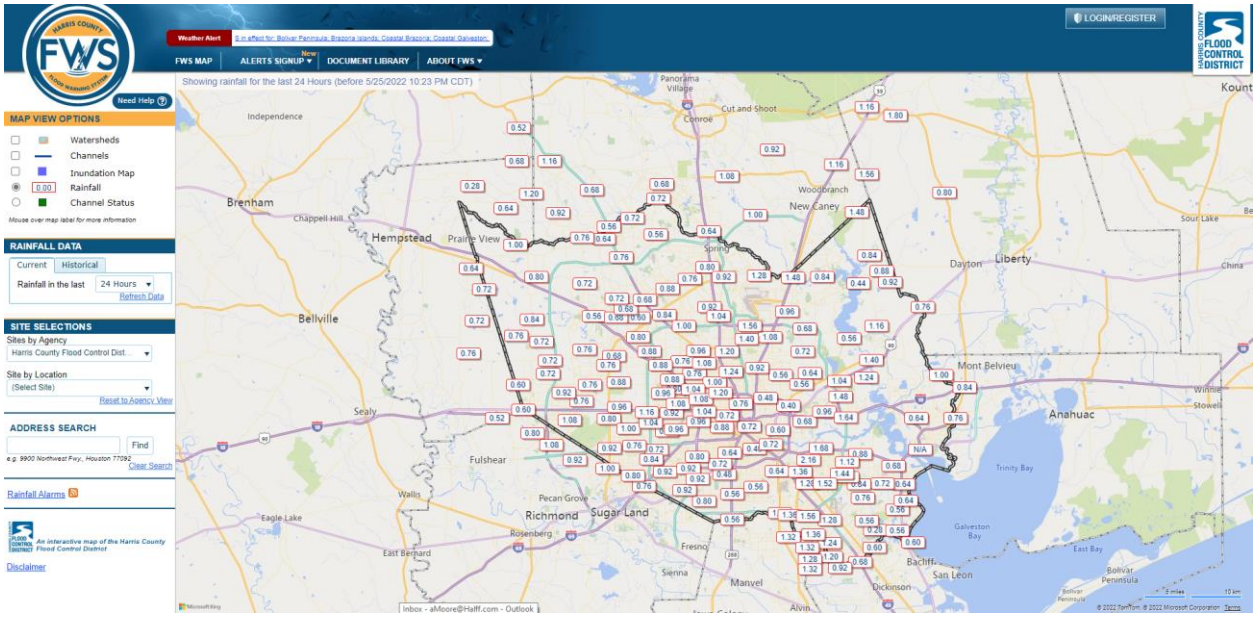

Figure 8: Harris County Flood Warning System Website

7.A.2.d. Agency Response

Agency response during flood events is most critical to protect life and property as well as to prepare for future flood response. Typical flood response activities undertaken by the various agencies within the region include:

- Closing flooded facilities including roadways, lakes, and recreational facilities to protect the public from entering high water
- Opening and staffing dedicated shelters for evacuees.
- Issuing evacuation orders for coastal areas in accordance with the evacuation protocol and maps.
- Providing high water rescue efforts as needed.
- Collecting and distributing food, clothing, first aid, and other essential services to evacuees.
- Providing traffic control during evacuations.
- Managing rumor control by providing information via social media pages and websites.
- Collecting high water marks and record flow information during the event.
- Communities use drones for a variety of flood response and traffic monitoring during disaster events.

7.A.3. Recovery

Recovery from flood events can be a long process as homes, roads, and facilities are repaired and rebuilt. Recovery includes local agencies conducting damage assessments for both private and public structures, coordination with federal disaster relief agencies, and assistance to victims with temporary housing and information regarding recovery efforts. The list below summarizes the various flood recovery actions within the San Jacinto Region:

- Providing public with information relating to flood insurance and the recovery process.
- Performing damage assessments for both infrastructure and structures and identifying unsafe structures and roadways.
- Removing debris from roadways and disposing at pre-determined debris collection points.
- Providing traffic control when returning to flooded areas.
- Assisting residents into temporary housing if available.
- Demobilizing shelters and mass-care facilities and return to normal use.
- Managing home buyout programs for frequently flooded properties.
- Regularly communicating with disaster victims.
- Compiling records of the events, including flooding observations and documentation of flooding location, magnitude, and duration.
- Reviewing and update building code requirements.
- Preparing after action plans for flooding and fire disasters.
- Coordinating with local businesses and industry to provide necessary materials to citizens.

Task 7.B. Relevant Entities in the Region

Preparedness, response, and recovery include a multitude of local communities as well as state, and federal agencies within the region each tasked with differing roles and responsibilities. Listed below are the various contributing entities and partners.

7.B.1. Local Communities

- Cities, or municipalities, are generally responsible for local response, recovery, and preparedness for flood disasters. There are 81 cities within the San Jacinto region with populations ranging from a few thousand to several million. Response for Cities includes emergency responders such as fire, police, and health/safety for alert and rescue during events. Public Works departments manage utilities including operating back-up generators for water and sewer plants. Road and maintenance crews monitor road conditions and close roadways to prevent vehicles from entering high water. City officials also update their citizens through social media posts and public alerts before, during and after events.
- County governments provide for safety and justice, facilitate elections at every level of government, building and maintaining roads, bridges and in some cases, county airports, emergency management services, health and safety services, collecting property taxes for the county and sometimes for other taxing entities, issuing vehicle registration and transfers, and registering voters. There are 11 counties within the San Jacinto region. During flood events, counties will provide public with critical information, close flooded roadways, perform high water rescues, and coordinate emergency operations.

- The Houston-Galveston Area Council (HGAC) is a regional organization that allows for coordination among local governments, mainly cities and counties, that seek to provide cooperative planning, coordination, and technical assistance on issues of mutual concern that cross jurisdictional lines. HGAC serves as a resource for flood data, flood planning, and flood management information
- The Harris County Flood Control District is a special purpose district created by the Texas Legislature and governed by County Commissioners Courts. It is a government agency established to reduce the effects of flooding through capital improvement projects, channel maintenance, flood mapping, communication, regulations, and outreach. The District mobilizes the Flood Watch team during flood events. District personnel monitor the District's extensive network of rainfall and streamflow gauges to provide accurate information to local officials and the public. Personnel conduct visual surveys and collect physical stream flow data during the flood event, when possible, to verify gauge information. District personnel also participate in the Harris County emergency operations center, providing timely information to local emergency management officials, the media, and the public. After flood events, the District is active in debris removal, emergency repairs and maintenance activities and many other tasks.
- Drainage districts are special purpose districts established to own and maintain drainage infrastructure within their jurisdiction. Districts will construct, improve, and maintain infrastructure as well as regulate development that discharges to their system. After flood disasters, the districts may remove debris and sediment within channels to restore conveyance.
- Dams and Levees are owned and operated by individuals, private and public organizations, and the government. The responsibility for maintaining a safe dam or levee rests with the owner. A failure resulting in an uncontrolled release into an otherwise protected area can have a devastating effect on persons and property. Dam and levee owners are a critical part of the flood planning process to ensure a collaborative and cohesive plan.

7.B.2. State Agencies

- The Texas Water Development Board (TWDB) leads the state's efforts in ensuring a secure water future for Texas and its citizens. The TWDB provides planning assistance, data collection and dissemination, technical assistance and financial assistance services during and after flood disasters to the region.
- The Texas Division of Emergency Management (TDEM), a division of the Texas Department of Public Safety (DPS), is charged with coordinating state and local responses to natural disasters and other emergencies in Texas. TDEM is intended to ensure the state and its local governments respond to and recover from emergencies and disasters and implement plans and programs to help prevent or lessen the impact of emergencies and disasters. There are six TDEM regions within Texas, each with Assistant Chiefs and District Coordinators. They serve as the Division's field response personnel stationed throughout the State. They have a dual role as they carry out emergency preparedness activities and coordinate emergency response operations. In their preparedness role, they assist local officials in emergency planning, training, and exercises, and developing emergency teams and facilities. They also teach a wide variety of emergency management courses. In their response role, they deploy to incident sites to assess damages, identify urgent needs, advise local officials regarding state assistance, and coordinate deployment of state emergency resources to assist local emergency responders. The San Jacinto region is in TDEM Region 2.
- The Texas Department of Transportation (TxDOT) is the state's primary transportation agency. Though the public face of the agency is generally associated with the construction and maintenance of the immense state highway system, the agency is also responsible for overseeing aviation, rail, and public transportation systems in the state. TxDOT can provide real time road closure and low water crossing information during and after a flood event.

- River Authorities are a public agencies established by the state legislature and given authority to develop and manage the waters of the state within their jurisdictional area. The San Jacinto Region includes the San Jacinto River Authority that has the power to conserve, store, control, preserve, utilize, and distribute the waters of a designated geographic region for the benefit of the public.
- Agriculture Extension Agents are employed by land-grant universities and serve the citizens of that particular state as an expert or teacher on the topic of Agriculture. Ag extension agents can provide valuable information specific to agricultural entities on preparation and recovery from flood events. The San Jacinto region has a significant agricultural footprint including farming, forestry, and ranching making working closely with Agriculture Extension Agents can be crucial to preventing flood losses.

7.B.3. Federal Agencies

- The Federal Emergency Management Agency (FEMA), initially created in 1977, is an agency of the United States Department of Homeland Security (DHS). While on-the-ground support of disaster recovery efforts is a major part of FEMA's charter, the agency provides state and local governments with experts in specialized fields, funding for rebuilding efforts, and relief funds for infrastructure by directing individuals to access low-interest loans, in conjunction with the Small Business Administration. In addition, FEMA provides funds for training of response personnel throughout the United States and its territories as part of the agency's preparedness effort.
- The National Oceanic and Atmospheric Administration (NOAA) is an American scientific and regulatory agency within the United States Department of Commerce that forecasts weather, monitors oceanic and atmospheric conditions, charts the seas, conducts deep sea exploration, and manages fishing and protection of marine mammals and endangered species in the U.S. exclusive economic zone. In addition to forecasting potential storm events, NOAA's National Center for Environmental Information (NCEI) provides historical data that can help communities determine their future probability of flood events and is key in the planning and mitigation process.
- The U.S. Army Corps of Engineers (USACE) is an important part of the nation's military. The agency is responsible for a wide range of efforts in the United States including addressing safety issues related to waterways, dams, and canals but also environmental protection, emergency relief, hydroelectric power, and much more. USACE is composed of several divisions with the San Jacinto region being in the Southwest Division and the Galveston and Fort Worth Districts.
- The National Weather Service (NWS) provides weather, water and climate data, forecasts, warnings, and impact-based decision support services for the protection of life and property and enhancement of the national economy. NWS provides flash flood indicators through watches, warnings, and emergency notices. Daily river forecasts are issued by the NWS West Gulf River Forecast Center using hydrologic models based on rainfall, soil characteristics, precipitation forecasts, and several other variables. These forecasts benefit a wide range of users, including those in agriculture, hydroelectric dam operation, and water supply resources. The forecasts can provide essential information on river levels and conditions.
- The U.S. Geological Survey (USGS) is the sole science agency for the U.S. Department of the Interior that collects, monitors, and analyzes information regarding natural resources conditions. Within the San Jacinto Basin, the USGS has a network of stream flow and stage gages that monitor and measure stream flow and water quality information for the major streams. The USGS will also collect high water mark surveys post-event to understand the extent of flooding for future This information is used by emergency managers to understand current stream conditions.

Task 7.C. Plans to be Considered

7.C.1. State and Regional Plans

The State of Texas provides the Texas Hazard Mitigation Plan every three years to the Federal Emergency Management Agency (FEMA) and, as a result, is eligible to receive Hazard Mitigation Assistance (HMA) funding to help both state and local communities achieve mitigation goals. The State Hazard Mitigation Plan is an effective instrument to reduce losses by reducing the impact of disasters upon people and property. Although mitigation efforts cannot completely eliminate impacts of disastrous events, the plan endeavors to reduce the impacts of hazardous events to the greatest extent possible.

The plan evaluates, profiles and ranks natural and human-caused hazards affecting Texas as determined by frequency of event, economic impact, deaths and injuries. The plan asesses hazard risk, reviews current state and local hazard mitigation and climate adaption capabilities, and develops strategies and identifies state agency (and other entities) potential actions to address needs.

7.C.2. Local Plans

In 2021 the San Jacinto Region requested local emergency management and emergency response plans that were publicly available. Some emergency plans are protected by law and are not available to the public such as emergency operation plans for high hazard or private dams in the region. In addition to the plans provided by local entities, the region also obtained Emergency Management Plans, Hazard Mitigation Plans and other regional and local flood planning studies from County and local jurisdictions.

An emergency management plan is a course of action developed to mitigate the damage of potential events that could endanger an organization's ability to function. Such a plan should include measures that provide for the safety of personnel and, if possible, property and facilities.

The San Jacinto Basin has several plans and regulations in place region wide that provide the framework that dictates a community's capabilities in implementing mitigation and preparedness actions. Having an up-to-date Hazard Mitigation Action Plan is key in assessing risk and in developing mitigation actions, or projects. Table 7-1 shows that each of the counties has a Hazard Mitigation Plan, with 10 out of 11 county plans currently approved by FEMA, and Grimes County currently in progress.

Table 7-1: Hazard Mitigation Plan Summary

Jurisdiction	Year of HMAP
Brazoria County	2017
Chambers County	2017
Fort Bend County	2018
Galveston County	2017
Grimes County	2013*
Harris County	2020
Liberty County	2017
Montgomery County	2017
San Jacinto County	2017
Walker County	2017
Waller County	2017

**denotes in progress*

The San Jacinto region's ability to prepare, respond, recover, and mitigate disaster events is affected by many factors. With a clear understanding of the plans that determine a community's capabilities, a recognition of the entities with whom coordination is key, and knowledge of the actions sustained to promote resiliency, the region can be better equipped to implement sound measures for flood mitigation and preparedness.