Chapter 7: Flood Response Information and Activities

The following chapter summarizes the flood response preparation information and activities in the Lower Brazos flood planning region using demographic, historical, projected, and statistical data from the previous chapters, and by implementing data from the survey responses. The scope of work specifically states that the RFPG "shall not perform analyses or other activities related to planning for disaster response or recovery activities." Therefore, the focus of this chapter is summarizing the information obtained and providing general recommendations regarding flood response activities.

7.1 Types of Flooding in the Lower Brazos Region

There are five types of floods that impact the Lower Brazos Region: coastal floods, flash floods, pluvial floods, riverine floods, and urban floods. The two most common are riverine and flash floods. Riverine flooding tends to be more widespread, encompassing huge swaths of land while flash floods tend to be more dangerous as they can occur suddenly and without warning. The Lower Brazos region is prone to each type of these floods depending on the location within the region.

Whenever there is a coastal process such as waves, tide, storm surge, or heavy rainfall from coastal storms that create a flood, it is referred to as Coastal flooding. Coastal flooding tends to be the most extreme when the storm surge is high.

Flash floods are floods caused by heavy rainfall over a relatively short period of time. The flood water can be very powerful making it extremely dangerous. Flash floods can occur within a few minutes or hours of excessive rainfall or a dam or levee failure making them unpredictable in nature.

Pluvial floods happen when there is flooding independent from an overflowing body of water due to extreme rain fall on internal drainage systems such as storm sewers or ditches. The most common example of this is when the drainage system is overwhelmed, and the excess water floods into the streets.

Riverine floods occur when rainfall runoff overwhelms the channel capacity and overtops the riverbank. This overtopping then spills the water onto the nearby land. Riverine flooding can be widespread and can cause dams and levees to break and overwhelm nearby areas

Urban flooding is flooding that is caused by excess runoff water in developed areas, where the water doesn't have anywhere else to go. Urban flooding is primarily due to excessive rain falling on impervious surfaces.

With the Lower Brazos region's vulnerability to multiple types of flooding, it is key to prepare, respond, recover, and mitigate flood related impacts. This chapter will look at the region's entities' individual roles, what types of plans are in place to provide the framework that dictate the region's capabilities, and what types of actions can be implemented to promote healthy floodplain management practices.

7.2 The Nature and Types of Flood Response Preparations

Figure 7.1 The Four Phases of Emergency Management

There are four phases to emergency management:

- **Flood Mitigation:** The implementation of actions, including both structural and non-structural solutions, to reduce flood risk to 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 activities.
- **Flood Response:** Actions taken during and in the immediate aftermath of a flood event.
- **Flood Recovery:** Actions taken after a flood event involving repairs or other actions necessary to return to pre-event conditions.

For example, when a severe rain event is projected to occur, steps are taken for **preparedness**: disaster preparedness plans are reviewed, drills and exercises are performed, an essential supply list is created, and potential vulnerabilities are assessed. During the **response** phase, disaster plans are implemented, search and rescues may occur, and low water crossing signs may be erected. In the **recovery** phase, evaluation of flood damage, rebuilding damaged structures, and removing debris occurs. The most important step of the four phases of emergency management is **mitigation**.

Hazard Mitigation is defined as any sustained action taken to reduce or eliminate the lasting risk to life and property from hazard events. It is an on-going process that occurs before, during, and after disasters and seeks to break the cycle of damage and restoration in hazardous areas.

Flood mitigation is the primary focus of the regional flood planning process and plan development efforts regarding identifying and recommending FMEs, FMSs and FMPs by the RFPG. The plan may also include flood preparedness FMEs, FMSs and FMPs.

For example, when a severe rain event is projected to occur, steps are taken for **preparedness**: disaster preparedness plans are in place, drills and exercises are performed, an essential supply list is created, and potential vulnerabilities are assessed. Examples of preparedness actions include installing disaster warning systems, purchasing radio communications equipment, or conducting emergency response training.

During the **response** phase, disaster plans are implemented, search and rescue activities may occur, and/or low water crossing signs may be erected. Response examples include addressing immediate flood needs through actions such as putting close gates at low water crossings, putting up signage on overtopped roads, or using sandbags to divert water.

In the **recovery** phase, evaluation of flood damage occurs. Examples of recovery activities can include comprehensive debris management, rebuilding damaged structures, as well as utilities restoration.

The most important step of the four phases of emergency management is **mitigation**. Examples of mitigation actions include planning and zoning, floodplain protection, property acquisition and relocation, or public outreach projects. Mitigation aids in breaking the cycle of damage and repair after flood events.

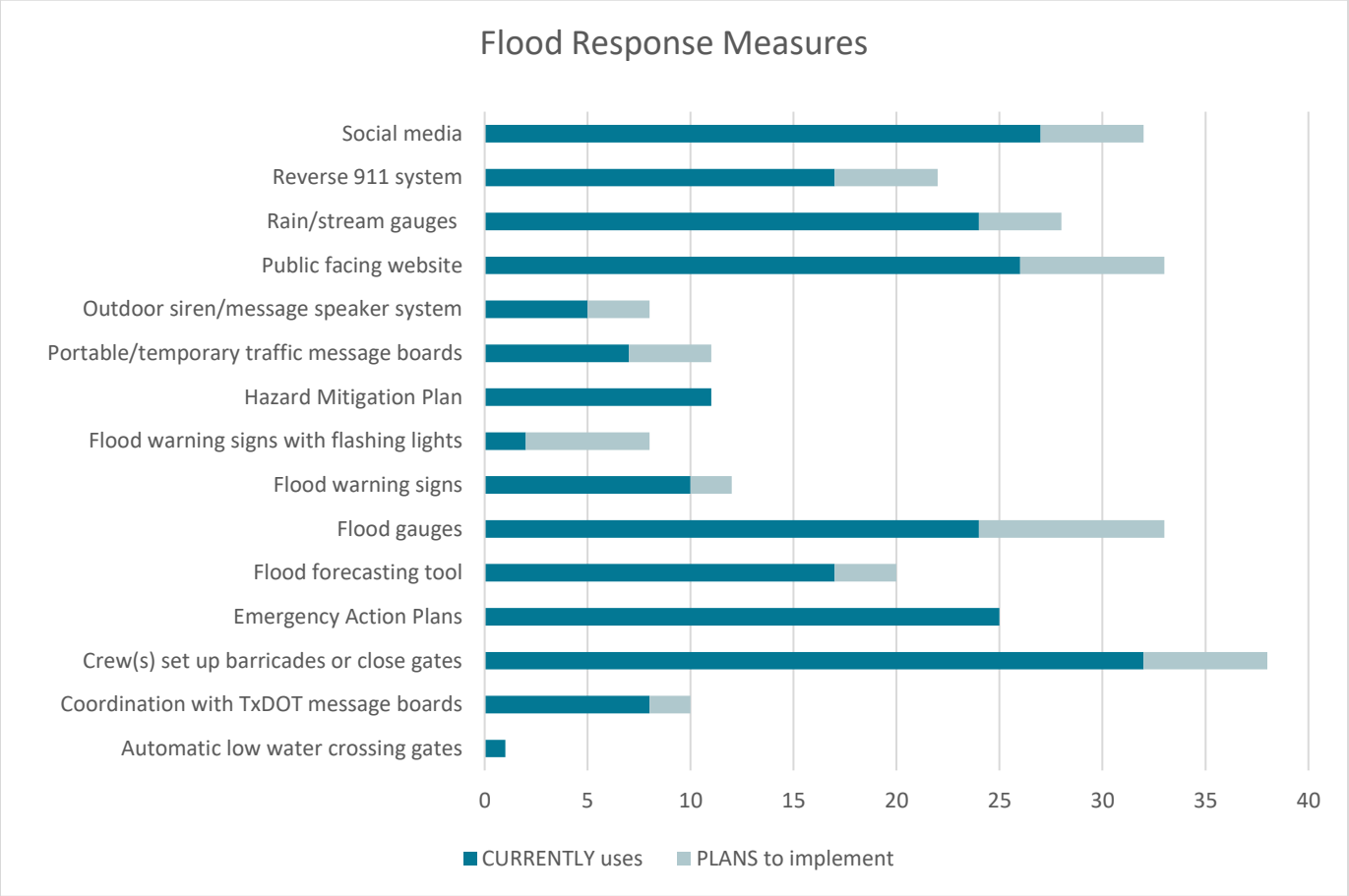
Actions and Preparations:

In evaluating types of actions and projects to implement in the mitigation process, reviewing Hazard Mitigation Plans can be useful. In addition to mitigation, these actions can be implemented to aid in the region's preparedness, response, and recovery capabilities.- Below are Mitigation Actions taken from Hazard Mitigation Action Plans in the Lower Brazos region:

- Buyout/Acquisition/Elevation projects
- Drainage Control & Maintenance
- Education & Awareness for Citizens
- Equipment Procurement for Response
- Erosion Control Measures
- Flood Insurance Education
- Flood Study/Assessment
- Infrastructure Improvement
- Installation/Procurement of Generators
- Natural Planning Improvement
- Outreach and Community Engagement
- Technology Improvement
- Urban Planning and Maintenance

Many of the flood response measures listed above align with data received from the Lower Brazos Stakeholder survey shown in **Figure 7.2**. Data from the survey indicated that several of the types of actions or measures listed were in place or planned for implementation in the next 5 years. These actions include obtaining and utilizing flood warning signs, implementing the reverse 911 system, utilizing a public facing website, mobilizing crews to set up barricades or close gates, applying social media engagement, creating Emergency Action Plans, and obtaining and utilizing flood gauges.

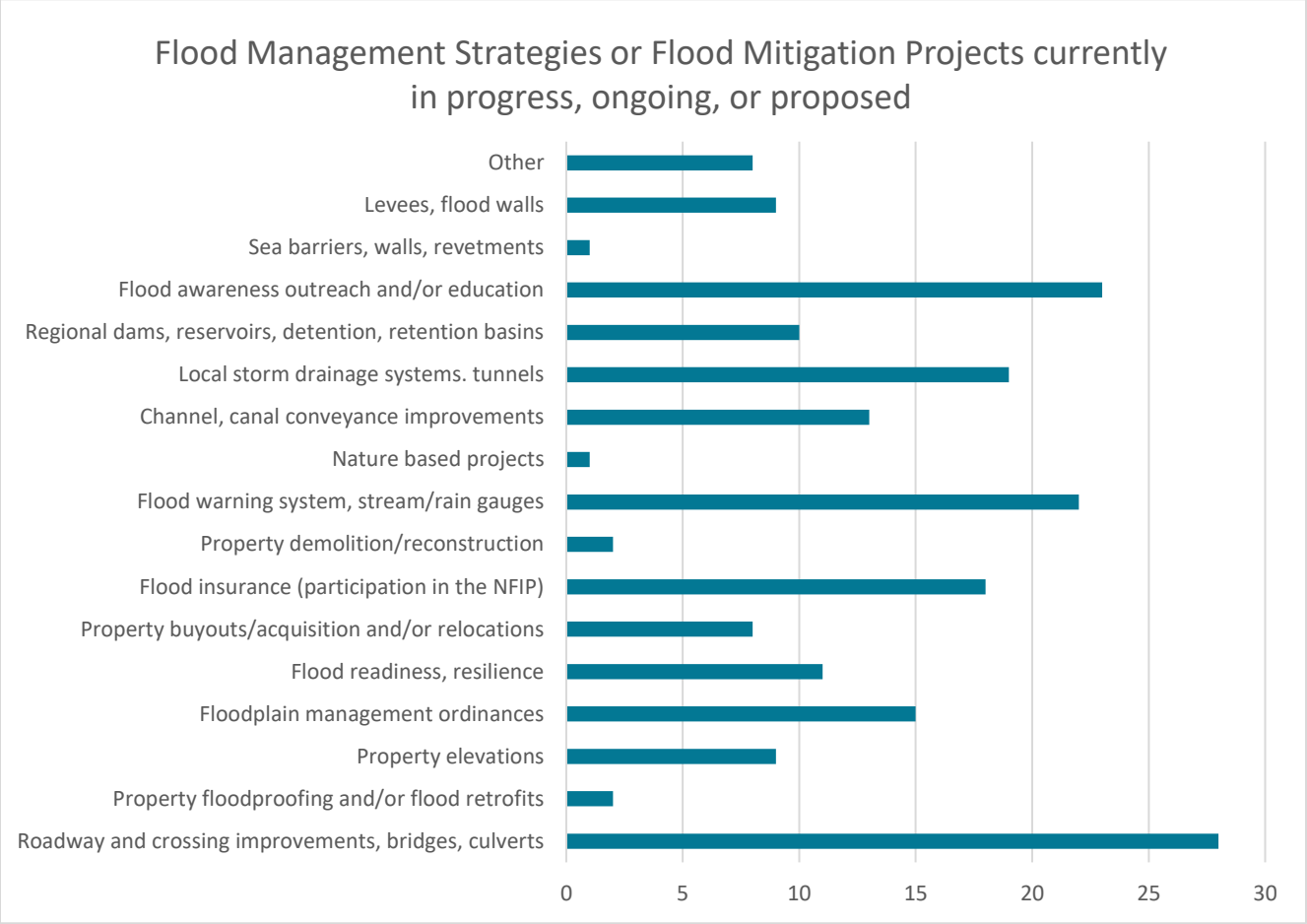
Figure 7.2 Lower Brazos Flood Response Measures



Source: Lower Brazos Stakeholder Survey

Per responses from the Lower Brazos Stakeholder survey, the top current, ongoing, or proposed projects include several roadway and crossing improvements such as bridges and culverts as well as significant flood awareness outreach and education efforts. Additional efforts include developing flood warning systems and implementing the use of stream and rain gauges.

Figure 7.3 Flood Management Strategies and Flood Mitigation Projects



Source: Lower Brazos Stakeholder Survey

Many of these mitigation and preparatory actions are done in conjunction with the relevant entities who put these actions into practice. The entities below are responsible for implementing flood preparedness, flood response, and flood recovery actions.

7.3 Relevant Entities in the Region

The purpose of flood risk management is to help prevent or reduce flood risk by using either structural or non-structural means or a combination of the two. Responsibility for flood risk management is shared between Federal, State, and local government agencies; private-sector stakeholders; and the general public. The various stakeholders that were contacted to provide data via the Lower Brazos Stakeholder survey were listed: Cities, Counties, Councils of Government (COGs), Districts such as MUDs, SUDs, etc., and State and Federal Agencies. Listed below are the various contributing entities and partners.

Ag Extension Agents are employed by land-grant universities and serve the citizens 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 Lower Brazos region has a significant agricultural footprint including farming, forestry, and ranching making working closely with Ag Extension Agents crucial to prevent losses.

- **Cities**, or Municipalities, generally take responsibility for parks and recreation services, police and fire departments, housing services, emergency medical services, municipal courts, transportation services (including public transportation), and public works (streets, sewers, snow removal, signage, and so forth). There are 178 municipalities within the Lower Brazos region.

- The major responsibilities of the 44 Lower Brazos region **County** governments include providing public safety and justice, holding elections at every level of government, maintaining Texans' most important records, building and maintaining roads, bridges and in some cases, county airports, providing emergency management services, providing health and safety services, collecting property taxes for the county and sometimes for other taxing entities, issuing vehicle registration and transfers, and registering voters.

- The eight regional **Councils of Governments (COGs)** in the Lower Brazos region are voluntary associations that represent member 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. COGs can serve a resource for flood data, flood planning, and flood management.
  Three Lower Brazos region COGS including the Capital Area Council of Governments, Central Texas Council of Governments, and Houston-Galveston Area Council received Community Development Block Grants for Disaster Recovery (CDBG-DR) allocated by the U.S. Department of Housing and Urban Development (HUD) for Hurricane Harvey housing recovery assistance. These funds are for housing, infrastructure, and planning through state and local programs.

- In a portion of the Lower Brazos Region as part of the North Central Texas Council of Governments (NCTCOG), is the **Public Works Emergency Response Team** (PWERT). This team was created to prove aid during an emergency or disaster when local public works is overwhelmed.

- The mission of the **Texas Water Development Board (TWDB)** is to lead the state's efforts in ensuring a secure water future for Texas and its citizens**.** TWDB provides water planning, data collection and dissemination, financial assistance, and technical assistance services to the citizens of Texas. TWDB is statutorily responsible for administering the regional water planning process and preparing and adopting the state water plan every five years. Additionally, TWDB offers a variety of cost-effective loan and grant programs that provide for the planning, acquisition, design, and construction of water related infrastructure and other water quality improvements

- The **Federal Emergency Management Agency** (**FEMA**) is an agency of the United States Department of Homeland Security (DHS), initially created in 1977. 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 to respond to disasters. The agency provides funding for rebuilding efforts and relief funds for infrastructure by directing individuals to access low-interest loans. 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.
- A **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.

- **Dams and Levees** are owned and operated by individuals, private and public organizations, and the government. The responsibility for maintaining a safe dam rests with the owner. A dam failure resulting in an uncontrolled release of the reservoir can have a devastating effect on persons and property downstream. It is critical that the owners are part of the flood planning process to ensure collaborative and cohesive flood planning.

- The **National Weather Service (NWS)** mission is to provide 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.
    - Flash Flood WATCH is issued when conditions look favorable for flash flooding. A watch usually encompasses several counties. Action plans should be considered at this stage should water begin to rise.
    - Flash Flood WARNING is issued when dangerous flash flooding is happening or will happen soon. A warning is usually a smaller, more specific area. This can be issued due to excessive heavy rain or a dam/levee failure. Preparations must be made to act quickly as flood waters may rise rapidly.
    - Flash Flood EMERGENCY is issued for the exceedingly rare situations when extremely heavy rain is leading to a severe threat to human life and catastrophic damage from a flash flood is happening or will happen soon. Typically, emergency officials are reporting life threatening water rises resulting in water rescues/evacuations.

- 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 potentially 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. NOAA's Office of Coastal Management plays a key role in providing information, technology, and flood management strategies.

- The **General Land Office (GLO)** is the oldest state agency in Texas. The GLO manages state lands, operates the Alamo, helps Texans recovering from natural disasters, helps fund Texas public education through the Permanent School Fund, provides benefits to Texas Veterans, and

manages the vast Texas coast. GLO, through the Community Development and Revitalization division, aids communities in rebuilding, restoring critical infrastructure, and mitigating future damage through resilient community planning. The GLO administers both Community Development Block Grant Disaster Recovery (CDBG-DR) and Mitigation (CDBG-MIT) funds from the U.S. Department of Housing and Urban Development (HUD) on behalf of the state of Texas. These funds are key elements in recovery and mitigation in the Lower Brazos region.

- **River Authorities or Districts** are public agencies established by the state legislature and given authority to develop and manage the waters of the state within their jurisdictional area. Lower Brazos has seven River Authorities within its region that each have the power to conserve, store, control, preserve, utilize, and distribute the waters of a designated geographic region for the benefit of the public. The largest River Authority in the region is the Brazos River Authority, with the Trinity River Authority, San Jacinto River Authority, Red River Authority, North Harris County Region Water Authority, North Fort Bend Water Authority, and the Lower Colorado River Authority accounting for small geographical areas.

- Daily river forecasts are issued by the thirteen **River Forecast Centers (RFCs)** using hydrologic models based on rainfall, soil characteristics, precipitation forecasts, and several other variables. Some RFCs, especially those in mountainous regions, also provide seasonal snowpack and peak flow forecasts. 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 **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.

  TDEM's Recovery and Mitigation divisions work closely with local jurisdictions, state agencies, and federal partners to ensure Texans successfully navigate recovery processes and become more resilient for future disasters. The Disaster Recovery Task Force was created to assist jurisdictions that have been impacted by an emergency or disaster, to recover more efficiently by starting the recovery process early in the response phase.

  There are six TDEM regions within Texas each with are 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 Lower Brazos region is mostly in TDEM Region 6 with some counties in Regions 1, 2, and 5.

Figure 7.4 Texas Department of Emergency Management Regions

- The **Texas Department of Transportation** (**TxDOT**) is a government agency in the state of Texas. Though the public face of the agency is generally associated with the construction and maintenance of the state's 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. Users can access this data through TxDOT's Drive Texas website: https://drivetexas.org.

- **Texas Public Works Emergency Response Council** serves as a Statewide database of response assets available for response as requested to man-made and natural disasters thru mutual aid. They serve to support and promote statewide emergency preparedness, disaster response, mutual aid assistance and training for Public Works Agencies and seeks to provide a system allowing jurisdictions impacted by disaster to request assistance through a standardized process.

- **Texas Association of Regional Councils** assist state and federal partners by coordinating and improving regional homeland security preparedness, planning and response activities across jurisdictional boundaries. The Texas Department of Emergency Management works with the regional councils to ensure that all regional and local emergency plans are up-to-date and compliant with Texas Government Code. Regional councils also work with TDEM in the event of a disaster within their region to access state resources in a timely manner.

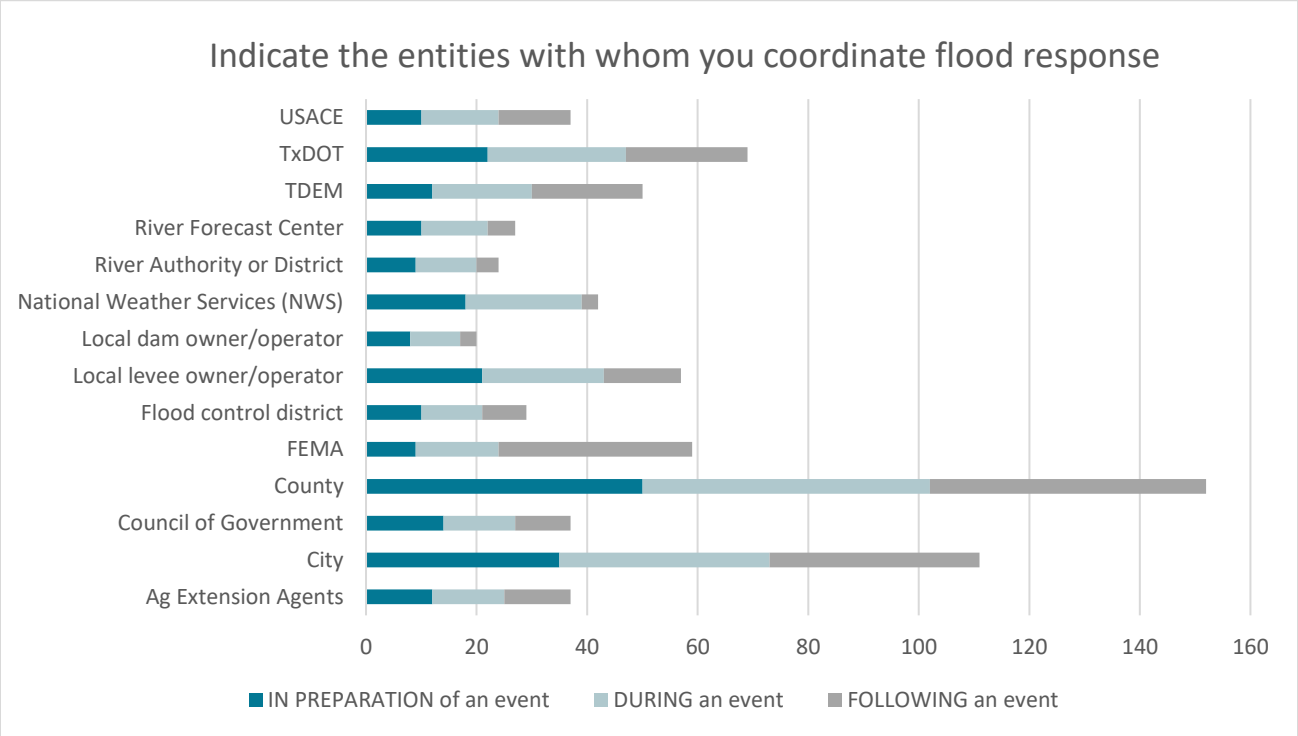
- The **U.S. Army Corps of Engineers (USACE)** is an important part of the nation's military. The agency is responsible for a wide range of efforts in the United States including addressing safety issues related to waterways, dams, and canals but also environmental protection, emergency relief, hydroelectric power, and much more. USACE owns and operates several large flood

control reservoirs in the Lower Brazos region. USACE is composed of several divisions with the Lower Brazos region being in the Southwest Division and the Galveston and Fort Worth Districts.

The USACE Flood Risk Management Program (FRMP) works across the agency to focus the policies, programs and expertise of USACE toward reducing overall flood risk. This includes the appropriate use and resiliency of structures such as levees and floodwalls, as well as promoting alternatives when other approaches (e.g., land acquisition, flood proofing, etc.) reduce the risk of loss of life, reduce long-term economic damages to the public and private sector, and improve the natural environment.

In the Lower Brazos basin, coordination with many of the entities listed above is essential before, during, and after a flood event. As indicated by the Lower Brazos Stakeholder survey in **Figure 7.5**, the entities in which coordination is most important at each stage in a flood event are as follows: County, City, TDEM, TxDOT, and levee owner/operators with all other entities accounting for much smaller responses.

Figure 7.5 Lower Brazos Coordinating Entities



Source: Lower Brazos Stakeholder Survey

Emergency Information

There are various means by which data can be collected and disseminated in a flood event. They can include gathering data via rain and stream gauge instruments and sending out emergency flood information through text messages or recorded messaging.

Two types of gauges used are rain gauges and stream gauges. A rain gauge is a meteorological instrument to measure precipitation in a given amount of time. Stream gauging is a technique used to measure the discharge, or the volume of water per unit time, of a stream at a particular location. The height of water in the stream channel, known as a stage or gauge height, can be used to determine the discharge in a stream.

In addition to the National Weather Service, local news stations or radio stations are vital components in relaying real time information of inclement weather and flooding to local residents. They can also alert residents to low water crossing closings, dam or levee breaches, and other potential dangers. They can also flood watches, warnings, and emergency notifications.

An Emergency Notification System is software that provides alert messages during an emergency. Messages can interrupt radio and television to broadcast emergency alert information. Messages cover a large geographic footprint including the entirety of the Lower Brazos region. Emergency message audio/text may be repeated twice, but EAS activation interrupts programming only once, then regular programming continues.

A reverse 911 system allows an agency to pull up a map on a computer, define an area and send off a recorded phone message to each business or residence in that area. It can provide data to residents of flood dangers in their area.

School emergency alert systems are tools that allow schools to communicate quickly to staff, students, first responders and others so that they can take appropriate action in the event of an emergency situation. Various versions this tool are used in schools through the region from daycares to K-12 grade, as well as universities. Messages may include important announcements about school events or emergency situations, such as inclement weather and local flooding.

7.4 Plans to be Considered

State and Regional Plans

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. As with Regional Hazard Mitigation Plans, the State Hazard Mitigation Plan is to be updated every 5 years and is currently in the process of being updated. This new cycle with also update the Plan to be an Enhanced State Hazard Mitigation Plan through demonstrating that the state of Texas has developed a comprehensive mitigation program, effectively uses available mitigation funding, and that it can manage the increased funding.

The State Hazard Mitigation 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:

- Assesses hazard risk.
- Reviews current state and local hazard mitigation and climate adaption capabilities.
- Develops strategies and identifies state agencies (and other entities) potential actions to address needs.

The Regional Emergency Preparedness Program is one of the largest and most effective programs of its kind nationwide. Bringing together urban, suburban, and rural jurisdictions, the program facilitates information sharing, collaboration, and cooperation between jurisdictions in a politically neutral and supportive environment. The Regional Preparedness Program accomplishes this through networking, standardization of policy and procedures, and coordination efforts with stakeholders.

Local Plans

In 2021 the Lower Brazos 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. 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 Lower Brazos 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 HMAP is key in assessing risk and in developing mitigation actions, or projects. While each of the counties have had a Hazard Mitigation Plan, 20 out of 30 county plan and one COG plan are currently approved by FEMA, as they are to be updated on a 5 year cycle. Five plans are in the process of being updated with one plan approvable pending adoption, and 5 counties with expired plans.

Figure 7.6 Lower Brazos Region Hazard Mitigation Plans Statuses

Jurisdiction	HMAP Status
Archer County	Plan Approved
Austin County	Plan Approved
Bastrop County	Plan in Progress
Bosque County	Plan Approved
Brazoria County	Plan in Progress
Brazos County	Plan Approved
Burleson County	Approvable Pending Adoption
Burnet County	Plan Expired
Central Texas Council of Governments (CTCOG)	Plan Approved
Erath County	Plan Approved
Falls County	Plan Approved
Fort Bend County	Plan Approved
Freestone County	Plan Approved
Grimes County	Plan in Progress
Hill County	Plan Approved
Hood County	Plan Approved
Jack County	Plan Approved
Johnson County	Plan in Progress
Lampasas County	Plan Expired
Lee County	Plan Expired
Leon County	Plan Approved
Limestone County	Plan Approved
Madison County	Plan Expired
Palo Pinto County	Plan Approved
Parker County	Plan Approved
Robertson County	Plan Approved
Somervell County	Plan in Progress
Waller County	Plan Approved
Washington County	Plan Approved
Williamson County	Plan Expired
Young County	Plan Approved

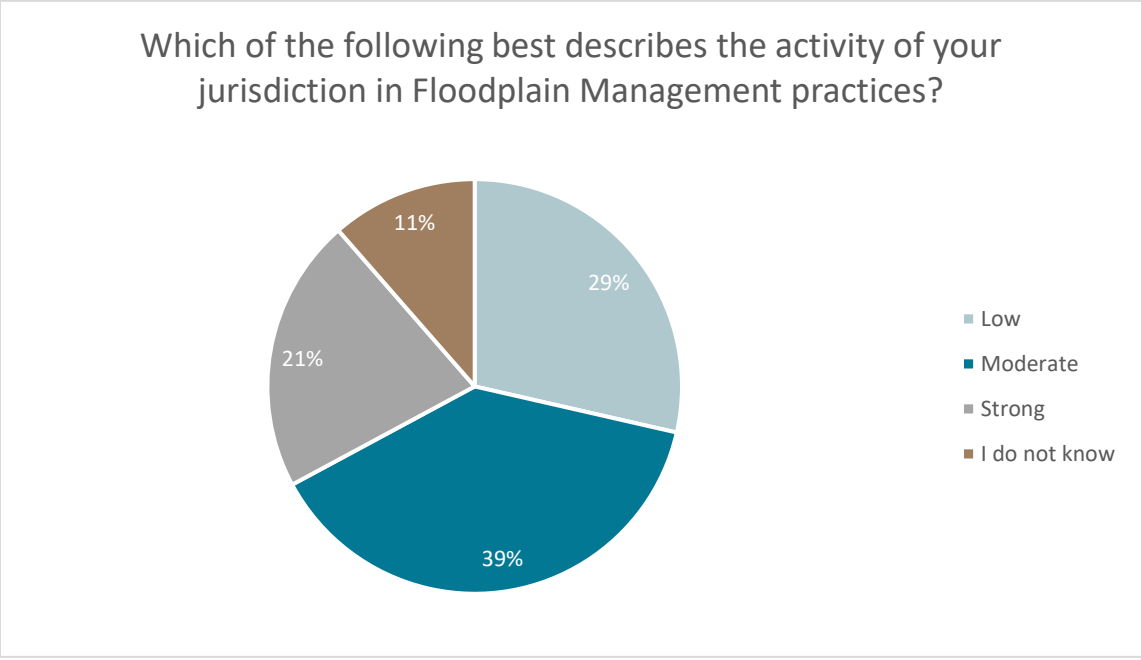
Hazard mitigation planning reduces loss of life and property by minimizing the impact of disasters. It begins with state, tribal, and local governments identifying natural disaster risks and vulnerabilities that are common in their area. After identifying these risks, they develop long-term strategies for protecting people and property from similar events. Mitigation plans are key to breaking the cycle of disaster damage and reconstruction.

In the private sector, an emergency action plan (EAP) is document required by the Occupational Safety and Health Administration (OSHA) standards. The purpose of an EAP is to facilitate and organize employer and employee actions during workplace emergencies. They are an essential element in emergency management for critical facilities. EAPs for dams are essential in identifying potential emergency conditions and specifying preplanned actions to be followed to minimize property damage and loss of life.

A watershed master plan helps in the understanding and address existing flooding, erosion, and water quality problems. It can be useful in preparing for future challenges and in addressing existing flood prone areas. Watershed Master Plans help educate the public and influence decision makers regarding land use changes, investment in capital projects and modifications to development regulations within the basin.

When asked which of the following best describes the activity of each respective jurisdiction in Floodplain Management practices, only 21% of survey respondents indicated that their jurisdiction maintained strong practices. Per **Figure 7.7**, there are improvements to be made to floodplain management practices. Improvements to these practices can be implemented at all four phases of emergency management.

Figure 7.7 Lower Brazos Floodplain Management Practices



Source: Lower Brazos Stakeholder Survey

Aligning common goals and objectives in the region can facilitate the efficacy of plans and actions taken. Having more robust floodplain practices both in local jurisdictions and regionally creates more robust flood mitigation approach and promotes good floodplain management practices.

The Lower Brazos region's ability to prepare, respond, recover, and mitigate disaster events is determined by several factors. Creating plans that establish the region's ability to implement the four phases of flood management, coordinating with the necessary entities in preparation of, during, and in the aftermath of an event, and acknowledgement of the actions sustained to promote resiliency are all key elements in creating and maintaining good floodplain management practices.