GUADALUPE COUNTY
HAZARD MITIGATION ACTION PLAN

DRAFT 2021

Maintaining a Safe, Secure, and Sustainable Community

H2O PARTNERS

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SECTION 1 – INTRODUCTION

SECTION 2 – PLANNING PROCESS

SECTION 3 – COUNTY PROFILE

SECTION 4 – RISK OVERVIEW

SECTION 5 – FLOOD

SECTION 6 – DAM AND LEVEE FAILURE

SECTION 7 – THUNDERSTORM WIND

SECTION 8 – LIGHTNING

SECTION 9 – DROUGHT

SECTION 10 – EXTREME HEAT

SECTION 11 – HAIL

SECTION 12 – TORNADO

SECTION 13 – WILDFIRE

SECTION 14 – WINTER STORM

SECTION 15 – HURRICANE WIND

SECTION 16 – EARTHQUAKE

SECTION 17 – MITIGATION STRATEGY

SECTION 18 – MITIGATION ACTIONS

SECTION 19 – PLAN MAINTENANCE

SECTION 1: INTRODUCTION

BACKGROUND

Guadalupe County is located ninety miles inland from the Gulf of Mexico in south central Texas. It is bounded by Comal, Hays, Caldwell, Gonzales, Wilson, and Bexar counties. The City of Seguin is the county seat and largest city.

Texas is prone to extremely heavy rains and flooding, holding half of the world-record rainfall rates (48 hours or less).[1] While flooding is a well-known risk, Guadalupe County is susceptible to a wide range of natural hazards, including but not limited to: extreme heat, tornadoes, hail, and wildfires. These life-threatening hazards can destroy property, disrupt the economy, and lower the overall quality of life for individuals.

While it is impossible to prevent an event from occurring, the effects from many hazards to people and property can be lessened. 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) is required to review the plan before the plan is sent to FEMA for review and final approval in accordance with the Disaster Mitigation Act of 2000.

Hazard mitigation activities are an investment in a community's safety and sustainability. It is widely accepted that the most effective hazard mitigation measures are implemented at the local government level, where decisions on the regulation and control of development are ultimately made. A comprehensive review to a hazard mitigation plan addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore, it is essential that a plan identifies projected patterns of how future development will increase or decrease a community's overall hazard vulnerability.

SCOPE AND PARTICIPATION

Guadalupe County's 2021 Plan is a multi-jurisdictional plan. The participating jurisdictions include Guadalupe County, the City of Cibolo, and the City of Seguin. These jurisdictions provided valuable input into the planning process. Throughout the plan, "Guadalupe County planning area" refers to the entire planning area including all participating jurisdictions. Similarly, the term "county-wide" refers to the entire planning area including all participating jurisdictions.

[1] http://floodsafety.com/texas/regional_info/regional_info/austin_zone.htm
[2] http://www.fema.gov/hazard-mitigation-planning-resources

SECTION 1: INTRODUCTION

The focus of the 2021 Plan is to identify activities to mitigate hazards classified as "high" or "moderate" risk, as determined through a detailed hazard risk assessment conducted for Guadalupe County and the participating jurisdictions. The hazard classification enables the participating jurisdictions to prioritize mitigation actions based on hazards which can present the greatest risk to lives and property in the geographic scope (i.e. planning area).

PURPOSE

The 2021 Plan was prepared by Guadalupe County, participating jurisdictions, and H2O Partners, Inc. The purpose of the Plan is to protect people and structures, and to minimize the costs of disaster response and recovery. The goal of the Plan is to minimize or eliminate long-term risks to human life and property from known hazards, by identifying and implementing cost-effective hazard mitigation actions. The planning process is an opportunity for Guadalupe County, stakeholders, and the general public to evaluate and develop successful hazard mitigation actions, reducing the future risk of fatalities and property damage resulting from a disaster in the planning area.

The Mission Statement of the Plan is: "*Maintaining a secure and sustainable future through the revision and development of targeted hazard mitigation actions to protect life and property.*"

Participating jurisdictions within Guadalupe County and planning participants identified 12 natural hazards to be addressed by the Plan. The specific goals of the Plan are to:

- Minimize disruption to participating jurisdictions within Guadalupe County following a disaster;
- Streamline disaster recovery by articulating actions to be taken before a disaster strikes in order to reduce or eliminate future damage;
- Demonstrate a firm local commitment to hazard mitigation principles;
- Serve as a basis for future funding that may become available through grant and technical assistance programs offered by the State or Federal government. The Plan will enable participating jurisdictions within Guadalupe County to take advantage of rapidly developing mitigation grant opportunities as they arise; and
- Ensure that participating jurisdictions within Guadalupe County maintain eligibility for the full range of future Federal disaster relief.

AUTHORITY

The Plan is tailored specifically for participating jurisdictions within Guadalupe County, and plan participants including Planning Team members, stakeholders, and the general public who participated in the Plan development process. The Plan complies with all requirements promulgated by the Texas Division of Emergency Management (TDEM), 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). Additionally, the Plan complies with the Interim Final Rules for the Hazard Mitigation Planning and Hazard Mitigation Grant Program (44 CFR, Part 201), which specify the criteria for approval of mitigation plans

required in Section 322 of the DMA 2000 and standards found in FEMA's "Local Mitigation Plan Review Guide" (October 2011) and the "Local Mitigation Planning Handbook" (March 2013). Additionally, the Plan is developed in accordance with FEMA's Community Rating System (CRS) Floodplain Management Plan standards and policies.

SUMMARY OF SECTIONS

Sections 1 and 2 of the Plan outline the Plan's purpose and development, including how Planning Team members, stakeholders, and members of the general public were involved in the planning process. Section 3 profiles the planning area's population and economy.

Sections 4 through 16 present a hazard overview and information on individual natural hazards in the planning area. The hazards generally appear in order of priority based on potential losses to life and property and other community concerns. For each hazard, the Plan presents a description of the hazard, a list of historical hazard events, and the results of the vulnerability and risk assessment process.

Section 17 presents hazard mitigation goals and objectives. Section 18 presents hazard mitigation actions for Guadalupe County and the participating jurisdictions. Section 19 identifies Plan maintenance mechanisms.

A list of Planning Team members is located in Appendix A. Public survey results are analyzed and presented in Appendix B. Appendix C contains a detailed list of critical facilities for the planning area, and Appendix D is dam locations. Appendix E contains information regarding workshops, including meeting documentation. Capability Assessment results for participating jurisdictions within Guadalupe County are located in Appendix F.[3]

[3] Information contained in some of these appendices are exempt from public release under the Freedom of Information Act (FOIA).

SECTION 2: PLANNING PROCESS

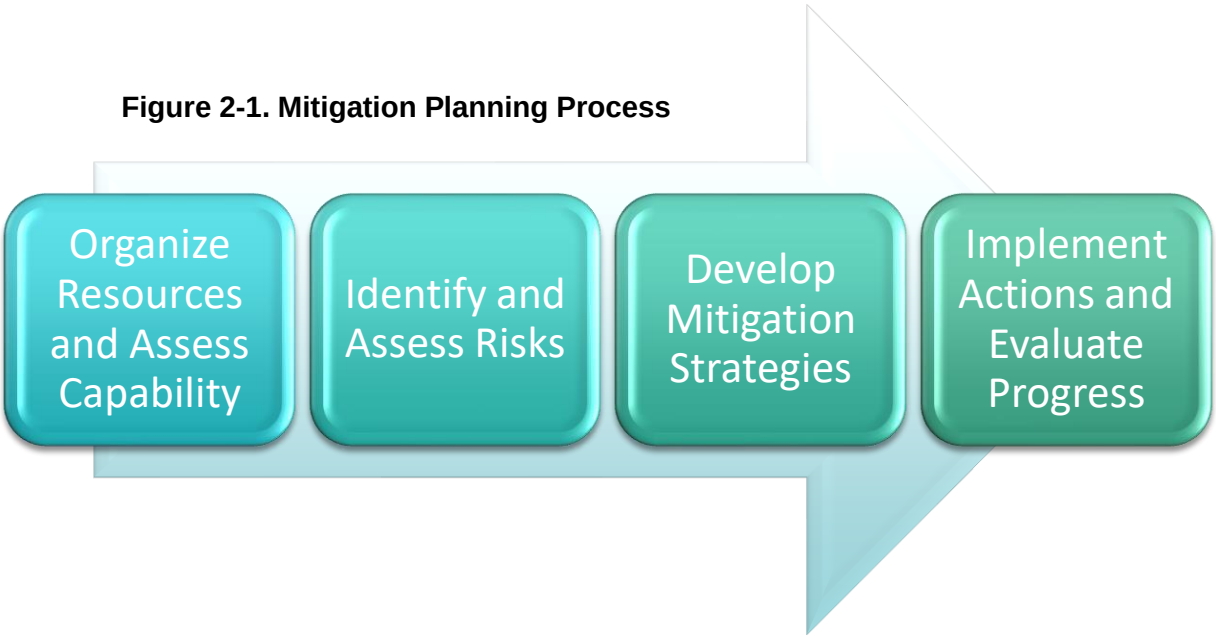
PLAN PREPARATION AND DEVELOPMENT

Hazard mitigation planning involves coordination with various constituents and stakeholders to develop a more disaster-resistant community. Section 2 provides an overview of the planning process, including the identification of key steps and a detailed description of how stakeholders and the public were involved.

OVERVIEW OF THE PLAN

Guadalupe County hired H2O Partners, Inc. (Consultant Team), to provide technical support and oversee the development of the 2021 Plan. The Consultant Team used the Federal Emergency Management Agency's (FEMA) "Local Mitigation Plan Review Guide" (October 1, 2011) and the "Local Mitigation Planning Handbook" (March 2013) to develop the Plan. The overall planning process is shown in Figure 2-1 below.

Figure 2-1. Mitigation Planning Process



Participating jurisdictions within Guadalupe County and the Consultant Team met in June 2020 to begin organizing resources, identifying Planning Team members, and conducting a Capability Assessment.

PLANNING TEAM

Key members of H2O Partners, Inc. developed the Plan in conjunction with the Planning Team. The Planning Team was established using a direct representation model. Some of the responsibilities of the Planning Team included: completing Capability Assessment surveys, providing input regarding the identification of hazards, identifying mitigation goals, and developing mitigation strategies. As shown in Table 2-1, an Executive Planning Team consisting of key personnel from each of the participating jurisdictions within Guadalupe County to coordinate planning efforts and request input and participation in the planning process. Table 2-2 reflects the Advisory Planning Team, consisting of additional representatives from the participating jurisdictions within Guadalupe County that participated throughout the planning process.

Table 2-1. Executive Planning Team

DEPARTMENT	TITLE
Guadalupe County	Assistant Fire Marshal / EMC
Guadalupe County	Fire Marshal / EMC
Guadalupe County	County Judge
City of Cibolo	Chief of Police
City of Cibolo	City Manager
City of Seguin	City Manager

Table 2-2. Advisory Planning Team

DEPARTMENT	TITLE
Guadalupe County	Environmental Health Director
Guadalupe County	Assistant Floodplain Manager (1)
Guadalupe County	Assistant Floodplain Manager (2)
Guadalupe County	Road and Bridge Administrator
Guadalupe County	Emergency Management Program Specialist
City of Cibolo	City Manager's Office
City of Cibolo	Finance Department Director
City of Cibolo	Fire Chief
City of Cibolo	Fire Department Lieutenant
City of Cibolo	Fire Department
City of Cibolo	Director of Planning and Engineering
City of Cibolo	Police Department (1)
City of Cibolo	Police Department (2)
City of Cibolo	Director of Public Works
City of Cibolo	Public Works
City of Seguin	Assistant City Manager
City of Seguin	City Engineer
City of Seguin	Planning Director
City of Seguin	Assistant Planning Director
City of Seguin	Floodplain Manager
City of Seguin	Water / Wastewater Director
City of Seguin	Electric Department Director
City of Seguin	Police Chief
City of Seguin	Fire Chief
City of Seguin	Fire Department
City of Seguin	Fire Marshal

DEPARTMENT	TITLE
City of Seguin	Public Works Director

Additionally, a Stakeholder Group was invited to participate in the planning process via e-mail. The Consultant Team, Planning Team, and Stakeholder Group coordinated to identify mitigation goals and develop mitigation strategies and actions for the Plan. Appendix A provides a complete listing of all participating Planning Team members and stakeholders by organization and title.

Based on results of the completed Capability Assessment, participating jurisdictions within Guadalupe County described methods for achieving future hazard mitigation measures by expanding existing capabilities. For example, the City of Seguin will use this plan as a guiding document when new ordinances or programs are considered, where there are hazards identified. Other options for improving capabilities include the following:

- Establishing Planning Team members with the authority to monitor the Plan and identify grant funding opportunities for expanding staff.
- Identifying opportunities for cross-training or increasing the technical expertise of staff by attending free training available through FEMA and the Texas Division of Emergency Management (TDEM), and by monitoring classes and availability through preparingtexas.org.
- Reviewing current floodplain ordinances for opportunities to increase resiliency, (above current standards) such as modifying permitting or building codes.
- Developing ordinances that will require all new developments to conform to the higher mitigation standards, exceeding current requirements.

Sample hazard mitigation actions developed with similar hazard risk were shared at the meetings. These important discussions resulted in development of multiple mitigation actions that are included in the Plan to further mitigate risk from natural hazards in the future.

The Planning Team developed hazard mitigation actions for mitigating risk from potential flooding and wildfires; these actions include upgrading undersized stormwater drains and culverts, as well as implementing a fuels reduction program. The Plan also includes an action to install generators at critical facilities to ensure continuity of operations after a hazard event.

PLANNING PROCESS

The process used to prepare the 2021 Plan followed the four major steps included in Figure 2-1. After the Planning Team was organized, a capability assessment was developed and distributed at the Kick-Off Workshop. Hazards were identified and assessed, and results associated with each of the hazards were provided at the Risk Assessment Workshop. Based on Guadalupe County's identified vulnerabilities, specific mitigation strategies were discussed and developed at the Mitigation Strategy Workshop. Finally, Plan maintenance and implementation procedures were developed and are included in Section 19. Participation of Planning Team members, stakeholders, and the public at each of the workshops is documented in Appendix E.

At the Plan development workshops held throughout the planning process described herein, the following factors were taken into consideration:

- The nature and magnitude of risks currently affecting the community;

- Hazard mitigation goals to address current and expected conditions;
- Whether current resources will be sufficient for implementing the Plan;
- Implementation problems, such as technical, political, legal, and coordination issues that may hinder development;
- Anticipated outcomes; and
- How participating jurisdictions within Guadalupe County, agencies, and partners will participate in implementing the Plan.

KICKOFF WORKSHOP

The Kickoff Workshop was held at the Guadalupe County Courthouse on June 29, 2020. The initial workshop informed participating officials and key department personnel about how the planning process pertained to their distinct roles and responsibilities, and engaged stakeholder groups such as surrounding Cities and ISDs. In addition to the kickoff presentation, participants received the following information:

- Project overview regarding the planning process;
- Public survey access information;
- Hazard Ranking form; and
- Capability Assessment survey for completion.

A risk ranking exercise was conducted at the Kickoff Workshop to get input from the Planning Team and stakeholders pertaining to various risks from a list of natural hazards affecting the planning area. Participants ranked hazards from high to low in terms of perceived level of risk, frequency of occurrence, and potential impact.

HAZARD IDENTIFICATION

At the Kickoff Workshop and through e-mail and phone correspondence, the Planning Team conducted preliminary hazard identification. In coordination with the Consultant Team, the Planning Team reviewed and considered a full range of natural hazards. Once identified, the teams narrowed the list to significant hazards by reviewing hazards affecting the area as a whole, the 2018 State of Texas Hazard Mitigation Plan Update, and initial study results from reputable sources such as federal and state agencies. Based on this initial analysis, the teams identified a total of 12 natural hazards which pose a significant threat to the planning area.

RISK ASSESSMENT

An initial risk assessment for participating jurisdictions within Guadalupe County was completed in September 2020 and results were presented to Planning Team members at the Risk Assessment / Mitigation Strategy Workshop held on September 22, 2020. At the workshop, the characteristics and consequences of each hazard were evaluated to determine the extent to which the planning area would be affected in terms of potential danger to property and citizens.

Potential dollar losses from each hazard were estimated using NOAA's National Centers for Environmental Information (NCEI). The damages given are for property and crop damage. The resulting risk assessment profiled hazard events, provided information on previous occurrences, estimated probability of future events, and detailed the spatial extent and magnitude of impact on people and property. Each participant at the Risk Assessment Workshop was provided a risk ranking sheet that asked participants to rank hazards in terms of the probability or frequency of

occurrence, extent of spatial impact, and the magnitude of impact. The results of the ranking sheets identified unique perspectives on varied risks throughout the planning area.

The assessments were also used to set priorities for hazard mitigation actions based on potential loss of life and dollar losses. A hazard profile and vulnerability analysis for each of the hazards can be found in Sections 4 through 16.

MITIGATION REVIEW AND DEVELOPMENT

Developing the Mitigation Strategy for the Plan involved identifying mitigation goals and new mitigation actions. A Risk Assessment / Mitigation Strategy Workshop was held on September 22, 2020. In addition to the Planning Team, stakeholder groups were invited to attend the workshop. Regarding hazard mitigation actions, Workshop participants emphasized the desire for actions that addressed flood and wildfire hazards. Additionally, participating jurisdictions were proactive in identifying mitigation actions to lessen the risk of all the identified hazards included in the Plan.

An inclusive and structured process was used to develop and prioritize new hazard mitigation actions for the 2021 Plan. The prioritization method was based on FEMA's STAPLE(E) criteria and included social, technical, administrative, political, legal, economic, and environmental considerations. As a result, each Planning Team Member assigned an overall priority to each hazard mitigation action. The overall priority of each action is reflected in the hazard mitigation actions found in Section 18.

Planning Team Members then developed action plans identifying proposed actions, costs and benefits, the responsible organization(s), effects on new and existing buildings, implementation schedules, priorities, and potential funding sources.

Specifically, the process involved:

- Listing optional hazard mitigation actions based on information collected from previous plan reviews, studies, and interviews with federal, state, and local officials. Workshop participants reviewed the optional mitigation actions and selected actions that were most applicable to their area of responsibility, cost-effective in reducing risk, easily implemented, and likely to receive institutional and community support.
- Workshop participants inventoried federal and state funding sources that could assist in implementing the proposed hazard mitigation actions. Information was collected, including the program name, authority, purpose of the program, types of assistance and eligible projects, conditions on funding, types of hazards covered, match requirements, application deadlines, and a point of contact.
- Planning Team Members considered the benefits that would result from implementing the hazard mitigation actions compared to the cost of those projects. Although detailed cost-benefit analyses were beyond the scope of the Plan, Planning Team Members utilized economic evaluation as a determining factor between hazard mitigation actions.
- Planning Team Members then selected and prioritized mitigation actions.

Hazard mitigation actions identified in the process were made available to the Planning Team for review. The draft 2021 Plan was posted on County's website, along with the participating jurisdictions' websites, for the general public to review.

REVIEW AND INCORPORATION OF EXISTING PLANS

REVIEW

Background information utilized during the planning process included various studies, plans, reports, and technical information from sources such as 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 Texas Commission on Environmental Quality (TCEQ), the Texas State Data Center, Texas A&M Forest Service, the Texas Division of Emergency Management (TDEM), and local hazard assessments and plans. Section 4 and the hazard-specific sections of the Plan (Sections 5-16) summarize the relevant background information.

Specific background documents, including those from FEMA, provided information on hazard risk, hazard mitigation actions currently being implemented, and potential mitigation actions. Previous hazard events, occurrences, and descriptions were identified through NOAA's National Centers for Environmental Information (NCEI). Results of past hazard events were found through searching the NCEI. The USACE studies were reviewed for their assessment of risk and potential projects in the region. State Data Center documents were used to obtain population projections. The State Demographer webpages were reviewed for population and other projections included in Section 3 of the Plan. Information from the Texas A&M Forest Service was used to appropriately rank the wildfire hazard and to help identify potential grant opportunities. Materials from FEMA and TDEM were reviewed for guidance on Plan development requirements.

INCORPORATION OF EXISTING PLANS INTO THE HMAP PROCESS

A Capability Assessment was completed by key department from participating jurisdictions within Guadalupe County and provided information pertaining to existing plans, policies, ordinances, and regulations to be integrated into the goals and objectives of the Plan. The relevant information was included in a master Capability Assessment, Appendix F.

Existing projects and studies were utilized as a starting point for discussing hazard mitigation actions among Planning and Consultant Team members. For example, the City of Cibolo has used the NFIP in development of their Unified Development Code, which impacts their planning and zoning ordinances, future land use maps, capital improvement projects, requirements for developers and project managers, and storm drain management program. Other plans were reviewed, such as Capital Improvements Plans, Comprehensive Land Use Plans, Emergency Operations Plans, and Stormwater Management Plans. Finally, the 2018 State of Texas Mitigation Plan Update, developed by TDEM, was discussed in the initial planning meeting in order to develop a specific group of hazards to address in the planning effort. The 2018 State Plan Update was also used as a guidance document along with FEMA materials in the development of the Guadalupe County Hazard Mitigation Action Plan.

INCORPORATION OF THE HMAP INTO OTHER PLANNING MECHANISMS

Planning Team members will integrate implementation of the Plan with other planning mechanisms for Guadalupe County, such as the Emergency Operations Plan and Continuity of Operations plan. Existing plans for participating jurisdictions will be reviewed and incorporated into the Plan as appropriate. This section discusses how the Plan will be implemented by the participating jurisdictions within Guadalupe County. It also addresses how the Plan will be

evaluated and improved over time, and how the public will continue to be involved in the hazard mitigation planning process.

Participating jurisdictions within Guadalupe County will be responsible for implementing hazard mitigation actions contained in Section 18. Each hazard mitigation action has been assigned to a specific County or City department that is responsible for tracking and implementing the action.

A funding source has been listed for each identified hazard mitigation action and may be utilized to implement the action. An implementation time period has also been assigned to each hazard mitigation action as an incentive and to determine whether actions are implemented on a timely basis.

Participating jurisdictions within Guadalupe County will integrate hazard mitigation actions contained in the Plan with existing planning mechanisms such as floodplain ordinances, Emergency Operation Plans, Evacuation Plans, and other local and area planning efforts. Guadalupe County will work closely with area organizations to coordinate implementation of hazard mitigation actions that benefit the planning area financially and economically.

Upon formal adoption of the 2021 Plan, Planning Team members from participating jurisdictions will review existing plans along with building codes to guide development and ensure that hazard mitigation actions are implemented. Each of the departments will be responsible for coordinating periodic review of the Plan with members of the Planning Team to ensure integration of hazard mitigation strategies into these planning mechanisms and codes. The Planning Team will also conduct periodic reviews of various existing planning mechanisms and analyze the need for any amendments or updates in light of the approved Plan. Participating jurisdictions within Guadalupe County will ensure that future long-term planning objectives will contribute to the goals of the Plan to reduce the long-term risk to life and property from moderate and high risk hazards. Within one year of formal adoption of the Plan, existing planning mechanisms will be reviewed and analyzed as they pertain to the Plan.

Planning Team members will review and revise, as necessary, the long-range goals and objectives in its strategic plan and budgets to ensure that they are consistent with the Plan.

Furthermore, Guadalupe County will work with neighboring jurisdictions to advance the goals of the Plan as it applies to ongoing, long-range planning goals and actions for mitigating risk from natural hazards throughout the planning area.

Table 2-3 identifies types of planning mechanisms and examples of methods for incorporating the Plan into other planning efforts.

Table 2-3. Examples of Methods of Incorporation

Planning Mechanism	Incorporation of Plan
Annual Budget Review	Various departments and key personnel that participated in the planning process for participating jurisdictions within Guadalupe County will review the Plan and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought and

Planning Mechanism	Incorporation of Plan
	mitigation actions that will be undertaken per the implementation schedule of the specific action.
Capital Improvement Plans	Participating jurisdictions within Guadalupe County have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, County or City departments will review the risk assessment and mitigation strategy sections of the HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Floodplain Management Plans	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 5 of this Plan discussing the people and property at risk to flood will be reviewed and revised when participating jurisdictions update their management plans or develops new plans.
Grant Applications	The Plan will be evaluated by participating jurisdictions within Guadalupe County when grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Regulatory Plans	Currently, participating jurisdictions within Guadalupe County have regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Land Use Plans, and Evacuation Plans. The Plan will be consulted when County or City departments review or revise their current regulatory planning mechanisms or in the development of regulatory plans that are not currently in place.

Appendix F provides an overview of Planning Team members' existing planning and regulatory capabilities to support implementation of mitigation strategy objectives. Appendix F also provides further analysis of how each jurisdiction intends to incorporate hazard mitigation actions into existing plans, policies, and the annual budget review as it pertains to prioritizing grant applications for funding and implementation of identified hazard mitigation projects.

It should be noted for the purposes of the plan that the HMAP has been used as a reference when reviewing and updating all plans and ordinances for the entire planning area, including all participating jurisdictions. The Emergency Management Plans developed independently by Guadalupe County, the City of Cibolo, and the City of Seguin are updated every 5 years and incorporates goals, objectives and actions identified in the current mitigation plan.

PLAN REVIEW AND PLAN UPDATE

As with the development of the Plan, participating jurisdictions within Guadalupe County will oversee the review and update process for relevance and to make necessary adjustments. At the beginning of each fiscal year, Planning Team Members will meet to evaluate the Plan and review other planning mechanisms to ensure consistency with long-range planning efforts. In addition, planning participants will also meet twice a year by conference call or presentation to re-evaluate prioritization of the hazard mitigation actions and the hazard assessment.

TIMELINE FOR IMPLEMENTING MITIGATION ACTIONS

The Executive Planning Team (Table A-1, Appendix A) will engage in discussions regarding a timeframe for how and when to implement each hazard mitigation action. Considerations include when the action will be started, how existing planning mechanisms' timelines affect implementation, and when the action should be fully implemented. Timeframes may be general and there will be short, medium, and long term goals for implementation; these goals will be based on prioritization of each action as identified on individual Hazard Mitigation Action worksheets included in the Plan for participating jurisdictions within Guadalupe County.

The Executive Planning Team will evaluate and prioritize the most suitable hazard mitigation actions for the community to implement. The timeline for implementation of actions will partially be directed by participating jurisdictions' comprehensive planning process, budgetary constraints, and community needs. Participating jurisdictions within Guadalupe County are committed to addressing and implementing hazard mitigation actions that may be aligned with and integrated into the Plan.

Overall, the Planning Team is in agreement that the goals and actions of the Plan shall be aligned with the timeframe for implementation of hazard mitigation actions, with respect to annual review and updates of existing plans and policies.

PUBLIC AND STAKEHOLDER INVOLVEMENT

An important component of hazard mitigation planning is public participation and stakeholder involvement. Input from individual citizens and the community as a whole provides the Planning Team with a greater understanding of local concerns and increases the likelihood of successfully implemented hazard mitigation actions. If citizens and stakeholders such as local businesses, non-profits, hospitals, and schools are involved, they are more likely to gain a greater appreciation of the risks that hazards may present in their community and take steps to reduce or mitigate their impact.

The public was involved in the development of the Guadalupe County Hazard Mitigation Action Plan at different stages prior to official Plan approval and adoption. Public input was sought using three methods: (1) open public meetings; (2) survey instruments; and (3) making the draft Plan available for public review at participating jurisdictions' websites.

The draft 2021 Plan was made available to the general public for review and comment on participating jurisdictions' websites. The public was notified at the public meetings and via social media posts that the draft Plan would be available for review online. Feedback was received from the public survey and on the draft 2021 Plan, and all relevant information was incorporated into the Plan. Information that was obtained from the survey assisted in determining the community's

concern about risk which drove the focus of the plan on areas of concern and assisted in the development of mitigation actions.

The 2021 Plan will be advertised and posted on Guadalupe County and participating jurisdictions' websites upon approval from FEMA and a copy will be kept at the Guadalupe County courthouse.

STAKEHOLDER INVOLVEMENT

Stakeholder involvement is essential to hazard mitigation planning since a wide range of stakeholders can provide input on specific topics and input from various points of view. Throughout the planning process, members of community groups, local businesses, neighboring jurisdictions, schools, and hospitals were invited to participate in the development of the 2021 Plan. The Stakeholder Group (Appendix A, Table A-3, and Table 2-4, below), included a broad range of representatives from both the public and private sector and served as a key component in Guadalupe County's outreach efforts for development of the Plan. Documentation of stakeholder meetings is found in Appendix E. A list of organizations invited to attend via e-mail is found in Table 2-4.

Table 2-4. Stakeholder Working Group

AGENCY	TITLE	PARTICIPATED
City of New Berlin	Fire Chief / EMC	
City of New Braunfels	EMC	
City of Staples	EMC	
GBRA (Guadalupe-Blanco River Authority)	Project and Community Representative	X
Navarro ISD	Director of Operations	
Schertz-Cibolo-Universal City ISD	Superintendent	
Schertz-Cibolo-Universal City ISD	Director of Transportation	X
Schertz-Cibolo-Universal City ISD	Coordinator of Safety / Security	X
Schertz-Cibolo-Universal City ISD	Executive Director of Facilities	X
Seguin ISD	Director of Safety	X
Texas House Member	Representative	
Texas Senate Member	Senator	
Texas Senate Member	Senator	

Stakeholders and participants from neighboring communities that attended the Planning Team and public meetings played a key role in the planning process. For example, stakeholders were concerned that citizens did not know of the hazards that affect their area and ways to mitigate for these hazards, so the jurisdictions included several education and awareness actions of the different hazards and steps citizens can take to reduce their risk to these hazards.

PUBLIC MEETINGS

A series of public meetings were held throughout the planning area to collect public and stakeholder input. Topics of discussion included the purpose of hazard mitigation, discussion of the planning process, and types of natural hazards. Representatives from area neighborhood associations and area residents were invited to participate. Additionally, participating jurisdictions within Guadalupe County utilized social media sources including Facebook, Twitter, and the local media to increase public participation in the Plan development process. Documentation on the public meetings can be found in Appendix E.

Public meetings were held on the following dates and locations:

- June 29, 2020 – Guadalupe County Courthouse
- September 22, 2020 – Cibolo YMCA

PUBLIC PARTICIPATION SURVEY

In addition to public meetings, the Planning and Consultant Teams developed a public survey designed to solicit public input during the planning process from citizens and stakeholders, and to obtain data regarding the identification of any potential hazard mitigation actions or problem areas. The survey was promoted by local officials and a link to the survey was posted on participating jurisdictions' websites. A total of 267 surveys were completed online and the results are analyzed in Appendix B. Participating jurisdictions within Guadalupe County reviewed the input from the surveys and decided which information to incorporate into the Plan as hazard mitigation actions. For example, several respondents discussed trimming trees from around power lines and to allow emergency vehicles to pass through streets easier. In response to public input, an action was included for all participating jurisdictions to implement a routine tree trimming program and to remove dead trees from rights-of-way and drainage systems on a scheduled basis.

SECTION 3: COUNTY PROFILE

OVERVIEW

After the Texas Revolution, the new government sent volunteer troops to protect people in remote areas. Much of the land given to Texas veterans for their service during the revolution was located in what became Guadalupe County. In 1838 a group of former Texas Rangers and other settlers founded the community of Walnut Springs on the northeast bank of the Guadalupe; its name was changed to Seguin in 1839 to honor Juan N. Seguin. The presence of troops encouraged many incoming families to stay near Seguin until the area became more secure. As a result, Seguin developed earlier and more rapidly than other communities in the future county and became the region's center of social and economic life. It was the natural choice for county seat when Guadalupe County was formed.

The Republic of Texas organized Guadalupe County as a judicial county in 1842 but discontinued it later that year when the Texas Supreme Court declared judicial counties to be unconstitutional. In March 1846, after the annexation of Texas to the United States, the legislature established the present county from parts of Bexar and Gonzales counties. Guadalupe County had an area of 862 square miles in 1846 but lost land in 1858 and 1874, when Blanco and Wilson counties were organized.

Cibolo Creek forms the border between Guadalupe and Bexar counties, and the San Marcos River separates Guadalupe and Caldwell counties. The county covers 713 square miles of flat to rolling terrain with local depressions and escarpments, and its elevation ranges from 450 to 800 feet above sea level. Vegetation consists primarily of mesquite, scrub brush, and grasses in the drier areas of the county, while water-tolerant hardwoods and conifers flourish near creeks.

Figure 3-1 shows the general location of Guadalupe County along with the Cities that are located within the County.

Figure 3-1. Location of Guadalupe County Planning Area

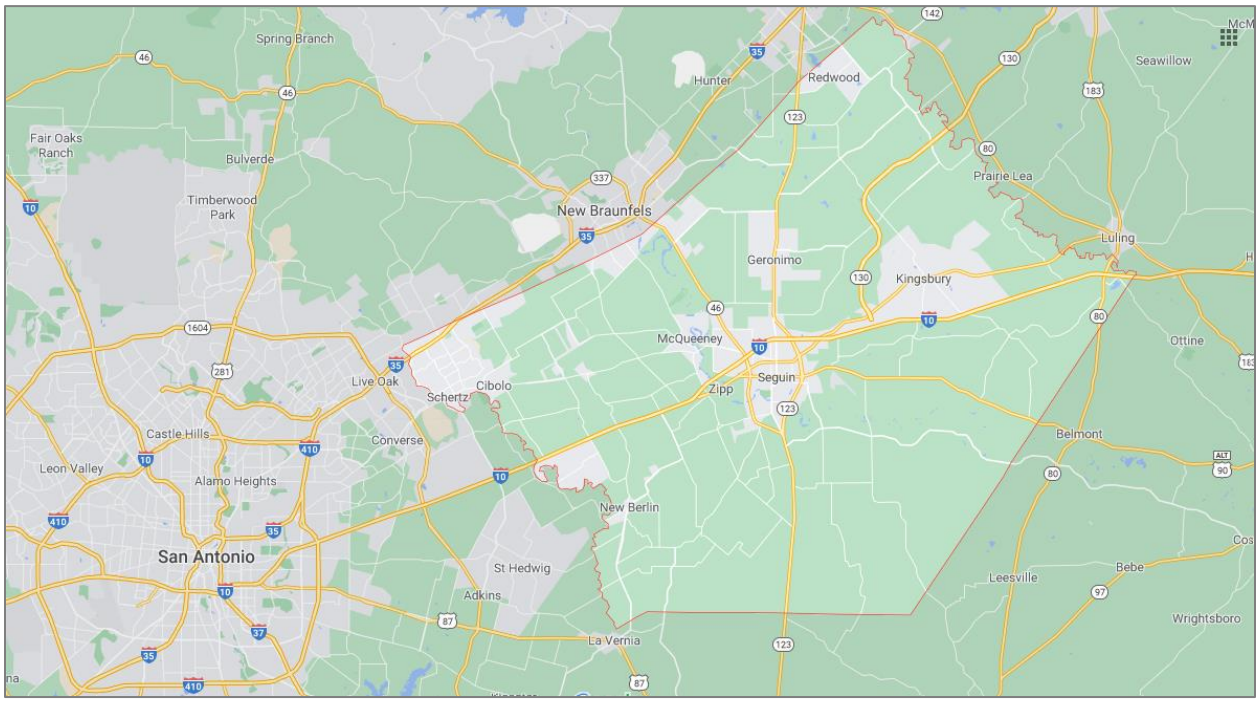
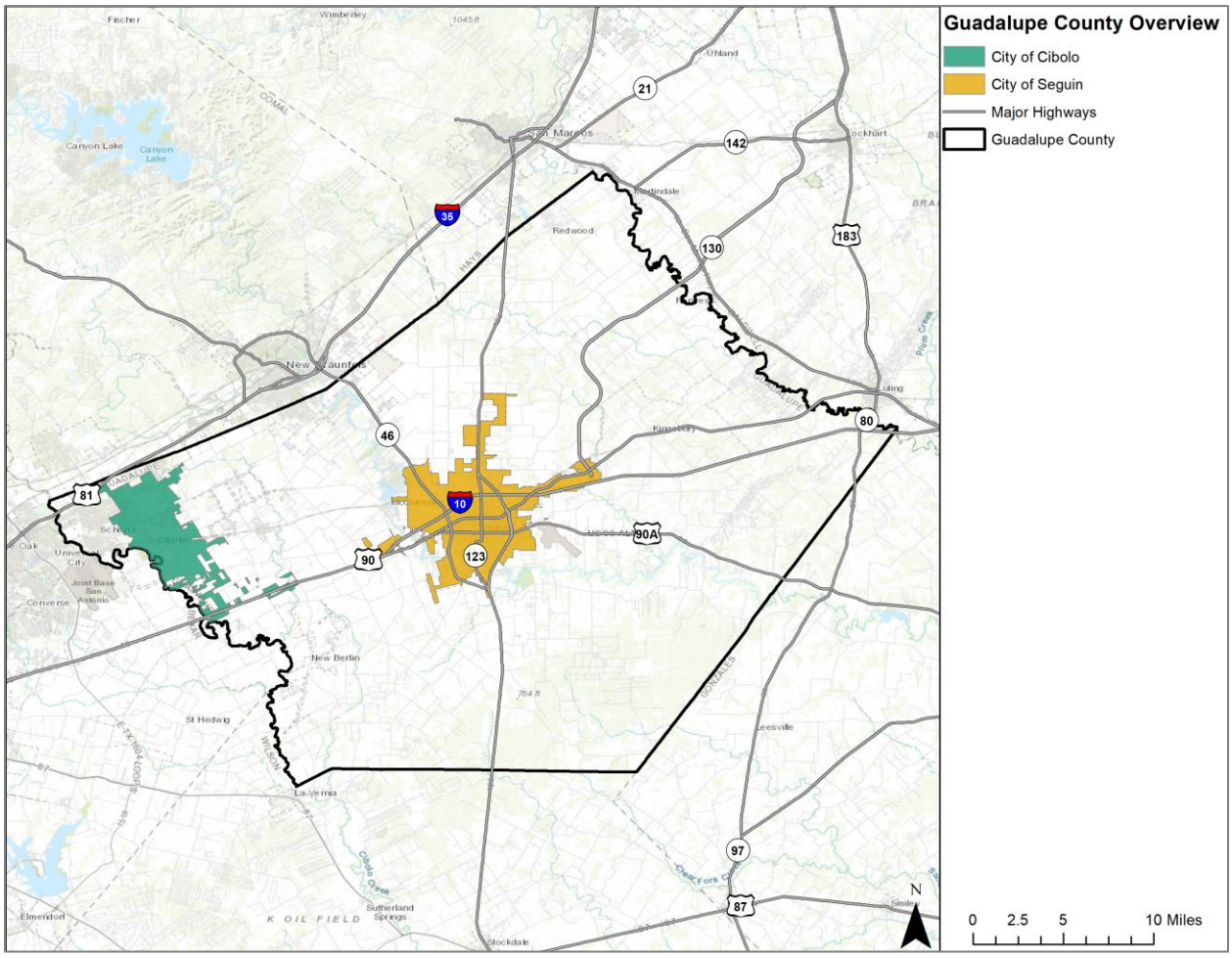


Figure 3-2 shows participating jurisdictions within Guadalupe County that are covered in the risk assessment analysis of the Plan.

Figure 3-2. Guadalupe County Planning Area



Provided in Table 3-1 below is a listing of the jurisdictions in Guadalupe County that participated in the Guadalupe County Hazard Mitigation Action Plan 2021.

Table 3-1. Participating Jurisdictions

PARTICIPATING JURISDICTIONS
Guadalupe County
City of Cibolo
City of Seguin

POPULATION AND DEMOGRAPHICS

In the official Census population count, as of April 1, 2010, Guadalupe County had a population of 131,533 residents. By 2018, the number was estimated at 155,137. Table 3-2 highlights the vulnerable or sensitive populations in Guadalupe County planning area.[1]

Between official U.S. Census population counts, the estimate uses a formula based on new residential building permits and household size. It is simply an estimate and there are many variables involved in achieving an accurate estimation of people living in a given area at a given time.

Table 3-2. Population Distribution by Jurisdiction

JURISDICTION	TOTAL 2010 POPULATION	PERCENTAGE (based on 2010 Population)	2018 POPULATION ESTIMATE	ESTIMATED VULNERABLE OR SENSITIVE POPULATIONS[2]		
				Youth (Under 5)	Elderly (Over 65)	Below Poverty Level
City of Cibolo	15,349	12%	27,963	1,838	2,095	1,790
City of Seguin	25,175	19%	28,357	1,693	5,109	5,189
Unincorporated Guadalupe County[3]	87,658	67%	98,817	6,379	13,535	7,759
Guadalupe County Total	**131,533**	**100%**	**155,137**	**9,910**	**20,739**	**14,738**

POPULATION GROWTH

The official 2010 Guadalupe County population is 131,533. Overall, Guadalupe County experienced an increase in population between 1980 and 2010 by 64.5 percent, or an increase by 84,825 people. All of the participating jurisdictions experienced an increase in their population from 1980 to 2010. Between 2000 and 2010, all of the participating jurisdictions, including Guadalupe County as a whole, experienced a population growth. Table 3-3 provides historic growth rates in Guadalupe County. A larger population means an increase in vulnerability and a growth in vulnerable populations, as well.

[1] Source: https://www.census.gov/quickfacts/fact/table/guadalupecountytexas,cibolocitytexas,seguincitytexas/PST045219 and https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2018/

[2] The Estimated Vulnerable or Sensitive Populations are based off the 2018 American Community Survey.

[3] For the purposes of this Plan and for the risk assessment, 'Unincorporated Guadalupe County' includes all jurisdictions within the County lines except for the Cities of Cibolo and Seguin.

Table 3-3. Population for Guadalupe County, 1980-2010

JURISDICTION	1980	1990	2000	2010	POP. CHANGE 1980-2010	PERCENT OF CHANGE	POP. CHANGE 2000-2010	PERCENT OF CHANGE
City of Cibolo	549	1,757	3,035	15,349	14,800	96.4%	12,314	80.2%
City of Seguin	17,854	18,853	22,011	25,175	7,321	29.1%	3,164	12.6%
Unincorporated Guadalupe County[4]	28,305	44,263	63,977	91,009	62,704	68.9%	27,032	29.7%
Guadalupe County	**46,708**	**64,873**	**89,023**	**131,533**	**84,825**	**64.5%**	**42,510**	**32.3%**

FUTURE DEVELOPMENT

To better understand how future growth and development in the County might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts. This section includes an analysis of the projected population change and economic impacts.

Population projections from 2010 to 2040 are listed in Table 3-4, as provided by the Office of the State Demographer, Texas State Data Center, and the Institute for Demographic and Socioeconomic Research. Population projections are based on a 0.5 scenario growth rate, which is 50 percent of the population growth rate that occurred during 2000-2010. This information is only available at the County level; however, the population projection shows an increase in population density for the County, which would mean overall growth for the County.

Table 3-4. Guadalupe County Population Projections

County	LAND AREA (SQ MI)	2010		2020		2030		2040	
		Population							
		Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)	Total Number	Density (Land Area, SQ MI)
Guadalupe	711	131,533	185.0	158,712	223.2	189,140	266.0	220,138	309.6

ECONOMIC IMPACT

Building and maintaining infrastructure depends on the economy, and therefore, protecting infrastructure from risk due to natural hazards is important to the participating jurisdictions within Guadalupe County. Whether it's expanding culverts under a road that washes out during flash flooding, shuttering a fire station, or flood-proofing a wastewater facility, infrastructure must be

[4] For the purposes of this Plan and for the risk assessment, 'Unincorporated Guadalupe County' includes all jurisdictions within the County lines except for the Cities of Cibolo and Seguin.

mitigated from natural hazards in order to continue providing essential utility and emergency response services in a fast-growing planning area.

The Cibolo Economic Development Corporation (CEDC) promotes economic development and businesses in the City of Cibolo. Their mission is to create primary jobs by attracting targeted industries and commercial developments to the City. The CEDC also works hard to retain and assist in the expansion of existing industries while creating a high quality of life for citizens.

The Seguin Economic Development Corporation (SEDC) was established to create, attract, retain, and expand business opportunities for Seguin and its residents. They create a probusiness climate by meeting with businesses to discuss their needs, tackling workforce initiatives, pulling together incentives and attracting investment for current and future growth. Their mission is to strengthen and grow the City's economic base and increase the standard of living for all its citizens by providing development support and resources for business attraction, retention, and expansion with the ultimate goal of creating primary jobs and capital investments.

EXISTING AND FUTURE LAND USE AND DEVELOPMENT TRENDS

Comprehensive or economic development plans are part of a continuous process to provide an environment for the citizens and to consider the general desire of the community to conserve, preserve, and protect the natural environment. These plans are used to guide individuals in making decisions which affect the community with the understanding of the long-term effects. Guadalupe County, the City of Cibolo, and the City of Seguin have a Comprehensive / Master Plan / Land Use Plan in place.

The Guiding Guadalupe County Strategic Plan communicates a community vision for the future growth of the County and highlights six strategic recommendations which address the pressing issues and anticipated needs of Guadalupe County. These six key strategic areas where the County can focus on a variety of initiatives include: Investing in County-wide infrastructure; Growing the economy while protecting local culture and heritage; Foster sustainable Development; Further strengthening regional collaboration; Exploring models for emergency services; and, Preparing the County organization and facilities for imminent growth.

The Cibolo Comprehensive Master Plan was developed to proactively plan for the future in an effort to embrace change while remaining true to its rural charm and heritage. The goals of the plan include: Providing adequate infrastructure to support projected growth; Providing for the health, safety, security and general welfare of all citizens; Providing community environment which will draw new families and businesses into the City, and encourage existing families and businesses to make long-term investments in Cibolo; Managing the growth of jobs and businesses in harmony with residential development; Providing parks, recreation, trails, and open space to serve existing and prospective citizens and visitors to Cibolo; and Identifying and preserving the character of Cibolo which sets itself apart as a City of Choice.

The Seguin Comprehensive Master Plan was developed to guide future growth and development. The planning framework provided a backdrop for the creation of the six plan elements, which include: the Future land use Plan, the Public Open Space Plan, the Thoroughfare Plan, the Infrastructure Plan, the Housing Plan, and the Public Facilities Plan. Each of these plan elements is intended to serve as a tool to guide future decisions made in the City.

SECTION 4: RISK OVERVIEW

HAZARD DESCRIPTION

Section 4 is the first phase of the Risk Assessment and provides background information for the hazard identification process and descriptions for the hazards identified. The Risk Assessment continues with Sections 5 through 16, which include hazard descriptions and vulnerability assessments.

Upon a review of the full range of natural hazards suggested under the Federal Emergency Management Agency (FEMA) planning guidance, participating jurisdictions within Guadalupe County identified 12 natural hazards that are addressed in the 2021 Hazard Mitigation Plan. Of the hazards identified, 10 natural hazards and one quasi-technological[1] hazard (dam failure) were identified as significant, as shown in Table 4-1. The hazards were identified through input from Planning Team members and a review of the current 2018 State of Texas Hazard Mitigation Plan Update (State Plan Update). Readily available online information from reputable sources, such as federal and state agencies, were also evaluated and utilized to supplement information as needed.

In general, there are 3 main categories of hazards including: atmospheric, hydrologic, and technological. Atmospheric hazards are events or incidents associated with weather generated phenomenon. Atmospheric hazards that have been identified as significant for the Planning Area include: extreme heat, hail, hurricane wind, lightning, thunderstorm wind, tornado, and winter storm (Table 4-1).

Hydrologic hazards are events or incidents associated with water related damage and account for over 75 percent of Federal disaster declarations in the United States. Hydrologic hazards identified as significant for the planning area include drought and flood.

Technological hazards refer to the origins of incidents that can arise from human activities, such as the construction and maintenance of dams. They are distinct from natural hazards primarily because they originate from human activity. The risks presented by natural hazards may be increased or decreased as a result of human activity, however they are not inherently human-induced. Therefore, dam failure is classified as a quasi-technological hazard and referred to as “technological,” in Table -1 for purposes of description.

For the Risk Assessment, the wildfire and earthquake hazards are considered “other,” since these hazards are not considered atmospheric, hydrologic, nor technological.

[1] While dam failure is generally considered a quasi-technological hazard, it is profiled in the Plan as a natural hazard, i.e. a breach caused by extensive rainfall or flooding or from an earthquake.

Table 4-1. Descriptions

HAZARD	DESCRIPTION
ATMOSPHERIC	
Extreme Heat	Extreme heat is the condition whereby temperatures hover 10 degrees or more above the average high temperature in a region for an extended period of time.
Hail	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.
Hurricane Wind	A hurricane is an intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph or higher.
Lightning	Lightning is a sudden electrostatic discharge that occurs during an electrical storm. This discharge occurs between electrically charged regions of a cloud, between two clouds, or between a cloud and the ground.
Thunderstorm Wind	A thunderstorm occurs when an observer hears thunder. Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. The destruction caused by tornadoes ranges from light to catastrophic, depending on the location, intensity, size, and duration of the storm.
Winter Storm	Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roads, and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.

HAZARD	DESCRIPTION
HYDROLOGIC	
Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality.
Flood	The accumulation of water within a body of water, which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, and shallow flooding.
OTHER	
Earthquake	An earthquake is the sudden, rapid, shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time. Initial mild shaking may strengthen and become extremely violent within seconds.
Wildfire	A wildfire is an uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase the risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors.
TECHNOLOGICAL	
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam.

Hazards that were not considered significant and were not included in the Plan are located in Table 4-2, along with the evaluation process used for determining the significance of each of these hazards. Hazards not identified for inclusion at this time may be addressed during future evaluations and updates.

Table 4-2. Hazard Identification Process

HAZARD CONSIDERED	REASON FOR DETERMINATION
Coastal Erosion	The planning area is not located on the coast, therefore coastal erosion does not pose a risk.

HAZARD CONSIDERED	REASON FOR DETERMINATION
Expansive Soils	There is no history of impact to critical structures, systems, populations or other community assets or vital services as a result of expansive soils and none is expected in the future.
Land Subsidence	There are no historical occurrences of land subsidence for the planning area and it is located in an area where occurrences are considered rare. There is no history of impact to critical structures, systems, populations, or other community assets or vital services as a result of land subsidence and impact is not expected in the future.

NATURAL HAZARDS AND CLIMATE CHANGE

Climate change is defined as a long-term hazard which can increase or decrease the risk of other weather hazards. It directly endangers property and biological organisms due to sea level rise and habitat destruction.

Global climate change is expected to exacerbate the risks of certain types of natural hazards impacted by rising sea levels, warmer ocean temperatures, higher humidity, the possibility of stronger storms, and an increase in wind and flood damages due to storm surges. While sea level rise is a natural phenomenon and has been occurring for several thousand years, the general scientific consensus is that the rate has increased in the past 200 years, from 0.5 millimeters per year to 2 millimeters per year.

Texas is considered one of the more vulnerable states in the U.S. to both abrupt climate changes and to the impact of gradual climate changes to the natural and built environments. Mega-droughts can trigger abrupt changes to regional ecosystems and the water cycle, drastically increase extreme summer temperature and fire risk, and reduce availability of water resources, as Texas experienced during 2011-2012.

Paleoclimate records also show that the climate over Texas had large changes between periods of frequent mega-droughts and the periods of mild droughts that Texas is currently experiencing. While the cause of these fluctuations is unclear, it would be wise to anticipate that such changes could occur again and may even be occurring now.

OVERVIEW OF HAZARD ANALYSIS

The methodologies utilized to develop the Risk Assessment are a historical analysis and a statistical approach. Both methodologies provide an estimate of potential impact by using a common, systematic framework for evaluation.

Records retrieved from the National Centers for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA) were reported for the Guadalupe County Planning Area. Remaining records identifying the occurrence of hazard events in the planning area and the maximum recorded magnitude of each event were also evaluated.

The use of geographic information system (GIS) technology to identify and assess risks for the Guadalupe County planning area and evaluate community assets and their vulnerability to the hazards.

SECTION 4: RISK OVERVIEW

The 4 general parameters that are described for each hazard in the Risk Assessment include frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.

Frequency of return was calculated by dividing the number of events in the recorded time period for each hazard by the overall time period that the resource database was recording events. Frequency of return statements are defined in Table 4-3, and impact statements are defined in Table 4-4 below.

Table 4-3. Frequency of Return Statements

PROBABILITY	DESCRIPTION
Highly Likely	Event is probable in the next year.
Likely	Event is probable in the next three years.
Occasional	Event is probable in the next five years.
Unlikely	Event is probable in the next ten years.

Table 4-4. Impact Statements

POTENTIAL SEVERITY	DESCRIPTION
Substantial	Multiple deaths. Complete shutdown of facilities for 30 days or more. More than 50 percent of property destroyed or with major damage.
Major	Injuries and illnesses resulting in permanent disability. Complete shutdown of critical facilities for at least 2 weeks. More than 25 percent of property destroyed or with major damage.
Minor	Injuries and illnesses do not result in permanent disability. Complete shutdown of critical facilities for more than 1 week. More than 10 percent of property destroyed or with major damage.
Limited	Injuries and illnesses are treatable with first aid. Shutdown of critical facilities and services for 24 hours or less. Less than 10 percent of property destroyed or with major damage.

Each of the hazard profiles includes a description of a general Vulnerability Assessment. Vulnerability is the total of assets that are subject to damages from a hazard, based on historic recorded damages. Assets in the region were inventoried and defined in hazard zones where appropriate. The total amount of damages, including property and crop damages, for each hazard is divided by the total number of assets (building value totals) in that community to determine the percentage of damage that each hazard can cause to the community.

To better understand how future growth and development in the County might affect hazard vulnerability, it is useful to consider population growth, occupied and vacant land, the potential for future development in hazard areas, and current planning and growth management efforts.

SECTION 4: RISK OVERVIEW

Hazard vulnerability for all participating jurisdictions within Guadalupe County was reviewed based on recent development changes that occurred throughout the planning area. Guadalupe County grew by 15 percent between 2010 and 2018 according to the U.S. Census Bureau, therefore the vulnerability to the population, infrastructure, and buildings has increased for hazards that do not have a geographical boundary. Participating jurisdictions within Guadalupe County have participated in multiple activities to reduce flood losses and protect citizens and property. Guadalupe County, the City of Cibolo, and the City of Seguin participate in the National Flood Insurance Program and regulations apply for buildings in the 25 year and 100-year floodplains. Therefore, vulnerability has not increased for flood.

Once loss estimates and vulnerability were known, an impact statement was applied to relate the potential impact of the hazard on the assets within the area of impact.

SECTION 5: FLOOD

HAZARD DESCRIPTION

Floods generally result from excessive precipitation. The severity of a flood event is determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Typically, floods are long-term events that may last for several days.

The primary types of general flooding are inland and coastal flooding. Inland or riverine flooding is a result of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Inland or riverine flooding is overbank flooding of rivers and streams, typically resulting from large-scale weather systems that generate prolonged rainfall over a wide geographic area, thus it is a naturally occurring and inevitable event. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly. Torrential rains from decaying hurricanes or tropical systems can also produce river flooding.

LOCATION

The Flood Insurance Rate Map (FIRM) data provided by FEMA for Guadalupe County, the City of Cibolo and the City of Seguin shows the following flood hazard areas:

- Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance requirements and floodplain management standards apply.
- Zone AE: Areas subject to inundation by 1-percent-annual-chance shallow flooding. It is the base floodplain where BFEs are provided. AE zones are now used on new format FIRMs instead of A1-30 zones.

- Zone X: Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones.

Locations of flood zones in Guadalupe County and all participating jurisdictions are based on the Digital Flood Insurance Rate Map (DFIRM) from FEMA are detailed below (Figure 5-1 through 5-3).

Figure 5-1. Estimated Flood Zones in the Guadalupe County

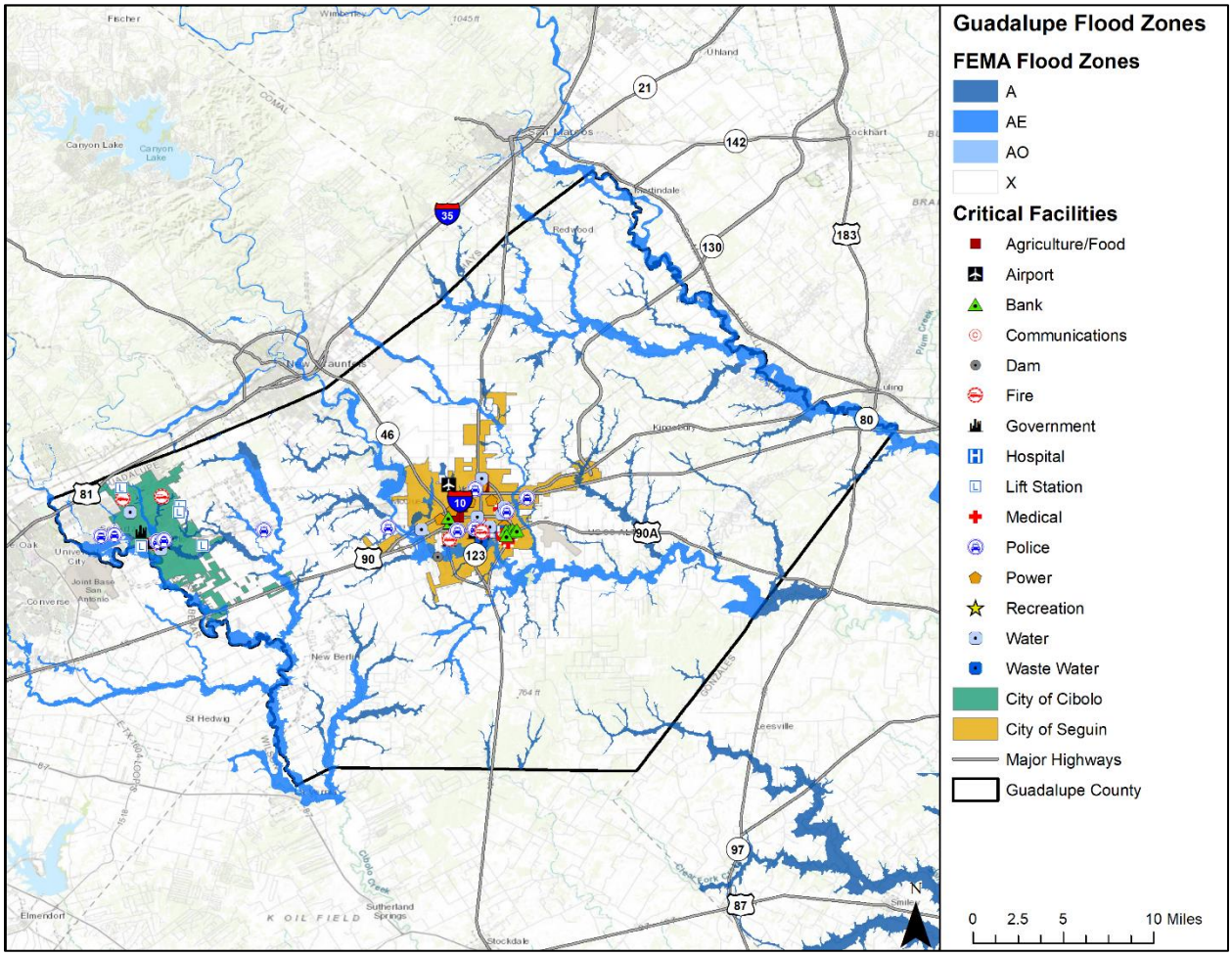


Figure 5-2. Estimated Flood Zones in the City of Cibolo

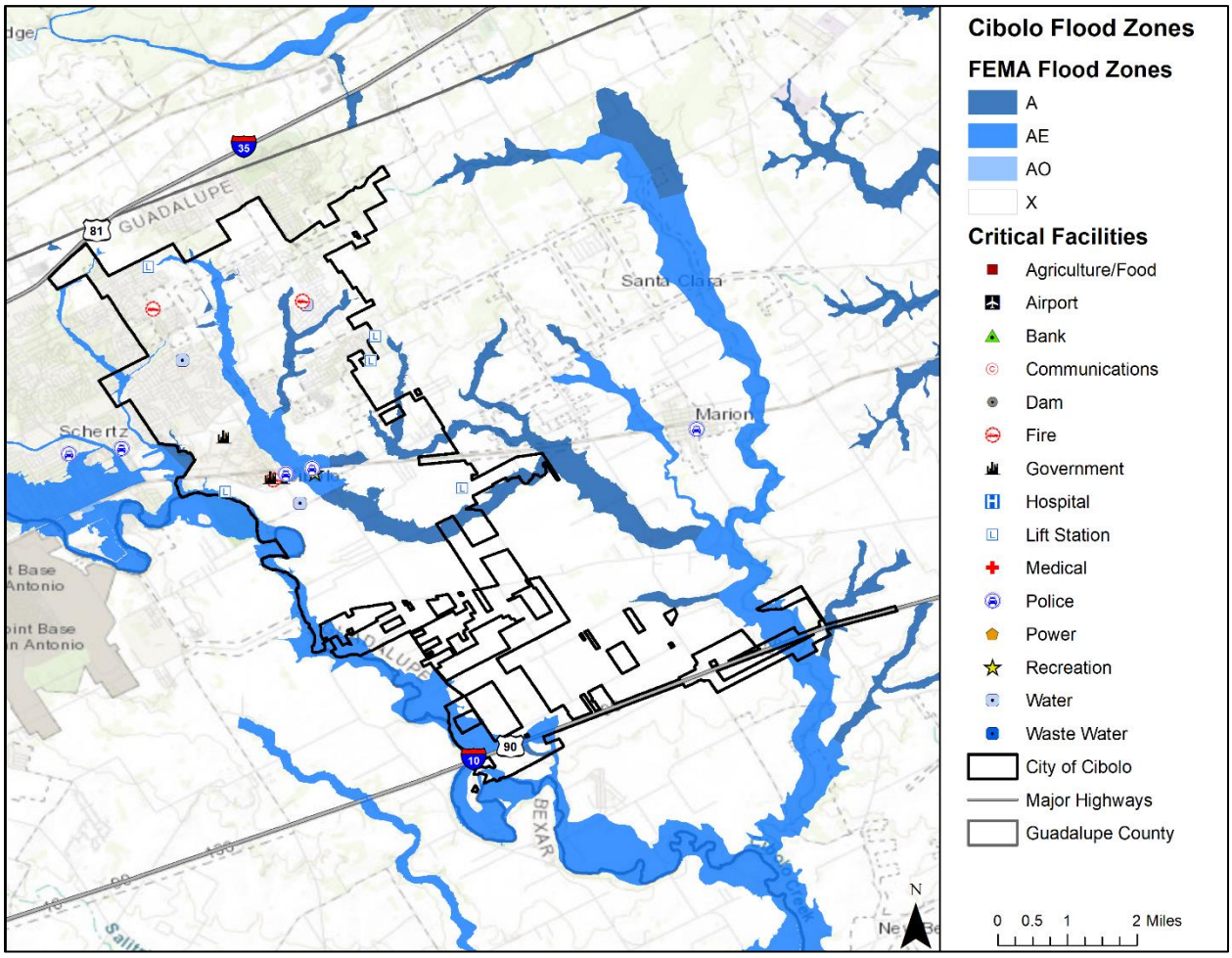
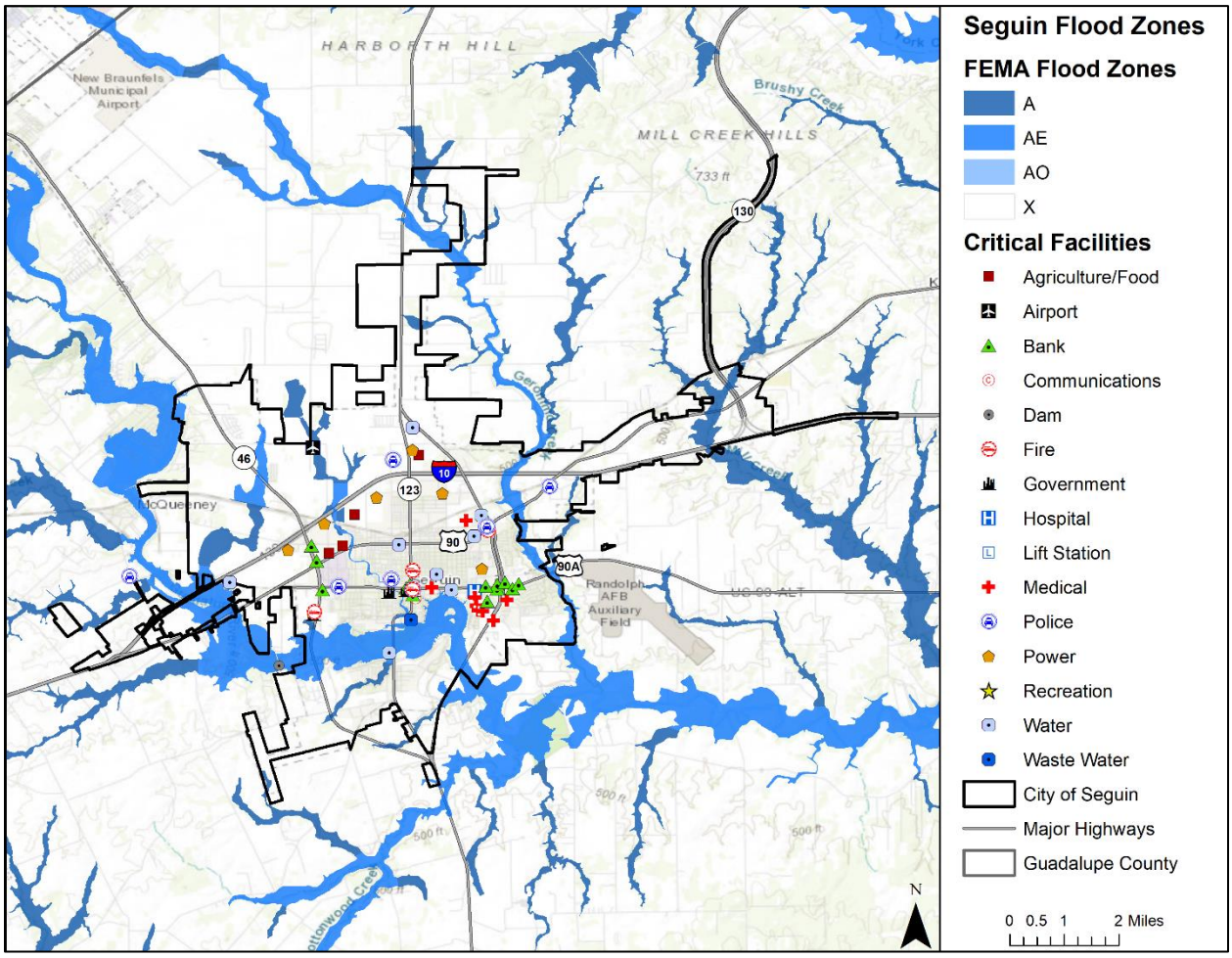


Figure 5-3. Estimated Flood Zones in the City of Seguin



EXTENT

The severity of a flood event is determined by a combination of several factors including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Typically, floods are long-term events that may last for several days.

Determining the intensity and magnitude of a flood event is dependent upon the flood zone and location of the flood hazard area in addition to depths of flood waters. Extent of flood damages can be expected to be more damaging in the areas that will convey a base flood. FEMA categorizes areas on the terrain according to how the area will convey flood water. Flood zones are the categories that are mapped on Flood Insurance Rate Maps. Table 5-1 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Flood Zones A, AE, VE and X are the only hazard areas mapped in the region. Figures 5-1 through 5-3 should be read in conjunction with the extent for flooding in Tables 5-1 and 5-2 to determine the intensity of a potential flood event.

Table 5-1. Flood Zones

INTENSITY	ZONE	DESCRIPTION
HIGH	ZONE A	Areas with a one percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
	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 Base Flood Elevation (BFE) (old format).
	ZONE AE	The base floodplain where base flood elevations are provided. AE Zones are now used on the new format FIRMs instead of A1-A30 Zones.
	ZONE AO	River or stream flood hazard areas and areas with a one percent or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from one to three feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	ZONE AH	Areas with a one percent annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from one to three feet. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	ZONE A99	Areas with a one percent annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones.
	ZONE AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
HIGH COASTAL	ZONE VE, V1-30	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26 percent chance of flooding over the life of a 30-year mortgage. No base flood elevations are shown within these zones.
MODERATE to LOW	ZONE X 500	An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than one foot or with drainage areas less than one square mile; or an area protected by levees from 100-year flooding.

Zone A is interchangeably referred to as the 100-year flood, the one-percent-annual chance flood, the Special Flood Hazard Area (SFHA), or more commonly, the base flood. This is the area that will convey the base flood and constitutes a threat to the planning area. The impact from a flood event can be more damaging in areas that will convey a base flood.

Structures built in the SFHA 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 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.

The intensity and magnitude of a flood event is also determined by the depth of flood waters. Table 5-2 describes the stream gauge data provided by the United States Geological Survey (USGS).

Table 5-2. Extent for Guadalupe County[1]

JURISDICTION[2]	PEAK FLOOD EVENT
Guadalupe County	Cibolo Creek near Saint Hedwig, Texas reached an overflow elevation of 32.65 feet in August 2007. The average peak flow for Cibolo Creek is 19.88 feet at this site.
Guadalupe County	The Guadalupe River at FM 1117 near Seguin, Texas reached an overflow elevation of 35.69 feet in October 2001. The average peak flow for the Guadalupe River is 23.92 feet at this site.
Seguin	The Guadalupe River at Highway 123-BR in Seguin, Texas reached an overflow elevation of 7.98 feet in May 2019. The average peak flow for the Guadalupe River is 6.92 feet at this site.
Guadalupe County	The Walnut branch near Seguin, Texas reached an overflow elevation of 9.1 feet in September 1973. The average peak flow for the Walnut branch River is 5.89 feet at this site.

The range of flood intensity that the planning area can experience is high, or Zone A. Based on historical occurrences, the planning area, including all participating jurisdictions could expect to experience up to 4.7 inches of rainfall within a 5-hour period, resulting in flash flooding.

The data described in Tables 5-1 and 5-2, together with Figures 5-1 through 5-3, and historical occurrences for the area, provides an estimated potential magnitude and severity for the planning area. For example, the City of Seguin, as shown in Figure 5-3, has areas designated as Zone AE. Reading this figure in conjunction with Table 5-1 means the area is an area of high risk for flood.

[1] Severity estimated by averaging floods at certain stage level over the history of flood events. Severity and peak events are based on U.S. Geological Survey data.
[2] Severity is provided for jurisdictions where peak data was provided.

HISTORICAL OCCURRENCES

Historical evidence indicates that areas within the planning area, including all participating jurisdictions, are susceptible to flooding, especially in the form of flash flooding. It is important to note that only flood events that have been reported have been factored into this risk assessment, therefore it is likely that additional flood occurrences have gone unreported before and during the recording period. Table 5-3 identifies historical flood events within the Guadalupe County planning area, including all participating jurisdictions. Table 5-4 provides the historical flood event summary by jurisdiction. Historical data is provided by the Storm Prediction Center (NOAA), NCEI database for Guadalupe County.

Table 5-3. Historical Flood Events, 1996-2020[3]

JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	6/6/1997	5:00 PM	0	0	$8,082	$0
Guadalupe County	6/21/1997	8:45 AM	0	0	$40,409	$0
Guadalupe County	6/22/1997	12:00 PM	0	20	$484,905	$161,635
Guadalupe County	8/22/1998	10:00 AM	0	0	$31,714	$31,714
Guadalupe County	8/23/1998	7:30 AM	0	0	$15,857	$7,928
Guadalupe County	10/17/1998	10:00 AM	0	250	$7,899,421	$126,391
Guadalupe County	10/17/1998	10:30 AM	4	500	$7,899,421	$157,988
Guadalupe County	10/17/1998	3:00 PM	0	50	$47,396,524	$78,994
Guadalupe County	6/21/1999	12:00 PM	0	0	$4,677	$0
Guadalupe County	6/10/2000	4:30 PM	0	0	$15,029	$0
Guadalupe County	11/2/2000	9:00 PM	0	0	$22,323	$0
Guadalupe County	11/3/2000	5:00 PM	0	0	$7,441	$0
Guadalupe County	11/5/2000	8:30 PM	0	0	$7,441	$0
Guadalupe County	11/23/2000	11:00 PM	0	0	$14,882	$0
Guadalupe County	4/23/2001	9:00 AM	0	0	$43,940	$0
Guadalupe County	8/27/2001	3:00 PM	0	0	$14,597	$14,597
Guadalupe County	8/30/2001	9:30 AM	0	0	$29,194	$43,792
Guadalupe County	8/31/2001	4:00 AM	0	0	$29,194	$0

[3] Only recorded events with fatalities, injuries, and/or damages are listed, values are in 2020 dollars. Historical events are listed from January 1996 through April 2020.

JURISDICTION	DATE	TIME	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	9/5/2001	12:30 PM	0	4	$116,254	$0
Guadalupe County	9/5/2001	8:15 PM	0	0	$14,532	$0
Guadalupe County	11/15/2001	5:30 PM	1	5	$116,844	$0
Guadalupe County	4/8/2002	2:00 AM	0	0	$72,053	$144,105
Guadalupe County	6/30/2002	3:35 AM	0	0	$14,403	$0
Guadalupe County	10/8/2002	11:00 PM	0	0	$42,874	$0
Guadalupe County	10/23/2002	3:30 AM	0	0	$42,874	$0
Guadalupe County	10/24/2002	10:30 AM	0	0	$42,874	$0
Guadalupe County	11/4/2002	1:15 PM	0	0	$14,291	$0
Guadalupe County	12/4/2002	5:00 AM	0	0	$14,323	$0
Guadalupe County	2/20/2003	8:15 AM	0	0	$14,151	$0
Guadalupe County	6/9/2004	12:00 PM	0	0	$341,462	$0
City of Seguin	3/11/2007	10:30 PM	1	0	$0	$0
Guadalupe County	7/20/2007	12:30 PM	0	0	$621,945	$0
Guadalupe County	6/9/2010	7:00 AM	0	0	$11,887,275	$0
Guadalupe County	5/25/2013	3:00 PM	1	0	$0	$0
Guadalupe County	3/10/2017	1:00 AM	1	0	$0	$0
TOTALS			**8**	**829**	**$77,321,206**	**$767,144**

Table 5-4. Summary of Historical Flood Events, January 1996-2020

JURISDICTION	NUMBER OF EVENTS	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	79	7	829	$77,321,206	$767,144
City of Cibolo	6	0	0	$0	$0
City of Seguin	12	1	0	$0	$0
TOTAL LOSSES	**97**	**8**	**829**	**$78,088,350**	

SIGNIFICANT EVENTS

Flood March 10, 2017 – Guadalupe County

There was heavy rain during the evening of March 9, which caused the Santa Clara Creek to flood a low water crossing on the I-10 access road near exit 599. A car was swept off the road and a woman passenger was killed.

Flash Flood November 15, 2001 – Guadalupe County

Rainfall through the late afternoon brought totals across the county to 2 to 3 inches, with isolated amounts in the Seguin area to near 6 inches. Widespread flash flooding swept cars into low water crossings across the county. The occupants of a mobile-home park were forced to evacuate when flood waters threatened their area. Some buildings of the Schertz-Cibolo-Universal City school district were flooded. A 19-year old woman drowned after the car she was riding in became stranded at a low water crossing across Geronimo Creek. The driver was rescued. Another vehicle was stalled in the deep water at the same time, but all occupants of that vehicle were able to be rescued.

Flood on October 17, 1998 – Guadalupe County

The event is known as the Great October Flood. Shortly before noon on Saturday, heavy rain began to spread eastward into Guadalupe, Caldwell, Bastrop, and Lee Counties. Through the mid afternoon, moderate to heavy rain continued between San Antonio and Austin, with widespread heavy rain over Comal, Hays, Caldwell, Guadalupe, and Gonzales Counties. By 5 pm CST, the strongest low-level flow had also shifted eastward, focusing the heaviest rainfall through the evening.

By midnight, heavy rain had exited the Cuero-Hallettsville area, and moderate rain had again broken out over Bexar and Comal Counties. The activity spread westward through the early morning hours on Sunday to Hondo and Uvalde and northwestward into the Hill Country. This event broke rainfall records across South Central Texas, producing 18 floods of record in South Central Texas streams. October became the wettest of any month in climate records for San Antonio since 1885. October 17th became the wettest day and wettest 24-hour period in San Antonio climatic records, nearly doubling both previous records. Rivers across the area reached or exceeded record stage heights, resulting in widespread flooding in the flood plains of streams, creeks, and rivers. Rainfall amounts on October 17 and 18th from northern Bexar County to southeast Kendall County, most of Comal County and southern Hays County ranged from 15 to 22 inches. Damage and destruction to livestock and agriculture, roads, and bridges and both public and property and buildings significantly exceeded that of previous flooding. Thousands to tens of thousands of livestock were killed, as nearly 3,000 homes were destroyed and another 8,000 or so homes were damaged. Nearly 1,000 mobile homes were destroyed and another 3,000 were damaged.

Twenty-five people drowned as a direct result of the flooding in October in South Central Texas. All nine deaths in Bexar County on Saturday, as well as the two on Sunday, were associated with driving vehicles into flooded waters. Four of the six Caldwell County deaths, two of the three Guadalupe County deaths, and all of the four deaths in Comal, Travis and Uvalde County were associated with vehicles, as well. Two deaths in Caldwell County and one in Guadalupe County occurred as residents were swept by flood waters from their homes. In addition, one man in Comal County suffered a heart attack and died waiting to be rescued. A third man in Guadalupe County

accidently touched a live wire while in his boat. He was severely shocked and died from drowning as a result of the shock.

PROBABILITY OF FUTURE EVENTS

Based on 97 recorded historical occurrences within a 24-year reporting period within the Guadalupe County planning area, including all participating jurisdictions, flooding is highly likely with 4 to 5 events per year anticipated.

VULNERABILITY AND IMPACT

A property's vulnerability to a flood depends on its location and proximity to the floodplain. Structures that lie along banks of a waterway are the most vulnerable and are often repetitive loss structures. The County and all participating jurisdictions encourage development outside of the floodplain, and the impact for flood for the entire planning area is "Minor" as facilities and services would be shut down for one week or more, more than 10 percent of property destroyed or with major damage. However, the number of fatalities and injuries indicate a "Substantial" impact with multiple fatalities possible depending on the size of the event.

Table 5-5 includes the critical facilities identified in Appendix C that were determined to be located within the SFHA by FIRM mapping and further by each participating jurisdiction.

Table 5-5. Critical Facilities in the Floodplain by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	1 Law Enforcement
City of Cibolo	1 Police Station, 1 Family YMCA
City of Seguin	3 Water Facilities

Historic loss estimates due to flood are presented in Table 5-6 below. Considering 97 flood events over a 24-year period, frequency is approximately four to five events every year.

Table 5-6. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$78,088,350	$3,253,681
City of Cibolo	$0	$0
City of Seguin	$0	$0
PLANNING AREA	**$78,088,350**	**$3,253,681**

While all citizens are at risk to the impacts of a flood, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 6.6% of the planning area population live below the poverty level (Table 5-7).

Table 5-7. Populations at Greatest Risk by Jurisdiction[4]

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Guadalupe County	10,239
City of Cibolo	1,286
City of Seguin	3,771

The severity of a flooding event varies depending on the relative risk to citizens and structures located within each city. Table 5-8 depicts the level of impact for Guadalupe County and each participating jurisdiction.

Table 5-8. Impact by Jurisdiction

JURISDICTION	IMPACT	DESCRIPTION
Guadalupe County	Substantial	It is anticipated that Guadalupe County could anticipate an impact of "minor" with critical facilities would be shut down for one week or more and more than 10 percent of property would be destroyed or damaged. However, the number of fatalities and injuries indicate a "Substantial" impact, with multiple fatalities possible depending on the size of the event.
City of Cibolo	Limited	It is anticipated that the City of Cibolo could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged.
City of Seguin	Substantial	It is anticipated that the City of Seguin could anticipate an impact of "limited" with critical facilities would be shut down for 24 hours or less and less than 10 percent of property would be destroyed or damaged. However, the past fatality indicates a "Substantial" impact, with multiple fatalities possible depending on the size of the event.

ASSESSMENT OF IMPACTS

Flooding is the deadliest natural disaster that occurs in the U.S. each year, and it poses a constant and significant threat to the health and safety of the people in the Guadalupe County planning area. The impact of climate change could produce larger, more severe flood events, exacerbating the current flood impacts. Worsening flood conditions can be frequently associated with a variety of impacts, including:

- Flood-related rescues may be necessary at swift and low water crossings or in flooded neighborhoods where roads have become impassable, placing first responders in harm's way.

[4] US Census Bureau 2018 data for Guadalupe County

- Evacuations may be required for entire neighborhoods because of rising floodwaters, further taxing limited response capabilities and increasing sheltering needs for displaced residents.
- Health risks and threats to residents are elevated after the flood waters have receded due to contaminated flood waters (untreated sewage and hazardous chemicals) and mold growth typical in flooded buildings and homes.
- Significant flood events often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage can result in an increase in structure fires and/or carbon monoxide poisoning as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- Floods can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.
- First responders are exposed to downed power lines, contaminated and potentially unstable debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities.
- Significant flooding can result in the inability of emergency response vehicles to access areas of the community.
- Critical staff may suffer personal losses or otherwise impacted by a flood event and unable to report for duty, limiting response capabilities.
- City or county departments may be flooded, delaying response and recovery efforts for the entire community.
- Private sector entities that the jurisdiction and its residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the flood may be negatively impacted while utilities are being restored or water recedes, further slowing economic recovery.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures substantially damaged by a flood may not be rebuilt for years and uninsured or underinsured residential structures may never be rebuilt, reducing the tax base for the community.
- Large floods may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.

- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities such as fishing, boating, and camping activities at Lake McQueeney, Lake Dunlap, Lake Placid, or along the Guadalupe River, may be unavailable and tourism can be unappealing for years following a large flood event, devastating directly related local businesses and negatively impacting economic recovery.
- Flooding may cause significant disruptions of clean water and sewer services, elevating health risks and delaying recovery efforts.
- The psycho-social effects on flood victims and their families can traumatize them for long periods of time, creating long term increases in medical treatment and services.
- Extensive or repetitive flooding can lead to decreases in property value for the affected community.
- Flood poses a potential catastrophic risk to annual and perennial crop production and overall crop quality leading to higher food costs.
- Flood related declines in production may lead to an increase in unemployment.
- Large floods may result in loss of livestock, potential increased livestock mortality due to stress and water borne disease, and increased cost for feed.

The overall extent of damages caused by floods is dependent on the extent, depth and duration of flooding, and the velocities of flows in the flooded areas. The level of preparedness and pre-event planning done by government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a flood event.

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 flood hazard. Guadalupe County and all participating jurisdictions are currently participating in the NFIP and are in good standing.

In addition, Guadalupe County is currently participating in the Community Rating System (CRS) with a current CRS class of 8. Guadalupe County participates in the CRS program to provide flood insurance incentives and expand the community's current NFIP policy base and reduce risk through the adoption of higher regulatory standards.

As of April 2021, Guadalupe County has 2,358 flood insurance policies with the NFIP, with total annual premiums of $2,694,561.

Table 5-9. Summary of NFIP Policies for Guadalupe County

JURISDICTION	NUMBER OF INSURED STRUCTURES	TOTAL INSURANCE COVERAGE VALUE	ANNUAL PREMIUMS PAID	NUMBER OF INSURANCE CLAIMS FILED	TOTAL LOSS PAYMENTS
Guadalupe County[5]	1,988	$512,456,800	$2,337,964	1,972	$89,792,117
City of Cibolo	94	$26,299,100	$66,524	7	$153,628
City of Seguin	276	$72,799,800	$290,073	353	$16,384,675

All participating jurisdictions currently have in place minimum NFIP standards for new construction and substantial improvements of structures. All jurisdictions are considering adopting additional higher regulatory NFIP standards to limit floodplain development. The flood hazard areas throughout the planning area are subject to periodic inundation, which may result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, of which adversely affect public safety.

These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, flood-proofed or otherwise protected from flood damage. Mitigation actions are included to address flood maintenance issues as well, including routinely clearing debris from drainage systems and bridges and expanding drainage culverts and storm water structures to more adequately convey flood waters.

It is the purpose of Guadalupe County and all participating jurisdictions to continue to promote the public health, safety, and general welfare by minimizing public and private losses due to flood conditions in specific areas. The NFIP participating jurisdictions in the Plan are guided by their local Flood Damage Prevention Ordinance. Each community will continue to comply with NFIP requirements through their local permitting, inspection, and record-keeping requirements for new and substantially developed construction. Further, the NFIP program promotes sound development in floodplain areas and includes provisions designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets, and bridges located in floodplains;
- Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and

[5] Guadalupe County includes the unincorporated areas and the Cities of Marion, Santa Clara, Schertz, Selma, and Staples.

- Ensure that potential buyers are notified that property is in a flood area.

In order to accomplish these tasks, Guadalupe County and all participating jurisdictions seek to follow these guidelines to achieve flood mitigation by:

- Restrict or prohibit uses that are dangerous to health, safety, or property in times of flood, such as filling or dumping, that may cause excessive increases in flood heights and/or velocities;
- Require that uses vulnerable to floods, including facilities, which serve such uses, be protected against flood damage at the time of initial construction as a method of reducing flood losses;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of floodwaters;
- Control filling, grading, dredging, and other development, which may increase flood damage; and
- Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

NFIP COMPLIANCE AND MAINTENANCE

As mentioned, Guadalupe County and all participating jurisdictions has developed mitigation actions that relate to either NFIP maintenance or compliance. Compliance and maintenance actions can be found in Section 18.

Flooding was identified by all participating communities as a high-risk hazard during hazard ranking activities at the Risk Assessment Workshop. As such, many of the mitigation actions were developed with flood mitigation in mind. A majority of these flood actions address compliance with the NFIP and implementing flood awareness programs. Guadalupe County recognizes the need and are working towards maintaining and improving the county's CRS class as well as implementing additional public flood awareness activities. In addition, to stay in compliance with the CRS program, the County reviews all properties that have received flood insurance claims. All participating jurisdictions recognize the need and are working towards adopting higher NFIP regulatory standards to further minimize flood risk in their community. In addition, each jurisdiction is focusing on public flood awareness activities. This includes promoting the availability of flood insurance by placing NFIP brochures and flyers in public libraries or public meeting places in participating jurisdictions.

Each NFIP participating jurisdiction has a designated floodplain administrator. The floodplain administrators in the planning area will continue to maintain compliance with the NFIP including continued floodplain administration, zoning ordinances, and development regulation. The floodplain ordinance adopted by jurisdictions outline the minimum requirements for development in special flood hazard areas.

REPETITIVE LOSS

The Severe Repetitive Loss (SRL) Grant Program under FEMA provides federal funding to assist states and communities in implementing mitigation measures to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the NFIP. The Texas Water Development Board (TWDB) administers the SRL grant program for the State of Texas. One of the goals of the FMA program is to reduce the burden of repetitive loss and severe

repetitive loss properties on the NFIP through mitigation activities that significantly reduce or eliminate the threat of future flood damages.

Repetitive Loss properties are defined as structures that are:

- Any insurable building for which 2 or more claims of more than $1,000 each, paid by the National Flood Insurance Program (NFIP) within any 10-year period, since 1978;
- May or may not be currently insured under the NFIP.

Severe Repetitive Loss properties are defined as residential properties that are:

- Covered under the NFIP and have at least four flood related damage claim payments (building and contents) over $5,000.00 each, and the cumulative amount of such claims payments exceed $20,000; or
- 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 market value of the building.

In either scenario, at least two of the referenced claims must have occurred within any ten-year period and must be greater than 10 days apart.[6] Table 5-10 shows repetitive loss and severe repetitive loss properties for the Guadalupe County planning area.

Table 5-10. Repetitive Loss and Severe Repetitive Loss Properties

JURISDICTION	BUILDING TYPE	NUMBER OF STRUCTURES	NUMBER OF LOSSES
Guadalupe County	Assumed Condo	1	4
	Non-Residential	2	6
	Other Residential	1	2
	Single Family	134	339
City of Cibolo	Single Family	2	4
City of Seguin	2-4 Family	1	2
	Assumed Condo	4	13
	Non-Residential	2	4
	Single Family	276	764

[6] Source: Texas Water Development Board

SECTION 6: DAM AND LEVEE FAILURE

HAZARD DESCRIPTION

DAMS

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;
- High winds, which can cause significant wave action and result in substantial erosion;
- Destructive acts of terrorism; and,
- Earthquakes, which typically cause longitudinal cracks at the tops of the embankments, leading to structural failure.

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 substantial 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 ensuring the safety of dams.

One major issue with the safety of dams is their age. The average age of America's 84,000 dams is 52 years. According to statistics released in 2009 by the Association of State Dam Safety

SECTION 6: DAM AND LEVEE FAILURE

Officials[1], more than 2,000 dams near population centers are in need of repair. In addition to the continual aging of dams, there have not been significant increases in the number of safety inspectors resulting in haphazard maintenance and inspection.

The Association of State Dam Safety Officials estimate that $16 billion will be needed to repair all high-hazard dams, but the total for all state dam-safety budgets is less than $60 million[2]. The current maintenance budget does not match the scale of America's long-term modifications of its watersheds. Worse still, more people are moving into risky areas. As the American population grows, dams that once could have failed without major repercussions are now upstream of cities and development.

LEVEES

A levee is simply a man-made embankment built to keep a river from overflowing its banks or to prevent ocean waves from washing into undesired areas. A levee is typically little more than a mound of less permeable soil, like clay, wider at the base and narrower at the top. These mounds run in a long strip in varying height, sometimes for many miles, along a river, lake or ocean. But there's no set height for levees. Their measurements vary according to the storms the area receives, even if those storms occur only once every hundred or thousand years.

Living by the water provides humans with a number of advantages: fertile farmland, transportation, trade and hydroelectric power. Levees allow humans to enjoy these assets without fear of flooding. But humans often forget how powerful waters behind a levee can be. In 1927, the Mississippi River swelled under heavy rains, charging through a line of levees and flooding

[1] Association of State Dam Safety Officials, Journal of Dam Safety
[2] Source: www.damsafety.org

an area the size of Ireland. In 1953, the North Sea broke through the Netherland's ancient system of dikes and killed thousands.

In 2005, New Orleans made international news when Hurricane Katrina breached its levees. Much of the city lies 10 feet (3 meters) below sea level. Over the course of the city's history, low-lying, boggy areas have been pumped dry to create new land. Much of this reclaimed land has sunk as it dried out. The entire city now depends on the levees, along with massive pumping stations, to keep the water out.

LOCATION

The State of Texas has 7,413 dams, all regulated by the Texas Commission on Environmental Quality (TCEQ). The National Dam Safety Review Board (in coordination with FEMA) and the National Inventory of Dams (NID) lists a total of twenty-eight dams or levees in or near the Guadalupe County planning area, including all participating jurisdictions (complete list located in Appendix D). Each of these dams were analyzed individually by location, volume, elevation, and condition (where available) when determining the risk, if any, for each dam. Each dam or levee site was further analyzed for potential risks utilizing FEMA's National Flood Hazard Layer (where available) to map locations and fully understand development near the dam or levee and topographical variations that may increase risk. Most of the dams listed were embankments for typically dry detention drainage areas, irrigation reservoirs, or shored up stream embankments. These types of structures are utilized for flood control and irrigation and do not pose a dam or levee failure risk. Other dams in the planning area feature such limited storage capacity that they pose no risk to structures, infrastructure, or citizens. Dams that were deemed to pose no past, current, or future risk to the planning area are not profiled in the plan as no loss of life or impact to critical facilities or infrastructure is expected in the event of a breach. Based on this detailed analysis, the planning team was able to determine that only five of the twenty-eight dams pose a risk to the planning area. The only jurisdictions profiling dam or levee failure are Guadalupe County and the City of Seguin. These dams, listed in Table 6-1, are profiled in detail in the Extent section of this hazard profile. Figure 6-1 illustrates the general location for the critical dams in the planning area. While inundation maps are not available for the profiled dams, an estimated inundation radius has been included on the location map for each profiled dam or levee (indicated by the red circle). For dams with a maximum storage capacity of 100,000 acre-feet or more, all structures within five miles are considered to be at risk to potential dam or levee failure hazards. For dams with a maximum storage capacity between 10,000 and 100,000 acre-feet, all structures within three miles are considered to be at risk to potential dam or levee failure hazards. For dams with a maximum storage capacity of less than 10,000 acre-feet, all structures within one mile are considered to be at risk to potential dam or levee failure hazards. It should be noted that the City of Cibolo is not located within any of the estimated inundation zones. This jurisdiction will not profile dam or levee failure as a hazard for their location.

Figure 6-1. Guadalupe County Critical Dam and Levee Locations

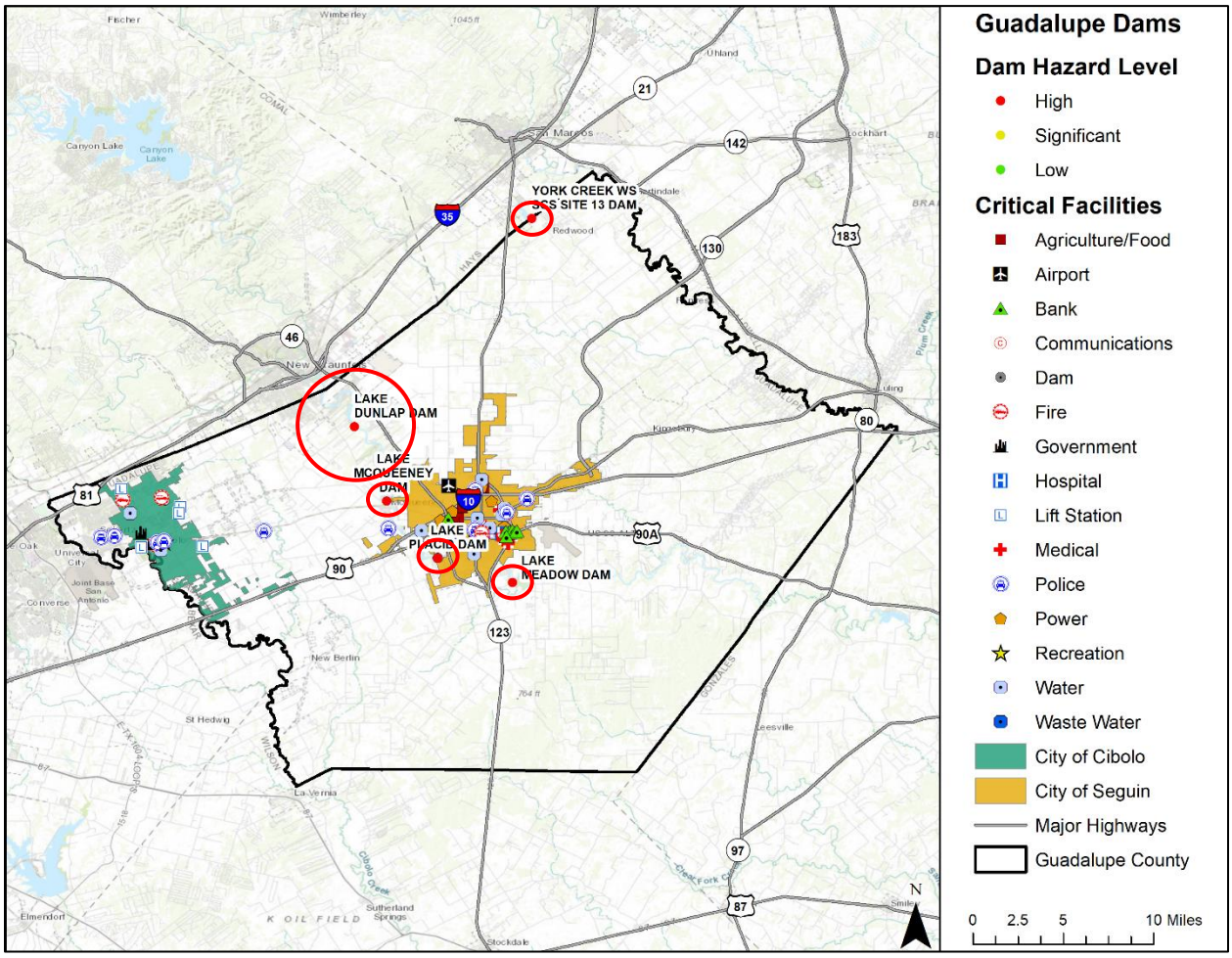


Table 6-1. Guadalupe County Dam and Levee Survey

JURISDICTION	DAM OR LEVEE NAME	HEIGHT (Ft.)	STORAGE (Acre Ft.)	CONDITION	PROFILED
Guadalupe County	Lake Meadow Dam	43.6	3,210	Not Rated	Yes
Guadalupe County	York Creek WS SCS Site 13	33	5,045	Not Rated	Yes
Guadalupe County	Lake McQueeney Dam	42	6,170	Not Rated	Yes
Guadalupe County	Lake Dunlap Dam	41	14,330	Not Rated	Yes
City of Seguin	Lake Placid Dam	46.8	5,650	Not Rated	Yes

EXTENT

The extent or magnitude of a dam or levee failure event is described in terms of the classification of damages that could result from a dam's failure, not the probability of failure. For dams with a maximum storage capacity of 100,000 acre-feet or more, all census blocks within five miles are

considered to be at risk to potential dam or levee failure hazards. For dams with a maximum storage capacity between 10,000 and 100,000 acre-feet, all census blocks within three miles are considered to be at risk to potential dam or levee failure hazards. For dams with a maximum storage capacity of less than 10,000 acre-feet, all census blocks within one mile are considered to be at risk to potential dam or levee failure hazards.

Lake Meadow Dam:
Lake Meadow Dam is located in unincorporated Guadalupe County on the Guadalupe River. The dam was constructed in 1930 and is used primarily for irrigation. It is owned by the Guadalupe-Blanco River Authority. The area located near the dam is semi-rural with limited development within a one-mile radius. A breach should follow the path of the river, but it is anticipated that the water released by the breach could temporarily exceed the capacity and overflow the banks of the river for approximately one mile. Approximately 25 residential structures and outbuildings, 5 commercial structures, and several access roads could be impacted by a breach. No critical facilities would be impacted. A dam failure could cause limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 183.7 feet with a maximum breach flow of 58,552 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth up to 15 feet with the highest depth in the immediate area of the dam breach.

York Creek WS SCS Site 13 Dam:
York Creek WS SCS Site 13 Dam is located in unincorporated Guadalupe County on the Cottonwood Creek and is used primarily for irrigation purposes. A breach should follow the path of the river, but it is anticipated that the water released by the breach could temporarily exceed the capacity and overflow the banks of the creek for approximately one mile. It is owned by the York Creek Improvement District and was constructed in 1964. The area located near the dam is semi-rural with limited development within a one-mile radius. Minimal populations in the plan area including approximately 200 residential structures, 3 churches, 10 commercial structures, and several access roads may be impacted. No critical facilities would be impacted. A dam failure could cause limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 191.9 feet with a maximum breach flow of 33,174 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth up to 15 feet with the highest depth in the immediate area of the dam breach.

Lake Placid Dam:
Lake Placid Dam is located in the City of Seguin on the Guadalupe River. The dam was constructed in 1932 and is used primarily for flood control. It is owned by the Guadalupe-Blanco River Authority. The area located near the dam is semi-rural with limited development within a one-mile radius. Minimal populations in the plan area including approximately 250 residential structures, 25 commercial structures, a courthouse, a bridge, a major access road, and multiple access roads may be impacted. No critical facilities would be impacted. A dam failure could cause limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 215.4 feet with a maximum breach flow of 106,249 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth up to 15 feet with the highest depth in the immediate area of the dam breach.

Lake McQueeney Dam:
Lake McQueeney Dam is located in unincorporated Guadalupe County. The dam was constructed in 1928 and is used primarily for flood control. It is owned by the Guadalupe-Blanco River Authority. The area located near the dam is semi-rural with limited development within a one-mile radius. Minimal populations in the plan area including approximately 100 residential structures, 25 commercial structures, an elementary school, and multiple access roads may be impacted. A dam failure could cause limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 214.3 feet with a maximum breach flow of 110,577 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth up to 15 feet with the highest depth in the immediate area of the dam breach.

Lake Dunlap Dam:
Lake Dunlap Dam is located in unincorporated Guadalupe County. The dam was constructed in 1928 and is used primarily for flood control. It is owned by the Guadalupe-Blanco River Authority. The area located near the dam is suburban with moderate development within a three-mile radius. Populations in the plan area including approximately 1,000 residential structures, more than 100 commercial structures, a fire station, elementary school, 3 churches, and multiple access roads may be impacted. A dam failure could cause limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 263.0 feet with a maximum breach flow of 93,710 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam breach could result in an estimated depth up to 15 feet with the highest depth in the immediate area of the dam breach.

Table 6-2 represents the extent or magnitude of a dam or levee failure event that could be expected for the Guadalupe County planning area for each profiled dam.

Table 6-2. Extent by Jurisdiction

JURISDICTION	PROFILED DAM	EXTENT (FLOW DEPTH)	LEVEL OF INTENSITY TO MITIGATE
Guadalupe County	Lake Meadow Dam	0-15 Feet	Dam failure presents a low threat for the county. Loss of life is not expected. While some residential and commercial structures could be impacted, the greatest threat in the event of a breach would be localized flooding. Critical facilities would not be impacted. Some infrastructure and utilities could be minimally impacted. Economic loss would be minimal.
Guadalupe County	York Creek WS SCS Site 13	0-15 Feet	Dam failure presents a low threat for the county. Loss of life is not expected. While some residential and commercial structures could be impacted, the greatest threat in the event of a breach would be localized flooding. Critical facilities would not be impacted. Some

JURISDICTION	PROFILED DAM	EXTENT (FLOW DEPTH)	LEVEL OF INTENSITY TO MITIGATE
			infrastructure and utilities could be minimally impacted. Economic loss would be minimal.
Guadalupe County	Lake McQueeney Dam	0-15 Feet	Dam failure presents a low threat for the county. Loss of life is not expected. While some residential and commercial structures could be impacted, the greatest threat in the event of a breach would be localized flooding. Critical facilities would not be impacted. Some infrastructure and utilities could be minimally impacted. Economic loss would be minimal.
Guadalupe County	Lake Dunlap Dam	0-15 Feet	Dam failure presents a low threat for the county. Loss of life is not expected. While some residential and commercial structures could be impacted, the greatest threat in the event of a breach would be localized flooding. Critical facilities would not be impacted. Some infrastructure and utilities could be minimally impacted. Economic loss would be minimal.
City of Seguin	Lake Placid Dam	0-15 Feet	Dam failure presents a low threat for the city. Loss of life is not expected. While some residential and commercial structures could be impacted, the greatest threat in the event of a breach would be localized flooding. Critical facilities would not be impacted. Some infrastructure and utilities could be minimally impacted. Economic loss would be minimal.

HISTORICAL OCCURRENCES

The State of Texas has not experienced loss of life or extensive economic damage due to a dam or levee failure since the first half of the twentieth century. However, there may be many incidents that are not reported and, therefore, the actual number of incidents is likely to be greater. There has not been a recorded dam or levee failure event for any of the participating jurisdictions in the Guadalupe County planning area.

PROBABILITY OF FUTURE EVENTS

No historical events of dam or levee failure have been recorded in the Guadalupe County planning area, though the risk of dam or levee failure is monitored closely. Due to the lack of historical occurrences, the probability of a future event is unlikely for those jurisdictions profiling dam or levee failure as a hazard, meaning an event is possible in the next ten years.

VULNERABILITY AND IMPACT

There are twenty-eight dams or levees in or near the Guadalupe County planning area. All dams or levees were evaluated in-depth to determine the risk, if any, associated with each dam. This analysis indicated five dams or levees in the planning area that presents a risk to structures or infrastructure in the planning area.

Flooding is the most prominent effect of dam or levee failure. If the dam or levee failure is extensive, a large amount of water would enter the downstream waterways forcing them out of their banks. There may be significant environmental effects, resulting in flooding that could disperse debris and hazardous materials downstream that can damage local ecosystems. If the event is severe, debris carried downstream can block traffic flow, cause power outages, and disrupt local utilities, such as water and wastewater, which could result in school closures. For specific vulnerability, please refer to the narrative for each dam or levee under the Extent section of this profile.

Annualized loss-estimates for dam or levee failure are not available; neither is there a breakdown of potential dollar losses for critical facilities, infrastructure and lifelines, or hazardous-materials facilities. If a significant dam or levee should fail, however, the severity of impact for the planning area would likely be minimal.

The severity of impact from a dam or levee breach would be “Limited,” meaning it could result in injuries that can be treated with first-aid, critical facilities being shut down for 24-hours or less and less than 10% of the property in the estimated breach inundation area destroyed or with major damage. For these reasons, creating mitigation actions to remove or protect people and structures from the path of destruction is necessary in order to minimize impact from dam or levee failure.

ASSESSMENT OF IMPACTS

Any individual dam or levee has a very specific area that will be impacted by a catastrophic failure. Dams identified as high or significant hazard can directly threaten the lives of individuals living or working in the inundation zone below the dam. The impact from any catastrophic failure would be similar to that of a flash flood. The impact of climate change could produce greater risk of dam or levee failures due to larger more frequent floods, exacerbating the current dam or levee failure impacts. Increased dam or levee failure threats can be associated with a variety of impacts, including:

- There could be injuries from impacts with debris carried by the flood.
- Swift-water rescue of individuals trapped by the water puts the immediate responders at risk for their own lives.
- Individuals involved in the cleanup may be at risk from the debris left behind.
- Continuity of operations for any jurisdiction outside the direct impact area could be very limited.

- Roads and bridges could be destroyed.
- Homes and businesses could be damaged or destroyed.
- Emergency services may be temporarily unavailable.
- Disruption of operations and the delivery of services in the impacted area.
- A large dam or levee with a high head of water could effectively scour the terrain below it for miles, taking out all buildings and other infrastructure.
- Scouring force could erode soil and any buried pipelines.
- Scouring action of a large dam or levee will destroy all vegetation in its path.
- Wildlife and wildlife habitat caught in the flow will likely be destroyed.
- Fish habitat will likely be destroyed.
- Topsoil will erode, slowing the return of natural vegetation.
- The destructive high velocity water flow may include substantial debris and hazardous materials, significantly increasing the risks to life and property in its path.
- Debris and hazardous material deposited downstream may cause further pollution of areas far greater than the inundation zone.
- Destroyed businesses and homes may not be rebuilt, reducing the tax base and impacting long term economic recovery.
- Historical or cultural resources may be damaged or destroyed.
- Recreational activities and tourism may be temporarily unavailable or unappealing, slowing economic recovery.

The economic and financial impacts of dam or levee failure on the area will depend entirely on the location of the dam, scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any dam or levee failure event.

SECTION 7: THUNDERSTORM WIND

HAZARD DESCRIPTION

Thunderstorms create extreme wind events which includes straight line winds. Wind is the horizontal motion of the air past a given point, beginning with differences in air pressures. Pressure that is higher at one place than another sets up a force pushing from the high toward the low pressure; the greater the difference in pressures, the stronger the force. The distance between the area of high pressure and the area of low pressure also determines how fast the moving air is accelerated.

Thunderstorms are created when heat and moisture near the Earth's surface are transported to the upper levels of the atmosphere. By-products of this process are the clouds, precipitation, and wind that become the thunderstorm.

According to the National Weather Service (NWS), a thunderstorm occurs when thunder accompanies rainfall. Radar observers use the intensity of radar echoes to distinguish between rain showers and thunderstorms.

Straight line winds are responsible for most thunderstorm wind damages. One type of straight-line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and make air travel extremely hazardous.

LOCATION

Thunderstorms wind events can develop in any geographic location and are considered a common occurrence in Texas. Therefore, a thunderstorm wind event could occur at any location within Guadalupe County's planning area, including all participating jurisdictions, as these storms develop randomly and are not confined to any geographic area within the County. It is assumed that the Guadalupe County planning area is uniformly exposed to the threat of thunderstorms winds.

EXTENT

The extent or magnitude of a thunderstorm wind event is measured by the Beaufort Wind Scale. Table 7-1 describes the different intensities of wind in terms of speed and effects, from calm to violent and destructive.

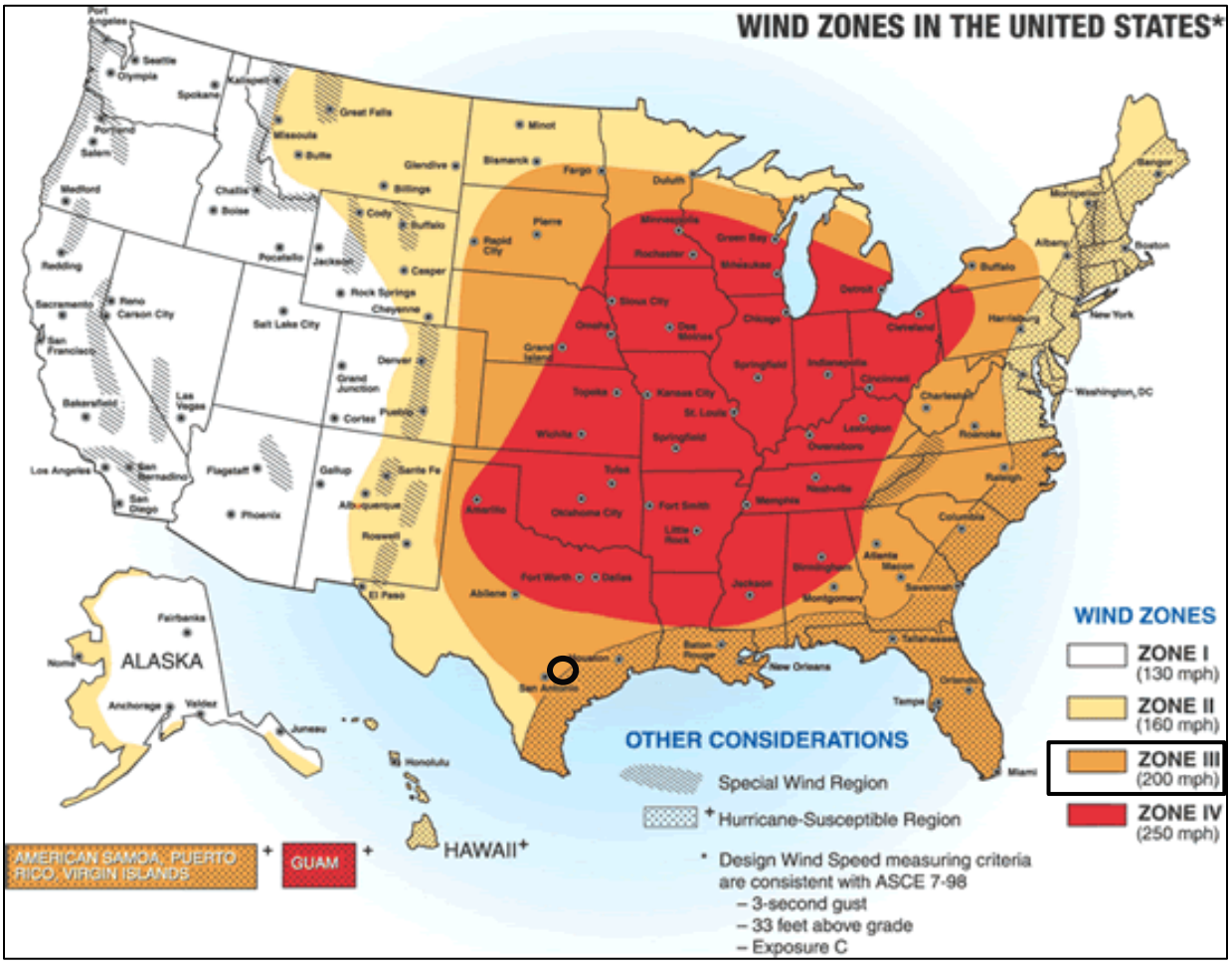
Table 7-1. Beaufort Wind Scale[1]

FORCE	WIND (MHP)	WMO CLASSIFICATION	APPEARANCE OF WIND EFFECTS
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-8	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	9-14	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	15-21	Moderate Breeze	Dust, leaves, and loose paper lifted; small tree branches move
5	22-28	Fresh Breeze	Small trees in leaf begin to sway
6	29-36	Strong Breeze	Larger tree branches moving, whistling in wires
7	37-44	Near Gale	Whole trees moving, resistance felt walking against wind
8	45-53	Gale	Whole trees in motion, resistance felt walking against wind
9	54-62	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	63-72	Storm	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	73-83	Violent Storm	If experienced on land, widespread damage
12	84+	Hurricane	Violence and destruction

Figure 7-1 displays the wind zones as derived from NOAA.

[1] Source: World Meteorological Organization

Figure 7-1. Wind Zones in the United States[2]



On average, the planning area experiences one to two thunderstorm wind events every year. The County is located in Zone III, meaning they can experience winds up to 200 mph. Guadalupe County has experienced a significant wind event or an event with winds in the range of "Force 10" on the Beaufort Wind Scale with winds up to 72 mph. Based on historical occurrences for thunderstorm wind events, a Force 10 on the Beaufort Wind scale is the maximum force anticipated for future events in the planning area.

HISTORICAL OCCURRENCES

Tables 7-2, 7-3, and 7-4 depict historical occurrences of thunderstorm wind events for the Guadalupe County planning area according to the National Centers for Environmental Information (NCEI) data. Since January 1960, 106 thunderstorm wind events are known to have impacted the Guadalupe County planning area, including all participating jurisdictions, based upon NCEI records. Table 7-3 presents information on known historical events impacting the Guadalupe County planning area with resulting damages, injuries, or fatalities. It is important to note that high

[2] Guadalupe County is indicated by the circle.

wind events associated with other hazards, such as tornadoes, are not accounted for in this section.

The NCEI is a national data source organized under the National Oceanic and Atmospheric Administration. The NCEI is the largest archive available for climate data; however, it is important to note that the only incidents recorded are those that are reported to the NCEI from 1960 through April 2020 have been factored into this risk assessment. In the tables that follow throughout this section, some occurrences seem to appear multiple times in one table. This is due to reports from various locations throughout the County. In addition, property damage estimates are not always available. Where an estimate has been provided in a table for losses, the dollar amounts have been altered to indicate the damage in 2020 dollars.

Historical thunderstorm wind data for the all participating jurisdictions are provided on a County-wide basis per the NCEI database.

Table 7-2. Historical Thunderstorm Wind Events with Reported Damages, 1960-2020

MAXIMUM WIND SPEED RECORDED (MPH)	NUMBER OF REPORTED EVENTS
0-30	37
31-40	1
41-50	7
51-60	19
61-70	30
71-80	0
81-90	0
91-100	0
Unknown	12

Table 7-3. Historical Thunderstorm Wind Events, 1960-2020[3]

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	8/24/1988	5:45 PM	0	0	3	$0	$0
City of Seguin	3/27/1994	1:50 AM	50	0	0	$8,800,985	$88,010
City of Seguin	5/13/1994	12:35 PM	0	0	0	$878,308	$87,831
Guadalupe County	4/28/1996	10:05 PM	Unknown	0	0	$8,289	$0
Guadalupe County	9/15/1996	4:45 AM	Unknown	0	0	$4,926	$0

[3] Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2020 dollars.

SECTION 7: THUNDERSTORM WIND

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
City of Seguin	5/27/1997	5:40 PM	Unknown	0	0	$32,367	$0
Guadalupe County	3/16/1998	3:20 AM	Unknown	0	0	$79,871	$0
City of Seguin	5/10/1999	6:05 PM	Unknown	0	0	$46,769	$0
Guadalupe County	5/17/1999	10:35 PM	Unknown	0	0	$15,590	$0
Guadalupe County	6/12/1999	8:50 PM	Unknown	0	0	$46,769	$0
City of Cibolo	6/12/1999	7:45 PM	Unknown	0	0	$109,128	$0
City of Seguin	3/26/2000	7:20 PM	Unknown	0	0	$121,075	$0
Guadalupe County	11/5/2000	8:20 PM	Unknown	0	0	$119,058	$0
Guadalupe County	3/19/2002	8:30 PM	Unknown	0	2	$724,555	$144,911
Guadalupe County	4/25/2007	12:00 AM	70	0	0	$100,288	$0
Guadalupe County	1/31/2008	12:00 PM	40	0	0	$6,138	$0
Guadalupe County	6/9/2010	7:15 AM	50	0	0	$59,436	$0
City of Seguin	5/12/2011	9:30 AM	45	0	0	$22,933	$0
Guadalupe County	6/11/2013	3:00 PM	43	0	0	$2,216	$0
Guadalupe County	5/9/2014	12:15 PM	43	0	0	$545	$0
Guadalupe County	5/3/2019	7:35 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:13 PM	61	0	0	$5,058	$0
Guadalupe County	6/9/2019	7:13 PM	65	0	0	$5,058	$0
Guadalupe County	6/9/2019	7:14 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:14 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:30 PM	56	0	0	$10,115	$0
Guadalupe County	6/9/2019	7:34 PM	61	0	0	$5,058	$0
Guadalupe County	6/9/2019	7:34 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:34 PM	65	0	0	$5,058	$0
Guadalupe County	6/9/2019	7:35 PM	61	0	0	$2,023	$0

JURISDICTION	DATE	TIME	MAGNITUDE (MPH)	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	6/9/2019	7:35 PM	56	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:36 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:36 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:41 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:42 PM	61	0	0	$2,023	$0
Guadalupe County	6/9/2019	7:43 PM	61	0	0	$2,023	$0
City of Seguin	6/9/2019	7:13 PM	65	0	0	$10,115	$0
City of Seguin	6/9/2019	7:30 PM	56	0	0	$30,346	$0
City of Seguin	6/9/2019	7:36 PM	61	0	0	$2,023	$0
City of Seguin	6/9/2019	8:00 PM	52	0	0	$2,023	$0
City of Cibolo	6/16/2019	11:50 PM	61	0	0	$1,012	$0
Guadalupe County	1/10/2020	7:56 PM	61	0	0	$25,110	$0
Guadalupe County	1/10/2020	8:15 PM	70	0	0	$20,088	$0
TOTALS			**(Max Extent)**	**0**	**5**	**$11,322,563**	**$320,752**

Table 7-4. Summary of Historical Thunderstorm Wind Events, 1961-2019

JURISDICTION	NUMBER OF EVENTS	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	87	70	0	5	$1,265,479	$144,911
City of Cibolo	4	61	0	0	$110,140	$0
City of Seguin	15	65	0	0	$9,946,944	$175,841
TOTAL LOSSES	**106**	**(Max Extent)**	**0**	**5**	**$11,643,315**	

SIGNIFICANT EVENTS

March 19, 2002 – Guadalupe County

High winds across the county caused widespread damage to homes, trees, and outbuildings. Damage in the south part of the county was spottier than over the north part. An anemometer at a school weather network in Seguin measured the wind gusts at 59 knots. Near Zorn, the high winds took sections of roofs off homes, and rolled and damaged several homes and mobile homes.

March 27, 1994 – City of Seguin
The thunderstorms moved eastward from Bexar County into Comal and Guadalupe Counties shortly after 1:00 a.m., producing damaging wind and large hail in Cibolo. They reached the City of Seguin just before 2:00 a.m. The Guadalupe County Sheriff reported 0.50 to 1.0 inch hail at Seguin near 1:50 a.m. Damaging winds occurred at the same time, uprooting several trees and knocking down numerous large tree limbs. This thunderstorm system caused extensive property damage and cut off electric service to 11,000 homes. Eleven power lines that had been built to withstand over 100 mph winds were twisted and toppled by the storm. Twenty-one residences in Schertz, Cibolo, and Marion were damaged, with four mobile homes destroyed and four with major damage. Winds were estimated at 50 to 60 mph, with golf ball-size hail. One woman at a flea market on the Interstate 35 portion of Schertz was hit by flying debris and was taken to a hospital. Damage in the Schertz-Cibolo region was estimated at well over $2 million. Barns and storage areas were blown over or damaged. Other damage was mainly to roofs and windows of houses and to windows of automobiles.

PROBABILITY OF FUTURE EVENTS

Most thunderstorm winds occur during the months of March, April, May, and September. Based on available records of historic events, there have been 106 events in a 60-year reporting period, which provides a probability of one to two events every year. Even though the intensity of thunderstorm wind events is not always damaging for the Guadalupe County planning area, the frequency of occurrence for a thunderstorm wind event is highly likely. This means that an event is probable within the next year for the Guadalupe County planning area, including all participating jurisdictions.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since thunderstorm wind events can occur at different strength levels, in random locations, and can create relatively narrow paths of destruction. Due to the randomness of these events, all existing and future structures and facilities in the Guadalupe County planning area, including all participating jurisdictions, could potentially be impacted and remain vulnerable to possible injury and property loss from strong winds.

Trees, power lines and poles, signage, manufactured housing, radio towers, concrete block walls, storage barns, windows, garbage recepticles, brick facades, and vehicles, unless reinforced, are vulnerable to thunderstorm wind events. More severe damage involves windborne debris; in some instances, patio furniture and other lawn items have been reported to have been blown around by wind and, very commonly, debris from damaged structures in turn have caused damage to other buildings not directly impacted by the event. In numerous instances roofs have been reported as having been torn off of buildings. The portable buildings typically used at schools and construction sites would be more vulnerable to thunderstorm wind events than typical site-built structures and could potentially pose a greater risk for wind-blown debris.

The US Census data indicates a total of 8,107 manufactured homes (approximately 14.2%) located in the Guadalupe County planning area, including all participating jurisdictions, (Table 7-5). In addition, 26.1% (approximately 14,889 structures) of the residential structures in the

Guadalupe County planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant wind events.

Table 7-5. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Guadalupe County[4]	8,107	14,889
City of Cibolo	410	627
City of Seguin	6	1,115

While all citizens are at risk to the impacts of thunderstorm wind, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 6.6% of the planning area population live below the poverty level (Table 7-6).

Table 7-6. Populations at Greatest Risk by Jurisdiction[5]

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Guadalupe County	10,239
City of Cibolo	1,286
City of Seguin	3,771

The following critical facilities would be vulnerable to thunderstorm wind events in each participating jurisdiction:

Table 7-7. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

[4] County totals includes all jurisdictions and unincorporated areas within the county.

[5] US Census Bureau 2018 data for Guadalupe County

SECTION 7: THUNDERSTORM WIND

A thunderstorm wind event can also result in traffic disruptions, injuries and in rare cases, fatalities. Impact of thunderstorms winds experienced in the Guadalupe County planning area has resulted in five injuries and no fatalities. Impact of thunderstorm wind events experienced in the Guadalupe County planning area, including all participating jurisdictions, would be "Minor," and injuries and illnesses do not result in permanent disability, more than ten percent of property damaged or destroyed, and facilities would be shut down for one week or more. Overall, the average loss estimate (in 2020 dollars) is $11,643,315, having an approximate annual loss estimate of $194,055 (Table 7-8).

Table 7-8. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$1,410,390	$23,507
City of Cibolo	$110,140	$1,836
City of Seguin	$10,122,785	$168,713
Planning Area	**$11,643,315**	**$194,055**

ASSESSMENT OF IMPACTS

Thunderstorm wind events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. The impact of climate change could produce larger, more severe thunderstorm wind events, exacerbating the current thunderstorm wind impacts. Worsening thunderstorm wind conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- During exceptionally heavy wind events, first responders may be prevented from responding to calls, as the winds may reach a speed in which their vehicles and equipment are unsafe to operate.
- Thunderstorm wind events often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning, as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.

- Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications.
- Critical staff may be unable to report for duty, limiting response capabilities.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- Private sector entities that the City and its residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by thunderstorm wind events may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to thunderstorm winds.
- Large scale wind events can have significant economic impact on the affected area, as it must now fund expenses such as infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.
- Activities at locations such as Lake McQueeney, Lake Dunlap, Lake Placid, or along the Guadalupe River attract tourism including hiking, camping, boating, and fishing throughout the year. A large thunderstorm wind event could impact recreational activities, placing visitors in imminent danger, potentially requiring emergency services or evacuations.
- Recreational areas and parks may be damaged or inaccessible due to downed trees or debris, causing temporary impacts to area businesses.

The economic and financial impacts of thunderstorm winds on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any thunderstorm wind event.

SECTION 8: LIGHTNING

HAZARD DESCRIPTION

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a “bolt” when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning often strikes outside of heavy rain and might occur as far as 10 miles away from any rainfall.

According to FEMA, an average of 300 people are injured and 80 people are killed in the United States each year by lightning. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities, and infrastructure. Lightning is also responsible for igniting wildfires that can result in widespread damages to property before firefighters have the ability to contain and suppress the resultant fire.

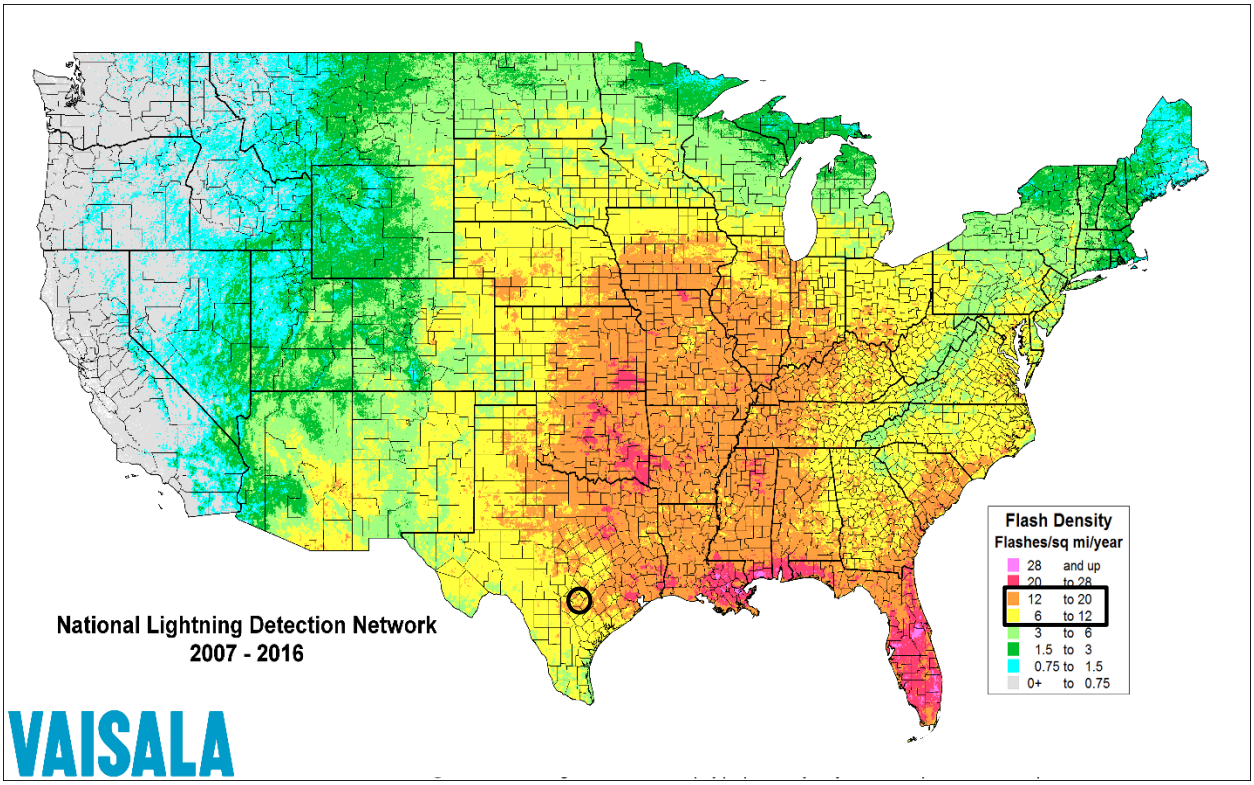
LOCATION

Lightning can strike in any geographic location and is considered a common occurrence in Texas. The Guadalupe County planning area, including all participating jurisdictions, is in a region of the country that is moderately susceptible to a lightning strike. Therefore, lightning could occur at any location within the entire planning area. It is assumed that the entire Guadalupe County planning area is uniformly exposed to the threat of lightning.

EXTENT

According to the NOAA, the average number of cloud-to-ground flashes for the State of Texas between 2007 and 2016 was 11.3 flashes per square mile. Vaisala’s U.S. National Lightning Detection Network lightning flash density map (Figure 8-1) shows a range of six to twenty cloud-to-ground lightning flashes per square mile per year for the entire Guadalupe County planning area. This rate equates to approximately 4,290 to 14,300 flashes per year for the entire planning area.

Figure 8-1. Lightning Flash Density, 2007-2016



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 (Table 8-1).

Table 8-1. NOAA Lightning Activity Levels (LAL)

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
1	No thunderstorms.	-
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

LAL	CLOUD & STORM DEVELOPMENT	LIGHTNING STRIKES/ 15 MIN
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	Similar to LAL 3 except thunderstorms are dry.	

The NCEI does not include the LAL for historical lightning events, therefore in order to determine the extent of lightning strikes, the yearly average range of estimated number of lightning strikes within the planning area (4,290 to 14,300 flashes) and a cloud-to-ground flash density of six to twenty per square mile were divided by the number[1] of thunderstorm events that occur annually in the planning area. Guadalupe County, including all participating jurisdictions, should expect an average range of two to seven lightning strikes within 15 minutes at any given time during a lightning or combined lightning and thunderstorm event, indicating lightning strikes have an average LAL of 2. The highest being a 2 on the LAL for all participating jurisdictions in the future.

HISTORICAL OCCURRENCES

Since January 1996, there has only been two recorded events for the Guadalupe County planning area. It is highly likely multiple lightning occurrences have gone unreported before and during the recording period. The NCEI is a national data source organized under the National Oceanic and Atmospheric Administration and considered a reliable resource for hazards. However, the flash density for the planning area along with input from local team members indicates regular lightning occurrences that simply have not been reported.

Table 8-2 Historical Lightning Events, 1996- 2020[2]

JURISDICTION	DATE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
City of Cibolo	7/18/2009	0	0	$120,316	$0
Guadalupe County	5/30/2015	0	0	$10,896	$0
TOTALS		**0**	**0**	**$131,211**	**$0**

SIGNIFICANT EVENTS

July 18, 2009 – City of Cibolo

A late afternoon thunderstorm tracked over Cibolo. Lightning struck a house and caused a fire, causing significant damage to the residence. Another storm in Val Verde County produced damaging winds.

[1] Analysis includes the highest number of events recorded in a given year during the reporting period in order to account for typical under reporting of thunderstorm and lightning events.

[2] Damages are reported in 2020 dollars.

May 30, 2015 – Guadalupe County
A complex of thunderstorms producing some wind damage, small hail, and eventually flash flooding moved in. The system intensified and expanded in coverage as it progressed eastward through the afternoon hours resulting in flash flooding for much of the area. The system exited during the late evening hours. The storm left many without power.

PROBABILITY OF FUTURE EVENTS

Based on historical records and input from the planning team the probability of occurrence for future lightning events in the Guadalupe County planning area, including all participating jurisdictions, is considered highly likely, or an event probable in the next year. The planning team stated that lightning occurs regularly in the area. According to NOAA, the Guadalupe County planning area is located in an area of the country that experiences six to twenty lightning flashes per square mile per year (approximately 4,290 to 14,300 flashes per year). Given this estimated probability of events, it can be expected that future lightning events will continue to threaten life and cause minor property damages throughout the planning area, including all participating jurisdictions.

VULNERABILITY AND IMPACT

Vulnerability is difficult to evaluate since lightning events can occur at different strength levels, in random locations, and can create a broad range of damages depending on the strike location. Due to the randomness of these events, all existing and future structures and facilities in the Guadalupe County planning area could potentially be impacted and remain vulnerable to possible injury and property loss from lightning strikes. The Guadalupe County planning area has two reported lightning events per the NCEI, however the county, including all participating jurisdictions, are vulnerable and could be impacted by lightning.

The direct and indirect losses associated with these events include injury and loss of life, damage to structures and infrastructure, agricultural losses, utility failure (power outages), and stress on community resources. The entire population of Guadalupe County, including all participating jurisdictions, is considered exposed to the lightning hazard. The peak lightning season in the State of Texas is from June to August; however, the most fatalities occur in July. Fatalities occur most often when people are outdoors and/or participating in some form of recreation. Population located outdoors is considered at risk and more vulnerable to a lightning strike compared to being inside a structure. Moving to a lower risk location will decrease a person's vulnerability.

The entire general building stock and all infrastructure of the Guadalupe County planning area, are considered exposed to the lightning hazard. Lightning can be responsible for damages to buildings, cause electrical, forest and/or wildfires, and damage infrastructure such as power transmission lines and communication towers. Agricultural losses can be extensive due to lightning and resulting fires.

While all citizens are at risk to the impacts of lightning, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 6.6% of the planning area population live below the poverty level (Table 8-3).

Table 8-3. Populations at Greatest Risk by Jurisdiction[3]

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Guadalupe County	10,239
City of Cibolo	1,286
City of Seguin	3,771

The following critical facilities would be vulnerable to lightning events in each participating jurisdiction:

Table 8-4. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Cibolo Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

Impact of lightning experienced in the Guadalupe County planning area has resulted in no injuries or fatalities. Impact of lightning events experienced in the Guadalupe County planning area, including all participating jurisdictions, would be “Limited,” and injuries and illnesses would be treatable with first aid. The quality of life lost would be minor, and facilities would be shut down for 24 hours or less. Overall, the average loss estimate for Guadalupe County, including all participating jurisdictions, is negligible.

Table 8-5. Potential Annualized Losses by Jurisdiction[4]

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATE
Guadalupe County	$10,896	$454
City of Cibolo	$120,316	$5,013
City of Seguin	$0	$0
PLANNING AREA	**$131,211**	**$5,467**

[3] US Census Bureau 2018 data for Guadalupe County
[4] Damage values are in 2020 dollars.

SECTION 8: LIGHTNING

ASSESSMENT OF IMPACTS

Lightning events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. The impact of climate change could produce more frequent and severe lightning events, exacerbating the current lightning impacts. Additional impacts to the planning area can include:

- Individuals exposed to the storm can be directly struck, posing significant health risks and potential death.
- Structures can be damaged or crushed by falling trees damaged by lightning, which can result in physical harm to the occupants.
- Lightning strikes can result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Lightning strikes can be associated with structure fires and wildfires, creating additional risk to residents and first responders.
- Emergency operations and services may be significantly impacted due to power outages and/or loss of communications.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- Economic disruption due to power outages and fires negatively impacts the programs and services provided by the community due to short and long term loss in revenue.
- Some businesses not directly damaged by lightning events may be negatively impacted while utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.

The economic and financial impacts of lightning on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the county, communities, local businesses, and citizens will also contribute to the overall economic and financial conditions in the aftermath of any lightning event.

SECTION 9: DROUGHT

HAZARD DESCRIPTION

Drought is a period of time without substantial rainfall that persists from one year to the next. Drought is a normal part of virtually 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. Droughts can be classified as meteorological, hydrologic, agricultural, and socioeconomic. Table 9-1 presents definitions for these different types of drought.

Droughts are one of the most complex of all natural hazards as it is difficult to determine their precise beginning or end. In addition, droughts 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. Therefore, a heat wave combined with a drought is a very dangerous situation.

Table 9-1. Drought Classification Definitions[1]

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.

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

LOCATION

Droughts occur regularly throughout Texas and the Guadalupe County planning area and are a normal condition. However, they can vary greatly in their intensity and duration. The Drought Monitor shows the planning area is currently experiencing abnormally dry conditions in the northwest half of the county (Figure 9-1). However, the planning area has experienced a range of conditions from normal to exceptional drought conditions over the last ten years (Figure 9-2). There is no distinct geographic boundary to drought; therefore, it can occur throughout the Guadalupe County planning area equally, including all participating jurisdictions.

Figure 9-1. U.S. Drought Monitor, October 2020

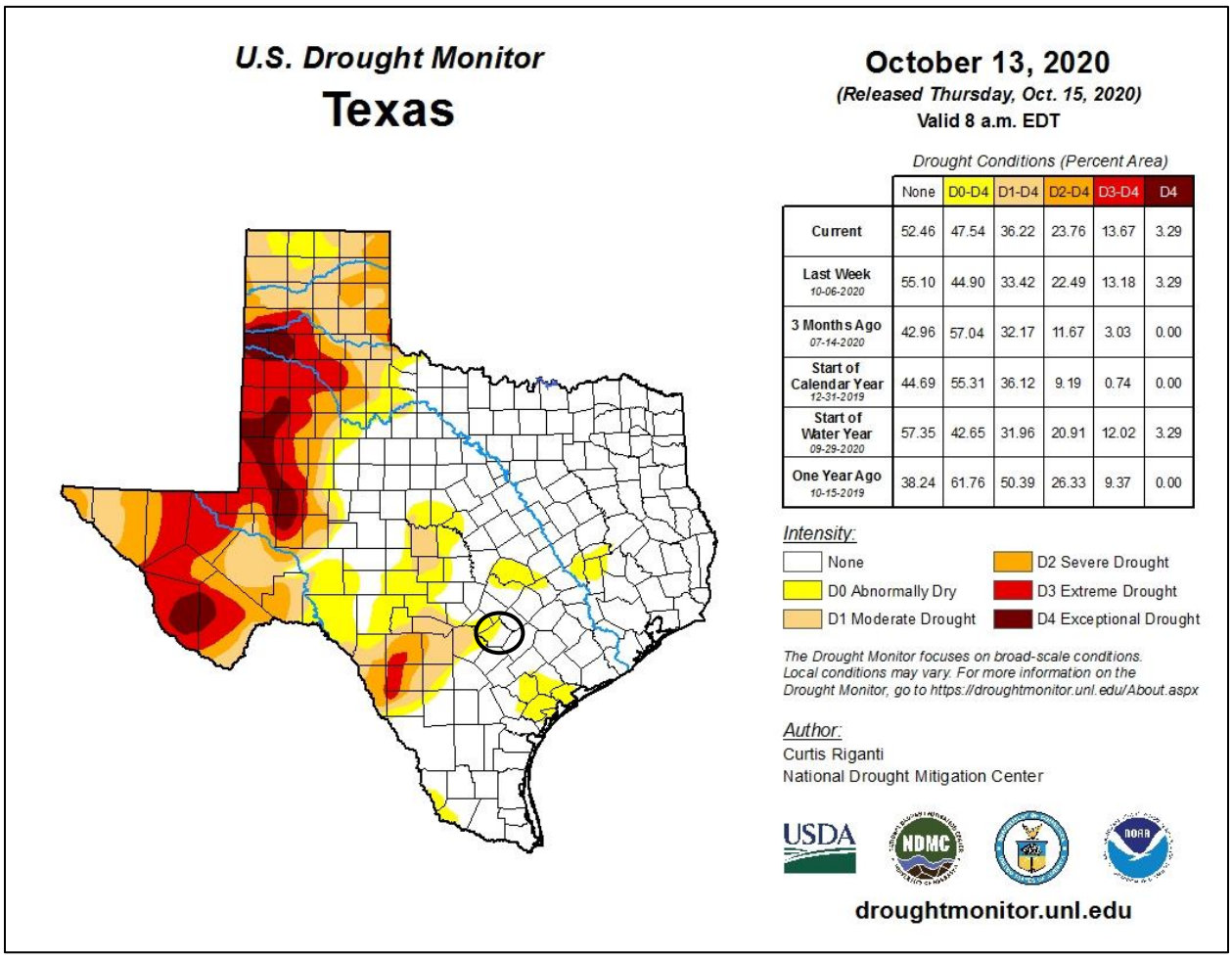
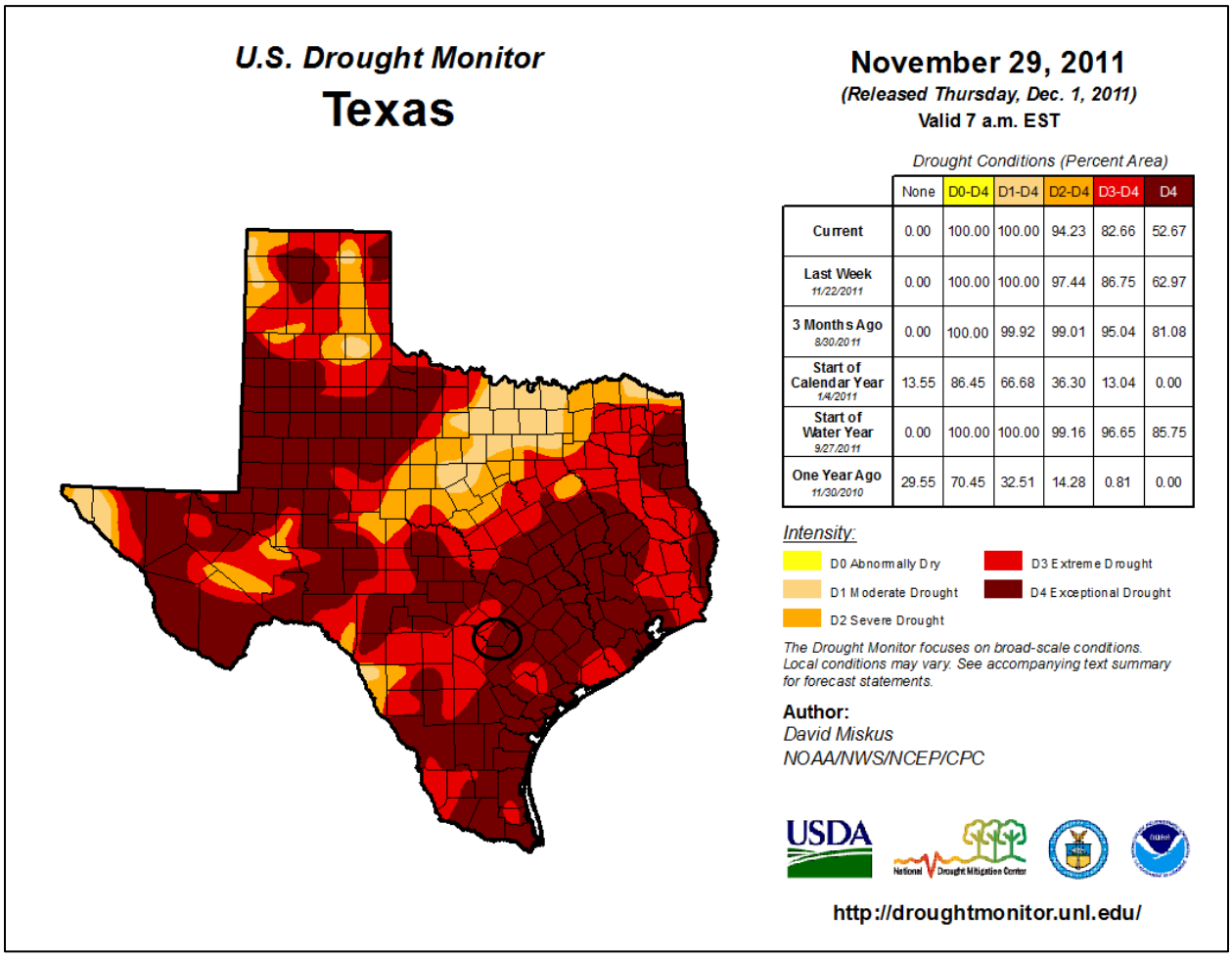


Figure 9-2. U.S. Drought Monitor, November 2011



EXTENT

The Palmer Drought Index is used to measure the extent of drought by measuring the duration and intensity of 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. He hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. Table 9-2 depicts magnitude of drought, while Table 9-3 describes the classification descriptions.

Table 9-2. Palmer Drought Index

DROUGHT INDEX	DROUGHT CONDITION CLASSIFICATIONS						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 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 +2.99	+3.00 to +3.99	+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 +2.99	+3.00 to +3.99	+4.00 and above

Table 9-3. Palmer Drought Category Descriptions[2]

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

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. and correspond to the intensity of drought.

Based on the historical occurrences for drought and the location of the Guadalupe County planning area, including all participating jurisdictions, the area can anticipate a range of drought from abnormally dry to exceptional, or D0 to D4, based on the Palmer Drought Category. The

[2] Source: National Drought Mitigation Center

entire planning area has experienced exceptional drought conditions. This is the most extreme drought conditions the planning area can anticipate in the future.

HISTORICAL OCCURRENCES

The Guadalupe County planning area may typically experience a severe drought. Table 9-4 lists historical events that have occurred in the Guadalupe County planning area as reported in the National Centers for Environmental Information (NCEI). Historical events are shown in Table 9-5. A total of 1237 reported historical drought events impacted the Guadalupe County planning area between 1996 through April 2020 (Summary Table 9-6).

Historical drought information shows drought activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event. Historical drought data for all participating jurisdictions in the Guadalupe County planning area are provided on a county-wide basis per the NCEI database.

Table 9-4. Historical Drought Years, 1996-2020[3]

DROUGHT YEAR
1996
2000
2011
2012
2013[4]
2014[5]
2015
2018
2019
2020
12 unique events

[3] Historical data is reported from January 1996 through April 2020.

[4] Two unique events were reported in this year.

[5] Two unique events were reported in this year.

Table 9-5. Historical Drought Events, 1996-2020

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	4/1/1996	0	0	$0	$0
Guadalupe County	5/1/1996	0	0	$0	$0
Guadalupe County	6/1/1996	0	0	$0	$0
Guadalupe County	7/1/1996	0	0	$0	$0
Guadalupe County	8/1/1996	0	0	$0	$0
Guadalupe County	7/1/2000	0	0	$0	$0
Guadalupe County	8/1/2000	0	0	$0	$0
Guadalupe County	9/1/2000	0	0	$0	$0
Guadalupe County	10/1/2000	0	0	$0	$0
Guadalupe County	5/1/2011	0	0	$0	$0
Guadalupe County	6/1/2011	0	0	$0	$0
Guadalupe County	7/1/2011	0	0	$0	$0
Guadalupe County	8/1/2011	0	0	$0	$0
Guadalupe County	9/1/2011	0	0	$0	$0
Guadalupe County	10/1/2011	0	0	$0	$0
Guadalupe County	11/1/2011	0	0	$0	$0
Guadalupe County	12/1/2011	0	0	$0	$0
Guadalupe County	1/1/2012	0	0	$0	$0
Guadalupe County	12/1/2012	0	0	$0	$0
Guadalupe County	2/1/2013	0	0	$0	$0
Guadalupe County	3/1/2013	0	0	$0	$0
Guadalupe County	4/1/2013	0	0	$0	$0
Guadalupe County	6/1/2013	0	0	$0	$0
Guadalupe County	7/1/2013	0	0	$0	$0
Guadalupe County	8/1/2013	0	0	$0	$0
Guadalupe County	2/1/2014	0	0	$0	$0
Guadalupe County	8/1/2014	0	0	$0	$0

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	9/1/2015	0	0	$0	$0
Guadalupe County	10/1/2015	0	0	$0	$0
Guadalupe County	8/1/2018	0	0	$0	$0
Guadalupe County	9/1/2018	0	0	$0	$0
Guadalupe County	9/1/2019	0	0	$0	$0
Guadalupe County	10/1/2019	0	0	$0	$0
Guadalupe County	11/1/2019	0	0	$0	$0
Guadalupe County	1/1/2020	0	0	$0	$0
Guadalupe County	2/1/2020	0	0	$0	$0
Guadalupe County	3/1/2020	0	0	$0	$0
TOTALS		**0**	**0**	**$0**	**$0**

Table 9-6. Historical Drought Events Summary, 1996-2020

JURISDICTION	NUMBER OF EVENTS	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	37	0	0	$0	$0

SIGNIFICANT EVENTS

Feb – April 2013 – Guadalupe County

February was a dry month across most of South Central Texas, moving Guadalupe County into a severe drought (D2). The fire danger was moderate to very high across the region and Texas A&M Agricultural reported rangeland and pastures continued to deteriorate forcing ranchers to continue supplemental feeding to livestock. Small trees and brush were budding, but growth was slow and weak. However, in March, Guadalupe rolled into an extreme drought (D3).

April brought some much-needed rain to South Central Texas. Most of the eastern half of the area received 150% or more of normal rainfall. Guadalupe County remained in a Stage D3 drought with outdoor burn bans staying in effect until the end of the month. The Texas Crop and Weather Report issued by Texas A&M Agricultural indicated livestock producers were supplying supplemental feed and de-stocking as necessary. The seven-day stream flow averages were much below normal (less than 10 percent) across the Colorado, Guadalupe, Nueces, and Frio River basins. Area lakes and reservoirs continued below normal pool elevations.

PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, there have been twelve extended time periods of drought (ranging in length from approximately 30 days to over 240 days) within a 24-year reporting

period, which provides a probability of one event every one to two years. This frequency supports a highly likely probability of future events. All participating jurisdiction events are included under the County.

VULNERABILITY AND IMPACT

Loss estimates were based on 24 years of statistical data from the NCEI. A drought event frequency-impact was then developed to determine an impact profile on agriculture products and estimate potential losses due to drought in the area. Table 9-7 shows annualized exposure.

Table 9-7. Potential Annualized Losses for Guadalupe County

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$0	$0

Drought impacts large areas and crosses jurisdictional boundaries. All existing and future buildings, facilities, and populations are exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop/livestock losses on agricultural lands and typically have no impact on buildings.

In terms of vulnerability, population, agriculture, property, socioeconomics and environment are all vulnerable to drought in the Guadalupe County planning area, including all participating jurisdictions. Typical demand can deplete water resources during extreme drought conditions. As resources are depleted, potable water is in short supply and overall water quality can suffer, elevating health concerns for all residents but especially vulnerable populations – typically children, the elderly, the ill, and those living below the poverty level. In addition, potable water is used for drinking, sanitation, patient care, sterilization, equipment, heating and cooling systems, and many other essential functions in medical facilities.

The average person will survive only a few days without potable water, and this timeframe can be drastically shortened for those people with more fragile health – typically children, the elderly, and the ill. Population over 65 in the Guadalupe County planning area is estimated at 13.4% of the total population, and children under the age of 5 are estimated at 6.4% or an estimated total of 30,649[6] potentially vulnerable residents in the planning area based on age. In addition, an estimated 6.6% of the planning area population live below the poverty level (Table 9-8) which may contribute to overall health impacts of a drought.

Table 9-8. Populations at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Guadalupe County[7]	20,739	9,910	10,239
City of Cibolo	2,095	1,838	1,286
City of Seguin	5,109	1,693	3,771

[6] US Census Bureau 2018 data for Guadalupe County

[7] County totals includes all incorporated jurisdictions and unincorporated areas.

The economic impact of droughts 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. If droughts extend over a number of years, the direct and indirect economic impact can be significant.

Habitat damage is a vulnerability of the environment during periods of drought for both aquatic and terrestrial species. The environment also becomes vulnerable during periods of extreme or prolonged drought due to severe erosion and land degradation.

Impact of droughts experienced in the Guadalupe County planning area, including all participating jurisdictions, has resulted in no injuries or fatalities supporting a “Limited” severity of impact meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property is destroyed or with major damage. Annualized loss over the 24-year reporting period in Guadalupe County is negligible.

ASSESSMENT OF IMPACTS

The Drought Impact Reporter was developed in 2005 by the University of Nebraska-Lincoln to provide a national database of drought impacts. Droughts can have an impact on: the agriculture; business and industry; energy; fire; plants and wildlife; relief, response, and restrictions; society and public health; tourism and recreation; and water supply and quality. The reports are submitted from individuals from Federal, State, and local agencies, as well as the general public. Table 9-9 lists the drought impacts to Guadalupe County from January 2005 to December 31, 2020 based on reports received by the Drought Impact Reporter.

Table 9-9. Drought Impacts, 2005-2020

DROUGHT IMPACTS 2005-2020	
Agriculture	66
Business & Industry	1
Energy	2
Fire	34
Plants & Wildlife	48
Relief, Response & Restrictions	30
Society & Public Health	3
Tourism & Recreation	0
Water Supply & Quality	28

Drought has the potential to impact people in the Guadalupe County planning area. While it is rare that drought, in and of itself, leads to a direct risk to the health and safety of people in the U.S., severe water shortages could result in inadequate supply for human needs. The impact of climate change could produce longer, more severe droughts, exacerbating the current drought

impacts. Worsening drought conditions can be frequently associated with a variety of impacts, including:

- The number of health-related low-flow issues (e.g., diminished sewage flows, increased pollution concentrations, reduced firefighting capacity, and cross-connection contamination) will increase as the drought intensifies.
- Public safety from forest/range/wildfires will increase as water availability and/or pressure decreases.
- Respiratory ailments may increase as the air quality decreases.
- There may be an increase in disease due to wildlife concentrations (e.g., rabies, Rocky Mountain spotted fever, Lyme disease).
- Jurisdictions and residents may disagree over water use/water rights, creating conflict.
- Political conflicts may increase between municipalities, counties, states, and regions.
- Water management conflicts may arise between competing interests.
- Increased law enforcement activities may be required to enforce water restrictions.
- Severe water shortages could result in inadequate supply for human needs as well as lower quality of water for consumption.
- Firefighters may have limited water resources to aid in firefighting and suppression activities, increasing risk to lives and property.
- During drought there is an increased risk for wildfires and dust storms.
- The community may need increased operational costs to enforce water restriction or rationing.
- Prolonged drought can lead to increases in illness and disease related to drought.
- Utility providers can see decreases in revenue as water supplies diminish.
- Utilities providers may cut back energy generation and service to their customers to prioritize critical service needs.
- Hydroelectric power generation facilities and infrastructure would have significantly diminished generation capability. Dams simply cannot produce as much electricity from low water levels as they can from high water levels.
- Fish and wildlife food and habitat will be reduced or degraded over time during a drought and disease will increase, especially for aquatic life.
- Wildlife will move to more sustainable locations creating higher concentrations of wildlife in smaller areas, increasing vulnerability and further depleting limited natural resources.
- Severe and prolonged drought can result in the reduction of a species or cause the extinction of a species altogether.
- Plant life will suffer from long-term drought. Wind and erosion will also pose a threat to plant life as soil quality will decline.
- Dry and dead vegetation will increase the risk of wildfire.
- Drought poses a significant risk to annual and perennial crop production and overall crop quality leading to higher food costs.
- Drought related declines in production may lead to an increase in unemployment.

- Drought may limit livestock grazing resulting in decreased livestock weight, potential increased livestock mortality, and increased cost for feed.
- Negatively impacted water suppliers may face increased costs resulting from the transport water or develop supplemental water resources.
- Long term drought may negatively impact future economic development.

The overall extent of damages caused by periods of drought is dependent on its extent and duration. The level of preparedness and pre-event planning done by government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a drought event.

SECTION 10: EXTREME HEAT

HAZARD DESCRIPTION

Extreme heat is a prolonged period of excessively high temperatures and exceptionally humid conditions. Extreme heat during the summer months is a common occurrence throughout the State of Texas, and Guadalupe County is no exception. The entire planning area, including all participating jurisdictions, typically experience extended heat waves. A heat wave is an extended period of extreme heat and is often accompanied by high humidity.

Although heat can damage buildings and facilities, it presents a more significant threat to the safety and welfare of citizens. The major human risks associated with severe summer heat include: heat cramps; sunburn; dehydration; fatigue; heat exhaustion; and even heat stroke. The most vulnerable population to heat casualties are children and the elderly or infirmed who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being.

LOCATION

Though a death from extreme heat has been recorded at a specific location in the County[1], there is no specific geographic scope to the extreme heat hazard. Extreme heat could occur anywhere within the Guadalupe County planning area, including all participating jurisdictions.

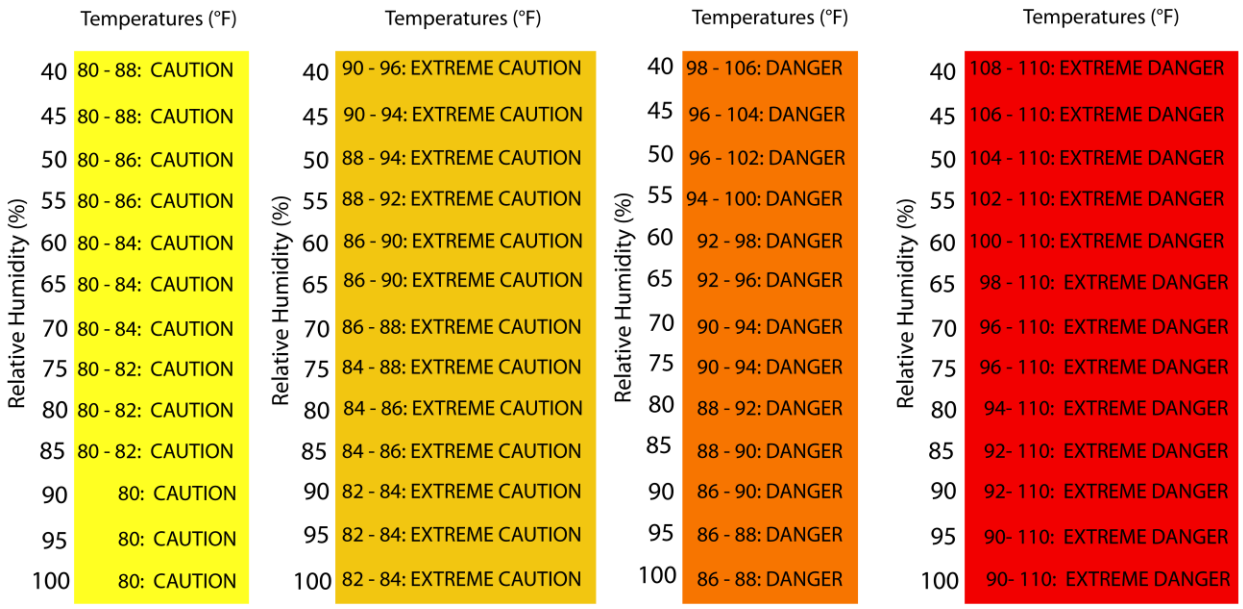
EXTENT

The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the “Heat Index” and is depicted in Figure

[1] Texas Health and Human Services, Heat-Related Deaths by County of Death: https://www.dshs.texas.gov/chs/vstat/Hotcolddths/occcounty.shtm.

10-1. This index measures how hot it feels outside when humidity is combined with high temperatures.

Figure 10-1. Extent Scale for Extreme Summer Heat[2]



The Extent Scale in Figure 10-1 displays varying categories of caution depending on the relative humidity combined with the temperature. For example, when the temperature is at 90 degrees Fahrenheit (°F) or lower, caution should be exercised if the humidity level is at or above 40 percent.

The shaded zones on the chart indicate varying symptoms or disorders that could occur depending on the magnitude or intensity of the event. “Caution” is the first category of intensity, and it indicates when fatigue due to heat exposure is possible. “Extreme Caution” indicates that sunstroke, muscle cramps, or heat exhaustion are possible, and a “Danger” level means that these symptoms are likely. “Extreme Danger” indicates that heat stroke is likely. The National Weather Service (NWS) initiates alerts based on the Heat Index as shown in Table 10-1.

[2] Source: NOAA

SECTION 10: EXTREME HEAT

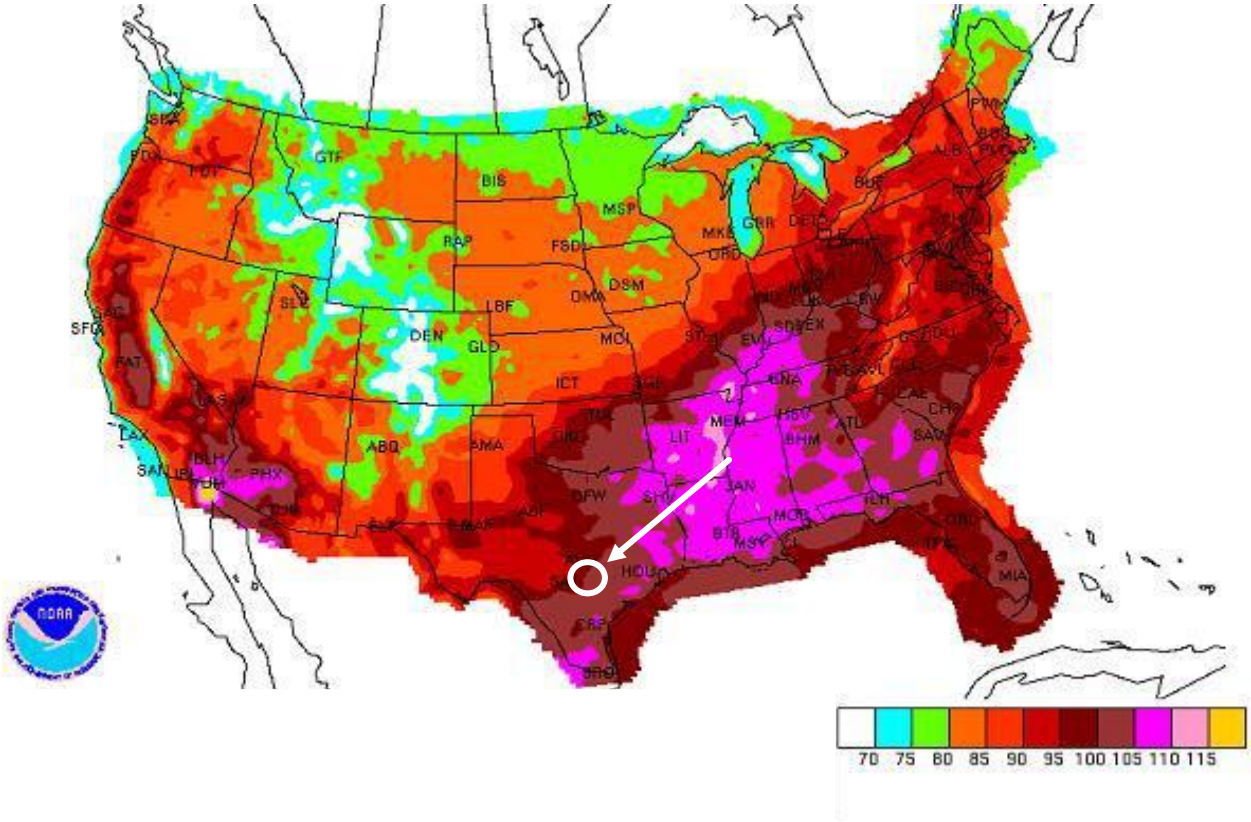
Table 10-1. Heat Index and Warnings

CATEGORY	HEAT INDEX	POSSIBLE HEAT DISORDERS	WARNING TYPE
Extreme Danger	125°F and higher	Heat stroke or sun stroke likely.	A heat advisory will be issued to warn that the Heat Index may exceed 105°F.
Danger	103 – 124°F	Sunstroke, muscle cramps, and/or heat exhaustion are likely. Heatstroke possible with prolonged exposure and/or physical activity.	
Extreme Caution	90 – 103°F	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.	An Excessive Heat Warning is issued if the Heat Index rises above 105°F at least 3 hours during the day or above 80°F at night.
Caution	80 – 90°F	Fatigue is possible with prolonged exposure and/or physical activity.	

Guadalupe County covers 715 square miles, and its elevation ranges from 450 to 800 feet above sea level. The northwestern section, near the border with Comal and Hays counties, is part of the Blackland Prairie; the rest of the county lies in the Upper Coastal Plain. Soil types vary from dark, calcareous clay in the northwest to fine, sandy loam in the southeast. Vegetation consists primarily of mesquite, scrub brush, and grasses in drier areas of the county, while water-tolerant hardwoods and conifers flourish near creeks. The area has a mild subtropical climate, with temperatures ranging from an average high of 96° in July and an average low of 42° in January. The annual rainfall in the county averages 33 inches, and the growing season averages 275 days.

Figure 10-2 displays the daily maximum heat index as derived from NOAA based on data compiled from 1838 to 2015. The white circle shows the Guadalupe County planning area. The dark red and brown colors indicate a daily maximum heat index of 95° to 105°F. Guadalupe County, including all participating jurisdictions could experience extreme heat from 90° to 105°F in the future. The record high temperature for the Guadalupe County planning area was 110°F in 2019. This is the highest temperature (danger category) the planning area can expect.

Figure 10-2. Average Daily Maximum Heat Index Days[3]



HISTORICAL OCCURRENCES

Every summer, the hazard of heat-related illness becomes a significant public health issue throughout much of the US. Mortality from all causes increases during heat waves, and excessive heat is an important contributing factor to deaths from other causes, particularly among the elderly. Table 10-2 depicts historical occurrences of mortality from heat from 1994 to 2004 from the Texas Department of State Health Services and 2005 through April 2020 from the NCEI database.

Table 10-2. Extreme Heat Related Deaths in Texas

YEAR	DEATHS
1994	1
1995	12
1996	10
1997	2

[3] Source: NRDC and the white circle indicates the Guadalupe County planning area.

YEAR	DEATHS
1998	66
1999	22
2000	71
2001	20
2002	1
2003	0
2004	3
2005	49
2006	2
2007	2
2008	7
2009	120
2010	4
2011	46
2012	3
2013	2
2014	0
2015	5
2016	6
2017	3
2018	7
2019	7
2020	0

Because the Texas Department of State Health Services reports on total events statewide, previous occurrences for extreme heat are derived from the NCEI database. According to heat related incidents located solely within Guadalupe County, there is only three heat waves[4] on record for the Guadalupe County planning area (Table 10-3). Historical extreme heat information,

[4] Even though the County experiences heat waves each summer, NCEI data only records events reported. Based on reports, only five events are on record.

as provided by the NCEI, shows extreme heat activity across a multi-county forecast area for each event, the appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event. Historical extreme heat data for all participating jurisdictions are provided on a County-wide basis per the NCEI database. Only extreme heat events that have been reported have been factored into this Risk Assessment. It is highly likely additional extreme heat occurrences have gone unreported before and during the recording period. Due to the limited number of reported events, average high temperatures have been analyzed in order to determine the probability of future events.

Table 10-3. Historical Extreme Heat Events, 1996-2020[5]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	6/4/2010	0	0	$0	$0
Guadalupe County	6/12/2011	0	0	$0	$0
Guadalupe County	7/23/2018	0	0	$0	$0
TOTALS		**0**	**0**	**$0**	**$0**

PROBABILITY OF FUTURE EVENTS

Average high temperatures for the planning area through the summer months indicate a probability of one event or more every year. This frequency supports a highly likely probability of future events.

VULNERABILITY AND IMPACT

There is no defined geographic boundary for extreme heat events. While the entire Guadalupe County planning area, including all participating jurisdictions, is exposed to extreme temperatures, existing buildings, infrastructure, and critical facilities are not likely to sustain significant damage from extreme heat events. Therefore, any estimated property losses associated with the extreme heat hazard are anticipated to be minimal across the area.

Extreme temperatures do however present a significant threat to life and safety for the population of the County as a whole. Heat casualties for example are typically caused by a lack of adequate air-conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well-being. Children may also be more vulnerable if left unattended in vehicles. In addition, populations living below the poverty level are unable to run air-conditioning on a regular basis and are limited in their ability to seek medical treatment. Another segment of the population at risk are those whose jobs consist of strenuous labor outdoors. Additionally,

[5] Events reported from January 1996 through April 2020.

livestock and crops can become stressed, decreasing in quality or in production, during times of extreme heat.

The population over 65 in the Guadalupe County planning area is estimated at 13.4% of the total population and children under the age of 5 are estimated at 6.4%, or an estimated total of 30,649[6] potentially vulnerable residents in the planning area based on age. In addition, an estimated 6.6% of the planning area population live below the poverty level (Table 10-4).

Table 10-4. Populations at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION UNDER 5	POPULATION BELOW POVERTY LEVEL
Guadalupe County[7]	20,739	9,910	10,239
City of Cibolo	2,095	1,838	1,286
City of Seguin	5,109	1,693	3,771

Extreme high temperatures can have significant secondary impacts, leading to droughts, water shortages, increased fire danger, and prompt excessive demands for energy. The possibility of rolling blackouts increases with unseasonably high temperatures in what is a normally mild month with low power demands.

Typically, more than 12 hours of warning time would be given before the onset of an extreme heat event. In terms of vulnerability the impact from extreme heat is considered “Limited”. It is possible that critical facilities and infrastructure could be shut down for 24 hours if cooling units are running constantly, leading to a temporary power outage. Less than ten percent of residential and commercial property could be damaged if extreme heat events lead to structure fires. Based on historical records over a 24-year period, annualized property and crop losses for the Guadalupe County planning area are negligible.

ASSESSMENT OF IMPACTS

The greatest risk from extreme heat is to public health and safety. The impact of climate change could produce longer, more severe heat waves, exacerbating the current impacts. Worsening extreme heat conditions can be frequently associated with a variety of impacts, including:

- Vulnerable populations, particularly the elderly and children under 5, can face serious or life-threatening health problems from exposure to extreme heat including hyperthermia, heat cramps, heat exhaustion, and heat stroke (or sunstroke).
- Response personnel, including utility workers, public works personnel, and any other professions where individuals are required to work outside, are more subject to extreme heat related illnesses since their exposure would typically be greater.
- High energy demand periods can outpace the supply of energy, potentially creating the need for rolling brownouts which would elevate the risk of illness to vulnerable residents.
- Highways and roads may be damaged by excessive heat causing asphalt roads to soften and concrete roads to shift or buckle.

[6] U.S. Census Bureau 2018 data for Guadalupe County

[7] County totals includes all incorporated jurisdictions and unincorporated areas.

- Vehicles engines and cooling systems typically run harder during extreme heat events resulting in increases in mechanical failures.
- Extreme heat events during times of drought can exacerbate the environmental impacts associated with drought, decreasing water and air quality and further degrading wildlife habitat.
- Extreme heat increases ground-level ozone (smog), increasing the risk of respiratory illnesses.
- Food suppliers can anticipate an increase in food costs due to increases in production costs and crop and livestock losses.
- Fisheries may be negatively impacted by extreme heat, suffering damage to fish habitats (either natural or man-made) and a loss of fish and/or other aquatic organisms due to decreased water flows or availability.
- Negatively impacted water suppliers may face increased costs resulting from the transport of water resources or development of supplemental water resources.
- Outdoor activities such as fishing, boating, and camping activities at Lake McQueeney, Lake Dunlap, Lake Placid, and along the Guadalupe River, may see an increase in injury or illness during extreme heat events.

The economic and financial impacts of extreme heat on the community will depend on the duration of the event, demand for energy, drought associated with extreme heat, and many other factors. The level of preparedness and the amount of planning done by the jurisdiction, local businesses, and citizens will impact the overall economic and financial conditions before, during, and after an extreme heat event.

SECTION 11: HAIL

HAZARD DESCRIPTION

Hailstorm events are a potentially damaging outgrowth of severe thunderstorms. During 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 the 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 typically greater than 0.75 inches in diameter. 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 in suspension in thunderclouds. The strength of the updraft is a by-product of heating on the Earth's surface. Higher temperature gradients above Earth's surface result in increased suspension time and hailstone size.

LOCATION

Hailstorms are an extension of severe thunderstorms that could potentially cause severe damage. As a result, they are not confined to any specific geographic location and can vary greatly in size, location, intensity, and duration. Therefore, the Guadalupe County planning area, including all participating jurisdictions, are equally at risk to the hazard of hail.

EXTENT

The National Weather Service (NWS) classifies a storm as "severe" if there is hail three-quarters of an inch in diameter (approximately the size of a penny) or greater, based on radar intensity or as seen by observers. The intensity category of a hailstorm depends on hail size and the potential damage it could cause, as depicted in the National Centers for Environmental Information (NCEI) Intensity Scale in Table 11-1.

Table 11-1. Hail Intensity and Magnitude[1]

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

The intensity scale in Table 11-1 ranges from H0 to H10, with increments of intensity or damage potential in relation to hail size (distribution and maximum), texture, fall speed, speed of storm translation, and strength of the accompanying wind. Based on available data regarding the previous occurrences for the area, the Guadalupe County planning area, including all participating jurisdictions, may experience hailstorms ranging from an H0 to an H10. The County can mitigate a storm from low risk or hard hail to a super hailstorm with baseball size hail that leads to extensive structural damage and could cause fatal injuries. The largest hail event in the Guadalupe County planning area resulted in hail measuring 4.0 inches in diameter, or a H10, Super Hailstorm. This is the worst extent the planning area can anticipate in the future.

[1] NCEI Intensity Scale, based on the TORRO Hailstorm Intensity Scale.

HISTORICAL OCCURRENCES

Historical evidence shown in Figure 11-1 demonstrates that the planning area is vulnerable to hail events overall, which typically result from severe thunderstorm activity. Historical events with reported damages, injuries, or fatalities are shown in Table 11-2. A total of 86 reported historical hail events impacted the Guadalupe County planning area between 1955 through April 2020 (Summary Table 11-3). These events were reported to NCEI and NOAA databases and may not represent all hail events to have occurred during the past 65 years. Only those events for the Guadalupe County planning area with latitude and longitude available were plotted (Figure 11-1).

Figure 11-1. Spatial Historical Hail Events, 1955-2020

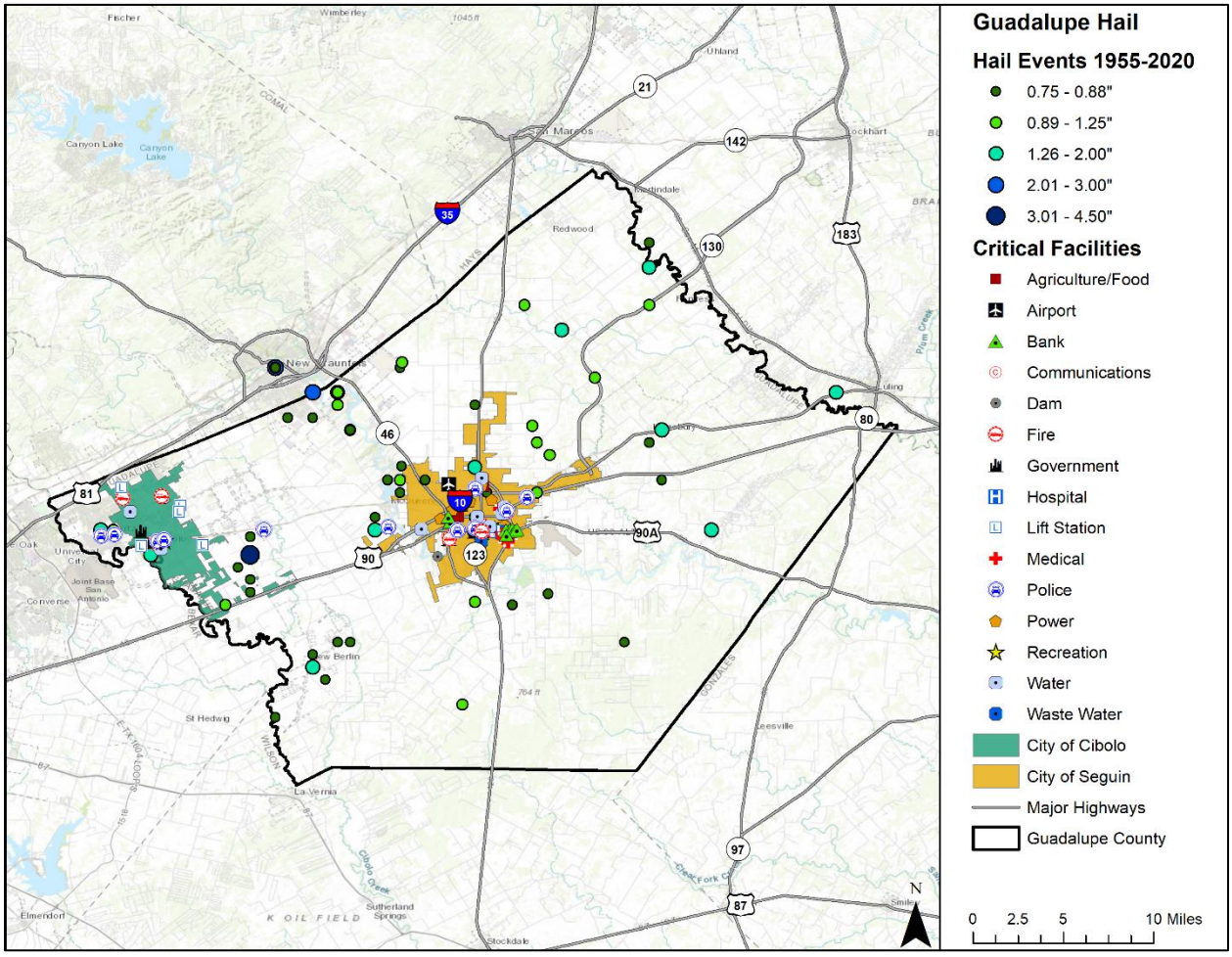


Table 11-2. Historical Hail Events, 1955-2020[2]

JURISDICTION	DATE	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
City of Cibolo	3/27/1994	0.75	1	0	$8,800,985	$88,010
City of Seguin	3/27/1994	1.75	0	0	$8,800,985	$88,010
City of Seguin	3/26/2000	2	0	0	$151,344	$75,672
Guadalupe County	4/24/2010	1.25	0	0	$2,377	$0
TOTALS		**(Max Extent)**	**1**	**0**	**$18,007,383**	

Table 11-3. Historical Hail Events Summary, 1955-2020

JURISDICTION	NUMBER of EVENTS	MAGNITUDE	INJURIES	FATALITIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	68	4.0 inches	0	0	$2,377	$0
City of Cibolo	1	0.75 inches	1	0	$8,800,985	$88,010
City of Seguin	17	2.0 inches	0	0	$8,952,329	$163,682
TOTAL LOSSES	**86**	**(Max Extent)**	**1**	**0**	**$18,007,383**	

SIGNIFICANT EVENTS

March 27, 1994 – Cities of Cibolo and Seguin

The thunderstorms moved eastward from Bexar County into Comal and Guadalupe Counties shortly after 1:00 a.m., producing damaging wind and large hail in Cibolo. The storms reached the City of Seguin just before 2:00 a.m. The Guadalupe County Sheriff reported 0.50 to 1 inch hail at Seguin near 1:50 a.m. Damaging winds occurred at the same time, uprooting several trees and knocking down numerous large tree limbs. This thunderstorm system caused extensive property damage and cut off electric service to 11,000 homes. Eleven power lines that had been built to withstand over 100 mph winds were twisted and toppled by the storm. Twenty-one residences in Schertz, Cibolo, and Marion were damaged, with four mobile homes destroyed and four with major damage. Winds were estimated at 50 to 60 mph, with golf ball-size hail. Damage in the Schertz-Cibolo region was estimated at well over $2 million. Barns and storage areas were blown over or damaged. Other damage was mainly to roofs and windows of houses and to windows of automobiles.

PROBABILITY OF FUTURE EVENTS

Based on available records of historic events, 86 events in a 65-year reporting period for Guadalupe County provides a probability of one event per year. This frequency supports a highly

[2] Only recorded events with fatalities, injuries, and/or damages are listed.

likely probability of future events for the Guadalupe County planning area including all participating jurisdictions.

VULNERABILITY AND IMPACT

Damage from hail approaches 1 billion dollars in the U.S. each year. Much of the damage inflicted by hail is to crops. Even relatively small hail can shred plants to ribbons in a matter of minutes. Vehicles, roofs of buildings and homes, and landscaping are most commonly damaged by hail.

Utility systems on roofs at school districts and critical facilities would be vulnerable and could be damaged. Hail could cause a significant threat to people as they could be struck by hail and falling trees and branches. Outdoor activities and events may elevate the risk to residents and visitors when a hailstorm strikes with little warning. Portable buildings typically utilized by schools and commercial sites such as construction areas would be more vulnerable to hail events than the typical site-built structures.

The Guadalupe County planning area features mobile or manufactured home parks throughout the planning area. These parks are typically more vulnerable to hail events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area, including all participating jurisdictions, which would also be more vulnerable. The US Census data indicates a total of 8,107 (14.2%) manufactured homes located in the Guadalupe County planning area including all participating jurisdictions (Table 11-4). In addition, 26.1 (approximately 14,889 structures) of the single family residential (SFR) structures in the Guadalupe County planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant hail events.

Table 11-4. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Guadalupe County[3]	8,107	14,889
City of Cibolo	410	627
City of Seguin	6	1,115

While all citizens are at risk to the impacts of a hail, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 6.6% of the planning area population live below the poverty level (Table 11-5).

[3] County totals includes all incorporated jurisdictions and unincorporated areas.

Table 11-5. Populations at Greatest Risk by Jurisdiction[4]

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Guadalupe County	10,239
City of Cibolo	1,286
City of Seguin	3,771

The following critical facilities would be vulnerable to hail events in each participating jurisdiction:

Table 11-6. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

Hail has been known to cause injury to humans and occasionally has been fatal. Overall, the average loss estimate of property and crops (in 2020 dollars) is $18,007,383, having an approximate annual loss estimate of $277,037. Based on historic loss and damages, the impact of hail damages on the Guadalupe County planning area, including all participating jurisdictions, can be considered “Minor” severity of impact meaning injuries and illness do not result in permanent disability, county area facilities are shut down for one week or more, and more than ten percent of property destroyed or with major damage.

Table 11-7. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATE
Guadalupe County	$2,377	$37
City of Cibolo	$8,888,995	$136,754
City of Seguin	$9,116,011	$140,246
Planning Area	**$18,007,383**	**$277,037**

[4] US Census Bureau 2018 data for Guadalupe County

SECTION 11: HAIL

ASSESSMENT OF IMPACTS

Hail events have the potential to pose a significant risk to people and can create dangerous situations. The impact of climate change could produce larger, more severe hail events, exacerbating the current hail impacts. Worsening hail conditions can be frequently associated with a variety of impacts, including:

- Hail may create hazardous road conditions during and immediately following an event, delaying first responders from providing for or preserving public health and safety.
- Individuals and first responders who are exposed to the storm may be struck by hail, falling branches, or downed trees resulting in injuries or possible fatalities.
- Residential structures can be damaged by falling trees, which can result in physical harm to occupants.
- Large hail events will likely cause extensive roof damage to residential structures along with siding damage and broken windows, creating a spike in insurance claims and a rise in premiums.
- Automobile damage may be extensive depending on the size of the hail and length of the storm.
- Hail events can result in power outages over widespread areas increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage can result in an increase in structure fires and/or carbon monoxide poisoning, as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- First responders are exposed to downed power lines, damaged structures, hazardous spills, and debris that often accompany hail events, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Downed power lines and large debris, such as downed trees, can result in the inability of emergency response vehicles to access areas of the community.
- Hazardous road conditions may prevent critical staff from reporting for duty, limiting response capabilities.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by the hail event may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.
- Hazardous road conditions will likely lead to increases in automobile accidents, further straining emergency response capabilities.
- Depending on the severity and scale of damage caused by large hail events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- A significant hail event could significantly damage agricultural crops, resulting in extensive economic losses for the community and surrounding area.
- Hail events may injure or kill livestock and wildlife.
- A large hail event could impact the accessibility of recreational areas and parks due to extended power outages or debris clogged access roads.

SECTION 11: HAIL

The economic and financial impacts of hail will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning conducted by the community, local businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of any hail event.

SECTION 12: TORNADO

HAZARD DESCRIPTION

Tornadoes are among the most violent storms on the planet. A tornado is a rapidly rotating column of air extending between, and in contact with, a cloud and the surface of the earth. The most violent tornadoes are capable of tremendous destruction and have wind speeds of 250 miles per hour or more. In extreme cases, winds may approach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long.

The most powerful tornadoes are produced by "Supercell Thunderstorms." These thunderstorms are created when horizontal wind shears (winds moving in different directions at different altitudes) begin to rotate the storm. This horizontal rotation can be tilted vertically by violent updrafts, and the rotation radius can shrink, forming a vertical column of very quickly swirling air. This rotating air can eventually reach the ground, forming a tornado**.**

Table 12-1. Variations among Tornadoes

WEAK TORNADOES	STRONG TORNADOES	VIOLENT TORNADOES
• 69% of all tornadoes • Less than 5% of tornado deaths • Lifetime 1-10+ minutes • Winds less than 110 mph	• 29% of all tornadoes • Nearly 30% of all tornado deaths • May last 20 minutes or longer • Winds 110 – 205 mph	• 2% of all tornadoes • 70% of all tornado deaths • Lifetime can exceed one hour • Winds greater than 205 mph

LOCATION

Tornadoes do not have any specific geographic boundary and can occur throughout the County uniformly. It is assumed that the entire Guadalupe County planning area including all participating jurisdictions are uniformly exposed to tornado activity. The entire Guadalupe County planning area is located in Wind Zone III (Figure 12-1), where tornado winds can be as high as 200 mph.

Figure 12-1. FEMA Wind Zones in the United States[1]

EXTENT

The destruction caused by tornadoes ranges from light to inconceivable, depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, such as residential homes (particularly mobile homes).

[1] Guadalupe County is indicated by the star.

Table 12-2. The Fujita Tornado Scale[2]

F-SCALE NUMBER	INTENSITY	WIND SPEED (MPH)	TYPE OF DAMAGE DONE	PERCENT OF APPRAISED STRUCTURE VALUE LOST DUE TO DAMAGE
F0	Gale Tornado	40 – 72	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	None Estimated
F1	Moderate Tornado	73 – 112	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	0% – 20%
F2	Significant Tornado	113 – 157	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	50% – 100%
F3	Severe Tornado	158 – 206	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	100%
F4	Devastating Tornado	207 – 260	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	100%
F5	Incredible Tornado	261 – 318	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	100%

Tornado magnitudes prior to 2005 were determined using the traditional version of the Fujita Scale (Table 12-2). Since February 2007, the Fujita Scale has been replaced by the Enhanced

[2] Source: http://www.tornadoproject.com/fscale/fscale.htm

Fujita Scale (Table 12-3), which retains the same basic design and six strength categories as the previous scale. The newer scale reflects more refined assessments of tornado damage surveys, standardization, and damage consideration to a wider range of structures.

Table 12-3. Enhanced Fujita Scale for Tornadoes

STORM CATEGORY	DAMAGE LEVEL	3 SECOND GUST (MPH)	DESCRIPTION OF DAMAGES	PHOTO EXAMPLE
EF0	Gale	65 – 85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.	
EF1	Weak	86 – 110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off roads; attached garages may be destroyed.	
EF2	Strong	111 – 135	Considerable damage; roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	
EF3	Severe	136 – 165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	
EF4	Devastating	166 – 200	Well-constructed homes leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	
EF5	Incredible	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles flying through the air in excess of 330 yards; trees debarked; steel reinforced concrete badly damaged.	

Both the Fujita Scale and Enhanced Fujita Scale should be referenced in reviewing previous occurrences since tornado events prior to 2007 will follow the original Fujita Scale. The largest magnitude reported within the planning area is an F3 on the Fujita Scale, a “Severe Tornado.”

Based on the planning areas location in Wind Zone III, the planning area could experience anywhere from an EF0 to EF5 depending on the wind speed.

The events in Guadalupe County (converted from the Fujita Scale) have been between EF0 and EF5 (Table 12-4). Therefore, the range of intensity that the Guadalupe County planning area, including all participating jurisdictions, would be expected to mitigate is a tornado event that would be a low to incredible risk, an EF0 to EF5. Historically, the strongest tornado to strike the planning area was a F3, which would be an EF5 on the Enhanced Fujita Scale with the highest wind speed. This is the strongest event the planning area can anticipate in the future.

HISTORICAL OCCURRENCES

Only reported tornadoes were factored into the Risk Assessment. It is likely that a high number of occurrences have gone unreported over the past 67 years. Historical tornado data for the county and participating jurisdictions is provided within a jurisdiction-wide basis per the NCEI database.

Figure 12-2 identifies the locations of previous occurrences in the Guadalupe County planning area from 1953 through April 2020. A total of 25 events have been recorded by the Storm Prediction Center (NOAA) and NCEI databases for the Guadalupe County planning area, including all participating jurisdictions.

Figure 12-2. Spatial Historical Tornado Events, 1953-2020[3]

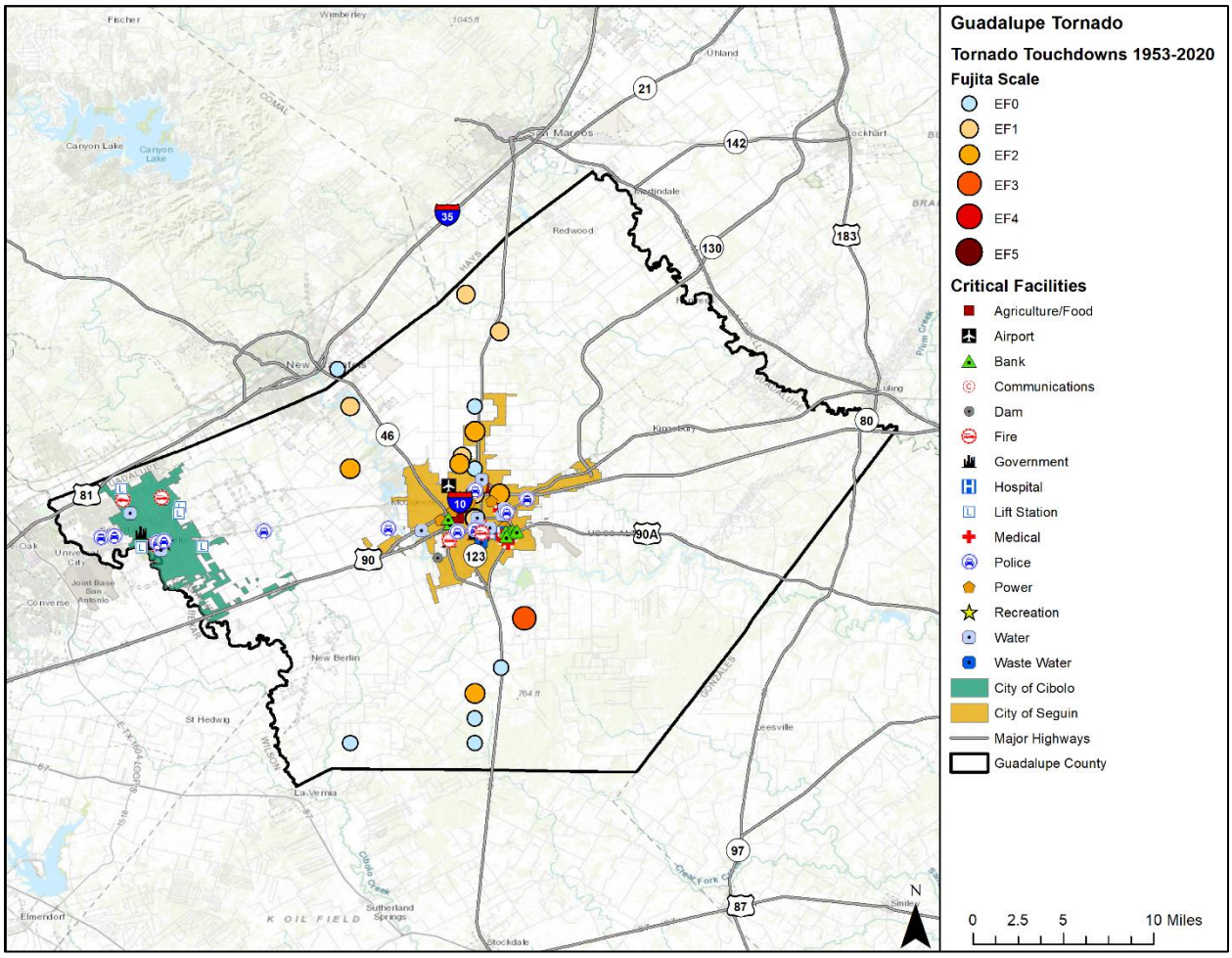


Table 12-4. Historical Tornado Events, 1953-2020[4]

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	12/1/1953	7:00 PM	F3	0	10	$2,408,002	$0
Guadalupe County	10/20/1956	4:25 PM	F2	0	1	$23,555	$0
Guadalupe County	8/20/1960	6:00 PM	F1	0	0	$21,884	$0
Guadalupe County	9/4/1961	2:57 PM	F2	0	0	$21,592	$0
Guadalupe County	10/28/1962	11:45 AM	F1	0	0	$213,076	$0
Guadalupe County	12/2/1962	7:15 AM	F1	0	0	$21,308	$0

[3] Source: NOAA Records
[4] Only recorded events with fatalities, injuries or damages are listed. Magnitude is listed when available. Damage values are in 2020 dollars.

JURISDICTION	DATE	TIME	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	5/1/1967	8:45 PM	F2	0	0	$19,511	$0
Guadalupe County	9/20/1967	1:15 PM	F1	0	0	$19,278	$0
Guadalupe County	9/20/1967	5:00 PM	Unavailable	0	0	$1,928	$0
Guadalupe County	5/22/1969	10:00 AM	F2	0	0	$17,795	$0
Guadalupe County	5/16/1972	3:50 PM	F1	0	0	$155,710	$0
City of Seguin	3/26/2000	7:25 PM	F0	0	0	$22,702	$0
Guadalupe County	11/15/2001	6:37 PM	F0	0	0	$73,027	$0
Guadalupe County	6/29/2004	4:00 PM	F0	0	0	$109,268	$0
City of Seguin	7/21/2007	4:25 AM	EF2	0	0	$62,194	$0
TOTALS			**(Max Extent)**	**0**	**11**	**$3,190,830**	**$0**

Table 12-5. Summary of Historical Events, 1953-2020[5]

JURISDICTION	Number of Events	MAGNITUDE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	20	F3	0	11	$3,105,934	$0
City of Cibolo	0	N/A	N/A	N/A	$0	$0
City of Seguin	5	EF2	0	0	$84,896	$0
TOTAL LOSSES	**25**	**(Max Extent)**	**0**	**11**	**$3,190,830**	

SIGNIFICANT EVENTS

July 21, 2017 – City of Seguin

At approximately 4:25 a.m. a tornado estimated to be an EF-2 touched down about 9 miles south of Seguin and 1/4 mile southeast of CR411. The tornado moved northward along SH123 for nearly 1 mile before turning slightly to the northwest and crossing CR410. It damaged three outbuildings, a residence, and a store, but no one was injured. The tornado ranged in width from 50 yards up to 150 yards. The total track length was approximately 2 miles.

June 29, 2004 – Guadalupe County

The Guadalupe County Emergency Manager reported that a small tornado touched down just southeast of New Berlin, destroying a barn and damaging several trees. The tornado was small and short-lived. It dissipated shortly after striking the trees.

[5] Damages reported in 2020 dollars.

PROBABILITY OF FUTURE EVENTS

Tornadic storms can occur at any time of year and at any time of day, but they are typically more common in the spring months during the late afternoon and evening hours. A smaller, high frequency period can emerge in the fall during the brief transition between the warm and cold seasons. According to historical records, Guadalupe County, including all participating jurisdictions, can experience a tornado touchdown approximately once every two to three years. This frequency supports a likely probability of future events for Guadalupe County, including all participating jurisdictions.

VULNERABILITY AND IMPACT

Because tornadoes often cross jurisdictional boundaries, all existing and future buildings, facilities, and populations in the entire Guadalupe County planning area, including all participating jurisdictions, are considered to be exposed to this hazard and could potentially be impacted. The damage caused by a tornado is typically a result of high wind velocity, wind-blown debris, lightning, and large hail.

The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. Consequently, vulnerability of humans and property is difficult to evaluate since tornadoes form at different strengths, in random locations, and create relatively narrow paths of destruction. Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Manufactured Homes;
- Homes on crawlspaces (more susceptible to lift); and
- Buildings with large spans, such as shopping malls, gymnasiums, and factories.

Tornadoes can cause a significant threat to people as they could be struck by flying debris, falling trees/branches, utility lines, and poles. Blocked roads could prevent first responders to respond to calls. Tornadoes commonly cause power outages which could cause health and safety risks to residents and visitors, as well as to patients in hospitals.

The Guadalupe County planning area features multiple mobile or manufactured home parks throughout the planning area, including all participation jurisdictions. These parks are typically more vulnerable to tornado events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area including all participating jurisdictions and unincorporated areas of the county which would also be more vulnerable. The US Census data indicates a total of 8,107 manufactured homes located in the Guadalupe County planning area (14.2%), including all participating jurisdictions (Table 12-6). In addition, 26.1% (approximately 14,889 structures) of the single family residential (SFR) structures in the entire planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant tornado events.

Table 12-6. Structures at Greater Risk by Jurisdiction

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Guadalupe County[6]	8,107	14,889
City of Cibolo	410	627
City of Seguin	6	1,115

While all citizens are at risk to the impacts of a tornado, forced relocation and disaster recovery drastically impacts low-income residents who lack the financial means to travel, afford a long-term stay away from home, and to rebuild or repair their homes. An estimated 6.6% of the planning area population live below the poverty level (Table 12-7).

Table 12-7. Populations at Greatest Risk by Jurisdiction[7]

JURISDICTION	POPULATION BELOW POVERTY LEVEL
Guadalupe County	10,239
City of Cibolo	1,286
City of Seguin	3,771

The following critical facilities would be vulnerable to tornado events in each participating jurisdiction:

Table 12-8. Critical Facilities at Risk by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

The average loss estimate of property and crop is $3,190,830 (in 2020 dollars), having an approximate annual loss estimate of $47,624 (Table 12-9). Based on historic loss and damages, the impact of tornado on the Guadalupe County planning area, including all participating

[6] County totals includes all incorporated jurisdictions and unincorporated areas.

[7] US Census Bureau 2018 data for Guadalupe County

jurisdictions, can be considered “Minor,” with more than 10 percent of property expected to be damaged or destroyed, injuries that do not result in permanent disability, and critical facilities shut down for one week or more.

Table 12-9. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$3,105,934	$46,357
City of Cibolo	$0	$0
City of Seguin	$84,896	$1,267
Planning Area	**$3,190,830**	**$47,624**

ASSESSMENT OF IMPACTS

Tornadoes have the potential to pose a significant risk to the population and can create dangerous situations. Often times, providing and preserving public health and safety is difficult. The impact of climate change could produce larger, more severe tornado events, exacerbating the current tornado impacts. More destructive tornado conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Manufactured homes may suffer substantial damage as they would be more vulnerable than typical site-built structures.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- Tornadoes often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outages can result in an increase in structure fires and/or carbon monoxide poisoning as individuals attempt to cook or heat their home with alternate, unsafe cooking or heating devices, such as grills.
- Tornadoes can destroy or make residential structures uninhabitable, requiring shelter or relocation of residents in the aftermath of the event.
- First responders must enter the damage area shortly after the tornado passes to begin rescue operations and to organize cleanup and assessments efforts, therefore they are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions, elevating the risk of injury to first responders and potentially diminishing emergency response capabilities.
- Emergency operations and services may be significantly impacted due to damaged facilities, loss of communications, and damaged emergency vehicles and equipment.

- City or county departments may be damaged or destroyed, delaying response and recovery efforts for the entire community.
- Private sector entities that the City and its residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Damage to infrastructure may slow economic recovery since repairs may be extensive and lengthy.
- Some businesses not directly damaged by the tornado may be negatively impacted while roads and utilities are being restored, further slowing economic recovery.
- When the community is affected by significant property damage it is anticipated that funding would be required for infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, and normal day-to-day operating expenses.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Residential structures destroyed by a tornado may not be rebuilt for years, reducing the tax base for the community.
- Large or intense tornadoes may result in a dramatic population fluctuation, as people are unable to return to their homes or jobs and must seek shelter and/or work outside of the affected area.
- Businesses that are uninsured or underinsured may have difficulty reopening, which results in a net loss of jobs for the community and a potential increase in the unemployment rate.
- Recreation activities may be unavailable and tourism can be unappealing for years following a large tornado, devastating directly related local businesses.

The economic and financial impacts of a tornado event on the community will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a tornado event.

SECTION 13: WILDFIRE

HAZARD DESCRIPTION

A wildfire event can rapidly spread out of control and occurs most often in the summer when the brush is dry and flames can move unchecked through a highly vegetative area. Wildfires can start as a slow burning fire along the forest floor, killing and damaging trees. The fires often spread more rapidly as they reach the tops of trees with wind carrying the flames from tree to tree. Usually, dense smoke is the first indication of a wildfire.

A wildfire event often begins unnoticed and spreads quickly, lighting brush, trees, and homes on fire. For example, a wildfire may be started by a campfire that was not doused properly, a tossed cigarette, burning debris, or arson.

Texas has seen a significant increase in the number of wildfires in the past 30 years, which included wildland, interface, or intermix fires. Wildland fires are fueled almost exclusively by natural vegetation, while interface or intermix fires are urban/wildland fires in which vegetation and the built environment provide the fuel.

LOCATION

A wildfire event can be a potentially damaging consequence of drought. Wildfires can vary greatly in terms of size, location, intensity, and duration. While wildfires are not confined to any specific geographic location, they are most likely to occur in open grasslands. The threat to people and property from a wildfire event is greater in the fringe areas where developed areas meet open grass lands, such as the WUI. (Figures 13-1 through 13-3). It is estimated that 66.7 percent of the total population in Guadalupe County live within the WUI. However, the entire Guadalupe County planning area is at risk for wildfires.

Figure 13-1. Wildland Urban Interface Map – Guadalupe County

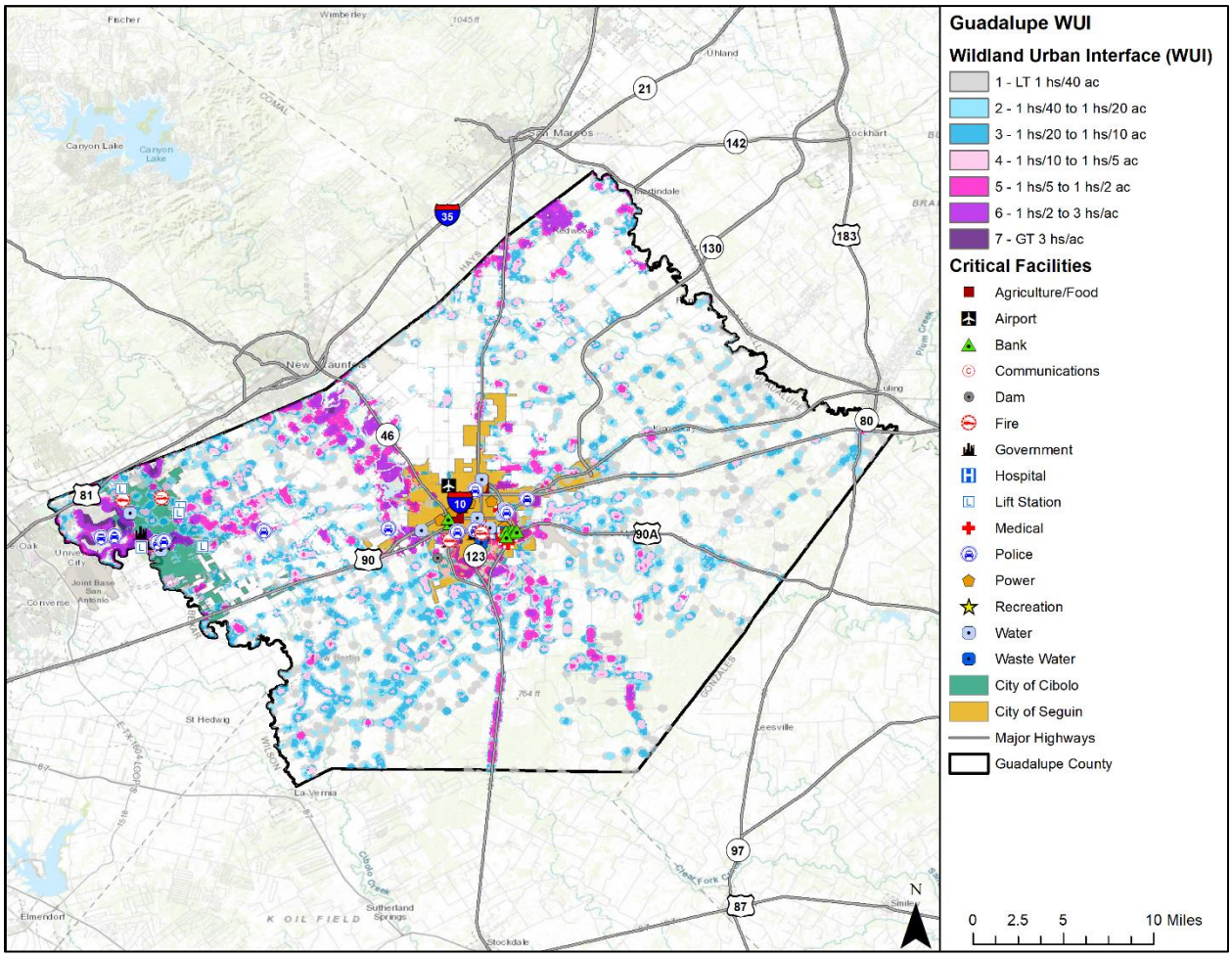
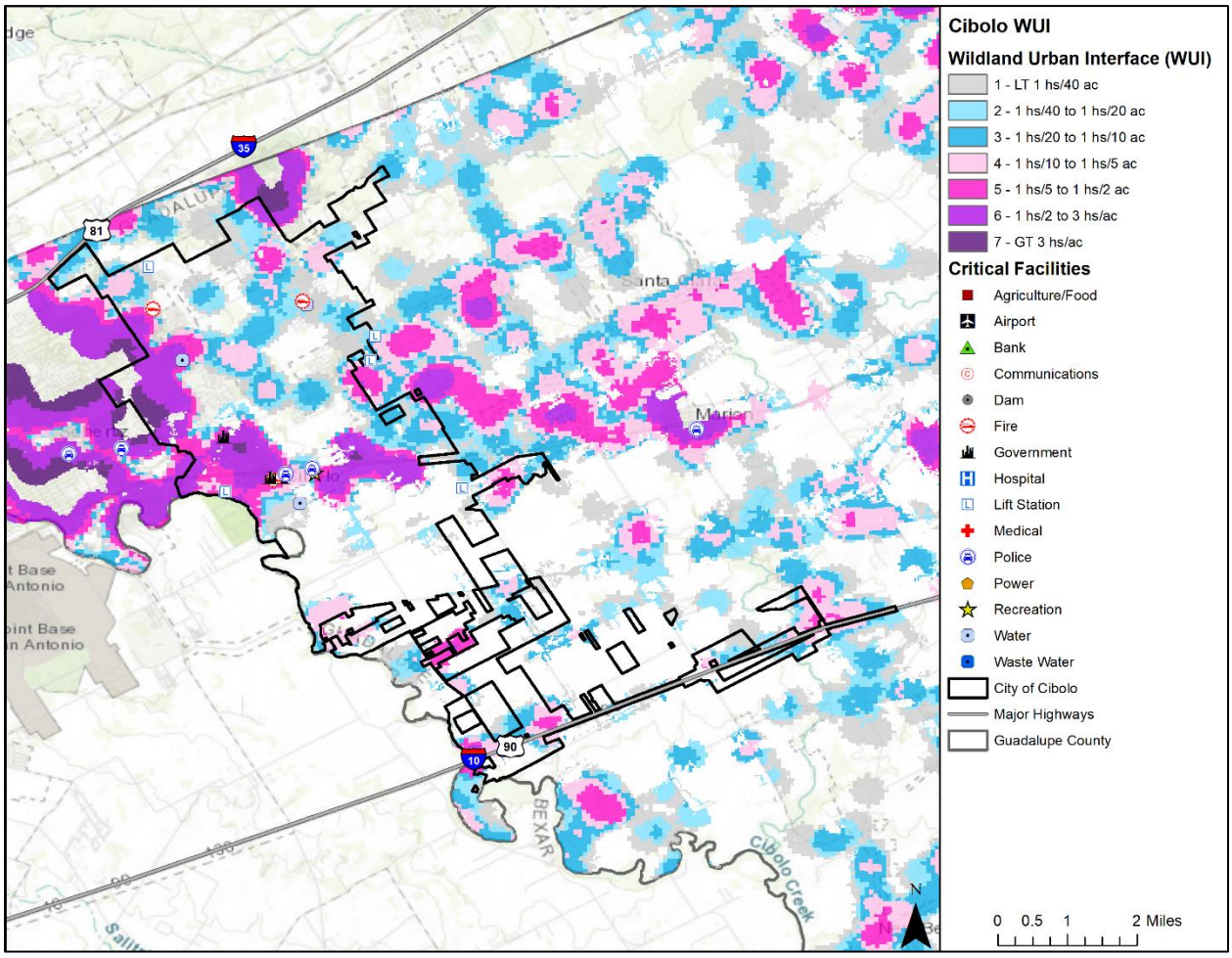
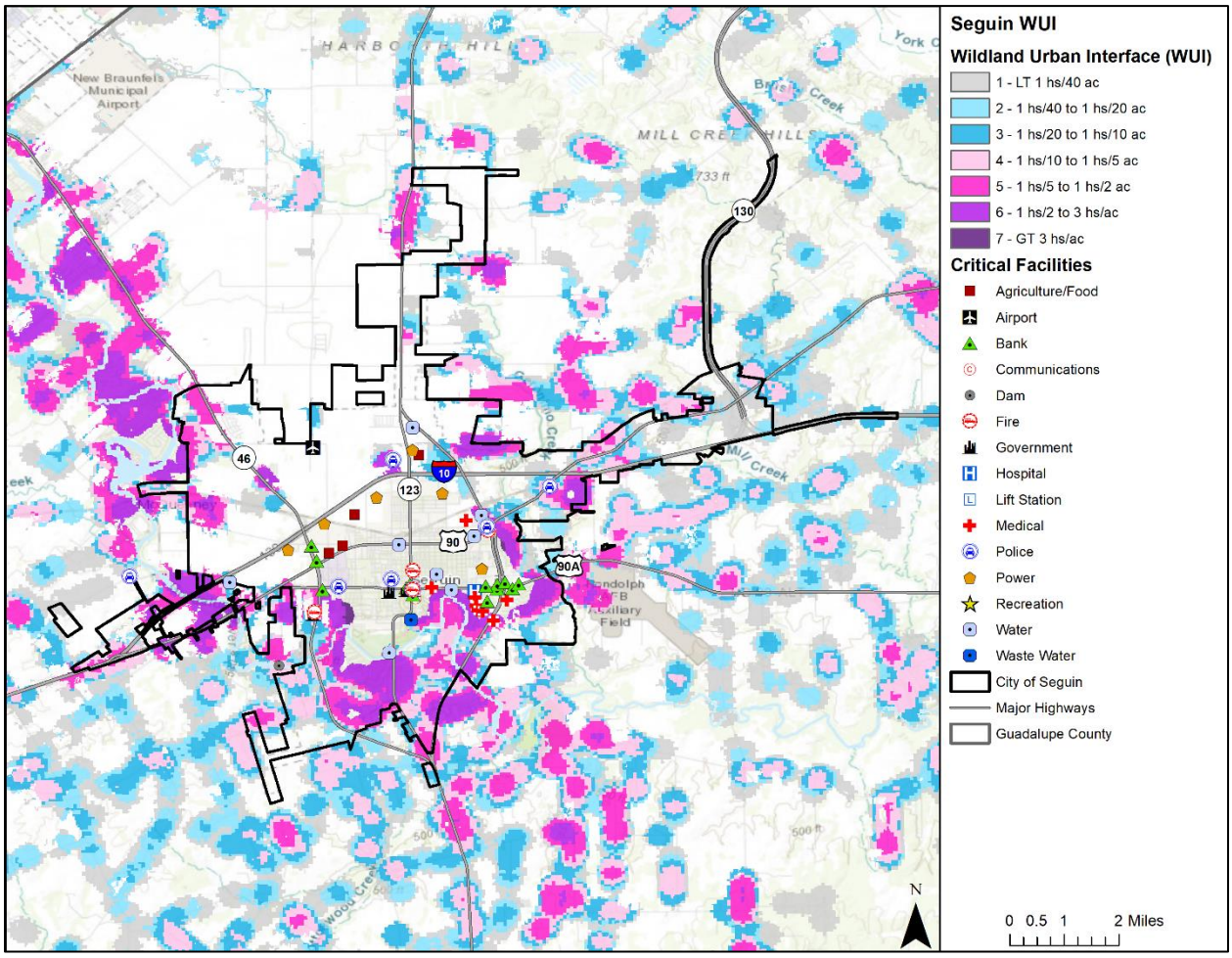


Figure 13-2. Wildland Urban Interface Map – City of Cibolo



It is estimated that 89.4 percent of the total population in the City of Cibolo live within the WUI. However, the entire City of Cibolo is at risk for wildfires.

Figure 13-3. Wildland Urban Interface Map – City of Seguin

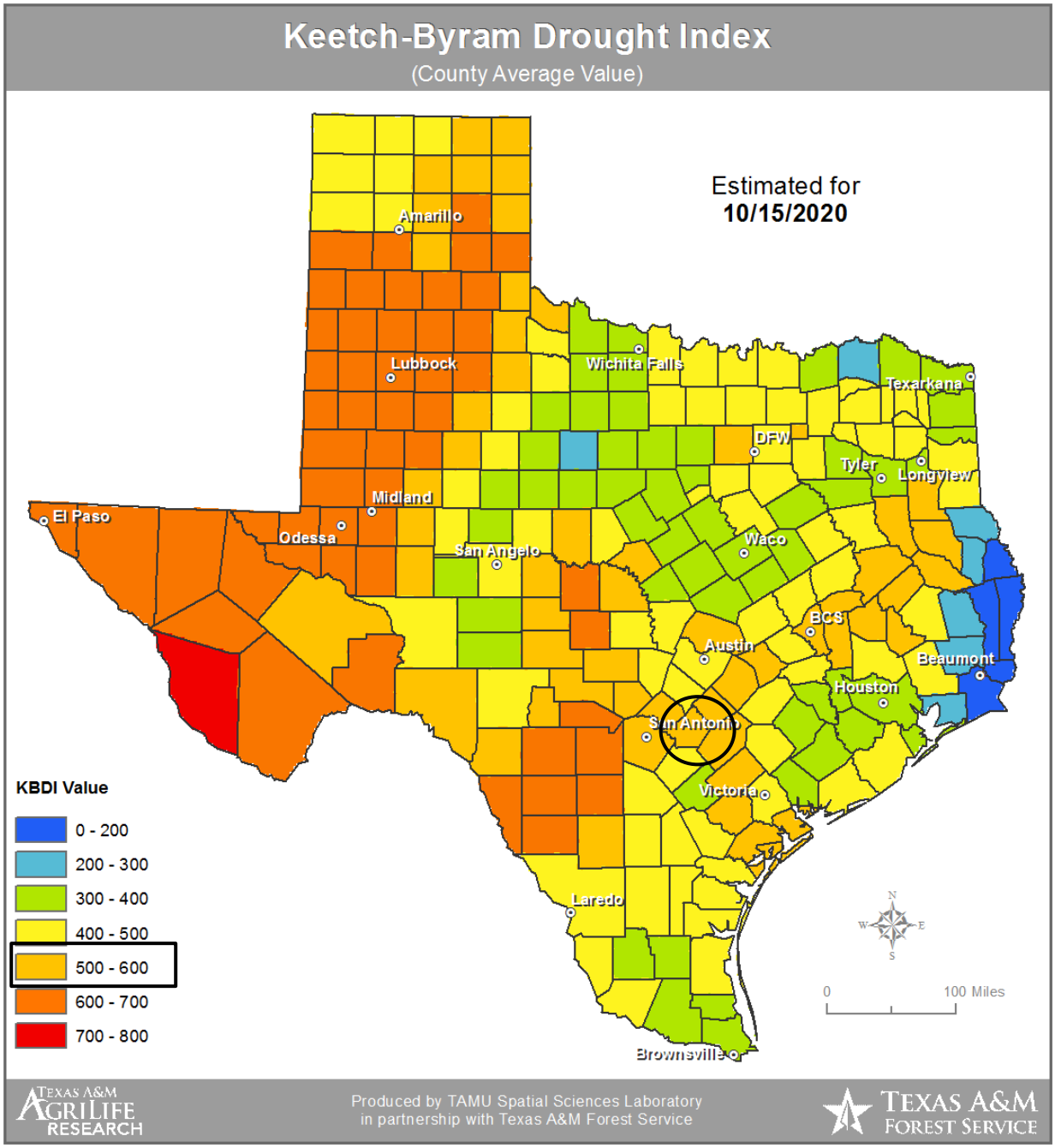


It is estimated that 26.1 percent of the total population in the City of Seguin live within the WUI. However, the entire City of Seguin is at risk for wildfires.

EXTENT

Risk for a wildfire event 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 daily water balance, derived by balancing a drought factor with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches), and is expressed in hundredths of an inch of soil moisture depletion.

Figure 13-4. Keetch-Byram Drought Index (KBDI) for the State of Texas, 2020[1]



[1] Guadalupe County is located within the black circle.

Fire behavior can be categorized at four distinct levels on the KBDI:

- **0 -200:** Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
- **200 -400:** Fires more readily burn and will carry across an area with no gaps. Heavier fuels will not readily ignite and burn. Expect smoldering and the resulting smoke to carry into and possibly through the night.
- **400 -600:** Fires intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
- **600 -800:** Fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The KBDI is a good measure of the readiness of fuels for a wildfire event. It should be referenced as the area experiences changes in precipitation and soil moisture, while caution should be exercised in dryer, hotter conditions.

The range of intensity for the Guadalupe County planning area in a wildfire event is within 276 to 694. The average extent to be mitigated for the Guadalupe County planning area, including all participating jurisdictions, is a KBDI of 584. At this level fires intensity begins to significantly increase. Fire will readily burn in all directions exposing mineral soils in some locations. The worst the planning area can anticipate based on historical occurrences and readily available fuel is 600 to 800 as 694 falls within this range. At this level fires will burn to mineral soil. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The Texas Forest Service's Fire Intensity Scale identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist based on weighted average of four percentile weather categories. Guadalupe County is between a potential limited to high wildfire intensities. Figures 13-5 through 13-7 identify the wildfire intensity for the Guadalupe County planning area.

Figure 13-5. Fire Intensity Scale Map – Guadalupe County

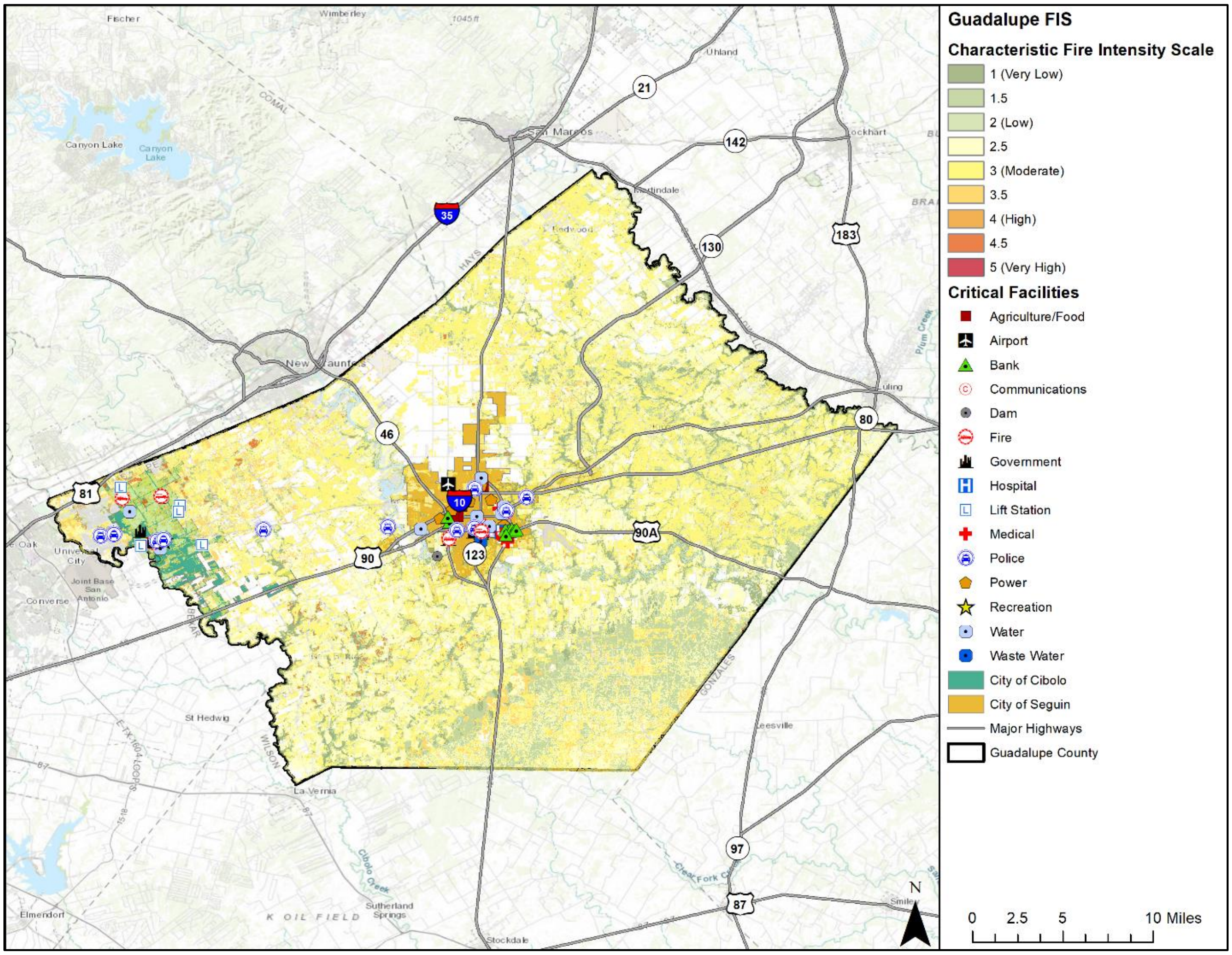


Figure 13-6. Fire Intensity Scale Map – City of Cibolo

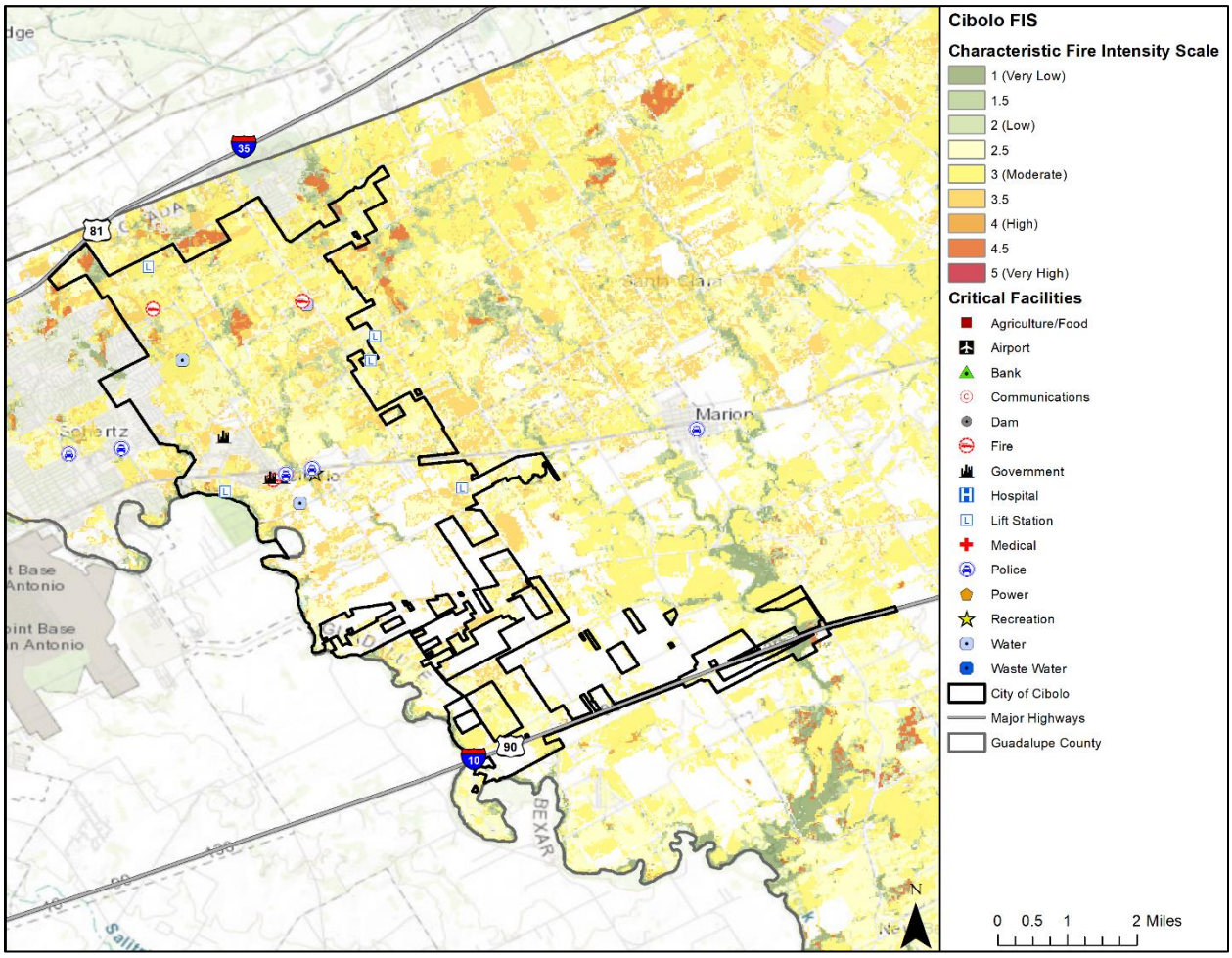
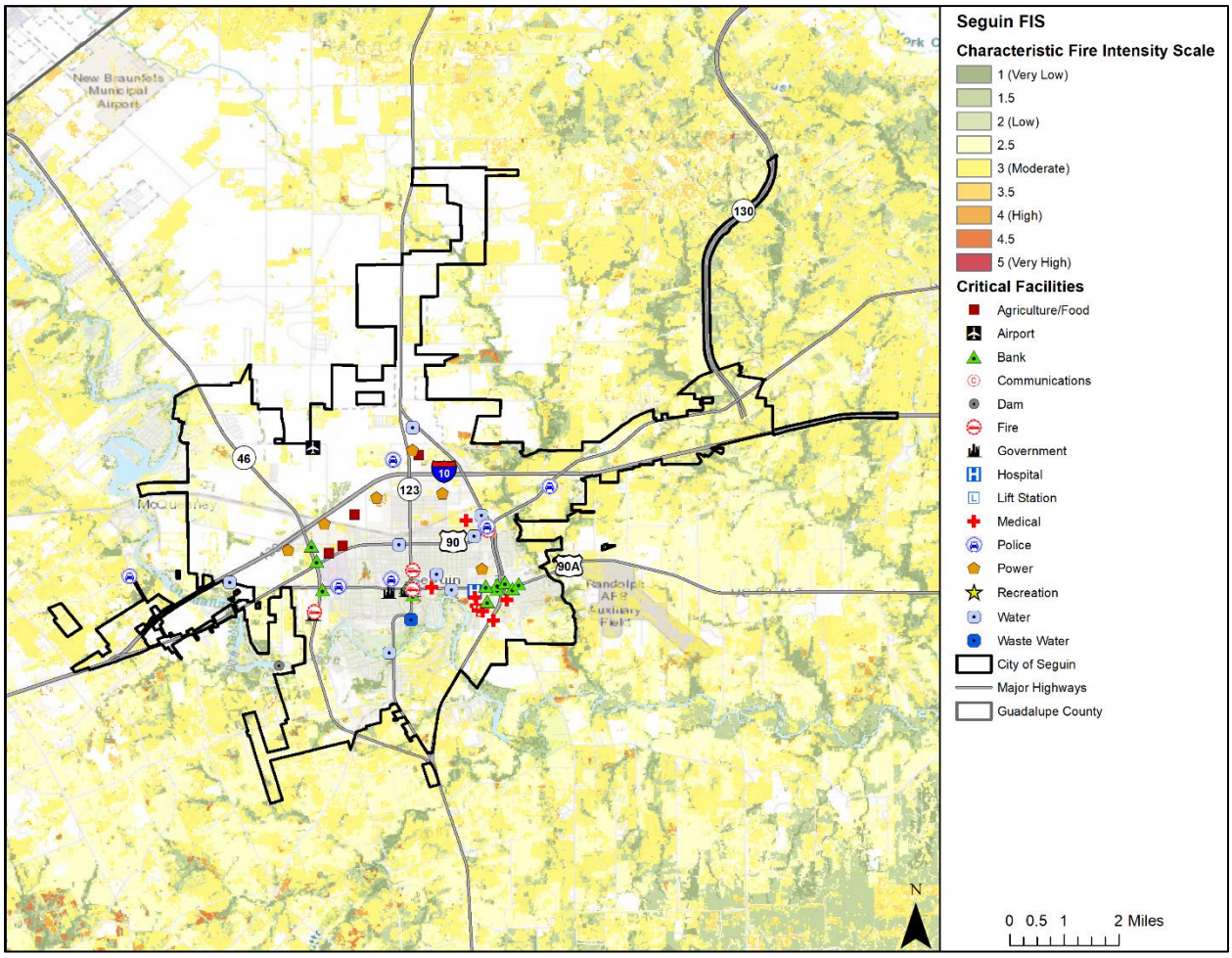


Figure 13-7. Fire Intensity Scale Map – City of Seguin



HISTORICAL OCCURRENCES

The Texas Forest Service reported 881 wildfire events between 2005 and 2015. The National Center for Environmental Information (NCEI) did not have any reported events from 1996 through April 2020. Due to a lack of recorded data for wildfire events prior to 2005 and after 2015[2], frequency calculations are based on an eleven-year period using only data from recorded years. The map below shows approximate locations of wildfires, which can be grass or brushfires of any size (Figure 13-8). Table 13-1 identifies the number of wildfires by jurisdiction and total acreage burned.

[2] The Texas Forest Service data is currently only available through 2015.

Figure 13-8. Location and Historic Wildfire Events for Guadalupe County Planning Area

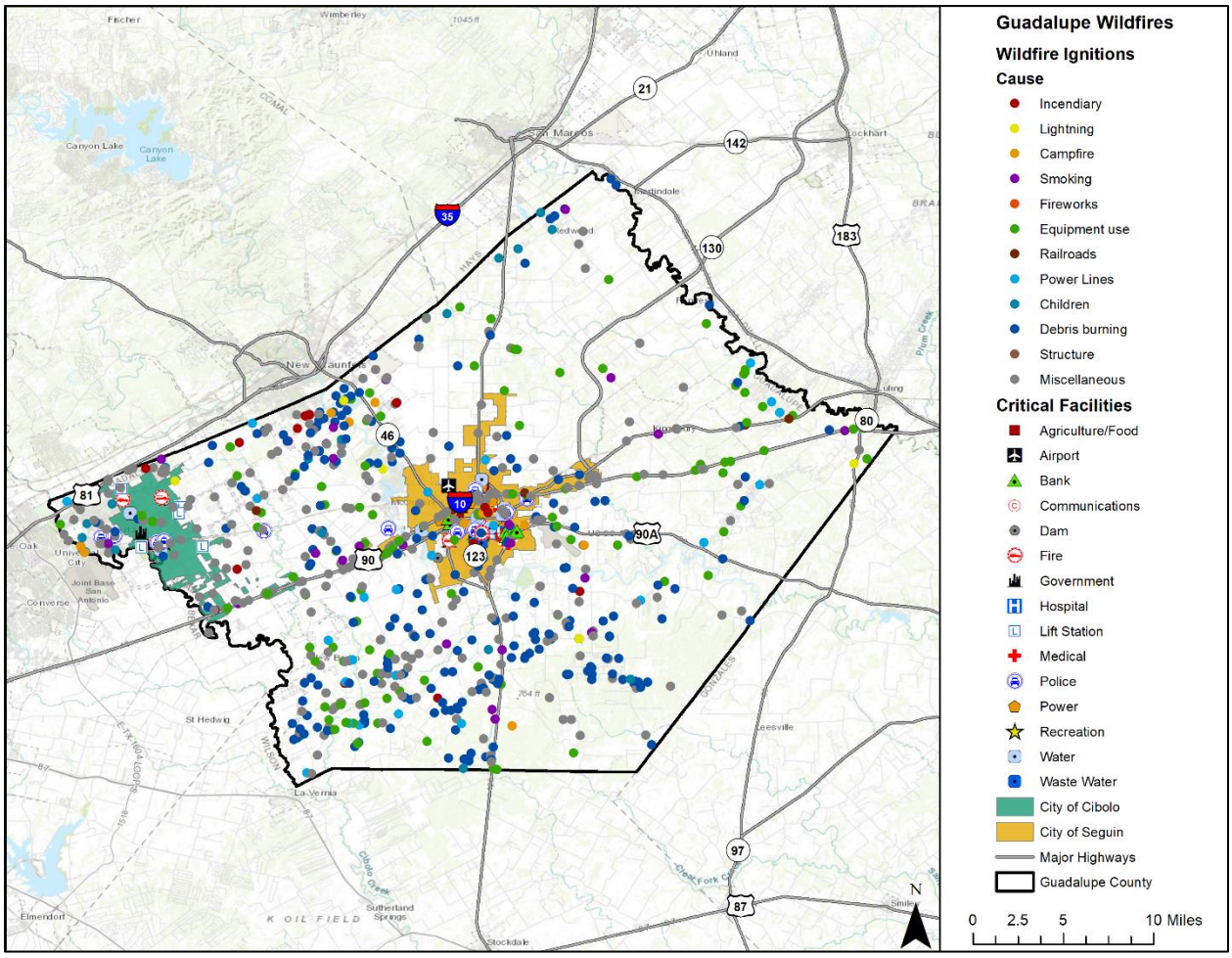


Table 13-1. Historical Wildfire Events Summary

JURISDICTION	NUMBER OF EVENTS	ACRES BURNED
Guadalupe County	769	11,979
City of Cibolo	14	24
City of Seguin	98	408

Table 13-2. Acreage of Suppressed Wildfire by Year

JURISDICTION	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Guadalupe County	3660	1048	325	3665	1821	127	614	70	372	31	246
City of Cibolo	0	6	0	5	3	0	4	2	3	1	0
City of Seguin	0	29	0	40	50	53	57	10	158	1	10

PROBABILITY OF FUTURE EVENTS

Wildfires can occur at any time of the year. As the jurisdictions within the county move into wildland, the potential area of occurrence of wildfire increases. With 881 events in an 11-year period, an event within Guadalupe County, including all participating jurisdictions, is highly likely, meaning an event is probable within the next year.

VULNERABILITY AND IMPACT

Periods of drought, dry conditions, high temperatures, and low humidity are factors that contribute to the occurrence of a wildfire event. Areas along railroads and people whose homes are in woodland settings have an increased risk of being affected by wildfire.

The heavily populated, urban areas of Guadalupe County are not likely to experience large, sweeping fires. Areas in the unincorporated areas of Guadalupe County are vulnerable, including rural areas such as Highway 90 east of Seguin, Interstate 10 east of Seguin, and Highway 123 south of Seguin near the county border. Unoccupied buildings and open spaces that have not been maintained have the greatest vulnerability to wildfire. The overall level of concern for wildfires is located mostly along the perimeter of the study area where wildland and urban areas interface. Figures 13-1 through 13-3 illustrate the areas that are the most vulnerable to wildfire throughout the planning area.

The following critical facilities are located in the WUI and are more susceptible to wildfire in each participating jurisdiction:

Table 13-3. Critical Facilities Located in WUI by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	7 Law Enforcements
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 4 S.S. Lift Stations; 3 Water Plants
City of Seguin	1 Banking/Finance Institute; 3 Emergency Services; 1 Public Health Facility; 5 Water Facilities

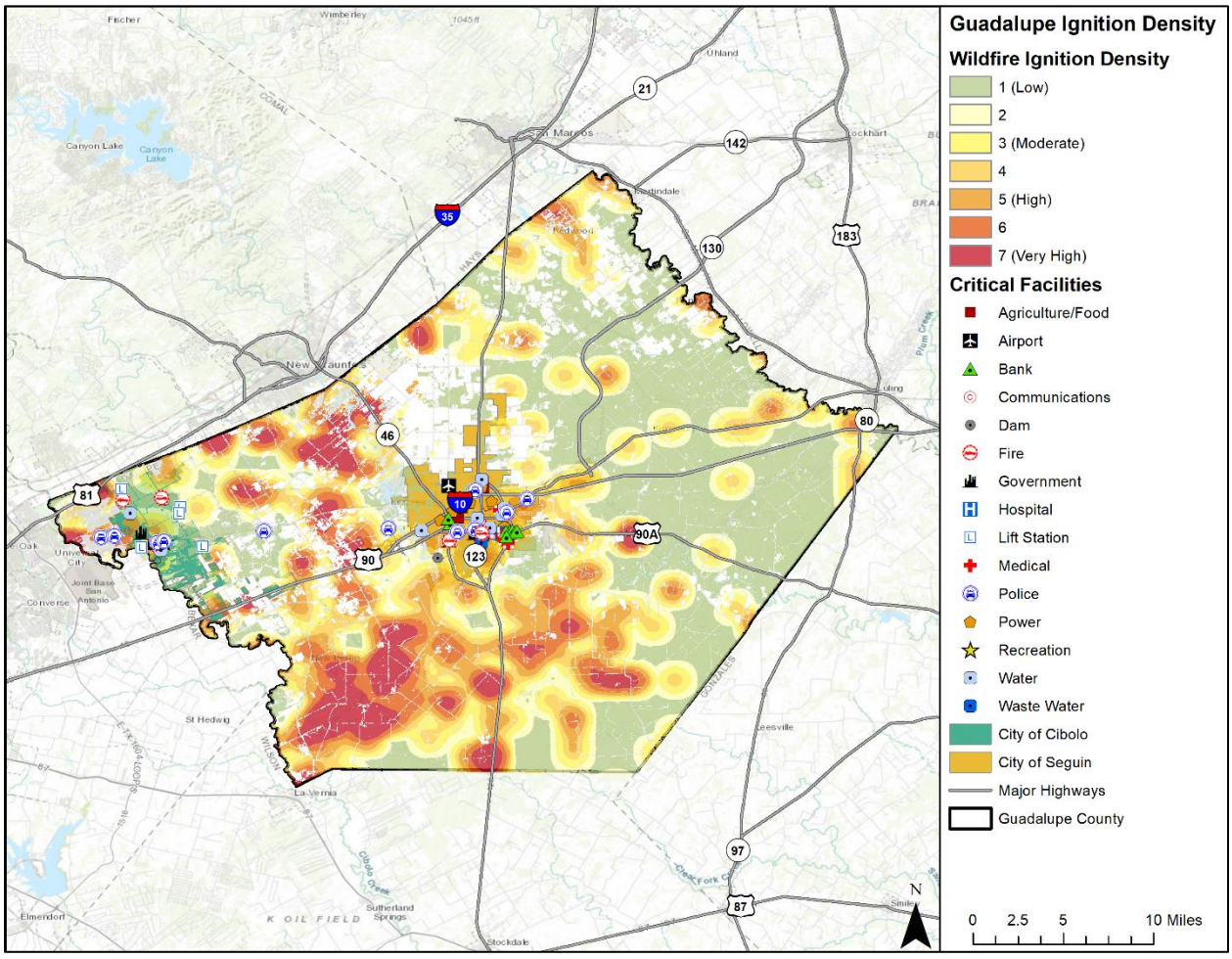
Within Guadalupe County, a total of 881 fire events were reported from 2005 to 2015. All of these events were suspected wildfires. Historic loss and annualized estimates due to wildfires are presented in Table 13-4 below. The frequency is approximately 10 events every year.

Table 13-4. Potential Annualized Losses by Jurisdiction[3]

JURISDICTION	ACRES BURNED	ANNUAL ACRE LOSSES
Guadalupe County	11,979	1,089
City of Cibolo	24	2
City of Seguin	408	37
Planning Area	**12,411**	**1,128.3**

Figures 13-9 through 13-11 show Guadalupe County and the threat of wildfire to the County and all participating jurisdictions.

Figure 13-9. Wildfire Ignition Density – Guadalupe County



[3] Events divided by 11 years of data.

Figure 13-10. Wildfire Ignition Density – City of Cibolo

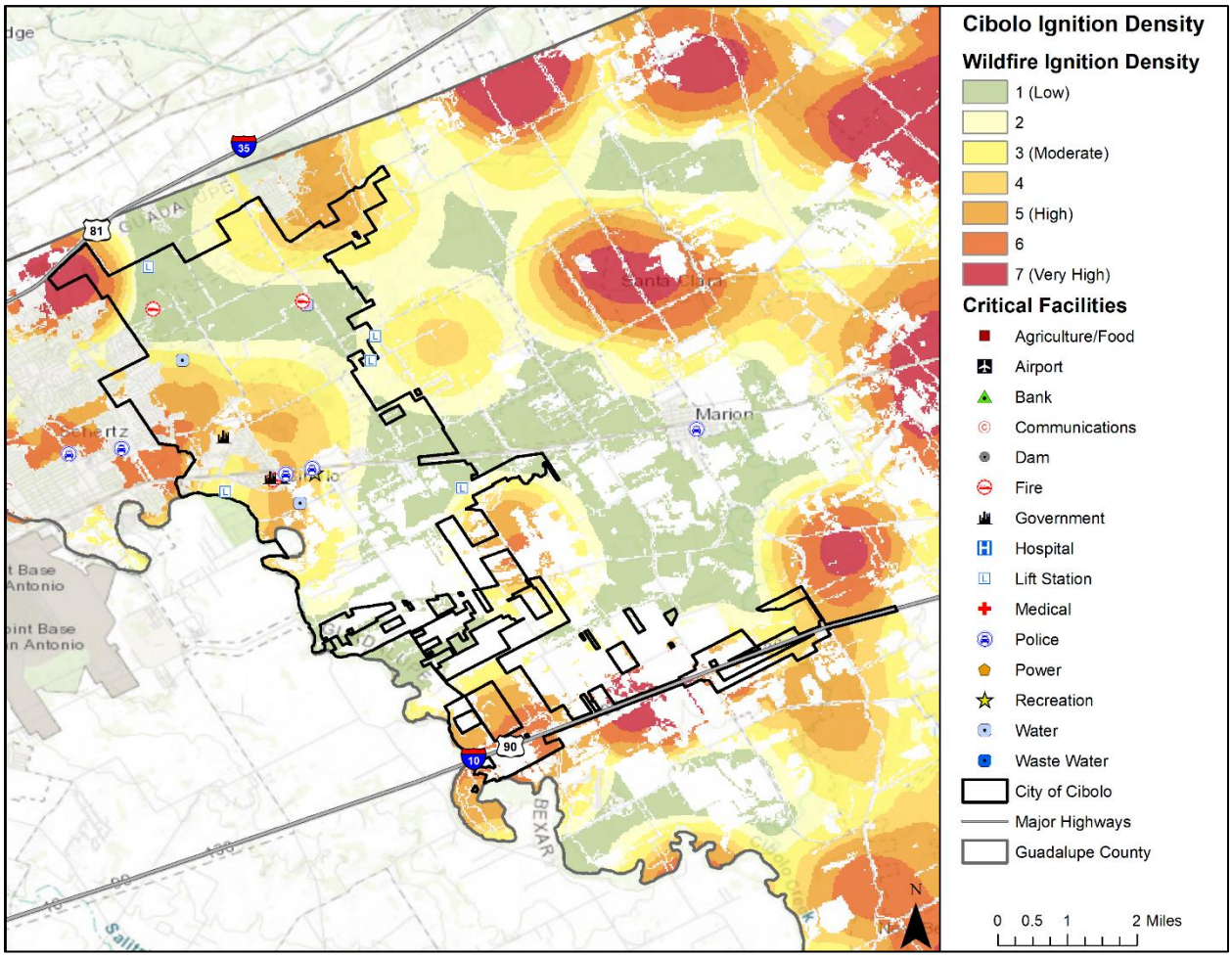
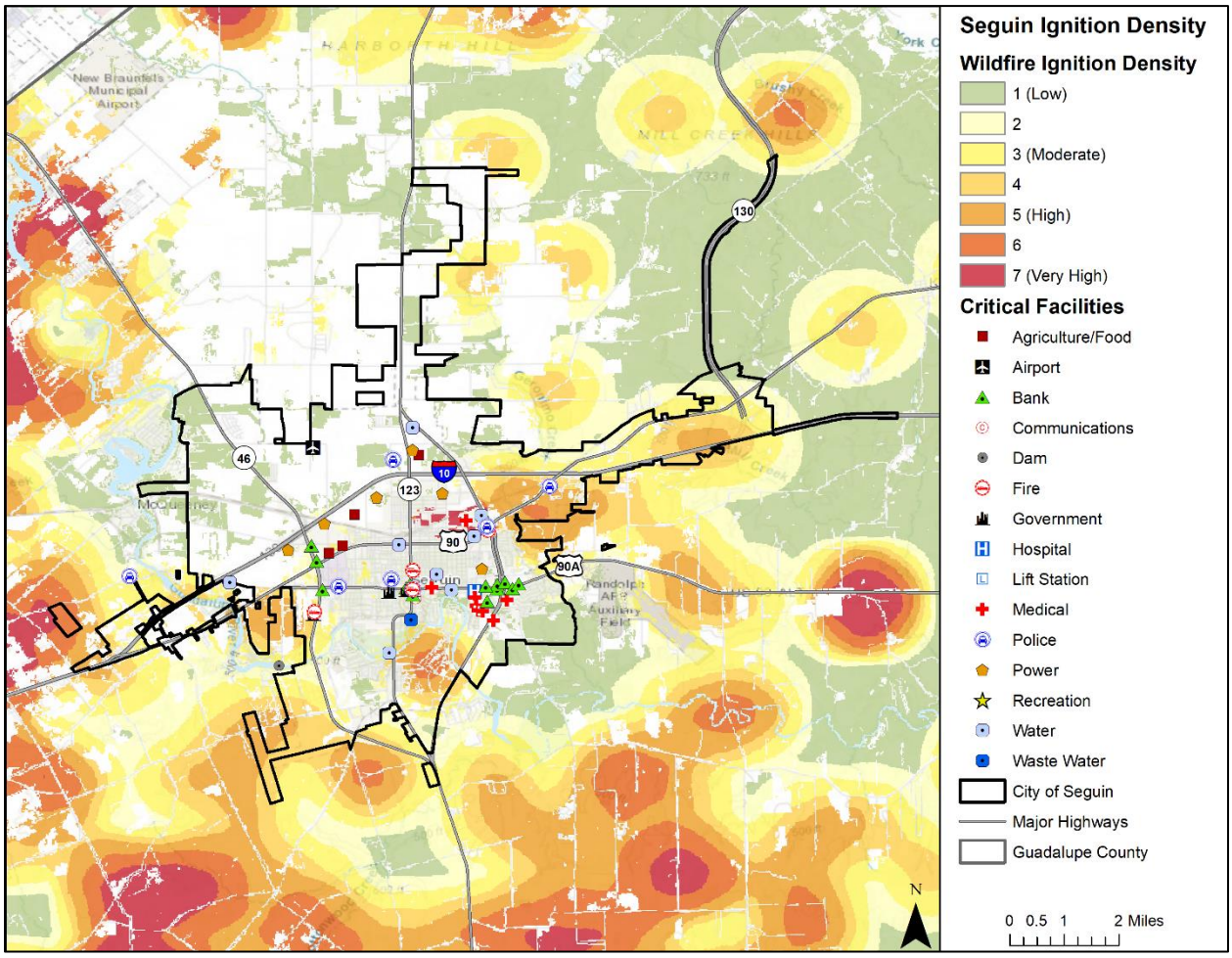


Figure 13-11. Wildfire Ignition Density – City of Seguin



Diminished air quality is an environmental impact that can result from a wildfire event and pose a potential health risk. The smoke plumes from wildfires can contain potentially inhalable carcinogenic matter. Fine particles of invisible soot and ash that are too small for the respiratory system to filter can cause immediate and possibly long-term health effects. The elderly or those individuals with compromised respiratory systems may be more vulnerable to the effects of diminished air quality after a wildfire event.

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

The severity of impact from major wildfire events can be substantial. Such events can cause multiple deaths, shut down facilities for 30 days or more, and cause more than 50 percent of affected properties to be destroyed or suffer major damage. Severity of impact is gauged by acreage burned, homes and structures lost, and the number of resulting injuries and fatalities.

For the Guadalupe County planning area, the impact from a wildfire event can be considered “Limited," meaning injuries and/or illnesses are treatable with first aid, shutdown of facilities and

services for 24 hours or less, and less than 10 percent of property is destroyed or with major damage. Severity of impact is gauged by acreage burned, homes and structures lost, injuries and fatalities. Based on this, impact for each participating jurisdiction is listed below in Table 13-5.

Table 13-5. Impact by Jurisdiction

JURISDICTION	IMPACT	DESCRIPTION
Guadalupe County	Limited	Guadalupe County has an estimated 80,990 people or 66.7 percent of the total population that live within the Wildland Urban Interface (WUI). Guadalupe County, including citizens in unincorporated areas, may suffer minor injuries that can be treated with first aid. Critical facilities could be shut down for 24 hours or less, and less than 10 percent of total property could be damaged.
City of Cibolo	Limited	The largest population in the City of Cibolo live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has a low wildfire threat. Citizens may suffer minor injuries treatable with first aid. Critical facilities could be shut down for 24 hours of less, and less than 10 percent of total property could be damaged.
City of Seguin	Limited	The entire population in the City of Seguin live in an area that is semi-dense (1-3 houses per 1 acre) in the WUI, and the City has a low wildfire threat. Citizens may suffer minor injuries treatable with first aid. Critical facilities could be shut down for 24 hours of less, and less than 10 percent of total property could be damaged.

ASSESSMENT OF IMPACTS

A Wildfire event poses a potentially significant risk to public health and safety, particularly if the wildfire is initially unnoticed and spreads quickly. The impacts associated with a wildfire are not limited to the direct damages. The impact of climate change could produce larger, more wide-spread wildfire events, exacerbating the current wildfire impacts. More extreme wildfire conditions can be frequently associated with a variety of impacts, including:

- Persons in the area at the time of the fire are at risk for injury or death from burns and/or smoke inhalation.
- First responders are at greater risk of physical injury since they are in close proximity to the hazard while extinguishing flames, protecting property, or evacuating residents in the area.
- First responders can experience heart disease, respiratory problems, and other long-term related illnesses from prolonged exposure to smoke, chemicals, and heat.
- Emergency services may be disrupted during a wildfire if facilities are impacted, roadways are inaccessible, or personnel are unable to report for duty.

- Critical city and/or county departments may not be able to function and provide necessary services depending on the location of the fire and the structures or personnel impacted.
- Non-critical businesses may be directly damaged, suffer loss of utility services, or be otherwise inaccessible, delaying normal operations and slowing the recovery process.
- Displaced residents may not be able to immediately return to work, further slowing economic recovery.
- Roadways in or near the WUI could be damaged or closed due to smoke and limited visibility.
- Older homes are generally exempt from modern building code requirements, which may require fire suppression equipment in the structure.
- Some high-density neighborhoods feature small lots with structures close together, increasing the potential for fire to spread rapidly.
- Air pollution from smoke may exacerbate respiratory problems of vulnerable residents.
- Charred ground after a wildfire cannot easily absorb rainwater, increasing the risk of flooding and potential mudflows.
- Wildlife may be displaced or destroyed.
- Historical or cultural resources may be damaged or destroyed.
- Tourism can be significantly disrupted, further delaying economic recovery for the area.
- Vegetated dunes can be stripped, significantly damaging the function of the dunes to protect inland areas from the destructive forces of wind and waves.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Fire suppression costs can be substantial, exhausting the financial resources of the community.
- Residential structures lost in a wildfire may not be rebuilt for years, reducing the tax base for the community.
- Area lakes such as Lake McQueeney, Lake Dunlap, and along the Guadalupe River, recreation and tourism can be unappealing for years following a large wildfire, devastating directly related businesses.
- Direct impacts to municipal water supply may occur through contamination of ash and debris during the fire, destruction of aboveground delivery lines, and soil erosion or debris deposits into waterways after the fire.

The economic and financial impacts of a wildfire event on local government will depend on the scale of the event, what is damaged, costs of repair or replacement, lost business days in impacted areas, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by government, businesses, and citizens will contribute to the overall economic and financial conditions in the aftermath of a wildfire event.

SECTION 14: WINTER STORM

HAZARD DESCRIPTION

A severe winter storm event is identified as a storm with snow, ice, or freezing rain. This type of storm can cause significant problems for area residents. Winter storms are associated with freezing or frozen precipitation such as freezing rain, sleet, snow, and the combined effects of winter precipitation and strong winds. Wind chill is a function of temperature and wind. Low wind chill is a product of high winds and freezing temperatures.

Winter storms that threaten Guadalupe County planning area usually begin as powerful cold fronts that push south from central Canada. Although the county is at risk to ice hazards, extremely cold temperatures, and snow, the effects and frequencies of winter storm events are generally mild and short-lived. As indicated in Figure 14-1, on average, the Guadalupe County planning area, including all participating jurisdictions, typically experience approximately 1-10 extreme cold days a year, meaning up to 10 days are at or around freezing temperatures. During times of ice and snow accumulation, response times will increase until public works road crews are able to make major roads passable. Table 14-1 describes the types of winter storms possible to occur in the Guadalupe County planning area, including all participating jurisdictions.

Figure 14-1. Extreme Cold Days, 1960-2003[1]

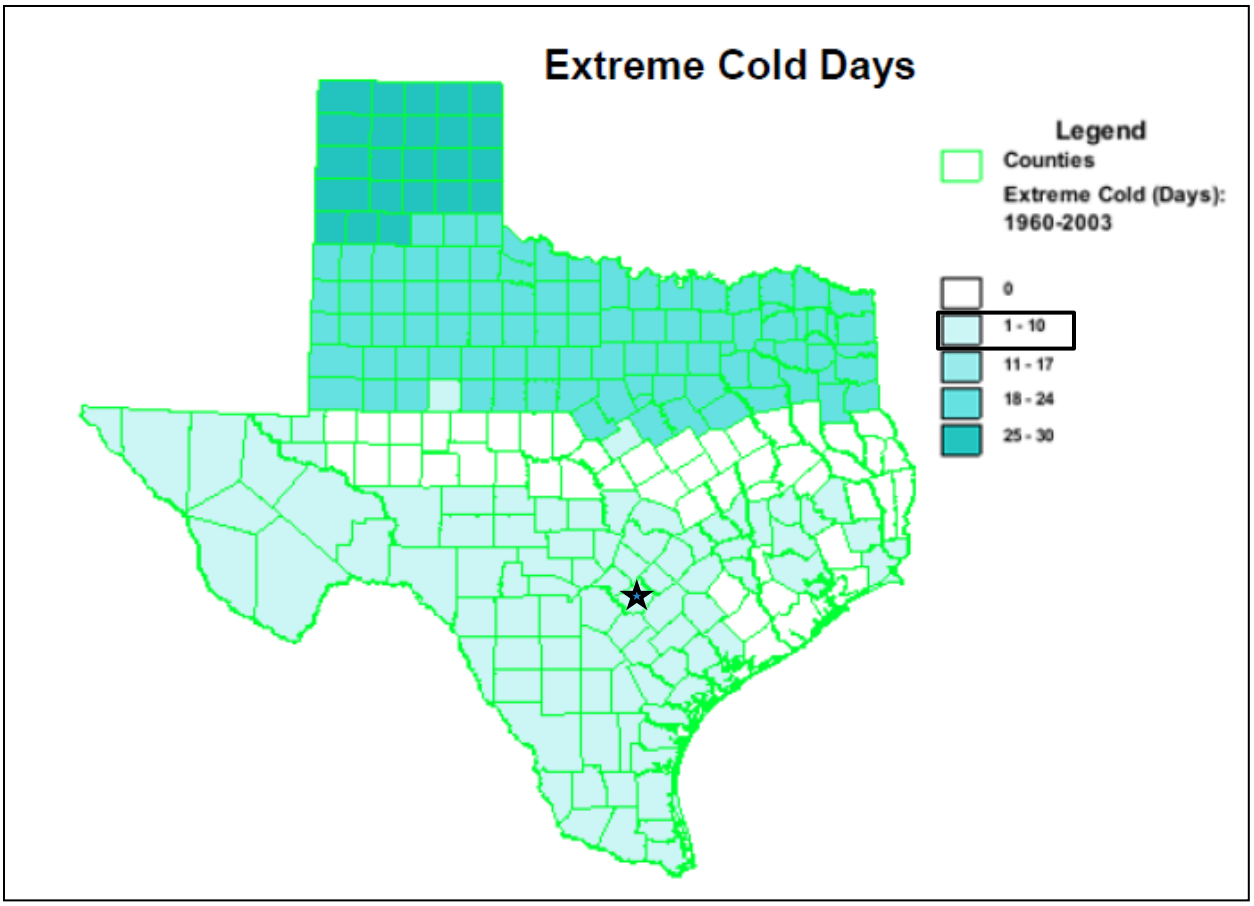


Table 14-1. Types of Winter Storms

TYPE OF WINTER STORM	DESCRIPTION
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may affect your area (freezing rain, sleet, or heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.

[1] Source: National Weather Service. Guadalupe County indicated by star.

TYPE OF WINTER STORM	DESCRIPTION
Blizzard Warning	Sustained wind speeds of at least 35 mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost/Freeze Warning	Below freezing temperatures are expected and may cause significant damage to plants, crops, and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind and temperature on exposed flesh is called the wind-chill factor.

LOCATION

Winter storm events are not confined to specific geographic boundaries. Therefore, all existing and future buildings, facilities, and populations in the Guadalupe County planning area, including all participating jurisdictions, are considered to be exposed to a winter storm hazard and could potentially be impacted.

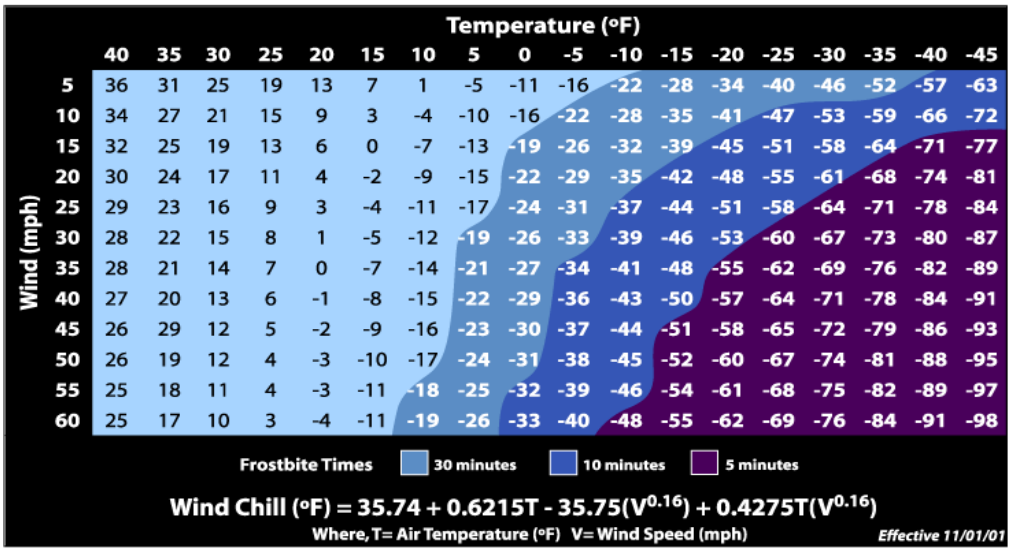
EXTENT

The extent or magnitude of a severe winter storm is measured in intensity based on the temperature and level of accumulations as shown in Table 14-2. Table 14-2 should be read in conjunction with the wind-chill factor described in Figure 14-2 to determine the intensity of a winter storm. The chart is not applicable when temperatures are over 50°F or winds are calm. This is an index developed by the National Weather Service.

Table 14-2. Magnitude of Severe Winter Storms

INTENSITY	TEMPERATURE RANGE (Fahrenheit)	EXTENT DESCRIPTION
Mild	40° – 50°	Winds less than 10 mph and freezing rain or light snow falling for short durations with little or no accumulations
Moderate	30° – 40°	Winds 10 – 15 mph and sleet and/or snow up to 4 inches
Significant	25° – 30°	Intense snow showers accompanied with strong gusty winds between 15 and 20 mph with significant accumulation
Extreme	20° – 25°	Wind driven snow that reduces visibility, heavy winds (between 20 to 30 mph), and sleet or ice up to 5 millimeters in diameter
Severe	Below 20°	Winds of 35 mph or more and snow and sleet greater than 4 inches

Figure 14-2. Wind Chill Chart



Wind chill temperature is a measure of how cold the wind makes real air temperature feel to the human body. Since wind can dramatically accelerate heat loss from the body, a blustery 30°F day would feel just as cold as a calm day with 0°F temperatures. The Guadalupe County planning area, including all participating jurisdictions, has never experienced a blizzard, but based on 12 previous occurrences recorded from 1996 through April 2020, it has been subject to winter storm watches, warnings, freezing rain, sleet, and wind chill.

The average number of cold days is similar for the entire planning area, including all participating jurisdictions. Therefore, the intensity or extent of a winter storm event to be mitigated for the area ranges from mild to significant according to the definitions at Table 14-2. Guadalupe County planning area, including all participating jurisdictions, can expect anywhere between 0.1 to 4.0 inches of ice and snow during a winter storm event and temperatures between 25 and 50 degrees with winds ranging from 0 to 20 mph. This is the worst that can be anticipated to mitigate against in the future for all participating jurisdictions.

HISTORICAL OCCURRENCES

Table 14-3 shows historical occurrences for Guadalupe County from 1996 through April 2020 provided by the NCEI database. There have been 12 recorded winter storm events in Guadalupe County, including all participating jurisdictions. Historical winter storm information, as provided by the NCEI, identifies winter storm activity across a multi-county forecast area for each event. The appropriate percentage of the total property and crop damage reported for the entire forecast area has been allocated to each county impacted by the event. Historical winter storm data for the county and all participating jurisdictions are provided on a County-wide basis per the NCEI database. Table 14-3 shows historical incident information for the planning area.

Table 14-3. Historical Winter Storm Events, 1996-2020[2]

JURISDICTION	DATE	DEATHS	INJURIES	PROPERTY DAMAGE	CROP DAMAGE
Guadalupe County	2/1/1996	0	0	$0	$0
Guadalupe County	1/11/1997	0	0	$0	$0
Guadalupe County	12/12/2000	0	0	$0	$0
Guadalupe County	11/28/2001	0	0	$0	$0
Guadalupe County	2/24/2003	0	0	$0	$0
Guadalupe County	1/16/2007	0	0	$0	$0
Guadalupe County	2/3/2011	0	0	$0	$0
Guadalupe County	2/6/2014	0	0	$0	$0
Guadalupe County	2/16/2015	0	0	$0	$0
Guadalupe County	12/7/2017	0	0	$0	$0
Guadalupe County	1/16/2018	0	0	$0	$0
Guadalupe County	2/5/2020	0	0	$0	$0
TOTALS		**0**	**0**	**$0**	

SIGNIFICANT EVENTS

January 16, 2018 – Guadalupe County

A cold front brought a shallow layer of subfreezing air to South Central Texas. Isentropic lift of warm moist air over this shallow cold layer led to wintry precipitation. Most of the precipitation was freezing rain and sleet, but there was some snow toward the end of the event. There were reports of 1/8 inch of ice accumulated in Leon Valley, New Braunfels, and San Geronimo. Icy roads were a problem across the region and closed many roads across the region and caused numerous vehicle accidents.

PROBABILITY OF FUTURE EVENTS

According to historical records, the planning area experiences approximately one winter storm event each year. Hence, the probability of a future winter storm event affecting the Guadalupe County planning area, including all participating jurisdictions, is highly likely, with a winter storm likely to occur within the next year.

[2] Values are in 2020 dollars.

VULNERABILITY AND IMPACT

During periods of extreme cold and freezing temperatures, water pipes can freeze and crack, and ice can build up on power lines, causing them to break under the weight or causing tree limbs to fall on the lines. These events can disrupt electric service for long periods.

An economic impact may occur due to increased consumption of heating fuel, which can lead to energy shortages and higher prices. House fires and resulting deaths tend to occur more frequently from increased and improper use of alternate heating sources. Fires during winter storms also present a greater danger because water supplies may freeze and impede firefighting efforts.

All populations, buildings, critical facilities, and infrastructure in the entire Guadalupe County planning area, including all participating jurisdictions, are vulnerable to severe winter events.

The following critical facilities would be vulnerable to Winter Storm events in each participating jurisdiction:

Table 14-4. Critical Facilities by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

People and animals are subject to health risks from extended exposure to cold air. Elderly people are at greater risk of death from hypothermia during these events, especially in the rural areas of the county where populations are sparse, icy roads may impede travel, and there are fewer neighbors to check in on the elderly. According to the U.S. Center for Disease Control, every year hypothermia kills about 600 Americans, half of whom are 65 years of age or older. In addition, populations living below the poverty level may not be able to afford to run heat on a regular basis.

Population over 65 in the entire Guadalupe County planning area is estimated at 13.4% of the total population or an estimated total of 20,739[3] potentially vulnerable residents in the planning area based on age. An estimated 6.6% of the planning area population live below the poverty level (Table 14-5).

[3] US Census Bureau 2018 data for Guadalupe County

Table 14-5. Population at Greater Risk by Jurisdiction

JURISDICTION	POPULATION 65 AND OLDER	POPULATION BELOW POVERTY LEVEL
Guadalupe County[4]	20,739	10,239
City of Cibolo	2,095	1,286
City of Seguin	5,109	3,771

Damages from winter storms in the planning area are considered negligible. The potential severity of impact for the Guadalupe County planning area, including all participating jurisdictions, is "Limited" meaning injuries are treatable with first aid, shutdown of facilities and services for 24 hours or less, and less than 10% of property destroyed or with major damage.

Table 14-6. Potential Annualized Losses for Guadalupe County

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$0	$0

ASSESSMENT OF IMPACTS

The greatest risk from a winter storm hazard is to public health and safety. The impact of climate change could produce longer, more intense winter storm events, exacerbating the current winter storm impacts. Worsening winter storm conditions can be frequently associated with a variety of impacts, including:

- Vulnerable populations, particularly the elderly and children under 5, can face serious or life-threatening health problems from exposure to extreme cold including hypothermia and frostbite.
- Loss of electric power or other heat source can result in increased potential for fire injuries or hazardous gas inhalation because residents burn candles for light or use fires or generators to stay warm.
- Response personnel, including utility workers, public works personnel, debris removal staff, tow truck operators, and other first responders, are subject to injury or illness resulting from exposure to extreme cold temperatures.
- Response personnel would be required to travel in potentially hazardous conditions, elevating the life safety risk due to accidents and potential contact with downed power lines.
- Operations or service delivery may experience impacts from electricity blackouts due to winter storms.
- Power outages are possible throughout the planning area due to downed trees and power lines and/or rolling blackouts.

[4] County totals includes all incorporated jurisdictions and unincorporated areas.

- Critical facilities without emergency backup power may not be operational during power outages.
- Emergency response and service operations may be impacted by limitations on access and mobility if roadways are closed, unsafe, or obstructed.
- Hazardous road conditions will likely lead to increases in automobile accidents, further straining emergency response capabilities.
- Depending on the severity and scale of damage caused by ice and snow events, damage to power transmission and distribution infrastructure can require days or weeks to repair.
- A winter storm event could lead to tree, shrub, and plant damage or death.
- Severe cold and ice could significantly damage agricultural crops.
- Schools may be forced to shut early due to treacherous driving conditions.
- Exposed water pipes may be damaged by severe or late season winter storms at both residential and commercial structures, causing significant damages.

The economic and financial impacts of winter weather on the community will depend on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of a winter storm event.

SECTION 15: HURRICANE WIND

HAZARD DESCRIPTION

According to the National Oceanic and Atmospheric Administration (NOAA), a hurricane is an intense tropical weather system of strong thunderstorms with well-defined surface circulation and maximum sustained winds of 74 mph or higher. In the Northern Hemisphere circulation of winds near the Earth's surface is counterclockwise.

Hurricanes often begin as tropical depressions that intensify into tropical storms when maximum sustained winds increase to between 35 – 64 knots (39 – 73 mph). At these wind speeds, the storm becomes more organized and circular in shape and begins to resemble a hurricane. Tropical storms resulting in high winds and heavy rainfall can be equally problematic without ever becoming a hurricane and can be dangerous to people and property, resulting in high winds and heavy rainfall, as Tropical Storm Hermine did for Travis and Williamson Counties in September 2010. Once sustained winds reach or exceed 74 mph, the storm becomes a hurricane. The intensity of a land falling hurricane is expressed in categories relating wind speeds to potential damage. Tropical storm-force winds are strong enough to be dangerous to those caught in them.

LOCATION

The Guadalupe County planning area is located inland from the coast and is outside of the hurricane wind speed hazard areas. Thus, the Guadalupe County planning area is in a low risk area for hurricane wind speeds of 90 miles per hour (mph) or less. However, the Guadalupe County planning area, including all participating jurisdictions, is susceptible to the indirect threats of a hurricane, including high winds and flooding. Additionally, the Guadalupe County planning area has hosted coastal area residents who evacuate during hurricane events.

EXTENT

As a hurricane develops, the barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can

intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane.

Hurricanes are categorized according to the strength and intensity of their winds using the Saffir-Simpson Hurricane Scale (Table 15-1). A Category 1 storm has the lowest wind speeds, while a Category 5 hurricane has the highest. However, a lower category storm can inflict greater damage than higher category storms depending on where they strike, the amount of storm surge, other weather they interact with, and how slow they move.

Table 15-1. Extent Scale for Hurricanes[1]

CATEGORY	MAXIMUM SUSTAINED WIND SPEED (Mph)	MINIMUM SURFACE PRESSURE (Millibars)	STORM SURGE (Feet)
1	74 – 95	Greater than 980	3 – 5
2	96 – 110	979 – 965	6 – 8
3	111 – 130	964 – 945	9 – 12
4	131 – 155	944 – 920	13 – 18
5	155 +	Less than 920	19+

Based on the historical storm tracks for hurricanes and the location of the Guadalupe County planning area, which is outside of the hurricane wind hazard area, the highest extent to be mitigated is for a Category 1 storm for the planning area.

HISTORICAL OCCURRENCES

By the time hurricanes and tropical storms have made landfall at various magnitudes (categories) in the Guadalupe County planning area, the storms have usually weakened to tropical storms or depressions, being near the end of their life cycle. With the storms having reduced winds, extreme rainfall is the hazard of concern. In Figure 15-1 below, hurricane tracks are reflective of their strength in the Guadalupe County planning area. Table 15-2 lists the storms that have tracked through the planning area. Historical hurricane data for Guadalupe County and all participating jurisdictions are provided on a County-wide basis per the National Center for Environmental Information (NCEI) and National Oceanic and Atmospheric Administration (NOAA) databases.

[1] Source: National Hurricane Center

Figure 15-1. Location of Historic Storm Tracks

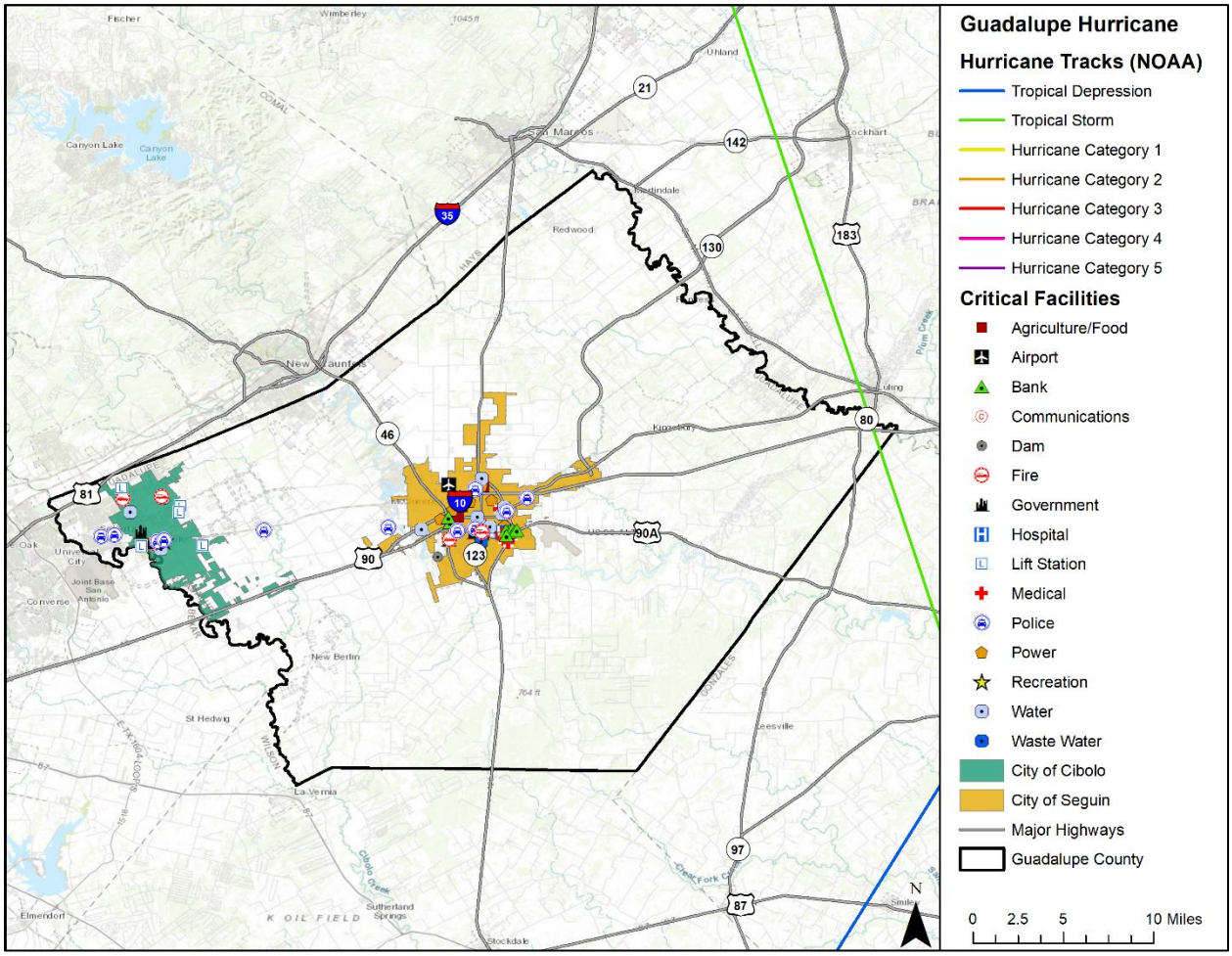


Table 15-2. Historic Storms

YEAR	STORM NAME	CATEGORY	PROPERTY DAMAGE (2020 DOLLARS)	CROP DAMAGE (2020 DOLALRS)
1968	Candy	Category 1	Unavailable	Unavailable
2010	Hermine	Tropical Storm	$52,766	$0
TOTALS			**$52,766**	**$0**

SIGNIFICANT EVENTS

Tropical Storm Hermine, September 3-9, 2010 – Guadalupe County

On Tuesday afternoon an intense rain band developed primarily along the I-35 stretching several hundred miles from Waco to south of San Antonio due to tropical storm Hermine. Rain rates of 2-3 inches per hour were experienced in the Austin-San Antonio I-35 corridor and brought widespread flash flooding by Tuesday evening. Widespread rain totals of 5-6 inches were

common along the corridor during the evening hours and the torrential rains continued over the next eight hours well past midnight early Wednesday morning.[2]

During the overnight hours early Wednesday September 8, tropical rains continued to fall across portions of Travis and Williamson Counties. The Shoal Creek and Brushy Creek watersheds were hit hardest. Several swift water rescues were performed as creeks overflowed their banks and flooded many low water crossings. The most intense rains of 10 - 16 inches occurred over the area from central Williamson County down into northern Travis County. A National Weather Service Cooperative Observer near Lake Georgetown recorded a total of 16.37 inches from September 7 - 9 with 14.57 inches of that total coming in a 24-hour time period. Shelters were set up as homes began to flood and RV parks were evacuated along Brushy Creek. For a time, I-35 in Georgetown was shut down with witnesses saying that water was as high as the center concrete barrier.

PROBABILITY OF FUTURE EVENTS

Based on historical occurrences of significant hurricane wind events, the probability of future events is Unlikely, with a frequency of occurrence of one event every ten years or more for the Guadalupe County planning area, including all participating jurisdictions.

VULNERABILITY AND IMPACT

Hurricane-force winds can cause major damage to large areas; hence all existing buildings, facilities and populations are equally exposed and vulnerable to this hazard and could potentially be impacted. Most structures in the planning area can resist the effects of all but the most severe wind storms. The Guadalupe County planning area features multiple mobile or manufactured home parks throughout the planning area. These parks are typically more vulnerable to hurricane events than typical site-built structures. In addition, manufactured homes are located sporadically throughout the planning area which would also be more vulnerable. The US Census data indicates a total of 8,107 (14.2%) manufactured homes located in the Guadalupe County planning area (Table 15-3). In addition, 26.1% (approximately 14,889 structures) of the single family residential (SFR) structures in the entire planning area were built before 1980. These structures would typically be built to lower or less stringent construction standards than newer construction and may be more susceptible to damages during significant hurricane events.

Table 15-3. Guadalupe County Structures at Greater Risk

JURISDICTION	MANUFACTURED HOMES	SFR STRUCTURES BUILT BEFORE 1980
Guadalupe County[3]	8,107	14,889
City of Cibolo	410	627
City of Seguin	6	1,115

[3] County totals includes all incorporated jurisdictions and unincorporated areas.

SECTION 15: HURRICANE WIND

The following critical facilities would be vulnerable to hurricane events in the planning area:

Table 15-4. Guadalupe County Critical Facilities at Risk

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

Storm track data was available for the past 150 years; and property and crop loss data was available from 1950 to the present. Only hurricane wind events that have been reported have been factored into this Risk Assessment. It is likely that additional hurricane wind occurrences have gone unreported before and during the recording period. Table 15-5 shows the annualized losses based on historical incident information for the planning area. The average annual loss estimate for the Guadalupe County planning area is approximately $2,199.

Table 15-5. Potential Annualized Losses by Jurisdiction

JURISDICTION	PROPERTY & CROP LOSS	ANNUAL LOSS ESTIMATES
Guadalupe County	$52,766	$2,199

The impact of hurricane wind events experienced in Guadalupe County has resulted in no injuries or fatalities. Based on the level of risk and historical occurrences for hurricane winds in the Guadalupe County planning area there is a “Limited” severity of impact; meaning the shutdown of critical facilities and services could be for 24-hours or less, and less than ten percent of property can be destroyed or experience major damage.

ASSESSMENT OF IMPACTS

Hurricane events have the potential to pose a significant risk to people and can create dangerous and difficult situations for public health and safety officials. The impact of climate change could produce larger, more severe hurricane events, exacerbating the current hurricane impacts. Worsening hurricane conditions can be frequently associated with a variety of impacts, including:

- Individuals exposed to the storm can be struck by flying debris, falling limbs, or downed trees causing serious injury or death.
- Structures can be damaged or crushed by falling trees, which can result in physical harm to the occupants.
- Driving conditions in all jurisdictions may be dangerous during a hurricane event, especially over the Causeway or other elevated bridges, elevating the risk of injury and accidents during evacuations if not timed properly.

- Additional resources may be required for emergency preparedness and response during the summer months due to increases in populations along the coast.
- Emergency evacuations may be necessary prior to a hurricane landfall, requiring emergency responders, evacuation routing and temporary shelters in the planning area.
- Significant debris and downed trees can result in emergency response vehicles being unable to access areas of the community.
- Downed power lines may result in roadways being unsafe for use, which may prevent first responders from answering calls for assistance or rescue.
- During hurricane landfall, first responders may be prevented from responding to calls, as the winds may reach a speed in which their vehicles and equipment are unsafe to operate.
- Hurricane events often result in widespread power outages increasing the risk to more vulnerable portions of the population who rely on power for health and/or life safety.
- Extended power outage often results in an increase in structure fires and carbon monoxide poisoning, as individuals attempt to cook or heat their homes with alternate, unsafe cooking or heating devices, such as grills.
- Extreme hurricane events may rupture gas lines and down trees and power lines, increasing the risk of structure fires during and after a storm event.
- Extreme hurricane events may lead to prolonged evacuations during search and rescue, and immediate recovery efforts requiring additional emergency personnel and resources to prevent entry, and protect citizens and property.
- First responders are exposed to downed power lines, unstable and unusual debris, hazardous materials, and generally unsafe conditions.
- Emergency operations and services may be significantly impacted due to damaged facilities and/or loss of communications.
- Critical staff may be unable to report for duty, limiting response capabilities.
- City or county departments may be damaged, delaying response and recovery efforts for the entire community.
- Private sector entities that the city and its residents rely on, such as utility providers, financial institutions, and medical care providers may not be fully operational and may require assistance from neighboring communities until full services can be restored.
- Economic disruption negatively impacts the programs and services provided by the community due to short- and long-term loss in revenue.
- Some businesses not directly damaged by the hurricane may be negatively impacted while roads are cleared and utilities are being restored, further slowing economic recovery.
- Older structures built to less stringent building codes may suffer greater damage as they are typically more vulnerable to hurricane damage.
- Large scale hurricanes can have significant economic impact on the affected area, as it must now fund expenses such as infrastructure repair and restoration, temporary services and facilities, overtime pay for responders, as well as normal day-to-day operating expenses.
- Businesses that are more reliant on utility infrastructure than others may suffer greater damages without a backup power source.

SECTION 15: HURRICANE WIND

The economic and financial impacts of a hurricane on the area will depend entirely on the scale of the event, what is damaged, and how quickly repairs to critical components of the economy can be implemented. The level of preparedness and pre-event planning done by the community, local businesses and citizens will also contribute to the overall economic and financial conditions in the aftermath of any hurricane event.

SECTION 16: EARTHQUAKE

HAZARD DESCRIPTION

An earthquake is the sudden movement of the Earth's surface cause by the release of stress accumulated within or along the edge of the Earth's tectonic plates, volcanic eruption, or by a manmade explosion. The majority of earthquakes occur along faults; however earthquakes can occur within plate interiors. Over geologic time, plates move and plate boundaries change, pushing weaken boundary regions to the interior part of the plates. These areas of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust.

Earthquakes' locations are described by their focal depth and geographic position of the epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter is the point on the Earth's surface directly above the hypocenter. Earthquakes usually occur without warning, with their effects impacting great distances away from the epicenter.

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may influence an individual's normal activities. Table 16-1 describes definition of examples.

Table 16-1. Definitions of Earthquake Hazards[1]

HAZARD	DESCRIPTION
Surface Faulting	Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
Ground Motion (shaking)	The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
Landslide	A movement of surface material down a slope.

[1] Source: USGS, 2012

HAZARD	DESCRIPTION
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
Tectonic Deformation	A change in the original shape of a material due to stress and strain.
Tsunami	A sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes, major submarine slides, or exploding volcanic islands.
Seiche	The sloshing of a closed body of water from earthquake shaking

LOCATION

Earthquake hazard areas are mapped by the US Geological Survey from lowest hazard to highest hazard areas. Figure 16-1 shows major earthquake hazard areas. An Earthquake Hazard Map, also known as a Percent Peak Ground Accelerations (%PGA) Map. The map shows the %PGA values with a 2% chance of being exceeded over 50 years. %PGA is an earthquake measurement that displays three things: the geographic area affected (all colored areas on the map), the probability of an earthquake of each given level of severity (2% chance in 50 years), and the strength of ground movement (severity) shown as percent of the acceleration force of gravity (%g) (the PGA is indicated by color). The Guadalupe County Planning Area including all participating jurisdictions, is identified in Table 16-1, is located in a low hazard area of 0-8%g peak ground acceleration.

Figure 16-1. U.S. Map of Peak Ground Acceleration

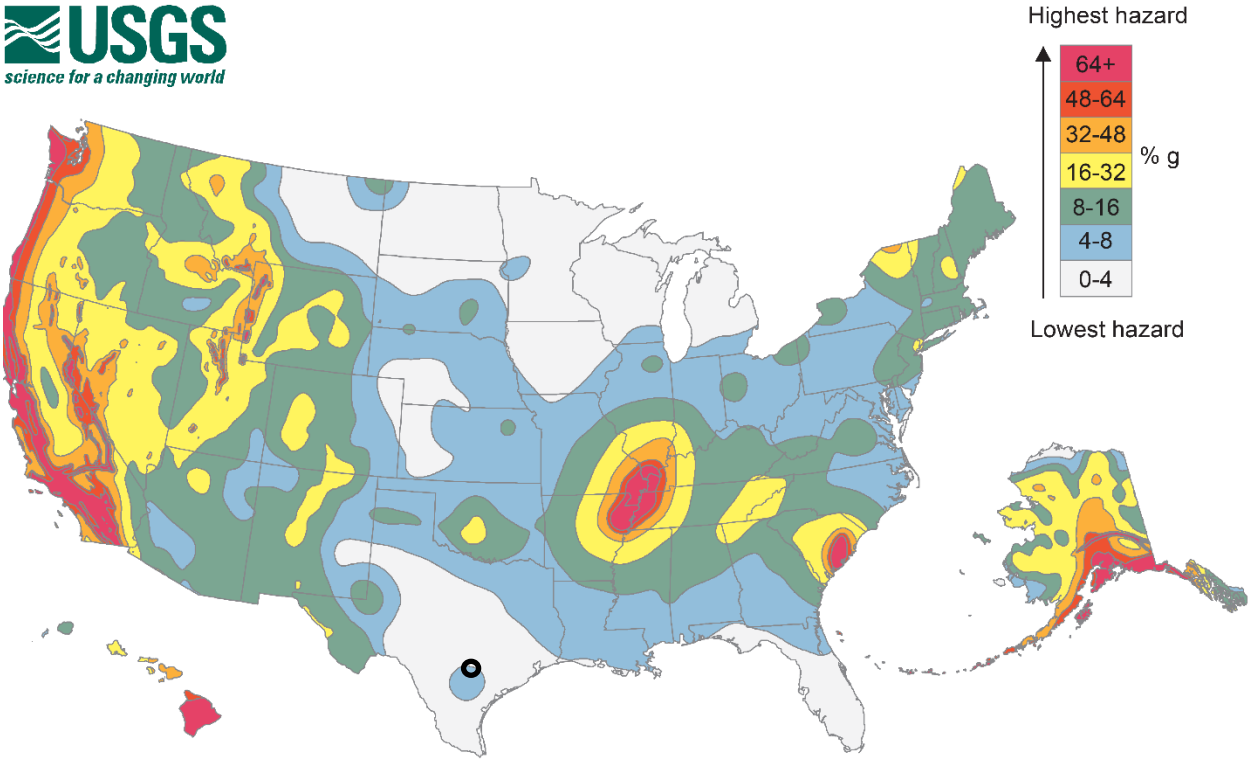
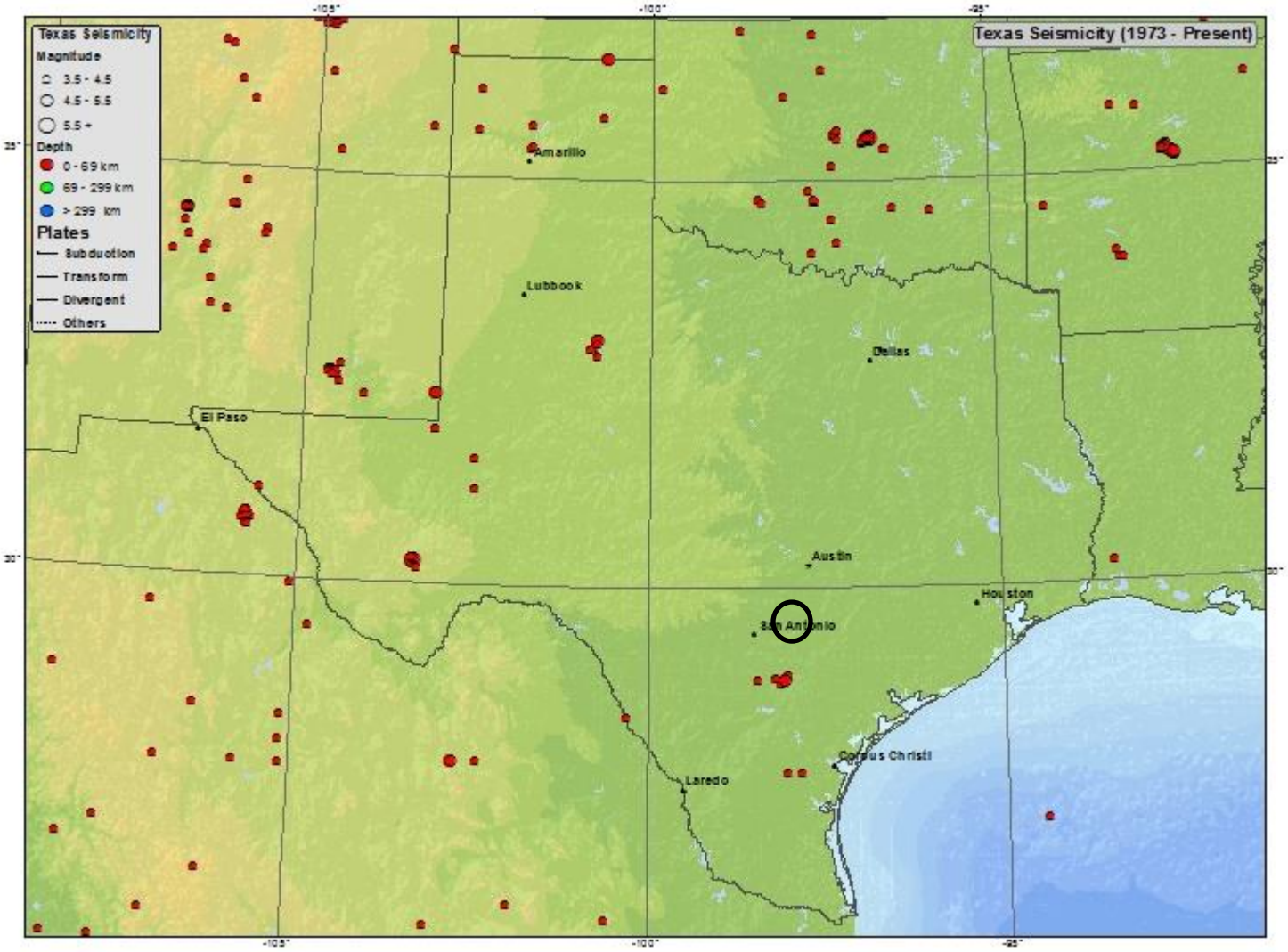


Figure 16-2 maps historic earthquake epicenters across Texas between 1973 and 2012.

Figure 16-2. Historic Earthquake Epicenters in Texas, 1973-2012



EXTENT

The magnitude, or intensity of an earthquake, is a recorded value of the amplitude of seismic waves. The Richter scale is the most commonly used scale that measures the magnitude of earthquakes. It has no upper limit and is not used to describe damage (Table 16-2).

Table 16-2. Richter Scale

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
2.5 or LESS	Usually not felt, but can be recorded by seismograph
2.5-5.4	Often felt, but only causes minor damage
5.5-6.0	Slight damage to buildings and other structures
6.1 TO 6.9	May cause a lot of damage in very populated areas
7.0 TO 7.9	Major earthquake; serious damage
8 OR GREATER	Great earthquake; can totally destroy communities near the epicenter

The intensity of an earthquake is expressed by the Modified Mercalli Scale, based on the effects of ground shaking on people, buildings, and natural features, and is location dependent. The Modified Mercalli Scale gives the intensity of the earthquake in values ranging from I to XII. Table 16-3 summarizes earthquake intensity as described by the Modified Mercalli Scale and provides a comparison between the Richter and Modified Mercalli Intensity Scales.

Table 16-3. Modified Mercalli Intensity (MMI) Scale

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
I	INSTRUMENTAL	Not Felt except by a very few under especially favorable conditions	
II	FEEBLE	Felt only by a few persons at rest, especially on upper floors of buildings	< 4.2
III	SLIGHT	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration Estimated	
IV	MODERATE	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER MAGNITUDE
V	SLIGHTLY STRONG	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.	< 4.8
VI	STRONG	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	< 5.4
VII	VERY STRONG	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken	< 6.1
VIII	DESTRUCTIVE	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned	
IX	RUINOUS	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.	< 6.9
X	DISASTROUS	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.	< 7.3
XI	VERY DISASTROUS	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	< 8.1
XII	CATASTROPHIC	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.	> 8.1

Table 16-4 lists the Modified Mercalli Intensity (MMI) with the corresponding Acceleration (%g) (PGA), as well as the perceived shaking and potential damage expected.

Table 16-4. Modified Mercalli Intensity (MMI) and PGA Equivalents

MMI	ACCELERATION (%g) (PGA)	PERCEIVED SHAKING	POTENTIAL DAMAGE
I	<.17	Not Felt	None
II	.17-1.4	Weak	None
III	.17-1.4	Weak	None
IV	1.4-3.9	Light	None
V	3.9-9.2	Moderate	Very Light
VI	9.2-18	Strong	Light
VII	18-34	Very Strong	Moderate

Taking into consideration the possible extent of an earthquake for the area, by reviewing Tables 16-2 through 16-4 in conjunction with previous occurrences as depicted in Figure 16-2, Guadalupe County Planning Area, including all participating jurisdictions, experience on average less than 2.5 Richter Scale or Level IV or instrumental impact based on the Modified Mercalli intensity scale. This is the greatest extent the entire planning area can anticipate in the future.

HISTORICAL OCCURRENCES

According to USGS, and the National Geophysical Data Center (NGDC), there are no “significant” earthquakes on record for the state of Texas and the entire Guadalupe County Planning Area from 2150 B.C. to present. A significant earthquake, as defined by NGDC, is one that has caused at least moderate damage (approximately $1 million or more), has resulted in 10 or more deaths, has registered as a magnitude 7.5 or greater, has registered as Modified Mercalli Intensity (MMI) Scale X or greater, or generated a tsunami. None of these criteria have been met by any seismic activity known to have impacted the Guadalupe County Planning Area, including all participating jurisdictions.

PROBABILITY OF FUTURE EVENTS

Earthquake Hazard Maps show the distribution of earthquake shaking levels that have a certain probability of occurring over a given period. According to the USGS, the entire Planning Area has a PGA of 0-8%g for earthquakes with a 2-percent probability of occurring within 50 years. Based on historical records, the probability of an earthquake affecting the Guadalupe County Planning Area, including all participating jurisdictions, is unlikely, meaning that an event is probable in the next ten years.

VULNERABILITY AND IMPACT

Little warning is usually associated with earthquakes and can impact areas a great distance away from the epicenter. The amount of damage depends on the density of population and buildings, and infrastructure construction in the affected area. Some places may be more vulnerable than

others based on soil type, building age, and building codes in the Guadalupe County Planning Area, including all participating jurisdictions.

Table 16-5 includes the critical facilities that would be vulnerable to Earthquake events in each participating jurisdiction:

Table 16-5. Critical Facilities by Jurisdiction

JURISDICTION	CRITICAL FACILITIES
Guadalupe County	16 Airports; 1 Dam; 1 Energy Facility; 5 Financial Institutes; 18 Fire Departments; 10 Governmental Facilities; 12 Law Enforcements; 12 Nursing Homes; 11 Public Health & Healthcare Facilities
City of Cibolo	1 Family YMCA; 3 Fire Stations; 3 Government Facilities; 1 Police Station; 5 S.S. Lift Stations; 3 Water Plants
City of Seguin	4 Agriculture/Food Facilities; 13 Banking/Finance Institutes; 10 Emergency Services; 6 Energy/Electricity Facilities; 1 Postal & Shipping Facility; 9 Public Health Facilities; 1 Telecommunications Facility; 1 Transportation Facility; 10 Water Facilities

With no historical events recorded, annualized loss-estimates for earthquakes are not available; neither is a breakdown of potential dollar losses of critical facilities and infrastructure. The potential severity of impact from an earthquake for the entire Guadalupe County Planning Area, including all participating jurisdictions, is classified as “limited”, meaning that less than 10 percent of infrastructure would be damaged with critical facilities being shut down for less than 24 hours.

SECTION 17: MITIGATION STRATEGY

MITIGATION GOALS

Based on the results of the risk and capability assessments, the Planning Team developed and prioritized the mitigation strategy. At the Mitigation Workshop in September 2020, Planning Team members refined the Plan's mitigation strategy. The following goals and objectives were identified.

GOAL 1

Protect public health and safety.

OBJECTIVE 1.1

Advise the public about health and safety precautions to guard against injury and loss of life from hazards.

OBJECTIVE 1.2

Maximize utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.

OBJECTIVE 1.3

Reduce the danger to, and enhance protection of, high risk areas during hazard events.

OBJECTIVE 1.4

Protect critical facilities and services.

GOAL 2

Build and support local capacity and commitment to continuously become less vulnerable to hazards.

OBJECTIVE 2.1

Build and support local partnerships to continuously become less vulnerable to hazards.

OBJECTIVE 2.2

Build a cadre of committed volunteers to safeguard the community before, during, and after a disaster.

OBJECTIVE 2.3

Build hazard mitigation concerns into county planning and budgeting processes.

GOAL 3
Increase public understanding, support, and demand for hazard mitigation.

OBJECTIVE 3.1
Heighten public awareness regarding the full range of natural hazards the public may face.

OBJECTIVE 3.2
Educate the public on actions they can take to prevent or reduce the loss of life and/or property from all hazards and increase individual efforts to respond to potential hazards.

OBJECTIVE 3.3
Publicize and encourage the adoption of appropriate hazard mitigation measures.

GOAL 4
Protect new and existing properties.

OBJECTIVE 4.1
Reduce repetitive losses to the National Flood Insurance Program (NFIP).

OBJECTIVE 4.2
Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.

OBJECTIVE 4.3
Enact and enforce regulatory measures to ensure that future development will not put people in harm's way or increase threats to existing properties.

GOAL 5
Maximize the resources for investment in hazard mitigation.

OBJECTIVE 5.1
Maximize the use of outside sources of funding.

OBJECTIVE 5.2
Maximize participation of property owners in protecting their properties.

OBJECTIVE 5.3
Maximize insurance coverage to provide financial protection against hazard events.

OBJECTIVE 5.4
Prioritize mitigation projects, based on cost-effectiveness and sites facing the greatest threat to life, health, and property.

GOAL 6
Promote growth in a sustainable manner.

OBJECTIVE 6.1
Incorporate hazard mitigation activities into long-range planning and development activities.

OBJECTIVE 6.2
Promote beneficial uses of hazardous areas while expanding open space and recreational opportunities.

OBJECTIVE 6.3
Utilize regulatory approaches to prevent creation of future hazards to life and property.

SECTION 18: MITIGATION ACTIONS

SUMMARY

As discussed in Section 2, at the mitigation workshop the planning team and stakeholders met to develop mitigation actions for each of the natural hazards included in the Plan. Each of the actions in this section were prioritized based on the Federal Emergency Management Agency's (FEMA) Social, Technical, Administrative, Political, Legal, Economic, and Environmental [STAPLE(E)] criteria necessary for the implementation of each action. As a result of this exercise, an overall priority was assigned to each mitigation action.

As part of the economic evaluation of the STAPLE(E) analysis, jurisdictions analyzed each action in terms of the overall costs, measuring whether the potential benefit to be gained from the action outweighed costs associated with it. As a result of this exercise, priority was assigned to each mitigation action by marking them as High (H), Moderate (M), or Low (L). An action that is ranked as "High" indicates that the action will be implemented as soon as funding is received. A "Moderate" action is one that may not be implemented right away depending on the cost and number of citizens served by the action. Actions ranked as "Low" indicate that they will not be implemented without first seeking grant funding and after "High" and "Moderate" actions have been completed.

All mitigation actions created by Planning Team members are presented in this section in the form of Mitigation Action Worksheets. More than one hazard is sometimes listed for an action, if appropriate. Actions presented in this section represent a comprehensive range of mitigation actions per current State and FEMA Guidelines, including two actions per hazard and of two different types for each participating jurisdiction. The term county-wide refers to Guadalupe County and all participating jurisdictions.

SECTION 18: MITIGATION ACTIONS

Table 18-1. Guadalupe County Mitigation Action Matrix

TYPE OF ACTION	
Action #1 – Plans/Regulations (Blue)	Action #4 – Structural (Orange)
Action #2 – Education/Awareness (Red)	Action #5 – Preparedness/Response (Black)
Action #3 – Natural Resources (Green)	

Jurisdiction	Flood	Dam Failure	Thunderstorm Wind	Lightning	Drought	Extreme Heat	Hail	Tornado	Wildfire	Winter Storm	Hurricane Wind	Earthquake
Guadalupe County	xxxx	xxx	xxx	xxx	xx	xx	xxx	xxx	xxxx	xxx	xxx	xx
City of Cibolo	xxxx	N/A	xx	xxx	xxxx	xxxx	xxx	xxx	xxx	xxx	xxx	xx
City of Seguin	xxxx	xxx	xxx	xx	xxxx	xxxx	xx	xxx	xxx	xx	xxx	xx

GUADALUPE COUNTY – COUNTY-WIDE

		Guadalupe County – County-Wide – Action #1
	Proposed Action:	Implement education and awareness program utilizing media, social media, bulletins, flyers, etc. to educate citizens of hazards that can threaten the area and mitigation measures to reduce injuries, fatalities, and property damages.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Promote hazard awareness and protect citizens from potential injuries and damages.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure (where applicable), Drought, Earthquake, Extreme Heat, Flood, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	County and City OEM
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – County-Wide – Action #2
	Proposed Action:	Acquire and install generators with hard wired quick connections at all critical facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions critical facilities
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Provide power for critical facilities during power outages and ensure continuity of critical services.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure (where applicable), Earthquake, Extreme Heat, Flood, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City OEM
Implementation Schedule:	Within 12-36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		Guadalupe County – County-Wide – Action #3
	Proposed Action:	Harden / retrofit critical facilities to hazard-resistant levels.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions critical facilities
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages at critical facilities; Ensure continuity of critical services during and after event; Reduce risk of injury to emergency and critical personnel.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure (where applicable), Earthquake, Extreme Heat, Flood, Hail, Hurricane Wind, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm
Effect on New/Existing Buildings:	Reduce risk to existing structures
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000 per jurisdiction
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City OEM
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan; Capital Improvement Plan

COMMENTS

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – County-Wide – Action #4
	Proposed Action:	Upgrade critical facilities to include drought mitigation measures such as greywater reuse systems and drought tolerant landscaping.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions critical facilities
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages at critical facilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Drought
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City OEM, Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

	Guadalupe County – County-Wide – Action #5
Proposed Action:	Adopt and implement a routine tree trimming program that clears tree limbs near power lines and/or hanging in right-of-way; Remove dead trees from right-of-way and drainage systems on a scheduled basis.
BACKGROUND INFORMATION	
Jurisdiction/Location:	County-wide, including all participating jurisdictions
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to infrastructure; Ensure continuity of services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Hurricane Wind, Flood, Thunderstorm Wind, Hail, Lightning, Tornado, Winter Storm, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County, City OEM, Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Maintenance Plan; CWPP (where applicable); Drainage Plan

COMMENTS
Cibolo: Power tree trimming is completed by GVEC (ongoing effort). City has an ordinance that mandates residents trim trees that are rooted in their property that overhang the ROW. City provides for tree maintenance on trees rooted in city right-of-way. Outreach to residents on required tree trimming would be a benefit.

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – County-Wide – Action #6
	Proposed Action:	Work with state and local agencies to determine locations to reduce fuel on public and private lands. Implement fuels reduction program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire through targeted fuels reduction programs.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City Fire Chief, Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	CWPP (where applicable)

COMMENTS

	Guadalupe County – County-Wide – Action #7
Proposed Action:	Install fire danger rating / burn ban signs.
BACKGROUND INFORMATION	
Jurisdiction/Location:	County-wide, including all participating jurisdictions
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through education and awareness programs; Reduce risk of damages and injuries.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County Road and Bridge and City Public Works, Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	CWPP (where applicable)

COMMENTS

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – County-Wide – Action #8
	Proposed Action:	Implement a community education program regarding fire dangers for identified risk areas; Distribute pamphlets through neighborhood associations or insert flyers in water bills to make residents aware of wildfire hazard areas and fire protection measures for homes and yards.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through education and awareness programs; Reduce risk of damages and injuries.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City Fire Department, Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	CWPP (where applicable)

COMMENTS

	Guadalupe County – County-Wide – Action #9
Proposed Action:	Upgrade undersized stormwater drains and culverts.
BACKGROUND INFORMATION	
Jurisdiction/Location:	County-wide, including all participating jurisdictions drainage system
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood damages through improved drainage capacity; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County, City Public Works, Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan; Drainage Plan

COMMENTS

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – County-Wide – Action #10
	Proposed Action:	Educate community on the dangers of low water crossings through the installation of warning signs and promotion of "Turn Around, Don't Drown" Program.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County-wide, including all participating jurisdictions
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of injuries, fatalities and damages through education and awareness.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County, City OEM, Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

SECTION 18: MITIGATION ACTIONS

	Guadalupe County – County-Wide – Action #11
Proposed Action:	Conduct public education program on fire risks and wildland fire mitigation, with the assistance of the Texas Forest Service.
BACKGROUND INFORMATION	
Jurisdiction/Location:	County-wide, including all participating jurisdictions
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through education and awareness programs; Reduce risk of damages and injuries.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	County and City Fire Chief, Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	CWPP (where applicable)

COMMENTS

GUADALUPE COUNTY

		Guadalupe County – Action #1
	Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains, and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Administration and Public Works
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		Guadalupe County – Action #2
	Proposed Action:	Develop a land acquisition program in flood hazard areas. Acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as open space.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide flood risk areas
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Eliminate risk of flood damages to high risk structures and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Natural Systems Protection (vacant land)

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Administration
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

		Guadalupe County – Action #3
	Proposed Action:	Retain and maintain natural vegetation in stormwater channels.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood damages due to erosion or scour during flood events.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Guadalupe County Public Works
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Flood Damage Prevention Ordinance; Local Ordinance

COMMENTS

		Guadalupe County – Action #4
	Proposed Action:	Implement stream restoration / channelization program to ensure adequate drainage / diversion of stormwater.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood damages through improved drainage capacity / stormwater diversion; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Public Works
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

SECTION 18: MITIGATION ACTIONS

		Guadalupe County – Action #5
	Proposed Action:	Educate community on the flood risk in their neighborhoods, the dangers of flooding, driving through flood waters, and risk reduction methods to protect lives and property.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of injuries, fatalities and damages through education and awareness.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Administration
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Guadalupe County – Action #6
	Proposed Action:	Marking and Placing electric gates at low water crossings.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide low water crossings
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of injuries, fatalities and damages through education and awareness; Reduce need for emergency services.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$20,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County OEM and Road & Bridge
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		Guadalupe County – Action #7
	Proposed Action:	Relocate critical facilities out of high hazard areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide critical facilities
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of damages to structures; Ensure continuity of critical services; Reduce risk of injuries to critical service employees.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire, Dam Failure
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County OEM
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan; Capital Improvement Plan

COMMENTS

		Guadalupe County – Action #8
	Proposed Action:	Adopt on-site retention basin program in conjunction with development to address excessive stormwater / firefighting water source.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Requiring developers to implement on-site retention basin for new developments will prevent downstream impacts, reduce impacts to floodplain and provide additional potential water sources for firefighting uses.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Guadalupe County OEM
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		Guadalupe County – Action #9
	Proposed Action:	Implement and enhance an area-wide telephone Emergency Notification System ("Reverse 911").
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens through improved communication and early warning.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Earthquake, Flood, Hurricane Wind, Thunderstorm Wind, Winter Storm, Tornado, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County OEM
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS

		Guadalupe County – Action #10
	Proposed Action:	Develop alternative evacuation routes / plans and designate emergency thoroughfares, particularly in areas with limited capacity. Educate citizens on evacuation routes and procedures.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk residents through improved evacuation alternatives and awareness efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Hurricane Wind, Wildfire, Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County OEM
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		Guadalupe County – Action #11
	Proposed Action:	Require standards for burial of electrical, telephone, cable lines and other utilities in new developments.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to infrastructure; Ensure continuity of critical services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind, Dam Failure, Flood, Hail, Lightning, Winter Storm, Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing and future structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Guadalupe County Administration
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		Guadalupe County – Action #12
	Proposed Action:	Bury existing utility lines.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to infrastructure; Ensure continuity of critical services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind, Dam Failure, Flood, Hail, Lightning, Winter Storm, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$20,000,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Guadalupe County Road and Bridge
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

		Guadalupe County – Action #13
	Proposed Action:	Cut firebreaks into public wooded areas according to risk factors.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire through targeted firebreaks.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Fire Department
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	CWPP

COMMENTS

		Guadalupe County – Action #14
	Proposed Action:	Allow no vegetation in easements or require fire-resistant landscaping.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire through improved development practices and building requirements / restrictions.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Guadalupe County Administration
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	CWPP; Local Building Codes/Ordinances

COMMENTS

		Guadalupe County – Action #15
	Proposed Action:	Install a network of dry hydrants in stock ponds, creeks, and small lakes to increase the supply of water for fire protection.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire by increasing water access and firefighting capabilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Road and Bridge
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into Existing Plans:	CWPP

COMMENTS

		Guadalupe County – Action #16
	Proposed Action:	Install awnings / covered parking to protect emergency vehicle fleet.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	County Emergency Vehicle Fleet
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to emergency vehicle fleet; Ensure continuity of services during and after event.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Hail, Thunderstorm Wind, Tornado
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local funds, State and Federal Grants
Lead Agency/Department Responsible:	Guadalupe County Police Department
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

	Guadalupe County – Action #17
Proposed Action:	Join the FIREWISE program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce fire fuels and mitigate wildfire and urban fire potential.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Texas Forest Service
Lead Agency/Department Responsible:	County Fire Department
Implementation Schedule:	Within 12-24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

CITY OF CIBOLO

	City of Cibolo – Action #1
Proposed Action:	Restrict future development in high risk areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of damages to new structures and infrastructure through building restrictions in high risk areas.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Cibolo – Action #2
	Proposed Action:	Adopt on-site retention basin program in conjunction with development to address excessive stormwater / firefighting water source.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Requiring developers to implement on-site retention basin for new developments will prevent downstream impacts, reduce impacts to floodplain and provide additional potential water sources for firefighting uses.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS
All developed areas of the City have fire hydrants in place.

		City of Cibolo – Action #3
	Proposed Action:	Prohibit animal shelters in known hazard areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to structures and animals by requiring development outside of hazardous areas; reduce burden on emergency response during hazardous events.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire, Hurricane Wind
Effect on New/Existing Buildings:	Reduce risk to new structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

	City of Cibolo – Action #4
Proposed Action:	Provide / construct additional means of access into single-entry neighborhoods; Update subdivision codes for a higher level of ingress and egress.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to residents through improved evacuation alternatives; improve firefighting capabilities through improved access alternatives.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$250,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances; Capital Improvement Plan

COMMENTS

	City of Cibolo – Action #5
Proposed Action:	Adopt smart growth initiatives. Incorporate a formal hazard mitigation plan in long-term community development planning activities.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk in high hazard areas by promoting and incentivizing development in low risk areas; Build resiliency within the community; Reduce risk of damages through improved planning and construction practices.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Hurricane Wind, Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduce risk to new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

	City of Cibolo – Action #6
Proposed Action:	Implement measures to secure traffic lights and traffic controls from high wind damage.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to structures and infrastructure; Reduce risk of injuries or fatalities.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$30,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Cibolo – Action #7
	Proposed Action:	Require standards for burial of electrical, telephone, cable lines and other utilities in new developments.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to infrastructure; Ensure continuity of critical services during and after event; Reduce damages associated with power outages; Reduce risk of injuries or fatalities to vulnerable populations.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind, Flood, Hail, Lightning, Winter Storm, Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Cibolo – Action #8
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and/or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress/egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	CWPP; Capital Improvement Plan

COMMENTS

	City of Cibolo – Action #9
Proposed Action:	Establish, adopt, and implement a "green infrastructure" program for parks, nature preserves, greenbelts, etc.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce impacts of flood through expanded greenspace and restoration of floodplains and wetlands; Reduce impacts of drought through green infrastructure that works to replenish groundwater reserves; Reduce impacts of Urban Island Heat effect in densely populated areas through tree planting.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Cibolo – Action #10
	Proposed Action:	Adopt and implement a program for clearing debris from bridges, drains, and culverts.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding by maintaining or restoring drainage capacity.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$50,000 (annually)
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Cibolo – Action #11
	Proposed Action:	Undertake a comprehensive study of flood risk and reduction alternatives, with the assistance of the U.S. Army Corps of Engineers. Implement feasible alternatives for flood reduction.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide flood hazard areas
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Improve risk assessment; Reduce risk of damages or injuries through drainage improvements; Reduce risk of damages and injuries.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Local Plans and Regulations (for unmapped areas)

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

	City of Cibolo – Action #12
Proposed Action:	Join the Community Rating System program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood insurance premiums for local residents; Reduce flood risk and build resiliency.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Local Floodplain Administrator
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

		City of Cibolo – Action #13
	Proposed Action:	Join the National Flood Insurance Program (NFIP).
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Provide access to flood insurance for local residents; Reduce flood risk and build resiliency.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Local Floodplain Administrator
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan; Flood Damage Prevention Ordinance

COMMENTS

	City of Cibolo – Action #14
Proposed Action:	Undertake an initiative to increase the number of flood insurance policies.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk and build resiliency; Increase flood risk awareness; Reduce damage impact on residents after a flood event; Reduce the burden on state and federal resources.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Local Floodplain Administrator
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

		City of Cibolo – Action #15
	Proposed Action:	Implement a flood awareness program by providing FEMA / NFIP materials to mortgage lenders, real estate agents and insurance agents and place them in local libraries.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk through education and awareness; Increase flood insurance coverage.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Cibolo – Action #16
	Proposed Action:	Implement stream restoration / channelization program to ensure adequate drainage / diversion of stormwater.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood damages through improved drainage capacity / stormwater diversion; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$12,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

	City of Cibolo – Action #17
Proposed Action:	Adopt and implement routine fire hydrant maintenance plan by the Cibolo Utility Division.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through routine maintenance of fire hydrants; Reduce risk of injury or damages.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new or existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$40,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	CWPP

COMMENTS

SECTION 18: MITIGATION ACTIONS

City of Cibolo – Action #18	
Proposed Action:	Adopt construction regulations for fire-resistant roofing materials, smoke alarm systems, sprinkler systems, cisterns, escape roads, fuels management requirements, and boxing of eaves, overhangs, and decks; Require fire extinguishers for all homes and businesses; Require large side yards between adjacent buildings in residential and commercial areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire through improved construction practices and building requirements.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	CWPP; Local Building Codes

COMMENTS

City of Cibolo – Action #19	
Proposed Action:	Build safe room shelters throughout the jurisdiction so that residents can reach shelter in less than five minutes.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens by providing shelter in high risk areas during extreme weather events.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Low
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Cibolo City Manager
Implementation Schedule:	Within 36 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan; Capital Improvement Plan

COMMENTS

CITY OF SEGUIN

	City of Seguin – Action #1
Proposed Action:	Obtain certification in the National Weather Service StormReady Program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community critical facilities
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens by educating the public on how to prepare for hazards and disasters.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Thunderstorm Wind, Winter Storm, Tornado, Hail, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds (staff time), State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Seguin – Action #2
	Proposed Action:	Restrict future development in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of damages to new structures and infrastructure through building restrictions in high risk areas.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Wildfire, Dam Failure
Effect on New/Existing Buildings:	Reduce risk to new structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$2,500
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Seguin – Action #3
	Proposed Action:	Implement and enhance an area-wide telephone Emergency Notification System ("Reverse 911").
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens through improved communication and early warning.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Earthquake, Flood, Hurricane Wind, Thunderstorm Wind, Winter Storm, Tornado, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS

		City of Seguin – Action #4
	Proposed Action:	Develop alternative evacuation routes / plans and designate emergency thoroughfares, particularly in areas with limited capacity. Educate citizens on evacuation routes and procedures.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk residents through improved evacuation alternatives and awareness efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Hurricane Wind, Wildfire, Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

		City of Seguin – Action #5
	Proposed Action:	Provide / construct additional means of access into single-entry neighborhoods; Update subdivision codes for a higher level of ingress and egress.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to residents through improved evacuation alternatives; improve firefighting capabilities through improved access alternatives.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$250,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances; Capital Improvement Plan

COMMENTS

	City of Seguin – Action #6
Proposed Action:	Adopt smart growth initiatives. Incorporate a formal hazard mitigation plan in long-term community development planning activities.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk in high hazard areas by promoting and incentivizing development in low risk areas; Build resiliency within the community; Reduce risk of damages through improved planning and construction practices.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Flood, Hurricane Wind, Wildfire, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduce risk to new structures
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Seguin – Action #7
	Proposed Action:	Equip sewer manholes with watertight covers and inflow guards.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood water contamination; Reduce risk of surface water infiltration and sewage backup; Ensure continuity of critical services.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Dam Failure
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Wastewater Management Plan

COMMENTS

		City of Seguin – Action #8
	Proposed Action:	Require "safe rooms" to be added when constructing new schools, daycares, rest homes and critical care facilities.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens by providing shelter in new critical facilities during extreme weather events.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Tornado, Thunderstorm Wind, Hurricane Wind
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes

COMMENTS

		City of Seguin – Action #9
	Proposed Action:	Evaluate access and road conditions for response vehicles. Develop and implement options to improve access and/or add redundant access routes in high risk areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through maintained and redundant access routes in high risk areas; Improve response time for emergency services; Reduce risk of injury or damages; Provide additional ingress/egress routes through high risk areas to prevent loss of life and avoid rescue efforts.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire, Flood
Effect on New/Existing Buildings:	Reduce risk to new or existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Capital Improvement Plan

COMMENTS

	City of Seguin – Action #10
Proposed Action:	Establish, adopt, and implement a "green infrastructure" program for parks, nature preserves, greenbelts, etc.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce impacts of flood through expanded greenspace and restoration of floodplains and wetlands; Reduce impacts of drought through green infrastructure that works to replenish groundwater reserves; Reduce impacts of Urban Island Heat effect in densely populated areas through tree planting.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Drought, Extreme Heat
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

	City of Seguin – Action #11
Proposed Action:	Require standard tie-downs of propane tanks.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages to structures and infrastructure; Reduce risk of hazardous material release and potential fires; Reduce risk of injuries or fatalities; Reduce risk of flood water contamination.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Thunderstorm Wind, Tornado, Hurricane Wind, Dam Failure, Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

	City of Seguin – Action #12
Proposed Action:	Develop a land acquisition program in flood hazard areas. Acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as open space.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide flood risk areas
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Eliminate risk of flood damages to high risk structures and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Natural Systems Protection (vacant land)

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

	City of Seguin – Action #13
Proposed Action:	Add thick vegetation on public lands along river banks.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of erosion or scour due to flooding; Reduce damages to infrastructure including roadways, sidewalks, bridges, and culverts; Reduce demands on emergency response during high water events.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$20,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

		City of Seguin – Action #14
	Proposed Action:	Undertake an initiative to increase the number of flood insurance policies.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk and build resiliency; Increase flood risk awareness; Reduce damage impact on residents after a flood event; Reduce the burden on state and federal resources.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Local Floodplain Administrator
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

		City of Seguin – Action #15
	Proposed Action:	Implement a flood awareness program by providing FEMA / NFIP materials to mortgage lenders, real estate agents and insurance agents and place them in local libraries.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk through education and awareness; Increase flood insurance coverage.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	High
Estimated Cost:	$3,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Seguin – Action #16
	Proposed Action:	Increase drainage capacity; add stormwater detention and / or retention basins as deemed necessary to reduce flood risk.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk through improved drainage capacity; Reduce risk of damages and injuries; Reduce emergency response demands.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24-48 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

	City of Seguin – Action #17
Proposed Action:	Flood-proof sewage treatment plants in flood hazard / low-lying areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of flood water contamination; Reduce risk of surface water infiltration and sewage backup; Ensure continuity of critical services.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood, Dam Failure
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$250,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Wastewater Management Plan

COMMENTS

		City of Seguin – Action #18
	Proposed Action:	Acquire and preserve open spaces adjacent to floodplain areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide flood risk fringe areas
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce flood risk to structures and infrastructure in and near the floodplain; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Natural Systems Protection

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

	City of Seguin – Action #19
Proposed Action:	Allow no vegetation in easements or require fire-resistant landscaping.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire through improved development practices and building requirements / restrictions.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$5,000
Potential Funding Sources:	Local Funds (staff time)
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	Local Building Codes/Ordinances

COMMENTS

		City of Seguin – Action #20
	Proposed Action:	Install a network of dry hydrants in stock ponds, creeks, and small lakes to increase the supply of water for fire protection.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of wildfires and the spread of wildfire by increasing water access and firefighting capabilities.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	Reduce risk to existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$500,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24-36 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Seguin – Action #21
	Proposed Action:	Undertake a comprehensive study of flood risk and reduction alternatives, with the assistance of the US Army Corps of Engineers. Adopt or revise flood damage prevention ordinance to include flood risk areas identified in the study. This study will cover all incorporated and unincorporated areas of the county that currently have limited studies with no determined base flood elevations as well as unmapped areas.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community-wide flood hazard areas
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Improve risk assessment; reduce risk of damages or injuries through improved building standards; reduce risk of damages and injuries.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Local Plans and Regulations (for unmapped or limited study areas)

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	High
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin Floodplain Manager
Implementation Schedule:	Within 12-36 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan; Flood Damage Prevention Ordinance

COMMENTS
Mapping high priority areas: Guadalupe Tributary 4a - Little Mill Creek Study (IH 10 to FM 78), Guadalupe Tributary 4a - above Cordova Road, Mays Creek Floodplain

	City of Seguin – Action #22
Proposed Action:	Implement a program to stabilize the riverbank at Max Starke Park along the banks of the Guadalupe River.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Max Starke Park
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding by protecting river bank subject to scour.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Capital Projects/Engineering
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

	City of Seguin – Action #23
Proposed Action:	Place flooded area warning lights to prevent unnecessary traffic in flooded areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk of injuries, fatalities and damages through education and awareness.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 12 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

	City of Seguin – Action #24
Proposed Action:	Install voice-over weather warning system.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Max Starcke Park Central Park Park West Manuel Castillo Park Along Hike & Bike Trail
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens through improved communication and early warning at public areas.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Earthquake, Flood, Hurricane Wind, Thunderstorm Wind, Winter Storm, Tornado, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$20,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS

	City of Seguin – Action #25
Proposed Action:	Place automatic flood gates with vehicle detection on inside of flooded area to allow for egress.
BACKGROUND INFORMATION	
Jurisdiction/Location:	San Antonio Street @ Walnut Branch Guadalupe River Drive @ Country Club Drive River Oak Drive @ Champions Drive Glenn Cove @ San Marcos Ruddleoff @ Walnut Branch Sunbelt @ Geronimo Creek Williams St @ Walnut Branch
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens through improved warning; Permanent barriers are more difficult to bypass. If no traffic can get through, then no lives can be lost.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Dam Failure, Earthquake, Flood, Hurricane Wind, Thunderstorm Wind, Winter Storm, Tornado, Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$100,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Response Plan

COMMENTS

	City of Seguin – Action #26
Proposed Action:	Implement FireWise or similar program.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk and spread of wildfires through education and awareness programs; Reduce risk of damages and injuries.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Wildfire
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin Fire Chief
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

		City of Seguin – Action #27
	Proposed Action:	Equip Hall of Fame Building to utilize as a cooling center or heating center during extreme temperatures.
	BACKGROUND INFORMATION	
	Jurisdiction/Location:	Community critical facilities
	Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce risk to citizens.
	Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Education and Awareness

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Extreme Heat, Winter Storm
Effect on New/Existing Buildings:	N/A
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$50,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Emergency Management Plan

COMMENTS

	City of Seguin – Action #28
Proposed Action:	Increase regional detention, Channel & Drainage System Improvements.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Walnut Branch (Above IH 10 to Guadalupe River), North Heideke Street Drainage System, North Guadalupe Street Drainage System, Downtown Street Drainage Improvements
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding through improved drainage.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$2,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Capital Projects/Engineering
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	N/A

COMMENTS

	City of Seguin – Action #29
Proposed Action:	Implement drainage improvements.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Walnut Branch (Above IH 10 to Guadalupe River), North Heideke Street Drainage System Improvements, North Guadalupe Street Drainage System Improvements, Downtown Street Drainage Improvements
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding through improved drainage.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$1,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Capital Projects/Engineering
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

City of Seguin – Action #30	
Proposed Action:	Drainage improvements at low water crossings.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Huber Road above Rudeloff Road (County Road 105 / County), Rudeloff Road between SH46 and Huber Road (3 crossings), Huber Road above Rudeloff Road (0.7 MI north of IH 10), Huber Road at IH 10, Aldama Street at Kingsbury Street (US 90), San Antonio Avenue at Walnut Branch, Williams Street at Walnut Branch, Campbell Street at Walnut Branch, River Oaks at Mays Creek, Guadalupe River Drive at Mays Creek, Sutherland Springs at Mays Creek, FM 464 at Little Mill Creek
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding through improved drainage.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$5,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Capital Projects/Engineering
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

	City of Seguin – Action #31
Proposed Action:	Drainage improvements and warning systems at low water crossings – ETJ Areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Still Meadow at Cottonwood Creek (ETJ) , Elm Creek Road at Campbell Banch (ETJ), FM 467 at Campbell Branch (ETJ), FM 725 at Mays Creek, SH46 at Mays Creek (ETJ), Kramms Creek at FM 477 (ETJ), FM 464 at FM477 (ETJ), FM 725 at Deadman Creek (ETJ), Gold Dust Road at Deadman Creek (ETJ), Longhorn Trail at Deadman Creek (ETJ) – 2 crossings, FM725 at Guadalupe Tributary 1a/Zipp Creek (ETJ), Stagecoach Road at Guadalupe Trib 1a (ETJ), Stagecoach Road at Guadalupe Trib 1a (ETJ) - 3 crossings, FM 78 at Youngs Creek (ETJ), Pioneer Road Between FM 78 at Schumann (ETJ) - 2 crossings, Short Cut Road at Youngs Creek, Admiral Benbow Lane over Lake McQueeney/Guadalupe River (ETJ), Huber Road at Geronimo Creek (ETJ), Link Road at Little Mill Creek (0.5 Mi West of Barbarossa)(ETJ), Laubach Road at Geronimo Tributary 7 (ETJ), Laubach Road at Geronimo Creek (ETJ), Thornmayer Rd at Geronimo Tributary 11 (ETJ), Glenewinkel Road at Geronimo Creek (ETJ), Martindale Road, 0.3 Mi. south of FM 20 (ETJ), Old Seguin-Luling Road at Mill Creek (ETJ), Old Seguin-Luling Road at Long Branch (ETJ), FM 2438 at Mill Creek (ETJ), FM 466 at Cordell Creek (ETJ), FM 466 at Polecat Creek (ETJ), FM 466 at Rocky Creek (ETJ), FM 466 at Salt Creek (ETJ), Fox Trotter Lane at Kunde Branch (ETJ)
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce damages caused by flooding through improved drainage; Reduce risk to citizens through improved warning.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Education and Awareness

SECTION 18: MITIGATION ACTIONS

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$10,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Capital Projects/Engineering
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Drainage Plan

COMMENTS

	City of Seguin – Action #32
Proposed Action:	Develop an acquisition and elevation program in flood hazard areas. Elevate or acquire and demolish repetitive loss properties. Acquire high risk vacant land and maintain as open space. Increase development standards in high risk areas.
BACKGROUND INFORMATION	
Jurisdiction/Location:	Community-wide flood risk areas
Risk Reduction Benefit *(Current Cost/ Losses Avoided)***:**	Reduce or eliminate risk of flood damages to high risk structures and prevent future losses in high risk flood hazard areas; Reduce downstream impacts associated with development in the floodplain; Reduce risk of injuries to citizens; Reduce burden on emergency services during and after a flood event.
Type of Action *(Local Plans and Regulations, Structure and Infrastructure projects, Natural System Protection, or Education and Awareness)*	Structure and Infrastructure Local Plans and Regulations

MITIGATION ACTION DETAILS	
Hazard(s) Addressed:	Flood
Effect on New/Existing Buildings:	Reduce risk to new and existing structures and infrastructure
Priority (High, Moderate, Low):	Moderate
Estimated Cost:	$3,000,000
Potential Funding Sources:	Local Funds, State and Federal Grants
Lead Agency/Department Responsible:	Seguin City Manager
Implementation Schedule:	Within 24 months of plan adoption
Incorporation into Existing Plans:	Floodplain Management Plan

COMMENTS

SECTION 19: PLAN MAINTENANCE

PLAN MAINTENANCE PROCEDURES

The following is an explanation of how the participating jurisdictions within Guadalupe County, and the general public will be involved in implementing, evaluating, and enhancing the Plan over time. The sustained hazard mitigation planning process consists of four main parts:

- Incorporation
- Monitoring and Evaluation
- Updating
- Continued Public Involvement

INCORPORATION

Participating jurisdictions within Guadalupe County will be responsible for further development and implementation of mitigation actions. Each action has been assigned to a specific department within the County or City. The following describes the process by which participating jurisdictions will incorporate elements of the mitigation plan into other planning mechanisms.

PROCESS OF INCORPORATION

Once the Plan is adopted, participating jurisdictions within Guadalupe County will implement actions based on priority and the availability of funding. The Planning Area currently implements policies and programs to reduce loss of life and property damage from hazards. The mitigation actions developed for this Plan enhance this ongoing effort and will be implemented through other program mechanisms where possible.

The potential funding sources listed for each identified action may be used when the jurisdiction seeks funds to implement actions. An implementation time period or a specific implementation date has been assigned to each action as an incentive for completing each task and gauging whether actions are implemented in a timely manner.

Participating jurisdictions within Guadalupe County will integrate implementation of their mitigation actions with other plans and policies such as construction standards and emergency

management plans, and ensure that these actions, or proposed projects, are reflected in other planning efforts. Coordinating and integrating components of other plans and policies into goals and objectives of the Plan will further maximize funding and provide possible cost-sharing of key projects, thereby reducing loss of lives and property, and mitigating hazards affecting the area.

Upon formal adoption of the Plan, planning team members from each participating jurisdiction will work to integrate the hazard mitigation strategies into other plans and codes as they are developed. Participating team members will conduct periodic reviews of plans and policies (once per year at a minimum) and analyze the need for amendments in light of the approved Plan. The planning team will review all comprehensive land use plans, capital improvement plans, annual budget reviews, emergency operations or management plans, transportation plans, and any building codes to guide and control development. Departments will ensure that capital improvement planning in the future will also contribute to the goals of this hazard mitigation Plan, in order to reduce the long-term risk to life and property from all hazards. Within 1 year of formal adoption of the hazard mitigation Plan, existing planning mechanisms will be reviewed by each jurisdiction.

Guadalupe County is committed to supporting the participating jurisdictions as they implement their mitigation actions. Planning team members will review and revise, as necessary, the long-range goals and objectives in strategic plan and budgets to ensure that they are consistent with this mitigation action plan. Additionally, the Planning Area will work to advance the goals of this hazard mitigation plan through its routine, ongoing, long-range planning, budgeting, and work processes.

Table 19-1 identifies types of planning mechanisms and examples of methods for incorporating the Plan into other planning efforts. The team members, listed in Table 19-2 below, will be responsible for the review of these planning mechanisms and their incorporation of the plan, with the exception of the Floodplain Management Plans; the jurisdictions who have a Floodplain Administrator on staff will be responsible for incorporating the plan when floodplain management plans are updated or new plans are developed.

Table 19-1. Methods of Incorporation of the Plan

Planning Mechanism	Department / Title Responsible	Incorporation of Plan
Annual Budget Review	Guadalupe County: EMC City of Cibolo: Chief of Police City of Seguin: City Manager	Various departments and key personnel that participated in the planning process for participating jurisdictions within Guadalupe County will review the Plan and mitigation actions therein when conducting their annual budget review. Allowances will be made in accordance with grant applications sought and mitigation actions that will be undertaken per the implementation schedule of the specific action.

SECTION 19: PLAN MAINTENANCE

Planning Mechanism	Department / Title Responsible	Incorporation of Plan
Capital Improvement Plans	Guadalupe County: EMC City of Cibolo: Chief of Police City of Seguin: City Manager	Participating jurisdictions within Guadalupe County have a Capital Improvement Plan (CIP) in place. Prior to any revisions to the CIP, County or City departments will review the risk assessment and mitigation strategy sections of the HMAP, as limiting public spending in hazardous zones is one of the most effective long-term mitigation actions available to local governments.
Floodplain Management Plans	Guadalupe County: Floodplain Manager City of Cibolo: Floodplain Manager City of Seguin: Floodplain Manager	Floodplain management plans include preventative and corrective actions to address the flood hazard. Therefore, the actions for flooding and information found in Section 5 of this Plan discussing the people and property at risk to flood will be reviewed and revised when participating jurisdictions update their management plans or develops new plans.
Grant Applications	Guadalupe County: EMC City of Cibolo: Chief of Police City of Seguin: City Manager	The Plan will be evaluated by participating jurisdictions within Guadalupe County when grant funding is sought for mitigation projects. If a project is not in the Plan, an amendment may be necessary to include the action in the Plan.
Regulatory Plans	Guadalupe County: EMC City of Cibolo: Chief of Police City of Seguin: City Manager	Currently, participating jurisdictions within Guadalupe County have regulatory plans in place, such as Emergency Management Plans, Continuity of Operations Plans, Land Use Plans, and Evacuation Plans. The Plan will be consulted when County or City departments review or revise their current regulatory planning mechanisms or in the development of regulatory plans that are not currently in place.

MONITORING AND EVALUATION

Periodic revisions of the Plan are required to ensure that goals, objectives, and mitigation actions are kept current. Revisions may be required to ensure the Plan is in compliance with federal and state statutes and regulations. This section outlines the procedures for completing Plan revisions, updates, and review. Table 19-2 indicates the jurisdiction and title of the party responsible for Plan monitoring, updating, and review of the Plan. Monitoring, evaluating, and updating the plan include the planning process, hazard risk assessment and the mitigation strategies and actions as they are written in the plan. In the paragraphs below when the plan is mentioned it is to include the hazard risk assessment and mitigation actions.

Table 19-2. Team Members Responsible for Plan Monitoring, Evaluation, Updating, and Review of the Plan

JURISDICTION	TITLE
Guadalupe County	Emergency Management Coordinator
City of Cibolo	Chief of Police
City of Seguin	City Manager

MONITORING

Designated Planning Team members are responsible for monitoring, updating, and reviewing the Plan, as shown in Table 19-2. Individuals holding the title listed in Table 19-2 will be responsible for monitoring the Plan on an annual basis. Plan monitoring includes reviewing the Plan and incorporating other existing planning mechanisms that relate or support goals and objectives of the Plan; monitoring the incorporation of the Plan into future updates of other existing planning mechanisms as appropriate; monitoring team members to maintain updated contact information and ensure availability throughout the planning cycle; reviewing mitigation actions submitted and coordinating with various County and City departments to determine if mitigation actions need to be re-evaluated and updated; evaluating the hazards that pose a risk to the planning area and updating the risk assessment when warranted; evaluating and updating the Plan as necessary; and monitoring plan maintenance to ensure that the process described is being followed, on an annual basis, throughout the planning process. The Planning Team will develop a brief report that identifies policies and actions in the plan that have been successfully implemented and any changes in the implementation process needed for continued success. Team meetings for monitoring the plan will include a sign-in sheet to record attendance and a written summary of meeting notes will report the particulars involved in developing an action into a project. In addition to the annual monitoring, the Plan will be similarly reviewed immediately after extreme weather events including but not limited to state and federally declared disasters.

EVALUATION

As part of the evaluation process, the Planning Team will assess changes in risk; determine whether the implementation of mitigation actions is on schedule; determine whether there are any implementation problems, such as technical, political, legal, or coordination issues; and identify changes in land development or programs that affect mitigation priorities for each respective department or organization.

SECTION 19: PLAN MAINTENANCE

The Planning Team will meet on an annual basis to evaluate the Plan, identify any needed changes, and assess the effectiveness of the plan achieving its stated purpose and goals. The Executive Planning Team will evaluate the team participants in the last planning cycle to determine if additional participants can contribute further areas of expertise during the current planning cycle and future updates. The team will evaluate the number of mitigation actions implemented along with the loss-reduction associated with each action. Actions that have not been implemented will be evaluated to determine if any social, political, or financial barriers are impeding implementation and if any changes are necessary to improve the viability of an action. The team will evaluate changes in land development and/or programs that affect mitigation priorities in their respective areas of authority. This annual evaluation process will include an annual meeting with a sign-in sheet to record attendance and a brief report that identifies any changes that may be necessary. In addition, the Plan will be similarly evaluated immediately after extreme weather events including but not limited to state and federally declared disasters.

UPDATING

PLAN AMENDMENTS

At any time, minor technical changes may be made to update the Guadalupe County Hazard Mitigation Action Plan. Material changes to 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 participating jurisdiction.

Participating jurisdictions within Guadalupe County will review proposed amendments and vote to accept, reject, or amend the proposed change. Upon ratification, the amendment will be transmitted to the Texas Division of Emergency Management (TDEM) for review and forwarding to FEMA for final approval of amendment.

In determining whether to recommend approval or denial of a Plan amendment request, participating jurisdictions will consider the following factors:

- 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 (5) YEAR REVIEW

The Plan will be thoroughly reviewed by the Planning Team at the end of 3 years from the approval date to determine whether there have been significant changes in the planning area that necessitate changes in the types of mitigation actions proposed. Factors that may affect the content of the Plan include new development in identified hazard areas, increased exposure to hazards, disaster declarations, an increase or decrease in capability to address hazards, and changes to federal or state legislation.

The Plan review process provides the participating jurisdictions within Guadalupe County an opportunity to evaluate mitigation actions that have been successful, identify losses avoided due to the implementation of specific mitigation measures, and address mitigation actions that may not have been successfully implemented as assigned.

It is recommended that the full Planning Team (Section 2, Table 2-2) meet to review the Plan at the end of 3 years because grant funds may be necessary for the development of a 5-year update. Reviewing planning grant options in advance of the 5-year Plan update deadline is recommended considering the timelines for grant and planning cycles can be in excess of a year.

Following the Plan review, any revisions deemed necessary will be summarized and implemented according to the reporting procedures and Plan amendment process outlined herein. Upon completion of the review, update, and amendment process, the revised Plan will be submitted to TDEM for final review and approval in coordination with the Federal Emergency Management Agency (FEMA).

CONTINUED PUBLIC INVOLVEMENT

Public input was an integral part of the preparation of this Plan and will continue to be essential for Plan updates. The Public will be directly involved in the implementation, monitoring and evaluation. Changes or suggestions to improve or update the Plan will provide opportunities for additional public input.

The public can review the Plan on the participating jurisdictions' websites and provide comment via email. Notification that the Plan is available for review and comment will be made via social media outlets.

The Planning Team may also designate voluntary citizens from the planning area or willing stakeholder members from the private sector businesses that were involved in the Plan's development to provide feedback on an annual basis. It is important that stakeholders and the immediate community maintain a vested interest in preserving the functionality of the planning area as it pertains to the overall goals of the mitigation plan. The Planning team is responsible for notifying stakeholders and community members on an annual basis and maintaining the Plan.

Media, including local newspapers and radio stations, will be used to notify the public of any maintenance or periodic review activities during the implementation, monitoring, and evaluation phases. Additionally, local news media will be contacted to cover information regarding Plan updates, status of grant applications, and project implementation. Local and social media outlets, such as Facebook and Twitter, will keep the public and stakeholders apprised of potential opportunities to fund and implement mitigation projects identified in the Plan. Social media outlets have been successful in communicating in the past and will continue to be utilized to not only inform the public of progress but utilized to create public awareness of activities and the need for their involvement going forward.

APPENDIX A: PLANNING TEAM

PLANNING TEAM MEMBERS

The Guadalupe County Plan 2021 (Plan), was organized using a direct representative model. An Executive Planning Team from the participating jurisdictions, shown in Table A-1, was formed to coordinate planning efforts and request input and participation in the planning process. Table A-2 reflects the Advisory Planning Team, consisting of area organizations and departments that participated throughout the planning process. Table A-3 is comprised of stakeholders who were invited to provide Plan input. Public outreach efforts and meeting documentation is provided in Appendix E.

Table A-1. Executive Planning Team

DEPARTMENT	TITLE
Guadalupe County	Assistant Fire Marshal / EMC
Guadalupe County	Fire Marshal / EMC
Guadalupe County	County Judge
City of Cibolo	Chief of Police
City of Cibolo	City Manager
City of Seguin	City Manager

Table A-2. Advisory Planning Team

DEPARTMENT	TITLE
Guadalupe County	Environmental Health Director
Guadalupe County	Assistant Floodplain Manager (1)
Guadalupe County	Assistant Floodplain Manager (2)
Guadalupe County	Road and Bridge Administrator
Guadalupe County	Emergency Management Program Specialist
City of Cibolo	City Manager's Office
City of Cibolo	Finance Department Director
City of Cibolo	Fire Chief

APPENDIX A: PLANNING TEAM

DEPARTMENT	TITLE
City of Cibolo	Fire Department Lieutenant
City of Cibolo	Fire Department
City of Cibolo	Director of Planning and Engineering
City of Cibolo	Police Department (1)
City of Cibolo	Police Department (2)
City of Cibolo	Director of Public Works
City of Cibolo	Public Works
City of Seguin	Assistant City Manager
City of Seguin	City Engineer
City of Seguin	Planning Director
City of Seguin	Assistant Planning Director
City of Seguin	Floodplain Manager
City of Seguin	Water / Wastewater Director
City of Seguin	Electric Department Director
City of Seguin	Police Chief
City of Seguin	Fire Chief
City of Seguin	Fire Department
City of Seguin	Fire Marshal
City of Seguin	Public Works Director

STAKEHOLDERS

The following groups listed in Table A-3 represent a list of organizations invited to stakeholder meetings, public meetings, and workshops throughout the planning process and include: non-profit organizations, private businesses, universities, and legislators. The public were also invited to participate via e-mail throughout the planning process. Many of the invited organizations and stakeholders participated and were integral to providing comments and data for the Plan. For a list of attendees at meetings, please see Appendix E[1].

[1] Information contained in Appendix E is exempt from public release under the Freedom of Information Act (FOIA).

Table A-3. Stakeholders

AGENCY	TITLE
City of New Berlin	Fire Chief / EMC
City of New Braunfels	EMC
City of Staples	EMC
GBRA (Guadalupe-Blanco River Authority)	Project and Community Representative
Navarro ISD	Director of Operations
Schertz-Cibolo-Universal City ISD	Superintendent
Schertz-Cibolo-Universal City ISD	Director of Transportation
Schertz-Cibolo-Universal City ISD	Coordinator of Safety / Security
Schertz-Cibolo-Universal City ISD	Executive Director of Facilities
Seguin ISD	Director of Safety
Texas House Member	Representative
Texas Senate Member	Senator
Texas Senate Member	Senator

APPENDIX B: PUBLIC SURVEY RESULTS

OVERVIEW

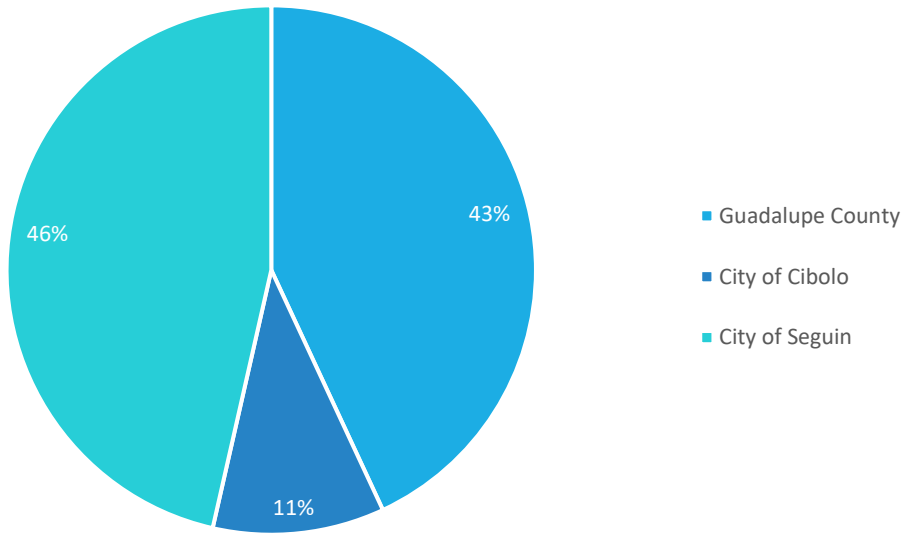
Guadalupe County prepared a public survey that requested public opinion on a wide range of questions relating to natural hazards. The survey was made available on the County's website, along with participating jurisdictions. This survey link was also distributed at public meetings and stakeholder events throughout the planning process.

A total of 267 surveys were collected, the results of which are analyzed in Appendix B. The purpose of the survey was twofold: 1) to solicit public input during the planning process, and 2) to help the jurisdictions identify any potential actions or problem areas.

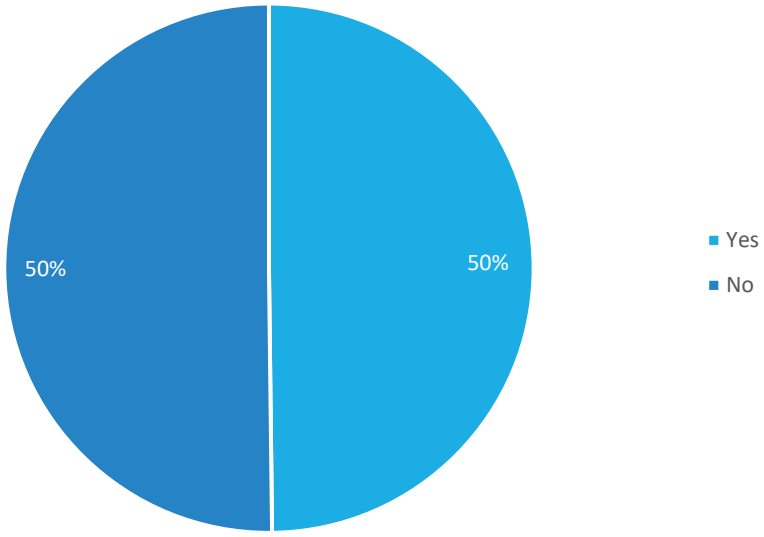
The following survey results depict the percentage of responses for each answer. Similar responses have been summarized for questions that did not provide a multiple-choice answer or that required an explanation.

PUBLIC SURVEY RESULTS

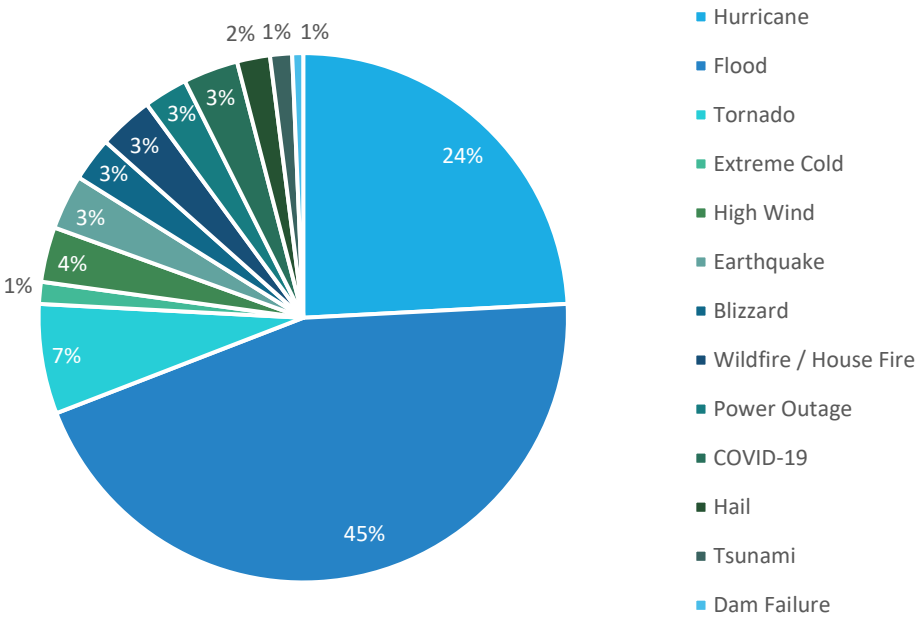
1. Please state the jurisdiction (city and community) where you reside.



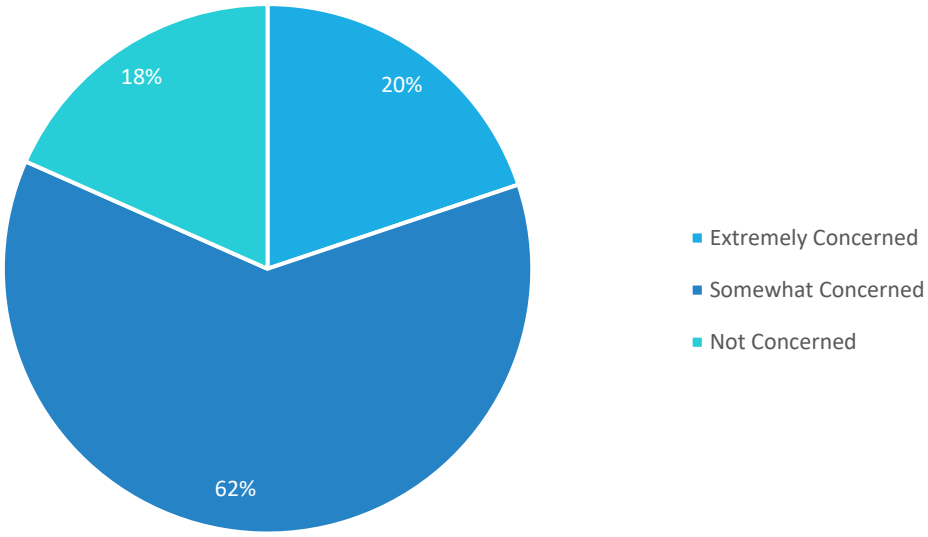
2. Have you ever experienced or been impacted by a disaster?



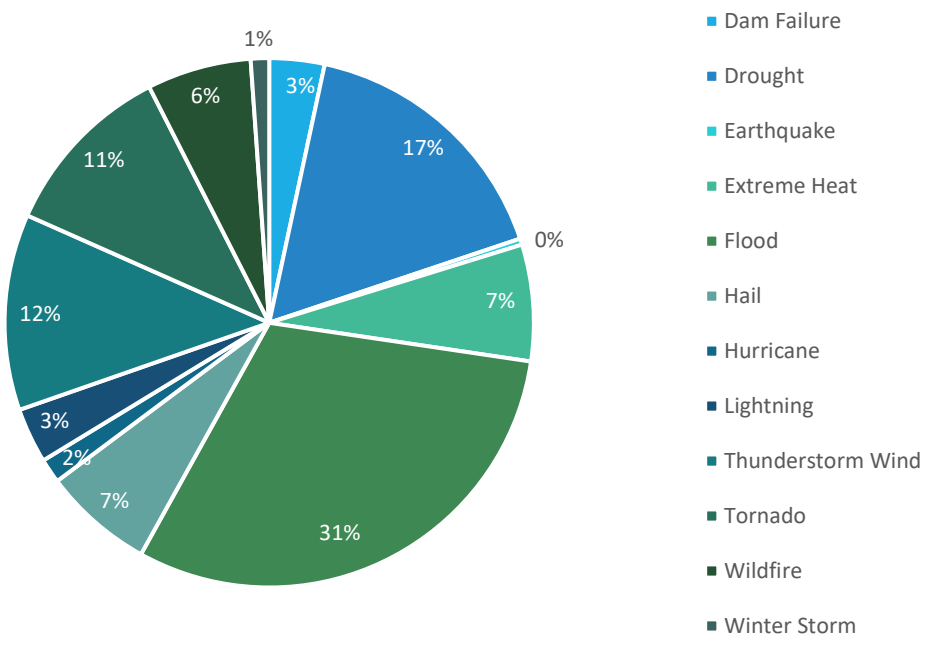
3. If you answered “Yes” to Question #2, please explain.



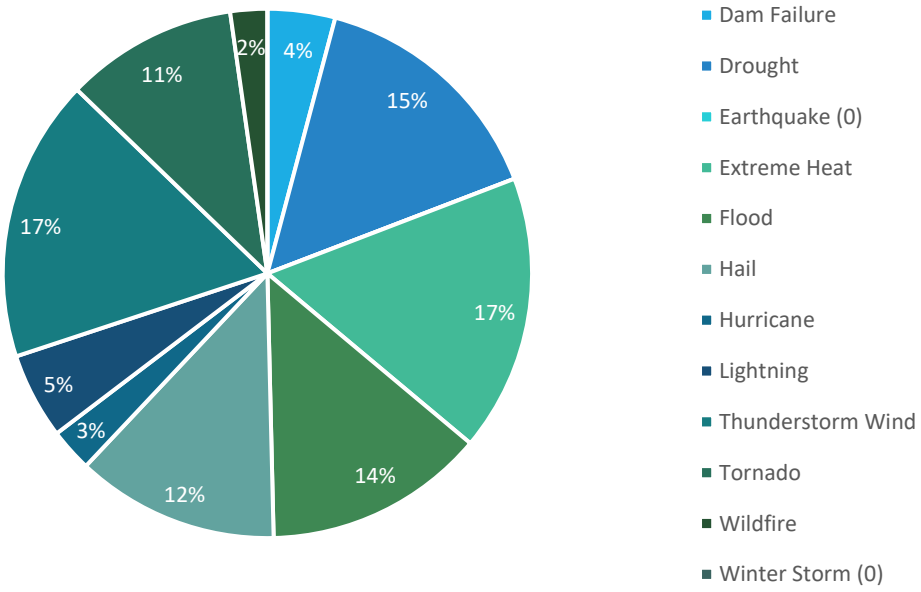
4. How concerned are you about the possibility of your community being impacted by a disaster?



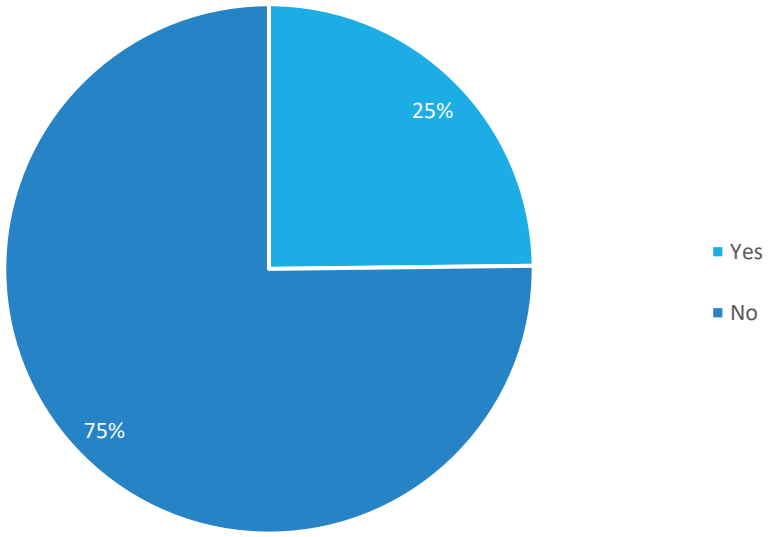
5. Please select the one hazard you think is the highest threat to your neighborhood:



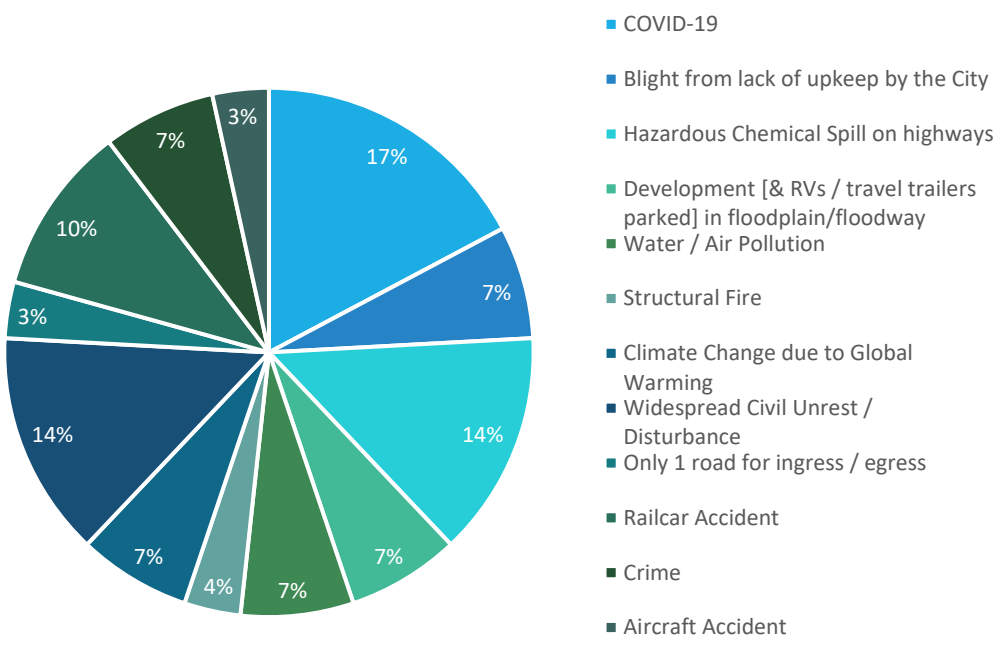
6. Please select the one hazard you think is the second highest threat to your neighborhood:



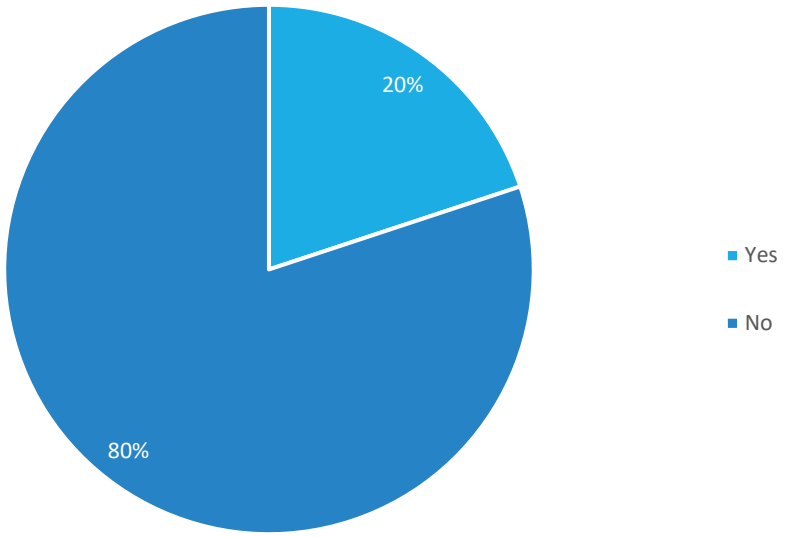
7. Is there another hazard not listed above that you think is a wide-scale threat to your neighborhood?



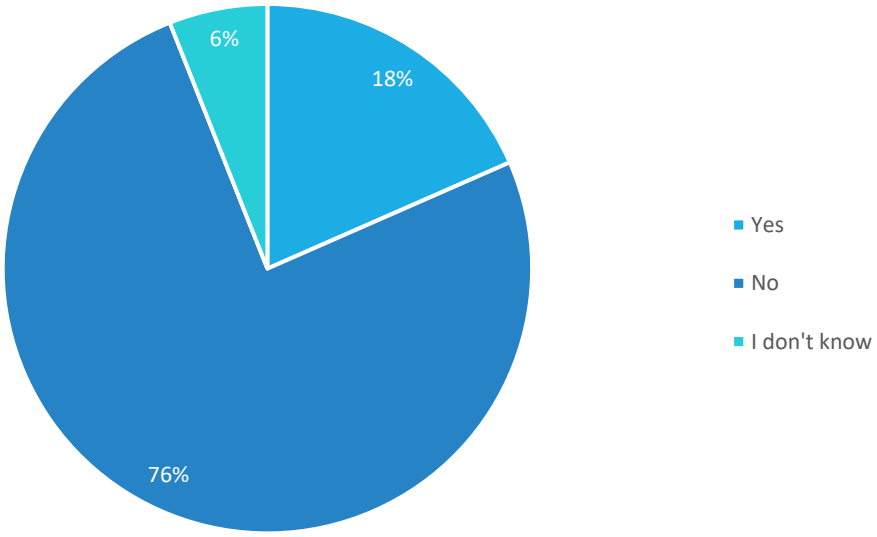
8. If you answered “Yes” to Question #7, please explain.



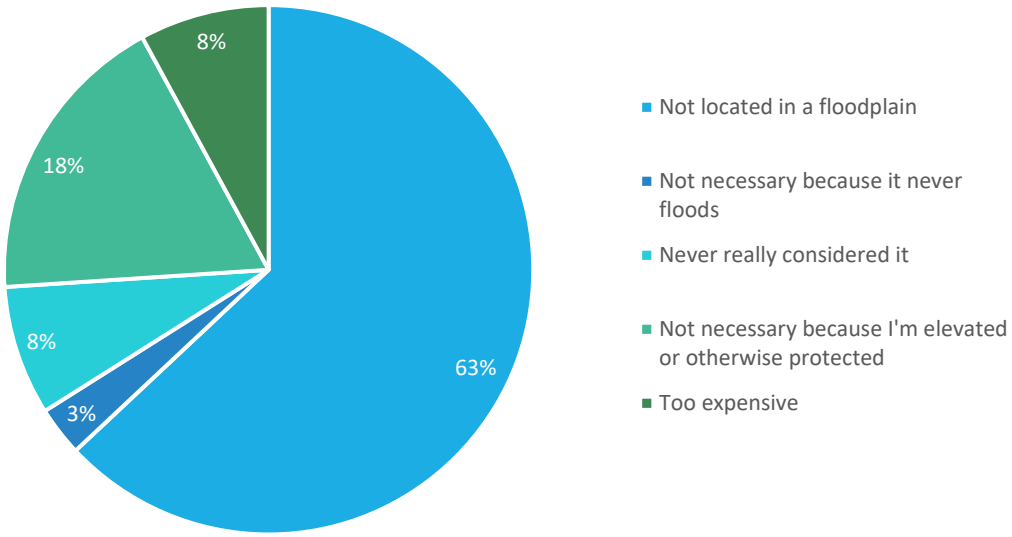
9. Is your home located in a floodplain?



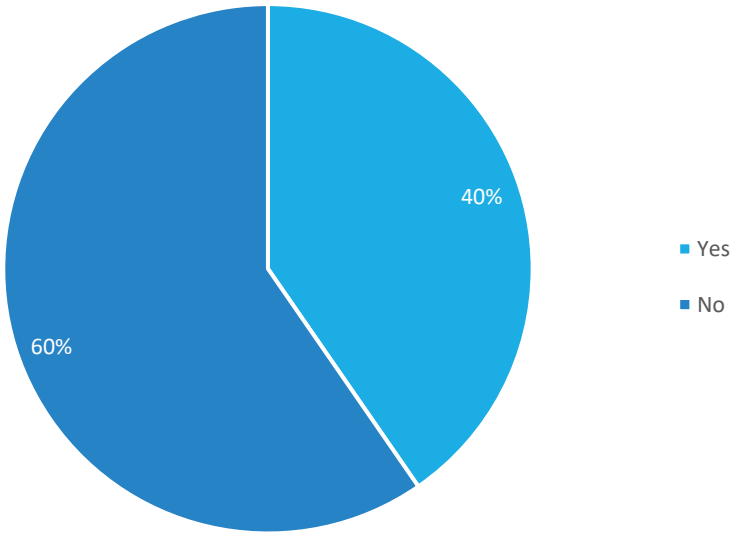
10. Do you have flood insurance?



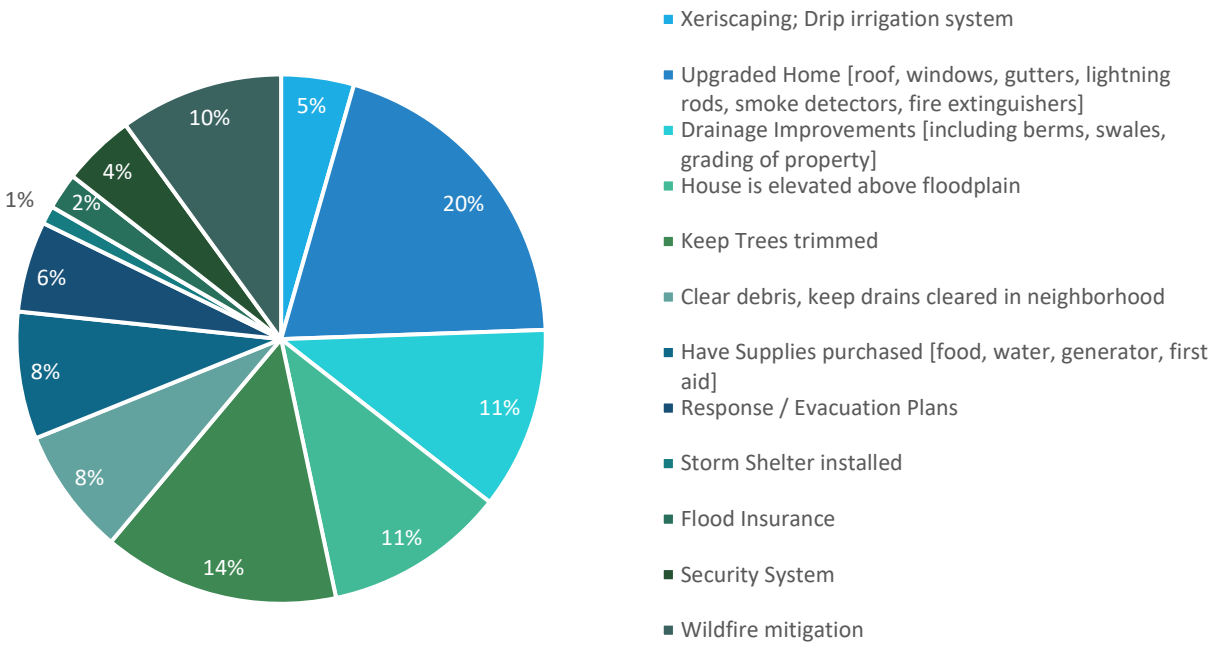
11. If you do not have flood insurance, why not?



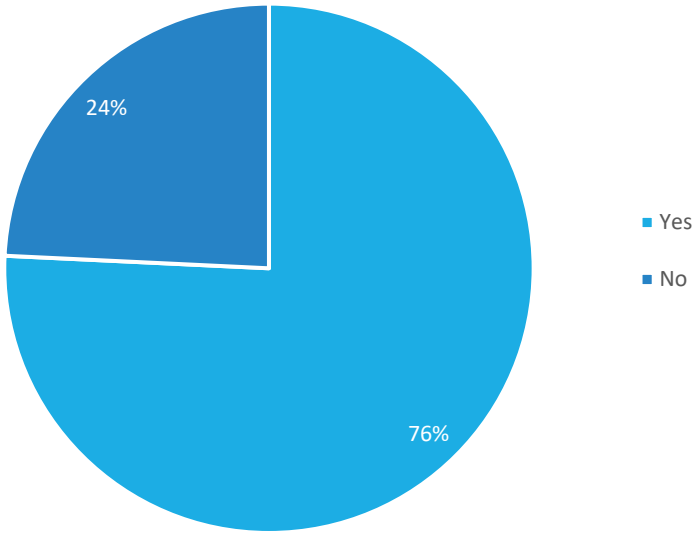
12. Have you taken any actions to make your home or neighborhood more resistant to hazards?



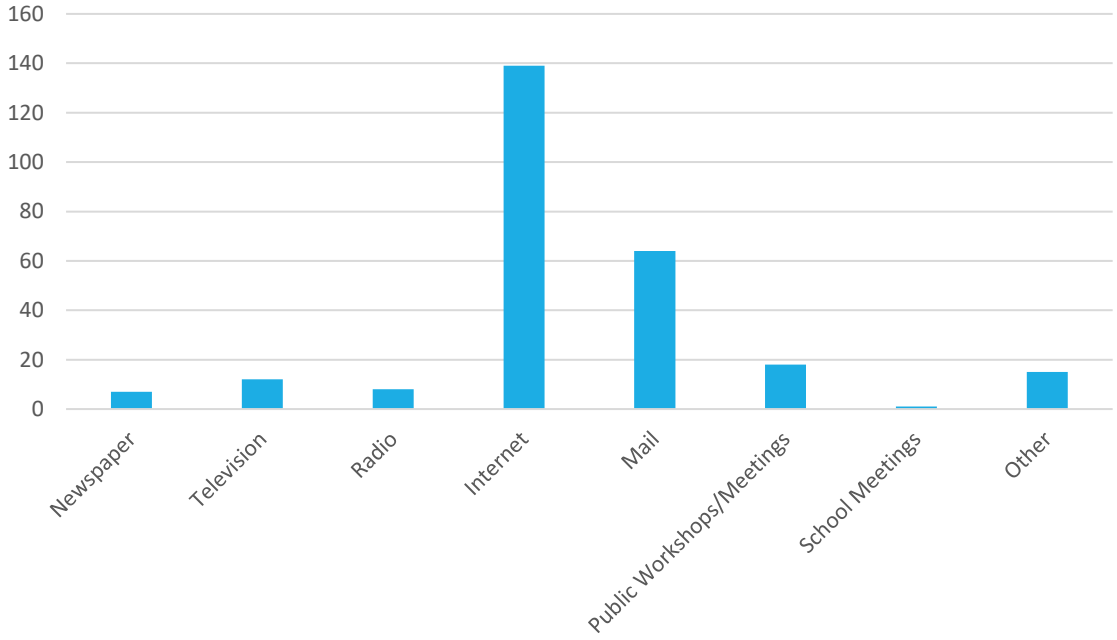
13. If you answered “Yes” to Question #12, please explain.



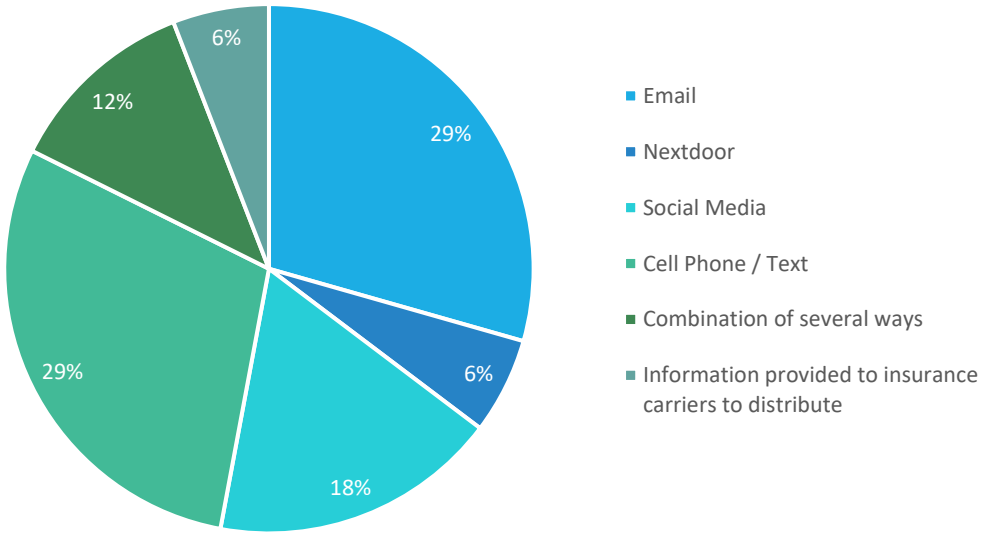
14. Are you interested in making your home or neighborhood more resistant to hazards?



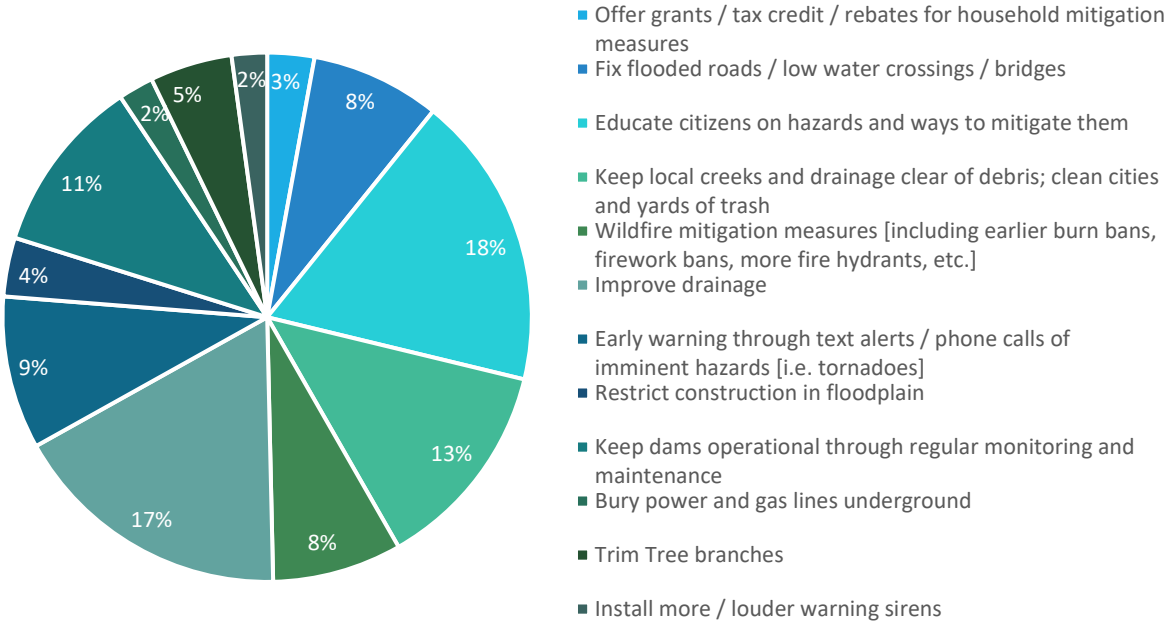
15. A. What is the most effective way for you to receive information about how to make your home and neighborhood more resistant to hazards?



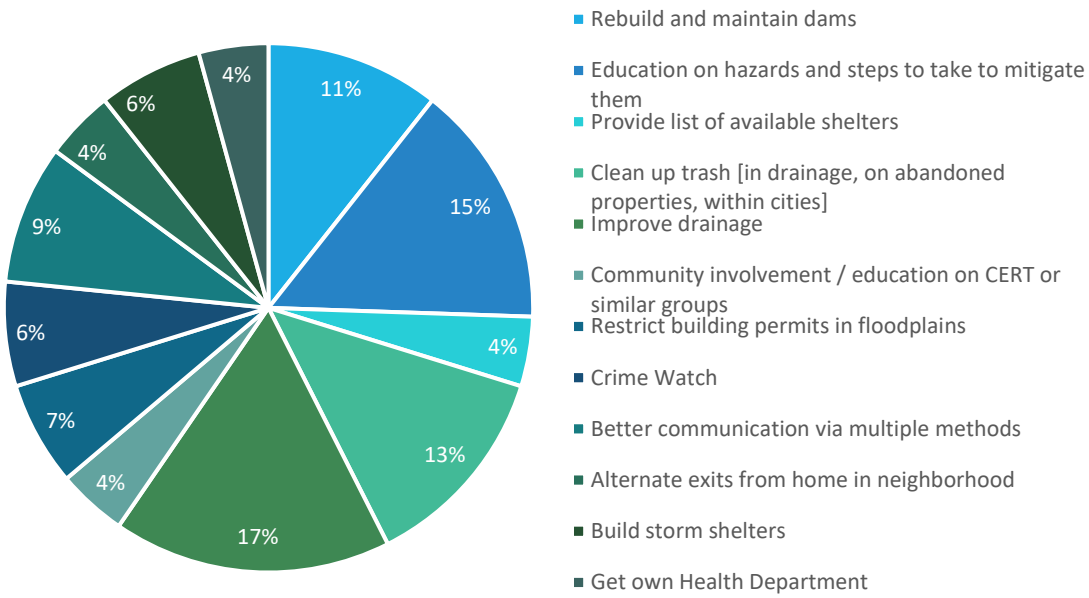
16. If you answered “Other” to Question #15, please explain.



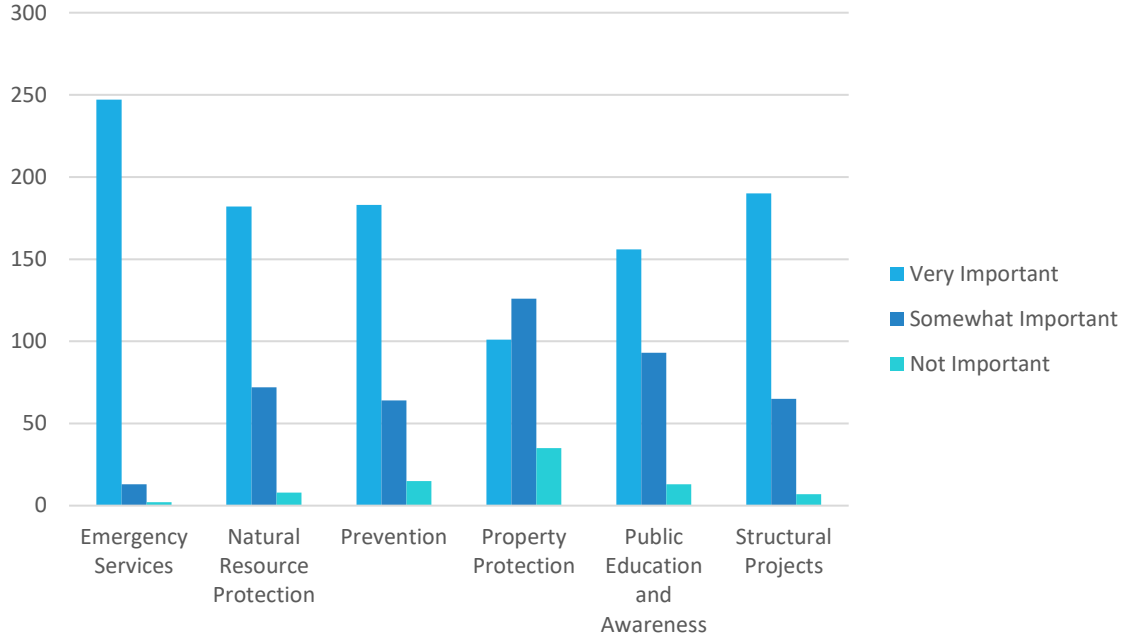
17. In your opinion, what are some steps your local government could take to reduce or eliminate the risk of future hazard damages in your neighborhood?



18. Are there any other issues regarding the reduction of risk and loss associated with hazards or disasters in the community that you think are important?



19. A number of community-wide activities can reduce the risk from hazards. In general, these activities fall into one of the following six broad categories. Please tell us how important you think each one is for your community to consider pursuing.



Emergency Services - Actions that protect people and property during and immediately after a hazard event. Examples include warning systems, evacuation planning, emergency response training, and protection of critical facilities or systems.

Natural Resource Protection - Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples include floodplain protection, habitat preservation, slope stabilization, riparian buffers, and forest management.

Prevention / Local Plans & Regulations - Administrative or regulatory actions that influence the way land is developed and buildings are built. Examples include planning and zoning, building codes, open space preservation, and floodplain regulations.

Property Protection - Actions that involve the modification of existing buildings to protect them from a hazard or removal from the hazard area. Examples include acquisition, relocation, elevation, structural retrofits, and storm shutters.

Public Education and Awareness - Actions to inform citizens about hazards and techniques they can use to protect themselves and their property. Examples include outreach projects, school education programs, library materials, and demonstration events.

Structural Projects - Actions intended to lessen the impact of a hazard by modifying the natural progression of the hazard. Examples include dams, levees, seawalls detention / retention basins, channel modification, retaining walls, and storm sewers.

APPENDIX C: CRITICAL FACILITIES

OVERVIEW

This Appendix is **For Official Use Only (FOUO)** and may be exempt from public release under FOIA. Figures C-1 through C-3 locate all critical facilities that were included in the risk assessment. Mapped facilities were provided by Planning Team members. Tables C-1 through C-3 note the critical facilities by type.

GUADALUPE COUNTY CRITICAL FACILITIES

Figure C-1. Critical Facilities in Guadalupe County

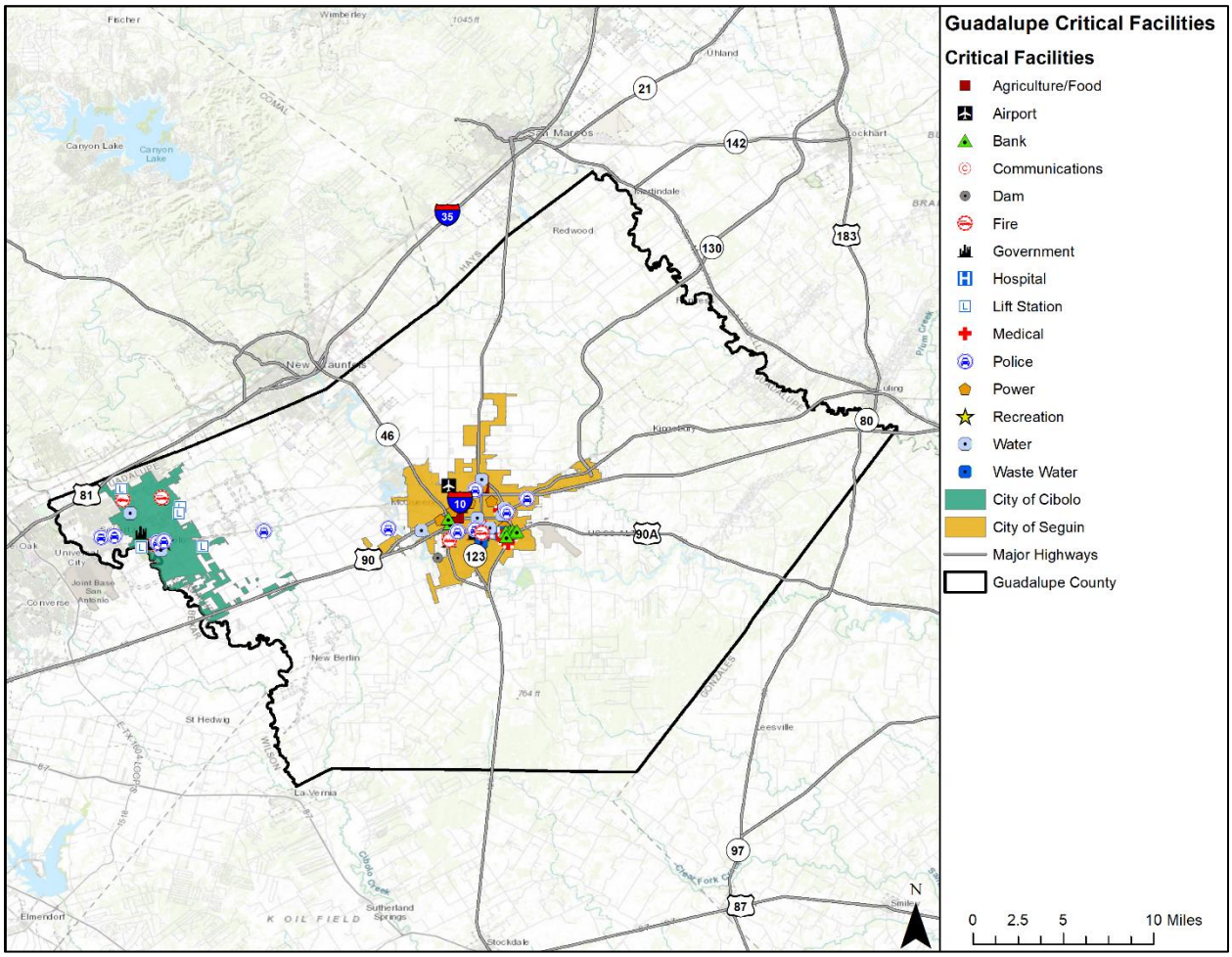


Table C-1. Critical Facilities by Type in Guadalupe County

TYPE	NUMBER
Airports	16
Dams	1
Energy	1
Financial	5
Fire Departments	18
Government Facilities	10
Law Enforcement	12
Nursing Homes	12

TYPE	NUMBER
Public Health & Healthcare	11

CITY OF CIBOLO CRITICAL FACILITIES

Figure C-2. Critical Facilities in the City of Cibolo

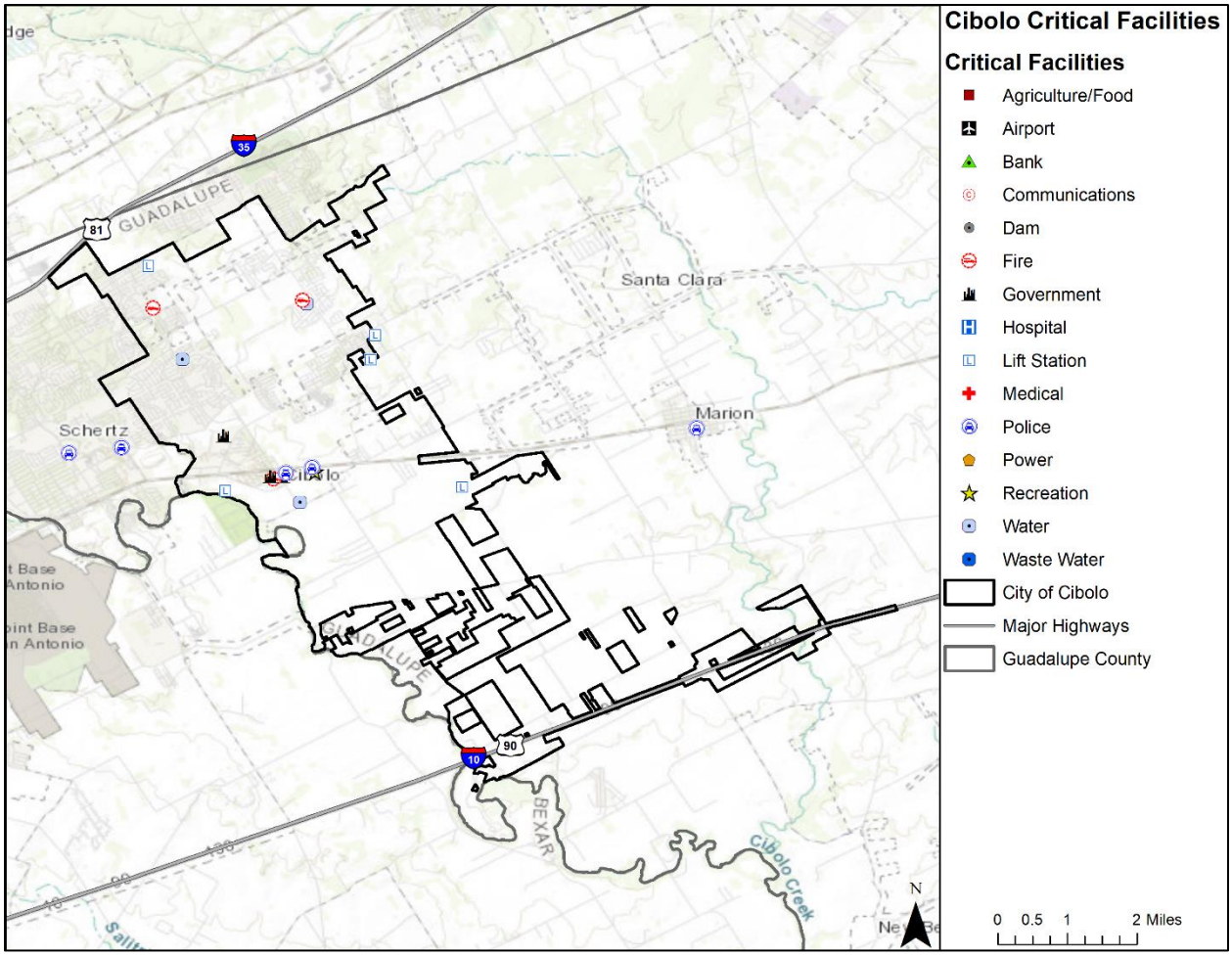


Table C-2. Critical Facilities by Type in the City of Cibolo

TYPE	NUMBER
Cibolo Family YMCA	1
Fire Station	3
Government Facilities	3
Police Station	1
S.S. lift Station	5
Water Plant	3

CITY OF SEGUIN CRITICAL FACILITIES

Figure C-3. Critical Facilities in the City of Seguin

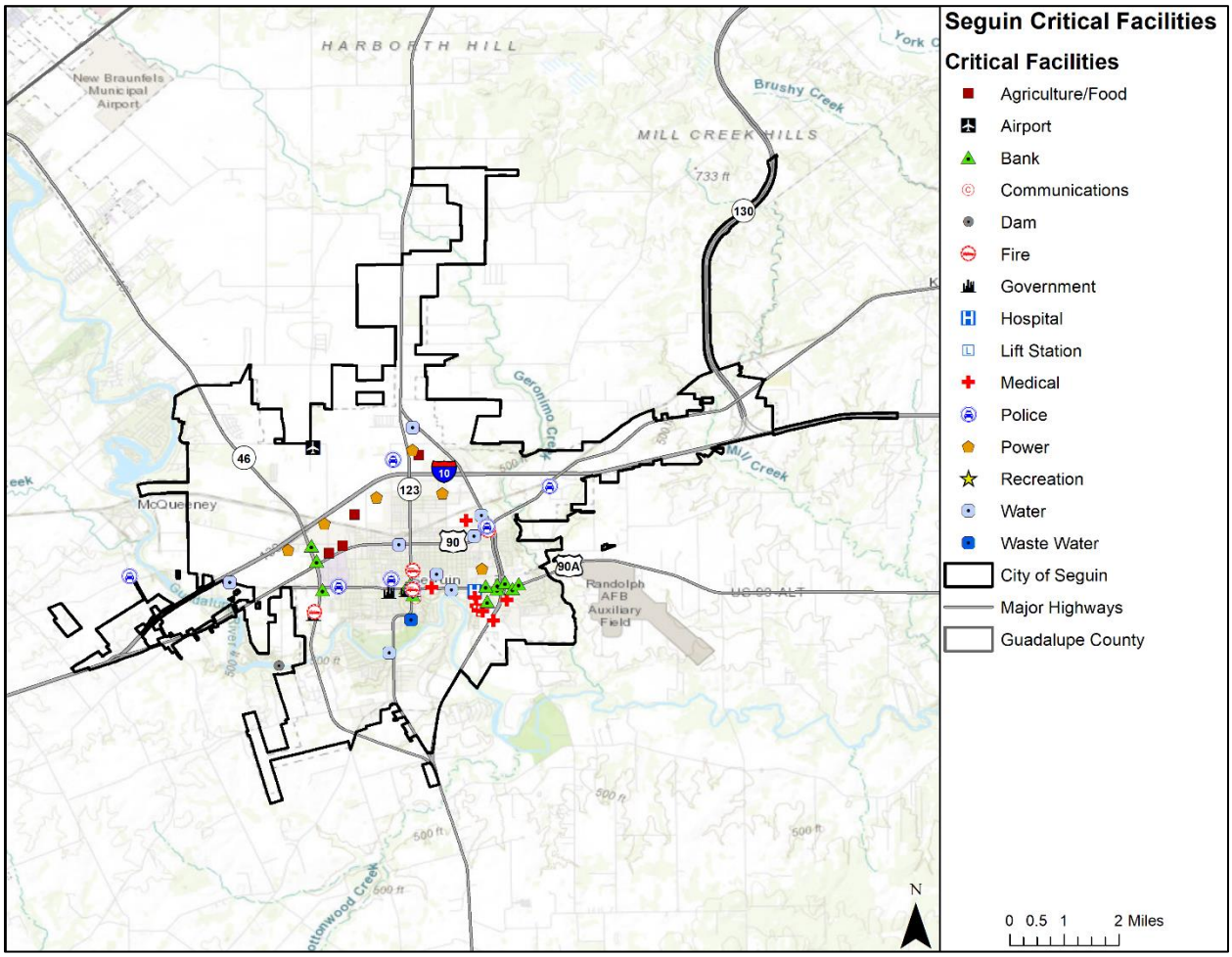


Table C-3. Critical Facilities by Type in the City of Seguin

TYPE	NUMBER
Agriculture / Food	4
Banking / Finance	13
Emergency Services	10
Energy / Electricity	6
Postal & Shipping	1
Public Health	9
Telecommunications	1
Transportation	1

APPENDIX C: CRITICAL FACILITIES

TYPE	NUMBER
Water	10

APPENDIX D: DAM LOCATIONS

OVERVIEW

Appendix D is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

DAM LOCATIONS

Table D-1 below reflects all dams that are located in the participating jurisdictions within the Guadalupe County Hazard Mitigation Action Plan 2021. This list includes High, Significant, and Low Hazard Dams. Section 6 of the Plan doesn't profile dams that were deemed to pose no past, current, or future risk to the planning area as no loss of life or impact to critical facilities or infrastructure is expected in the event of a breach. The asterisk denotes those that were profiled in the hazard assessment.

Table D-1. List of Dam Locations and Storage Capacities

JURISDICTION	LATITUDE	LONGITUDE	HEIGHT (Feet)	STORAGE (Acre Feet)
Guadalupe County	29.646287	-97.647736	28	1,450
Guadalupe County	29.515568	-97.789108	24	298
Guadalupe County	29.507052	-97.772421	11	85
Guadalupe County*	29.528826	-97.93947	43.6	3,210
Guadalupe County*	29.594357	-98.040702	42	6,170
Guadalupe County*	29.653992	-98.066285	41	14,330
Guadalupe County	29.709332	-97.918453	35	2,491
Guadalupe County	29.713477	-97.887086	46	1,459
Guadalupe County	29.739377	-97.974636	31	877
Guadalupe County	29.734417	-97.957605	31	869
Guadalupe County	29.731796	-97.938017	28	756
Guadalupe County	29.737552	-97.862422	36	837
Guadalupe County	29.75665	-97.961702	38	994
Guadalupe County	29.759641	-97.930428	40	2,987
Guadalupe County*	29.820756	-97.924092	33	5,045

APPENDIX D: DAM LOCATIONS

JURISDICTION	LATITUDE	LONGITUDE	HEIGHT (Feet)	STORAGE (Acre Feet)
Guadalupe County	29.802878	-97.888871	25	1,006
Guadalupe County	29.779587	-97.895432	36	770
Guadalupe County	29.736418	-97.98898	10	68
Guadalupe County	29.657635	-97.835512	30	236
Guadalupe County	29.668326	-97.716098	9	72
Guadalupe County	29.588952	-97.877357	25	114
Guadalupe County	29.746667	-97.961667	10	230
Guadalupe County	29.769446	-97.901837	26	115
Guadalupe County	30.768887	-98.803886	22	115
Guadalupe County	29.0006	-97.7594	20	90.9
Guadalupe County	29.511238	-98.182578	12	150
City of Seguin*	29.548446	-97.999636	46.8	5,650
City of Seguin	29.590542	-97.985082	11.5	568.1

APPENDIX E: MEETING DOCUMENTATION

WORKSHOP DOCUMENTATION

Appendix E is **For Official Use Only (FOUO)** and may be exempt from public release under the Freedom of Information Act (FOIA).

Guadalupe County held a series of Planning Team workshops: a Kickoff Workshop on June 29, 2020 and a Risk Assessment / Mitigation Strategy Workshop on September 22, 2020. At each of these workshops members of the Planning Team were informed of the planning process, expressed opinions, and volunteered information. The sign-in sheets for each workshop and public meeting are included below. For more details on the workshops and planning process, see Section 2.

APPENDIX E: MEETING DOCUMENTATION

Figure E-1. Guadalupe County Kickoff Workshop, 06/29/20

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H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Kickoff Workshop
Guadalupe County Courthouse
101 East Court Street, Seguin, TX 78155
June 29, 2020

Name/Title	Department	Phone	Email
Rachel Andrews (Mitigation Specialist)	H2O Partners	512-983-0092	rachel@h2opartnersusa.com
[illegible] Segura	Asst. Director City of Seguin (Planning & Codes)	(830) 401-2603	[illegible]@seguintexas.gov
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Mario Thompson	Cibolo FD Fire Chief		[illegible]@cibolotx.gov
Leigh Ann Rogers	City of Cibolo - City Manager's Office	(210) 619 0003	lrogers@cibolotx.gov
Bryan Hugghins	Cibolo P.D/Emergency Mgmt	(210) 659-1999	bhugghins@cibolotx.gov
Skylar Dailey	Guad Co OEM	830 303 8856	skylardailey@co.guadalupe.tx.us
Bruce Holton	Guadalupe Co OEM	830 303 8856	[illegible]@co.guadalupe.tx.us
Kelly [illegible]	Asst. Floodplain Manager Environmental Health	830-303-3350	kelly.[illegible]@co.guadalupe.tx.us
Melissa Zewicke	Asst. Floodplain Manager Environmental Health	830-303-8858	melissa.zewicke@co.guadalupe.tx.us
Shelly Coleman	EH Floodplain Manager	830 303 8858	scoleman@co.guadalupe.tx.us
Anna Miranda Finance Director	City of Cibolo	210 566 6146	amiranda@cibolotx.gov

1

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H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Kickoff Workshop
Guadalupe County Courthouse
101 East Court Street, Seguin, TX 78155
June 29, 2020

Name/Title	Department	Phone	Email
Rudy Klein, FPA Director of Planning & Engineering	City of Cibolo	210.658.9900 x3139	rklein@cibolotx.gov
Timothy D. Fousse Dir. of Public Works	City of Cibolo	210.658.9900 x7160	tfousse@cibolotx.gov

2

Figure E-2. Guadalupe County Risk Assessment / Mitigation Strategy Workshop, 09/22/20

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H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Risk Assessment and Mitigation Strategy Joint Workshop
Cibolo YMCA
176 FM 78 East, Cibolo, TX 78108
September 22, 2020

Name/Title	Department	Phone	Email
Rachel Andrews / Mitigation Specialist	H2O Partners	512-983-0092	rachel@h2opartnersusa.com
Rhonda Murphy / Mitigation Planner	H2O	512-571-2088	rmurphy@H2Opartnersusa.com
Shelly Jackson	Guadalupe County, Director of Environmental Health	830-303-8858	shelly.jackson@co.guadalupe.tx.us
Melissa Zwicke	Guadalupe Co. Floodplain manager	830-303-8858	melissa.zwicke@co.guadalupe.tx.us
Kelly Schmidt	Guadalupe Co. Floodplain	830-303-8383	Kelly.Schmidt@co.guadalupe.tx.us
Bryce Hartley	Guadalupe Co. Asst Fire Marshal / Emc	830-303-3[illegible]	bryce.hartley@co.guadalupe.tx.us
Bryan Hugghins	Cibolo PD	210-659-1999	bhugghins@cibolotx.gov
Francisco Perez	SCUC ISD Director of Transportation	210-639-5267	fperez@scuc.txed.net
Ryan Clark	SCUC ISD Coord. of Safety/Security	210-945-6060	rclark@scuc.txed.net
Allen Scott Lee, Lieutenant	Cibolo Fire	210-995-9755	slee@cibolotx.gov
Mario Trevino Jr.	Cibolo FD	-	MTrevino@cibolotx.gov
Harold Melton	Cibolo FD	830-481-0756	hmelton@cibolotx.gov

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H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Risk Assessment and Mitigation Strategy Joint Workshop
Cibolo YMCA
176 FM 78 East, Cibolo, TX 78108
September 22, 2020

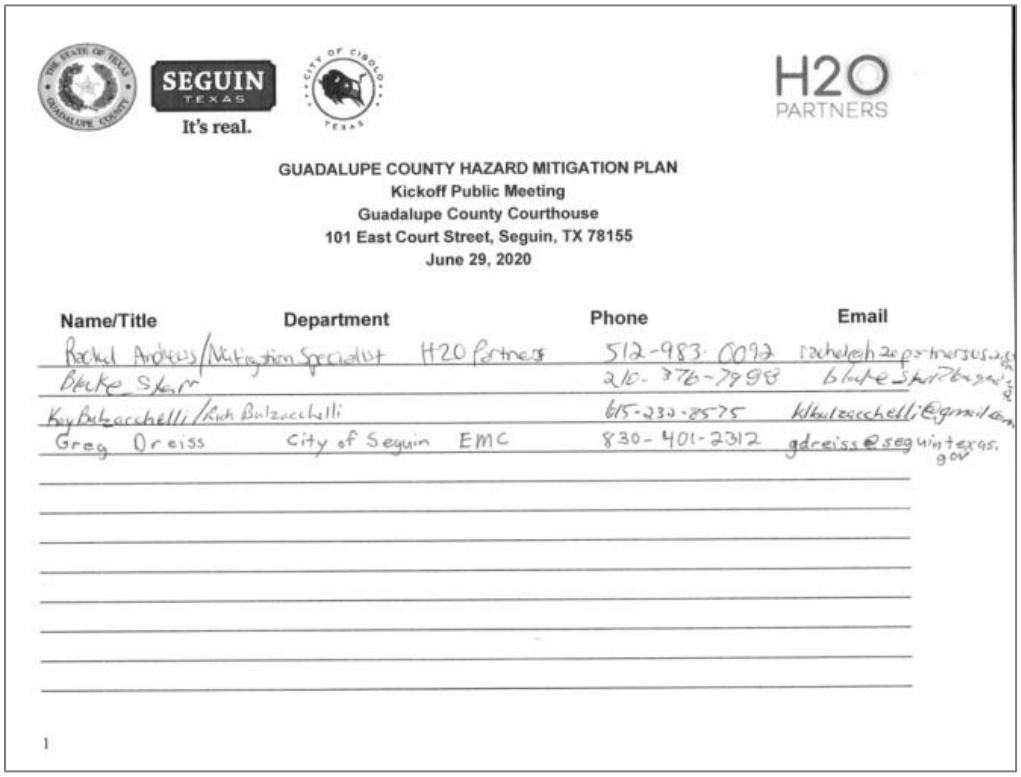
Name/Title	Department	Phone	Email
Dale Skinner, Fire Chief	Seguin FD	830-401-2310	dskinner@seguintexas.gov
JD Mosley, Exec D. Facilities	SCUC ISD	210-945-6206	jmosley@scuc.txed.net
Shannon Billings	Seguin Fd	830-401-2319	sbillings@seguintexas.gov
Victor Pacheco / Director of Safety	Seguin ISD	830 660-6228	vpacheco@seguin.k12.tx.us
Robby Castillo / Director of Operations	Navarro ISD	(830)556-2992	Robby.Castillo@NISD.US
Patrick Pinder	Fire Marshal / EMC	830-305-1401	patrick.pinder@co.guadalupe.tx.us
Chris Wright	Cibolo Public Works	210-658-9900 x-3162	cwright@cibolotx.gov

2

PUBLIC MEETING DOCUMENTATION

As discussed in Section 2, public meetings were held throughout the planning process. Documentation in the form of sign-in sheets for each of the meetings follows.

Figure E-3. Guadalupe County Kickoff Public Meeting, 06/29/20



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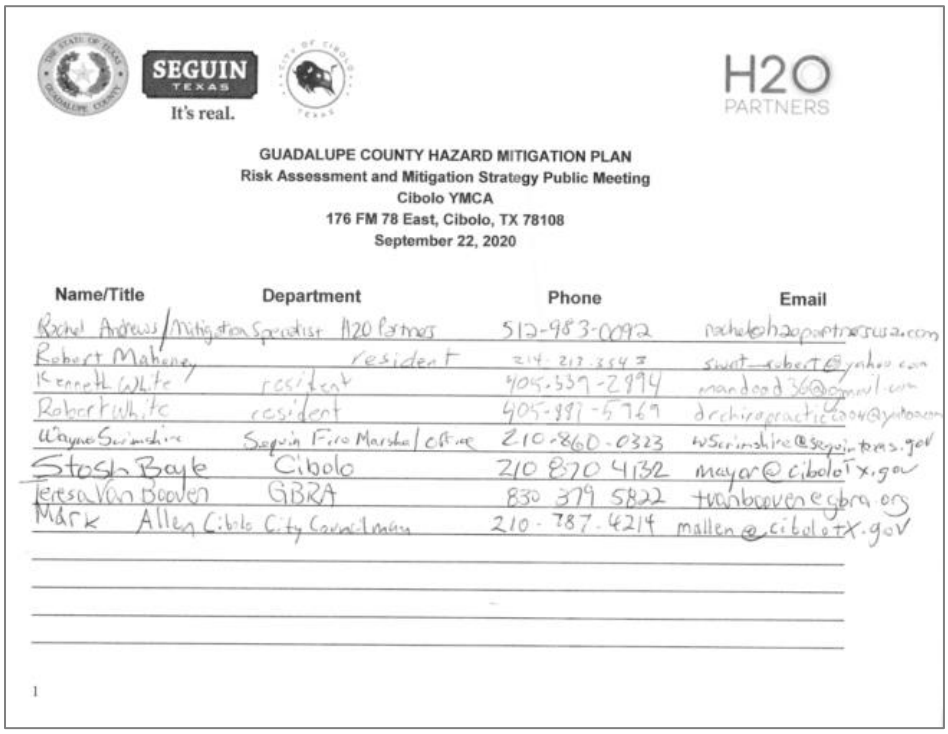
H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Kickoff Public Meeting
Guadalupe County Courthouse
101 East Court Street, Seguin, TX 78155
June 29, 2020

Name/Title	Department	Phone	Email
Rachel Andrews/Mitigation Specialist	H2O Partners	512-983-0092	rachelah2opartnersusa.com
Blake Starr		210-376-7998	blakestarr@gmail.com
Kay Butzacchelli/Rich Butzacchelli		615-232-8575	klbutzacchelli@gmail.com
Greg Oreiss	City of Seguin EMC	830-401-2312	gdreiss@seguintexas.gov

1

Figure E-4. Guadalupe County Risk Assessment / Mitigation Strategy Public Meeting, 09/22/20



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H2O PARTNERS

GUADALUPE COUNTY HAZARD MITIGATION PLAN
Risk Assessment and Mitigation Strategy Public Meeting
Cibolo YMCA
176 FM 78 East, Cibolo, TX 78108
September 22, 2020

Name/Title	Department	Phone	Email
Rachel Andrews / Mitigation Specialist	H2O Partners	512-983-0092	rachel@h2opartnersusa.com
Robert Mahoney	resident	214-213-3543	swat_robert@yahoo.com
Kenneth White	resident	405-339-2994	mandead36@gmail.com
Robert White	resident	405-881-5769	drchiropractic@cox.net
Wayne Swinshire	Seguin Fire Marshal Office	210-860-0323	wSwinshire@seguintexas.gov
Stosh Bayle	Cibolo	210 870 4132	mayor@cibolotx.gov
Teresa Van Booven	GBRA	830 379 5822	tvanbooven@gbra.org
Mark Allen	Cibolo City Council Member	210-787-4214	mallen@cibolotx.gov

1

PUBLIC NOTICES

Public notices to announce Guadalupe County's participation in the Plan development process were posted on various websites and Facebook, as shown in Figures E-5 through E-12.

Figure E-5. Public Notice, Guadalupe County Website, 06/29/20 Public Meeting

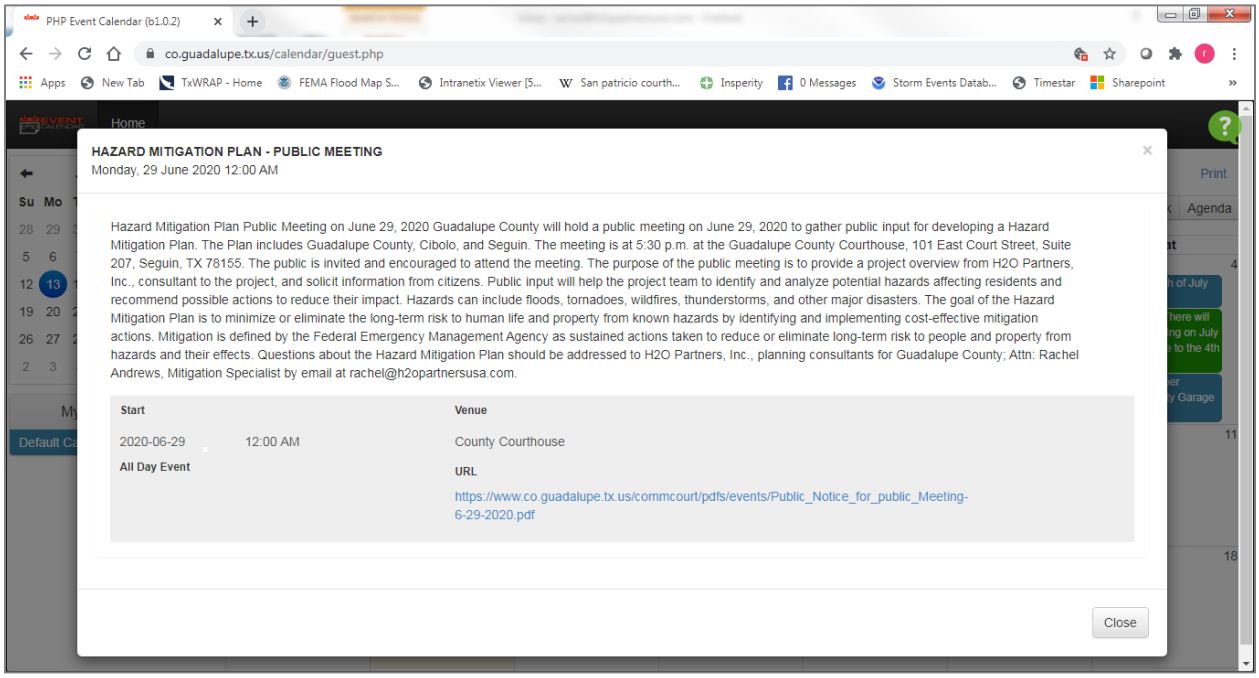


Figure E-6. Public Notice, City of Cibolo Website, 06/17/20 Public Meeting

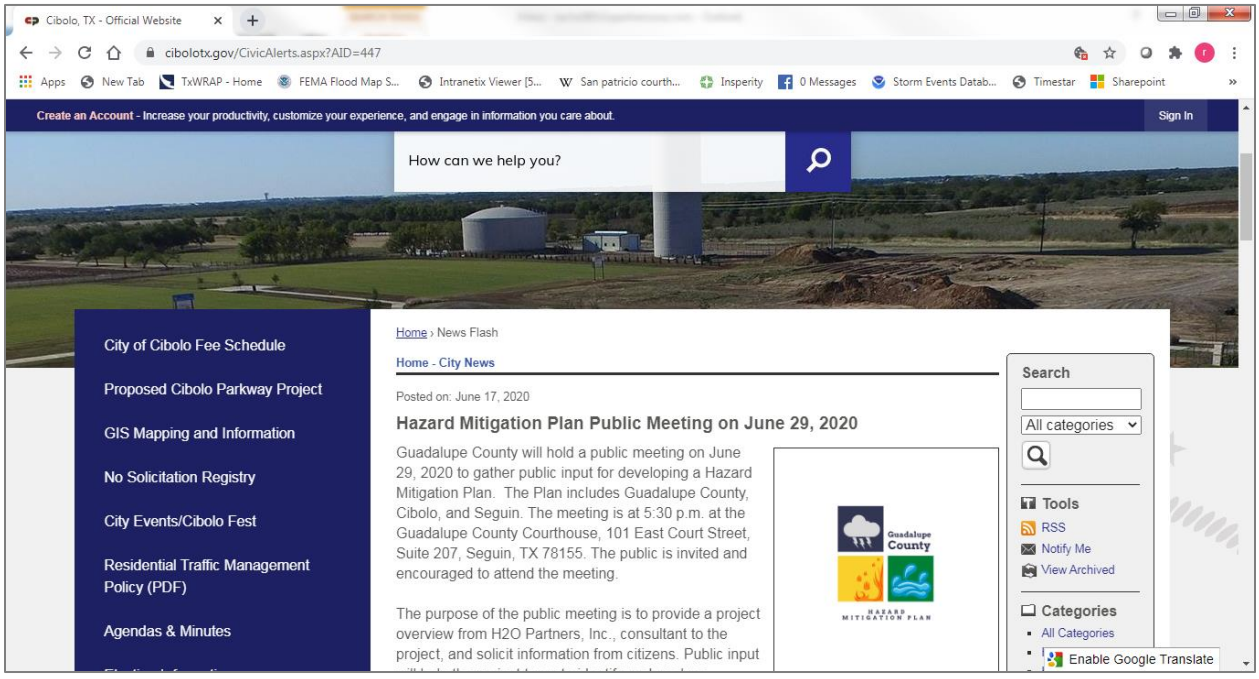


Figure E-7. Public Notice, Guadalupe County Texas Emergency Management and Fire Marshal Facebook page, 06/29/20 Public Meeting

Figure E-8. Public Notice, City of Cibolo Facebook page, 06/17/20 Public Meeting

Figure E-9. Public Notice, Guadalupe County Texas Emergency Management and Fire Marshal Facebook page, 09/14/20 Public Meeting and Survey Link

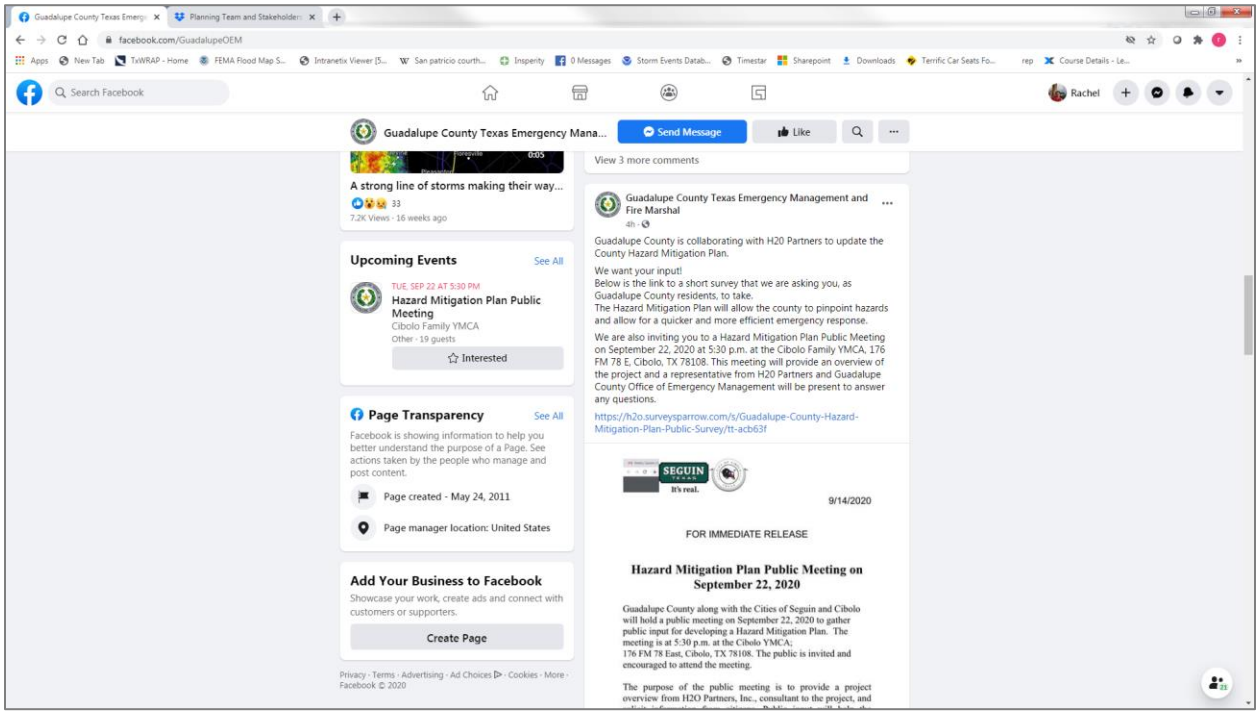


Figure E-10. Public Notice, City of Cibolo Website, 09/17/20 Public Meeting and Survey Link

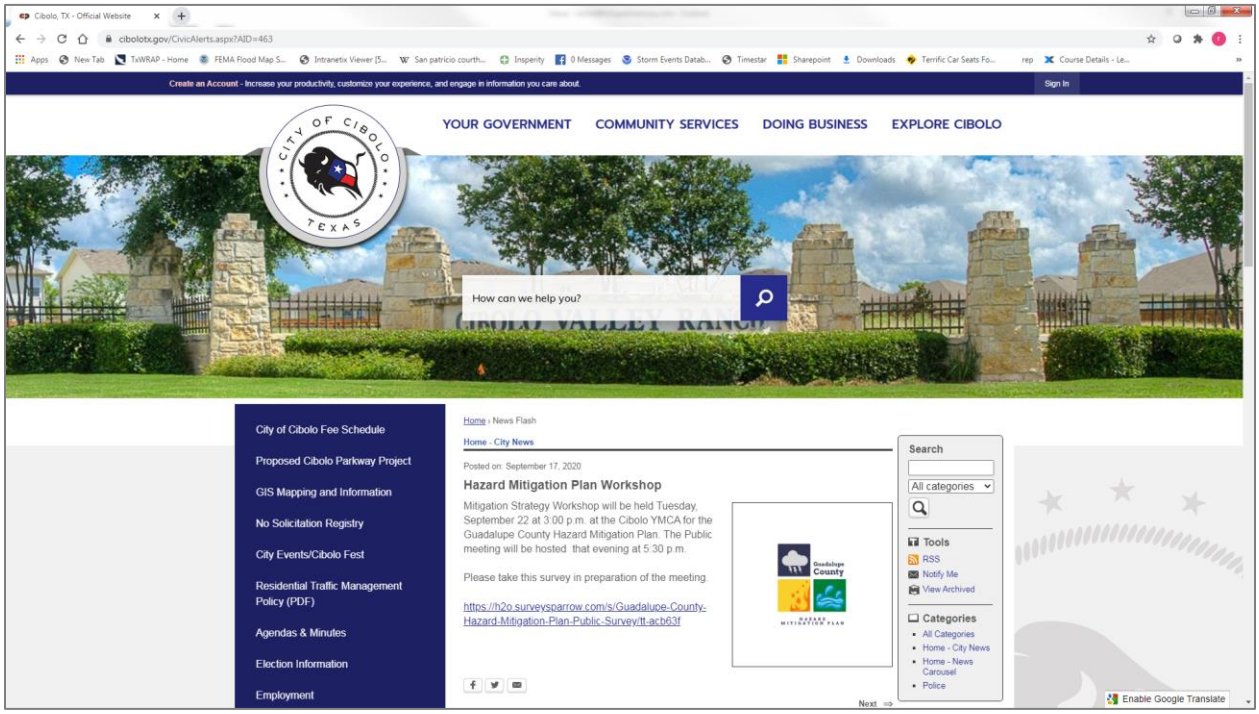


Figure E-11. Public Notice, Seguin Police Department Facebook page, 09/17/20 Survey Link

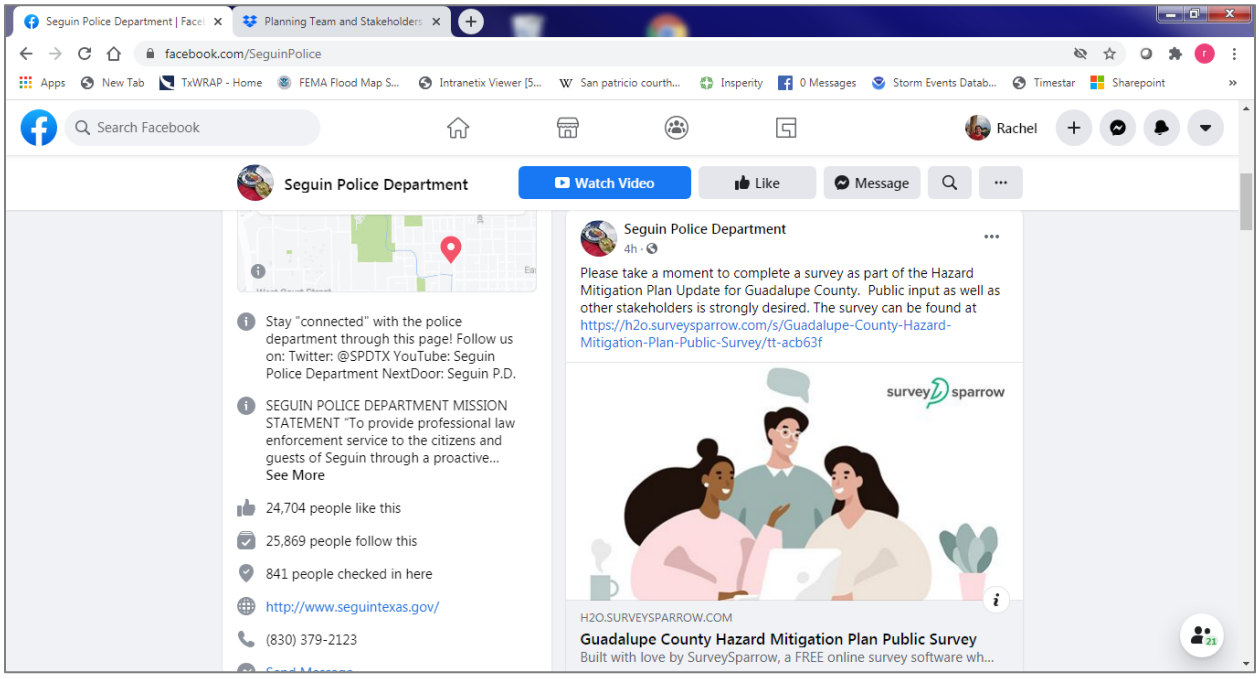
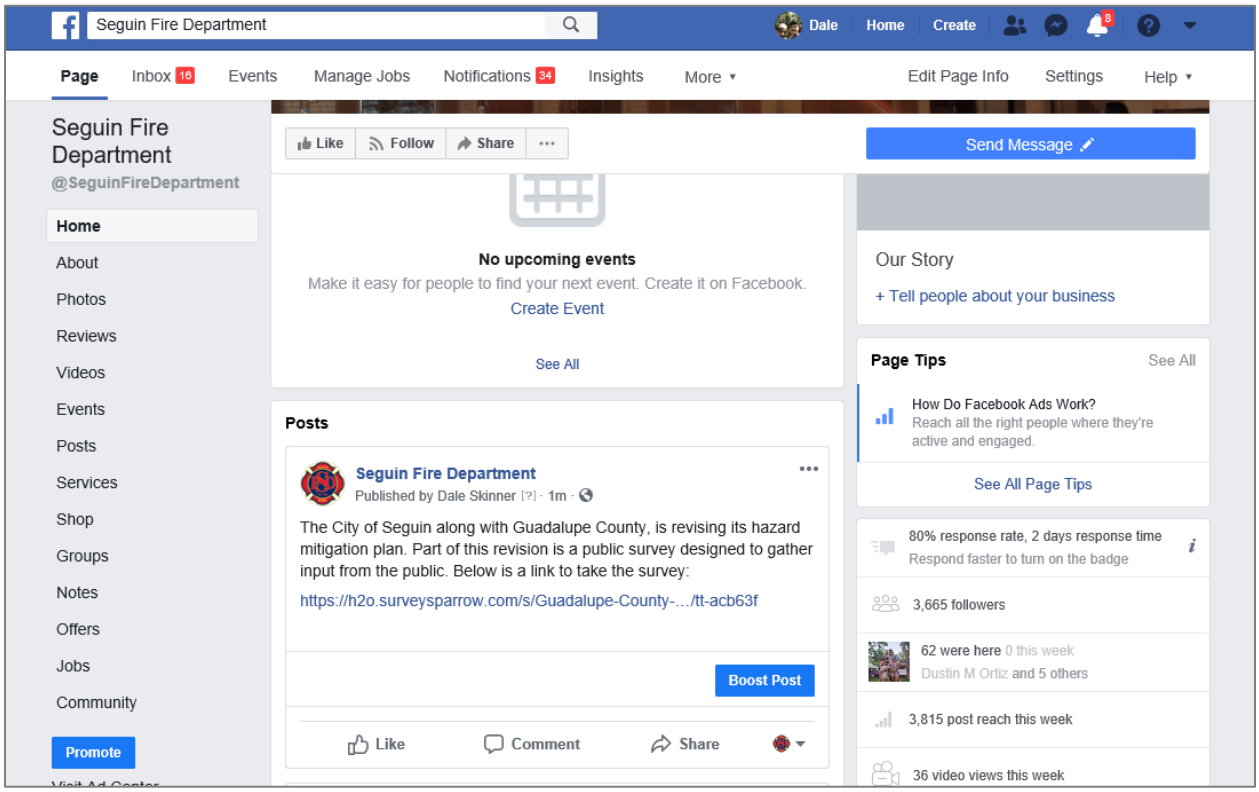


Figure E-12. Public Notice, Seguin Fire Department Facebook page, 09/18/20 Survey Link



APPENDIX F: CAPABILITY ASSESSMENT

OVERVIEW

The Planning Team completed a Capability Assessment Survey at the beginning of the planning process. The completed Capability Assessment Checklist, included in Appendix F, provides information on existing policies, plans, and regulations for participating jurisdictions within Guadalupe County.

A Capability Assessment is an integral component of the Plan development process. The Capability Assessment serves to evaluate a community's existing planning and regulatory capabilities to support implementation of the Plan's Mitigation Strategy Objectives.

Each community has a unique set of capabilities including policies, programs, staff, funding, and other resources available to accomplish hazard mitigation objectives and reduce long-term vulnerability. The Planning Team identified existing capabilities in each jurisdiction that currently reduce disaster losses or could be used to reduce losses in the future, and capabilities that inadvertently increase risks in the community.

COMMUNITY CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY CHECKLIST	*Guadalupe County*	*City of Cibolo*	*City of Seguin*
Plans / Regulatory Tool			
Capital Improvements Plan	X	X	X
Community Wildfire Protection Plan	X	X	
Comprehensive/Master Plan / Land Use Plan	X	X	X
Continuity of Operations	X	X	X
Emergency Operations Plan	X	X	X
Evacuation Plan	X	X	X
Hazard Mitigation Plan	X	X	X
Stormwater Management Plan	X	X	X
Policies / Ordinances			
Building Codes	X	X	X
Fire Code	X	X	X
Floodplain Ordinance	X	X	X
Stormwater Ordinance	X	X	X
Subdivision Regulations	X	X	X
Wildfire Ordinance	X	X	
Zoning Ordinance/Land Use Restrictions		X	X
Programs / Studies			
Floodplain Maps/Flood Insurance Studies	X	X	X
Hydrologic/Hydraulic Studies	X	X	X

APPENDIX F: CAPABILITY ASSESSMENT

COMMUNITY CAPABILITY CHECKLIST	*Guadalupe County*	*City of Cibolo*	*City of Seguin*
Mutual Aid Agreement	X	X	X
National Flood Insurance Program Participant	X	X	X
NFIP Community Rating System Participant	X	X	X
Property Acquisition Program	X	X	
Public Education/Awareness Programs	X	X	X
Storm Drainage Systems Maintenance Program	X	X	X
Stream Maintenance Program	X	X	X
Warning Systems/Services	X	X	X
Administrative and Technical Capability			
Building Code Official		X	X
Emergency Manager	X	X	X
Engineer		X	X
Environmental Conservation Specialist			
Floodplain Administrator	X	X	X
GIS Coordinator	X	X	X
Planner	X	X	X
Public Information Official	X	X	X
Resource Development/Grant Writer	X	X	X