Brownsville Public Utilities Board

2022 Hazard Mitigation Action Plan

Participating Planning Partner: City of Brownsville

FINAL

Volume 1

August 2022

TETRA TECH

BROWNSVILLE PUBLIC UTILITIES BOARD

TABLE OF CONTENTS

Volume I

Appendices

SECTION 1. INTRODUCTION

1.1 Purpose

The Brownsville Public Utilities Board and the City of Brownsville (the Planning Area) have prepared this multi-hazard mitigation plan to better protect the residents and property throughout the Planning Area from the effects of hazard events. This plan demonstrates the Planning Area's commitment to reducing risk from hazards, increasing resilience overall, and provide a tool to help decision makers integrate mitigation in their day-to-day processes. This plan was also developed to position the Brownsville Public Utilities Board (BPUB) and the City of Brownsville for eligibility of pre- and post-disaster Federal Emergency Management Agency (FEMA) grants, including: Hazard Mitigation Assistance grant programs (HMA), which include Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA). This plan also aligns with the planning elements of the National Flood Insurance Program's Community Rating System (CRS) which provides for lower flood insurance premiums in CRS communities.

1.2 Background

A Hazard Mitigation Action Plan (HMAP) is a living document that communities use to reduce their vulnerability to hazards. It forms the foundation for a community's long-term strategy to reduce disaster losses and creates a framework for decision making to reduce damages to lives, property, and the economy from future disasters. Examples of mitigation projects include home acquisitions or elevations to remove structures from high risk areas, upgrades to critical public facilities, and infrastructure improvements. Ultimately, these actions reduce vulnerability, and communities are able to recover more quickly from disasters. The Planning Area has demonstrated its commitment to reducing disaster losses by initially developing its HMAP in 2015 and updating information upon which to base a successful mitigation strategy to reduce the impacts of natural disasters and to increase the resiliency of the Planning Area.

Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.

FEMA defines a **Hazard Mitigation Plan** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), which requires local governmental agencies to develop and update their HMP every five years, this plan serves as the 2022 update to the 2015 Brownsville Public Utilities Board Hazard Mitigation Action Plan. During the course of the planning process, the entire plan was updated with a focus on examining changes in vulnerability due to hazard events, reviewing capabilities and how they implement hazard mitigation, and reviewing the mitigation strategy and identifying new initiatives to increase overall resiliency in the Planning Area.

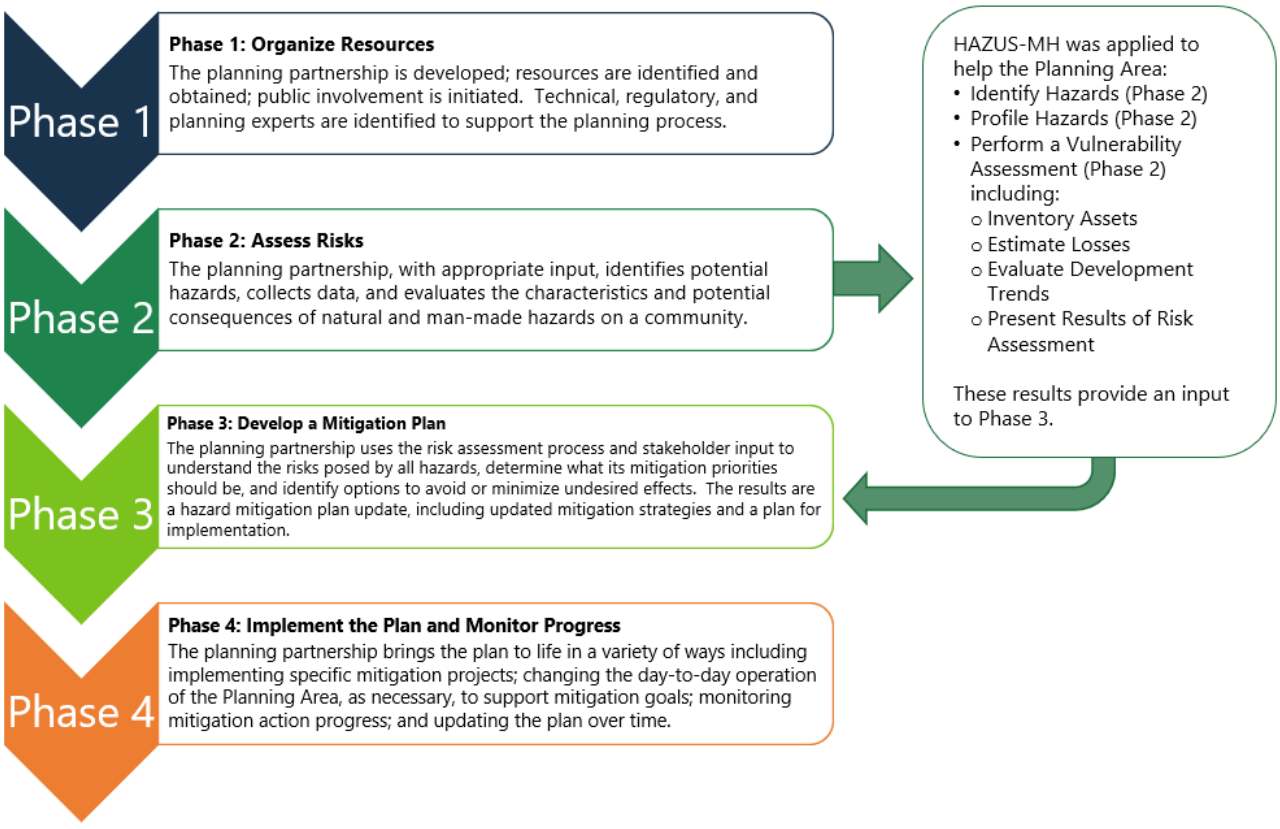
1.3 Plan Organization

The Brownsville Public Utilities Board Hazard Mitigation Action Plan 2022 Update is organized as a two-volume plan and is in alignment with the DMA planning requirements, the 2013 FEMA Local Mitigation Planning Handbook, and the FEMA Local Mitigation Plan Review Tool.

Volume I provides information on the overall planning process and hazard profiling and vulnerability assessments, which serves as a basis for understanding risk and identifying mitigation actions. As such, Volume I is intended for use as a resource for ongoing mitigation analysis.

Volume II provides an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; identifies vulnerabilities to hazards; documents mitigation plan integration with other planning efforts; records status of past mitigation actions; and presents an individualized mitigation strategy. The annexes are intended to provide a useful resource for each jurisdiction for implementation of mitigation projects and future grant opportunities, as well as a place for each jurisdiction to record and maintain their local aspect of the multi-jurisdictional plan.

Figure 1-1. BPUB Hazard Mitigation Planning Process



Volume I of this HMP includes the following sections:

Section 1: Introduction: Overview of the planning process and layout of the plan.

Section 2: Planning Process: Description of the HMP methodology and development process; Steering Committee, Planning Committee, Planning Partnership, and stakeholder involvement efforts; and a description of how this HMP will be incorporated into existing programs.

Section 3: Planning Area Profile: Overview of the Planning Area, including: (1) physical setting, (2) land use, (3) land use trends, (4) population and demographics, (5) general building stock and (6) critical facilities and lifelines.

Section 4: Risk Assessment: Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety, health, general building stock, critical facilities, the economy); description of the status of local data; and planned steps to improve local data to support mitigation planning.

Section 5: Capability Assessment: A summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the Planning Area.

Section 6: Mitigation Strategy: This section provides information regarding the mitigation goals and objectives in response to priority hazards of concern and the process by which Planning Area mitigation strategies have been developed or updated.

Section 7: Plan Maintenance Procedures: System established to continue to monitor, evaluate, maintain, and update the HMAP.

Volume II of this plan includes the following sections:

Section 8: Planning Partnership: Description of the planning partnership, their responsibilities, and description of jurisdictional annexes.

Section 9: Jurisdictional Annexes: Jurisdiction-specific annexes for BPUB and the City of Brownsville containing their hazards of concern, hazard ranking, capability assessment, mitigation actions, action prioritization specific only to BPUB or the City of Brownsville, progress on prior mitigation activities (as applicable), and a discussion of prior local hazard mitigation plan integration into local planning processes.

Appendices include the following:

Appendix A: Plan Adoption: Resolutions from BPUB and the City included as each formally adopts the HMP update.

Appendix B: Participation Documentation: Matrix to give a broad overview of who attended meetings and when input was provided to the HMP update and additional worksheets submitted during workshops conducted throughout the planning process.

Appendix C: Meeting Documentation: Agendas, attendance sheets, minutes, and other documentation (as available and applicable) of planning meetings convened during the development of the plan.

Appendix D: Public and Stakeholder Outreach Documentation: Documentation of the public and stakeholder outreach effort including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan process.

Appendix E: Mitigation Strategy Supplementary Data: Documentation of the broad range of actions identified during the mitigation process; types of mitigation actions; the mitigation catalog developed using jurisdiction input and potential mitigation funding sources.

Appendix F: Plan Maintenance Tools: Examples of plan review tools and templates available to support annual plan review.

Appendix G: Critical Facilities: Includes a full list of critical facilities identified for the update of the HMP. Due to the sensitive nature of the information, critical facility details have been redacted.

1.4 The Plan Update – What is Different?

The 2022 update builds on the previous plan and includes the following changes and enhancements:

- Updated data and tools provided for a more detailed and accurate risk assessment. The risk assessment was prepared to better support future grant applications by providing risk and vulnerability information that would directly support the measurement of "cost-effectiveness" required under FEMA mitigation grant programs.
- The plan identified implementable actions, with enough information to serve as the basis for policy and funding decisions and represent measurable impacts on resiliency and mitigation progress. Strategies provide direction, but actions are fundable under grant programs.
- Each participating jurisdiction has their own jurisdictional annex in the plan, found in Volume II, Section 9.

It should be noted that due to the limitations on participation posed by the pandemic and the strains on time and resources for many local governments and other community organizations from 2020 to present, participation of stakeholders at the municipal level was limited. In accordance with FEMA guiding principles for inclusive participation at various levels, the planning team will place a high priority on an expanded effort on stakeholder participation with local planning committees in future plan updates.

Table 1-1 indicates the major changes between the two plans as they relate to 44 CFR planning requirements.

Table 1-1. Plan Changes Crosswalk

44 CFR Requirement	2015 HMP	2022 Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to	The 2015 plan followed an outreach strategy utilizing multiple media	Building upon the success of the 2015 plan, the 2022 planning effort

44 CFR Requirement	2015 HMP	2022 Updated Plan
reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports and technical information.*	developed and approved by the Planning Team. This strategy involved the following: • Key department personnel formed an Advisory Committee for the plan. • All Planning Partnership meetings were open to the public. • Social media posts and a video recording were distributed to engage the public. • Use of a public participation survey. • Stakeholders were identified and coordinated with throughout the process. • Draft plan deliverables were made available on the BPUB and City websites and at local libraries. • A variety of existing studies, plans, reports, and technical information were reviewed as part of the planning process. • Adjacent communities, along with the County, were invited to participate in the planning meetings.	deployed the same public engagement methodology. The plan included the following enhancement: • Web-deployed survey. As with the 2015 plan, the 2022 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2015 plan included a risk assessment of hazards of concern. The risk assessment included frequency of return, approximate annualized losses, a description of general vulnerability, and a statement of the hazard's impact.	The 2022 plan update includes a comprehensive update to the risk assessment. The flood hazard was expanded to include urban flooding (or flooding outside of the floodplain). New and updated hazards of concern were included. The hazard ranking methodology was adjusted and includes adaptive capacity and climate change. Jurisdiction-specific risk assessment results are summarized in Section 4 (Risk Assessment) and in each jurisdictional annex (Section 9).
§201.6(c)(2)(i): [The risk assessment] shall include a] description of the … location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2015 plan presented a risk assessment of each hazard of concern. Each section included the following: • Hazard description • Location	A similar format, using new and updated data, was used for the 2022 plan update. Each section of the risk assessment includes the following: • Hazard profile, including maps of extent and location, previous

44 CFR Requirement	2015 HMP	2022 Updated Plan
	• Extent • Historical occurrences • Probability of future events Vulnerability and impact	occurrences, and probability of future events. • Climate change impacts on future probability. • Vulnerability assessment including: impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. The vulnerability assessment also includes changes in vulnerability since the 2015 plan.
§201.6(c)(2)(ii): [The risk assessment] shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i). This description shall include an overall summary of each hazard and its impact on the community.	Vulnerability was assessed for all hazards of concern. Each hazard of concern included a summary of assets exposed to the hazard (people/parcels annualized losses and expected damage to critical facilities).	A robust vulnerability assessment was conducted for the 2022 plan update, using new and updated asset and hazard data. Volume 1, Section 4.3 summarizes the planning area's vulnerability for each hazard of concern. The jurisdictional annexes (Section 9) include a summary table of impacts on both planning partners.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged by floods.	A summary of NFIP insured properties identified as repetitive loss and severe repetitive loss locations was included in the plan.	The resolution of the RL data accessible to support this planning effort was limited by FEMA's Privacy Act Policies and the time associated with processing the requisite Information Sharing Access Agreement (ISAA).
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	A complete inventory of the numbers and types of buildings exposed was generated for each hazard of concern. The Planning Team defined "critical facilities" for the planning area, and these were inventoried by exposure.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). In addition, critical facilities considered lifelines in accordance with FEMA's definition were identified.
Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern by using readily available information.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). Estimated potential losses are reported in both Volume 1, Section 4.3 and Volume II Section 9 for each jurisdiction.
Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the	There is a summary of anticipated development in the Profile section.	A spatial analysis using identified growth areas, and potential new development identified by municipalities was conducted to determine if located in hazard areas.

44 CFR Requirement	2015 HMP	2022 Updated Plan
community so that mitigation options can be considered in future land use decisions.		These results were reported to all participants and summarized in their annexes to discuss mitigation measures. In Volume I, Section 4.3, projected changes in population and development are discussed in each hazard section and how these projected changes may lead to increased vulnerability, or plans/regulations/ordinances in place to implement mitigation to protect the development.
§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2015 plan contained goals, objectives, and actions. The identified actions covered multiple hazards, goals, and objectives.	The Planning Team reviewed and updated the goals and objectives. A mitigation strategy workshop with associated tools and guidance on problem statement development was deployed to inform the identification of mitigation actions. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions was carried over to the 2022 plan, and in some cases, new actions were added to the action plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Planning Team identified goals and objectives targeted specifically for this hazard mitigation plan. These planning components supported the actions identified in the plan.	The Planning Team reviewed and updated the goals and objectives. Several new objectives were identified to align with updated Planning Area priorities.
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	For each identified hazard, mitigation strategies were developed and prioritized.	For the 2022 update, a mitigation catalog was developed to provide a comprehensive range of specific mitigation actions to be considered. A table with the analysis of mitigation actions by type and hazard was used in jurisdictional annexes to the plan. Mitigation action worksheets with an alternative project evaluation were prepared for FEMA-eligible projects.
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	The city identified an action to implement an NFIP public education program to increase the number of flood insurance policies by promoting availability of flood insurance.	The city identified an action to implement an NFIP public education program to increase the number of flood insurance policies by promoting availability of flood insurance.
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented and administered by the local jurisdiction. Prioritization shall	Each of the actions in this were prioritized based on FEMA's STAPLEE criteria, which includes consideration of the social, technical, administrative, political, legal, economic and	A revised methodology based on the STAPLEE criteria and using new and updated data was used for the 2022 plan update. The 14 criteria were used to evaluate each potential mitigation

44 CFR Requirement	2015 HMP	2022 Updated Plan
include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	environmental factors necessary for the implementation of each action.	action. The evaluation included a qualitative benefits and cost review. The results of the evaluation were used to identify the actions to include in the plan and assist with the prioritization.
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2015 plan details a plan maintenance strategy stating that the plan will be revised and maintained as required.	The 2022 plan details a plan maintenance strategy similar to that of the initial plan.
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2015 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2022 plan details recommendations for incorporating the plan into other planning mechanisms such as the following: • Comprehensive/Master Plan. • Emergency Response Plan/ Emergency Operations Plan. • Capital Improvement Programs. • Municipal Code.
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2015 plan details a strategy for continuing public involvement.	The 2015 plan maintenance strategy was carried over to the 2022 plan.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).	The Brownsville Public Utilities Board and the City of Brownsville adopted the 2015 HMP.	The 2022 plan achieves DMA compliance for BPUB and the City of Brownsville. Resolutions for each partner adopting the plan can be found in Appendix A of this volume.

SECTION 2. PLANNING PROCESS

2.1 Introduction

This section includes a description of the planning process used to update the 2015 Brownsville Public Utilities Board (BPUB) Hazard Mitigation Action Plan (HMAP), including how it was prepared, who was involved in the process, and how the public was involved. To ensure that the plan meets requirements of the DMA 2000 and that the planning process would have the broad and effective support of the participating jurisdictions, regional and local stakeholders, and the public, an approach to the planning process and plan documentation was developed to achieve the following goals:

- The HMAP is multi-jurisdictional and considers natural and human-caused hazards facing the Planning Area, thereby satisfying the natural hazards mitigation planning requirements specified in the DMA 2000.
- BPUB and the City of Brownsville are the plan participants.
- The HMAP was developed following the process outlined by the DMA 2000, FEMA regulations, and prevailing FEMA and TDEM guidance. Following this process ensures all the requirements are met and support HMP review.

The BPUB HMAP update was written using the best available information obtained from a wide variety of sources. Throughout the HMAP update process, a concerted effort was made to gather information from local and regional agencies and staff, as well as stakeholders, federal and state agencies, and the residents of the Planning Area. The HMAP Planning Team solicited information from local agencies and individuals with specific knowledge of certain hazards and past historical events, as well as considering planning and zoning codes, ordinances, and other recent planning decisions. The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, county and regional agencies, Planning Area residents, and stakeholders.

This section describes the mitigation planning process, including (1) Organization of the Planning Process; (2) Stakeholder Outreach and Involvement; (3) Public Participation; (4) Incorporation of Existing Data, Plans, and Technical Information; (5) Integration with Existing Planning Mechanisms and Programs; and (6) Continued Public Involvement.

2.2 Organization of the Planning Process

Many parties supported the preparation of this HMAP update: County officials, municipal officials, the Planning Team, stakeholders and planning consultant. This planning process does not represent the start of hazard risk management in the Planning Area; rather it is part of an ongoing process that various state, county and local agencies and individuals have continued to embrace. A summary of the past and ongoing mitigation efforts

is provided in Section 6 (Mitigation Strategy), as well as in Volume II Section 9 (Jurisdictional Annexes), to give an historical perspective of the Planning Area and local activities implemented to reduce vulnerability to hazards.

This section of the HMP identifies how the planning process was organized with the many "planning partners" involved and outlines the major activities that were conducted in the development of this HMP update.

2.2.1 Organization of the Planning Team

BPUB applied for and was awarded a planning grant under the FEMA Hazard Mitigation Grant Program (HMGP) (DR-4454-0003), which supported the development of this update of the multi-jurisdictional HMP. Project management and grant administration has been the responsibility of the Brownsville Public Utilities Board.

A contract planning consultant (Tetra Tech, Inc. referred herein as Tetra Tech) was selected to guide BPUB through the HMP update process. A contract between Tetra Tech and BPUB was executed in June 2021. Specifically, Tetra Tech, the contract consultant, was tasked with the following:

- Assisting with the organization of the Core Planning Team and Planning Team.
- Assisting with the development and implementation of a public and stakeholder outreach program.
- Data collection.
- Facilitation and attendance at meetings (Core Planning Team, Planning Team, stakeholder, public and other).
- Review and update of the hazards of concern, hazard profiling and risk assessment.
- Assistance with the review and update of mitigation planning goals and objectives.
- Assistance with the review of past mitigation strategies progress.
- Assistance with the screening of mitigation actions and the identification of appropriate actions.
- Assistance with the prioritization of mitigation actions.
- Authoring of the draft and final plan documents.

To facilitate plan development, BPUB developed a Planning Team to provide guidance and direction to the HMP update effort and to ensure the resulting document will be embraced both politically and by the constituency within the planning area (BPUB and the City of Brownsville) (Table 2-1). Specifically, the Planning Team was charged with the following:

- Attending and participating in Planning Team meetings.
- Represent their jurisdiction throughout the planning process and assure participation expectations are met by their jurisdiction.
- Support and promote the public involvement process.
- Assisting with the development and completion of certain planning elements, including:
    - Reviewing and updating the hazards of concern.
    - Developing a public and stakeholder outreach program.

  - Assuring that the data and information used in the plan update process are the best available.
  - Reviewing and updating the hazard mitigation goals.
  - Report on progress of mitigation actions identified in prior or existing HMPs, as applicable.
  - Identifying and screening of appropriate mitigation strategies and activities.
- Reviewing and commenting on plan documents prior to submission to TDEM and FEMA.
- Adopt, implement, and maintain the plan update.

Table 2-1. Brownsville Public Utilities Board Hazard Mitigation Planning Team

Name	Title	Organization	Planning Team Member	Core Planning Team Member
George Rangel	Fiscal Manager	BPUB	✓	✓
Conrad Taylor	Grants Coordinator	BPUB	✓	✓
Lina Alvarez	Energy Risk Manager	BPUB	✓	
Jose Armando Garza	Water Treatment Manager	BPUB	✓	
Hazael Becerra	GIS Manager	BPUB	✓	
Jaime Estrada	Director Of Operational Support Services	BPUB	✓	
Ryan Greenfield	Public Relations Manager	BPUB	✓	
Jacob Galvan	W/WW Operator Chief	BPUB	✓	
Odee Ann Leal	Emergency Management Director	City of Brownsville	✓	
Noel Bernal	City Manager	City of Brownsville	✓	
Rick Vasquez	Planning and Redevelopment Director	City of Brownsville	✓	
Doroteo Garcia, Jr.	Engineering and Public Works	City of Brownsville	✓	
Tina Garza	GIS	City of Brownsville	✓	
Olga Moya	Grant Manager	City of Brownsville	✓	
Eryka Duberney	Grant Analyst	City of Brownsville	✓	

Appendix B (Participation Matrix), identifies those individuals who represented the planning partners during this planning effort and indicates how they contributed to the planning process.

2.2.2 Planning Activities

Members of the Planning Team, as well as key stakeholders, convened and/or communicated regularly to share information and participate in workshops to identify hazards; assess risks; review existing inventories of and identify new critical facilities; assist in updating and developing new mitigation goals and strategies; and provide continuity through the process to ensure that natural hazards vulnerability information and appropriate mitigation strategies were incorporated. All members of the Planning Team and Planning Team had the opportunity to review the draft plan and supported interaction with other stakeholders and assisted with public involvement efforts.

A summary of Planning Team meetings held and key milestones met during the development of the HMP update is included in Table 2-2 that also identifies which DMA 2000 requirements the activities satisfy. Documentation of meetings (e.g., agendas, sign-in sheets, meeting notes) are in Appendix C (Meeting Documentation). Table 2-2 identifies only the formal meetings held during plan development and does not

reflect all planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between BPUB, committee members, and the contract consultant through individual local meetings, electronic mail (email), and by phone.

Table 2-2. Summary of Mitigation Planning Activities / Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
June 30, 2021	2	Pre-Kick Off Meeting with BPUB: Plan timing and administration, data needs and sharing, hazards of concern, dates and next steps	BPUB Grants Coordinator, Tetra Tech
August 12, 2021	2	Planning Team Meeting #1: Introduce Planning Team to the HMP update process, discuss mitigation planning, project organization, roles and responsibilities, data collection, hazards of concern, and schedule of plan.	BPUB Grants Coordinator, BPUB GIS, BPUB staff, City of Brownsville Engineering and Public Works, City of Brownsville GIS, City of Brownsville staff, Tetra Tech
October 7, 2021	2, 4a	Planning Team Meeting #2: Review project schedule and status, hazards of concern, goals and objectives, SWOO exercise and next steps	BPUB Grants Coordinator, BPUB Fiscal Manager, BPUB Smart Grid Applications Manager, City of Brownsville EM Planner, City of Brownsville EM Preparedness Coordinator, City of Brownsville Public Engagement Coordinator, City of Brownsville Communications Specialist, City of Brownsville Grant Manager, City of Brownsville City Manager, City of Brownsville Communications and Marketing Director, Tetra Tech
December 8, 2021	2, 3a, 3b, 3c, 3d, 3e	Risk Assessment Presentation: Review project schedule and status, present risk ranking, and go over how to review and provide input	BPUB, City of Brownsville, Tetra Tech
January 26, 2022	2, 4a, 4b	Mitigation Action Workshop: Review project schedule and status, hazards of concern, critical facilities and lifelines, goals and objectives, SWOO exercise and next steps.	BPUB EM, BPUB Fiscal Manager, BPUB Grants Coordinator, BPUB staff, City of Brownsville Grant Writer, City of Brownsville Grant Manager, City of Brownsville City Engineer, City of Brownsville Grant Analyst, City of Brownsville EM Administrator, City of Brownsville staff, Tetra Tech
March 23, 2022	2	Draft Plan Review Presentation: Overview of entire plan and sections; confirmed plan maintenance schedule	BPUB, City of Brownsville, and Tetra Tech
TBD	1b, 2	Draft HMP posted to public project website; all plan participants were notified and asked to assist with the public outreach including social media. Neighboring communities and stakeholders were notified of the posting as well.	Public and Stakeholders

Date	DMA 2000 Requirement	Description of Activity	Participants
TBD	2	HMP submitted to TDEM and FEMA Region VI	TDEM, FEMA Region VI
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating jurisdictions	All Plan Participants

Note: All activities/efforts were conducted during the National Emergency response to the COVID-19 pandemic.
TBD = to be determined.
Each number in column 2 identifies specific DMA 2000 requirements, as follows:
1a – Prerequisite – Adoption by the Local Governing Body
1b – Public Participation
2 – Planning Process – Documentation of the Planning Process
3a – Risk Assessment – Identifying Hazards
3b – Risk Assessment – Profiling Hazard Events
3c – Risk Assessment – Assessing Vulnerability: Identifying Assets
3d – Risk Assessment – Assessing Vulnerability: Estimating Potential Losses
3e – Risk Assessment – Assessing Vulnerability: Analyzing Development Trends
4a – Mitigation Strategy – Local Hazard Mitigation Goals
4b – Mitigation Strategy – Identification and Analysis of Mitigation Measures
4c – Mitigation Strategy – Implementation of Mitigation Measures
5a – Plan Maintenance Procedures – Monitoring, Evaluating, and Updating the Plan
5b – Plan Maintenance Procedures – Implementation through Existing Programs
5c – Plan Maintenance Procedures – Continued Public Involvement

2.3 Stakeholder Outreach and Involvement

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the HMP, including all planning partners. Diligent efforts were made to assure broad regional, county and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Planning Team. Stakeholder outreach was performed early on, and continually throughout the planning process. This HMP update includes information and input provided by these stakeholders where appropriate, as identified in the references.

This subsection discusses the various stakeholders that were invited to participate in the development of this HMP update, and how these stakeholders participated and contributed. This summary listing cannot possibly represent the total of stakeholders that were aware of and/or contributed to this HMP update, as outreach efforts were being made, both formally and informally, throughout the process by the many planning partners involved in the effort, and documentation of all such efforts is impossible. Instead, this summary is intended to demonstrate the scope and breadth of the stakeholder outreach efforts made during the plan update process:

- All Planning Team meetings were open to the public and advertised via the BPUB HMP website (https://www.brownsvillepub-hmp.com/).
- The Planning Team was provided outreach materials to post on their websites, social media platforms, and distribute printed materials.

- Distributed a stakeholder survey and neighbor survey to provide input regarding vulnerabilities, capabilities and mitigation projects.
- Posted draft plan on the BPUB HMP website and advertised using social media platforms.
- Email correspondence to regional stakeholders and neighboring communities to review the draft HMP and provide input.

2.3.1 Federal, State, and County Agencies

The following describes the various departments and agencies that were involved during the planning process.

2.3.1.1 Federal Agencies

Please see Appendix B (Participation Documentation) for further details regarding federal agency participation. All responses to the stakeholder surveys may be found in Appendix D (Public and Stakeholder Outreach).

FEMA Region VI: Provided updated planning guidance and conducted plan review.

Information regarding hazard identification and the risk assessment for this plan update were requested and received or incorporated by reference from the following agencies and organizations:

- National Climatic Data Center (NCDC)
- National Hurricane Center (NHC)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Storm Prediction Center (SPC)
- U.S. Army Corps of Engineers (USACE)
- U.S. Census Bureau
- U.S. Department of Agriculture (USDA)
- U.S. Department of Health and Human Services
- U.S. Environmental Protection Agency (USEPA)
- U.S. Geological Survey (USGS)

2.3.1.2 State Agencies

Please see Appendix B (Participation Documentation) for further details regarding state agency participation. All responses to the surveys may be found in Appendix D (Public and Stakeholder Outreach).

Texas Division of Emergency Management (TDEM): Administered the planning grant; provided updated planning guidance; provided review of the draft HMP update.

2.3.1.3 Planning Area Agencies and Departments

Several planning area agencies and departments were represented on the Planning Team and involved in the HMP update planning process. Appendix B (Participation Matrix) provides further details regarding regional and local stakeholder agencies. All responses to the stakeholder surveys are in Appendix D (Public and Stakeholder Outreach). Refer to Section 5 (Capability Assessment) for details on each department and their roles during the HMP update and their overall responsibilities in the planning area.

- BPUB Grants Department
- BPUB GIS Department
- BPUB Fiscal Department
- BPUB Smart Grid Applications Department
- City of Brownsville City Manager
- City of Brownsville Enterprise Applications
- City of Brownsville Engineering and Public Works Department
- City of Brownsville Office of Emergency Management
- City of Brownsville Communications and Marketing Department
- City of Brownsville Financial Services Department

2.3.2 Regional and Local Stakeholders

All Planning Team meetings were announced on the BPUB HMP project website and posted on social media to invite residents and stakeholders. In addition, Planning Team representatives emailed regional and local stakeholders requesting their participation in stakeholder sector-specific surveys to provide input on vulnerable assets, capabilities, and current/potential future mitigation projects; and invited to provide input on the draft HMP. Refer to Appendix C (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings and Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

2.3.2.1 Academia

Schools, universities and other academia institutions were invited to attend planning process meetings and asked to complete the stakeholder survey. The following provided input during the process:

- Brownsville Independent School District
- Southern Careers Institute – Brownsville Campus
- University of Texas Rio Grande Valley - Brownsville

2.3.2.2 Business, Commercial, and Non-Profit Interests

The following business and commercial industries in the planning area were invited to take the stakeholder survey and provide input to the planning process:

- Port of Brownsville
- Brownsville Chamber of Commerce
- Tip of Texas Family Outreach

2.3.2.3 Emergency Services

Local emergency service providers (police, fire, and EMS) were invited to take the stakeholder survey and provide input to the planning process including the following:

- National Weather Service
- Brownsville Office of Emergency Management and Homeland Security
- Brownsville Fire Department
- Brownsville Police Department

2.3.2.4 Healthcare

Healthcare facilities and providers located in the planning area were invited to take the stakeholder survey and provide input to the planning process, including:

- Alta Vista Rehabilitation & Healthcare

2.3.2.5 Transportation

County and local highway and public works departments were notified of the stakeholder survey and invited to provide input on the draft HMP, including the following:

- B-Metro
- Brownsville South Padre Island International Airport

2.3.2.6 Utilities

Utility providers in the planning area were invited to take the stakeholder survey and provide input to the planning process, including the following:

- Cameron County Drainage District #1
- Brownsville Irrigation District

2.3.2.7 County and Adjacent Municipalities

BPUB has made an effort to keep the county and surrounding municipalities appraised of the project, invited to take the stakeholder survey, and allowed the opportunity to provide input to this planning process, including the following:

- City of Los Fresnos – Emergency Management

- City of South Padre Island – Emergency Management
- City of South Padre Island – Planning Department
- City of San Benito – Emergency Management
- Cameron County – Emergency Management
- City of Port Isabel – Public Safety

2.3.3 Stakeholder Survey Summary

The following provides a summary of the results and feedback received by stakeholders who completed the survey. Feedback was reviewed by the Planning Team and integrated where appropriate in the plan.

2.3.3.1 Stakeholder Survey

The stakeholder survey was designed to help identify general needs for hazard mitigation and resiliency within Brownsville Public Utilities Board from its perspective, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including the various county and municipal departments and agencies in the county. As of January 28, 2022, one stakeholder completed the survey, representing the business/commerce sector.

The respondent said the buildings/facilities/structures they have worked in and/or are responsible for have been impacted by a hazard. Those that experienced damage stated that the structures damage due to inclement weather, flooding, and structural damage from severe winds. When asked what areas are most vulnerable to hazards in the Planning Area, answers included low lying areas that impede access to roadways and key structural assets. The respondent indicated that their infrastructure and facilities are equipped to handle disasters and damages.

The respondent stated that the have the following plans in place: Emergency Operations Plan, Business Continuity Plan, and an Energy Restoration Plan.

2.3.3.2 Neighbor Survey

The neighbor survey was sent to the surrounding municipalities of the City of Brownsville due to their proximity to and because effects of hazard events that impact the Planning Area would be similar to that of their neighbors. As of March 15, 2022, no responses have been received.

2.4 Public Participation – Public Involvement

In order to facilitate better coordination and communication between the Planning Team and citizens and to involve the public in the planning process, it was determined that meeting dates/locations will be made available to the public via the BPUB HMAP website (https://www.brownsvillepub-hmp.com/) and social media; and the draft HMAP available on the BPUB HMAP website. The participating partners also feel that community

input on the HMAP will increase the likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of the Planning Area.

The Planning Team has made the following efforts toward public participation in the development and review of the HMP:

- A dedicated website was created for this project (https://www.brownsvillepub-hmp.com/). The website went live in September 2021 and was continuously updated throughout the planning process. The public website contains a project overview, meeting announcements, draft documents for review and comment, and a link to the public and stakeholder surveys.
- All hazard mitigation Planning Team meetings that were open to the public were advertised on the BPUB HMP website and various social media accounts (Facebook and Twitter). Additional examples of municipal outreach are presented in Appendix D.
- An on-line natural hazards preparedness public survey was developed to gauge household preparedness that may impact the Planning Area and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss of those hazards. The questionnaire asked quantifiable questions about citizen perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asked several demographic questions to help analyze trends. The questionnaire was available on the public website from September 2021 to March 2022, and further advertised on additional Planning Team websites and on printed materials. Reponses were collected and provided back to plan participants for consideration in the mitigation action development (54 responses in total). Appendix D summarizes public input received through the website, the online survey, and other sources.
    - Results from the natural hazards preparedness survey were used to inform the action plans of the planning partners. To address the most requested types of projects that residents wanted local and county agencies to be doing, many planning partners included actions to improve and strengthen infrastructure, improve the damage resistance of utilities, buy out flood prone properties, improve protective structures, and provide greater control over development in high hazard areas.
- All plan participants were encouraged to post links to the project webpage and citizen survey. In addition, all participants were requested to advertise the availability of the project website, citizen survey and stakeholder surveys via local homepage links, and other available public announcement methods (e.g., Facebook, Twitter, email blasts). Refer to Appendix D which highlights these local efforts.
- Residents of the City of Brownsville were provided opportunity to comment on the draft HMP before submittal to FEMA. The HMP was posted on the HMP public website on March 29, 2022 for review. All Planning Team participants were requested to assist with advertising the plan was posted via their websites and social media. Public comments received through April 12, 2022 were distributed to Planning Team for their consideration.
- Additional examples of public outreach efforts, and results of surveys distributed, are presented in Appendix D (Public and Stakeholder Outreach Documentation).

2.4.1 Public Survey Responses

Demographically, survey respondents were from the City of Brownsville, with 60% having lived in the city for 20 years or more, and the majority (74.5%) in their own home. The most common (29.6%) age of respondents were between the ages of 31 and 40. Residents were asked the ways in which they receive their information concerning a natural disaster. The majority (77.4%) of respondents rely on the internet to receive information concerning natural disasters. Three-quarters of respondents (74.1%) receive information through TV news and just over half (61.2%) receive information through social media.

Survey respondents were asked how concerned they were about 21 different hazards, on a scale of not concerned to extremely concerned. Respondents were most concerned (reporting "concerned", "very concerned", or "extremely concerned") about hurricanes/tropical storms, flooding, extreme temperatures, and severe storms.

About 56.6% of respondents' properties are not located in the floodplain, with 16.6% within a floodplain and 26.6% are unsure. Nearly half of those do not have flood insurance (48.3%), 38.7% do have flood insurance, and 12.9% are unsure if they have flood insurance. Residents were then asked what types of projects they believe local, county, state, or federal government agencies could be doing in order to reduce the damage and disruption of disasters in the Planning Area including:

- Improve and strengthen infrastructure, such as elevating roadways and improving drainage systems (100%)
- Work on improving the damage resistance of utilities (electricity, communications, water/wastewater facilities etc.) (78.2%)
- Install or improve protective structures, such as bulkheads, floodwalls or levees to protect against flooding (43.4%)
- Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas (34.7%)
- Assist vulnerable property owners with securing funding to mitigate their properties (30.4%)
- Improve and strengthen critical facilities such as police, schools, hospitals (26%)
- Inform property owners of ways they can mitigate damage to their properties (26%)
- Provide better information about hazard risks and high-hazard areas (26%)
- Enhance dune restoration and beach nourishment projects/programs (17.3%)
- Replace inadequate or vulnerable bridges and causeways (13%)
- Buy out flood prone properties and maintain as open-space (8.7%)

2.5 Incorporation of Existing Plans, Studies, Reports, and Technical Information

The Brownsville Public Utilities Board HMAP strives to use the best available technical information, plans, studies and reports throughout the plan process to support hazard profiling; risk and vulnerability assessment;

review and evaluation of mitigation capabilities; and the identification, development and prioritization of county and local mitigation strategies.

The asset and inventory data used for the risk and vulnerability assessments is presented in the Planning Area Profile (Section 3). Details of the source of this data, along with technical information on how the data was used to develop the risk and vulnerability assessment, is presented in the Risk Assessment, specifically in Section 4.2 Methodology and Tools, as well as throughout the hazard profiles in Section 4.3 (Hazard Profiles). Further, the source of technical data and information used may be found within the References section.

Plans, reports, and other technical information were identified and provided directly by the Planning Team, and numerous stakeholders involved in the planning effort, as well as through independent research by the planning consultant. The Planning Team was tasked with updating the inventory of their Planning and Regulatory capabilities in Section 9 (Jurisdictional Annexes) and providing relevant planning and regulatory documents, as applicable. Relevant documents, including plans, reports, and ordinances were reviewed to identify the following:

- Existing local and regional capabilities.
- Needs and opportunities to develop or enhance capabilities, which may be identified within the mitigation strategies.
- Mitigation-related goals or objectives considered in the review and update of the overall Goals and Objectives in Section 6 (Mitigation Strategy).
- Proposed, in-progress, or potential mitigation projects, actions, and initiatives to be incorporated into the updated County and local mitigation strategies.

The following local regulations, codes, ordinances, and plans were reviewed during this process to develop mitigation planning goals, objectives, and strategies that are consistent across local and regional planning and regulatory mechanisms to accomplish complementary and mutually supportive strategies:

- Master/Comprehensive Plans
- Building Codes
- Zoning and Subdivision Ordinances
- NFIP Flood Damage Prevention Ordinances
- Site Plan Requirements
- Stormwater Management Plans
- Emergency Management and Response Plans
- Land Use and Open Space Plans
- Capital Plans
- State of Texas Hazard Mitigation Plan (2018)

2.6 Integration With Existing Planning Mechanisms and Programs

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the Planning Area there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those mechanisms.

Section 5 (Capability Assessment) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, and local) that support hazard mitigation within the Planning Area. Within each jurisdictional annex in Section 9, BPUB and the City identified how they integrate hazard risk management into their existing planning, regulatory, and operational/administrative framework (integration capabilities) and how they intend to promote this integration (integration actions). In addition, as noted above, a summary of the plan reviews indicating relevant goals and mitigation actions is provided in Appendix E. This information provided input to identify integration of mitigation concepts into the operations of the Planning Area.

A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 (Plan Maintenance).

2.7 Continued Public Involvement

BPUB and the City of Brownsville are committed to the continued involvement of the public in the hazard mitigation process. This HMAP update will be made available for review on the HMAP public website. Each jurisdiction's elected official shall be responsible for receiving, tracking, and filing public comments regarding this HMAP update. Further details regarding continued public involvement are provided in Section 7 (Plan Maintenance).

A notice regarding annual updates of the plan and the location of plan copies will be publicized annually after the annual plan evaluation meeting (refer to Section 7 – Plan Maintenance) and posted on the public website at https://www.brownsvillepub-hmp.com/.

The public will have an opportunity to comment on the HMAP update as a part of the annual mitigation planning evaluation process and the next five-year mitigation plan update. The HMP Coordinator (currently Conrad Taylor, Grants Coordinator) is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the 5-year plan update as appropriate; however, members of the Planning Team will assist the HMP Coordinator. Additional meetings may also be held as deemed necessary. The purpose of these meetings would be to provide the public an opportunity to express concerns, opinions, and ideas about the HMP.

After completion of this HMAP update, implementation and ongoing maintenance will continue to be a function of the Planning Team. The Planning Team will review the plan and accept public comment as part of an annual review and as part of five-year mitigation plan updates.

A notice regarding annual updates of the plan will be publicized annually after the HMP Committee's annual evaluation and posted on the public web site.

Conrad Taylor has been identified as the ongoing HMP Coordinator (see Section 7), and is responsible for receiving, tracking, and filing public comments regarding this HMP update. Contact information is:

Mailing Address:	Brownsville Public Utilities Board 1425 Robinhood Drive, Brownsville, TX 78521
Contact Name:	Conrad Taylor
Email Address:	ctaylor@brownsville-pub.com

SECTION 3. COMMUNITY PROFILE

This profile provides general information for the Brownsville Public Utilities Board and the City of Brownsville and critical facilities located within the planning area. Examining the physical setting, population and demographics, general building stock, and land use and population trends leads to a better understanding of the study area, including economic, structural, and population assets at risk, and concerns that could be related to hazards analyzed later in this plan.

3.1 General Information

For more than a century, Brownsville Public Utilities Board (BPUB) has been part of the planning area's growth and future. In 1904, the utility that would become BPUB was created by a unanimous vote under the City of Brownsville's Home Rule Charter. BPUB was formally chartered by the City of Brownsville in 1960 to provide electrical, water and wastewater services to its customers in the southernmost part of Texas.

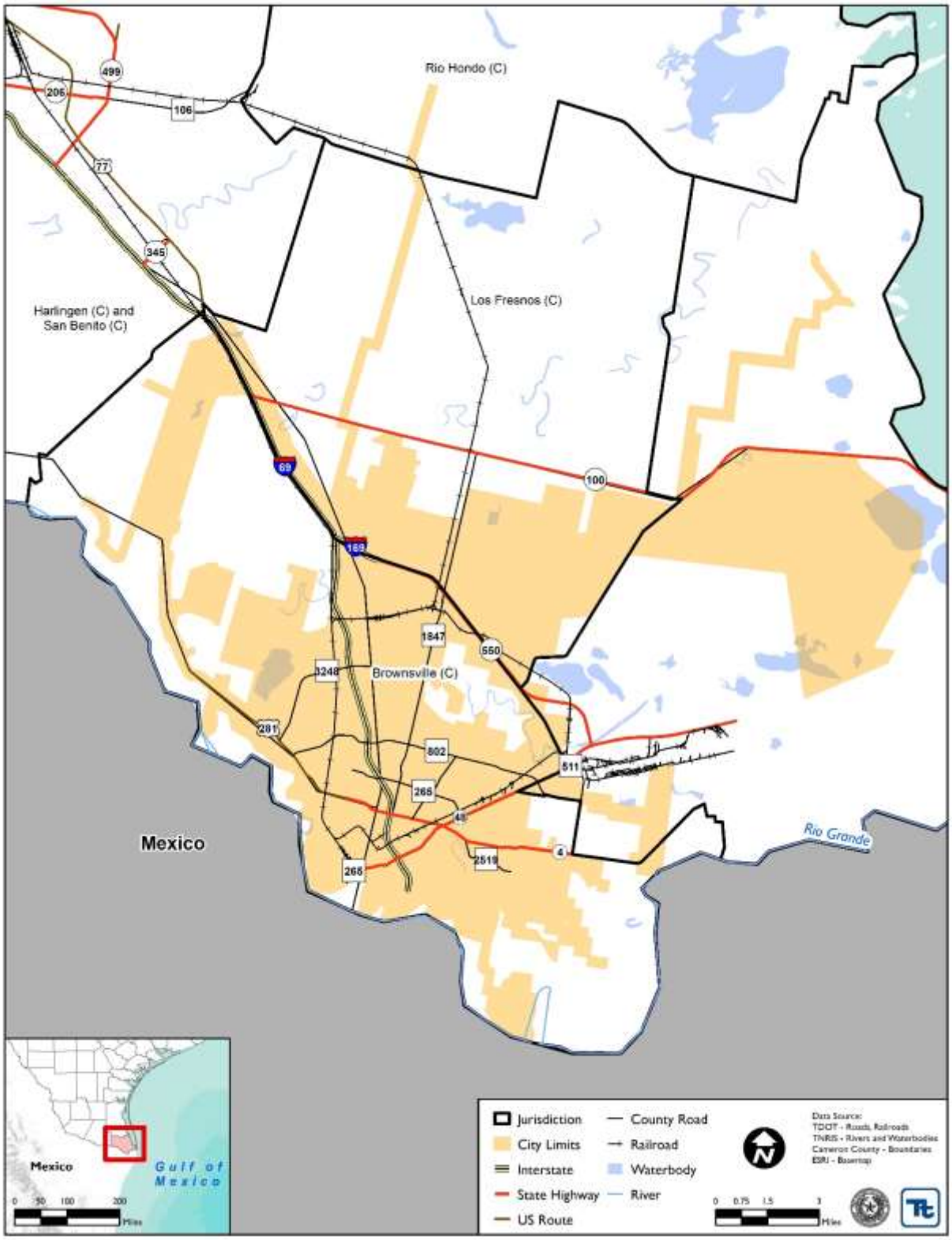
Under the charter, management, operation and control of the City's combined water, wastewater and electric utilities systems were delegated to the BPUB Board of Directors. The Board is composed of seven members: six appointed by the City Commission to four-year terms and the City's mayor serving as the seventh member (ex-officio).

By delivering exceptional electric, water and wastewater services to the Brownsville area, BPUB has set the standard as a customer-focused, municipally owned utility (MOU) offering reliable services the community can depend on. Today, BPUB is ranked as one of the largest MOUs in the state and country.

The City of Brownsville is the county seat of Cameron County. Located on the southernmost tip of Texas, on the northern bank of the Rio Grande, Brownsville is the largest city in the Rio Grande Valley. The City of Brownsville has nearly quadrupled its wealth in the past 15 years, with the port setting new records in 2020 (About Brownsville n.d., Seatrade Maritime News 2021). Across the Rio Grande lies Brownsville's sister City, Matamoros, Tamaulipas, Mexico. Brownsville has a rich history as it has served as a site for several battles in the American Civil War, the Mexican American War, and the Texas Revolution. Today, Brownsville acts as an important trade link between the United States and Mexico.

BPUB actively partners with the community through event sponsorships and employees that routinely volunteer to give back to the community. Most notably, BPUB participates in the City of Brownsville's annual Hurricane Awareness Fair promoting education, safety, and well-being of the community. BPUB is also represented by employees at community-wide events such as Relay for Life and March of Dimes. Local cultural events such as the Charro Days Parade and the Christmas Parade are both sponsored and participated in by BPUB.

Figure 3-1. BPUB and City of Brownsville Planning Area



3.2 Major Past Hazard Events

Presidential disaster declarations are issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government. No specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts operationalizes federal recovery programs to assist disaster victims, businesses and public entities. Programs can be matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and identify targets for risk reduction. Table 3-1 shows FEMA disaster declarations that have included Cameron County (including the Brownsville Public Utilities Board and the City of Brownsville) from 1967 through August 2021.

Table 3-1. History of FEMA Disaster Declarations in Cameron County, Texas

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-232-TX	September 28, 1967	September 28, 1967	Hurricane	HURRICANE BEULAH
DR-313-TX	September 18, 1971	September 18, 1971	Flood	HEAVY RAINS, HIGH WINDS & FLOODING
DR-627-TX	August 11, 1980	August 11, 1980	Hurricane	HURRICANE ALLEN
DR-696-TX	January 7, 1984	December 22-26, 1983	Freezing	SEVERE FREEZING WEATHER
DR-726-TX	October 2, 1984	September 16-18, 1984	Flood	SEVERE STORMS & FLOODING
DR-816-TX	October 5, 1988	September 15-17, 1988	Hurricane	HURRICANE GILBERT
DR-850-TX	January 9, 1990	December 21, 1989	Freezing	SEVERE FREEZE
DR-900-TX	April 12, 1991	April 5, 1991	Severe Storm(s)	SEVERE STORMS, TORNADOES & FLOODING
DR-1239-TX	August 26, 1998	August 22, 1998	Severe Storm(s)	TROPICAL STORM CHARLEY
DR-1287-TX	August 22, 1999	August 21, 1999	Hurricane	HURRICANE BRET
DR-1439-TX	November 5, 2002	October 24, 2002	Severe Storm(s)	SEVERE STORMS, TORNADOES AND FLOODING
EM-3171-TX	February 1, 2003	February 1, 2003	Other	LOSS OF THE SPACE SHUTTLE COLUMBIA
EM-3216-TX	September 2, 2005	August 29, 2005	Hurricane	HURRICANE KATRINA EVACUATION
EM-3261-TX	September 21, 2005	September 20, 2005	Hurricane	HURRICANE RITA
DR-1606-TX	September 24, 2005	September 23, 2005	Hurricane	HURRICANE RITA
DR-1624-TX	January 11, 2006	November 27, 2005	Fire	EXTREME WILDFIRE THREAT
EM-3277-TX	August 18, 2007	August 17, 2007	Hurricane	HURRICANE DEAN
EM-3284-TX	March 14, 2008	March 14, 2008	Fire	WILDFIRES
DR-1780-TX	July 24, 2008	July 22, 2008	Hurricane	HURRICANE DOLLY
EM-3290-TX	August 29, 2008	August 27, 2008	Hurricane	HURRICANE GUSTAV
EM-3294-TX	September 10, 2008	September 7, 2008	Hurricane	HURRICANE IKE
EM-3313-TX	June 29, 2010	June 27, 2010	Hurricane	TROPICAL STORM ALEX
DR-1931-TX	August 3, 2010	June 30, 2010	Hurricane	HURRICANE ALEX

Disaster Number	Declaration Date	Event Date	Incident Type	Title
DR-4245-TX	November 25, 2015	October 22, 2015	Severe Storm(s)	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND FLOODING
DR-4377-TX	July 6, 2018	June 19, 2018	Flood	SEVERE STORMS AND FLOODING
DR-4454-TX	July 17, 2019	June 24, 2019	Flood	SEVERE STORMS AND FLOODING
EM-3458-TX	March 13, 2020	January 20, 2020	Biological	COVID-19
DR-4485-TX	March 25, 2020	January 20, 2020	Biological	COVID-19 PANDEMIC
EM-3530-TX	July 26, 2020	July 25, 2020	Hurricane	HURRICANE HANNA
EM-3540-TX	August 24, 2020	August 23, 2020	Hurricane	TROPICAL STORMS MARCO AND LAURA
EM-3554-TX	February 14, 2021	February 11, 2021	Severe Ice Storm	SEVERE WINTER STORM
DR-4586-TX	February 19, 2021	February 11, 2021	Severe Ice Storm	SEVERE WINTER STORMS

Source: FEMA 2021

3.3 Physical Setting

This section presents the physical setting of the planning area, including land use/land cover, location, climate, hydrography and hydrology, topography and geology.

3.3.1 Location

The planning area is located in the Lower Rio Grande Valley on the western Gulf Coast in South Texas. It covers nearly 150 square miles and is adjacent to the border with Matamoros, Mexico.

3.3.2 Topography and Geology

The planning area terrain is generally flat with an elevation of almost 22 feet at the airport and approximately 33 feet in the downtown area. Floodplain deposits in the planning area from the lower course of the Rio Grande are dominantly mud and areas of silt and sand (Bureau of Economic Geology (BEG). Geologic Atlas of Texas 2014).

3.3.3 Hydrography and Hydrology

The Rio Grande River forms the southern boundary between Brownsville and Matamoros before it flows into the Gulf of Mexico (HNTB Corporation 2008). Its width and depth vary with seasonal changes and irrigation. Numerous resacas and creeks are located throughout the planning area. These are former channels of the Rio Grande River that have been cut off from the river. Resacas play an important role in water retention and detention, easing the effects of floodplain areas within the City (Imagine Brownsville Comprehensive Plan 2009). Some of the naturally occurring resacas have disappeared with land development but may be studied to evaluate environmental restoration to improve flood protection, enhance water storage, and ecosystem restoration (U.S. Army Corps of Engineers 2012).

3.3.4 Climate

The planning area has a semi-tropical climate. The city has an average temperature of 74 degrees and an average rainfall of 25.55 inches. Summer daytime temperatures are in the 90's. January is the coldest month of the year with an average temperature of 63 degrees. Average relative humidity is 75.25% (Brownsville Chamber of Commerce n.d.).

3.3.5 Land Use and Land Cover

See Figure 3-2 for a map of the existing land uses described in this section. Commercial uses follow the southern portions of Padre Island Highway, Boca China Boulevard, US 77/83, Central Boulevard, and in the center of the downtown area. Industrial uses include areas around the airport, shipping port and channel, and some northern portions of Padre Island Highway. Residential, primarily consisting of single-family detached homes, fill most of the remainder of the city. There are very few parks or public open spaces within the developed part of the planning area. Civic land use areas are primarily surrounded by residential uses (Imagine Brownsville Comprehensive Plan 2009). According to the Environmental Protection Agency, more than half of Brownsville land is covered by grass, agriculture, trees and forests, shrubs, and orchards (EPA EnviroAtlas 2018). Water, wetlands, impervious materials and soil make up the remainder of land cover. Much of the planning area is located in the Tamaulipan brushland, a collection of eleven distinct biotic communities that exist in the Lower Rio Grande Valley. The Sabal Palm Forest is one these biotic communities, the home of the two remaining large stands of Sabal Palms. Resaca de la Palma State Park encompasses 1,175 acres in the west area of Brownsville and includes woodlands and marsh vegetation along the resaca (HNTB Corporation 2008).

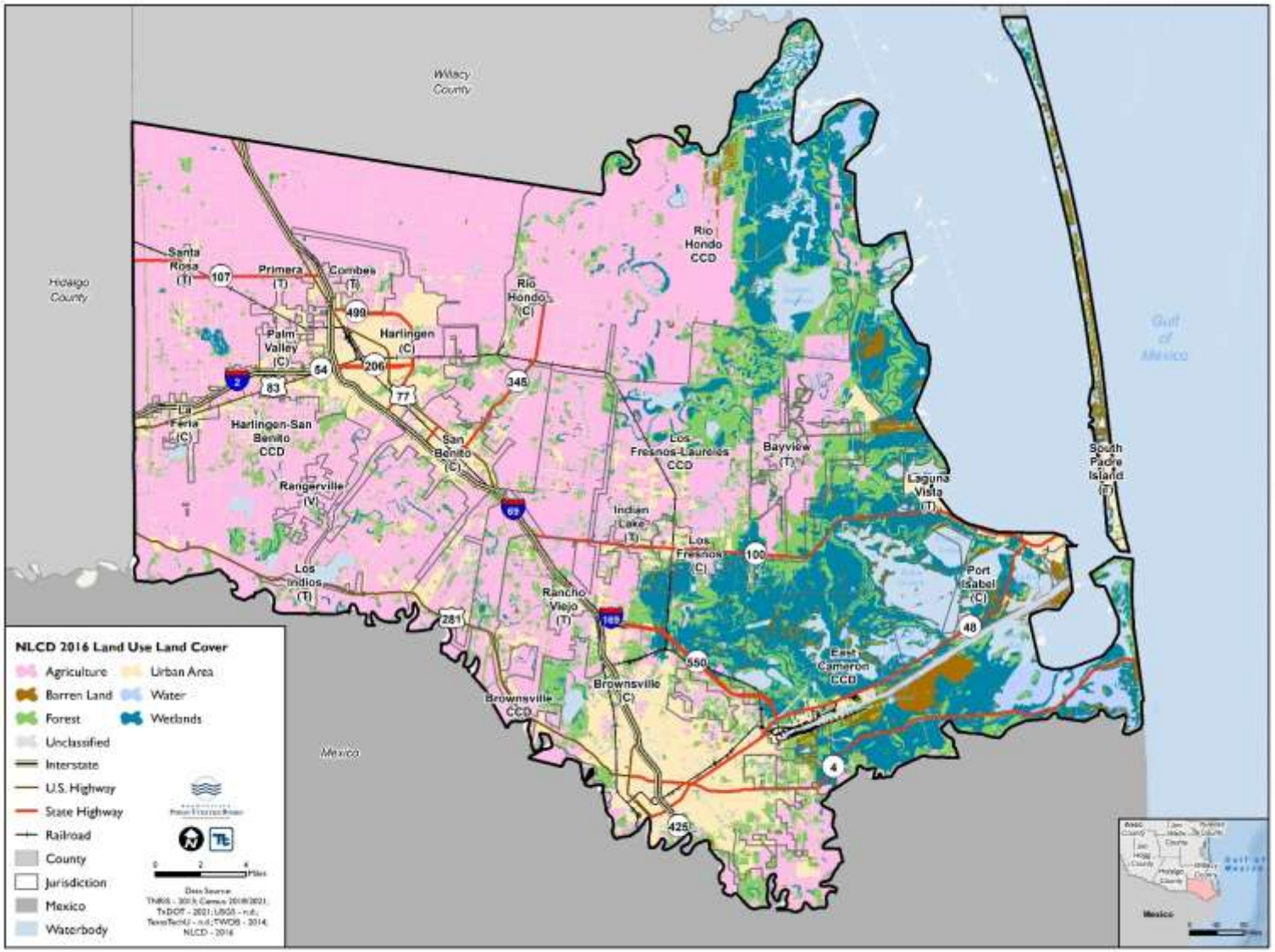
3.4 Population and Demographics

According to the 2019 American Community Survey, the City of Brownsville had a population of 186,738 people which represents an increase from the 2010 U.S. Census population of 175,023 people. HAZUS demographic data will be used in the loss estimation analyses in Section 4 of this plan. All demographic data in HAZUS corresponds to the 2010 U.S. Census data. Table 3-2 presents the population statistics for the City of Brownsville based on the 2000 and 2010 U.S. Census data. For the purposes of this plan, the 2010 Census was used where the data was available and supplemented with HAZUS data (representing 2010 data).

Table 3-2. Population Statistics in the BPUB Planning Area

Municipality	2000 Census	2010 Census	2019 ACS
Brownsville	163,961	175,023	182,271

Figure 3-2. Existing Land Use in Brownsville



3.4.1 Population and Demographic Trends

This section discusses population trends to use as a basis for estimating future changes that could result from the seasonal character of the population and significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to consider and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

The City of Brownsville experienced an increase in population between 1980 and 2020 by 83.3 percent or 84,910 people. The City continued to have population growth between 2010 and 2020 by 6.7 percent, or 11,715 people. Table 3-3 shows the rapid population growth the City of Brownsville has experienced.

Table 3-3. BPUB Planning Area Population Trends, 1980 to 2020

Year	Population	Change in Population	Percent (%) Population Change
1980	101,828	-	-
1990	128,232	26,404	25.9%
2000	163,961	35,729	27.9%
2010	175,023	11,062	6.7%
2020	186,738	11,715	6.7%

Source: U.S. American Community Survey 2019 (Five-Year)
Note: Change in population and percent in population change were calculated from available data.

Population estimates and projections are not available specifically for the planning area, but the Texas Demographic Center has produced population estimates for the region that were last updated in 2018 based on 2010 Census data. The estimates show a projected population growth of less than 1 percent between 2025 and 2030, then a projected population decrease of between 0.27 and 2.5 percent every five years from 2030 to 2050.

Table 3-4. Cameron County Population Projected Change, 2025 to 2050

Year	Population Projection	Change in Population	Percent (%) Population Change
2025	434,887	-	-
2030	438,143	3,256	0.75%
2035	436,976	-1,167	-0.27%
2040	431,963	-5,013	-1.15%
2045	423,859	-8,104	-1.19%
2050	413,140	-10,716	-2.5%

Source: Texas Demographic Center, 2018

3.4.2 Vulnerable Populations

DMA 2000 requires that HMPs consider socially vulnerable populations. Some populations are at greater risk from hazard events because of decreased resources or physical abilities. People living near or below the poverty line, the elderly, individuals with disabilities, women, children, ethnic minorities, and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary

from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability—such as disability, age, poverty, and minority race and ethnicity—often overlap in the geographically most vulnerable locations.

Table 3-5. BPUB Planning Area Vulnerable Population Statistics

	ACS 2019				2020 Census
Jurisdiction	Total	Pop. 65+	Pop. <5	Low-Income Pop.	Total
Brownsville	182,271	21,873	15,273	52,879	186,738

Source: American Community Survey 2019 (5-year estimates 2015-2019), 2020 Decennial Census

3.4.2.1 Income

Economically disadvantaged families have limited ability to absorb losses due to hazard impacts. Wealth enables families to absorb and recover from losses more quickly, due to insurance, savings, and often the availability of low-cost credit. People with lower incomes tend not to have access to these resources. At the same time, poorer families are likely to inhabit poor quality housing and reside in locations that are most vulnerable to hazard events. Economically disadvantaged neighborhoods are also likely to have relatively poor infrastructure and facilities, which exacerbate the disaster consequences for residents there. The City of Brownsville's median annual household income is estimated at $41,271 with over 28-percent of the total population identified as low income.

The spatial U.S. Census data for household income provided in HAZUS includes two ranges (less than $10,000 and $10,000-$20,000/year) that were totaled to provide the *low-income* data used in this study. This does not correspond exactly with the *poverty* thresholds established by the 2016 U.S. Census Bureau data. This difference is not believed to be significant for the purposes of this planning effort; therefore, for the exposure and loss estimations in the risk assessment, the 2010 U.S. Census data in Hazus is reported.

3.4.2.2 Physically or Mentally Disabled

Persons with disabilities or other access and functional needs are more likely to have difficulty responding to a hazard event than the general population. Family, neighbors, and local government are the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. Emergency managers need to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with access and functional needs allows emergency management personnel and first responders to anticipate the services needed by that population.

Nearly 11 percent of the population in the City live with at least one disability. Ambulatory disability (6.7 percent), followed by independent living difficulty (5.5 percent), and cognitive difficulty (4.6 percent), are the largest types of disability experienced by Brownsville residents.

3.4.2.3 Non-English Speakers

For populations with limited English proficiency, disaster communication may be difficult, especially in communities for whom translators and accurate translations of advisories may be scarce. Such households are likely to rely on relatives and local social networks (i.e., friends and neighbors) for information for preparing for a disaster event. About 5 percent of the population in the planning area does not speak English. Nearly 86 percent of the population speaks a language other than English at home. Among those, Spanish is the predominant language.

3.4.2.4 Age

Children, especially in the youngest age groups, often cannot protect themselves during a disaster because they lack the necessary resources, knowledge, or life experiences to effectively cope with the situation. People 65 years old and older are likely to require financial support, transportation, medical care, or assistance with ordinary daily activities, especially during disasters. They are more likely to be vision, hearing, and/or mobility impaired, more likely to experience mental impairment or dementia, and more likely to live in assisted-living facilities where emergency preparedness is at the discretion of facility operators. The needs of young and senior populations should be considered in hazard mitigation. According to the 2019 ACS, 8.2-percent (15,273) of the City's population is under the age of 5 and 11.7-percent (21,873) of the City's population is 65 years of age and older.

3.5 General Building Stock

The US Census data identifies 52,162 household units in Brownsville City. The U.S. Census Bureau defines household as all the persons who occupy a housing unit and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. The median value of owner-occupied housing units in Brownsville City was estimated at $90,000 in 2019 (American Community Survey 5-Year Estimates).

For this update, a customized general building stock was created using building footprints and parcel data from the City, which was supplemented with city provided data and 2021 RS Means replacement cost value for building and content replacement costs. Contents for residential structures are valued at 50-percent of the building's value. For non-residential facilities, the value of the contents are valued at 100-percent of the building's structural value.

The updated building inventory contains 202,224 buildings in Cameron County, which includes 78,873 in the City of Brownsville, with a total building replacement value (structure and content) of approximately $174.8 billion and $55.7 billion, respectively. This inventory was incorporated into Hazus at the structure and aggregate level. Approximately 81-percent of the buildings (164,421 buildings) and 45-percent of the building stock replacement value (approximately $78.7 billion) are associated with residential housing in the County. In Brownsville City, residential housing accounts for approximately 76-percent of buildings (6,0002) and 42-percent of the building stock replacement value ($23.6 billion). Commercial buildings make up the second building classification at approximately 49-percent of the total building replacement value in the county and 48-percent in the City.

Table 3-6. Number of Buildings and Improvement Value in Brownsville

Jurisdiction	Count	All Occupancies Estimated Structure RCV	Estimated Contents RCV	Total (structure + contents)
City of Brownsville	78,873	$31,479,854,233.91	$24,250,712,796.05	$55,730,567,029.96

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021

3.6 Land Use and Population Trends

Texas exhibits a limited type of home rule for municipalities that meet population thresholds. Pursuant to Title 7, Section 211 of Local Government Code, a home-rule municipality can regulate the bulk of buildings as well as land use. Zoning regulations are required to be consistent with a comprehensive plan per Section 211.004. To promote orderly development and make recommendations to City Council about land use, the City of Brownsville established a Planning and Zoning Commission in 1971.

This Hazard Mitigation Action Plan provides a general overview of population, land use, and types of development occurring within the study area. An understanding of these development trends can assist in planning for further development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

3.6.1 Land Use Trends

Brownsville does not currently have a Future Land Use Map, however examining existing land use patterns reveals basic trends based on zoning and on-site observations. Key policy objectives as stated in the 2009 Comprehensive Land Use Plan for Brownsville, Texas include three different types of modules:

1. **Node modules** are clusters of high intensity and greatly mixed uses, located at intersections of key roadways.
2. **Corridor modules** are linear areas that are located around key roadways in Brownsville.
3. **District modules** are larger areas that tend to be slightly more homogeneous and tailored toward uses as dictated by historic patterns, existing conditions, and/or environmental systems.

Withing these three main types of modules, 24 designated land use modules are summed up by the following initiatives:

1. **Downtown**—Significant residential and commercial development are anticipated in the downtown area.
2. **Regional Corridors**—Preserve the potential created by public investment in the Regional System.
3. **Regional Nodes**—Special planning district improvements and expansion.
4. **Local Corridors**—Infill development and lad assembly are included in this initiative.
5. **Local Nodes**—Transform the local system to encourage differentiation.
6. **Districts**—Provide for making progress withing the various Land Use Districts, including drainage improvements to the resacas.

7. **Applicable To All Modules In the Future Land Use Plan**—Implement initiatives related to all land use modules.

3.6.1.1 Economy

Much of the commercial land use in Brownville is not a significant source of revenue for the City due to low land and improvement values. A majority of commercial land uses are concentrated along existing major transportation corridors. Industrial areas are located around the airport, shipping port and channel, and some northern portions of Padre Island Highway (Imagine Brownsville Comprehensive Plan 2009).

3.6.1.2 Agriculture and Ranching

The Rio Grande Valley has a long agricultural and livestock history; however, these activities are limited within the Brownsville city limits. The areas within the city that are zoned for these activities are the West, Central, and East Emerging Districts which are currently rural and agricultural but have been designated for City expansion in the future. The northern and western reaches of Brownsville's ETJ (Extended Territorial Jurisdiction) are currently in agricultural use or undeveloped. This area is suitable for agricultural/ranch properties and large lot homes (Imagine Brownsville Comprehensive Plan 2009).

3.6.1.3 Corridors and Gateways

As both a border crossing and port, the planning area is an important gateway to Cameron County and other parts of Texas. Interstate 69 East is aligned with U.S. Route 77 and connects Brownsville to Corpus Christi. State Highways 4 and 48 align and have several local names within the planning area. As State Highway 48 leaves the Brownsville city limits, it is known as Brownsville-Port Isabel Highway. State Highway 550 is a toll road that connects the northern part of the planning area to the Port of Brownsville.

Interstate 69 East, extending from Brownsville to the Canadian border has been studied and under development for decades. When completed, it will connect trade between Mexico and Canada.

There are four border crossings in the Brownsville region that allow cross-border private and commercial movement.

Veterans International Bridge at Los Tomates - Since 1999, this is the primary commercial vehicle crossing in the Brownville region, processing all northbound trucks. The bridge is part of a designated "heavy truck corridor" that allows permitted, overweight trucks to travel between Mexico and the Port of Brownsville. The bridge also allows privately operated vehicles and pedestrians.

Gateway International Bridge - This bridge serves all southbound commercial and privately operated vehicles and pedestrian travel in both directions. The bridge is also a segment of the "heavy truck corridor" for southbound commercial vehicles.

Brownsville & Matamoros (B&M) Bridge - This is the only privately owned bridge in the Brownsville region. Since 1999, it only handles privately operated vehicles and pedestrians. Its adjacent rail bridge ceased handling rail cars in 2015.

Brownsville West Rail Bridge - In 2015, this bridge became the first new rail crossing on the Rio Grande River in more than 100 years. It is the only rain crossing serving the Lower Rio Grande Valley region.

Between 1996 and 2017, northbound truck crossings grew by 1% and northbound railway crossings grew by 75%. In 2017, 99 percent of imports and 83 percent of exports were via truck or railway transportation (Texas Department of Transportation 2018).

3.6.2 Future Growth and Development

To better understand how future growth and development in the BPUB service area and the City 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, the number of permits that have been issued throughout the County, and economic impacts.

Population projections from 2020 to 2050 are listed in Table 3-7, as provided by the Texas Demographic Center, State Demographer (Texas Demographic Center Population Projections 2018). This information is only available at the County level; however, the population projection shows an increase in population density for the County through 2030, which would mean overall growth for the planning area.

Table 3-7. Cameron County Population Projections

		2020		2030		2040		2050	
		Population							
COUNTY	LAND AREA	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)
Cameron	890.9	427,881	480.3	438,143	491.8	431,963	484.9	413,140	463.7

3.6.2.1 Building Permits

Building permits indicate what types of buildings are being constructed and their relative uses. Table 3-8 lists the number of residential building permits for the City of Brownsville that have been granted between 1996 and 2013 and the number of units permitted between 2014 and 2020. The data includes all sizes of family homes for reported permits, as well as the construction costs to show the potential increase in vulnerability of structures to the various hazards assessed in this risk assessment. The increase in vulnerability can be attributed to the higher construction costs that would be factored into repairing or replacing a structure using current market values.

Table 3-8 City Residential Building Permits

City of Brownsville			
Year	Buildings*	Units*	Construction Cost*
1996	795	1,292	$54,817,509
2000	1,615	1,763	$11,295,407
2005	1,492	1,666	$138,753,537
2010	589	600	$57,282,439
2011	612	613	$58,684,369
2012	602	634	$58,968,386
2013	601	657	$60,550,626
2014	-	1,417	$138,336,000
2015	-	1,285	$143,131,000
2016	-	1,569	$188,322,000
2017	-	1,245	$140,491,000
2018	-	1,487	$173,152,000
2019	-	1,817	$195,067,000
2020	-	1,904	$208,366,000

**Records from 2014 – 2020 are reported by the U. S. Census Bureau for the combined Brownsville-Harlingen statistical area and include the total number of individual units, not the number of buildings (Census.gov - Building Permits Survey n.d.).*

3.6.3 Economic Impacts

Building and maintaining infrastructure depends on the economy; therefore, protecting infrastructure from risk due to natural hazards in the planning area is equally important to both BPUB and the City of Brownsville. 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 mitigated from natural hazards in order to continue providing essential utility and emergency response services in a fast-growing planning area.

The City of Brownsville is home to the Brownsville Economic Development Council (BEDC), which helps companies establish or expand operations in the Brownsville area. The BEDC offers several forms of assistance to new businesses in the area such as financial, job training, and site location assistance. Other services including guidance through zoning and permits, identifying potential suppliers, and setting appointments with appropriate community leaders are also offered. The Brownsville Economic Development Council has four main goals: Economic Performance, Operational Efficiency, Institutional Effectiveness, and Regional Competitiveness.

The major employers in the area are critical to the health of the economy. According to the Brownsville Economic Development Council, the major employers of the area include: Brownsville Independent School District, Caring for You Home Health, Cameron County, University of Texas at Brownsville, Keppel Amfels, City of Brownsville, Abundant Life Home Health, Wal-Mart, H-E-B Grocery, and Valley Regional Medical Center.

The transportation connectivity of the City of Brownsville is also important. The planning area is served by Interstate Highway 69 East to Kingsville/Corpus Christi, U.S. Route 83 to Harlingen, and U.S. Route 281 to Pharr, Texas State Highway 550, Texas State Highway 4 to Boca Chica State Park, Texas State Highway 48 to Port Isabel. Brownsville also has three international bridges: Brownsville & Matamoros International Bridge, Gateway International Bridge, and Veteran's International Bridge. One of the regional mitigation actions considered by BPUB Plan Participants is a second bridge connecting Cameron County with South Padre Island. This new bridge would be key to evacuating island residents and tourists during hurricane events.

3.7 Critical Facilities and Community Lifelines

Critical infrastructure and facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. Critical facilities are those that maintain essential and emergency functions and are typically defined to include police and fire stations, schools, and emergency operations centers. Critical infrastructure can include the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, electricity, and communication services to the community. Also included are Tier II facilities (hazardous materials) and rail yards; rail lines hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event.

Critical Facilities are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities, and essential facilities

Essential facilities are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. For the risk assessment, this category was defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.

Lifelines enable the continuous operation of critical business and government functions and are essential to human health and safety or economic security.

Beginning in 2017, FEMA developed a new construct to increase effectiveness for disaster operations and position response to catastrophic incidents. This construct, known as "community lifelines", represents the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into seven categories which include:

- Safety and Security
- Food, Water, Shelter
- Health and Medical
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

To facilitate consistency with the National Response Framework, FEMA Strategic Plan, and guidance for the Building Resilient Infrastructure and Communities (BRIC) grant program, critical facilities in the Planning Area are discussed in terms of lifelines.

A comprehensive inventory of critical facilities and lifelines in the Planning Area was developed from various sources including input from the Planning Team. The inventory of critical facilities presented in this section represents the current state of this effort at the time of publication of the HMP and was used for the risk assessment in Section 4 (Risk Assessment).

3.7.1 Safety and Security

This section provides information on Safety and Security lifelines. Components of this lifeline category include law enforcement/security, fire services, search and rescue services, government services, and community safety (e.g. dams). The Planning Team identified 111 safety and security lifelines in the planning area. Refer to Figure 3-3 which shows the location of the Safety and Security lifelines.

3.7.1.1 Emergency Services

For the purpose of this HMP, emergency services include police, fire, EMS, and emergency operations centers. There are 14 emergency service facilities in the Planning Area including: nine fire stations, one EOC, and four police stations.

3.7.1.2 Schools

The Planning Area contains 59 primary education facilities, 27 secondary education facilities, and 5 post-secondary education facilities.

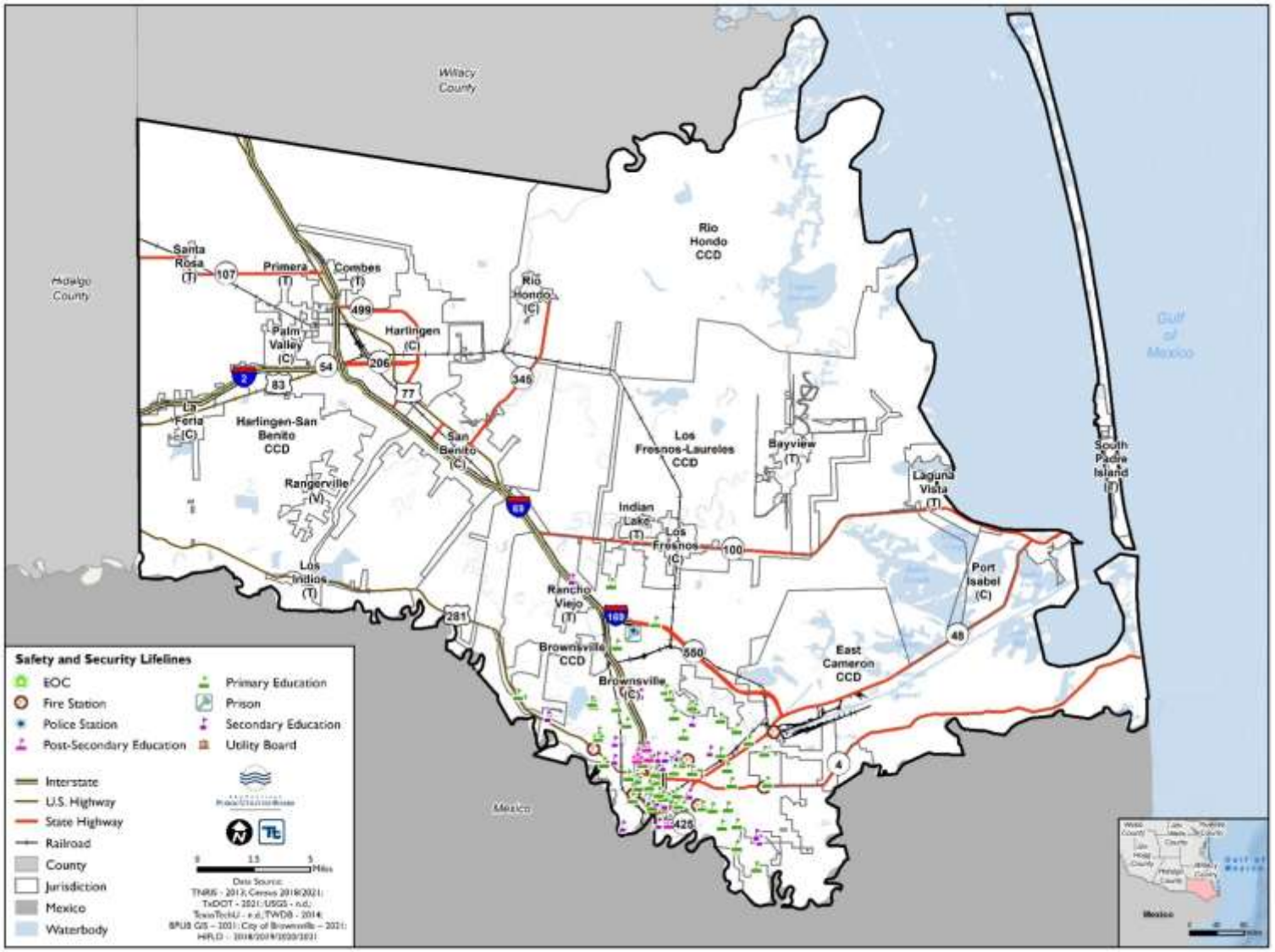
3.7.1.3 Government Services

The government services identified for this plan include five prisons.

3.7.1.4 Other Safety and Security Lifelines

The Brownsville Utilities Board SCADA (Supervisory Control and Data Acquisition) Department facility is also identified as a safety and security lifeline.

Figure 3-3. Safety and Security Lifelines



3.7.2 Food, Water, Shelter

Food, Water, and Shelter lifelines include facilities pertaining to food supply (distribution facilities, programs, and supply chain), water supply (including both potable and wastewater systems), shelter (housing and hotels), and agricultural facilities. The Planning Team identified 233 food, water, and shelter lifelines in the planning area. Figure 3-4 shows the food, water, and shelter lifelines in the Planning Area.

3.7.2.1 Food

Food supply includes commercial food distribution, commercial food supply chains, and food distribution programs. Numerous grocery stores, including large chain stores and small farmer's markets are located in the area. In addition, there are multiple locations throughout the planning area that provide food and meals to residents in need.

3.7.2.2 Water

Potable Water

There are seven potable water facilities, four potable water pumps, six potable water tanks, and 19 potable water wells in the planning area, all operated by BPUB.

Wastewater Facilities

The planning area contains 193 wastewater lift stations and 2 treatment plants maintained by BPUB.

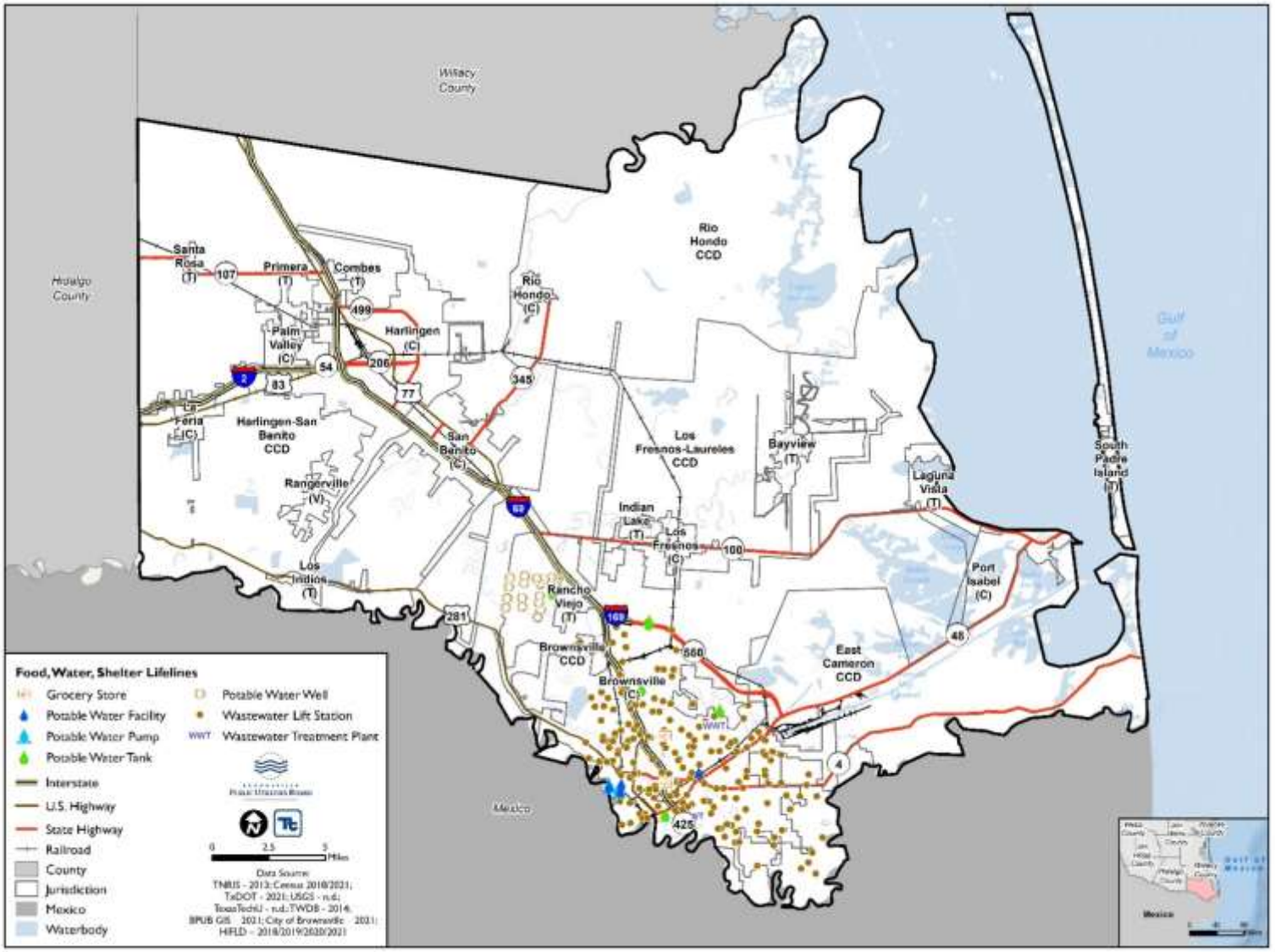
3.7.2.3 Shelter

Emergency shelters were not identified in this planning effort; however, dozens of hotels are located throughout the planning area.

3.7.3 Health and Medical

Health and medical lifelines include: medical care (e.g., hospitals, pharmacies, long-term care facilities), patient movement (e.g., EMS), fatality management, public health, and medical supply chain. The Planning Team identified 22 health and medical lifelines in the Planning Area. This includes four medical centers, five hospitals, four EMS providers, and nine nursing homes. Figure 3-5 illustrates the health and medical facility locations in the Planning Area.

Figure 3-4. Food, Water, and Shelter Lifelines



3.7.4 Energy (Power & Fuel)

The energy (power and fuel) lifeline includes facilities pertaining to the power grid and fuel supplies. The Planning Team identified 81 energy lifelines in the planning area. Figure 3-6 shows the energy lifelines in the Planning Area.

3.7.4.1 Power (Grid)

The Planning Area contains 35 generators, 32 substations, one electric generating plant, and one natural gas power plant.

3.7.4.2 Fuel

Twelve oil/natural gas wells are located in the Planning Area.

3.7.5 Communications

Communication lifelines include facilities pertaining to infrastructure; alerts, warnings, and messages; 911 and dispatch; responder communications; and finance. The Planning Team identified 42 communication lifelines in the Planning Area. Figure 3-7 shows the communication facilities in the Planning Area.

3.7.5.1 Infrastructure

Eight communication towers are located throughout the Planning Area.

3.7.5.2 Alerts, Warnings, and Messages

CodeRED is the community alert emergency notification system managed by the Cameron County Emergency Communications District (CCECD). Alerts are sent out via phone, text, email, and social media.

3.7.5.3 911 and Dispatch

The City of Brownsville provides 911 emergency dispatching services.

3.7.5.4 Finance

The Planning Area has 34 banks.

Figure 3-5. Health and Medical Lifelines

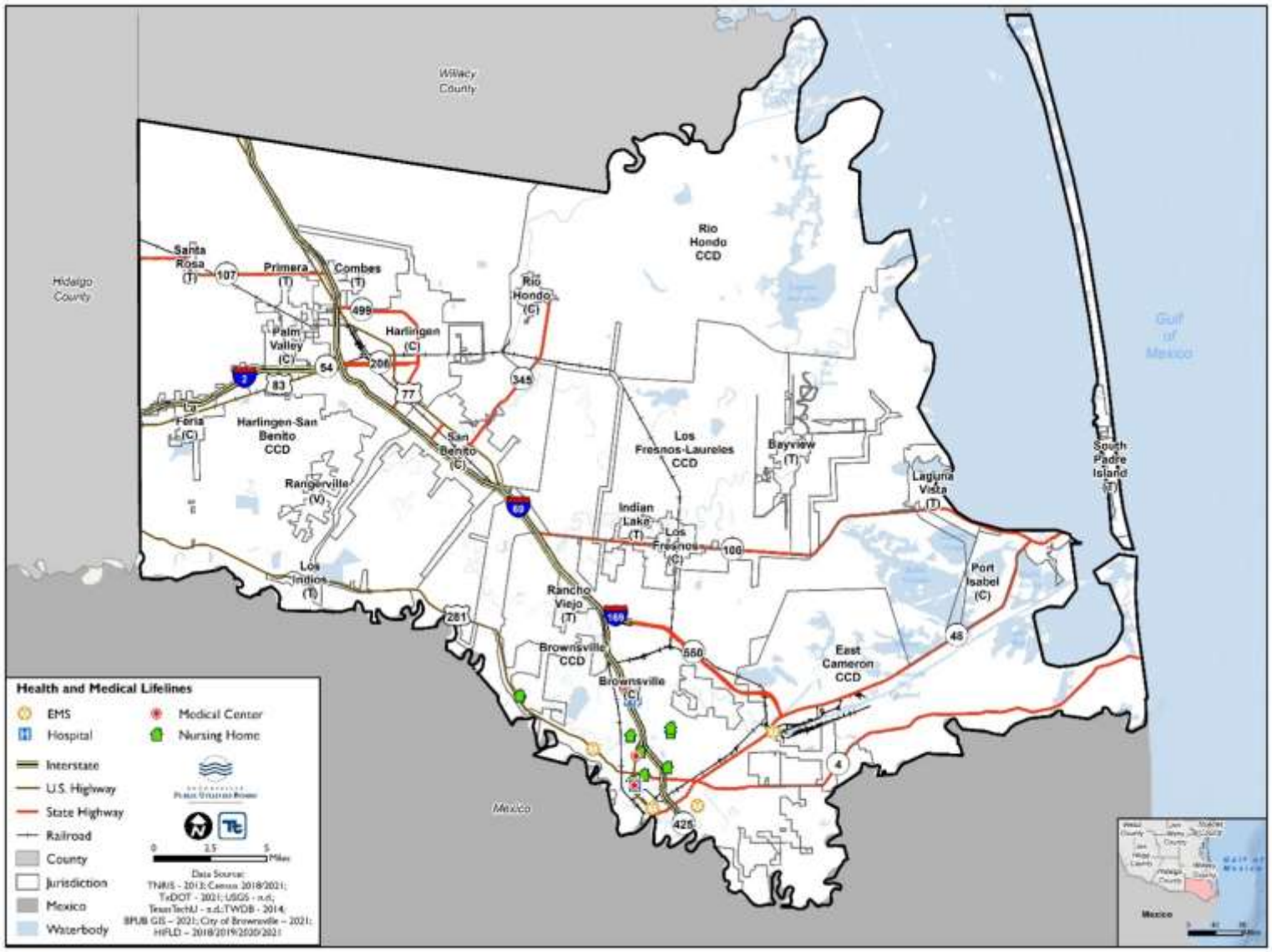


Figure 3-6. Energy Lifelines

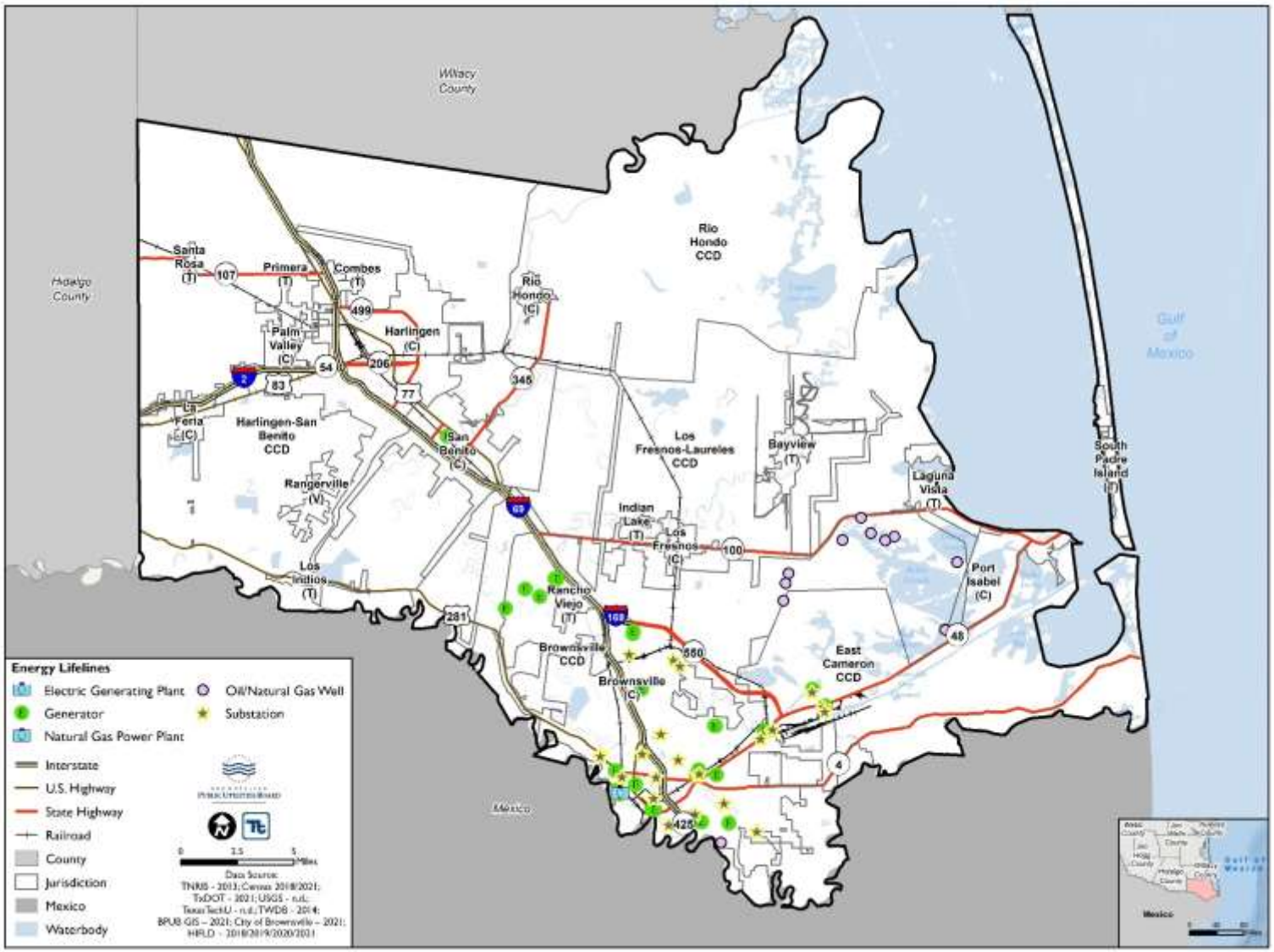
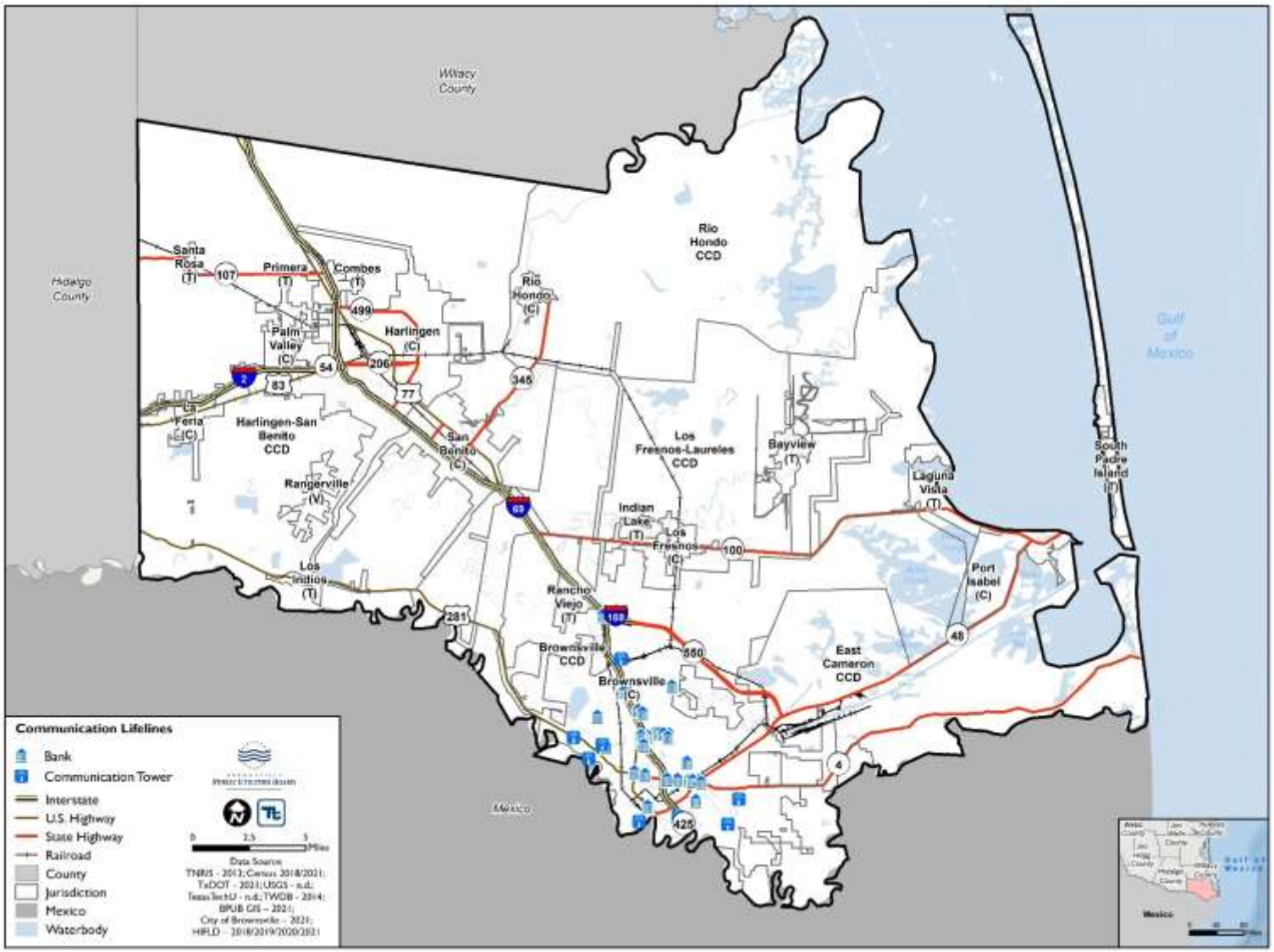


Figure 3-7. Communication Lifelines



3.7.6 Transportation

Transportation lifelines include facilities pertaining to highways/roadways, mass transit, railway, aviation, and maritime. The Planning Team identified eleven transportation lifelines in the Planning Area. Figure 3-8 illustrates the transportation lifelines in the Planning Area.

3.7.6.1 Highway/Roadway

The City of Brownsville contains more than 500 miles of paves roads in fair to good condition (City of Brownsville 2022). Major highways in the planning area include Interstate 69E/U.S. Route 77/83, State Highways 4, 48, 550, U.S. Route 281.

3.7.6.2 Mass Transit

There are multiple public transportation providers in the planning area including fixed-route bus services, ADA paratransit services and taxis. One bus terminal is identified in the Planning Area.

3.7.6.3 Railway

There are nine railroad bridges.

3.7.6.4 Aviation

There is one airport located in the City of Brownsville. The Brownsville South Padre Island International Airport serves as a strategic port of entry and serves international, domestic, corporate, and general aviation operators.

3.7.6.5 Maritime

The Port of Brownsville is the only deep water port located on the U.S.-Mexico border and is the largest land-owning public port authority in the nation with approximately 40,000 acres.

3.7.7 Hazardous Materials

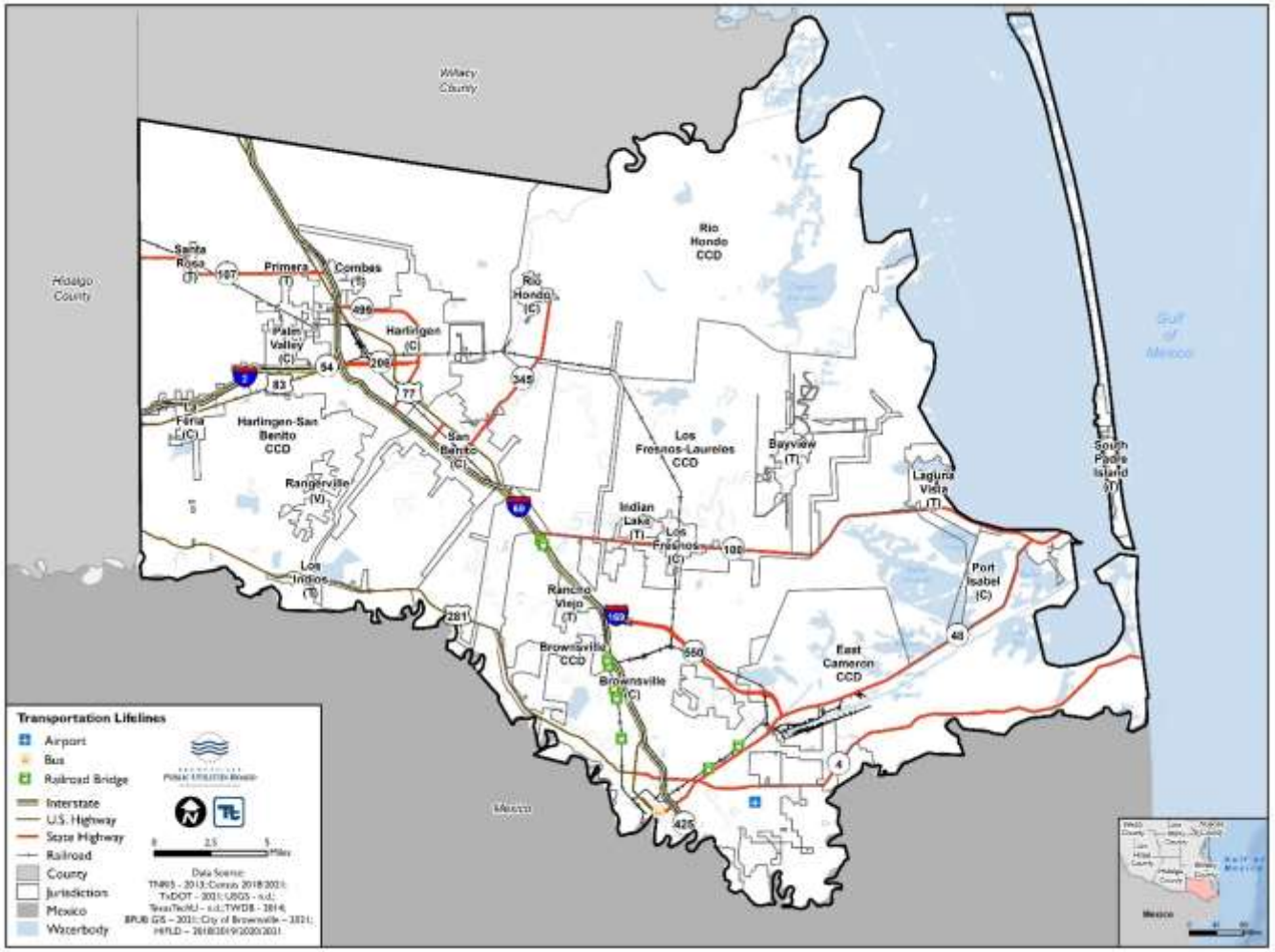
The hazardous material lifeline includes facilities pertaining to facilities containing hazardous materials and HAZMAT/pollutants/containments. The Planning Team did not identify hazardous material lifelines in the planning area.

3.7.7.1 Facilities

A Superfund site consists of land in the United States that has been contaminated by hazardous waste and identified by the U.S. Environmental Protection Agency (EPA) as a candidate for cleanup because it poses a risk to human health or the environment. These sites are placed on the National Priorities List (NPL), the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide EPA in determining which sites warrant further investigation.

Abandoned hazardous waste sites placed on the federal NPL include those that EPA has determined present a significant risk to human health or the environment, with the sites being eligible for remediation under the Superfund Trust Fund Program. As of February 2022, there are no Superfund sites located in or around the Planning Area (EPA 2021).

Figure 3-8. Transportation Lifelines



4.1 Identification of Hazards of Concern

To provide a strong foundation for mitigation actions considered in Sections 6 (Mitigation Strategy), the Planning Team focused on considering a full range of hazards that could impact the area and then identified and ranked those hazards that presented the greatest concern. The hazard of concern identification process incorporated input from the Planning Team; review of the State of Texas Hazard Mitigation Plan (2019); review of the 2015 BPUB HMP; research and local, state, and federal information on the frequency, magnitude, and costs associated with the various hazards that have previously, or could feasibly, impact the region; and qualitative or anecdotal information regarding natural (not manmade) hazards and the perceived vulnerability of the study area's assets to them. Table 4.1-1 documents the process of identifying the natural hazards of concern for further profiling and evaluation. Specific hazards not identified as a hazard of concern for the Planning Area will not be further discussed in detail.

4.1.1 Changes from the 2015 Hazard Mitigation Plan

Since the development of the last plan, hazards and disasters not assessed in the prior plan have occurred in the Planning Area. These hazards were identified by stakeholders as areas to address in the plan. One hazard was removed due to its nonexistence in the Planning Area.

The prior plan did not address disease outbreak as a hazard of concern. Beginning in March 2020, the Planning Area was hit with the COVID-19 pandemic along with the rest of the world. As of September 24, 2021, there were 9,872 confirmed cases in Cameron County.

The prior plan only addressed coastal and riverine flooding, but this update also addresses flash flooding and urban/stormwater flooding.

The prior plan did not address erosion as a stand-alone hazard. This update includes coastal and inland erosion in the erosion hazard profile.

The prior plan did not address lightning as a stand-alone hazard. This update includes lightning as a hazard of concern.

The prior plan addressed earthquake as a hazard. The Planning Team agreed that the earthquake risk is nonexistent and should not be included in this update.

The 2022 Brownsville Public Utilities Board Hazard Mitigation Plan Update includes best available data throughout the plan to present an updated understanding the Planning Area's risk.

4.1.2 Hazard Groupings

As per the 2015 BPUB HMP, the Planning Team maintained the grouping of hazards based on the similarity of hazard events, typical concurrence or impacts, consideration of how hazards have been grouped in FEMA guidance documents (*FEMA 386-2 Understanding Your Risks, Identifying Hazards and Estimating Losses*; *Multi-*

Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy; *Local Mitigation Planning Handbook*), and consideration of hazard grouping in the State of Texas HMP.

The *Dam and Levee Failure* profile addresses dam/levee failures that may impact the Planning Area.

The *Disease Outbreak* hazard profile addresses diseases with the potential to impact the Planning Area, including the novel coronavirus (COVID-19), West Nile Virus, and Influenza.

The *Drought* hazard profile specifically addresses drought events that occurred in the Planning Area.

The *Erosion* profile addresses coastal and inland erosion associated with water that may occur in the Planning Area.

The *Extreme Heat* hazard profile specifically addresses periods of extreme heat that occurred in the Planning Area.

The *Flood* hazard includes riverine, flash flooding, coastal and stormwater flooding. Inclusion of the various forms of flooding is consistent with that used in FEMA's *Multi-Hazard Identification and Risk Assessment* guidance.

The *Hail* hazard profile specifically addresses hail events that occurred in the Planning Area.

The *Hurricane and Tropical Storm* profile addresses hurricanes and tropical storms that occurred in or impacted the Planning Area.

The *Lightning* hazard profile specifically addresses lightning events that occurred in the Planning Area.

The *Thunderstorm Wind* hazard profile specifically addresses thunderstorm events that occurred in the Planning Area.

The *Tornado* hazard profile specifically addresses tornado events that occurred in the Planning Area.

The *Wildfire* profile addresses wildfire events that may impact the Planning Area.

The *Winter Weather* profile includes heavy snow, blizzards, and ice storms. This grouping is consistent with the State of Texas HMP.

Table 4.1-1. Identification of Hazards of Concern for the Planning Area

Hazard	Description
Dam & Levee Failure	• The 2018 State of Texas HMP includes dam/levee failure as a hazard of concern for the State. • According to the National Inventory of Dams, there are 13 dams and levees in the Planning Area. Only two of them have hazard classifications which are both considered low hazard dams. • There have been no reported dam or levee incidents in the Planning Area. • Dam and levee failure was identified as a hazard of concern for the Planning Area.
Disease Outbreak	• The Planning Area has experienced two separate public health events since 2003. These include West Nile Virus and COVID-19. • At the time of this plan's writing, COVID-19 continues to impact public health both locally and globally.
Drought	• Cameron County was the subject of seven USDA declarations for drought that occurred between 2012 and 2021. • Due to the history of occurrence and the impacts drought can have, drought was identified as a hazard of concern for the Planning Area.
Erosion (Coastal and Inland)	• Inland and coastal erosion are identified as hazards of concern in the 2018 State of Texas Hazard Mitigation Plan; however, they were profiled individually. • Erosion is common along the resacas and other inland and coastal waterways. • The coastal and inland erosion hazard is identified as a hazard of concern for the Planning Area.
Extreme Heat	• Extreme heat was identified as a hazard of concern in the State of Texas HMP. • Cameron County has been impacted by seven heat events between 2008 and 2021. • Cameron County has experienced extreme heat events and will continue to experience them in the future. Therefore, extreme heat was identified as a hazard of concern for the Planning Area.
Flood	• Riverine and coastal flooding are identified as hazards of concern in the 2018 State of Texas Hazard Mitigation Plan; however, they were profiled individually. • 30 flood events have been identified as occurring in the Planning Area since 1954. The flood events have resulted in four FEMA disaster declarations. • As of September 2021, there are 3,262 flood insurance policies in force and claims that have totaled over $8.2 million since 1978. • The State HMP indicated that Cameron County is located in one of the storm surge basins and has a large percentage of land inside the SFHA. The Planning Area will continue to experience flood events. • Based on the history of events and losses, flooding was identified as a hazard of concern for the Planning Area.
Hail	• Hailstorms were identified as a hazard of concern in the 2018 Texas State Hazard Mitigation Plan. • Cameron County was not subject to a hail-related major disaster/emergency declaration; however, the Planning Area has been subject to five hail events reported to NOAA-NCEI since 1993, resulting in $50 million of property damage. • Hail was identified as a hazard of concern for the Planning Area.
Hurricane & Tropical Storm	• Hurricanes and tropical storms were identified as a hazard of concern in the 2018 State Hazard Mitigation Plan. • Cameron County was included in 12 of 29 hurricane-related FEMA major disaster and emergency declarations. Since 1954, there have been 15 tropical storm/hurricane events affecting the Planning Area.

Hazard	Description
	• Based on history of occurrences and losses, the hazard was identified as a hazard of concern for the Planning Area.
Lightning	• Lightning was identified as a hazard of concern in the 2018 State Hazard Mitigation Plan. • Lightning is a somewhat frequent occurrence in the Planning Area. However, based on available data, there have been only three reported events since 1996. • The hazard was identified as a hazard on concern for the Planning Area.
Thunderstorm Wind	• Severe Winds were identified as a hazard in the State Hazard Mitigation Plan. • For this plan, Severe Winds were included as part of the Thunderstorm Wind hazard. • Cameron County has not been subject to any thunderstorm-related major disaster declarations; however, 21 known thunderstorm wind events have impacted the City of Brownsville between 1950 and 2020. • The hazard was identified as a Hazard of Concern for the Planning Area.
Tornado	• The Texas State Hazard Mitigation Plan identified tornadoes as a state hazard of concern. • Cameron County has been included in three tornado-related FEMA disaster declarations. Four tornado events have been recoded in the Planning Area since 1996 causing almost $300,00 in property damage. • The tornado hazard was identified as a hazard of concern for the Planning Area.
Wildfire	• The Texas State Hazard Mitigation Plan identified wildfires as a state hazard of concern. • While wildfires have occurred in the Planning Area, there is insufficient data on losses and no record of impacts from wildfires. • The wildfire hazard was identified as a hazard of concern for the Planning Area.
Winter Weather	• Winter weather was identified as a hazard of concern in the State Hazard Mitigation Plan. • Six recorded events between 2004 and 2021 have resulted in property damages in the tens of thousands of dollars. • The hazard was identified as a hazard of concern for the Planning Area.

4.2 Methodology and Tools

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- Hazard identification—Use all available information to determine what types of hazards may affect a jurisdiction, how often they can occur, and their potential severity.
- Exposure identification—Estimate the total number of people and properties in the jurisdiction that are likely to experience a hazard event if it occurs.
- Vulnerability identification and loss estimation—Assess the impact of hazard events on the people, property, environment, economy and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this hazard mitigation plan update evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the Disaster Mitigation Act (44 CFR, Section 201.6(c)(2)).

To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

4.2.1 Risk Assessment Tools

4.2.1.1Mapping

National, state, county, and local databases were reviewed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of hazards when such datasets were available. These maps are included in the hazard profile chapters of this document.

4.2.1.2 Hazus

In 1997, FEMA developed the standardized Hazards U.S. (Hazus) model to estimate losses caused by earthquakes and identify areas that face the highest risk and potential for loss. Hazus was later expanded into a multi-hazard methodology with new models for estimating potential losses from hurricanes and floods.

Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data, such as demographics, building stock, critical facility, transportation and utility lifeline, and multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.

- Provides a way to save data so that they can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Level of Detail for Evaluation

Hazus provides default data for inventory, vulnerability, and hazards; these default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- Level 1—All of the information needed to produce an estimate of losses is included in the software's default data. These data are derived from national databases and describe in general terms the characteristic parameters of the planning area.
- Level 2—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- Level 3—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

4.2.2 Risk Assessment Approach

The risk assessments in this plan describe the risks associated with each hazard of concern identified. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
  - Warning time likely to be available for response.
- **Determine exposure to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Tools such as GIS and FEMA's hazard-modeling program Hazus were used for this assessment for the flood and hurricane hazards. Outputs similar to those from Hazus were generated for other hazards, using data generated through GIS.

4.2.2.1 Flood and Hurricane

The following hazards were evaluated using Hazus.

Flood

The 1-percent and 0.2-percent chance flood events were examined to evaluate the Brownsville Public Utilities Board and City of Brownsville's risk and vulnerability to the flood hazard.

The service area for the Brownsville Public Utilities Board and the geographic location of the City of Brownsville is located in Cameron County, Texas. Therefore, the effective FEMA Digital Flood Insurance Rate Map (DFIRM) dated February 16, 2018 for Cameron County was used to evaluate potential future losses caused by the 1-percent and 0.2-percent annual chance flood events. These flood events are generally those considered by planners and evaluated under federal programs such as the NFIP.

The coastal flood risk area for the 1-percent annual chance flood event was published on the FEMA map service center September 2015. The 2015 coastal flood risk area was used to divide the AE zones in the 2019 effective DFIRMs into coastal and riverine AE zones. The coastal AE zones were merged with 2019 VE zones to create the coastal flood hazard boundary, which was used to create the coastal depth grids for the 1-percent annual chance flood event. The riverine AE zones were merged with the AO and A zones to create the 1-percent annual chance flood event riverine depth grid. The final coastal and riverine depth grids were processed using a 2018 USGS 1-meter resolution Digital Elevation Model (DEM). These depth grids were integrated into the Hazus v5.0 riverine and coastal flood models used to estimate potential losses for the 1-percent annual chance flood event.

A Level 2 Hazus riverine and coastal flood analysis was performed. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the Hazus riverine and coastal flood model was run to estimate potential losses for the Brownsville Public Utilities Board and the City of Brownsville for the 1-percent annual chance flood event. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2010 U.S. Census data), potential damages to the general building stock, and potential damages to critical facility inventories based on the depth grids generated and the default Hazus damage functions in the flood model. Furthermore, social impacts and debris were estimated by Hazus at the census block level. These results were presented at the municipal level. Since there are multiple census blocks that contain more than one jurisdiction, a density analysis was used to extract the percent of building structures that fall within each block and jurisdiction. The percentage was multiplied against the results calculated for each block and summed for each municipality.

Hurricane

A Hazus probabilistic analysis was performed to analyze the wind hazard losses caused by the 100- and 500-year mean return period events for the Brownsville Public Utilities Board and the City of Brownsville. The probabilistic Hazus hurricane model activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated

with the risk assessment area. Hazus contains data on historic hurricane events and wind speeds. It also includes surface roughness and vegetation (tree coverage) maps for the area. Surface roughness and vegetation data support the modeling of wind force across various types of land surfaces. Default demographic and updated building and critical facility inventories in Hazus were used for the analysis. Although damages are estimated at the census tract level, results were presented at the municipal level which covers the service area extent of the Brownsville Public Utilities Board and the City of Brownsville. Since there are multiple census tracts that contain more than one jurisdiction, a density analysis was used to extract the percent of building structures that fall within each tract and jurisdiction. The percentage was multiplied against the results calculated for each tract and summed for each municipality.

4.2.2.2 Coastal and Inland Erosion

Best available data was used to assess the Brownsville Public Utilities Board and City of Brownsville vulnerability to coastal and inland erosion. Asset data (population, building stock, critical facilities, and new development) were used to support an evaluation of potential impacts and losses. To help understand the geographic distribution of assets at risk to coastal erosion, a 100-foot buffer was created from NOAA's 2011 shoreline. The inland erosion hazard area was determined using Cameron County's USDA's Natural Resources Conservation Service's 2020 soil data, which represents the service area for the Brownsville Public Utilities Board and contains the City of Brownsville. Soils with an erodibility factor (k) of 0.49 or greater were extracted to assess risk to inland erosion. To determine what assets are at risk to coastal and inland erosion, the centroids of these assets located in the hazard area were totaled to estimate the number of persons, buildings, and facilities at risk to impacts from coastal and inland erosion.

4.2.2.3 Sea Level Rise: 1-foot Increments

Projected sea-level rise data (in one-foot increments) available from the NOAA Office of Coastal Management (https://coast.noaa.gov/slrdata/) was considered and used for this analysis to understand the Brownsville Public Utilities Board and City of Brownsville's risk to sea level rise (refer to Section 4.3.6 – Flood). Please note these levels do not include additional storm surge due to a hurricane or Nor'easter. The current Flood Insurance Rate Maps (FIRMs) also do not include the effects of sea-level rise. To assess the Brownsville Public Utilities Board and City of Brownsville's risk to sea level rise, the 2017 NOAA 1-foot, 2-feet, 3-feet, and 4-feet sea level rise hazard areas were referenced.

Asset data (population, building stock, critical facilities and lifelines, and new development) were used to support an evaluation of assets exposed and potential impacts and losses. To determine what assets are vulnerable to sea-level rise, the assets for the Brownsville Public Utilities Board and City of Brownsville were overlaid with the hazard area. Assets with their centroid located in the hazard area were totaled to estimate the number of persons, buildings, and facilities at risk to impacts from sea-level rise.

4.2.2.4 Severe Winter Weather

All of the assets for the Brownsville Public Utilities Board and the City of Brownsville (population, buildings, and environment) are exposed and vulnerable to the winter storm hazard. In general, structural impacts include

damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. A percentage of the custom-building stock structural replacement cost value was utilized to estimate damages that could result from winter storm conditions (i.e., 1-percent, 5-percent, and 10-percent of total replacement cost value). Given professional knowledge and currently available information, the potential losses for this hazard are considered to be overestimated; hence, providing a conservative estimate for losses associated with winter storm events.

4.2.2.5 Storm Surge: Categories 1-4

Storm surge hazard data available from the NOAA was considered and used for this analysis to understand the Brownsville Public Utilities Board and City of Brownsville's risk to hurricane storm surge (refer to Section 4.3.9 – Hurricane). This risk assessment used NOAA's 2014 Sea Lake Overland Surge from Hurricanes (SLOSH) data to analyze the risk to impacts from hurricane storm surge. SLOSH represents potential flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide were used to estimate exposure. Please note these inundation zones do not include riverine flooding caused by hurricane surge or inland freshwater flooding. The model, developed by the NOAA National Hurricane Center to forecast surges that occur from wind and pressure forces of hurricanes, considers only storm surge height and does not consider the effects of waves. The SLOSH spatial data includes boundaries for Category 1 through Category 4 hurricane events.

To estimate exposure to the SLOSH Category 1 through Category 4 flood hazard areas, the spatial flood hazard boundaries were overlaid on centroids of updated assets (population, building stock, critical facilities and lifelines, and new development). Centroids that intersected the hazard areas were totaled to estimate the building replacement cost value and population vulnerable to the storm surge inundation areas.

4.2.2.6 Wildfire

The Wildfire-Urban Interface (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin – Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For this risk assessment, the high-, medium-, and low-density interface areas were combined and used as the "Interface" hazard area, and the high-, medium-, and low-density intermix areas were combined and used as the "Intermix" hazard areas.

Asset data (population, building stock, critical facilities, and new development) were used to support an evaluation of assets exposed and potential impacts and losses. To determine what assets are at risk to impacts from wildfires, the assets for the Brownsville Public Utilities Board and the City of Brownsville were overlaid with the hazard area. Assets with their centroid located within the wildfire hazard areas were totaled to estimate the number of persons, buildings, and facilities at risk to impacts from wildfire events.

4.2.2.7 All Other Assessed Hazards

No GIS format datasets appropriate for an exposure analysis were identified for the following hazards: dam and levee failure, disease outbreak, drought, extreme heat, hail, lightning, thunderstorm wind, and tornado.

4.2.3 Sources of Data Used in Hazus Modeling and Exposure Analyses

Assets for the Brownsville Public Utilities Board and the City of Brownsville were identified to assess potential exposure and loss associated with the hazards of concern. For this HMP, the Brownsville Public Utilities Board and the City of Brownsville assessed exposure vulnerability of the following types of assets: population, buildings and critical facilities/infrastructure and the environment. Some assets may be more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

4.2.3.1 Building and Cost Data

Detailed structure information derived from 2021 building footprints, parcel, and tax assessor data provided by the Brownsville Public Utilities Board, 2020 MODIV parcels, and 2018 Microsoft Bing footprints were used to create a general building stock that was loaded into Hazus. This general building stock was also built using 2021 RS Means values to estimate each structure's total replacement cost value.

Replacement cost is the cost to replace the entire structure with one of equal quality and utility. Replacement cost is based on industry-standard cost-estimation models published in *RS Means Square Foot Costs* (RS Means, 2021). It is calculated using the RS Means square foot cost for a structure, which is based on the Hazus occupancy class (i.e., multi-family residential or commercial retail trade), multiplied by the square footage of the structure from the tax assessor data. The construction class and number of stories for single-family residential structures also factor into determining the square foot costs.

4.2.3.2 Critical Facilities and Lifelines

The 2022 HMP critical facility inventory, which includes essential facilities, utilities, government offices, transportation features and user-defined facilities was created using facilities provided by the Brownsville Public Utilities Board and collected from Homeland Infrastructure Foundation-Level Data (HIFLD) where there were gaps. The facilities were reviewed for accuracy, additions or deletions of new/moved critical assets, identification of backup power for each asset (if known) and whether the critical facility is considered a lifeline in accordance with FEMA's definition. To protect individual privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities.

4.2.3.3 Population

Total population statistics from the 2015-2019 ACS 5-year estimate were used to estimate the exposure and potential impacts to the Brownsville Public Utilities Board constituents and the City of Brownsville population in place of the 2010 U.S. Census block estimates. Cameron County's population statistics were referenced in lieu of

the total count of constituents within the Brownsville Public Utilities Board service area. At the time of this 2022 HMP, the 2020 decennial population data was not available for the Brownsville Public Utilities Board risk assessment area. Population counts were evenly distributed by the number of residential buildings per municipality generated from the building stock inventory used in the hazard mitigation plan update. This estimate is a more precise distribution of population across the Brownsville Public Utilities Board service area and the City of Brownsville compared to only using the Census block or Census tract boundaries. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate for planning purposes.

As discussed in Section 3 (Community Profile), research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in the Brownsville Public Utilities Board service area and the City of Brownsville included in the risk assessment are children, elderly, population below the poverty level, non-English speaking persons, and persons with a disability.

4.2.3.4 Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Flood**—The effective Digital Flood Insurance Rate Map (DFIRM) was used to delineate flood hazard areas and estimate potential losses. Using the DFIRM floodplain boundaries and base flood elevation information, and the USGS 1-meter digital elevation model data, flood depth grids were generated and integrated into the Hazus model.
- **Hurricane**—Hazus hurricane probabilistic data were used for the analysis of this hazard.

4.2.3.5 Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. Data sources for specific hazards were as follows:

- **Coastal Erosion**—NOAA 2011 CUSP Shoreline 100-foot buffer
- **Inland Erosion**—USDA Natural Resources Conservation Service soils data where erosion factor (k) is equal or greater than 0.49
- **Storm Surge**—NOAA 2014 storm surge data
- **Sea Level Rise**—NOAA 2017 sea level rise data
- **Wildfire**—Wildland Urban Interface (WUI) data was acquired from the University of Wisconsin

No GIS format datasets appropriate for an exposure analysis were identified for the following hazards: dam and levee failure, disease outbreak, drought, extreme heat, hail, lightning, thunderstorm wind, and tornado.

4.2.3.6 Data Source Summary

Table 4.2-1 summarizes the data sources used for the risk assessment for this plan.

Table 4.2-1. Data Sources

Data	Source	Date	Format
Critical Facilities	Brownsville Public Utilities Board; HIFLD	2021; 2018/2019/2020/2021	Digital (GIS) format
General Building Stock	CameronCAD; Brownsville Public Utilities Board; Microsoft Bing; RS Means	2021; 2021; 2018; 2021	Digital (GIS) format
Population data	American Community Survey 5-year Estimates	2019	Digital (GIS and tabular) format
Digital Elevation Model	USGS	2018	Digital (GIS) format
FEMA Effective DFIRM Data	FEMA	2018	Digital (GIS) format
Coastal Flood Hazard Area	FEMA	2015	Digital (GIS) format
Coastal Erosion	USDA/NRCS; NOAA	2020; 2011	Digital (GIS) format
Inland Erosion	NOAA	2011	Digital (GIS) format
Sea Level Rise	NOAA	2017	Digital (GIS) format
SLOSH	NOAA	2014	Digital (GIS) format
Wildfire	University of Wisconsin	2010	Digital (GIS) format

4.2.4 Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event.

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, the Brownsville Public Utilities Board and the City of Brownsville will collect additional data to assist in estimating potential losses associated with other hazards.

4.3 Hazard Profiles

4.3.1 Dam and Levee Failure

The following section provides the hazard profile and vulnerability assessment for the dam and levee failure hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.1.1 Hazard Profile

Hazard Description

Dam Failure

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

- Prolonged periods of rainfall and flooding, which cause most failures;
- Inadequate spillway capacity, resulting in excess overtopping of the embankment;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, or maintain gates, valves, and other operational components;
- Improper design or use of improper construction materials;
- Failure of upstream dams in the same drainage basin;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion;
- Destructive acts of terrorists; 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 great property damage. A devastating effect on water supply and power generation could be expected as well (Brownsville Public Utilities Board 2015).

Levee Failure

Levees have been constructed in the State of Texas for over 100 years to protect farms, ranch land, and populated areas from flooding (State of Texas Hazard Mitigation Plan 2018). A levee is a physical barrier constructed to protect areas from rising floodwaters. Levees typically remove valuable floodplain storage and block the ability of the channel to move water. There are also concerns with rainfall that falls on the levee itself. Most important is the possibility for catastrophic and sudden failure under extreme flood events, potentially resulting in loss of life and total destruction of property.

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. Earthen levees can be damaged in several ways. Strong river currents and waves can erode the surface. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.

Regulatory Oversight for Levees

USACE and FEMA have differing roles and responsibilities related to levees. USACE addresses a range of operation and maintenance, risk communication, risk management, and risk reduction issues as part of its responsibilities under the Levee Safety Program. FEMA addresses mapping and floodplain management issues related to levees, and it accredits levees as meeting requirements set forth by the National Flood Insurance Program.

Depending on the levee system, USACE and FEMA may be involved with the levee sponsor and community independently or—when a levee system overlaps both agency programs—jointly. Under both scenarios, the long-term goals are similar: to reduce risk and lessen the devastating consequences of flooding. Some USACE and FEMA partnering activities related to levees include:

- Joint meetings with levee sponsors and other stakeholders
- Integration of levee information into the National Levee Database
- State Silver Jackets teams
- Sharing of levee information
- Targeted task forces to improve program alignment

The Silver Jackets is a program that provides an opportunity to consistently bring together multiple state, federal, tribal, and local agencies to learn from each other and apply their knowledge to reduce risk. The Program's primary goals include the following:

- Create or supplement a mechanism to collaboratively identify, prioritize, and address risk management issues and implement solutions;
- Increase and improve risk communication through a unified interagency effort;

- Leverage information and resources and provide access to such national programs as FEMA's Risk MAP and USACE's Levee Inventory and Assessment Initiative;
- Provide focused, coordinated hazard mitigation assistance in implementing high-priority actions such as those identified by state hazard mitigation plans;
- Identify gaps among agency programs and/or barriers to implementation, such as conflicting agency policies or authorities, and provide recommendations for addressing these issues.

The State of Texas has a Silver Jackets team. Their vision is to increase efficiency and coordination between the state and federal governments in developing comprehensive and sustainable solutions to flood risk management in the State of Texas. The team provides a variety of projects, plans, and outreach to help the State mitigate and prevent future floods. Information about the team can be found online: https://silverjackets.nfrmp.us/State-Teams/Texas

Coordination between USACE and FEMA with regard to levees is now standard within many of each agency's policies and practices. Over the past several years, both agencies coordinated policies where appropriate; jointly participated in meetings with stakeholders; and participated in many multiagency efforts, such as the National Committee on Levee Safety, the Federal Interagency Floodplain Management Task Force, and the Silver Jackets Program.

National Committee on Levee Safety

The National Committee on Levee Safety was created by Congress to "develop recommendations for a national levee safety program, including a strategic plan for implementation of the program." The Committee adopted the vision of "an involved public and reliable levee system working as part of an integrated approach to protect people and property from floods," and has been working toward this goal since October 2008 (National Committee on Levee Safety 2010). The Committee is made up of representatives from state, regional, and local agencies; the private sector; USACE; and FEMA.

Location

The National Inventory of Dams identifies 42 total dams and levees in or near Cameron County. Most of the dams are embankments for dry detention drainage areas, irrigation reservoirs, or shore up stream embankments. Other dams in the Planning Area have limited storage capacity and do not pose risk to people or the built environment. Of the 42 dams/levees in or near the Planning Area, only three dams/levees are considered to pose a risk due to their height or water storage capacity. The other 39 will not be discussed. All three dams/levees are in Cameron County; none are in the City of Brownsville (U.S. Army Corps of Engineers (USACE) n.d.).

Adams Gardens Reservoir Levee is located south of the City of La Feria, with Bass Boulevard to the west and north, Weaver Road to the east, and Jimenez and Zimner Roads to the south.

La Feria Reservoir is located south of the City of La Feria, with Dodd Lane to the north, Dukes Highway to the east, W Parker Road to the south and Orange Grove Road to the west.

Montgomery Dam is located south of the City of Rio Hondo with Parkway Avenue to the north, S Reynolds Street to the east, Lakeview Drive to the South, and Arroyo Colorado to the west.

Details for the three dams/levees are listed in Table 4.3.1-1.

Table 4.3.1-1. Dams and Levees of Concern in the Planning Area

Dam or Levee Name	Height (ft.)	Storage (acre ft.)	Last Inspection Date	Potential Hazard Classification[a]
Adams Gardens Reservoir Levee	16	4,100	01/31/1990	Significant
La Feria Reservoir	20	2,480	02/09/2015	Significant
Montgomery Dam	21	505	04/18/1979	Significant

Sources: 2015 BPUB HMAP, USACE 2022

a. *As classified in the National Inventory of Dams map legend*

Extent

The extent or magnitude of a dam failure event is described in terms of the classification of damages that could result from a dam's failure, not the probability of failure. The Interagency Committee on Dam Safety (ICODS) defines high hazard dams as those where failure or mis-operation would cause loss of human life. Dams classified as "significant" are those at which failure or mis-operation probably would not result in loss of human life but could cause economic loss, environmental damage, disruption of lifeline facilities or other significant damage. Low hazard potential dams are those at which failure or mis-operation probably would not result in loss of human life but would cause limited economic and/or environmental losses. Losses would be limited mainly to the owner's property (ICODS 2004).

When a levee system fails or is overtopped, severe flood damage can occur due to increased water surface elevation associated with levees and the resulting increase in water velocity. The resulting torrent from a levee breach can quickly swamp a large area behind the failed levee with little or no warning.

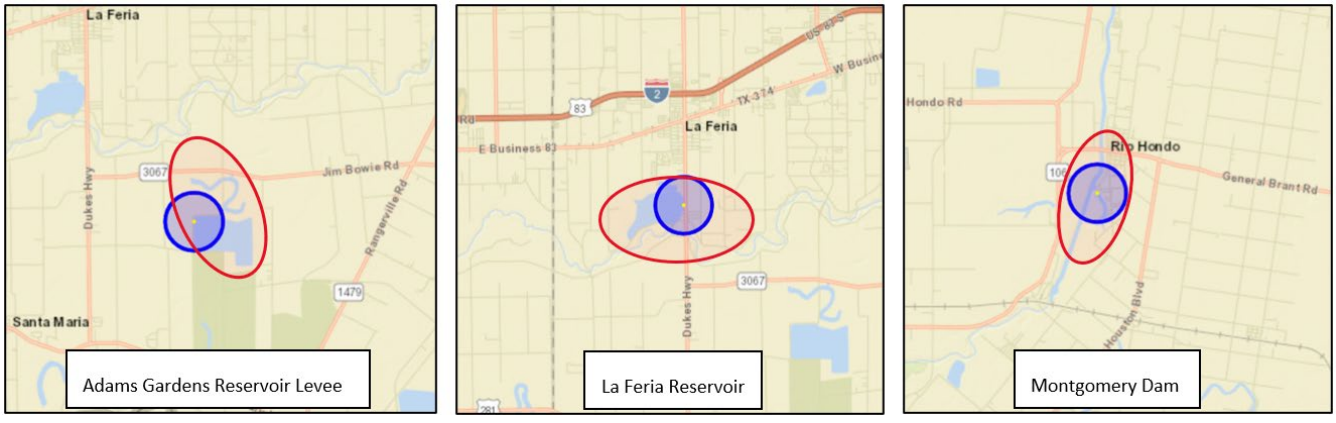
There are no inundation maps for the Planning Area. This data deficiency is addressed by a mitigation action for the City of Brownsville. For dams with a maximum storage capacity of 10,000 acre-feet, inundation can be expected within a mile in all directions of the dam (Figure 4.3.1-1).

Montgomery Dam is located in unincorporated Cameron County on the Arroyo Colorado River. The dam was constructed in 1963 and is used primarily for irrigation. It is owned by the City of Rio Hondo. 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 48 residential structures, a county park and agricultural land 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 96.4 feet with a maximum breach flow of 17,248 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 10 feet with the highest depth in the immediate area of the dam breach (Cameron County 2021.

La Feria Reservoir is located in unincorporated rural west Cameron County next to the City of La Feria. It uses off-channel water from the Arroyo Colorado River and is used 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 channel for approximately one mile. It is owned by La Feria Irrigation District Cameron County No. 3 and was constructed in 1926 by earthen construction with a core of homogeneous, earth. 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 80 residential structures and several access roads may be impacted. No critical facilities would be impacted. If there was a breach, it is estimated the average breach width would be 141.8 ft. with a maximum breach flow of 37,413 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 (Cameron County 2021.

Adams Gardens Reservoir Levee Dam is located in unincorporated Cameron County. The levee was constructed in 1934 and is used primarily for irrigation. It is owned by the Adams Gardens Irrigation District 19. It uses off-channel water from the Resaca De Los Fresnos and is used 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 channel for approximately one mile. The area located near the levee is rural with limited development within a one-mile radius. Agricultural land and several access roads could be impacted by a breach. No critical facilities would be impacted. A levee failure could cause very limited infrastructure damages, power outages, and utility systems disruptions. In the event of a breach, it is estimated the average breach width would be 152 feet with a maximum breach flow of 19,036 cubic feet per second according to the National Weather Service (NWS) Dam Break Equation. A dam or levee breach could result in an estimated depth up to 8 feet with the highest depth in the immediate area of the levee breach (Cameron County 2021).

Figure 4.3.1-1. Significant Hazard Dam/Levee Locations and Approximate Inundation Areas



Source: USACE 2022

Note: Blue circle indicates dam/levee location, red oval or circle indicates approximate inundation area

Worst-Case Scenario

While the probability of a levee or dam failure is low, a worst-case scenario would be a 0.2% (500-year) flood event, likely caused by a hurricane or tropical storm that would stall over the Planning Area. Such an event could trigger levee and dam failures, resulting in potential property damages and injuries.

Previous Occurrences and Losses

According to available records from the State of Texas 2018 HMP Update, Brownsville Public Utilities Board 2015 HMAP, the National Performance of Dams Program, and feedback from the Planning Team, there have been no reported dam or levee failures recorded for the Planning Area.

Previous Occurrences

FEMA Disaster Declarations

There have been no FEMA disaster declarations for dam or levee failure in the Planning Area (FEMA 2022).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. There have been no USDA disaster declarations for dam or levee failure in the Planning Area (USDA 2021).

Previous Events

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 have been no historical occurrences of dam or levee failure in the Planning Area.

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, rainstorms are more intense, and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). Periods of extreme precipitation increase the risk of dam failure (Centers for Climate and Energy Solutions n.d.).

An increasing average annual temperature will directly impact the atmospheric moisture potential. The probability of expanding atmospheric moisture leads to an increasing amount of rainfall during storm events. The increased potential volume of rainfall will directly lead to an increasing pressure placed on dams and levee systems during future riverine flood events (State of Texas Hazard Mitigation Plan 2018).

Probability of Future Occurrences

The likelihood of a dam or levee failure in the Planning Area is difficult to predict. For levees, a complete failure is infrequent and typically coincides with events that cause the failure. Future climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Since dam

overtopping and levee failures are often caused by excessive rainfall, it is appropriate to relate the future vulnerability of dams and levees directly with the potential for increased rainfall in the Planning Area.

No historical events of dam or levee failures have been recorded in the Planning Area, though the risk of failures is monitored closely. See Table 4.3.1-2. Due to the lack of historical occurrences, the probability of a future event is unlikely, meaning an event is not likely to occur or has a less than 1 percent annual chance of occurring (Cameron County Office of Emergency Management 2021).

Table 4.3.1-2. Probability of Future Dam and Levee Failure Events

Hazard Type	Number of Occurrences Between 1954 and 2021	% chance of occurrence in any given year
Dam and Levee Failure	0	0%

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all dam and levee failure events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for dam/levee failure in the Planning Area is considered 'rare'.

4.3.1.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The locations in the Planning Area that are downstream of a dam or protected by a levee are vulnerable to the dam and levee failure hazard. The following text evaluates and estimates the potential impact of the dam and levee failure hazard in the County as a whole.

Impact on Life, Health, and Safety

The impact of dam and levee failure on life, health, and safety is dependent on several factors such as the class of dam/levee, the area that the dam/levee is protecting, the location of the dam/levee, and the proximity of structures, infrastructure, and critical facilities to the dam or levee structure. The level of impact that a failure could have can be predicted based upon the hazard potential classification as rated by the USACE.

Table 4.3.1-3. USACE Hazard Potential Classifications for Dams

Hazard Category (a)	Direct Loss of Life (b)	Lifeline Losses (c)	Property Losses (d)	Environmental Losses (e)
Low	None (rural location, no permanent structures for human habitation)	No disruption of services (cosmetic or rapidly repairable damage)	Private agricultural lands, equipment, and isolated buildings	Minimal incremental damage
Significant	Rural location, only transient or day-use facilities	Disruption of essential facilities and access	Major public and private facilities	Major mitigation required

High	Certain (one or more) extensive residential, commercial, or industrial development	Disruption of essential facilities and access	Extensive public and private facilities	Extensive mitigation cost or impossible to mitigate

Source: (FEMA 2004)

Note:
a. Categories are assigned to overall projects, not individual structures at a project.
b. Loss-of-life potential is based on inundation mapping of area downstream of the project. Analyses of loss-of-life potential should take into account the population at risk, time of flood wave travel, and warning time.
c. Lifeline losses include indirect threats to life caused by the interruption of lifeline services from project failure or operational disruption; for example, loss of critical medical facilities or access to them.
d. Property losses include damage to project facilities and downstream property and indirect impact from loss of project services, such as impact from loss of a dam and navigation pool, or impact from loss of water or power supply.
e. Environmental impact downstream caused by the incremental flood wave produced by the project failure, beyond what would normally be expected for the magnitude flood event under which the failure occurs.

Levee failure impacts depend on several factors including severity of the event and whether or not adequate warning time is provided to residents. The population living in or near the inundation areas are considered exposed to the hazard. However, exposure should not be limited only to those who reside within a defined hazard zone, but everyone who may be affected by a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event); the degree of that impact varies and is not strictly measurable.

Vulnerable populations are all populations downstream from levee failures that are incapable of escaping the area within the allowable time frame. This population includes the elderly, young and individuals with disabilities, access or functional needs who may be unable to get themselves out of the inundation area. The vulnerable population also includes individuals who would not have adequate warning from the emergency warning system (e.g., television or radio); this would include residents and visitors. The population adversely affected by a levee failure may also include those beyond the disaster area that rely on the dam for providing potable water.

Floods created from a levee failure and their aftermath present numerous threats to public health and safety including exposure to unsafe food, contaminated drinking and washing water, mosquitoes, animals, mold and mildew. For more detailed descriptions of these and additional threats to public health and safety, refer to Section 4.3.7 (Flood). Current loss estimation models such as Hazus are not equipped to measure public health impacts such as these. The best preparation for these effects includes awareness that they can occur, education of the public on prevention, and planning to deal with them during responses to dam or levee failure events.

Impact on General Building Stock

Vulnerable properties are those closest to the dam or levee area. These properties would experience the largest, most destructive surge of water. Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues. This includes all roads, railroads and bridges in the path of the dam inundation. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines could also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Impact on Critical Facilities

Transportation routes are vulnerable to dam inundation and have the potential to be wiped out, creating isolation issues and significant disruption to travel, including all roads, railroads and bridges in areas in and around the levee. Those that are most vulnerable are those that are already in poor condition and would not be able to withstand a large water surge. Utilities such as overhead power lines, cable and phone lines in the inundation zone could also be vulnerable. If phone lines were lost, significant communication issues may occur in the Planning Area due to limited cell phone reception in many areas. In addition, emergency response would be hindered due to the loss of transportation routes as well as some protective-function facilities located in the inundation zone. Recovery time to restore many critical functions after an event may be lengthy, as wastewater, potable water, and other community facilities are located in the dam inundation zone.

Impact on Economy

Severe flooding that follows an event like a dam failure can cause extensive structural damage and withhold essential services. The cost to recover from flood damages after a surge will vary depending on the hazard risk of each dam. Severe flooding that follows an event like a dam failure can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities can become temporarily out of operation. Debris from surrounding buildings can accumulate should the dam mimic major flood events, such as the 1-percent annual chance flood event that is discussed in Section 4.3.7 (Flood).

Levee failure events can significantly impact the local and regional economy. Similar to flooding, losses include, but are not limited to, damages to buildings and infrastructure, agricultural losses, business interruption and impacts on tax base. Flooding as a result of levee failure can cause extensive damage to public utilities and disruptions in delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities may be temporarily out of operation.

Impact on the Environment

The environmental impacts of a dam or levee failure can include significant water-quality and debris-disposal issues or severe erosion that can impact local ecosystems. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals may get added to flood waters. Hazardous materials may be released and distributed widely across the floodplain. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The

Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Any areas of growth in the Planning Area that are downstream of a dam or protected by a levee could be potentially impacted by the dam and levee failure hazard because these areas are exposed and vulnerable. Areas in and around the levees are the most vulnerable to losses; therefore, any development in these areas will be more susceptible to levee failure impacts.

Projected Changes in Population

The Planning Area has experienced an increase in population between the 2010 Census (406,220) and the estimated 2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the dam and levee failure hazard.

Climate Change

An increasing average annual temperature will directly impact the atmospheric moisture potential. The probability of expanding atmospheric moisture leads to an increasing amount of rainfall during storm events. The increased potential volume of rainfall will directly lead to an increasing pressure placed on dam and levee systems during future riverine flood events (State of Texas HMP 2018).

Change of Vulnerability Since 2015 HMAP

Overall, the Planning Area's vulnerability has not changed and BPUB and the City of Brownsville will continue to be exposed and vulnerable to dam and levee failure events, especially those located within or near downstream inundation zones. Because of the sensitive nature of the dam failure inundation zones, potential losses have not been quantified and presented in this plan. To estimate potential losses to population, buildings, critical facilities and infrastructure, inundation areas and depths of flooding may be used to generate depth grids. Hazus may be used to estimate potential losses for the Planning Area in future HMAP updates.

4.3 Hazard Profiles

4.3.2 Disease Outbreak

This section provides the hazard profile and vulnerability assessment for the disease outbreak hazard for the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.2.1 Hazard Profile

Hazard Description

An outbreak or an epidemic occurs when new cases of a certain disease, in a given population, substantially exceed what is expected. An epidemic may be restricted to one locale, or it may be global, at which point it is called a pandemic. Pandemic is defined as a disease occurring over a wide geographic area and affecting a high proportion of the population. A disease outbreak can cause sudden, pervasive illness in all age groups on a local or global scale. A pandemic is a novel virus to which humans have no natural immunity that spreads from person-to-person. A pandemic will cause both widespread and sustained effects and is likely to stress the resources of both the State and federal government (Madhav, et al. 2017). In addition to health impacts, disease outbreaks reaching pandemic proportions can cause social and economic impacts on a global scale (Shang, Li and Zhang 2021).

Coronavirus

Coronavirus disease (COVID-19) is an infectious disease first identified in 2019. The virus rapidly spread into a global pandemic by spring of 2020. Older people, and those with underlying medical problems like cardiovascular disease, diabetes, chronic respiratory disease, and cancer are more likely to develop serious illness (World Health Organization n.d.). With the virus being relatively new, information regarding transmission and symptoms of the virus is still new. The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes. Reported illnesses have ranged from mild symptoms to severe illness. Reported symptoms include fever or chills, cough, shortness of breath or difficulty breathing and fatigue. Symptoms may appear 2-14 days after exposure to the virus (CDC 2021).

In an effort to slow the spread of the virus, the federal government and states have urged the public to avoid touching of the face, properly wash hands often, masking, and use various social distancing measures. At the time of this plan update, there are three approved and authorized vaccines available in the United States to reduce risk of severe illness (CDC 2021).

Influenza

The risk of a global influenza pandemic has increased over the last several years. This disease is capable of claiming thousands of lives and adversely affecting critical infrastructure and key resources. An influenza pandemic has the ability to reduce the health, safety, and welfare of the essential services workforce; immobilize core infrastructure; and induce fiscal instability.

Pandemic influenza is different from seasonal influenza (or "the flu") because outbreaks of seasonal flu are caused by viruses that are already among people. An influenza pandemic is a global outbreak of a new influenza A virus. Pandemics happen when new (novel) influenza A viruses emerge which are able to infect people easily and spread from person to person in an efficient and sustained way (CDC n.d.).

At the national level, the CDC's Influenza Division has a long history of supporting the World Health Organization (WHO) and its global network of National Influenza Centers (NIC). With limited resources, most international assistance provided in the early years was through hands-on laboratory training of in-country staff, the annual provision of WHO reagent kits (produced and distributed by CDC), and technical consultations for vaccine strain selections. The Influenza Division also conducts epidemiologic research including vaccine studies and serologic assays and provided international outbreak investigation assistance (CDC n.d.).

West Nile Virus

West Nile Virus (WNV) encephalitis is a mosquito-borne viral disease, which can cause an inflammation of the brain. WNV is commonly found in Africa, West Asia, the Middle East and Europe. West Nile Virus was first reported in Texas in 2002. In a small number of cases, WNV has been spread by blood transfusion, which has resulted in the screening of blood donations for the virus in the US, or by organ transplantation. WNV can also be spread from mother to baby during pregnancy, delivery, or breast-feeding in a small number of cases. The symptoms of severe infection (West Nile encephalitis or meningitis) can include headache, high fever, neck stiffness, muscle weakness, stupor, disorientation, tremors, seizures, paralysis, and coma. WNV can cause serious illness, and in some cases, death. Usually, symptoms occur from two to 14 days after being bitten by an infected mosquito (Texas Department of State Health Services n.d.).

Location

Disease outbreaks can occur without regard for location. However, factors such as density, visitation, and the length of time in which the public spends in a location all contribute to the spread of infectious diseases. For example, COVID-19 is more likely spread by persons in close contact. Indoor areas in which people are in close contact with each other appear to be significant vectors for the disease, which is spread through respiratory droplets. Infectious diseases spread by insects may be subject to other types of location hazards. For example, the prevalence of standing water can provide breeding grounds for diseases such as West Nile Virus. Diseases that can infect humans are variable in nature and methods of transmission. Ultimately, residents need to be vigilant about diseases altogether in order to better understand and respond to disease outbreak hazards.

Extent

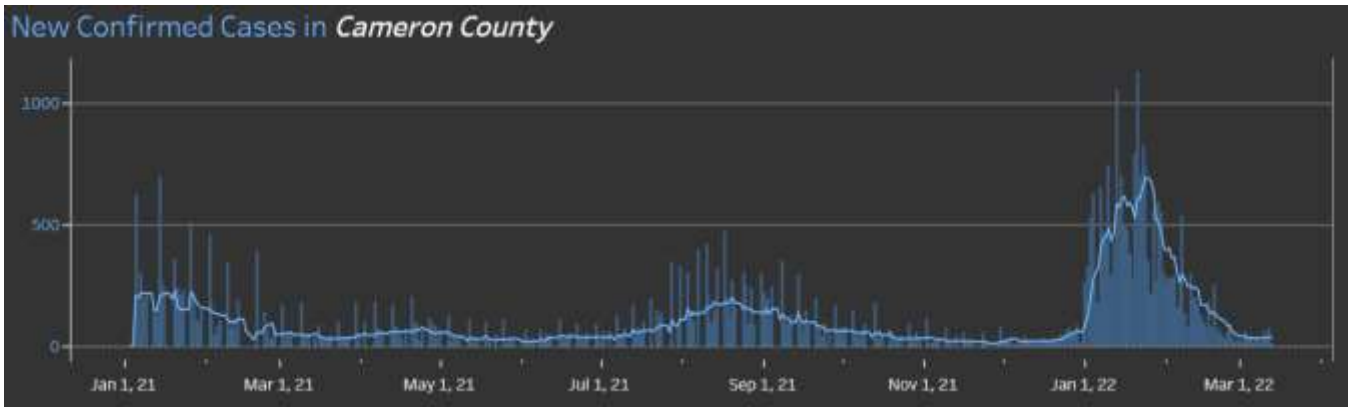
The exact size and extent of an infected population depends on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

Coronavirus

The most recent large-scale disease outbreak is COVID-19, which is ongoing at the time of this report's publication. During this ongoing outbreak, several hazard levels have prompted warnings and recommendations for public safety. For example, in August 2021, the Planning Area was at "Level 3 – Significant" on the COVID-19 threat matrix. Community members were encouraged to minimize contact with those outside of their immediate household, limit gatherings to ten people, avoiding any medium or large meetings, and visit permissible businesses that follow public health guidance, including wearing a mask, despite vaccinated or unvaccinated status (Brownsville TX 2021).

Texas's first COVID-19 cases were reported on March 6th, 2020. By mid-April, hundreds of new cases were being confirmed each day. Beginning in May, daily new cases in excess of 1,000 were reported, with the number of daily new cases growing near-exponentially beginning in mid-June. On a county-wide basis, there have been 99,698 confirmed cases as of March 13, 2022 (Texas Department of State Health Services 2021). The graph in Figure 4.3.2-1 shows the rate of cases in Cameron County between January 1, 2021 and March 13, 2022.

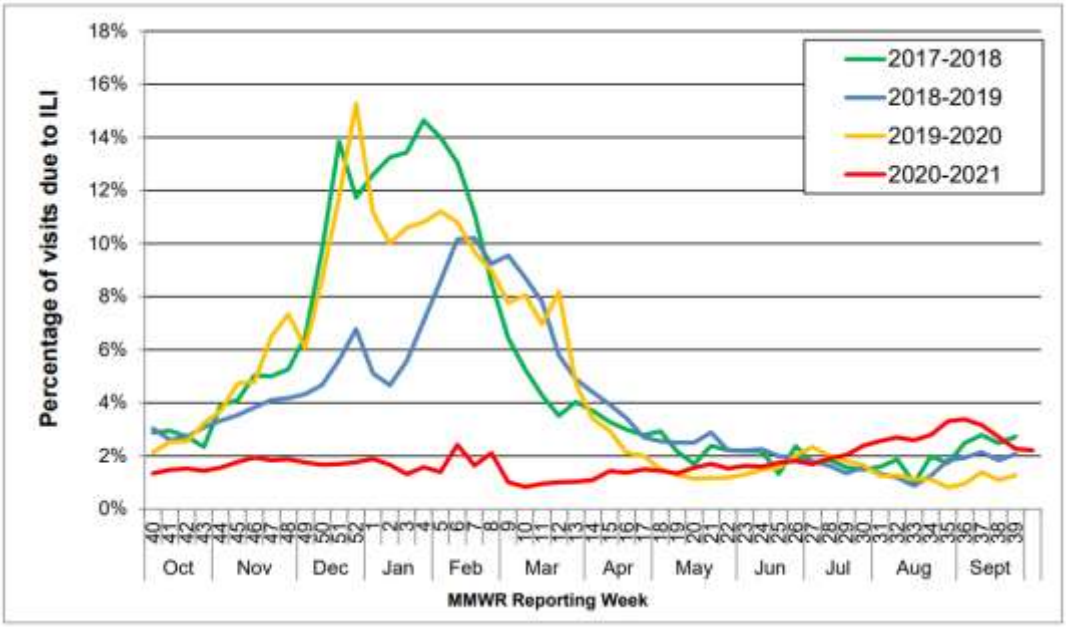
Figure 4.3.2-1 Rate of COVID-19 Cases in Cameron County



Influenza

Seasonal flu is common in many areas, however, at the time of this planning effort, Cameron County has not been impacted by a pandemic-level influenza. The Texas Department of State Health Services tracks statewide reported influenza cases each season. The graph in Figure 4.3.2-2 shows the percentage of outpatient visits for influenza-like illness (ILI) during the past four flu seasons (Texas Department of State Health Services 2022).

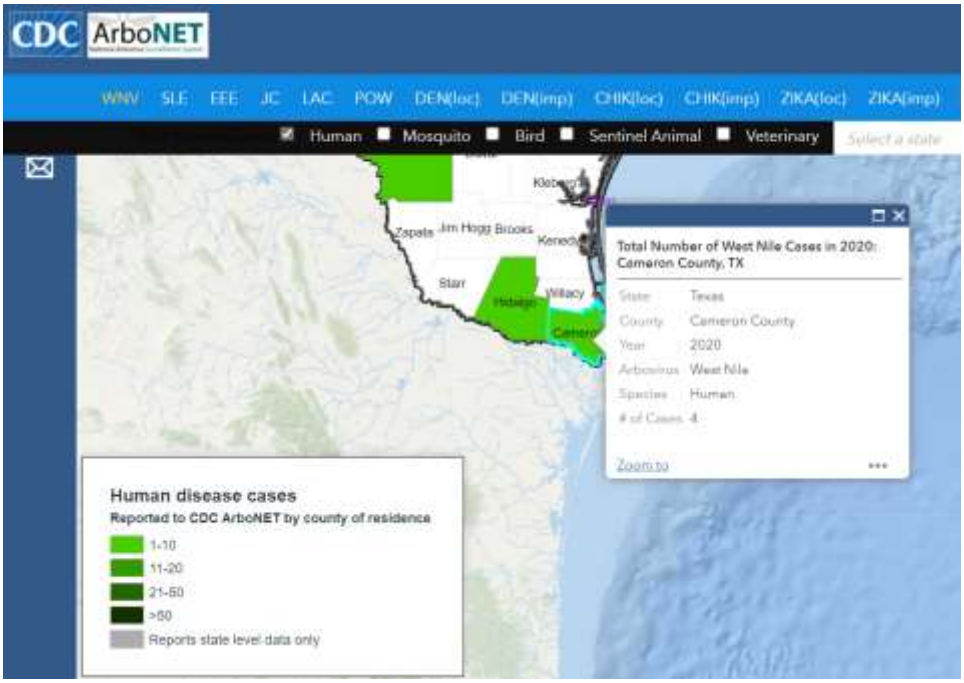
Figure 4.3.2-2 Percentage of Outpatient Visits for Influenza-like Illness in Texas, 2017-2021



West Nile Virus

A small number of West Nile Virus cases have been reported in Cameron County in recent years but have not reached the level of a disease outbreak. The CDC tracks reported West Nile Virus cases on a county level each year. Figure 4.3.2-3 shows the most recent year of reported cases in the county.

Figure 4.3.2-3 2020 West Nile Virus Cases, Cameron County



Worst-Case Scenario

A worst-case scenario would be a global pandemic similar to the COVID-19 pandemic that began affecting the Planning Area in early 2020, but with more severe health impacts. This could lead to high rates sickness and deaths; strain on healthcare systems; income stress and financial loss; and negative mental health impacts.

Previous Occurrences

Between 1953 and 2021, FEMA issued a disaster (DR) or emergency (EM) declaration for the State of Texas for one pandemic-related event. Cameron County (where the Planning Area is located within), was included in this declaration for COVID-19. Known disease outbreaks that have impacted Cameron County between 2003 and 2021 are identified in the table below. It should be noted that disease outbreak events are typically regional; therefore, Table 4.3.2-1 below includes events that impacted Cameron County on a whole.

Table 4.3.2-1 Disease Outbreaks in the Planning Area

Date(s) of Event	Event Type	FEMA Declaration Number	Cameron County Designated?	Description
January 2020-Present	COVID-19 Pandemic	DR-4485	Yes	As of March 13, 2022, there have been 99,698 COVID-19 cases in Cameron County
N/A	Influenza	None	N/A	N/A
2003-Present	West Nile Virus	None	N/A	Between 2003 and 2021, 33 human cases of West Nile Virus were reported in Cameron County

Sources: FEMA 2022, CDC 2022

Climate Change Projections

Climate change will likely have significant indirect impacts on disease outbreaks. In Texas, higher temperatures, decreased water availability, and more severe storm events are anticipated due to climate change. According to the World Health Organization, changing climatic conditions are being studied for impacts upon disease transmission. Seasonal infectious diseases that are influenced by meteorological conditions may see significant variability in recurrence and duration. The World Health Organization concludes that variations in infectious disease transmission patterns are likely major consequences of climate change.

Probability of Future Occurrences

Though occurrences of disease outbreaks overall are often difficult to predict at the local level, it is anticipated that the Planning Area will continue to be impacted by disease outbreaks for the foreseeable future. Additionally, seasonality for cold and flu is well established and anticipated in Texas on an annual basis.

In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for disease outbreak in the Planning Area is considered 'occasional'.

4.3.2.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable to the identified hazard. The following discusses the Planning Area's vulnerability, in a qualitative nature, to the disease outbreak hazard.

Impact on Life, Health, and Safety

The entire population of the Planning Area is vulnerable to the disease outbreak hazard. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2021). According to the 2019 American Community Survey, 13.5% of Planning Area residents (or approximately 57,032 people) are over the age of 65. As of March 13, 2022 there have been 99,698 positive COVID-19 cases in the Planning Area.

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreak events.

Impact on Critical Facilities

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients, but it is unlikely that there will be damages or interruption of services. However, large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020 coronavirus pandemic has led to overwhelmed hospitals in numerous hotspots.

Impact on Economy

Disease outbreaks impacts on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. As evidenced in the COVID-19 outbreak, quarantines, shutdowns, and social distancing measures can have outsized economic impacts, particularly on the leisure, tourism, and food/accommodations sectors.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The

Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the disease outbreak hazard because the entire Planning Area is exposed and vulnerable. Additional development of structures in close proximity to waterbodies or areas with high population density are at an increased risk.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the County is expected to increase in the near future. The increase in population will expose more people to the pandemic hazard as residents move into area and the population exposed increases. Population density changes when households move throughout the Planning Area could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, but density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease.

Climate Change

The relationship between infectious diseases occurrence and climate change is difficult to predict with certainty. However, there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease. For example, in the wake of Hurricane Harvey prolonged and intense precipitation provided breeding grounds for mosquitos that necessitated mosquito control measures.

The relationship between climate change and infectious diseases is not universally agreed upon. Climate change may affect the spread of disease, while others are not convinced. However, research indicates that the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Change of Vulnerability Since 2015 HMAP

Pandemic is a new hazard profile for the 2022 HMAP update. The occurrence and prevalence of COVID-19 in the Planning Area underscores the need to address disease outbreak as part of the hazard mitigation planning process. The Planning Area will continue to be exposed and vulnerable to pandemic events.

- The COVID-19 pandemic revealed that social distancing and quarantine had unprecedented impacts on public gatherings, shopping and activities. This caused significant, unanticipated impacts on economic and social activity, as well as government. The need to adjust operations to account for social distancing has been identified.
- Secondary hazards can lead to long term physical and mental health impacts.
- Standing water that results from rainstorms and hurricanes can serve as breeding grounds for mosquitos that carry diseases such as West Nile Virus.

4.3 Hazard Profiles

4.3.3 Drought

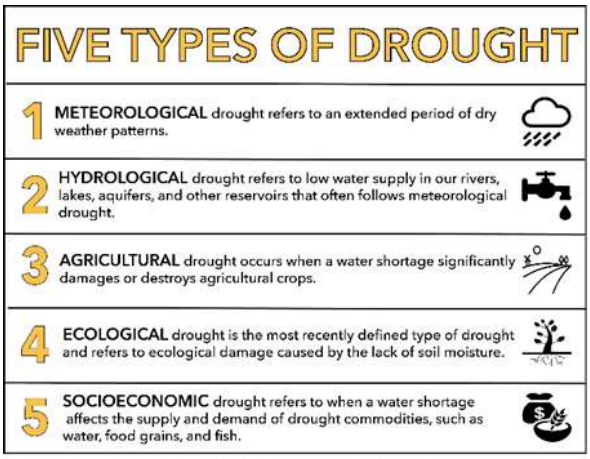
This section provides a hazard profile and vulnerability assessment of the drought hazard for the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.3.1 Hazard Profile

This section presents information regarding the description, extent, location, previous occurrences and losses, climate change projections and probability of future occurrences for the drought hazard.

Hazard Description

Drought is defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length (State of Texas Hazard Mitigation Plan 2018). Drought conditions occur in virtually all climatic zones. Drought characteristics vary significantly from one region to another and are relative to the normal precipitation in that region. Drought can increase wildfire/brush fire risk and can affect agriculture, water supply, aquatic ecology, wildlife, and plant life. There are five classifications of drought, as presented in the figure to the right.



Source: University of Nevada Cooperative Extension 2020

Location

A drought occurs on a regional scale; therefore, the entire Planning Area is vulnerable and at risk. Droughts can occur at any time and have the potential to directly or indirectly impact every person in the Planning Area, as well as the local economy.

Extent

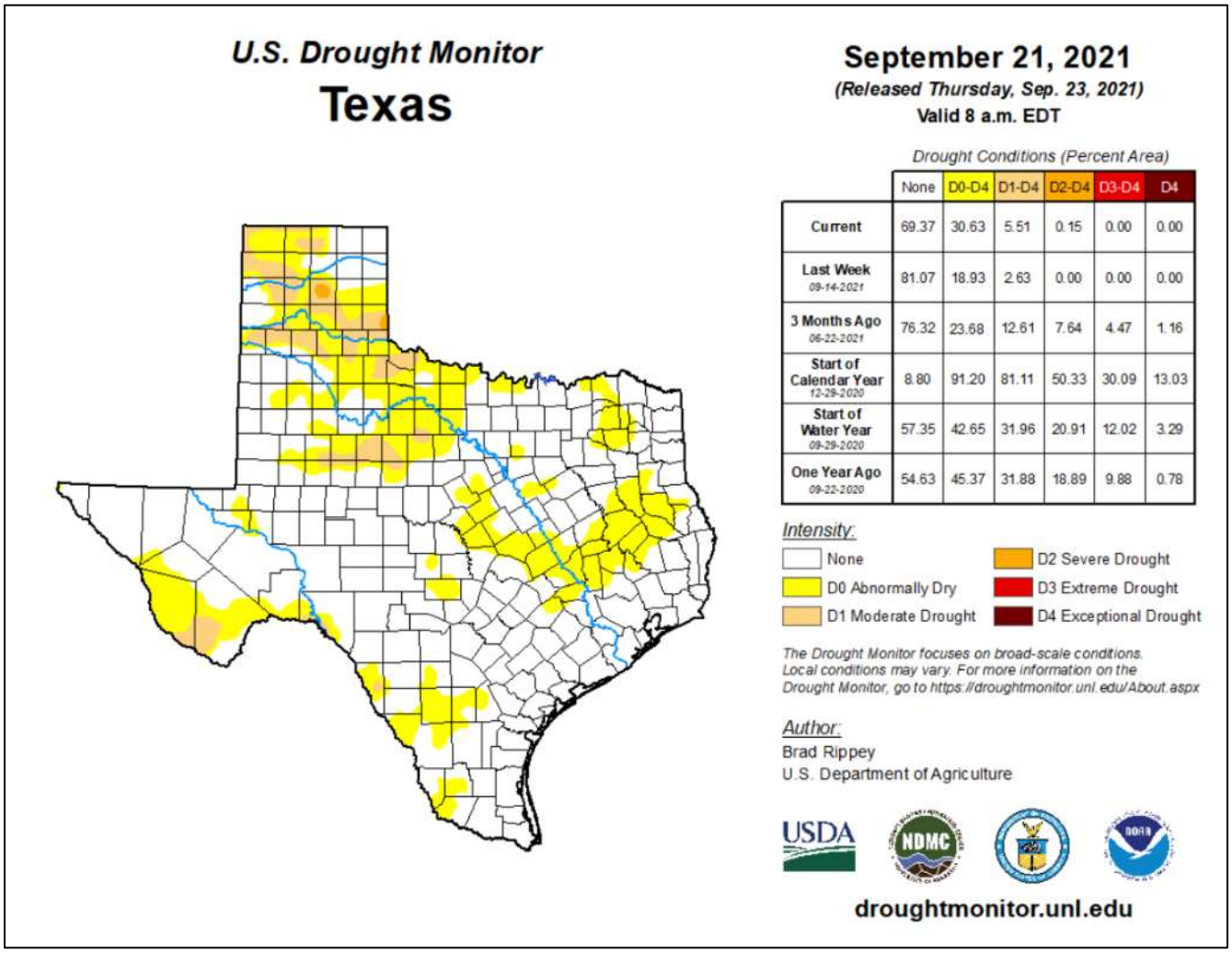
The severity of a drought depends on the degree of moisture deficiency, the duration of the event, and the size and location of the affected area. The longer the duration of the drought and the larger the area impacted, the more severe the potential (University of Nevada, Reno Extension College of Agriculture, Biotechnology & Natural Resources n.d.). The Planning Area has the potential to experience the entire range of effects, from extreme drought to extremely moist conditions, as described in the Palmer Drought Severity Index (PDSI).

U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a map that shows the location and intensity of drought across the United States. The data is updated every Tuesday and the map is released on Thursdays. The USDM uses a five-category system, labeled Abnormally Dry or D0, (a precursor to drought, not actually drought), and Moderate (D1), Severe (D2), Extreme (D3) and Exceptional (D4) Drought. Drought categories show experts' assessments of conditions related to dryness and drought including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year. USDM data goes back to 2000 (National Integrated Drought Information System 2020). Figure 4.3.3-2 shows the percent of Cameron County affected by drought from 2000 to 2021.

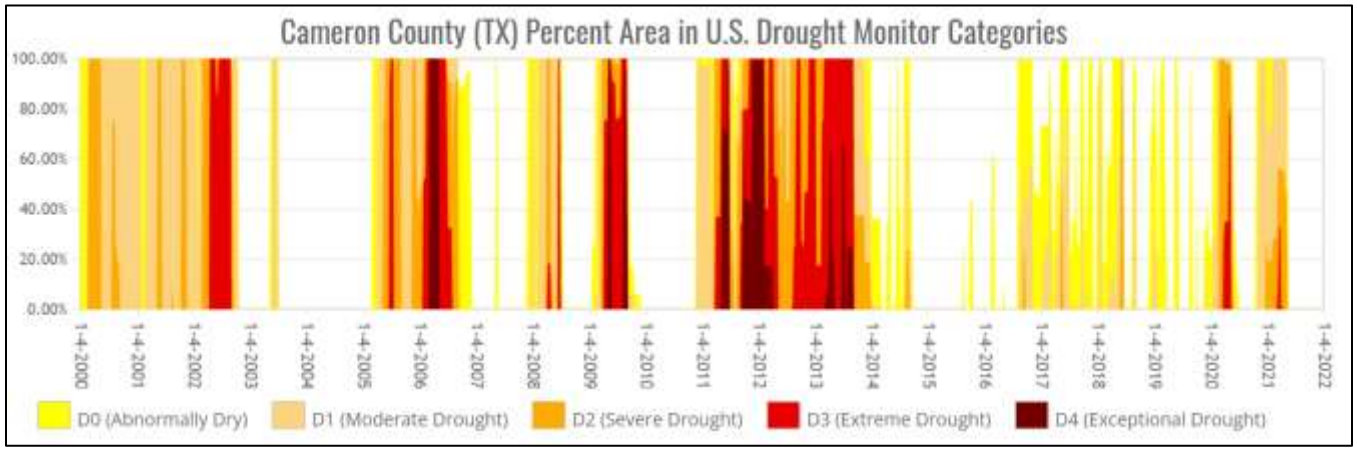
shows the USDM for the State of Texas for September 21, 2021. The figure is shows that Cameron County was experiencing no drought intensity during that week. Figure 4.3.3-2 shows the percent of Cameron County affected by drought from 2000 to 2021.

Figure 4.3.3-1 Texas Drought Monitor for September 21, 2021



Source: U.S. Drought Monitor 2021

Figure 4.3.3-2 Percent of Cameron County Affected by Drought 2000-2021



Source: U.S. Drought Monitor 2021

Palmer Drought Severity Index

The Palmer Drought Severity Index (PDSI) is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 4.3.3-1 lists the PDSI classifications. At the one end of the spectrum, 0 is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI can reflect excess precipitation using positive numbers; however, this is not shown in Table 4.3.3-1. The PDSI is commonly converted to the Palmer Drought Category (U.S. Drought Monitor n.d.).

Table 4.3.3-1 Palmer Drought Category and Palmer Drought Index Descriptions

Category	Description	Possible Impacts (for Texas)	Palmer Drought Index
D0	Abnormally Dry	• Producers begin supplemental feeding for livestock • Planting is postponed; forage germination is stunted; hay cutting is reduced • Grass fires increase • Surface water levels decline	-1.0 to -1.9
D1	Moderate Drought	• Dryland crops are stunted • Early cattle sales begin • Wildfire frequency increases • Stock tanks, creeks, streams are low; voluntary water restrictions are requested	-2.0 to -2.9
D2	Severe Drought	• Pasture conditions are very poor • Soil is hard, hindering planting; crop yields decrease • Wildfire danger is severe; burn bans are implemented • Wildlife moves into populated areas • Hydroelectric power is compromised; well water use increases; mandatory water restrictions are implemented	-3.0 to -3.9
D3	Extreme Drought	• Soil has large cracks; soil moisture is very low; dust and sandstorms occur • Row and forage crops fail to germinate; decreased yields for irrigated crops and very large yield reduction for dryland crops are reported	-4.0 to -4.9

Category	Description	Possible Impacts (for Texas)	Palmer Drought Index
		• Need for supplemental feed, nutrients, protein, and water for livestock increases; herds are sold • Increased risk of large wildfires is noted • Many sectors experience financial burden • Severe fish, plant, and wildlife loss reported • Water sanitation is a concern; reservoir levels drop significantly; surface water is nearly dry; river flow is very low; salinity increases in bays and estuaries	
D4	Exceptional Drought	• Exceptional and widespread crop loss is reported; rangeland is dead; producers are not planting fields • Culling continues; producers wean calves early and liquidate herds due to importation of hay and water expenses • Seafood, forestry, tourism, and agriculture sectors report significant financial loss • Extreme sensitivity to fire danger; firework restrictions are implemented • Widespread tree mortality is reported; most wildlife species' health and population are suffering • Devastating algae blooms occur; water quality is very poor • Exceptional water shortages are noted across surface water sources; water table is declining • Boat ramps are closed; obstacles are exposed in water bodies; water levels are at or near historic lows	-5.0 or less

Source: U.S. Drought Monitor 2021

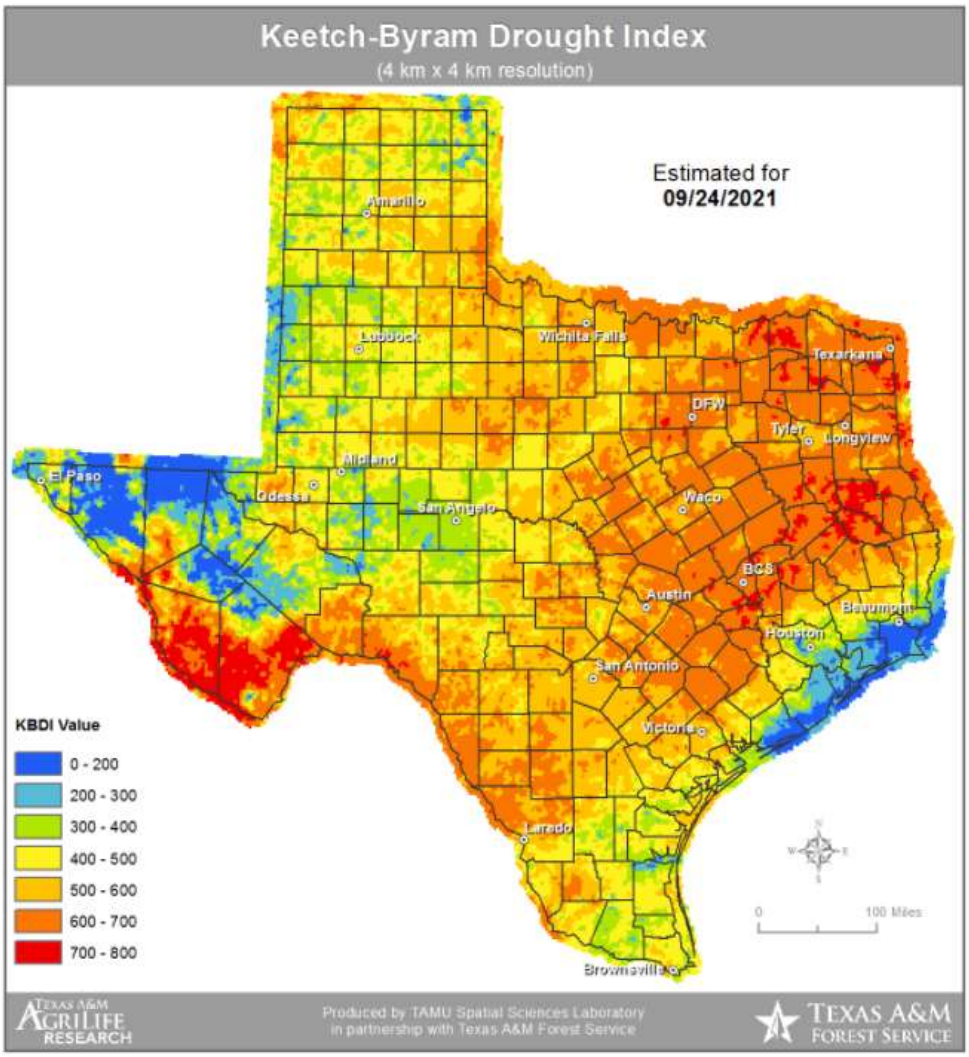
Keetch-Byram Drought Index (KBDI)

The KBDI is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced 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. The index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, while an index of 800 represents absolutely dry conditions (USFS - Wildland Fire Assessment System n.d.).

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

This index is currently derived from ground-based estimates of temperature and precipitation resulting from weather stations and interpolated manually by experts at the Texas Forest Service (TFS) for counties across the State (Texas Weather Connection n.d.). Figure 4.3.3-3 shows the KBDI for the State of Texas for September 24, 2021.

Figure 4.3.3-3 KBDI for the State of Texas, September 24, 2021



Source: Texas Weather Connection 2021

Worst-Case Scenario

A multi-year drought with a Palmer Drought Category of D4 (exceptional drought) that impacts the southeastern portion of Texas, like the 2005 to 2013 drought, is the worst-case scenario for the Planning Area. If another severe drought occurs before these systems have a chance to recover, it could exacerbate the stress already placed on existing Planning Area water resources. Severe droughts can also lead to crop and livestock losses, impacting the food supply and economy.

Previous Occurrences

Between January 2000 and November 2021, the U.S. Drought Monitor recorded 23 drought events for Cameron County with a combined total of 722 weeks of drought during 18 of the nearly 22 years. See Table 4.3.3-2 for each drought timeframe and intensity.

Table 4.3.3-2 Percent of Cameron County in Highest Reached U.S. Drought Monitor Categories

Week of	U.S. Drought Monitor Categories				
	D0-D4	D1-D4	D2-D4	D3-D4	D4
November 2, 2021	0.21	-	-	-	-
September 9, 2021	99.53	-	-	-	-
October 27, 2020-May 18, 2021	100.00	100.00	55.77	32.79	
November 26, 2019-June 20, 2020	100.00	100.00	100.00	80.76	
October 8, 2019	63.61	-	-	-	-
August 27-September 3, 2019	94.72	-	-	-	-
May 21-June 11, 2019	100.00	2.37	-	-	-
December 4, 2018-March 26, 2019	100.00	36.40	-	-	-
August 14-September 11, 2018	100.00	83.83	-	-	-
January 2-June 19, 2018	100.00	100.00	100.00	-	-
August 9, 2016-December 5, 2017	100.00	83.84	52.10	-	-
May 10, 2016	12.14	-	-	-	-
February 16-March 8, 2016	62.30	-	-	-	-
October 6-20, 2015	42.86	-	-	-	-
August 18-25, 2015	33.11	-	-	-	-
June 3-September 23, 2014	100.00	85.24	23.40	-	-
November 30, 2010-May 6, 2014	100.00	100.00	100.00	100.00	100.00
January 27, 2009-December 1, 2009	100.00	100.00	100.00	100.00	100.00
December 4, 2007-July 15, 2008	100.00	100.00	100.00	100.00	-
May 15-22, 2007	100.00	-	-	-	-
March 8, 2005-December 5, 2006	100.00	100.00	100.00	100.00	100.00
June 20-July 8, 2003	100.00	100.00	-	-	-
January 4, 2000-October 22, 2002	100.00	100.00	100.00	100.00	-

The U.S. Department of Agriculture (USDA) keeps records of agricultural disasters. Table 4.3.3-3 lists the seven USDA drought declarations for Cameron County between 2012 and 2021 (USDA 2021). Loss data is not available for specific drought events.

Table 4.3.3-3 Cameron County Drought Disaster History

Designation Number	Drought Begin Date	Approval Date	Crop Disaster Year
S4924	November 1, 2020	March 5, 2021	2021
S4666	March 31, 2020	April 9, 2020	2020
S4658	March 3, 2020	March 18, 2020	2020
S4669	February 18, 2020	May 6, 2020	2020
S3465	November 1, 2012	January 9, 2013	2013
S3681	April 1, 2013	April 23, 2014	2013
S3288	January 1, 2012	July 12, 2012	2012

Source: USDA Farm Service Agency 2021

Climate Change Projections

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as droughts. While predicting changes of drought events under a

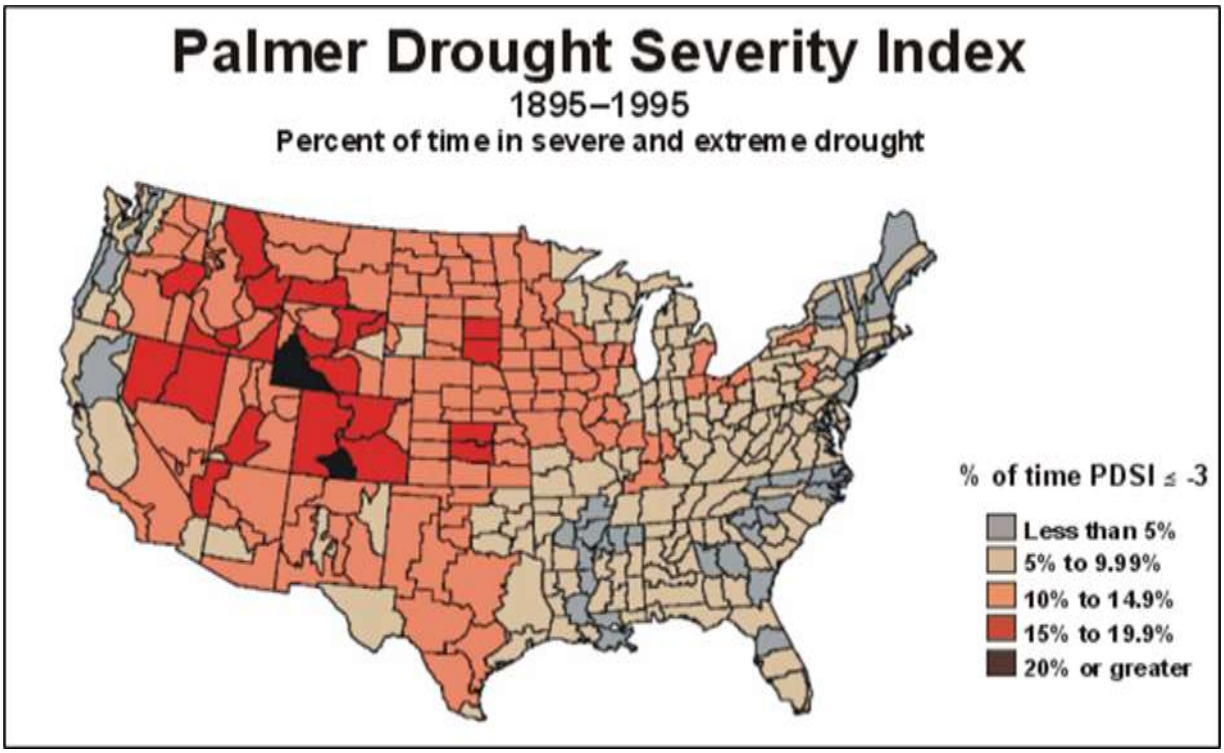
changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (EPA 2016)

With a warmer climate, droughts can become more frequent, more severe, and longer lasting. According to the National Climate Assessment, variable precipitation and rising temperatures are intensifying droughts, increasing heavy downpours, reducing snowpack, and causing declines in water survey quality. Future warming will add to the stress on water supplies and impact the availability of water supply (USGCRP 2018).

Probability of Future Occurrences

The frequency of droughts is difficult to forecast as drought occurrences are cyclical in nature and will occur in the future. Based on national annual data from 1895 to 1995, Cameron County, including the Planning Area, underwent severe or extreme conditions approximately 5 to 9.9% of the time (illustrated in Figure 4.3.3-4).

Figure 4.3.3-4 Palmer Drought Severity Index (1895 to 1995)



Source: National Drought Mitigation Center 2020

Information from the U.S. Drought Monitor database was used to identify the number of drought events that occurred between 2000 and 2021 in Cameron County. Table 4.3.3-4 presents the probability of future occurrence of drought events in Cameron County and the Planning Area based on that data.

Table 4.3.3-4 Probability of Future Drought Events in Cameron County

Hazard Type	Number of Occurrences Between 2000 and November 2021	Percent chance of occurrence in any given year
Drought	23	100%

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected drought events since 1968. Due to limitations in data, not all drought events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the 23 recorded drought events over 22 years, the Planning Area averages about one drought each year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for drought in the Planning Area is considered 'occasional'.

4.3.3.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entire Planning Area is exposed to the drought hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a drought event. The following text evaluates and estimates the potential impact of the drought hazard in the Planning Area.

Impact on Life, Health, and Safety

The entire population of the Planning Area is vulnerable to drought events (2019 American Community Survey 5-Year Estimate: 421,017 people). Drought conditions can affect public health and safety, including reduced local firefighting capabilities, health problems related to low water flows and poor water quality, and health problems related to dust. If droughts are severe enough, these health problems can lead to loss of human life.

Other possible impacts include recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Due to their age, health conditions, and limited ability to mobilize to shelters, cooling, and medical resources, the infirm, young, and elderly are particularly susceptible to drought and extreme temperatures, sometimes associated with drought conditions. Some drought-related health effects are short term, while others can be long term (CDC 2020).

Impact on General Building Stock

No structures will be directly affected by drought conditions, though some structures may become vulnerable to wildfires, which are more likely following years of drought. Droughts can have significant impacts on other types of property such as landscaped areas and economically important natural resources.

Impact on Critical Facilities

Water supply facilities may be affected by drought events. However, a majority of the critical facilities defined for this plan will continue to be operational during a drought.

Impact on Economy

Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors, power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought can lead to other losses because so many sectors are affected—losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease.

According to the 2017 Census of Agriculture, Cameron County has 271,480 acres of farmland, resulting in a $122.5 million market value of products sold (USDA 2017). According to the 2018 State of Texas HMP, between 1996 and 2016, the County experienced drought-related losses (property plus crop losses) ranging between $12.2 million and $143.5 million (State of Texas Hazard Mitigation Plan 2018).

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The Planning Team considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the drought hazard because the entire Planning Area is exposed and vulnerable to droughts. Future growth and development could impact the amount of potable water available due to a drain on the available water resources. An increased drain on water resources would not only impact the Planning Area's population, but it would also exacerbate impacts to other areas of the county as discussed above, including agriculture and recreational facilities.

Projected Changes in Population

The Planning Area has experienced an increase in population between the 2010 Census (406,220) and the estimated 2019 American Community Survey population of 421,017. Population is expected to increase over the next few years. With an increase in population, the demand for water supply will increase. During a drought, the amount of water needed might not be available. This might require reallocation of water resources to meet

demands during a drought. If needed, county and local jurisdictions can pass special ordinances regulating the amount of water consumed and used during periods of drought to conserve water.

Climate Change

Climate change as the potential to impact the number of and the severity of droughts. An increased incidence of drought might impact availability of water supplies, primarily placing an increased stress on the population. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, could increase and threaten structures. If a wildfire were to occur during a drought, emergency services might face complications from a water shortage depending on their water source, and critical water-related service sectors might need to adjust management practices and actively manage resources. Increased incidence of drought increases the potential for impacts on the local economy, including the production of agricultural products.

Change of Vulnerability Since 2015 HMAP

Since the 2015 HMAP, the Planning Area has grown in population, but the economic value of its agricultural sector has decreased. Therefore, the number of people exposed to the hazard has increased while the farms exposed to the hazard has decreased. Overall, the Planning Area will continue to be exposed and vulnerable to drought events.

4.3 Hazard Profiles

4.3.4 Erosion

The following section provides the hazard profile and vulnerability assessment for the erosion hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.4.1 Hazard Profile

Hazard Description

Erosion is the process of the wearing away of beaches and bluffs along the coastline by large storms, flooding, strong wave action, sea level rise, fluvial currents, and human activities. In the State of Texas, there are two types of erosion: coastal erosion and inland erosion.

Coastal Erosion

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline, or dune material because of natural coastal processes or manmade influences. Coastal erosion is linked to hurricane damage in that healthy coastal dunes and beaches help reduce impacts of hurricane, tropical storms, tropical depressions, and severe coastal flooding. Mitigating coastal erosion also mitigates those hazards (State of Texas Hazard Mitigation Plan 2018).

Erosion is measured as a rate of change in the position or displacement of a shoreline over a period of time. Short-term erosion typically results from periodic natural events, such as wave action, storm surges and wind. Long-term erosion is a result of repetitive occurrences of this type and of severe storm and flooding events. Erosion can affect natural and built environments. Impacts depend on topography, soils, building types and construction materials. Coastal erosion can affect natural systems, coastal food supplies, tourism industry, and small town viability. When a natural barrier erodes and sea water infiltrates freshwater wetlands, they can die, removing key habitats for animals and a protective buffer for nearby communities (State of Texas Hazard Mitigation Plan 2018).

Inland Erosion

Inland erosion is the wearing-away of soil or removal of the banks of streams or rivers. It involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity. Soil erosion on cropland is of particular interest because of its onsite impacts on soil quality and crop productivity, and its off-site impacts on water quantity and quality, air quality, and biological activity. Erosion is measured as a rate of change in the position or displacement of a river or stream bank over a period of time or the amount of soil removal. Short-term erosion results from periodic flooding and wind. Long-term erosion is a result of repetitive events of this type and of prolonged drought.

Erosion caused by water is the primary concern for the Planning Area. Water erosion is the detachment and removal of soil by water. The process can occur naturally or be accelerated by human activity. The rate of erosion

can be a slow process that continues relatively unnoticed or can occur very rapidly. The rate is dependent on the type of soil, the local landscape, and weather conditions (Ritter 2018, USDA 2000).

There are three types of water erosion that can occur: sheet, rill, and gully. Sheet erosion is the most difficult to see as it is a uniform soil layer being remove from an area over the surface. Rill erosion starts as water flowing over the soil surface concentrates into small streams, creating channels of water flow. Gully erosion is when rill erosion is not kept under control and creates gullies (deeper and wider cuts) (Soil Science Society of America n.d.)

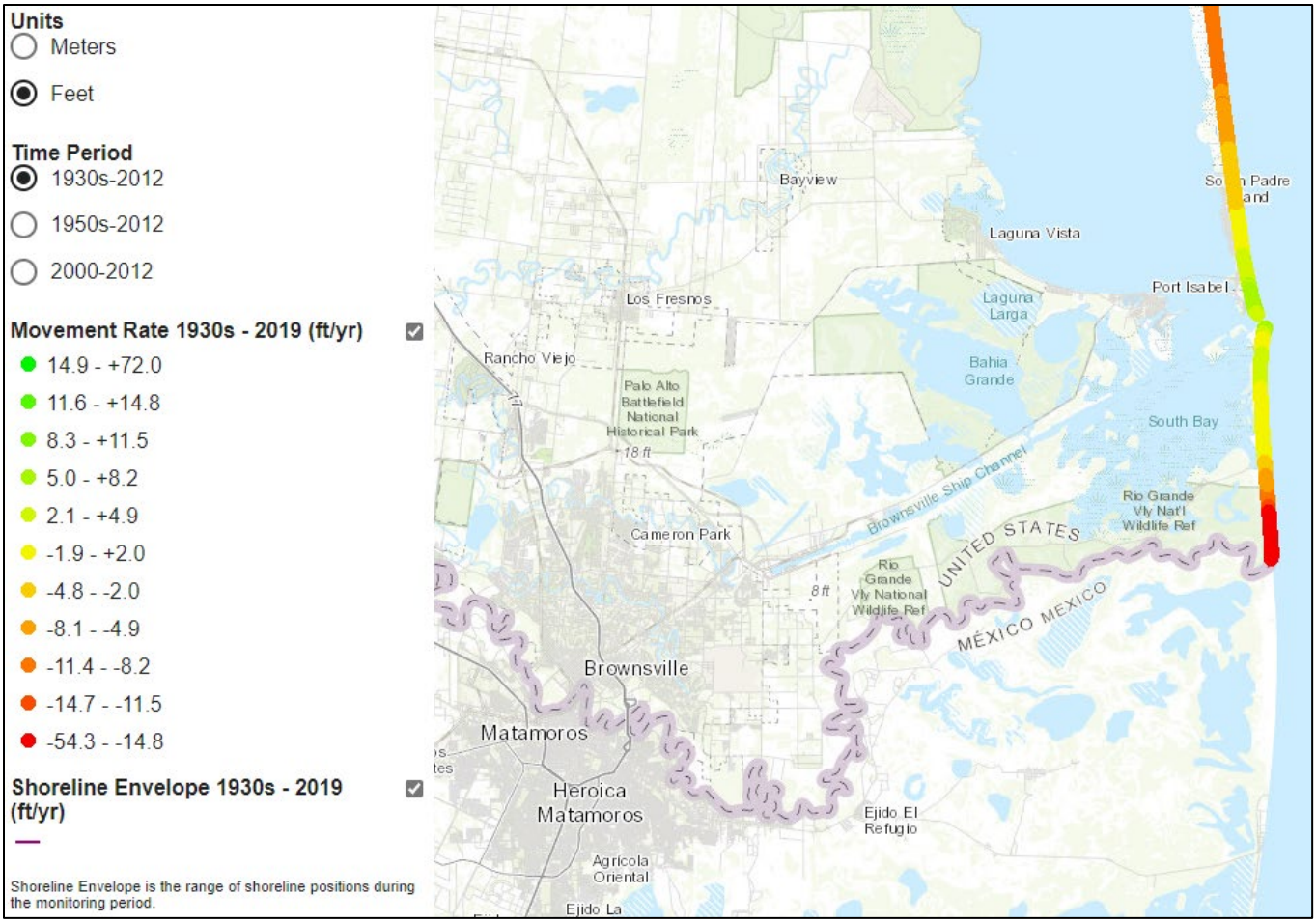
Erosion can be most severe where urbanization, development, recreational activities, logging and agricultural practices take place. Extreme rainfall events, lack of vegetative cover, fragile soils and steep slopes combine to accelerate erosion (Ritter 2018). In the Planning Area, the banks along the Rio Grande and resacas are experiencing erosion.

Location

Coastal Erosion

The most vulnerable jurisdictions in Texas are the cities and towns along the coast and barrier islands in Region 2, Region 3, and Region 6. The Planning Area is in Region 3 and therefore especially vulnerable to coastal erosion. See Figure 4.3.5-1 for shoreline movement rates. Mitigation techniques include dune and beach restoration, building seawalls, and placing semi-permanent obstructions perpendicular to beaches. Coastal erosion mitigation actions have the benefit of helping reduce impacts from hurricanes and severe coastal flooding. The Texas General Land Office (GLO) manages coastal erosion and documents its progress to the legislature in Coastal Erosion Planning and Response Act reports.

Figure 4.3.5-1 Texas Shoreline Movement Rate Map



Source: (Bureau of Economic Geology, University of Texas 2012)

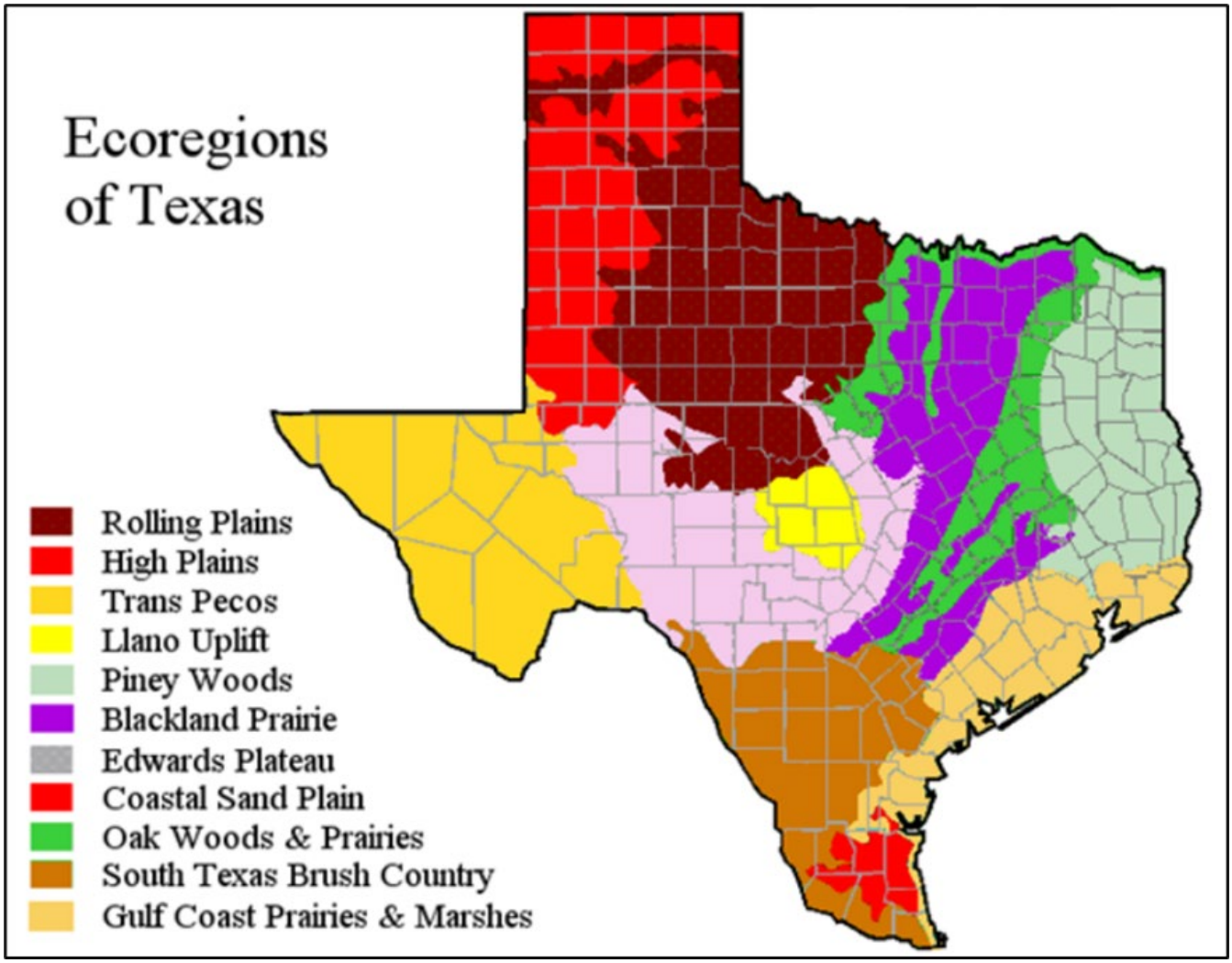
Inland Erosion

The Rio Grande forms the southern border and 3,500 acres of resacas are located throughout the Planning Area (EPA 1998). Erosion along the banks of the river and resacas is a major concern for the Planning Area. Rainfall events that occur upstream can create major flood stages and high flow rates in the waterways. This causes the water to move at high speeds through the Planning Area, causing erosion along the waterway banks. The mouth of the Rio Grande has become silted up, obstructing its flow into the Gulf of Mexico (Jepsen, et al. 2003).

A river's meander belt is the area within which a river shifts its channel across its floodplain over time. The numerous resacas in the Planning Area testify to the massive meandering the Rio Grande. The river's width and depth vary with seasonal changes and irrigation.

In the State of Texas, inland erosion is more prominent in the High Plains, Rolling Plains, and Coastal Sand Plains. The Planning Area is south of the Coastal Sand Plains (see Figure 4.3.5-2).

Figure 4.3.5-2 Ecoregions of Texas - Erosion Areas



Source: Kids on the Land, 2021

Extent

It is difficult to directly measure erosion and the risk of erosion. There are other properties, however, that can be used to measure erosion: soil surface stability, aggregate stability, infiltration, compaction, and content of organic matter. Measuring these properties can help with understanding the susceptibility of erosion at a specific location. Comparing visual observations along with quantitative measurements can help provide information about soil surface stability, sedimentation, and soil loss (USDA 2001).

Coastal erosion estimates were developed for Cameron County by the General Land Office. According to the analysis, the Planning Area can expect an average annual coastal erosion rate between 3 and 12 feet per year (General Land Office 2013).

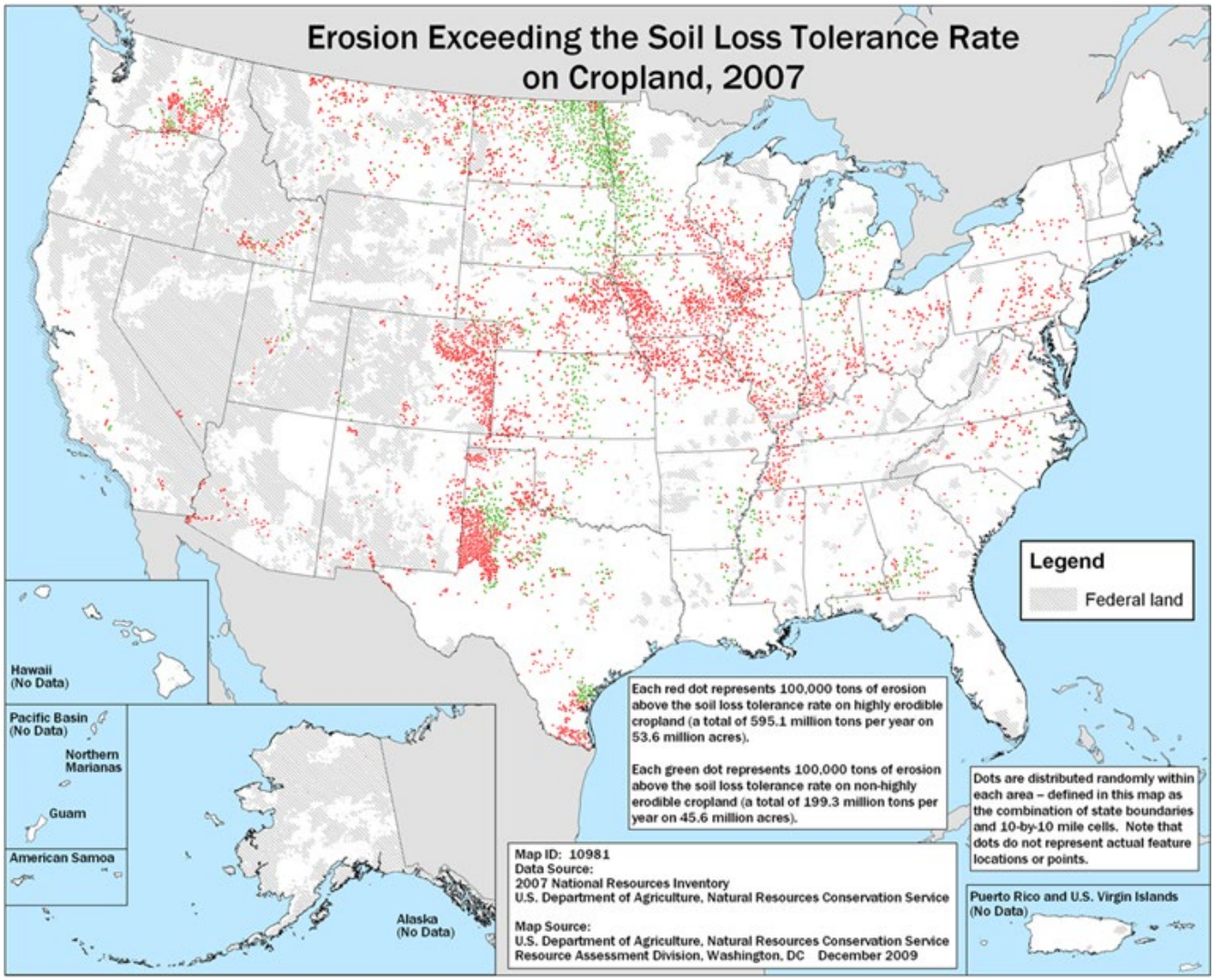
Every five years the Natural Resources Conservation Service conducts a statistical survey of natural resource conditions and trends on non-federal land in the United States called the National Resources Inventory (NRI). The

NRI provides nationally consistent statistical data on erosion resulting from water and wind processes on cropland. It uses a variety of tables and maps to document the ongoing state of erosion across the Planning Area (State of Texas Hazard Mitigation Plan 2018, NRCD 2010). According to the most recent report, inland soil erosion from wind and water is occurring at an average annual rate of 4.49 tons per acre (National Resources Inventory 2017).

One key measure used in the NRI is the Erodibility Index (EI). This index is a numerical expression of the potential of a soil to erode, considering climatic factors and the soils' physical and chemical properties. The higher the index, the greater is the investment needed to maintain the sustainability of the soil resource base of high-yield crops. Highly Erodible Land is defined to have an EI of at least 8 (State of Texas Hazard Mitigation Plan 2018).

Another soil erosion component is the soil loss tolerant rate. Identified as 'T', this is the maximum rate of annual soil loss that will permit crop productivity to be economically sustained. Erosion is considered to be greater than 'T' if either water or wind erosion rates exceed the soil tolerance rate (State of Texas Hazard Mitigation Plan 2018). Figure 4.3.5-3 illustrates the locations of where erosion exceeded the soil loss tolerance rates across the United States. Each red dot represents 100,000 tons of erosion above the soil loss tolerance. According to this figure, areas of erosion exceeding the soil loss tolerance rates are near, but not part of, the Planning Area.

Figure 4.3.5-3 National Erosion Loss Rates



Source: NRI 2007

Worst-Case Scenario

Magnitude scales for erosion events do not currently exist, but a 0.2% (500 year) storm that produces significant amounts of rain in a short period of time could lead to a worst-case scenario for an erosion incident along the shoreline, rivers, and resacas in the Planning Area. Storms that occur in rapid succession similar to the events that occurred in July, August, September, and October 2020 (see Table 4.3.5-1) may cause several feet of beach and inland erosion, similar to those previous events. Additionally, rainfall events that occur upstream from the Planning Area can create major flood stages and high flow rates along the Rio Grande. This causes the water to move at high speeds through the area, causing erosion along the river.

A slow moving Category 5 hurricane with a large storm surge and severe wave action would be the worst-case scenario for a single coastal erosion event. A series of severe coastal storm events with little time for natural recovery of the shoreline or manmade repairs would also be a worst-case scenario in coastal areas. Impacts from

such events includes road closures, damage to infrastructure and buildings, and inaccessible areas that can disrupt emergency response.

Previous Occurrences

Between 1953 and 2021, the State of Texas was not included in any erosion-specific FEMA disaster declarations; however, Cameron County was included in 14 hurricane and tropical storm declarations which typically include heavy coastal erosion and flooding impacts. For the 2022 HMAP Update, there was limited information regarding specific erosion events in the Planning Area. Local agencies do not typically have the capabilities to monitor or report statistical data for erosion for a specific event (Cameron County Office of Emergency Management 2021). However, Table 4.3.5-1 lists events that were identified with erosion and associated with severe weather events.

Table 4.3.5-1 Severe Storm/Erosion Events for the Planning Area, 2000-2021

Start Date of Event	Event Type	Event Details
October 8, 2020	Hurricane Delta	The passage of Hurricane Delta about 200 miles east of South Padre Island produced peak sea heights of 35 feet. Swell periods of more than 12 seconds began during the late afternoon at the site and propagated quickly to the Cameron County Beaches. The combination of strong wave push with above-predicted tides produced significant beach erosion at public beach access point 5. Visual inspection did show water had risen above previously calved dunes from Hurricane Laura and Tropical Storm Beta in late August and late September, respectively. Renourishment costs are likely to run above $5 million based on data from earlier erosion from Hurricane Laura.
September 20, 2020	Tropical Storm Beta	An NWS survey of tidal run-up and overwash on South Padre Island found significant dune erosion at many of City and County beach access points between Isla Blanca Park and Clayton's Beach Bar. Beta's water eroded more dunes that began with run-up associated with Hurricane Laura in late August.
August 26, 2020	Hurricane Laura	As swells from Hurricane Laura reached the lower Texas coast late on August 26th, the wave energy from this swell combined with high tide caused some coastal erosion along the beaches of South Padre Island as high waves (up to 10+ feet in some cases) set-up and ran up into gaps in the dunes, into the dunes, or calved more robust dunes by erosion. Erosion began several hours prior to high tide due to wave action as Laura propagated its peak swell four to six hours prior to landfall.
July 25, 2020	Hurricane Hanna	Hurricane Hanna rainfall of 4 to 6+ inches by mid evening began to produce flash flooding in La Feria and Harlingen which continued due to poor drainage situations, especially in the La Feria/Santa Rosa area.

Start Date of Event	Event Type	Event Details
		Public and individual assistance dollar damages, as well as insured damages, was likely to be more than $50 to $100 million in total.
June 20, 2018	Flash Flood	Several days of torrential rainfall resulted in widespread flooding in and east of Brownsville and Los Fresnos, with farm and subdivisions under 2 to 3+ feet of water. Additional flooding on saturated soils produced more damage including more erosion to drainage canals/ditches and mainly rural roads. Total damage in all areas was around $20 million.
September 26, 2010	Tropical Storm	Tropical Storm Hermine brought damaging winds and flooding rains to Brownsville, Harlingen, and Raymondville. Rainfall of more than 3 inches in just a few hours flooded roads and farmland, especially in a small swath from northeast Cameron County to southern Willacy County. Tide departures peaked around 1.5 feet which produced run-up to the dune line and closed the county beach access points on South Padre Island to vehicular traffic.
June 30, 2010	Flash Flood, Storm Surge	More than 6 inches of nearly steady rain in less than 12 hours created poor drainage and flash flood conditions in the Town of South Padre Island, where main and secondary roads became impassible for a period of time during the afternoon of June 30th. Increasing and persistent east to northeast flow built seas above 22 feet east of the Lower Texas coast on June 30th with a swell period of more than 12 seconds brought a minor to moderate storm surge to South Padre Island and neighboring communities along Laguna Madre Bay, including Port Isabel, Laguna Heights, and Laguna Vista. Water reached into the dunes but did not breach them completely; beach surf was reported at 7 to 9 feet. The event and impact on the beach was similar to that from Gustav on Labor Day (September 1) 2008; erosion was minor to moderate and the beach recovered quickly.
September 12, 2008	Storm Surge	Large swells and high waves radiating well west of Ike's growing core over the southeast and south central Gulf of Mexico reached the coast of Deep South Texas. Very high seas, severe beach erosion, coastal flooding, and big surf prevailed. The continuous pounding of the beach by Ike eroded nearly all of the slope of the beach below the dune line, and calved a number of dunes along the southern Cameron County shoreline. Estimated water levels were at least 5 feet above normal as of 9 AM.
September 1, 2008	Storm Surge	Hurricane Gustav generated swells produce high surf and tidal overwash along the coast of Deep South Texas.

Start Date of Event	Event Type	Event Details
July 23, 2008	Hurricane Dolly	Hurricane Dolly brought torrents of heavy rainfall and flash flooding as high as 5 feet in some places. Measured and estimated rainfall totals in the flash flood areas from Dolly ranged from 14 to 18 inches. High water and general flooding continued for days and much longer in backed up drainage areas.
March 17, 2008	High Surf	A low pressure system produced 20 knot or higher wind from deep in the Bay of Campeche northwest through the South Texas coast. Sea heights had built to near 16 feet at the NOAA Buoy east of Padre Island (Kenedy County), and, along with a wave period of 10 to 11 seconds, both tidal overwash and rough, confused, and high surf was observed along South Padre Island.
October 4, 2005	High Surf	Tropical Storm Stan brought swells along the coastlines of South Padre Island. These swells produce heavy surf, dangerous rip currents, and minor tidal overflow. Minor damage to sand dunes was reported.
July 20, 2005	Hurricane Emily	Minor to moderate beach erosion was reported in Cameron County, with a storm surge associated with the landfall of Hurricane Emily in northern Mexico creating a storm tide of 3 to 5 feet above normal. This storm tide caused erosion of the dunes and the beaches of Boca Chica and South Padre Island. No significant damage reported.
July 14, 2003	High Surf	Heavy surf combined with tidal levels 1 to 2 feet above normal produced coastal flooding over Cameron, Kennedy, and Willacy counties. The heavy surf and above normal tides were the result of Hurricane Claudette in the Gulf of Mexico.

Source: *NOAA-NCEI 2022*

Note: *Due to limitations in data, not all erosion events are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated*

Climate Change Projections

Climate change may impact storm patterns, increasing the probability of more frequent, intense storms, including hurricanes. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). Major clusters of summertime storms in North America will grow larger, more intense, and more frequent later this century in a changing climate, leading to increased rainfall and posing a greater threat of flooding across wide areas (UCAR 2017). Warming temperatures also could increase the occurrence and duration of droughts, which would increase the probability of wildfire, reducing the vegetation that helps to support slopes. Coastal areas are sensitive to sea-level rise, changes in precipitation and the frequency and intensity of storms and warmer oceans. Increased storm intensity can result in increased impacts on coastal erosion. Increased storm wave heights may cause coastal erosion and flooding at twice the rate from sea-level rise alone (NASA 2010). All of these factors would increase the probability for inland and coastal erosion to occur.

Probability of Future Occurrences

It is anticipated that erosion will continue to occur along the Rio Grande the numerous resacas, and the coastal areas in the Planning Area. As the frequency of storms occurs due to climate change, the probability for future events will likely increase as well. Table 4.3.5-2 summarizes data regarding the probability of occurrences of erosion events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the NOAA-NCEI Storm Events Database and FEMA.

Table 4.3.5-2 Probability of Future Occurrence of Erosion Events

Hazard Type	Number of Occurrences Between 2000 and 2021	Rate of Occurrence	% chance of occurrence in any given year
Erosion	14	0.67	63.64%

Source: NOAA-NCEI 2022

Based on the 14 recorded erosion events over 21 years, the Planning Area averages more than one erosion event every two years. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for erosion in the Planning Area is considered 'rare'.

4.3.4.2 Vulnerability Assessment

To assess the Planning Area's risk to the coastal and inland erosion hazards, a spatial analysis was conducted using the best available data. To help understand the geographic distribution of the Planning Area's risk to coastal erosion, a 100-foot buffer was created from NOAA's 2011 shoreline. The inland erosion hazard area was determined using USDA's Natural Resources Conservation Service's 2020 soil data for Cameron County. Soils with an erodibility factor (k) of 0.49 or greater were extracted to assess the Planning Area's risk to inland erosion. Figure 4.3.5-4 depicts these hazard areas in the Planning Area.

Refer to Section 4.1 (Methodology and Tools) for additional details on the methodology used to assess coastal and inland erosion risk.

Impact on Life, Health, and Safety

Coastal and inland erosion is not generally considered an imminent threat to public safety when the changes are gradual over many years. However, drastic changes to the shoreline may occur as a result of a single storm event which can threaten homes and public safety. Furthermore, erosion can cause damage to residential buildings, displace residents, and block major roadways, thus inhibiting travel for emergency responders or populations trying to evacuate the area.

Erosion can create water quality problems in surface waters and drainage ways. These problems can adversely impact the health and biological diversity of water bodies. According to the USDA, this includes:

Excess nutrients impact water quality through eutrophication, a process where excess nitrogen and phosphorus causes unwanted biological growth in water bodies.

Sediment reduces water quality by making the water cloudy. Turbidity prevents sunlight from penetrating the water and reduces photosynthesis and underwater vegetation. Oxygen levels are reduced in turbid waters, further degrading habitat for fish and other aquatic organisms.

Sediment can build up in stream channels, lowering flow capacity. The problem of low stream capacity is compounded as runoff increases from newly built-up or paved areas and causes stream channels to receive larger amounts of water in shorter periods of time. This leads to more frequent flooding in areas that never or only rarely flooded in the past. In floodprone areas, levees may need to be built or enlarged to better protect public safety.

A financial burden results from cleanup of sediment-damaged areas. Taxpayers often bear the cost of removing sediment from public roads, road ditches, culverts or streams; not to mention damage to homes and the safety hazards associated with flooding. Other costs of erosion that are borne by the public are degraded soils, a polluted environment, more runoff, greater need for irrigation, and aesthetically unpleasing sites (USDA n.d.).

The population exposed, or located in the estimated hazard area, is considered vulnerable to this hazard. The analysis indicates that 4,756 people are located in the estimated coastal erosion hazard area, and a total of 10,657 are located in the inland erosion hazard area Figure 4.3.5-4.

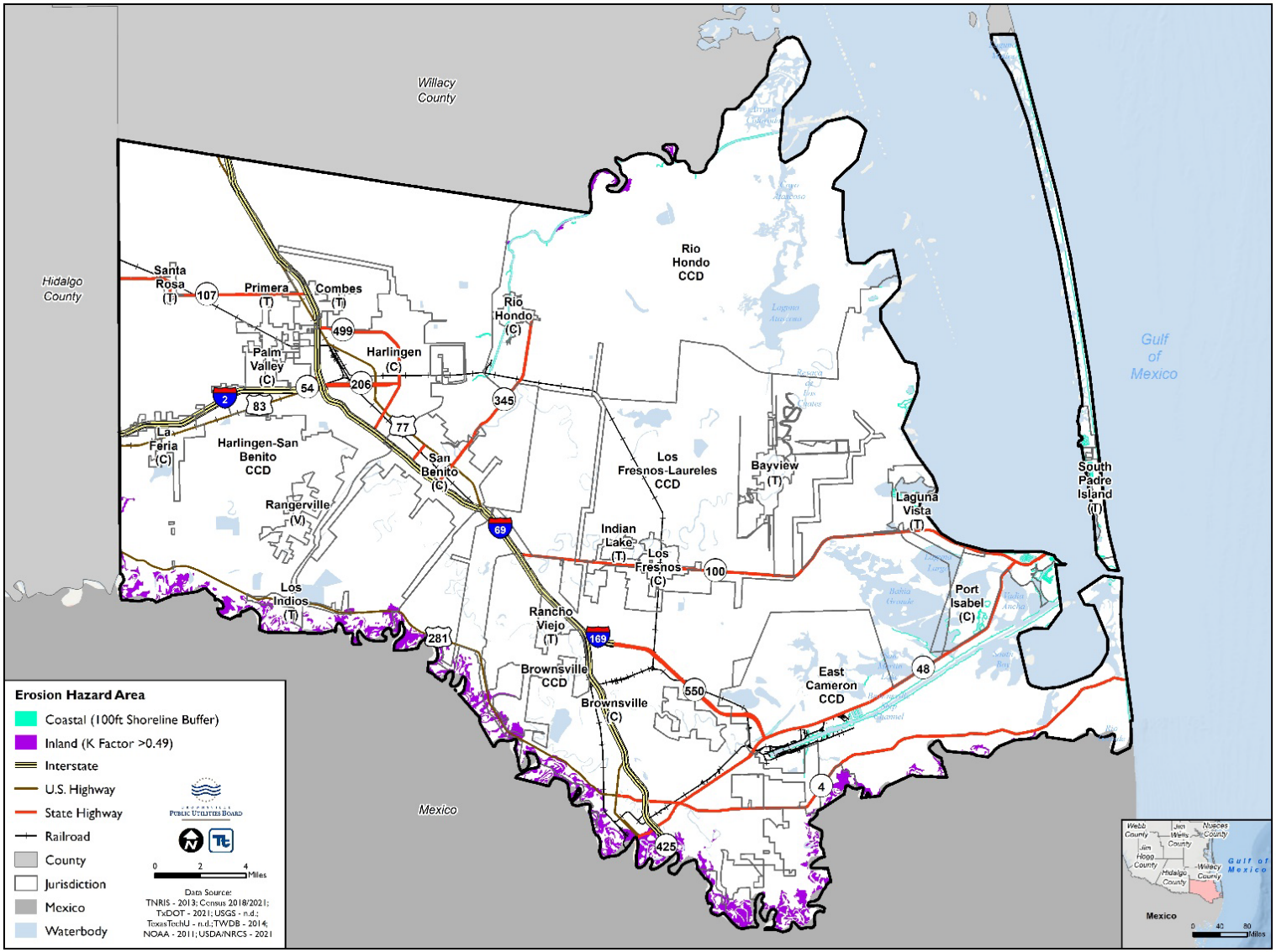
Table 4.3.5-3 Estimated Population Located in the Coastal Erosion Hazard Area

Jurisdiction	Total Population (American Community Survey 2015-2019)	Estimated Population Located in the Erosion Hazard Areas			
		Number of Persons Located in the Coastal Erosion Hazard Area	Percent of Total	Number of Persons Located in the Inland Erosion Hazard Area	Percent of Total
Brownsville (City)	186,738	0	0.0%	9,629	5.2%
BPUB Constituents	**421,017**	**4,756**	**1.1%**	**10,657**	**2.5%**

Source: ACS 5-year Estimate 2015-2019; USDA/NRCS 2020; NOAA 2011

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Figure 4.3.5-4 Erosion Hazard Areas in the Planning Area



Impact on General Building Stock

After considering the population exposed and potentially vulnerable to the coastal and inland erosion, the built environment was evaluated. Erosion can impact structures located along the banks of waterways, having the potential to destabilize the foundation of structures. It can also impact infrastructure such as dams, levees, roads, and other developed land. Table 4.3.5-4 and Table 4.3.5-5 summarize the results of the vulnerability analysis regarding erosion in the Planning Area.

In summary, 2,692 buildings accounting for approximately $2.23 billion of replacement cost value are located in the estimated coastal erosion hazard area (Figure 4.3.5-4). In total, this represents nearly 1.3 percent of the Planning Area's total general building stock inventory. Furthermore, 4,919 structures accounting for approximately $5.58 billion) are located in inland erosion hazard area (Table 4.3.5-5). In total, this represents 2.4 percent of the Planning Area's total general building stock inventory.

Table 4.3.5-4 Estimated Buildings Located in the Coastal Erosion Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the Coastal Erosion Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the Coastal Erosion Hazard Area	Percent of Total
Brownsville (City)	78,873	$55,730,567,030	0	0.0%	$0	0.0%
BPUB Constituents	**202,224**	**$174,838,504,517**	**2,692**	**1.3%**	**$2,231,928,774**	**1.3%**

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, NOAA 2011

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.5-5 Estimated Buildings Located in the Inland Erosion Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings Located in the Inland Erosion Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the Inland Erosion Hazard Area	Percent of Total
Brownsville (City)	78,873	$55,730,567,030	4,249	5.4%	$4,808,996,482	8.6%
BPUB Constituents	**202,224**	**$174,838,504,517**	**4,919**	**2.4%**	**$5,579,866,628**	**3.2%**

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, NOAA 2011

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on Critical Facilities

Coastal and inland erosion may potentially impact critical facilities and lifelines identified within the Planning Area. Critical services may not be available if critical facilities or lifelines are directly damaged or transportation routes to access these critical facilities are breached due to erosion. Erosion may destabilize the roadways leading to facilities or destroy the foundation that supports the critical facilities along the shoreline. Table 4.3.5-6 provides the estimated number of lifeline facilities located in the coastal and inland erosion hazard areas.

Table 4.3.5-6 Estimated Critical Facilities and Lifelines in the Coastal and Inland Erosion Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Coastal Erosion Hazard Area	Number of Lifelines Located in the Inland Erosion Hazard Area
Communications	42	0	2
Energy	81	0	13
Food, Water, Shelter	233	0	15
Health and Medical	22	0	1
Safety and Security	111	0	6
Transportation	11	0	1
BPUB and City of Brownsville (Total)	**500**	**0**	**38**

Source: Cameron County Planning Partners 2021; HIFLD 2020, NOAA 2011

In addition to critical facilities, utility lines located in erosion hazard areas pose a significant risk for utility outages and the interruption of critical services. Table 4.3.5-7 lists the utility lines located in the Planning Area and the exposure to the coastal and inland erosion hazard areas.

Table 4.3.5-7 Estimated Critical Facilities and Lifelines in the Inland Erosion Hazard Area

Utility Line	Total Length (Feet)	Total Feet of Utility Line Located in the Coastal Erosion Hazard Area	Percent of Total	Total Feet of Utility Line Located in the Inland Erosion Hazard Area	Percent of Total
UG Secondary Conductor	3,238,672	271	0.0%	74,139	2.3%
UG Primary Conductor	2,089,990	2,289	0.1%	66,251	3.2%
OH Secondary Conductor	2,892,681	6,797	0.2%	229,788	7.9%
OH Primary Conductor	2,817,947	7,799	0.3%	165,976	5.9%
Fiber Optic	593,857	0	0.0%	69,306	11.7%
Water Pipelines	3,765,798	0	0.0%	174,049	4.6%
Wastewater Force Mains	548,255	0	0.0%	23,672	4.3%
Wastewater Gravity Mains	3,084,283	0	0.0%	135,884	4.4%
BPUB (Total)	**19,031,483**	**17,157**	**0.1%**	**939,065**	**4.9%**

Source: Cameron County Planning Partners 2021; HIFLD 2020, NOAA 2011

Impact on Economy

The impact of erosion on the economy and estimated dollar losses are difficult to measure. Erosion and other geological hazards can impose direct and indirect impacts on society. Erosion directly causes damages to buildings. The total replacement cost value of structures located in the coastal and inland erosion hazard areas in the Planning Area is $7.81 billion ($2.23 billion coastal and $5.58 billion inland).

Coastal and inland erosion can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities may be temporarily out of operation. Additionally, disruption to business operations can occur in cases where infrastructure is breached by erosion. Loss of income may occur as a secondary impact if businesses are closed under repairs due to this breaching. To prevent these potential business losses, public expenditures may need to

be spent to implement shoreline stabilizers and to protect key infrastructure like highways and interstates that follow along the coastline. Furthermore, erosion may result in additional clean-up costs, reduced property values, and loss of productivity, all of which are difficult to measure (USDA n.d.).

Impact on the Environment

Erosion is a natural or man-made process that can greatly impact the environment. Sediment transferred through streams, lakes, rivers can erode soil and impact ecosystems. High sediment concentrations can benefit the environment by retaining dead plant production and capturing suspended sediment (Delaware Estuary Regional Sediment Management Plan Workgroup 2013). Alternatively, upland erosion can degrade water quality and quantity, ultimately impacting aquatic life. Negative overall impacts to the environment occur when erosion eliminates or contaminates critical habitats. For instance, filter-feeding bivalves consume small particles, which, if contaminated from erosion runoff, could kill them (Kreeger, et al. 2010).

FEMA estimates that every dollar spent on erosion control and mitigation to preserve wetlands and other natural ecosystems provides a return on average of four dollars in cost-savings for the future. Preliminary studies following Hurricane Harvey indicated this ration will increase from 1:4 to 1:6. Without healthy beaches, dunes and wetlands to protect the coast, there is more day-to-day wear and the impact of major storms and hurricanes is far more severe (Texas HMP 2018).

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed and illustrated in Section 3 (Community Profile), areas targeted for future growth and development have been identified across the Planning Area. Any areas of growth could be affected by erosion if the growth areas are within identified hazard areas. Areas targeted for potential future growth and development could be potentially impacted by erosion if they are located within areas prone to erosion.

Projected Changes in Population

Increasing population trends in the Texas coastal region or areas prone to inland erosion will directly increase the risks associated with erosion. A larger population will require additional structures to be constructed on land that is eroding in the coastal regions. Structures built in erosion prone areas are likely to require maintenance costs.

Climate Change

A direct impact of climate change on erosion is difficult to determine. Multiple secondary effects of climate change have the potential to increase the likelihood of erosion. Warming temperatures resulting in wildfires would reduce vegetative cover along steep slopes and destabilize the soils due to destruction of the root system; increased intensity of rainfall events would increase saturation of soils on steep slopes. Sea level rise will increase the severity of coastal erosion. Any changes in the frequency or severity of coastal storms will also increase the severity of coastal erosion.

Change of Vulnerability Since 2015 HMAP

Erosion was not included in the 2015 HMAP and is a new hazard of concern for this 2022 update.

4.3 Hazard Profiles

4.3.5 Extreme Heat

The following section provides the hazard profile and vulnerability assessment for the extreme heat hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.5.1 Hazard Profile

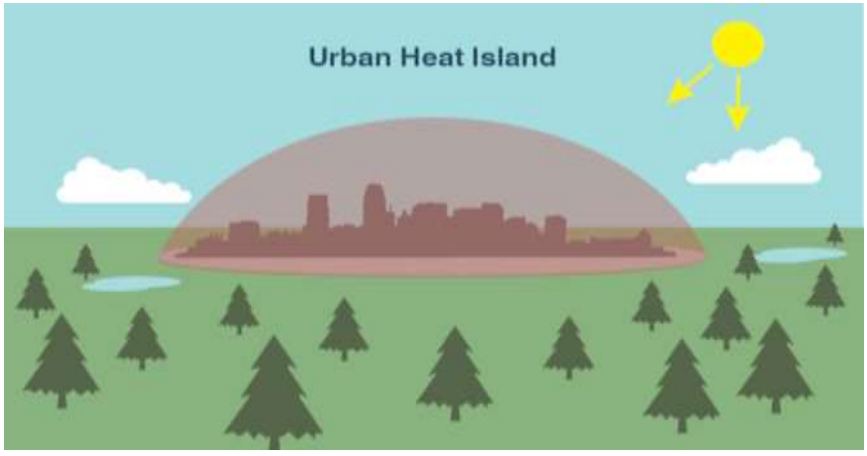
Hazard Description

Extreme heat can have a significant impact to human health, commercial/agricultural businesses and primary and secondary effects on infrastructure (e.g., power failure). What constitutes extreme heat can vary across different areas of the country, based upon what the population is accustomed.

Location

Extreme temperature events can occur in any part of the Planning Area. Metropolitan areas could experience more extreme heat events due to urban heat islands. Heat island describes built up areas that are hotter than nearby rural areas (see Figure 4.3.5-1). The urban centers of Brownsville and Harlingen are more susceptible to the heat island affect that the outlying farming and ranching areas. According to the U.S. EPA, the annual mean daytime air temperature in urban areas can be 1-7°F warmer than its surroundings. In the evening, the difference can be 2-5°F higher. Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water pollution (EPA 2021).

Figure 4.3.5-1 Urban Heat Island



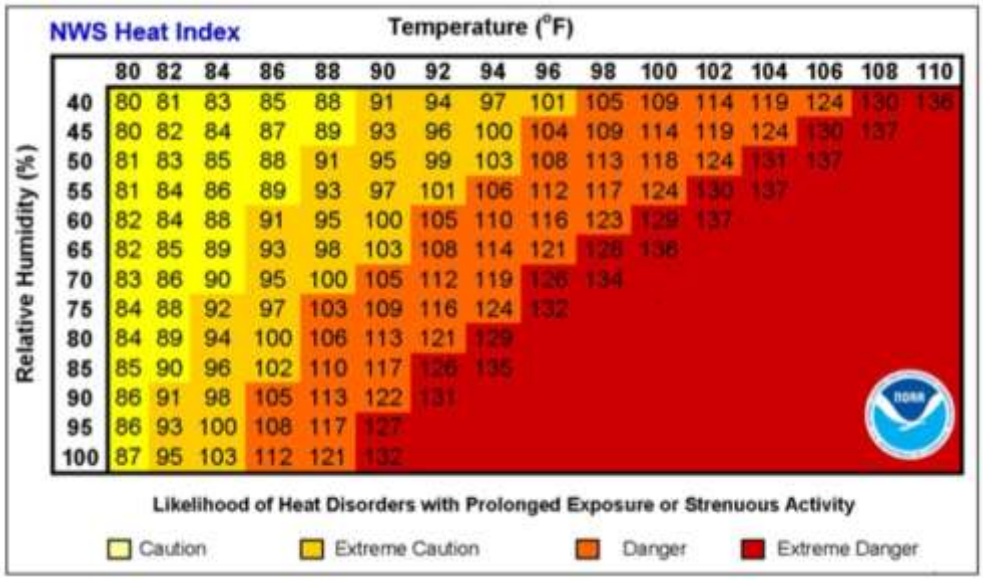
Source: NASA/JPL-Caltech, 2021

Extent

The extent of extreme heat temperatures generally is measured through the Heat Index, identified in Figure 4.3.5-2. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. To determine the Heat Index, the temperature and relative humidity are needed. Once both values are identified, the Heat Index is the corresponding number of both the values. This provides a measure of how temperatures feel; however, the values are devised for shady, light wind conditions. Exposure to full sun can increase the index by up to 15 degrees.

Relative humidity is the amount of moisture in the air at a certain temperature compared to what the air can "hold" at that temperature…it is measured as a percentage or ratio of the amount of water vapor in a volume of air RELATIVE to a given temperature and the amount it can hold at that given temperature. Warm air can hold more moisture than cold air.

Figure 4.3.5-2 Heat Index Chart



Source: National Weather Service, 2022

Each National Weather Service office issues some or all of the following heat-related products as conditions warrant:

- **Excessive Heat Warning—Take Action!** An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and night time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas not used to extreme heat conditions. If you don't take precautions immediately when conditions are extreme, you may become seriously ill or even die.
- **Excessive Heat Watches—Be Prepared!** Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.

- **Heat Advisory—Take Action!** A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Advisory is when the maximum heat index temperature is expected to be 100° or higher for at least 2 days, and night time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas that are not used to dangerous heat conditions. Take precautions to avoid heat illness. If you don't take precautions, you may become seriously ill or even die.
- **Excessive Heat Outlooks—Be Aware!** The outlooks are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead-time to prepare for the event.

Worst-Case Scenario

An extreme heat event could impact the entire population of the Planning Area. The vulnerable populations (over 65 and under 5, below poverty threshold) would be more susceptible to the warmer temperatures. Extreme heat worst-case scenario would be a multi-day event of record temperatures exceeding 100°F, like that experienced in June 2017, August 2012, and August 2019. Those that are outside could be more vulnerable to heat-related illnesses. Another event like this could lead to power outages, magnifying health impacts for those unable to find relief from the high temperatures.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with extreme temperatures in Cameron County and the Planning Area. According to the NOAA-NCEI Storm Events Database, Cameron County has been impacted by seven extreme heat events between 2008 and 2021 (Table 4.3.5-1).

Table 4.3.5-1 Extreme Temperature Events in Cameron County, 2008-2021

Hazard Type	Number of Occurrences Between 2008 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Heat	7	1	0	$0	$0

Source: *NOAA-NCEI 2021*

Note: *Extreme temperature events typically occur over a large area; therefore, the total number of events included in the table are for Cameron County and includes the City of Brownsville.*

According to the Brownsville/Rio Grande Valley Weather Forecast Office, the local weather data collection center with comprehensive data in the Planning Area, the mean number of days between 2000 and 2021 with a daily maximum temperature equal to or greater than 90°F was 146 days. The greatest number of days which the Planning Area experienced extreme heat is 174 in 2012, while the highest temperature recorded was 106°F on March 27, 1984. Between 2000 and 2021, 43 days saw temperatures 100°F or greater.

Table 4.3.5-2 Monthly Number of Days with Maximum Temperature ≥ 90°F, 2000-2021

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2000	0	0	2	4	19	26	31	28	24	6	0	0	140
2001	0	0	2	9	15	30	29	29	20	9	0	0	143
2002	0	0	1	16	22	27	28	31	22	6	0	0	153
2003	0	0	0	2	26	27	28	29	14	2	0	0	128
2004	0	0	0	0	7	26	30	31	24	18	1	0	137
2005	0	0	4	4	14	30	28	31	27	16	1	0	155
2006	0	2	3	15	24	26	27	31	23	4	1	0	156
2007	0	0	0	2	3	23	28	27	22	14	0	0	119
2008	0	0	2	7	9	30	21	28	11	1	0	0	109
2009	0	0	1	6	20	29	31	30	23	12	0	0	152
2010	0	0	0	3	25	29	27	31	21	5	1	0	142
2011	0	1	0	16	21	28	29	31	30	7	1	0	164
2012	0	0	0	10	24	28	30	30	29	22	1	0	174
2013	0	0	2	7	13	29	29	30	17	13	0	0	140
2014	0	0	1	4	7	28	30	30	15	11	0	0	126
2015	0	0	0	1	9	25	29	30	20	7	1	1	123
2016	0	1	1	3	10	22	31	31	27	20	3	0	149
2017	1	4	1	7	23	27	27	31	23	11	6	0	161
2018	0	1	2	1	27	29	31	31	21	15	2	0	160
2019	0	0	0	9	24	30	31	31	27	18	0	2	172
2020	0	0	7	16	24	25	27	31	16	17	2	0	165
2021	0	0	1	6	12	25	27	31	25	21	1	0	149
Mean	0	0	1	7	17	27	29	30	22	12	1	0	146
Maximums	1 2017	4 2017	7 2020	16 2020	27 2018	30 2019	31 2019	31 2021	30 2011	22 2012	6 2017	2 2019	174 2012
Minimums	0 2021	0 2021	0 2019	0 2004	3 2007	22 2016	21 2008	27 2007	11 2008	1 2008	0 2019	0 2020	109 2008

Source: NOAA National Weather Service, 2022

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. Seventy years from now, Texas is likely to have three or four times as many days per year above 100°F as it has today (EPA 2016). With the increase in temperatures, heat waves will become more frequent and intense, increasing heat-related illness and death and posing new challenges to the energy system, air quality and agriculture.

Probability of Future Occurrences

It is anticipated that the Planning Area will experience extreme heat events each year. The probability of future occurrences for extreme heat can be determined by assessing historical averages. Based on the information provided by the National Weather Service over the past 21 years, the Planning Area can expect, on average, approximately 160 days a year with temperatures greater than or equal to 90°F.

Table 4.3.5-3 Probability of Occurrences of Extreme Heat Events

Hazard Type	Number of Occurrences Between 2000 and 2021	% chance of occurrence in any given year
Temperature ≥ 90°F	3,363	100%

Source: NOAA National Weather Service, 2022

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected extreme heat events since 1968. Due to limitations in data, not all extreme heat events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the number of extreme heat events over 21 years, the Planning Area averages 160 events a year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for extreme heat in the Planning Area is considered 'frequent'.

4.3.5.2 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed and vulnerable. For the extreme temperature hazard, the entire Planning Area has been identified as exposed; therefore, all assets are potentially vulnerable. The following text estimated potential impacts of extreme temperatures on the Planning Area.

Impact on Life, Health, and Safety

The entire population (421,017) of Cameron County is exposed to the extreme temperature hazard. Extreme temperature events have potential health impacts including injury and death. According to the Centers for Disease Control and Prevention, populations most at risk to extreme heat events include the following: 1) the elderly, who are less able to withstand temperatures extremes due to their age, health conditions, and limited mobility to access shelters; 2) infants and children up to four years of age; 3) individuals with chronic medical conditions (e.g., heart disease, high blood pressure), 4) low-income persons that cannot afford proper cooling; and 5) the general public who may overexert during work or exercise during extreme heat events (CDC 2017). The number of people vulnerable to extreme heat are presented in Table 4.3.5-4.

Table 4.3.5-4 Vulnerable Populations in the Planning Area

Jurisdiction	Over 65	Percent of Jurisdiction Total	Under 5	Percent of Jurisdiction Total	Poverty Level	Percent of Jurisdiction Total
Brownsville (C)	21,873	11.7%	15,273	8.2%	52,879	28.3%
BPUB Constituents	**57,032**	**13.5%**	**34,450**	**8.2%**	**117,663**	**27.9%**

Source: 2015-2019 American Community Survey Estimates

Note: The totals shown represent all jurisdictions served by the Brownsville Public Utilities Board services.

Exposure to excessive heat can pose a number of health risks to individuals. Table 4.3.5-5 identifies the different health hazards related to extreme heat conditions.

Table 4.3.5-5 Health Effects of Extreme Heat

Health Hazard	Symptoms
Sunburn	Redness and pain. In severe cases: swelling of skin, blisters, fevers, and headaches
Dehydration	Excessive thirst, dry lips, and slightly dry mucous membranes
Heat Cramps	Painful spasms, usually in muscles of legs and abdomen, and possible heavy sweating
Heat Exhaustion	Heavy sweating; weakness; cold, pale and clammy skin; weak pulse; possible fainting and vomiting
Heat Stroke	High body temperature (103°F or higher); hot, red, dry skin; fast, strong pulse; losing consciousness

Source: CDC 2017

Meteorologists can accurately forecast extreme heat event development and the severity of the associated conditions with several days of lead time. These forecasts provide an opportunity for public health and other officials to notify vulnerable populations, implement short-term emergency response actions, and focus on surveillance and relief efforts on those at greatest risk. Adhering to extreme temperature warnings can significantly reduce the risk of temperature-related deaths.

Impact on General Building Stock

All the building stock in the Planning Area is exposed to the extreme temperature hazard. Extreme heat generally does not impact buildings; however, elevated summer temperatures increase the energy demand for cooling. Losses can be associated with the overheating of heating, ventilation, and air conditioning (HVAC) systems. Additionally, manufactured homes (mobile homes) and antiquated or poorly constructed facilities can have inadequate capabilities to withstand extreme heat

Impact on Critical Facilities

All critical facilities in the Planning Area are exposed to the extreme heat hazard. Impacts to critical facilities are the same as described for general building stock. Additionally, it is essential that critical facilities remain operational during natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as brown-outs, due to increased usage from air conditioners and other energy-intensive appliances. Backup power is recommended for critical facilities and infrastructure.

Impact on Economy

Extreme heat events also have impacts on the economy, including loss of business function and damage to and loss of inventory. Business-owners can be faced with increased financial burdens due to unexpected repairs caused to the building, higher than normal utility bills, or business interruption due to power failure (i.e., loss of electricity, telecommunications).

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The

Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

The ability of new development to withstand extreme heat impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Surfaces that were once permeable and moist are now impermeable and dry. These changes cause urban areas to become warmer than the surrounding areas forming an island of higher temperatures (EPA 2021).

Projected Changes in Population

Increasing population trends in the Planning Area will directly increase the risks associated with extreme heat. A larger population will place additional burden on utilities that may be stressed by extreme heat events.

Climate Change

As the climate warms, extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face increased vulnerability to extreme heat and its associated illnesses, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat.

Change of Vulnerability Since 2015 HMAP

Overall, the entire Planning Area remains vulnerable to extreme temperatures. As existing development and infrastructure continue to age they can be at increased risk to failed utility systems (e.g., HVAC) if they are not properly maintained. Similarly, an increase in the elderly population remaining in the Planning Area increases the vulnerable population.

4.3 Hazard Profiles

4.3.6 Flood

The following section provides the hazard profile and vulnerability assessment for the flood hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.6.1 Hazard Profile

Hazard Description

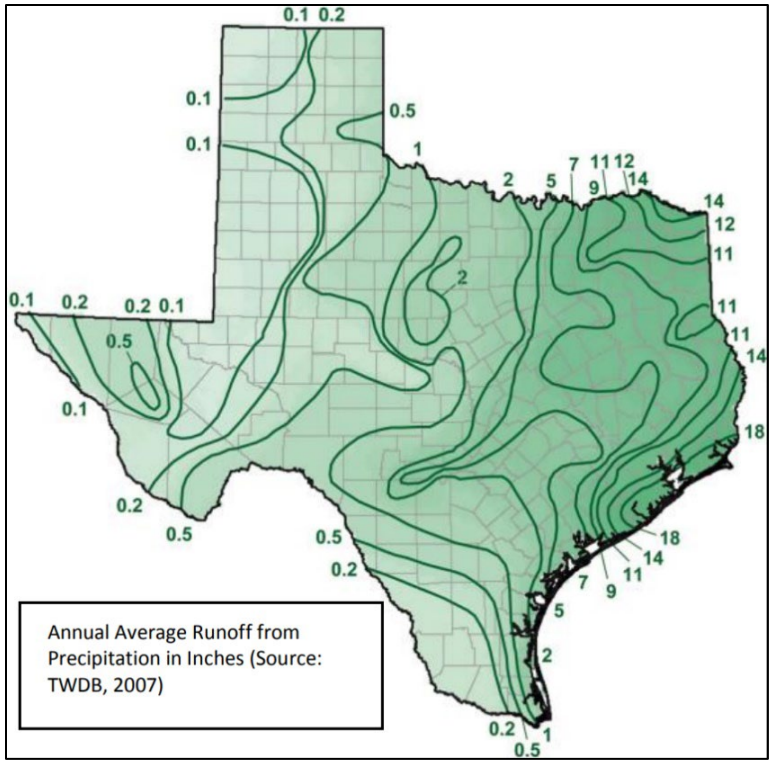
Floods are one of the most common natural hazards in the U.S. They can develop slowly over a period of days or develop quickly, with disastrous effects that can be local (impacting a neighborhood or community) or regional (affecting entire river basins, coastlines and multiple counties or states) (FEMA 2017). As defined in the State of Texas HMP, floods are the accumulation of water within a water body and the overflow of excess water into adjacent floodplain lands (Texas Division of Emergency Management 2013).

In hydrologic analysis, runoff is that portion of rainfall which, in combination with other factors, contributes to the stream flow of any surface drainage way. When runoff exceeds the carrying capacity of the stream or drainage, flooding occurs. Runoff is a product of two major groups of factors, climate and physiographic. Climatic factors may include precipitation, evaporation, transpiration and interception. Physiographic factors would include the characteristics of the watershed such as size, shape and slope of the basin's drainage area, the general land use within the basin. Average annual runoff decreases unevenly moving east to west across Texas, the localized variations based on these factors listed above (Texas Division of Emergency Management 2013). Figure 4.3.6-1 illustrates the annual average runoff from precipitation across the State. In Cameron County, the average runoff is between 0.2 and 1 inch.

When surface water runoff enters into streams, rivers, or dry creek beds, riverine flooding conditions occur whenever the water carrying capacity of the water channel is compromised by excess runoff (Texas Division of Emergency Management 2013).

If the local basin drainage area is relatively flat, shallow, slow-moving floodwater can last for days. In drainage areas with substantial slope, or the channel is narrow and confined, rapidly moving and extreme high water conditions, called a flash flood, can occur (Texas Division of Emergency Management 2013).

Figure 4.3.6-1 Annual Average Runoff from Precipitation, in Inches



Source: Texas Division of Emergency Management 2013

Coastal Flooding

Coastal flooding is primarily caused by storm surge, a cascading effect of hurricanes and coastal storms that pushes water toward the shore. The storm surge usually arrives ahead of the storm's actual landfall and the more intense the storm is, the sooner the surge is likely to arrive. The result can be waves that extend further inland, causing damage to development that would not normally be subject to wave action. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.

Storm surge heights, and associated waves, are dependent upon the local width of the continental shelf and the depth of the ocean bottom. A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. The storm surge is usually highest in the right-front quadrant of the storm system. As the storm approaches shore, the storm surge can be magnified by the local bathymetry.

Due to the high risk and vulnerability to this flood-specific hazard, it was analyzed independently in this chapter rather than as a cascading effect of hurricanes.

Riverine Flooding

Riverine flooding occurs when rivers overflow their banks in response to excessive precipitation levels and water runoff volumes within the watershed. Riverine floodplains may be broad, as when a river crosses an extensive flat landscape, or narrow, as when a river is confined in a canyon.

Flash Flooding

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events can also occur from accelerated snow melt due to heavy rains, a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds, uprooting trees, destroying buildings, and obliterating bridges and roads.

Urban/Stormwater Flooding

Urban flooding occurs when development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Sea Level Rise

Sea level rise associated with climate change will have significant effects on coastal areas, including the Planning Area. Long-term sea level records show changes in global temperatures, hydrologic cycles, coverage of glaciers and ice sheets, and storm frequency and intensity. Sea levels provide a key to understanding the impact of climate change.

There are two ways sea level rise is discussed: global and relative. Global sea level rise refers to the increase currently observed in the average global sea level trend (primarily attributed to changes in ocean volume due to ice melt and thermal expansion). The melting of glaciers and continental ice masses can contribute significant amounts of freshwater input to the earth's oceans. In addition, a steady increase in global atmospheric temperature creates an expansion of saltwater molecules, increasing ocean volume.

Local sea level refers to the height of the water as measured along the coast relative to a specific point on land. Water level measurements at tide stations are referenced to stable vertical points on the land and a known relationship is established. Measurements at any given tide station include both global sea level rise and vertical land motion (subsidence, glacial rebound, or large-scale tectonic motion). The heights of both the land and water are changing; therefore, the land-water interface can vary spatially and temporally and must be defined over time. Relative sea level trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications (coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, and sustainable habitat restoration) (NOAA 2022).

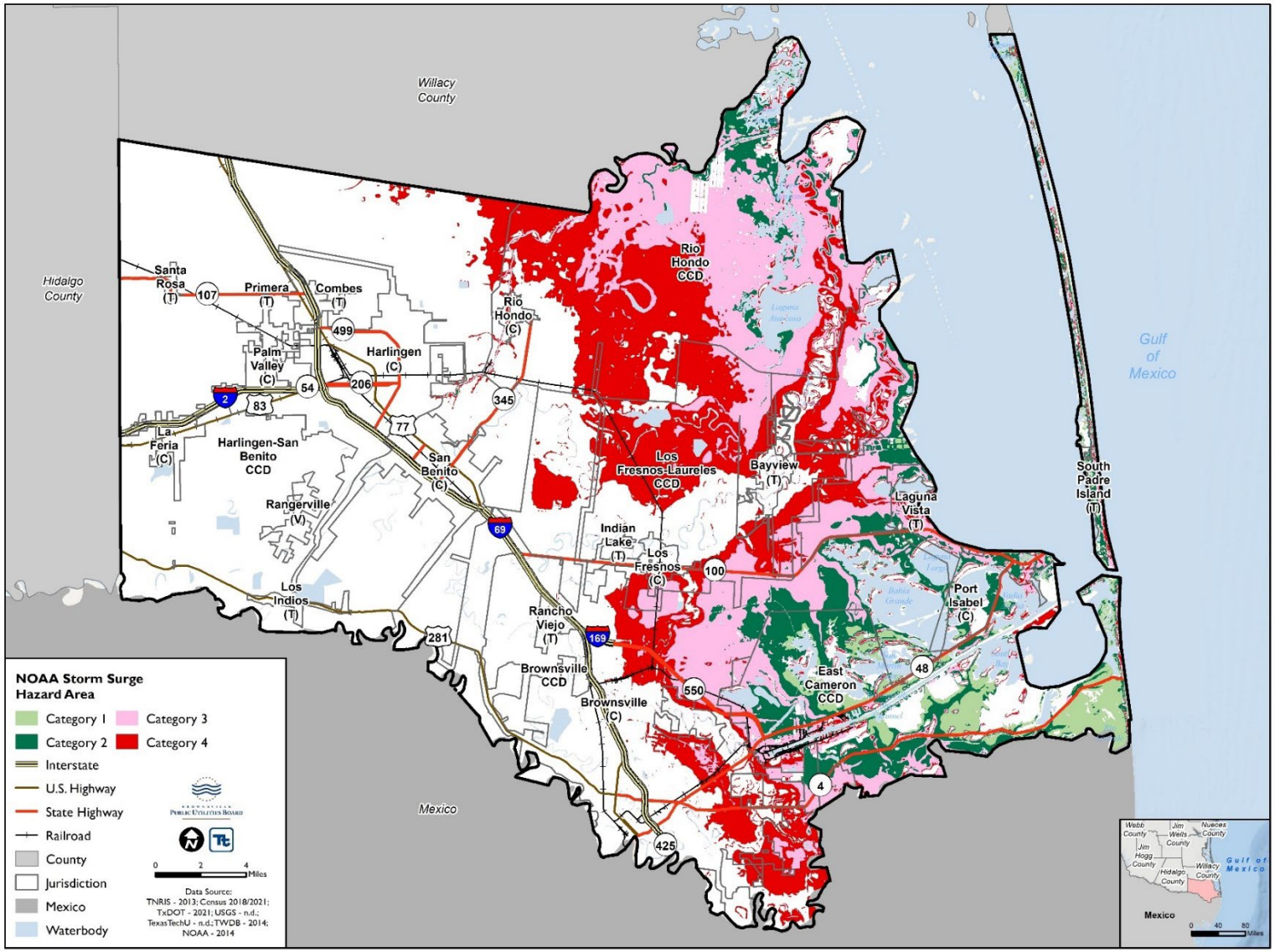
Location

Flooding potential is influenced by climatology, meteorology, and topography (elevations, latitude, and water bodies and waterways). Flooding potential for each type of flooding that affects the City is described in the subsections below.

Coastal Flooding

Coastal flooding and storm surge are most likely to affect the eastern part of the Planning Area closest to the coastline. Figure 4.3.6-1 shows storm surge hazard areas for Category 1 through Category 4 hurricanes, representing the maximum extent of storm surge for each category of hurricane.

Figure 4.3.6-2 NOAA Storm Surge Hazard Areas



Riverine Flooding

The numerous resacas (former channels of the Rio Grande, now cut off from the river) and the Rio Grande are susceptible to riverine flooding during heavy rainfall events.

Flash Flooding

Flash floods can occur anywhere in the Planning Area depending on intensity of rainfall, but areas below resacas or other bodies of water are more susceptible to flash floods if an embankment fails suddenly.

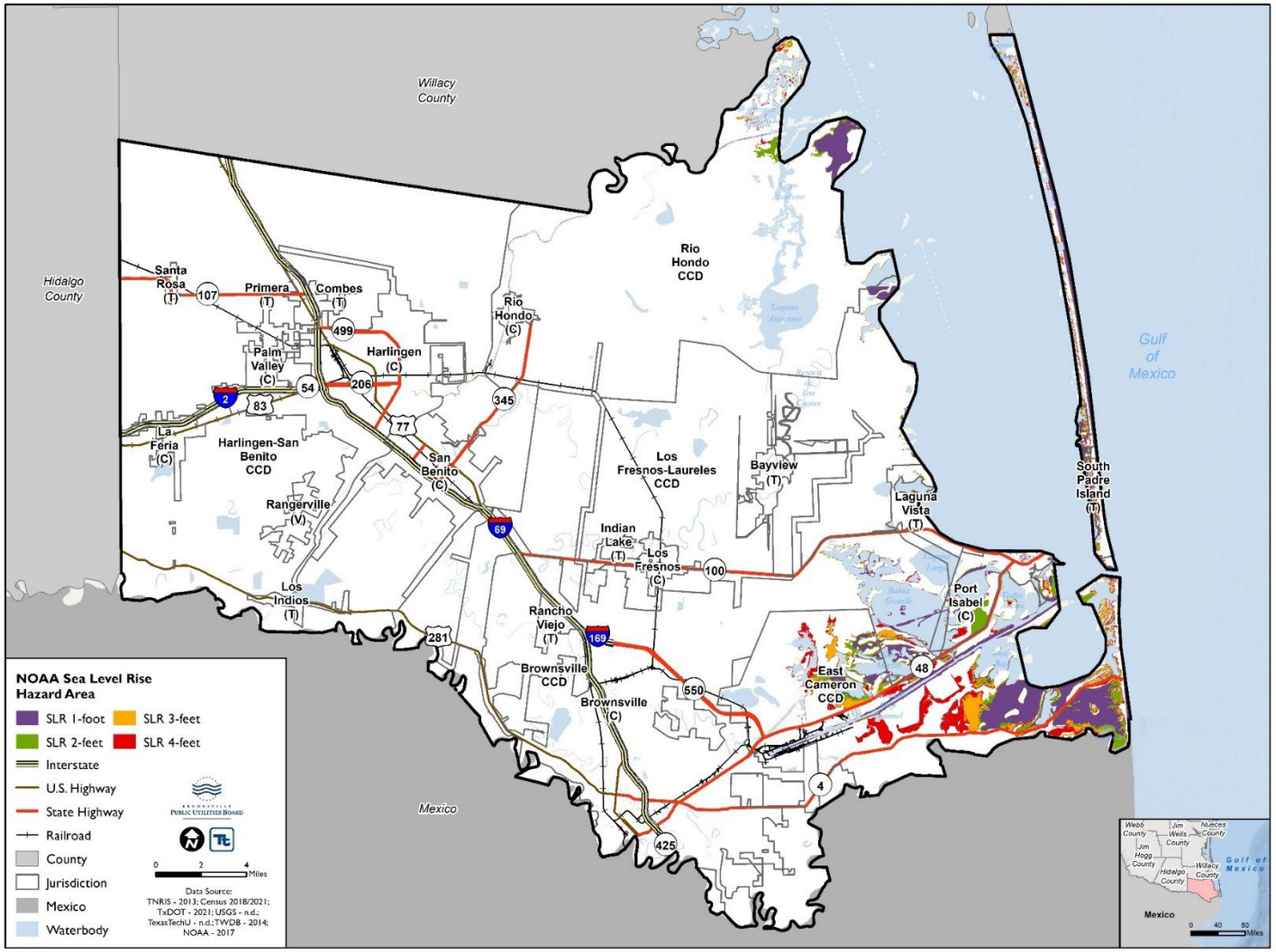
Urban/Stormwater Flooding

The entire built Planning Area may be affected by urban flooding during heavy rainfall events, especially where stormwater drainage infrastructure is aging, undersized, or becomes blocked.

Sea Level Rise

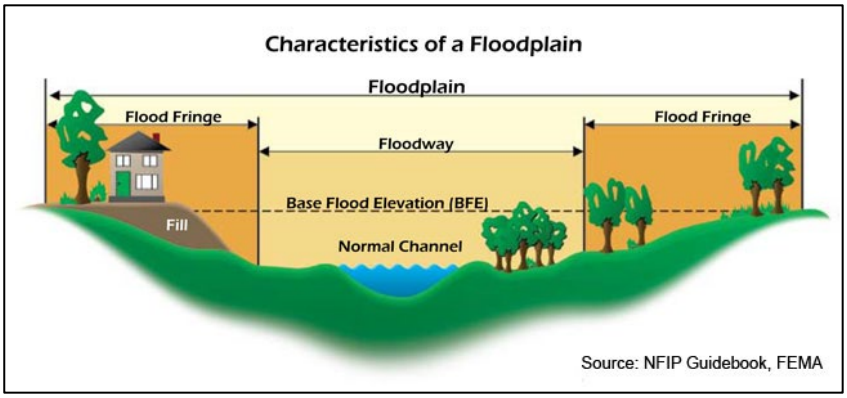
Low-lying coastal areas could be exposed to sea level rise. The rate of sea level rise in the Planning Area will be largely dependent on the global rate of sea level rise. The western Gulf of Mexico is expected to have a faster rate of sea level rise than the global average due to high rates of land subsidence (NOAA 2022). Figure 4.3.6-3 displays areas of Planning Area that could experience permanent inundation from one to four feet of sea level rise.

Figure 4.3.6-3 Sea Level Rise Hazard Areas



Floodplains

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In the Planning Area, floodplains line the rivers and streams of the City. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques.



Flood Map Terms

- Flood hazard areas identified on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA).
- SFHA = the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.
- 1-percent annual chance flood = the base flood or 100-year flood.
- SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30.
- Zone B or Zone X (shaded) = Moderate flood hazard areas and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood.
- Zone C or Zone X (unshaded) = Areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled.

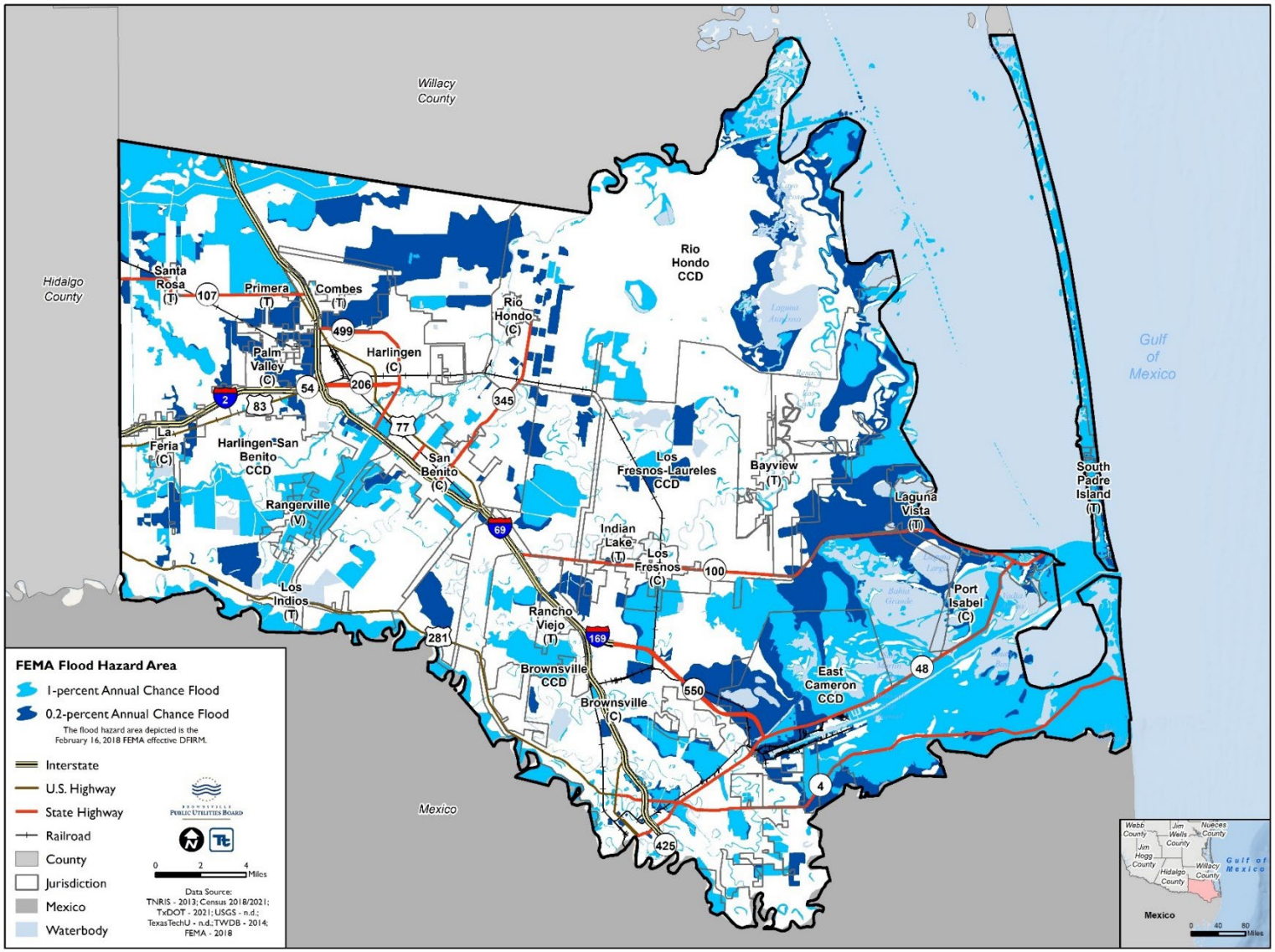
Source: FEMA 2020

Flood hazard areas are identified as Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1 percent chance of being equaled to or exceeded in any given year. The 1 percent annual chance flood is also referred to as the base flood or 100-year flood. A 100-year floodplain is not a flood that will occur once every 100 years; the designation indicates a flood that has a 1-percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time. Similarly, the moderate flood hazard area (500-year floodplain) will not occur every 500 years but is an event with a 0.2-percent chance of being equaled or exceeded each year (FEMA 2020). The 1-percent annual chance floodplain establishes the area that has flood insurance and floodplain management requirements

Locations of flood zones in the Planning Area as depicted on the FEMA preliminary Digital Flood Insurance Rate Map (DFIRM) are illustrated in Figure 4.3.6-4. Flood hazard zones occur throughout the Planning Area, with the largest areas along the coastline, resacas, and the Rio Grande. The areas that experience the most flooding are the areas near the coastline. The Digital Flood Insurance Rate Map (DFIRM) data provided by FEMA for the Planning Area show 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 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.

Figure 4.3.6-4 FEMA Flood Hazard Areas in the Planning Area



Flood Insurance in the Planning Area

National Flood Insurance Program

The City of Brownsville participates in the NFIP with 3,336 insurance policies in force providing nearly $943.8 million in insurance coverage. According to FEMA statistics as of March 31, 2021, 790 flood insurance claims have been paid for a total of $8.15 million, an average of $10,320 per claim.

Properties constructed after a FIRM has been adopted are eligible for reduced flood insurance rates. Such structures are less vulnerable to flooding since they were constructed after regulations and codes were adopted to decrease vulnerability. Properties built before a FIRM is adopted are more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in the Planning Area were available in 1978.

Community Rating System

The CRS is a voluntary program within the NFIP that encourages floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premiums are discounted to reflect the reduced flood risk resulting from community actions meeting the following three goals of the CRS:

- Reduce flood losses.
- Facilitate accurate insurance rating.
- Promote awareness of flood insurance.

For participating communities, flood insurance premium rates are discounted in increments of 5 percent. For example, a Class 1 community would receive a 45 percent premium discount, and a Class 9 community would receive a 5 percent discount. (Class 10 communities are those that do not participate in the CRS; they receive no discount.) The discount partially depends on location of the property. Properties outside the SFHA receive smaller discounts: a 10-percent discount if the community is at Class 1 to 6 and a 5-percent discount if the community is at Class 7 to 9 (FEMA 2021). The CRS classes for local communities are based on 18 creditable activities in the following categories:

- Public information
- Mapping and regulations
- Flood damage reduction
- Warning and response

CRS activities can help to save lives and reduce property damage. Communities participating in the CRS represent a significant portion of the nation's flood risk; over 66 percent of the NFIP's policy base is located in these communities. Communities receiving premium discounts through the CRS range from small to large and represent a broad mixture of flood risks, including both coastal and riverine flood risks.

The City of Brownsville is not currently participating in CRS but has included a mitigation action for joining the CRS program in order to reduce risk and provide flood insurance incentives to expand the community's current NFIP policy base and reduce risk through adoption of higher regulatory standards.

Extent

The severity of a flood event is typically 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. The principle factors affecting flood damage are flood depth and velocity. Shallow flooding with high velocities can cause as much damage as deep flooding with slow velocity. Wave action has significant velocity, and waves as small as 1.5 feet can cause substantial damage to structures and other development. Generally, floods are long-term events that may last for several days.

Coastal Flooding

A storm surge is a large dome of water created by the winds, wave, and atmospheric pressure of a storm over water, often 50 to 100 miles wide and rising up to 30 feet depending on the magnitude of the storm. The surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage.

Impacts on the Planning Area due to coastal flooding include but are not limited to temporary and permanent displacement of residents and businesses, loss of life, widespread power outages, long-term limited mobility for residents and responders, and long-term closure or limited functionality of critical infrastructure facilities.

Riverine Flooding

Regarding the riverine flood hazard, once a river reaches flood stage, flood extent or severity categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category is defined as follows, based on property damage and level of public threat:

- Minor Flooding – minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding – some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding – extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NWS 2009).

USGS uses stream gages to determine the severity of flood at different points along a body of water. There are two gages in the vicinity of the Planning Area, one is on the Rio Grande and the other is Old Main Drain No 2 at SH 4, east of the airport. However, flood stages were not identified for either gage. The USGS website provides details about each of the gages (https://waterwatch.usgs.gov/index.php).

Flash Flooding

Flash floods are usually characterized by raging torrents after heavy rains that rip through riverbeds or urban streets. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed.

Urban/Stormwater Flooding

Urban/Stormwater floods are typically due to high intensity rainfall, inadequate or blocked drainage, overtopping in the resacas or river, and flooding due to high tides.

Sea Level Rise

The rate of sea level rise that Cameron County is likely to experience is largely tied to the global rate of sea level rise. The global rate of sea level rise is based upon the rate that oceans warm and land ice melts. The western Gulf of Mexico is likely to see a faster rate of sea level rise than the global average due to local impacts from land subsidence. According to recent research from NOAA, the western Gulf of Mexico is likely to see close to 2 feet of sea level rise by 2050 and over 5 feet of sea level rise by 2100 (relative to a sea level baseline from 2000) (NOAA 2022).

Worst-Case Scenario

Any storm that produces significant amounts of rain in a short period of time at the 0.2% (500 year) flood level, similar to the event that occurred in June 2018, could lead to a worst-case scenario flood event for the Planning Area. The resacas and Rio Grande could overflow, causing massive flooding throughout the Planning Area. Loss of life, damage to infrastructure, buildings, and the natural environment could all result from a worst-case scenario flood.

A slow-moving Category 5 hurricane making landfall at or just south of Cameron County would be the worst-case coastal flooding scenario. A worst-case sea level rise scenario would involve the highest potential rate of rise due to rapid warming of the ocean and rapid collapse of large glaciers and ice sheets resulting in sea level rise rates of up to 2.3 feet by 2050 and 8.5 feet by 2100 (relative to a sea level baseline from 2000 (NOAA 2022).

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with flooding in the Planning Area. This HMAP update includes known flood events that have impacted the Planning Area between 1996 and 2021. Table 4.3.6-1 includes the events reported to the NOAA-NCEI Storm Events Database, and the federal disaster declarations are listed in Table 4.3.6-2.

According to the NOAA-NCEI Storm Events Database, the Planning Area has been impacted by 46 flood, flash flood, and coastal flood events between 1996 and 2021. Many of these occurrences were a combination of flood, flash flood, and coastal flood events that caused more than $444 million in property damage and $27.2 million in crop damage. A USDA disaster was designated for crop damage in 2020. Of the combined flood, flash flood, and coastal flood events, eleven had urban and street flooding in the Planning Area, but no damages were reported (see Table 4.3.6-1).

Table 4.3.6-1 Flood Event History, 1996-2021

Date(s) of Event	Event Type	Fatalities	Injuries	Damages (Property & Crop)	Event Details*
November 18, 2021	Flood	0	0	$0	Numerous showers and storms across the populated Lower Rio Grande Valley. Heaviest rains, estimated at 4 to 5 inches, fell along the Rio Grande southeast of Brownsville; over 2 inches in less than 2 hours created localized urban flooding in the city.
October 1, 2021	Flood/Flash Flood	0	0	$26,500 (property)	A heavy-precipitation supercell event dropped rainfall of 4 to 8 inches in just two hours or so.

Date(s) of Event	Event Type	Fatalities	Injuries	Damages (Property & Crop)	Event Details*
					Multiple records for daily rainfall were shattered, specifically in the Harlingen and Brownsville areas.
July 9, 2021	Flood/Flash Flood	0	0	$55,000 (property)	Multiple rounds of storms dropped 4 to more than 6 inches of rain in a 2 to 3 hour span across the Brownsville-Los Fresnos area, leading to many instances of flash flooding. Minor flooding was noted in Port Isabel and South Padre Island.
May 19, 2021	Coastal Flood/Flash Flood	0	0	$20,000 (property)	High northerly winds contributed to enhanced northerly swell which led to coastal flooding across portions of Coastal Cameron County. Heavy, locally flooding rain across much of the lower Rio Grande Valley occurred, with rainfall of 2 to nearly 5 inches. Water depths of 2 to 3 feet were common in the heaviest rainfall.
July 25, 2020	Flood/Flash Flood	0	0	$3.3 million (property) $27.1 million (crop)	Torrential rains and storm surge flooding from Hurricane Hanna caused 18 inches to 4 feet of water depth in many areas. The rainfall wiped out 95% of the region's cotton crop.
May 16, 2020	Flood	0	0	$0	A shortwave trough moved eastward across Texas. Thunderstorms developed in a very unstable and moist environment.
October 12-13, 2018	Coastal Flood	0	0	$0	The beaches of South Padre and Boca Chica had floodwaters up to the stairwells of beachfront property as well as the sea wall as a result of back-swell from Hurricane Michael.
June 20, 2018	Flash Flood	0	0	$60 million (property)	One day after 3 to more than 5 inches fell between Brownsville and Los Fresnos, a repeat event occurred, causing devastating flooding across western Cameron and eastern Hidalgo County. The second day rainfall produced more widespread flooding across locations in and east of Brownsville and Los Fresnos, with farm and subdivisions under 2 to 3+ feet of water. The additional flooding on saturated soils produced more damage including more erosion to drainage canals/ditches and mainly rural roads.
October 22, 2014	Flash Flood	0	0	$0	Flash flooding was reported across portions of Brownsville, especially the western and downtown areas. There were several reports of 3 feet or more of water into properties.
November 6, 2013	Flash Flood	0	0	$10,000 (property)	Between 4.23 to 4.96 inches of rainfall fell in less than 90 minutes across western Brownsville, leading to flash flooding across that portion of the city. Several businesses had water in them and numerous thoroughfares with several inches to nearly 2 feet of water on them across the area limited travel. During the peak of the rains, 42 streets had flooding that reduced travel to one lane or less. Some resacas also reached bank-full or flooded low lying grassy areas.

Date(s) of Event	Event Type	Fatalities	Injuries	Damages (Property & Crop)	Event Details*
June 30, 2012	Flash Flood	0	0	$75,000 (property)	Heavy rain fell during the afternoon hours across Brownsville with totals over 5 inches. Flash floods closed several roads, overtopped resacas, and reached into properties near and in downtown. Price Road was mostly closed, Boca Chica Blvd was closed in a few spots, and other streets were closed as well.
September 19, 2010	Flash Flood	0	0	$5 million (property)	Three days of on and off rainfall followed by a persistent band of tropical rains, dumping 4 to 7 inches of rain in a 3 to 5 hour span and flooding a number of communities and dozens of roads especially between Brownsville and Los Fresnos. About one hundred homes from Brownsville to San Benito were flooded, with dozens of residents evacuating to shelters for several days.
September 6, 2010	Flash Flood	0	0	$10,000 (crop)	Torrential and quick hitting rainfall associated with persistent feeder bands around the middle core of Tropical Storm Hermine left widespread farm/field flooding across extreme northeast Cameron County.
June-August 2010	Flood	0	0	$260,500 (property) $100,000 (crop)	Due to rainfall from feeder bands through residuals of Hurricane Alex, steady, locally torrential rains added up to roughly 6 to 9 inches for the entire episode across the Lower Rio Grande Valley. High and fast flowing waters continued through the North Floodway in extreme northwest Cameron County, as water continued to flow through the Anzalduas (Hidalgo County) Diversion Dam into the Lower Rio Grande Flood Control Project.
April 16, 2010	Flash Flood	0	0	$2,000 (property)	An upper level disturbance produced flooding rains.
September 12, 2008	Coastal Flooding	0	0	$20,000 (property)	Coastal flooding impacts from Hurricane Ike were relatively minor, with damage restricted to vulnerable structures not protected by dunes or a barrier wall beach side, and to businesses and residences with minimal elevation bay side.
July 23, 2008	Flood/Flash Flood	0	2	$367.5 million (property)	Hurricane Dolly dumped copious rainfall across the area, causing numerous instances of flooding primarily of low lying and poor drainage locations, as well as filling local resacas and arroyos, and causing notable rises on larger area creeks and rivers.
May 24-25, 2007	Flash Flood	0	0	$120,000 (property)	Thunderstorms with torrential rainfall hit Willacy, Cameron, and Hidalgo Counties.
March 12, 2007	Flash Flood	0	0	$0	A slow-moving line of thunderstorms produced heavy rains across Cameron County. Numerous intersections in Brownsville and Los Fresnos had standing water 2-4 feet deep.
July 7, 2006	Flash Flood	0	0	$0	Extensive flash flooding of streets in Brownsville.

Date(s) of Event	Event Type	Fatalities	Injuries	Damages (Property & Crop)	Event Details*
July 20, 2005	Flash Flood	0	0	$0	Heavy rains from the outer rainbands of Hurricane Emily produced flash flooding, resulting in Highway 4 closure seven miles north of F.M. Road 511.
May 8, 2004	Flash Flood	0	0	$2 million (property)	Torrential rainfall developed over central and eastern Cameron county. Approximately 170 homes and resacas in Brownsville received at least minor flooding. Flooding of homes and businesses was also reported in Los Fresnos, and in homes between Los Fresnos and San Benito. An estimated 200-250 homes were affected by flooding, and the standing water resulted in many road closures across the county, especially in the Brownsville area.
April 5, 2004	Flash Flood	0	0	$0	Road closures due to flash flooding, heavy rains.
March 15, 2004	Flash Flood	0	0	$25,000 (property)	Flash flooding of roads and small streams was reported over western sections of the city of Brownsville and also in the Paseo de la Resaca area.
October 26, 2003	Flash Flood	0	0	$0	Heavy rains in Cameron county resulted in the flash flooding of the Resaca Calmada over its banks in the Paseo de la Resaca development.
October 13, 2003	Flood	0	0	$4.5 million (property)	A strong weather disturbance combined with abundant tropical moisture across the region to produce intense rainfall across Deep South Texas. Over 550 homes across Deep South Texas suffered minor to moderate damage due to the flood waters.
October 7, 2003	Flash Flood	0	0	$50,000 (property)	Heavy rains produced flash flooding of roadways and businesses in Harlingen. Several cars stalled in high water near the expressway and the heavy rain caused a roof failure to a local business.
September 18-19, 2003	Flood/Flash Flood	0	0	$1.425 million (property)	Cameron County received 6 to 12 inches of rain. The heavy rains caused extensive flooding of urban areas. Approximately 467 homes were affected by flooding rains in Cameron County.
August 12, 2003	Flash Flood	0	0	$0	Strong thunderstorms with very heavy rain produced flash flooding on U.S. Highway 77 as well as areas adjacent to the highway.
November 4, 2002	Flash Flood	0	0	$0	Heavy rains and saturated soil conditions led to severe flooding in San Benito. Homes and streets were flooded, prompting Cameron County officials to evacuate around 500 residents.
November 2, 2002	Flood	0	0	$0	Torrential rains and saturated soil conditions produced flash flooding over southeast Cameron county. The rains produced flash flooding on South Padre Island. Severe flash flooding of homes, businesses and roads was reported in Laguna Vista and Laguna Heights and some small streams or resacas in Brownsville overflowed their banks.
October 29-31, 2002	Flood/Flash Flood	0	0	$0	Strong thunderstorms produced flash flooding that entered homes in Brownsville.

Date(s) of Event	Event Type	Fatalities	Injuries	Damages (Property & Crop)	Event Details*
October 20, 2002	Flood	0	0	$0	Street flooding reported in Los Fresnos.
October 9, 2002	Flash Flood	0	0	$0	Intense thunderstorms produced very heavy rains and flash flooding throughout eastern portions of Cameron County. Water entered several homes and businesses in Brownsville.
October 3, 2002	Flood	0	0	$0	Swells and high tides associated with the presence of Hurricane Lili in the Gulf of Mexico, produced coastal flooding along the shores of South Padre Island. Tides ran 1 to 2 feet above high tide levels.
September 23, 2002	Flood	0	0	$0	Moderate to heavy rains produced extensive urban flooding and flooding of low spots in Brownsville.
September 22, 2002	Flood	0	0	$0	Heavy surf and large swells from Hurricane Isidore caused coastal flooding at South Padre Island.
June 29, 2002	Flash Flood	0	0	$0	Intense thunderstorms produced flash flooding of roads and ditches on South Padre Island.
September 9, 2001	Flash Flood	0	0	$0	Widespread street flooding around Harlingen.
June 10, 2000	Flash Flood	0	0	$0	A house in Laguna Heights was inundated with flood water. 3.76 inches of rainfall measured at Port Isabel.
May 2, 2000	Flash Flood	0	0	$0	The large supercell produced flash flooding rainfall. Highway 100 at Laguna Vista and South Padre Island was closed because of high water and storm debris.
October 11-13, 1997	Flood	0	0	$41,400 (Property)	Extensive flooding in Brownsville, San Beinito, and Los Fresnos in Cameron County.
March 12, 1997	Flood	0	0	$0	Countywide flooding.
October 5-8, 1996	Coastal Flood	0	0	$0	Swells from Tropical Storm Josephine caused extensive beach flooding and erosion on Padre Island and Boca China beaches.
October 4, 1996	Flash Flood	0	0	$0	Rain associated with the fringes of Tropical Storm Josephine/T.D.10 produced widespread rainfall totals of more than 6 inches, and more than 10 inches in Brownsville. Extensive flooding of streets and low areas occurred with the worst in Green Valley east of San Benito, and in the eastern half of Brownsville where numerous homes were flooded.
August 22-24, 1996	Coastal Flood	0	0	$0	Coastal flooding in the areas of Padre Island and Boca Chica beach.

Source: NOAA-NCEI 2021; 2015 BPUB HMAP

** Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table*

NCEI National Centers for Environmental Information
NOAA National Oceanic and Atmospheric Administration
NWS National Weather Service

Between 1954 and 2021, FEMA included the State of Texas in 40 flood-related major disaster (DR) or emergency (EM) declarations. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Cameron County was included in four of these flood-related declarations; refer to Table 4.3.6-2.

Table 4.3.6-2 Flood FEMA Declarations for Cameron County, 1954-2021

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-4454	June 24-25, 2019	Flood	Severe Storms and Flooding
DR-4377	June 19-July 13, 2018	Flood	Severe Storms and Flooding
DR-726	September 16-18, 1984	Flood	Severe Storms and Flooding
DR-313	September 18, 1971	Flood	Heavy Rains, High Winds, Flooding

Source: FEMA 2021

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense, and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, leading to increased rainfall and posing a greater threat of flooding across wide areas (National Center for Atmospheric Research 2018). Temperatures are predicted to increase in Cameron County and ocean temperatures are forecast to continue to increase, which may lead to an increase in intensity and frequency of hurricanes. As oceans warm, the length of hurricane season may expand. The past six hurricane seasons have featured a tropical system occurring before the official start of the season. In 2016, a very rare winter hurricane named Alex developed in the middle of January (BBC 2019). Sea-level rise also promotes more frequent and severe flooding. Higher background water levels mean that deadly and destructive storm surges push farther inland than they once did. Higher sea level also means more frequent high-tide flooding, sometimes called “nuisance flooding” because it isn't generally deadly or dangerous, but it can be disruptive and expensive (NOAA 2021).

Probability of Future Occurrences

Table 4.3.6-3 summarizes data regarding the probability of occurrences of flood events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 BPUB HMAP, the NOAA-NCEI Storm Events Database, and FEMA.

Table 4.3.6-3 Probability of Future Occurrence of Flood Events

Hazard Type	Number of Occurrences Between 1996 and 2021	% chance of occurrence in any given year
Flood	46	100%

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected flood events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the 46 recorded flood events over 22 years, the Planning Area averages more than two floods every year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for flood in the Planning Area is considered ‘occasional’.

4.3.6.2 Vulnerability Assessment

To assess the Planning Area's risk to the flood hazard, a spatial analysis was conducted using the best available spatially delineated flood hazard areas. A quantitative assessment of exposure to the flood hazard was conducted using the asset inventory developed for this plan and two mapped flood areas:

- The 1% annual chance flood hazard area; and
- The 0.2% annual chance flood hazard area

Impact on Life, Health and Safety

Impacts of flooding on life, health, and safety depend on several factors including severity of the event and whether adequate warning time is provided to residents. Vulnerable populations are all populations residing or located in the floodplain or downstream of dam failures that are incapable of escaping the area within the required timeframe to reach safety. However, exposure should not be limited only to those who reside within a defined hazard zone, but everyone who may be affected by a hazard event (e.g., people are considered at risk if they are traveling in flooded areas, or their access to emergency services is compromised during an event). Flash floods can be localized events that affect areas outside of the floodplain due to localized drainage issues and can directly impact populations and comprise access to emergency services. The degree of that impact varies and is not strictly measurable.

An estimated 42,606 people reside in the 1-percent annual chance event boundary, and 8,936 people within the 0.2-percent annual chance flood boundary. These residents may be displaced by the flooding of their homes, requiring them to seek temporary shelter with friends and family or in emergency shelters. Table 4.3.6-4 lists population estimates within flood hazard zones in the Planning Area.

Table 4.3.6-4. Estimated Population Exposed to the Flood Hazard

Jurisdiction	Total Population (American Community Survey 2015-2019)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Persons Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Brownsville (City)	186,738	21,197	11.4%	30,792	16.5%
BPUB Constituents	**421,017**	**42,606**	**10.1%**	**78,936**	**18.7%**

Sources: American Community Survey 2019 (5-year estimates 2015-2019), FEMA 2018; February 16, 2018 FEMA Effective DFIRM
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Coastal areas are exposed to potential flooding from storm surge. Table 4.3.6-5 shows the population exposed to the storm surge hazard, based on the Sea, Lake, and Overland Surges from Hurricanes model (SLOSH).

Table 4.3.6-5. Estimated Population Exposed to the Storm Surge Hazard

Jurisdiction	Total Population (American Community Survey 2015-2019)	Number of Persons Located in the SLOSH Categories 1-4 Storm Surge Hazard Area							
		Storm Surge Category 1		Storm Surge Category 2		Storm Surge Category 3		Storm Surge Category 4	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total	Number of Persons	Percent of Total	Number of Persons	Percent of Total
Brownsville (City)	186,738	0	0.0%	0	0.0%	931	0.5%	23,572	12.6%
BPUB Constituents	**421,017**	**2,378**	**0.6%**	**7,250**	**1.7%**	**15,549**	**3.7%**	**55,413**	**13.2%**

Sources: American Community Survey 2019 (5-year estimates 2015-2019), NOAA 2014
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Sea level rise represents long term inundation risk to coastal areas. While the greatest short term risk of sea level rise is an increase in the frequency and severity of coastal flooding events, permanent inundation could impact many individuals living close to today's sea level. Table 4.3.6-6 displays exposure to different rates of sea level rise. The time frame for these sea level increases to be realized will be dependent on global sea level rise rates.

Table 4.3.6-6. Estimated Population Exposed to the Sea Level Rise Hazard

Jurisdiction	Total Population (American Community Survey 2015-2019)	Number of Persons Located in the Sea Level Rise 1-foot through 4-Feet Hazard Area							
		Sea Level Rise 1-foot		Sea Level Rise 2-feet		Sea Level Rise 3-feet		Sea Level Rise 4-feet	
		Number of Persons	Percent of Total	Number of Persons	Percent of Total	Number of Persons	Percent of Total	Number of Persons	Percent of Total
Brownsville (City)	186,738	0	0.0%	0	0.0%	0	0.0%	0	0.0%
BPUB Constituents	**421,017**	**755**	**0.2%**	**860**	**0.2%**	**1,109**	**0.3%**	**1,683**	**0.4%**

Sources: American Community Survey 2019 (5-year estimates 2015-2019), NOAA 2017
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Of the population exposed, the most vulnerable include the economically disadvantaged and the population over age 65. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions to evacuate based on net economic impacts to their families. The population over age 65 is also more vulnerable because available medical services may be disrupted, and they are more likely to seek or need medical attention that may not be available due to isolation during a flood event. They also may have more difficulty evacuating. Table 4.3.6-7 presents the estimated potential sheltering needs as a result of the 1-percent flood event.

Table 4.3.6-7. Estimated Population Displaced or Seeking Short-Term Shelter from Flood Events

Jurisdiction	Total Population (American Community Survey 2015-2019)	1-Percent Annual Chance Flood Event	
		Displaced Population	Persons Seeking Short-Term Sheltering
Brownsville (City)	186,738	17,716	4,530
BPUB Constituents	**421,017**	**34,361**	**8,377**

Source: American Community Survey 2019 (5-year estimates 2015-2019), FEMA 2018; February 16, 2018 FEMA Effective DFIRM
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.
Note: Differences in totals reported from flood GSR because we are referencing GBS distribution by block, not defaulting to Hazus pop distribution by block.

Total numbers of injuries and casualties resulting from typical riverine flooding are generally limited based on advance weather forecasting, blockades, and warnings. Injuries and deaths generally are not anticipated if proper warning and precautions occur. In contrast, warning time for flash flooding is limited. These events are frequently associated with other natural hazard events such as earthquakes, landslides, or severe weather, which limits their predictability and compounds the hazard. Populations without adequate warning of the event are highly vulnerable to this hazard.

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Molds can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2021).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue (CDC 2021)

Current loss estimation models such as Hazus v5.0 cannot measure public health impacts. The best ways to mitigate these impacts are to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Impact on General Building Stock

To assess potential impacts on buildings, both exposure (located in the hazard area) and estimated loss to the exposed inventory generated by Hazus v5.0 were examined for the 1% flood scenario.

Table 4.3.6-8 summarizes the results.

Table 4.3.6-8. Estimated General Building Stock Exposure to a 1-Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	All Occupancies		Residential		Commercial		Agricultural, Industrial, Religious, Education and Government	
		Estimated Loss	Percent of Total Replace-ment Cost Value	Estimated Loss	Percent of Total Replace-ment Cost Value	Estimated Loss	Percent of Total Replace-ment Cost Value	Estimated Loss	Percent of Total Replace-ment Cost Value
Brownsville (City)	$55,730,567,030	$565,833,838	1.0%	$341,599,371	0.6%	$102,896,579	0.2%	$121,337,888	0.2%
BPUB Constituents	**$174,838,504,517**	**$7,013,637,565**	**4.0%**	**$3,650,462,131**	**2.1%**	**$1,671,999,075**	**1.0%**	**$1,691,176,359**	**1.0%**

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, FEMA 2018; February 16, 2018 FEMA Effective DFIRM
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Coastal areas are exposed to potential flooding from storm surge. Table 4.3.6-9 shows the population exposed to the storm surge hazard, based on the SLOSH model.

Table 4.3.6-9. Estimated General Building Stock Exposure to Storm Surge Hazard Areas

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings and Total Replacement Cost Value of Structures Located in the SLOSH Categories 1-4 Storm Surge Hazard Area															
			Storm Surge Category 1				Storm Surge Category 2				Storm Surge Category 3				Storm Surge Category 4			
			Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total
Brownsville (City)	78,873	$55,730,567,030	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	410	0.5%	$630,086,180	1.1%	10,273	13.0%	$6,334,645,032	11.4%
BPUB Constituents	**202,224**	**$174,838,504,517**	**1,429**	**0.7%**	**$1,520,873,059**	**0.9%**	**5,119**	**2.5%**	**$7,265,799,928**	**4.2%**	**10,637**	**5.3%**	**$13,725,000,601**	**7.9%**	**31,621**	**15.6%**	**$27,969,467,876**	**16.0%**

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, NOAA 2014
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Sea level rise could result in permanent inundation of low lying coastal areas. This could result in permanent inundation of critical facilities. Table 4.3.6-10 displays exposure to different rates of sea level rise. The time frame for these sea level increases to be realized will be dependent on global sea level rise rates.

Table 4.3.6-10. Number of Buildings and Total Replacement Cost Value of Structure Located in Sea Level Rise Hazard Areas

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings and Total Replacement Cost Value of Structures Located in the Sea Level Rise 1-foot through 4-feet Hazard Area															
			Sea Level Rise 1-foot				Sea Level Rise 2-feet				Sea Level Rise 3-feet				Sea Level Rise 4-feet			
			Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total	Number of Buildings	Percent of Total	Total Replacement Cost Value	Percent of Total
Brownsville (City)	78,873	$55,730,567,030	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
BPUB Constituents	202,224	$174,838,504,517	397	0.2%	$843,168,712	0.5%	452	0.2%	$871,147,389	0.5%	627	0.3%	$1,040,661,224	0.6%	1,173	0.6%	$2,421,696,111	1.4%

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, NOAA 2017
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

NFIP

According to the September 30, 2021 HUDEX report, Cameron County has 20,446 NFIP policies for a total NFIP premium of $11,055,130 and $4,913,908,800 in coverage (direct and write your own policy for all statistics).

A property is considered a repetitive loss (RL) property when there are "two or more losses reported which were paid more than $1,000 for each loss. The two losses must be within 10 years of each other and be at least 10 days apart. Only losses from (*sic* since) 1/1/1978 that are closed are considered. A severe repetitive loss (SRL) property is defined as a residential property covered under an NFIP flood insurance policy, and satisfying either of conditions 1 and 2, as well as condition 3 (Section 1361A of the National Flood Insurance Act 42 *United States Code* 4102a):

1. "At least four NFIP claim payments for the property (including building and contents) over $5,000 each have occurred, and the cumulative amount of such claims payments exceeded $20,000.
2. At least two separate claims payments for the property (building payments only) have occurred, and the cumulative amount of the building portion of such claims exceeded the market value of the building.
3. For either of the above, at least two of the referenced claims must have occurred within any 10-year period and must have occurred more than 10 days apart".

Due to a contractual agreement with FEMA, current repetitive loss data is pending. The NFIP is only available to municipalities; the Brownsville Public Utility Board is not a participant. The following statistics from the previous planning effort are the best available data and acceptable for planning purposes:

City of Brownsville Residential Repetitive Loss Properties—40
City of Brownsville Residential Severe Repetitive Loss Properties—5
City of Brownsville Non-Residential Repetitive Loss Properties—4
City of Brownsville Non-Residential Severe Repetitive Loss Properties—0

Impact on Critical Facilities

It is important to determine the critical facilities and infrastructure within the Planning Area that may be at risk to flooding (riverine, dam failure, flash/stormwater flooding), and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the Planning Area to many service providers needing to get to vulnerable populations or to make repairs. Utilities such as overhead power, cable, and phone lines could also be vulnerable due to utility poles damaged by standing water or the surge of moving water. Loss of these utilities could create additional isolation issues for the inundation zones.

Critical facility exposure to the flood hazard was examined. Table 4.3.6-11 summarizes these results. Table 4.3.6-12 displays the utility lines exposed to the flood risk.

Table 4.3.6-11. Critical Facility Types Located in the 1% and 0.2% Annual Chance Flood Hazard Areas and Damages

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the 1-percent Annual Chance Flood Event Hazard Area	Number of Lifelines Located in the 0.2-percent Annual Chance Flood Event Hazard Area
Communications	42	1	1
Energy	81	17	29
Food, Water, Shelter	233	34	49
Health and Medical	22	0	1
Safety and Security	111	15	17
Transportation	11	1	1
BPUB and City of Brownsville (Total)	**500**	**68**	**98**

Source: Cameron County Planning Partners 2021; HIFLD 2020, FEMA 2018; February 16, 2018 FEMA Effective DFIRM

Table 4.3.6-12. Utility Lines Located in the 1% and 0.2% Annual Chance Flood Hazard Areas

Utility Line	Total Length (Feet)	Total Feet of Utility Line Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Feet of Utility Line Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
UG Secondary Conductor	3,238,672	387,364	12.0%	525,476	16.2%
UG Primary Conductor	2,089,990	244,250	11.7%	339,616	16.2%
OH Secondary Conductor	2,892,681	347,654	12.0%	572,323	19.8%
OH Primary Conductor	2,817,947	385,414	13.7%	724,199	25.7%
Fiber Optic	593,857	62,977	10.6%	108,577	18.3%
Water Pipelines	3,765,798	414,774	11.0%	582,315	15.5%
Wastewater Force Mains	548,255	67,795	12.4%	88,271	16.1%
Wastewater Gravity Mains	3,084,283	326,558	10.6%	485,031	15.7%
BPUB (Total)	**19,031,483**	**2,236,785**	**11.8%**	**3,425,808**	**18.0%**

Source: Cameron County Planning Partners 2021; HIFLD 2020, FEMA 2018; February 16, 2018 FEMA Effective DFIRM

Critical facilities located near coastal areas could be exposed to the storm surge hazard. Table 4.3.6-13 displays the number of critical facilities exposed to storm surge, based upon the SLOSH model. Table 4.3.6-14 displays the utility lines exposed to storm surge.

Table 4.3.6-13. Number of Critical Facilities Located in Storm Surge Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the SLOSH Category 1 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 2 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 3 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 4 Storm Surge Hazard Area
Communications	42	0	0	0	1
Energy	81	0	8	15	20
Food, Water, Shelter	233	0	0	6	44
Health and Medical	22	0	0	1	1
Safety and Security	111	0	0	1	7

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the SLOSH Category 1 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 2 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 3 Storm Surge Hazard Area	Number of Lifelines Located in the SLOSH Category 4 Storm Surge Hazard Area
Transportation	11	0	0	0	2
BPUB and City of Brownsville (Total)	**500**	**0**	**8**	**23**	**75**

Source: Cameron County Planning Partners 2021; HIFLD 2020, NOAA 2014

Table 4.3.6-14. Utility Lines Located in Storm Surge Areas

Utility Line	Total Length (Feet)	Total Feet of Utility Line Located in the SLOSH Category 1 Storm Surge Hazard Area	Percent of Total	Total Feet of Utility Line Located in the SLOSH Category 2 Storm Surge Hazard Area	Percent of Total	Total Feet of Utility Line Located in the SLOSH Category 3 Storm Surge Hazard Area	Percent of Total	Total Feet of Utility Line Located in the SLOSH Category 4 Storm Surge Hazard Area	Percent of Total
UG Secondary Conductor	3,238,672	16	0.0%	954	0.0%	22,158	0.7%	281,915	8.7%
UG Primary Conductor	2,089,990	0	0.0%	4,909	0.2%	29,950	1.4%	250,527	12.0%
OH Secondary Conductor	2,892,681	1,837	0.1%	25,518	0.9%	96,508	3.3%	263,749	9.1%
OH Primary Conductor	2,817,947	4,630	0.2%	100,472	3.6%	357,563	12.7 %	641,910	22.8%
Fiber Optic	593,857	0	0.0%	11,258	1.9%	51,450	8.7%	110,018	18.5%
Water Pipelines	3,765,798	0	0.0%	0	0.0%	39,581	1.1%	39,581	1.1%
Wastewater Force Mains	548,255	0	0.0%	0	0.0%	9,947	1.8%	141,084	25.7%
Wastewater Gravity Mains	3,084,283	0	0.0%	0	0.0%	18,304	0.6%	442,533	14.3%
BPUB (Total)	**19,031,483**	**6,482**	**0.0%**	**143,112**	**0.8%**	**625,462**	**3.3%**	**2,171,317**	**11.4%**

Source: Cameron County Planning Partners 2021; HIFLD 2020, NOAA 2014

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Sea level rise could result in permanent inundation of low lying coastal areas. This could result in permanent inundation of critical facilities. Table 4.3.6-15 displays exposure to different rates of sea level rise. The time frame for these sea level increases to be realized will be dependent on global sea level rise rates.

Table 4.3.6-15. Number of Critical Facilities Located in Sea Level Rise Hazard Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Sea Level Rise 1-foot Hazard Area	Number of Lifelines Located in the Sea Level Rise 2-feet Hazard Area	Number of Lifelines Located in the Sea Level Rise 3-feet Hazard Area	Number of Lifelines Located in the Sea Level Rise 4-feet Hazard Area
Communications	42	0	0	0	0
Energy	81	3	3	3	3

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Sea Level Rise 1-foot Hazard Area	Number of Lifelines Located in the Sea Level Rise 2-feet Hazard Area	Number of Lifelines Located in the Sea Level Rise 3-feet Hazard Area	Number of Lifelines Located in the Sea Level Rise 4-feet Hazard Area
Food, Water, Shelter	233	0	0	0	0
Health and Medical	22	0	0	0	0
Safety and Security	111	0	0	0	0
Transportation	11	0	0	0	0
BPUB and City of Brownsville (Total)	**500**	**3**	**3**	**3**	**3**

Sources: BPUB Planning Partners 2021; HIFLD 2020; NOAA 2017

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, agricultural losses, business interruption, and effects on tourism.

In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the section earlier which discusses direct impacts to buildings in the Planning Area.

Flooding can cause extensive damage to public utilities and disruptions to the delivery of services. Loss of power and communications may occur; drinking water and wastewater treatment facilities may be temporarily out of operation.

Debris management may also be a large expense after a flood event. Hazus v5.0 estimates the amount of structural debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.); and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 4.3.6-16 summarizes the Hazus v5.0 countywide debris estimates for the 1-percent annual chance flood event. Please note that this table only estimates structural debris generated by flooding and does not include non-structural debris or additional potential damage and debris possibly generated by wind that may be associated with a flood event or storm that causes flooding.

Table 4.3.6-16. Estimated Debris Generated from a 1-Percent Chance Annual Flood

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Brownsville (City)	26,189	19,094	4,015	3,079
BPUB Constituents	**118,512**	**83,572**	**19,965**	**14,976**

Source: Hazus v5.0

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on the Environment

Floodplains serve beneficial and natural functions on ecological, environmental, social, and economic levels. Areas in the floodplain that typically provide these natural functions and benefits are wetlands, riparian areas, sensitive areas, and habitats for rare and endangered species. Floods, however, can also lead to negative impacts on the environment. Disruption of natural systems and the benefits they provide can have long-term consequences for entire regions. According to FEMA, well-known, water-related functions of floodplains include the following:

- Natural flood and erosion control
- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation
- Surface water quality maintenance
- Process organic wastes
- Moderate temperatures of water
- Groundwater recharge
- Filter nutrients and impurities from runoff
- Promote infiltration and aquifer recharge
- Reduce frequency and duration of low-surface flows

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Any areas of growth could be impacted by the flood hazard if located in the floodplain. The Flood Damage Prevention Ordinance regulates not only how land in designated floodplain areas may be used or altered, but the location and types of structures that are permitted in those areas as well as the specifications to which they must build. All structures, including residential and commercial properties, manufactured homes, and the developments of subdivisions are regulated.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (406,220) and the estimated 2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the flood hazard, especially those living in and around flood hazard areas.

Climate Change

Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in the exposure of populations, buildings, and critical facilities and infrastructure that were previously outside the floodplain. This increase in exposure would result in an increased risk to life and health, an increase in structural

losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by future flooding events due to loss of service or access.

Climate change may result in changes in the intensity and frequency of hurricanes, leading to more impactful storm surge events. Rising sea levels will increase the frequency and severity of coastal flooding events.

Change of Vulnerability Since the 2015 HMAP

The Planning Area continues to be vulnerable to flood storms with an increase in population. Furthermore, the vulnerability of the building stock was not assessed. The 2015 plan did not include Hazus estimates for damages and impacts as part of the vulnerability assessment. The 2022 update therefore provides more accurate estimated exposure and potential losses due to flooding for the Planning Area.

4.3 Hazard Profiles

4.3.7 Hail

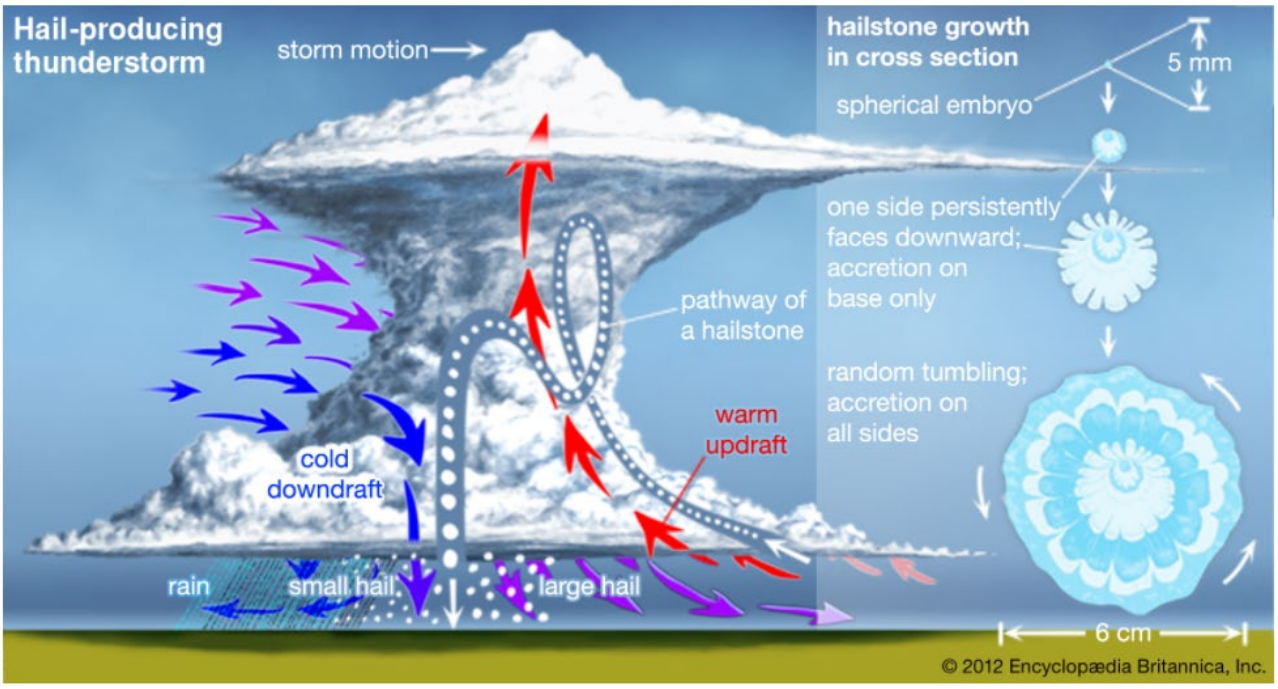
The following section provides the hazard profile and vulnerability assessment for the hail hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.7.1 Hazard Profile

Hazard Description

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32 °F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail. Figure 4.3.7-1 shows the hail formation process. Most hail is small and typically less than two inches in diameter (NOAA NWS 2009).

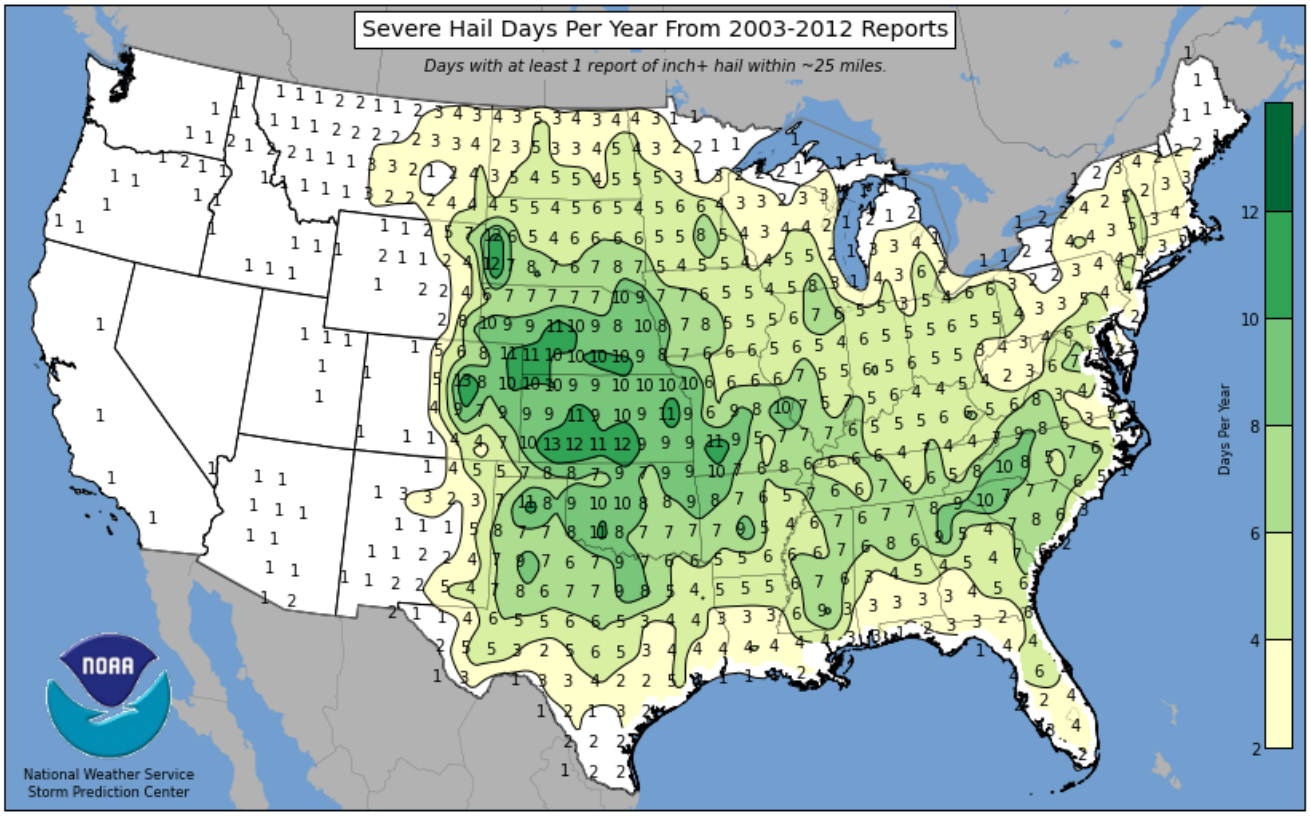
Figure 4.3.7-1 Hail Formation



Source: Encyclopedia Britannica 2012

Figure 4.3.7-2 shows the annual frequency of hailstorms in the United States as recorded from 2003 to 2012. Hailstorms have been observed in almost every location where thunderstorms occur throughout the United States. They are most frequent in the southern and central plain states where the climate produces violent thunderstorms. The figure shows that the Planning Area experiences two severe hail days each year. Severe hail day is defined as a day with at least one report of one inch or more hail within 25 miles.

Figure 4.3.7-2 Severe Hail Days Per Year From 2003-2012



Source: SPC 2016

Location

The entire Planning Area is exposed and vulnerable to hail.

Extent

The severity of hail is measured by duration, hail size, and geographic extent. Most hail stones from hail events are made up of variety of sizes. Only the very largest hail stones pose serious risk to people, if exposed. The size of hail is estimated by comparing it to a known object. **Error! Reference source not found.** shows the different sizes of hail and the comparison to real-world objects.

Table 4.3.7-1 Hail Size

Size	Inches in Diameter
Pea	0.25 inch
Small Marble	0.50 inch
Penny or Large Marble	0.75 inch
Nickel	0.875 inch
Quarter	1.0 inch
Ping-Pong Ball	1.5 inches
Golf Ball	1.75 inches
Hen Egg	2.0 inches
Tennis Ball	2.5 inches
Baseball	2.75 inches
Teacup	3.0 inches
Grapefruit	4.0 inches
Softball	4.5 inches

Source: NOAA 2021

The Tornado and Storm Research Organization (TORRO) Hailstorm Intensity Scale (H0 to H10) relates typical damage and hail sizes (refer to Table 4.3.7-2).

Table 4.3.7-2 TORRO Hailstorm Intensity Scale

TORRO Hailstorm Intensity Scale	Intensity Category	Typical Hail Diameter (mm)	Typical Damage Impacts
H0	Hard Hail	5	No damage
H1	Potentially Damaging	5-15	Slight general damage to plants, crops
H2	Significant	10-20	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60	Bodywork of grounded aircraft dented; brick walls pitted
H7	Destructive	50-75	Severe roof damage, risk of serious injuries
H8	Destructive	60-90	(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Source: TORRO 2021

Worst-Case Scenario

Hail usually occurs with thunderstorms. A worst-case scenario would be a severe thunderstorm producing large hail (quarter-size [1-inch] and larger). This event would be an H10 (super) hailstorm event on the TORRO intensity scale. An event like this can cause severe damage to structures and severe or fatal injuries to people. The aftermath of a severe hail event could lead to millions of dollars in damages.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with hail events in the Planning Area. According to the NOAA-NCEI Storm Events Database, Cameron County has been impacted by 22 hail events between 1996 and 2020 that caused more than $50 million in property damage. Of those events, the City Brownsville reported 3 hail events between 1996 and 2021 (refer to Table 4.3.7-3).

Table 4.3.7-3 Total Hail Events in Cameron County, 1996-2021

Hazard Type	Number of Occurrences Between 1996 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Hail	22	0	5	$50 million	$0

Source: NOAA-NCEI 2022

Note: Due to limitations in data, not all thunderstorm wind events occurring between 1950 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated

Between 1953 and 2021, the State of Texas was included in five hail-related major disaster (DR) or emergencies (EM) declarations. Cameron County was not included in any of those declarations. This HMAP update includes known hail events that have impacted the Planning Area between 1996 and 2021. These individual events are shown in Table 4.3.7-4. The events listed in Table 4.3.7-4 represent only those that were reported to the NOAA-NCEI Storm Events Database and the Storm Prediction Center and may not represent all hail events that have occurred in the Planning Area.

Table 4.3.7-4 Individual Hail Events in Cameron County, 1993-2021

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Magnitude	Injuries	Property Damages	Event Details
April 25, 2019	Hail	N/A	0.88 inch	0	$0	Nickel sized hail at the intersection of New Hampshire Ave. and I-69E in Harlingen.
April 2, 2017	Hail	N/A	3.01 inches	0	$15,000	Measured hail report of 3.01 inches via social media. Hail broke windshield at residence with other windshields broken in neighborhood.
April 21, 2018	Hail	N/A	1.0 inch	0	$0	Quarter sized hail in Olmito near the intersection of Noble Pine and Chestnut Oak.
April 18, 2016	Hail	N/A	1.0 inch	0	$0	Quarter sized hail on South Padre Island.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Magnitude	Injuries	Property Damages	Event Details
April 24, 2015	Hail	N/A	1.0 inch	0	$0	Quarter size hail in Los Indios.
May 28, 2014	Hail	N/A	0.75 inch	0	$0	Penny sized hail in Port Isabel.
December 5, 2012	Hail	N/A	1.25 inches	0	$0	Quarter to half dollar size hail fell in La Feria, near FM 506. The hail lasted for a few minutes.
May 12, 2012	Hail	N/A	1.25 inches	0	$500	Nickel to quarter size hail reported at Altas Palmas and Highway 83 and quarter size hail along Highway 83 on the west side of Harlingen. Car windshield was broken from the hail.
April 20, 2012	Hail	N/A	1.0 inch	0	$0	Nickel to quarter size hail at the intersection of Southmost and International Blvd in Brownsville.
February 4, 2012	Hail	N/A	1.0 inch	0	$0	Quarter sized hail about 1.75 miles north of the center of Rio Hondo in extreme northern Cameron County.
September 16, 2009	Hail	N/A	1.0 inch	0	$0	The public reported hail up to an inch in size fell during a thunderstorm near the intersection of Elizabeth Street and Central Boulevard.
May 27, 2009	Hail	N/A	1.75 inches	0	$0	Hail up to golf ball size during an intense thunderstorm northwest of the center of Los Fresnos.
February 12, 2008	Hail	N/A	1.0 inch	0	$0	Hail fell in Arroyo City with some of the hail measuring up to 1 inch in diameter; produced by an isolated thunderstorm which occurred along a cold front.
May 3, 2007	Hail	N/A	0.88 inch	0	$0	Severe thunderstorms developed and produced severe weather over Zapata, Starr, Hidalgo and Cameron Counties. Numerous reports of wind damage and large hail were reported in Rio Grande City. Large hail reports were also received in Zapata, Hidalgo and Cameron Counties.
May 14, 2006	Hail	N/A	1.0 inch	0	$0	Large hail was reported by the Rio Hondo Fire Department.
August 12, 2003	Hail	N/A	0.75 inch	0	$0	0.75-inch hail
April 25, 2003	Hail	N/A	1.75 inches	0	$0	1.75-inch hail

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	Magnitude	Injuries	Property Damages	Event Details
April 8, 2003	Hail	N/A	3 inches	5	$50 million in property damages	One of the most destructive hail events in recorded history for the City of Brownsville. The hail destroyed roofs of homes and businesses, broke windows of automobiles and homes, and damaged vegetation.
March 14, 2000	Hail	N/A	1.75 inches	0	$0	1.75-inch hail
April 26, 1999	Hail	N/A	1.75 inches	0	$0	Thunderstorms produced several areas of hail from Kennedy to Cameron County.
February 21, 1998	Hail	N/A	0.75 inch	0	$0	0.75-inch hail
February 1, 1998	Hail	N/A	1.75 inches	0	$0	1.75-inch hail

Source: NOAA-NCEI 2022

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense, and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). While predicting the trends of hail as a result of climate change is difficult, it is anticipated that more frequent and intense storms will occur. Some of these storms can bring hail.

Probability of Future Occurrences

Error! Reference source not found. summarizes data regarding the probability of occurrences of hail events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the NOAA-NCEI Storm Events Database, including only those events that identified hail occurring in the City of Brownsville.

Table 4.3.7-5 Probability of Future Occurrence of Hail Events

Hazard Type	Number of Occurrences Between 1996 and 2021	% chance of occurrence in any given year
Hail	22	84.62%

Source: NOAA-NCEI 2022

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected hail events since 1968. Due to limitations in data, not all hail events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

The Planning Area is expected to continue experiencing the direct and indirect impacts of hail events each year. The Planning Area experienced 22 hail incidents in 25 years, giving the Planning Area an 84.62% chance of being impacted by a hail incident in any given year. In Section 4.4, the identified hazards of concern for the Planning

Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for hail in the Planning Area is considered 'occasional'.

4.3.7.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the hail hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a hail event. The following text evaluates and estimates the potential impact of the hail hazard in the Planning Area.

Impact on Life, Health and Safety

The impact of hail events on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of Cameron County (421,017) is assumed to be exposed to this hazard (U.S. Census 2019 ACS 5-Year Population Estimate).

People are vulnerable to the effects of hail events, including injuries, power outages, impacts on transportation routes, damage to homes, and damage to vehicles. First responders are also at risk of being injured during a significant hail event if they are responding to an incident. People located outdoors (e.g., recreational activities, farming, emergency responders) are considered most vulnerable to hailstorms because there is little to no warning time, and shelter might not be available. Moving to a lower risk location can decrease a person's vulnerability.

Impact on General Building Stock

Depending on the size of the hail and severity of the storm, the Planning Area could see damage from hail impacting structures. While damage to the building stock is possible as a result of hail, it is difficult to estimate and would not have as wide of an impact as a high wind or tornado event.

Impact on Critical Facilities

All critical facilities in the Planning Area are vulnerable to being affected by hail events.

Impact on Economy

Hail-producing severe storms impact the economy; impacts include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. Additionally, vehicles parked outdoors are vulnerable to hail damage and could increase economic impacts of a storm. The 2015 HMAP predicted that annual property losses due to hail would amount to $1,011,591 for the City of Brownsville (Brownsville Public Utilities 2015 Hazard Mitigation Action Plan).

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the hail hazard because the entire Planning Area is exposed and vulnerable.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to further increase over the next few years. The increase in population will expose more people to the hail hazard.

Climate Change

The entire State of Texas is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (UCAR 2017). Section 4.3.6 (Flood) provides a discussion related to the impact of climate change due to increases in rainfall. An increase in storms will produce more wind events and can increase tornado activity (refer to Section 4.3.11 [Tornadoes]). With an increased likelihood of strong storms, all of the Planning Area's assets will experience additional risk for losses as a result of hail-producing storm events.

Changes in Vulnerability Since the 2015 HMAP

Cameron County's population increased since the last plan; increasing the number of people impacted during a hail event. Therefore, the entire Planning Area remains vulnerable to hail events.

4.3 Hazard Profiles

4.3.8 Hurricane and Tropical Storm

The following section provides the hazard profile and vulnerability assessment for the hurricane and tropical storm hazard in the Planning Area. The impacts of storm surge from hurricanes and tropical storms are discussed in the flood profile (Section 4.3.6). Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

4.3.8.1 Hazard Profile

Hazard Description

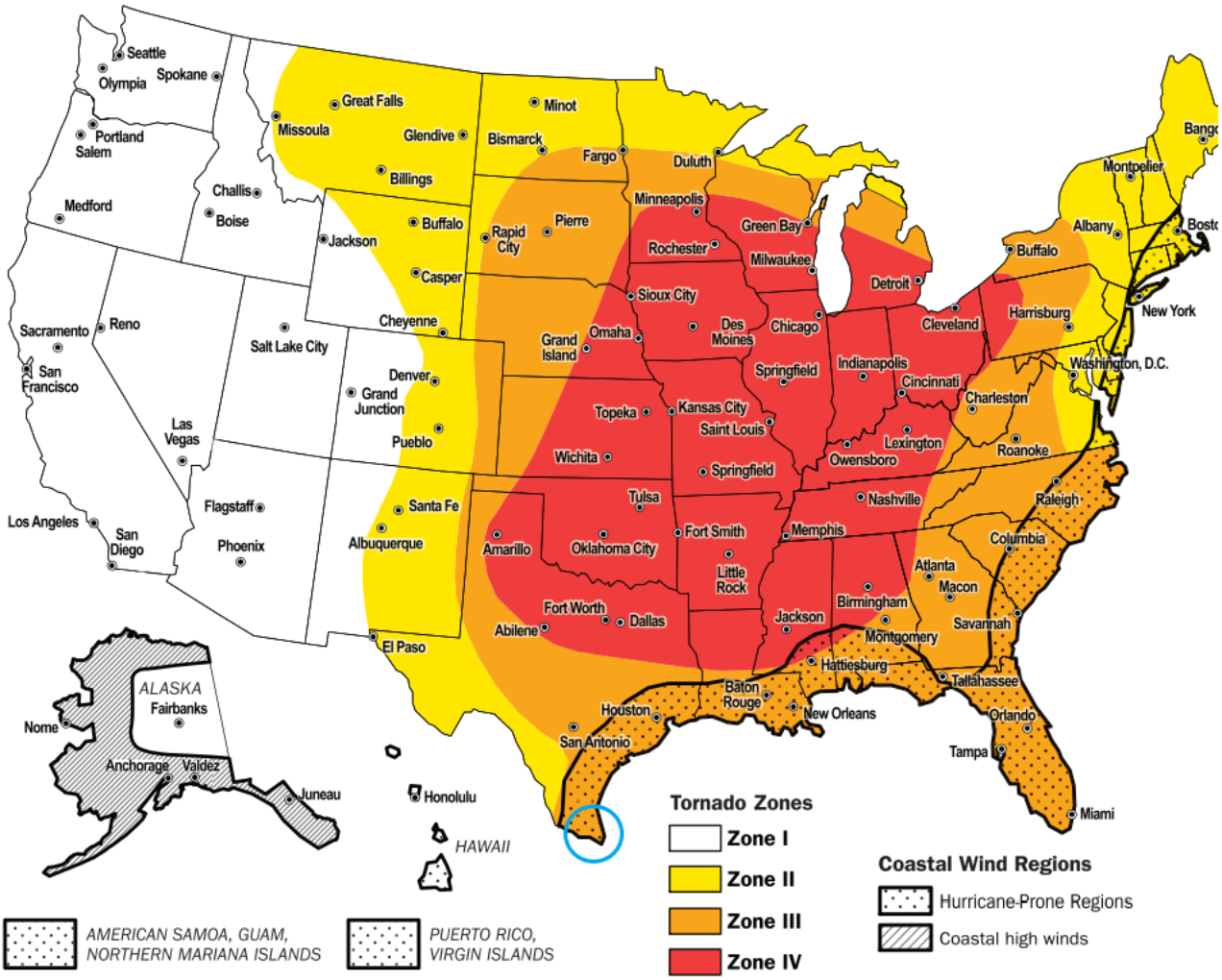
Tropical cyclones are fueled by a different heat mechanism than other cyclonic windstorms, such as Nor'easters and polar lows. The characteristic that separates tropical storms from other cyclonic systems is that at any height in the atmosphere, the center of a tropical storm will be warmer than its surroundings, a phenomenon called *warm core* storm systems (NOAA n.d.). Tropical cyclones strengthen when water evaporated from the ocean is released as the saturated air rises, resulting in condensation of water vapor contained in the moist air. Tropical cyclones begin as disturbed areas of weather, often referred to as tropical waves. As the storm organizes, it is designated as a tropical depression.

A tropical storm system is characterized by a low-pressure center and numerous thunderstorms that produce strong winds of 39 to 73 mph and heavy rain. A hurricane is a tropical storm that attains hurricane status when its wind speed reaches 74 mph or higher. Tropical systems can develop in the Atlantic between the Lesser Antilles and the African coast or in the warm tropical waters of the Caribbean Sea and Gulf of Mexico. These storms can move up the Atlantic coast of the United States, impacting the eastern seaboard, or move into the United States through the states along the Gulf Coast, bringing wind and rain as far north as New England before moving eastward offshore.

Location

Similar to that of severe weather events (e.g., tornadoes, thunderstorms), hurricanes and tropical storms do not have any specific geographic boundary and can occur anywhere in the Planning Area. According to the FEMA Winds Zones of the United States map, the Planning Area is located in Wind Zone III, where wind speeds can reach up to 200 mph. Additionally, the Planning Area is located in the hurricane-susceptible region. Figure 4.3.8-1 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 70 years of tornado data and 160 years of hurricane data collected by FEMA (FEMA 2021).

Figure 4.3.8-1 Wind Zones in the United States

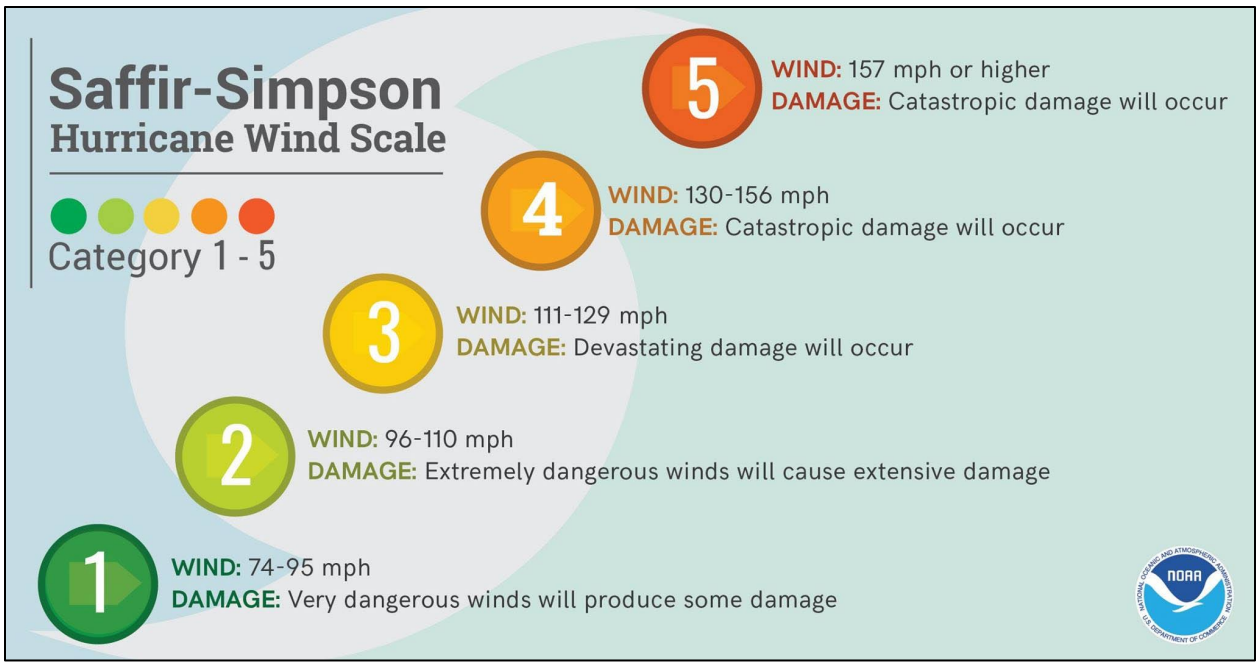


Source: *FEMA 2021*
Note: *The blue circle indicates the approximate location of the Planning Area.*

Extent

The extent of a hurricane or tropical storm is commonly categorized in accordance with the Saffir-Simpson Hurricane Wind Scale, which assigns a designation of tropical storm for storms with sustained wind speeds below 74 mph and a hurricane category rating of 1–5 based on a hurricane's increasing sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered *major hurricanes* because of their potential for significant loss of life and damage. Tropical Storms and Category 1 and 2 storms are still dangerous and require preventative measures (NWS NOAA n.d.). Figure 4.3.8-2 presents this scale, which is used to estimate the potential property damage and flooding expected when a hurricane makes landfall.

Figure 4.3.8-2 Saffir-Simpson Hurricane Wind Scale



Source: Disaster Readiness Portal 2020

The NWS issues hurricane and tropical storm watches and warnings. These watches and warnings are issued or will remain in effect after a tropical cyclone becomes post-tropical, when such a storm poses a significant threat to life and property. The NWS allows the National Hurricane Center (NHC) to issue advisories during the post-tropical stage. The following are the definitions of the watches and warnings:

- *Hurricane/Typhoon Warning* is issued when sustained winds of 74 mph or higher are expected somewhere within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the warning is issued 36 hours in advance of the anticipated onset of tropical storm-force winds. The warning can remain in effect when dangerously high water or combination of dangerously high water and waves continue, even though winds may be less than hurricane force.
- *Hurricane Watch* is issued when sustained winds of 74 mph or higher are possible within the specified area in association with a tropical, subtropical, or post-tropical cyclone. Because hurricane preparedness activities become difficult once winds reach tropical storm force, the hurricane watch is issued 48 hours prior to the anticipated onset of tropical storm-force winds.
- *Tropical Storm Warning* is issued when sustained winds of 39 to 73 mph are expected somewhere within the specified area within 36 hours in association with a tropical, subtropical, or post-tropical storm.
- *Tropical Storm Watch* is issued when sustained winds of 39 to 73 mph are possible within the specified area within 48 hours in association with a tropical, sub-tropical, or post-tropical storm (NHC NOAA 2010).

Mean Return Period

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past

recorded events. The MRP is the average period of time, in years, between occurrences of a particular hazard event, equal to the inverse of the annual frequency of exceedance.

Peak wind speed projections were generated using Hazus v4.2. Hazus v4.2 estimated the maximum 3-second gust wind speeds for the City of Brownsville:

- 100-year MRP – between Category 2 (96-110 mph) and Category 2 (96-110 mph) Hurricane force winds.
- 500-year MRP – between Category 3 (111-129 mph) and Category 4 (130-156 mph) Hurricane force winds.

The associated impacts and losses from these 100- and 500-year MRP hurricane event model runs are reported in the Vulnerability Assessment**.** Figure 4.3.8-3 and Figure 4.3.8-4 show the estimated maximum 3-second gust wind speeds that can be anticipated in the study area associated with the 100- and 500-year MRP events.

Figure 4.3.8-3 Wind Speeds for the 100-Year MRP Event

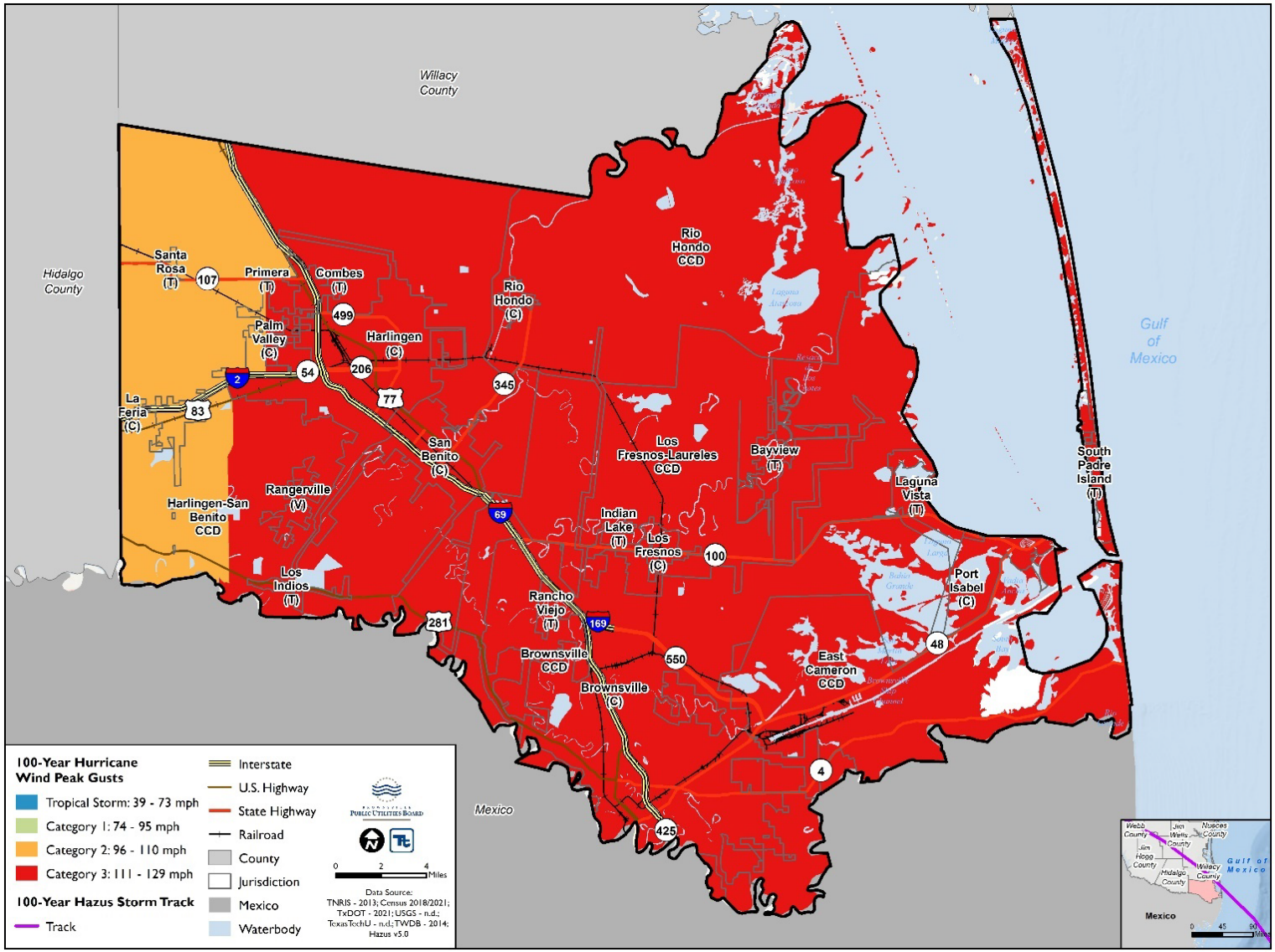
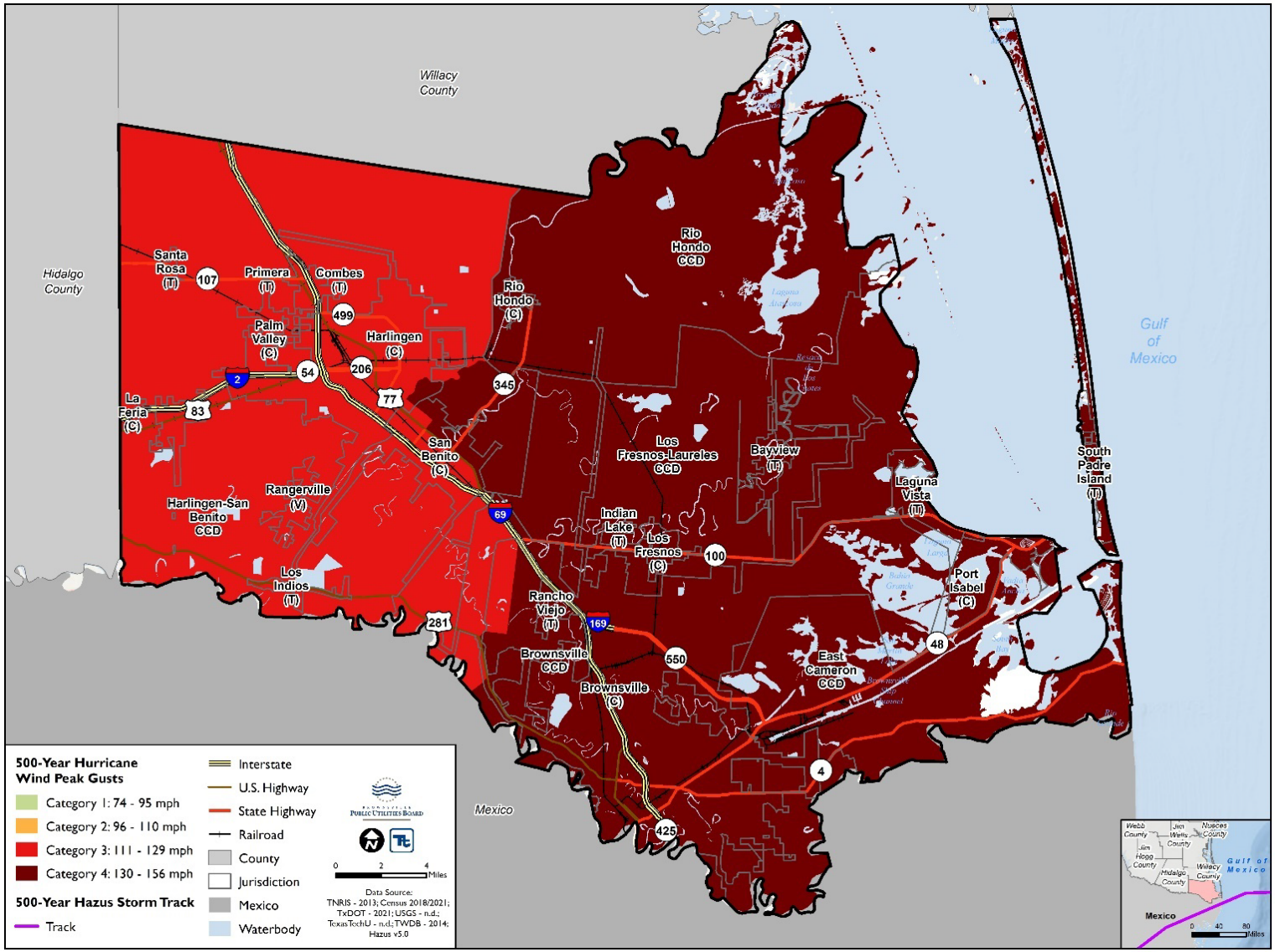


Figure 4.3.8-4 Wind Speeds for the 500-Year MRP Event



Worst-Case Scenario

A category 5 hurricane would be the worst-case scenario hurricane for the Planning Area. The extreme winds associated with a category 5 (speeds of 157 mph and higher) would cause catastrophic damages, leading to downed trees, downed power lines, widespread power outages, significant damage to buildings and infrastructure, and limited access to areas of the Planning Area. Heavy rains and storm surge from a category 5 hurricane could lead to significant flooding and associated damages.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with hurricanes and tropical storms in the Planning Area. According to the NOAA-NCEI Storm Events Database, Cameron County has been impacted by 12 hurricane and tropical storm events between 1996 and 2021 that caused over $407 million in property and crop damage and two injuries (refer to Table 4.3.8-1).

Table 4.3.8-1 Hurricane and Tropical Storm Events in Cameron County, 1996-2021

Hazard Type	Number of Occurrences Between 1996 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Tropical Storm / Tropical Depression	5	0	0	$12 million	$0
Hurricane	7	0	2	$369.49 million	$25.9 million

Source: NOAA-NCEI 2022

Between 1953 and 2021, FEMA included the State of Texas in 24 hurricane-related major disaster (DR) or emergency (EM) declarations. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. Cameron County was included in 12 of these hurricane-related declarations; refer to Table 4.3.8-2.

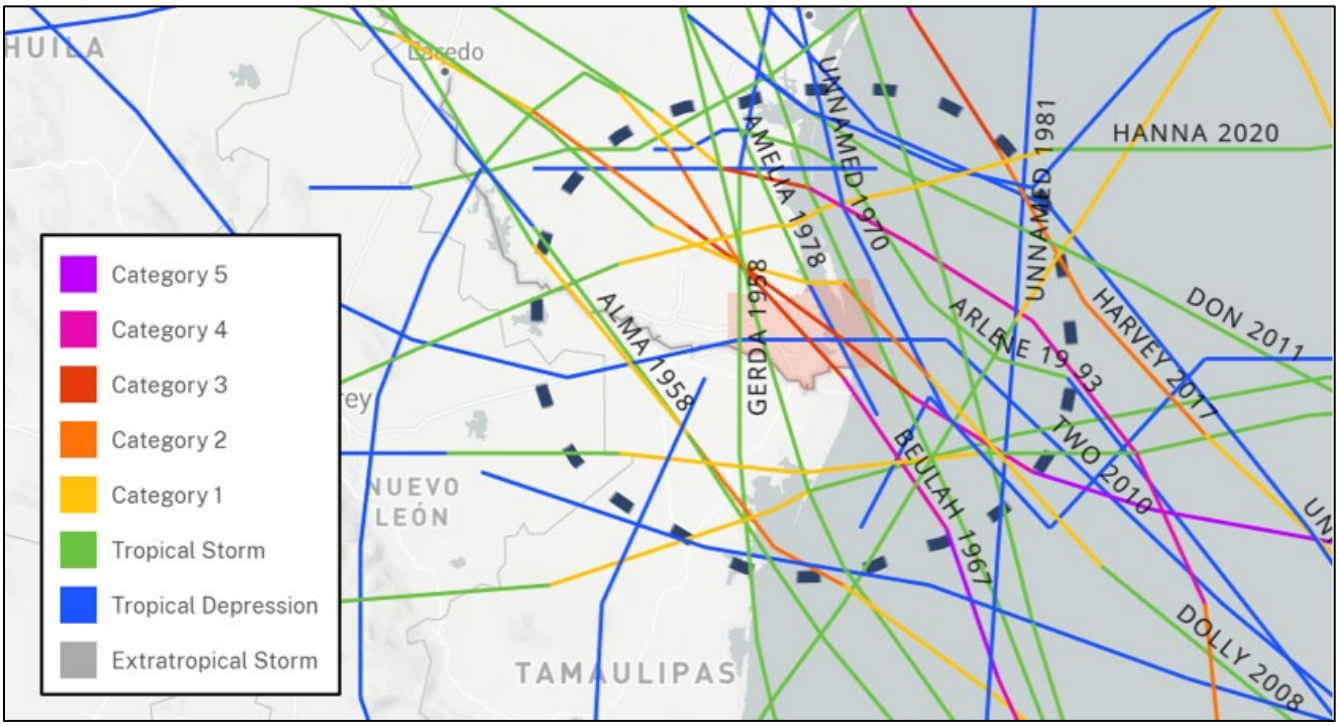
Table 4.3.8-2 Hurricane-Related FEMA Declarations for Cameron County, 1953-2021

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-118	September 16, 1961	Hurricane	Hurricane Carla
DR-232	September 28, 1967	Hurricane	Hurricane Beulah
DR-627	August 11, 1980	Hurricane	Hurricane Allen
DR-816	September 15 - 17, 1988	Hurricane	Hurricane Gilbert
DR-1287	August 21 - 26, 1999	Hurricane	Hurricane Bret
EM-3261 and DR-1606	September 20 - October 14, 2005	Hurricane	Hurricane Rita
EM-3277	August 17 - September 5, 2007	Hurricane	Hurricane Dean
DR-1780	July 22 - August 1, 2008	Hurricane	Hurricane Dolly
EM-3290	August 27-September 7, 2008	Hurricane	Hurricane Gustav
DR-1931 and EM-3313	June 30 - August 14, 2010	Hurricane	Hurricane Alex
EM-3530	July 25 - 31, 2020	Hurricane	Hurricane Hanna

Source: FEMA 2021

Figure 4.3.8-5 from the NOAA Historical Hurricane Tracker illustrates the tracks of storms between 1950 and 2019 within 60 nautical miles of the City of Brownsville. NOAA showed 28 hurricanes or tropical storms being tracked within 60 miles of the Planning Area. As the figure depicts, the Planning Area is frequently impacted by hurricanes, tropical storms, and tropical depressions.

Figure 4.3.8-5 Historical Hurricane Tracks within 60 Nautical Miles of the Planning Area 1950-2021



Source: *NOAA 2022*
Note: *Category refers to hurricane category strength. Category 1 Hurricane, Category 2 Hurricane, Category 3 Hurricane, Category 4 Hurricane, Category 5 Hurricane*

This HMAP update includes known hurricane and tropical storm events that have impacted the Planning Area between 1996 and 2021. These events are shown in Table 4.3.8-3. The events listed in Table 4.3.8-3 represent only those that were reported to the NOAA-NCEI Storm Events Database, FEMA, and the 2015 Brownsville Public Utilities Board HMAP, and may not represent all hurricane and tropical storm events that have occurred since 1996.

Table 4.3.8-3 Hurricane and Tropical Storm Events Impacting the Planning Area, 1996-2021

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages	Event Details
September 6-11, 1998	Tropical Storm Frances	N/A	N/A	0	0	$0	Tropical Storm Frances produced widespread heavy rain, gusty winds, high tides, and beach flooding. The strongest winds measured were 34 knots gusts to 42 knots at Port Isabel/Cameron County Airport.
August 18-25, 1999	Hurricane Bret	DR-1287	Yes	N/A	N/A	N/A	Category 4 hurricane passed to the northeast of Cameron County
August 4-9, 2002	Tropical Storm Bertha	N/A	N/A	N/A	N/A	N/A	The storm headed directly toward Cameron County, then, approximately 60 nautical miles from the County, veered northwest
August 14-17, 2003	Hurricane / Tropical Storm Erika	N/A	N/A	0	0	$10,000 (property)	Strong wind gusts between 50 and 60 mph associated with Tropical Storm Erika produced minor wind damage over South Padre Island and Brownsville.
2005	Hurricane Emily Category 5	N/A	N/A	0	0	$75,000	Emily produced heavy rains over south Texas with storm total rainfall amounts between 1.5 and 5 inches. Storm tides caused minor to moderate flooding from the port Mansfield jetties southward to the Rio Grande. Only minimal and isolated damage was reported. Heavy rains from the outer rainbands of Hurricane Emily produced flash flooding that resulted in the closing of Highway 4 seven miles north of F.M. Road 511.
July 20-27, 2008	Hurricane Dolly Category 2	DR-1780	Yes	0	2	$367.5 million	After edging northward just off the Cameron County coastline during the early to mid-morning, the inner western eyewall reached South Padre Island at around 11 am CDT, further intensifying between 11 am and 1 pm while edging across Laguna Madre into Port Isabel, Bayview, Laguna Heights, and Laguna Vista. Sustained winds peaked at 78 mph on South

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages	Event Details
							Padre Island. Peak sustained winds at higher exposed locations, may have occasionally reached or exceeded 100 mph. Entire roofs or shingles were torn off buildings and walls were damaged. Hundreds of wooden telephone poles were blown over and hundreds of large tree limbs were blown down. Power outages were widespread and of long duration, generally from one to two weeks in most locations. There were two notable injuries on South Padre Island.
June 30, 2010	Hurricane Alex	DR-1931 and EM-3313	Yes	0	0	$25,000 (property)	Feeder bands from intensifying Hurricane Alex produced a prolonged period of locally heavy rain, gusty winds, and a few tornadoes during the day and evening of June 30th. As the center of Alex neared landfall about 100 to 110 miles south of the Cameron County/Mexico border, sustained winds peaked between 39 and 51 mph, with gusts peaking between 56 and 66 mph
July 7-10, 2010	Tropical Depression Two	N/A	N/A	0	0	$0	Heavy rains of 1 to 3 or more inches fell roughly between Brownsville and the southwest corner of Cameron County during the mid-morning of July 8th as weak Tropical Depression #2 made landfall along the Lower Texas coast. Rainfall of more than 3 inches was recorded at Brownsville/South Padre Island International Airport over the course of two days, with 1.71 inches falling on the 8th. Minor, nuisance urban-type flooding was reported in southern Cameron County.
September 4-10, 2010	Tropical Storm Hermine	N/A	N/A	0	0	$12 million (property)	Damaging winds and flooding rains pounded Brownsville, Harlingen, and Raymondville as the eyewall of Hermine tracked along and east of Federal Highway 77 in Cameron and Willacy Counties. Peak wind gusts reached or exceeded 70 mph, causing

Dates of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages	Event Details
							widespread damage to trees and power lines. Rainfall of more than 3 inches in just a few hours flooded roads and farmland. More than 250,000 residents were impacted by the core of Hermine during the middle of the night.
July 27-30, 2011	Tropical Storm Don	N/A	N/A	0	0	$0	Tropical Storm Don passed northwest of Cameron County
August 16-September 2, 2017	Hurricane Harvey	DR-4332	No	N/A	N/A	N/A	Category 4 hurricane passed approximately 50 miles east of Cameron County.
July 23-26, 2020	Hurricane Hanna	EM-3530	Yes	0	0	$1.88 million (property) $25.9 million (crop)	Hurricane Hanna spawned a tornado that touched down near the Brownsville-South Padre Island Airport. Trees and powerlines were downed and roof damages was reported. Up to 15 inches of rain in the Valley caused flooding including overflowed resacas in Brownsville. Crop damage was significant, with sugar cane snapped in many fields and young fruit being blown off citrus trees, which also sustained damage.

Sources: NOAA, 2022; NOAA-NCEI 2022; FEMA, 2022

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016).

Temperatures are predicted to increase in the Planning Area and ocean temperatures are forecast to continue to increase, which may lead to an increase in intensity and frequency of hurricanes. As oceans warm, the length of hurricane season may expand. The past six hurricane seasons have featured a tropical system occurring before the official start of the season. In 2016, a very rare winter hurricane named Alex developed in the middle of January (BBC 2019). According to NOAA's database, 40 storms formed in the Atlantic Basin before June 1 from 1851 through 2021, a long-term average of one such early storm every four to five years. The 2010s had the most such storms, and there has been a steady increase since the 1990s. However, the 1950s had six such storms, the 1930s had four and there was another four preseason storm streak from 1887 through 1890. It is possible there were other such storms in the era before satellites – before the mid-1960s – that were missed by ship observations or reports from areas impacted. It remains to be seen if expansion of the traditional hurricane season is a long-term trend or a common occurrence (The Weather Channel 2020). It remains to be seen if other factors such as steering currents, atmospheric sheer, and the presence of Saharan dust will be impacted in ways which increase or decrease the risk of hurricanes in the Planning Area.

Probability of Future Occurrences

The information used to calculate the probability of occurrences is based on the NWS's Historic Hurricane Tracker and only includes events that were tracked within 60 miles of the Planning Area (see Table 4.3.8-4).

Table 4.3.8-4 Probability of Future Occurrence of Hurricane/Tropical Storm Events

Hazard Type*	Number of Occurrences Between 1996 and 2021	% chance of occurrence in any given year
Tropical Storms	7	26.92%
Hurricanes (Categories 1 and 2)	5	19.23%
Major Hurricanes (Categories 3, 4, and 5)	2	7.69%
TOTAL	14	53.85%

Source: NOAA 2022

*Note: * Storms may be listed more than once in the summary according to the different intensity categories they reached during the event.*

The Planning Area is expected to continue experiencing the direct and indirect impacts of hurricanes and tropical storms each year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for hurricanes and tropical storms in the Planning Area is considered 'occasional'.

4.3.8.2 Vulnerability Assessment

A probabilistic assessment was conducted for the 100- and 500-year MRPs through a Level 2 analysis in Hazus to analyze the wind hazard associated with hurricanes and tropical storms and provide a range of loss estimates due to wind impacts. Refer to Section 4.2 (Methodology and Tools) for additional details on the methodology used to assess hurricane and tropical storm risk. See section 4.3.6 (Flood) for information on storm surge exposure.

Impact on Life, Health and Safety

The impact of hurricanes and tropical storms on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time was provided to residents. All Planning Area residents are exposed to the hurricane storm and tropical storm hazard.

Research has shown that some populations, while they may not have more hazard exposure, may experience exacerbated impacts and prolonged recovery if/when impacted. This is due to many factors including their physical and financial ability to react or respond during a hazard. Economically disadvantaged populations are vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact to their family and may not have funds to evacuate. The population over the age of 65 is also vulnerable and, physically, they may have more difficulty evacuating. Additionally, the elderly are considered vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention which may not be available due to isolation during a storm event. According to the 5-year population estimates from the American Community Survey, Cameron County has a total of 117,663 persons living in poverty and 57,032 over the age of 65 years old. Please refer to Section 3 (Community Profile) for the statistics of these populations.

Residents may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings and debris carried by high winds can lead to injury or loss of life. Socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Hazus estimates that 3,741 and 23,395 households will be displaced during the 100-year and 500-year MRP hurricane wind events, respectively. Hazus also estimates that 4,018 and 27,853 persons will be seeking short-term shelter during the 100-year and 500-year MRP hurricane wind events, respectively. Refer to Table 4.3.8-5 for a summary of the displaced households by jurisdiction. Please note that estimates are only based on wind speed and do not account for sheltering needs associated with flooding and storm surge that may accompany hurricane and tropical storm events.

Table 4.3.8-5. Estimated Hurricane Impact on Persons and Households

Jurisdiction	100-Year Mean Return Period Hurricane		500-Year Mean Return Period Hurricane	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Brownsville (City)	994	1,162	13,067	15,801
BPUB Constituents	3,741	4,018	23,395	27,853

Source: American Community Survey 2019 (5-year estimates 2015-2019), Hazus v4.2

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on General Building Stock

All buildings in the Planning Area are exposed to the hurricane and tropical storm hazard. To better understand these risks, Hazus was used to estimate the expected wind-related building damages. Specific types of wind damages are also summarized in Hazus at the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 4.3.8-6 summarizes the definition of the damage categories. Table 4.3.8-7 and Table 4.3.8-8 display the estimated building losses caused by the 100-year and 500-year mean return period hurricanes.

Table 4.3.8-6. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very Limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: Hazus v4.2

Table 4.3.8-7. Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Building Replacement Cost Value	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane	Percent of Total	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Commercial Structures Only
Brownsville (City)	$55,730,567,029.96	$1,467,413,022	2.6%	$1,011,342,301	$397,214,525
BPUB Constituents	**$174,838,504,517.37**	**$5,918,899,139**	**3.4%**	**$3,969,422,399**	**$1,775,960,803**

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, Hazus v4.2

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.8-8. Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Building Replacement Cost Value	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane	Percent of Total	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Commercial Structures Only
Brownsville (C)	$55,730,567,029.96	$7,510,295,843	13.5%	$5,152,750,656	$1,978,790,057
BPUB Constituents	$174,838,504,517.36	$16,859,469,503	9.6%	$11,413,250,230	$4,753,031,731

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, Hazus v4.2

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on Critical Facilities

Critical facilities are at risk of being impacted by high winds associated with structural damage, or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. For example, vulnerable populations in the Planning Area are at risk if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. Emergency personnel such as police, fire, and EMS will not be able to effectively respond in a power loss event to maintain the safety of its citizens.

Hazus was used to determine the anticipated impacts to critical facilities in the Planning Area from the 100-year and 500-year MRP hurricane wind events. Table 4.3.8-9 and Table 4.3.8-10 display these results.

Table 4.3.8-9. Estimated Impacts to Critical Facilities Exposed to 100-Year Mean Return Period Hurricane

Facility Type*	100-Year Mean Return Period Hurricane				
	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
EOC	0	21.0%	13.6%	3.0%	0.0%
Medical Facilities	0 - 2	14.7% - 15.7%	18.8% - 29.9%	1.0% - 4.4%	<0.1% - 0.2%
Police Stations	0	21.0% - 22.7%	13.6% - 23.2%	2.8% - 11.2%	0.0%
Fire Stations/EMS	0	11.8% - 14.4%	7.7% - 21.3%	1.0% - 9.1%	<0.1% - 0.4%
Schools	3 - 17	8.2% - 11.8%	25.4% - 44.5%	1.3% - 10.1%	0.0% - <0.1%

Source: Cameron County Planning Partners 2021; HIFLD 2020, Hazus v4.2

*Note: *Facilities shown represent all constituents served by the Brownsville Public Utilities Board services.*

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.8-10. Estimated Impacts to Critical Facilities Exposed to 500-Year Mean Return Period Hurricane

Facility Type*	500-Year Mean Return Period Hurricane				
	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
EOC	0	14.2%	30.8%	41.2%	<0.1%
Medical Facilities	17 - 35	4.1% - 6.4%	34.3% - 39.7%	31.9% - 40.9%	3.4% - 6.7%

Facility Type*	500-Year Mean Return Period Hurricane				
	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
Police Stations	0 - 1	9.2% - 14.2%	25.8% - 30.8%	41.2% - 55.7%	<0.1%
Fire Stations/EMS	0	6.1% - 9.9%	30.0% - 32.5%	25.95% - 39.0%	2.5% - 7.7%
Schools	70 - 168	2.1% - 3.8%	25.8% - 39.6%	38.4% - 56.2%	1.2% - 5.1%

Source: Cameron County Planning Partners 2021; HIFLD 2020, Hazus v4.2
*Note: *Facilities shown represent all constituents served by the Brownsville Public Utilities Board services.*
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

At this time, Hazus does not estimate losses to transportation lifelines and utilities as part of the hurricane model. Transportation lifelines are not considered particularly vulnerable to the wind hazard; they are more vulnerable to cascading effects such as flooding, falling debris etc. Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting) transportation needs. Furthermore, evacuation routes are vulnerable to coastal storm surge events and hurricane wind events.

Impact on Economy

Damage to structures from flooding and wind can be the most immediate result of coastal storm events; however, this damage can have long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss and rental loss due to the repair/replacement of buildings. As evidenced by Hurricane Harvey, the State of Texas, including the Planning Area, lost millions of dollars in wages and economic activity.

Hazus estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event. Table 4.3.8-11 displays the economic impacts of the 100-year and 500-year mean return period hurricane wind events.

Table 4.3.8-11. Economic Impacts of 100-Year and 500-Year Mean Return Period Hurricane Wind Event

Mean Return Period (MRP)	Income Loss	Relocation Loss	Building Losses	Wages Losses	Rental Losses
100-Year MRP	$69,199,360	$1,162,425,450	$5,918,899,140	$110,825,820	$509,433,200
500-year MRP	$261,166,290	$2,982,028,800	$16,859,469,500	$376,615,100	$1,275,124,160

Source: Hazus v4.2
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Debris management can be costly and may also impact the local economy. Hazus estimates the amount of building and tree debris that may be produced as result of the 100- and 500-year MRP wind events. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree

debris consist of downed trees that would likely be collected and disposed at public expense. Refer to the User Manual for additional details regarding these estimates. Table 4.3.8-12 and Table 4.3.8-13 display the estimated debris created during the 100-year and 500-year mean return period hurricane wind events.

Table 4.3.8-12. Estimated Debris Created During the 100-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Estimated Debris Created During the 100-Year Mean Return Period Hurricane Wind Event*			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Brownsville (City)	234,729	732	0	0
BPUB Constituents	933,673	3,655	0	0

Source: Hazus v4.2

*Note: *Debris is based upon census tracts where general building stock is located and excludes results for tracts that do not have buildings.*

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.8-13. Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event*			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Brownsville (City)	1,078,099	7,295	0	0
BPUB Constituents	2,474,777	16,957	0	0

Source: Hazus v4.2

*Note: *Debris is based upon census tracts where general building stock is located and excludes results for tracts that do not have buildings.*

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the hurricane and tropical storm hazard because the entire Planning Area is exposed and vulnerable; however, due to increased standards and codes, new development can be less vulnerable to the hazard compared with the aging building stock in the Planning Area.

Projected Changes in Population

Cameron County has experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the

Planning Area is expected to increase over the next few years. The increase in population will expose more people to the hurricane and tropical storm hazard.

Climate Change

The entire State of Texas is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (UCAR 2017). Warmer ocean temperatures may result in more frequent and more severe tropical storm and hurricane events. Warming temperatures may also result in a longer hurricane season. Overall, the Planning Area will continue to remain vulnerable to the hurricane and tropical storm hazard.

Changes in Vulnerability Since the 2015 HMAP

The Planning Area continues to be vulnerable to hurricanes and tropical storms. Hazus was not run for the 2015 HMAP; therefore, estimated losses were not populated. Therefore, this vulnerability assessment provides more accurate estimated exposure and potential losses for the Planning Area.

4.3 Hazard Profiles

4.3.9 Lightning

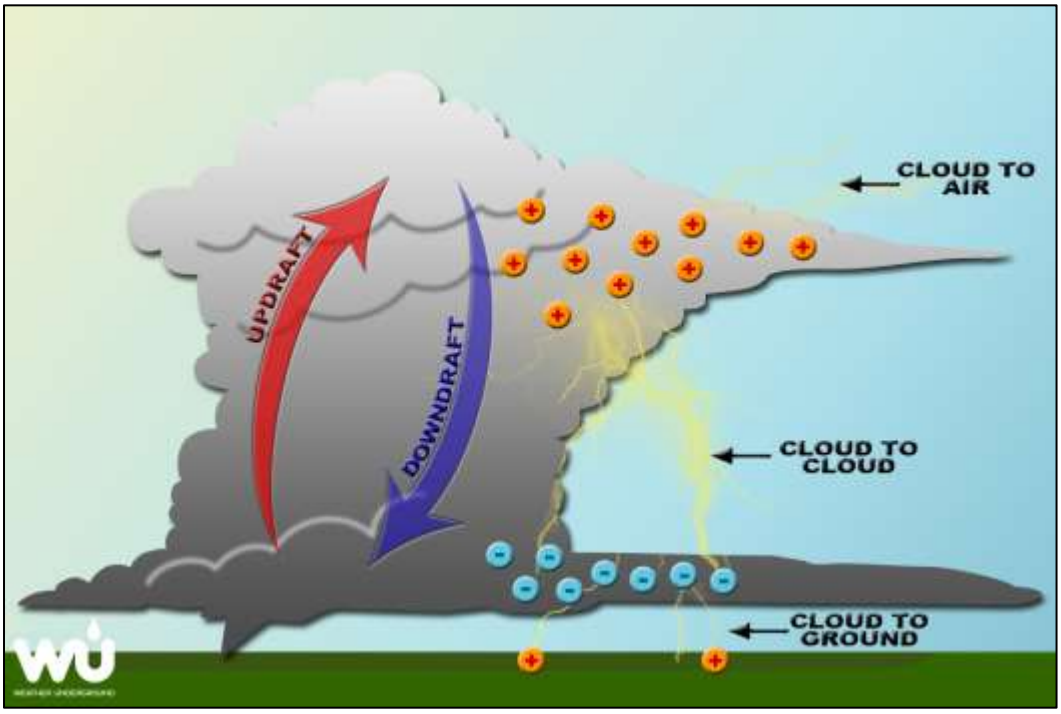
4.3.9.1 Hazard Profile

The following section provides the hazard profile and vulnerability assessment for the lightning hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

Hazard Description

Lightning is a giant spark of electricity in the atmosphere between clouds, the air, or the ground, produced by a thunderstorm (refer to Section 4.3.10 for details regarding the thunderstorm hazard). Energy from lightning channel heats the air to around 18,000°F. This causes the air to rapidly expand, creating a sound wave known as thunder. Thunder can be heard up to 25 miles away from the lightning discharge (NOAA n.d.). Figure 4.3.9-1 illustrates how lightning develops.

Figure 4.3.9-1 How Lightning Develops



Source: Weather Underground 2021

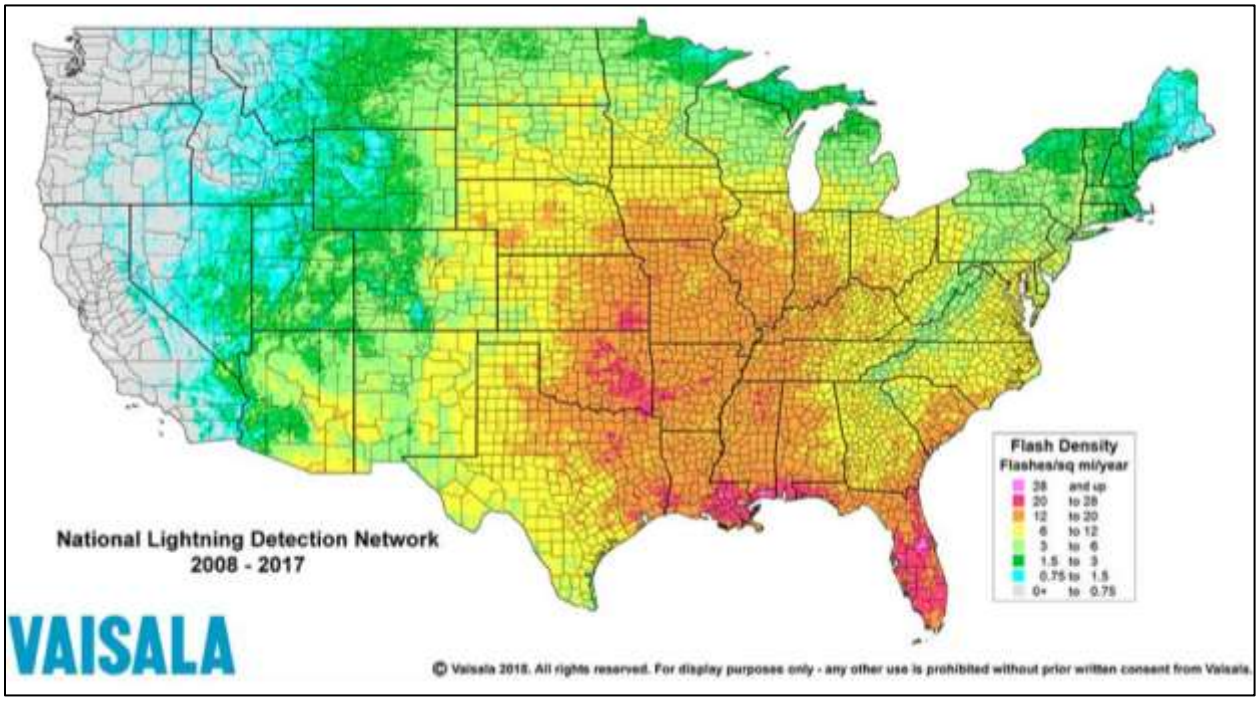
Lightning is a major cause of storm-related deaths in the United States, with an average of 43 reported fatalities and 243 injuries each year (NWS n.d.). Between 1990 and 2003, 52 lightning-related deaths were reported in the

State of Texas, ranking second in the United States for deaths associated with lightning strikes (National Lighting Safety Institute 2021).

Location

Lightning occurs with thunderstorms, making the entire Planning Area susceptible to the lightning hazard. The National Lightning Detection Network (NLDN) collects cloud-to-ground lightning data for the continental United States. Figure 4.3.9-2 illustrates the cloud-to-lightning incidence across the United States. The figure shows that Planning Area experienced 3 to 6 flashes per square mile each year.

Figure 4.3.9-2 Cloud-to-Lightning Incidence, 2008 to 2017



Source: Vaisala 2021

Extent

Lightning is most often associated with moderate to severe thunderstorms. The severity of lightning refers to the frequency of lightning strikes during a storm. The Lightning Activity Level (LAL) is a scale which describes lightning activity. The scale is part of the National Fire Danger Rating System. The scale is a range of numbers, from one to six, which reflects frequency and character of cloud-to-ground lightning (National Wildfire Coordinating Group n.d.) (NWS n.d.).

Table 4.3.9-1 Lightning Activity Level

Lightning Activity Level (LAL)	Conditions
1	No thunderstorms
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a 5-minute period.

Lightning Activity Level (LAL)	Conditions
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5-minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5-minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5-minute period.
6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Sources: National Wildfire Coordinating Group 2021; NWS 2021

Worst-Case Scenario

A worst-case scenario for lightning strikes would be an event similar to that of the storm on September 29, 2011 that had multiple recorded lightning strikes, including one that struck a radio tower near the Brownsville Public Utilities Board facility, starting a small blaze. An event with frequent lightning strikes could lead to power outages, structural fires, injuries, and deaths. A Planning Area wide power outage would disrupt operations, inundate shelters, increase emergency response calls, and impact critical services that relies on power to assist the community.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with lightning strikes in the Planning Area. According to the NOAA-NCEI Storm Events Database Cameron County has been impacted by 5 lightning events between 1996 and 2021 that caused more than $7 million in property damages (refer to Table 4.3.9-2).

Table 4.3.9-2 Planning Area Lightning Events 1996-2021

Hazard Type	Number of Occurrences Between 1996 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Lightning	5	0	0	$7.016 million	$0

Source: NOAA-NCEI 2022; BPUB HMAP 2015
Note: Due to limitations in data, not all thunderstorm wind events occurring between 1950 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated

As stated earlier, lightning occurs with thunderstorms. Between 1953 and 2021, the State of Texas was included in three thunderstorm-related FEMA major disaster (DR) or emergency (EM) declarations, however Cameron County was not included in those declarations.

This HMAP update includes known lightning strikes that have resulted in damage and other impacts in the Planning Area between 1996 and 2021. These events listed in Table 4.3.9-3 represent only those that were reported in the NOAA-NCEI Storm Events Database and the BPUB 2015 HMAP. However, local knowledge indicates more instances of lightning strikes occurring in the Planning Area. Therefore, Table 4.3.9-3 may not represent all lightning strikes that have occurred prior to or since 2021.

Table 4.3.9-3 Lightning Events in the Planning Area, 1996-2021

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Property Damages	Event Details*
May 27, 2009	Lightning	N/A	N/A	N/A	Outflows from thunderstorms, an unstable air mass, and an upper level disturbance moving across Deep South Texas set the stage for more showers and strong to severe thunderstorms. Frequent lightning was common with a large cell in southern Cameron County; the same cell produced large hail, heavy rains, and a prolonged downburst that produced one wind damage event.
September 29, 2011	Lightning	N/A	N/A	$1,500	Lightning struck a radio tower near the Brownsville Public Utilities Board facility just before noon on September 29th, starting a small blaze in a storage room which was quickly put out by firefighters. Fiber stored in the room were deemed a total loss. Dollar damage was assumed to be in the thousands of dollars.
May 12, 2012	Lightning	N/A	N/A	$5,000	Palm Valley resident reported 5 palm trees set on fire by a lightning strike.
May 28, 2014	Lightning	N/A	N/A	$10,000	Northerly flow on the back side of a departing upper level disturbance, combined with hot, humid, unstable air along the Rio Grande to promote several areas of strong to severe thunderstorms. Scattered reports of large hail, urban flooding, frequent cloud to ground lightning strikes, and pockets of wind damage to tree limbs and power lines was common. Local law enforcement officials reported two house fires started by lightning strikes in the town of Laguna Vista.
May 16, 2020	Lightning	N/A	N/A	$7 million	One early morning lightning strike burned down a large portion of a condominium complex on South Padre Island, leaving several million dollars in damage behind.

Source(s):FEMA 2021; NOAA-NCEI 2022; BPUB HMAP 2015
** Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table*

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016).

Climate change may lead to an increase in the number of lightning-producing storms. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (UCAR 2017). At century's end, the number of summertime storms that produce extreme downpours could increase by more than 400% across parts of the United States, including sections of the Gulf Coast, Atlantic Coast, and the

Southwest. In addition, the intensity of individual extreme rainfall events could increase by as much as 70% in some areas (National Science Foundation 2016).

Probability of Future Occurrences

Table 4.3.9-4 summarizes data regarding the probability of occurrences of lightning events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 BPUB HMAP, the NOAA-NCEI Storm Events Database, and FEMA.

Table 4.3.9-4 Probability of Future Occurrence of Lighting Events

Hazard Type	Number of Occurrences Between 1996 and 2021	% chance of occurrence in any given year
Lightning	5	19.23%

Source: NOAA-NCEI 2022; FEMA 2021; BPUB HMAP 2015
Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected flood events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

The Planning Area will continue experiencing the direct and indirect impacts of lightning events each year. Based on information from the 2015 BPUB HMAP and the NOAA-NCEI Storm Events Database, there have only been five reported lightning strikes in the City in 25 years. However, as stated earlier, local knowledge indicates many more instances of lightning strikes occurring in the Planning Area. Therefore, the calculated probability based on recorded incidents might not represent the actual probability of occurrence. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for lightning in the Planning Area is considered 'occasional'.

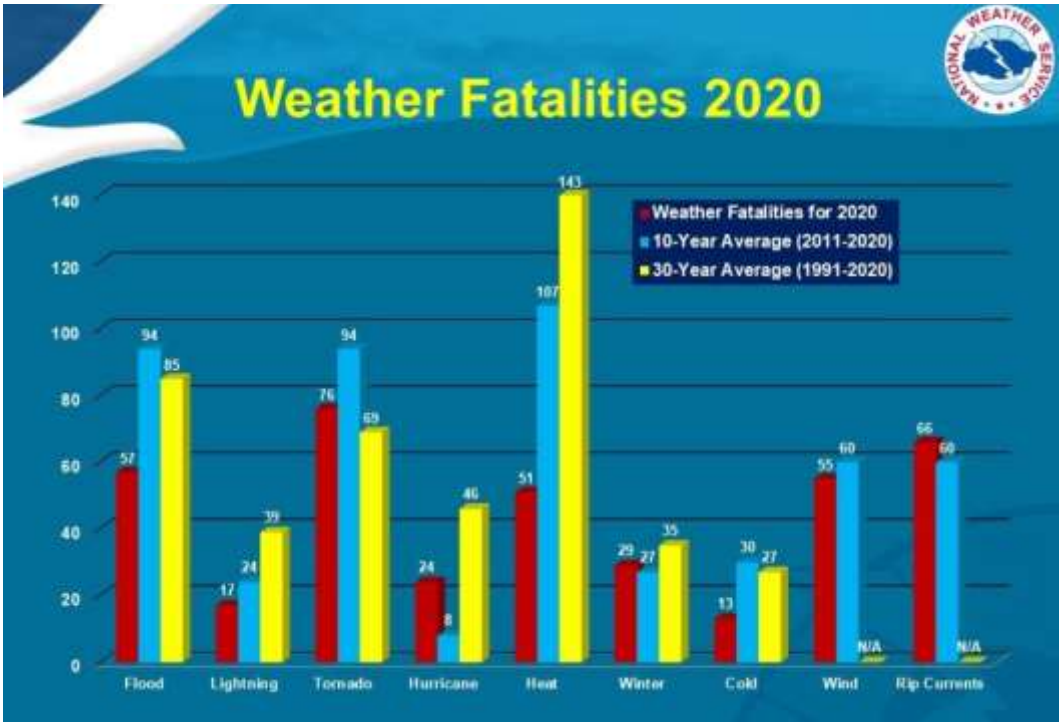
4.3.9.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the lightning hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a thunderstorm event. The following text evaluates and estimates the potential impact of the lightning hazard in the Planning Area.

Impact on Life, Health and Safety

Across the United States, the 10-year average (2009 to 2018) for lightning-caused fatalities is 27, while the 30-year average (1989 to 2018) is 43 (NWS n.d.). Refer to Figure 4.3.9-3 for an illustration of these statistics.

Figure 4.3.9-3. Weather Fatalities in the United States, 2020



Source: (NWS n.d.)

The impact of a lightning on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of the Planning Area is assumed to be exposed to this hazard.

Lightning can be responsible for deaths, injuries, and property damage. Lightning-based deaths and injuries typically involve heart damage, inflated lungs, or brain damage, as well as loss of consciousness, amnesia, paralysis, and burns, depending on the severity of the strike. Additionally, most people struck by lightning survive, although they may have severe burns and internal damage. People located outdoors (i.e., recreational activities and farming) are considered most vulnerable to lightning strikes because there is little to no warning, and shelter might not be available. Moving to a lower risk location will decrease a person's vulnerability.

Impact on General Building Stock

For the purpose of this plan update, the entire general building stock and all infrastructure in the Planning Area are considered exposed to the lightning hazard. Lightning can spark wildfires or building fires, especially if structures are not protected by surge protectors on critical electronic, lighting, or information technology systems. While damage to the building stock is possible as a result of lightning, it is difficult to estimate and would not have as wide of an impact as a high wind or tornado event.

Impact on Critical Facilities

For the purpose of this plan update, all critical facilities in the Planning Area are considered exposed to the lightning hazard.

Impact on Economy

According to NOAA's Technical Paper on *Lightning Fatalities, Injuries, and Damage Reports in the United States from 1959 - 1994*, monetary losses for lightning events range from less than $50 to greater than $5 million (larger losses associated with forest fires with homes destroyed and crop loss) (NOAA 1997).

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Areas targeted for potential future growth and development could be potentially impacted by thunderstorms since the entire the Planning Area is exposed to the lightning hazard. However, due to increased standards and codes, new development can be less vulnerable to the lightning hazard compared with the aging building stock in the Planning Area.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the lightning hazard.

Climate Change

Climate change may lead to an increase in the number of lightning strikes and lightning-producing storms. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, leading to increased rainfall and posing a greater threat of flooding across wide areas (University Corporation for Atmospheric Research [UCAR] 2017). The changing climate may also increase the frequency of lightning flashes could rise by an estimated 50-percent across the continental United States over the next century. A warmer atmosphere can hold more moisture and moisture is one of the key ingredients for triggering a lightning strike (Sanders 2014).

Changes in Vulnerability Since the 2015 HMAP

Cameron County's population increased since the last plan; increasing the number of people impacted during a lightning. Therefore, the entire of the Planning Area remains vulnerable to lightning.

4.3 Hazard Profiles

4.3.10 Thunderstorm Wind

4.3.10.1 Hazard Profile

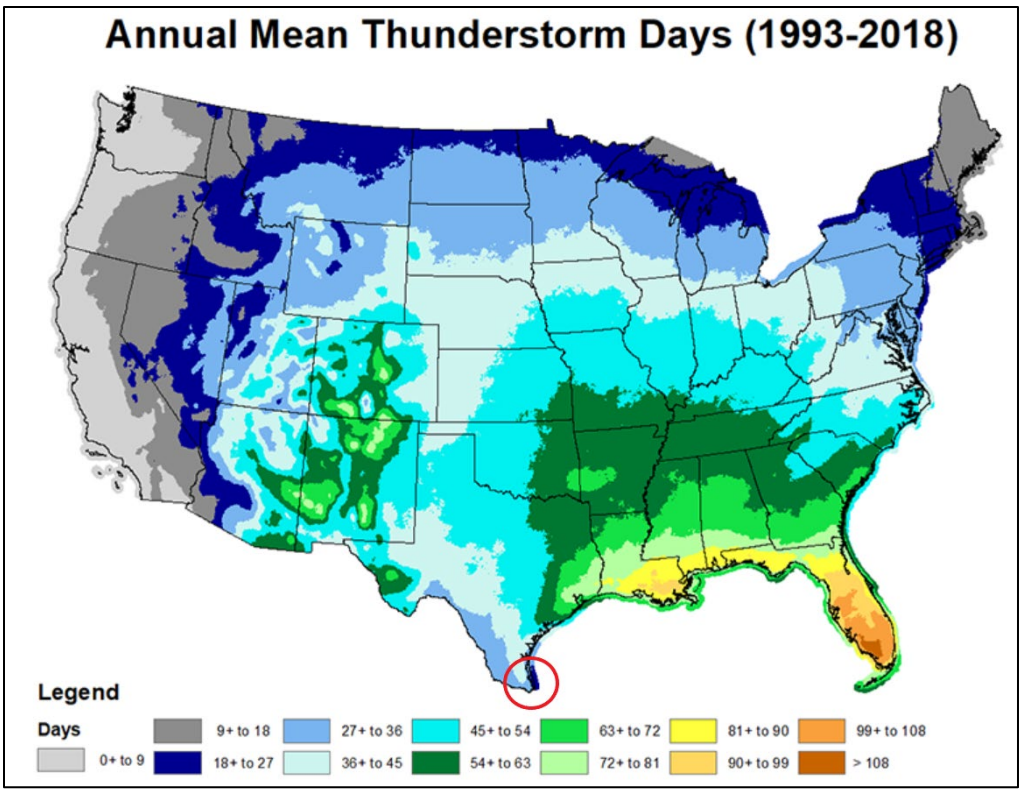
The following section provides the hazard profile and vulnerability assessment for the wind-related events associated with thunderstorms in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

Hazard Description

A thunderstorm is a storm with lightning and thunder produced by cumulonimbus clouds, usually producing wind gusts, heavy rain, and sometimes hail or tornadoes (NWS n.d.). Thunderstorms are usually short-lived (less than two hours), but they can deliver strong winds and enough rain to cause urban or flash flooding. The NWS considers a thunderstorm severe only if it produces damaging wind gusts of 58 mph or higher, large hail one inch (quarter size) in diameter or larger, or tornadoes (NWS n.d.). Thunderstorms can occur at any time. However, they usually occur during the spring and summer months and during the afternoon and evening. Severe thunderstorms are most common from Texas to southern Minnesota; however, severe storms can occur anywhere in the United States (NOAA n.d.).

It is estimated that each year there are 16 million thunderstorms worldwide. Approximately 100,000 thunderstorms occur in the United States each year (NOAA n.d.). Figure 4.3.10-1 illustrates the average number of days with thunderstorms using data from 1993 to 2018. This figure shows that the Planning Area experiences between 27 and 36 days of thunderstorms each year.

Figure 4.3.10-1 Annual Mean Thunderstorm Days, 1993-2018



Source: National Weather Service
Note: The approximate location of the Planning Area is outlined in a red circle.

Thunderstorms can lead to flooding, landslides, strong winds, tornadoes, lightning, and hail. Roads could become impassable from flooding, downed trees or power lines, or a landslide. Strong straight-line winds (up to more than 12 mph) associated with thunderstorms can down trees and utility poles, causing utility outages. Thunderstorms can create tornadoes with winds of up to 300 mph. Lightning can damage homes and injure people. In the United States, an average of 300 people are injured and 80 people are killed by lightning each year. Thunderstorms can produce hail up to the size of softballs damaging cars and windows, and killing livestock caught out in the open (NOAA n.d.).

High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms. Wind begins with differences in air pressures. It is usually horizontal movement of air caused by the uneven heating of the Earth by the sun and the Earth's own rotation. Winds range from light breezes to natural hazards (National Geographic Society 2021).

Location

Since thunderstorms can develop anywhere in the United States, all of the Planning Area is exposed and vulnerable to the impacts of thunderstorms.

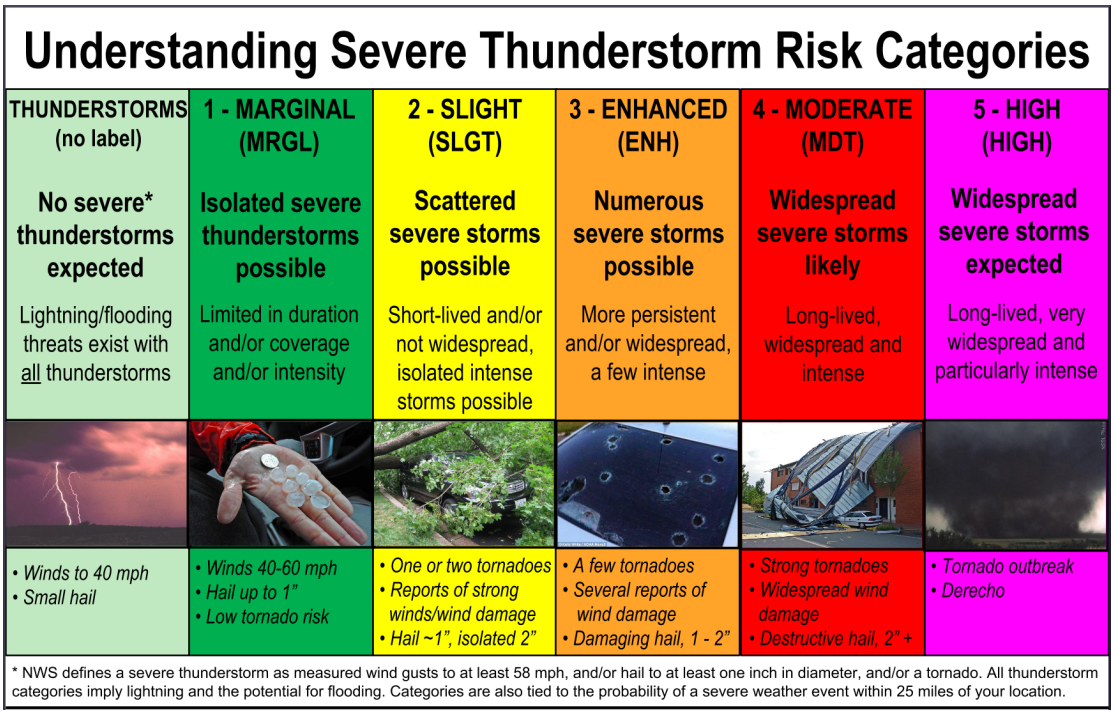
Extent

Severe thunderstorm watches and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. Watches and warnings for thunderstorms in Cameron County are as follows:

- Severe Thunderstorm Warnings are issued when there is evidence based on radar or a reliable spotter report that a thunderstorm is producing, or forecast to produce, wind gusts of 58 mph or greater, structural wind damage, or hail one inch in diameter or greater. A warning will include where the storm was located, what municipalities will be impacted, and the primary threat associated with the severe thunderstorm warning. After it has been issued, the NWS office will follow up periodically with Severe Weather Statements that contain updated information on the severe thunderstorm and advise the public when the warning is no longer in effect (NOAA NWS 2009).
- Severe Thunderstorm Watches are issued by the SPC when conditions are favorable for the development of severe thunderstorms over a larger-scale region for a duration of at least three hours. Tornadoes are not expected in such situations, but isolated tornado development can also occur. A Severe Thunderstorm Watch is issued when an organized episode of hail 1 inch diameter or larger and/or damaging thunderstorm winds are expected during a two-to-eight-hour period. During the watch, the NWS will keep the public informed on what is happening in the watch area and also advise public when the watch has expired or been cancelled (SPC 2021) (NOAA NWS 2009).

The SPC will issue severe thunderstorm outlooks several days ahead of an anticipated thunderstorm event. Figure 4.3.10-2 presents the severe thunderstorm risk categories, as provided by the SPC.

Figure 4.3.10-2 Severe Thunderstorm Risk Categories.



Source: SPC 2020

Winds associated with thunderstorms are measured according to the Beaufort Wind Scale, as outlined in Table 4.3.10-1. This scale was one of the first to estimate wind speeds. The Scale starts with 0 for calm conditions and goes to a force of 12 which would represent hurricane force winds.

Table 4.3.10-1 Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects on Land
0	Less than 1	Calm	Calm, smoke rises vertically
1	1-3	Light Air	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Seldom experienced on land, trees broken or uprooted, considerable structural damage occurs
11	56-63	Violent Storm	If experienced on land, widespread damage
12	64+	Hurricane	Violence and destruction

Source: (NWS n.d.)

The NWS issues advisories and warnings for winds. Issuance is normally site-specific. High wind advisories, watches, and warnings are products issued by the NWS when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS, wind warnings and advisories for the Planning Area are as follows:

- *High Wind Warnings* are issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for wind gusts of 58 mph or greater for any duration.
- *Wind Advisories* are issues when sustained winds of 31 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration (NWS n.d.).

Worst-Case Scenario

A worst-case scenario would involve prolonged high winds of 65 mph and greater, Force 12 on the Beaufort Wind Scale, during a thunderstorm event. This type of event would have both a short- and long-term effects on the Planning Area. The strong winds would lead to downed trees and power lines, creating road closures and power outages. Parts of the Planning Area could experience limited ingress and egress.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with thunderstorms in Cameron County. According to the NOAA-NCEI Storm Events Database, there were 24 thunderstorm wind events recorded in Cameron County between 2011 and 2021. Damages reported for these events totaled almost $2.7 million (refer to Table 4.3.10-2).

Table 4.3.10-2. Thunderstorm Wind Events in Cameron County, 2011-2021

Hazard Type	Number of Occurrences Between 2011 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Thunderstorm Wind	24	0	0	$2,696,500	$0

Source: NOAA-NCEI 2022

Note: Due to limitations in data, not all thunderstorm wind events occurring between 1950 and 1920 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated

Between 1950 and 2021, the State of Texas was included in three thunderstorm-related FEMA major disaster (DR) or emergency (EM) declarations. However, Cameron County was not included in any of those declarations.

This HMAP update includes 24 known thunderstorm wind events that have impacted Cameron County between 2011 and 2021. These events are shown in Table 4.3.10-3. The events listed in Table 4.3.10-3 represent only those that were reported to the NOAA-NCEI Storm Events Database, FEMA, and the 2015 BPUB HMAP, and may not represent all thunderstorm wind events that have occurred since 2011.

Table 4.3.10-3 Thunderstorm Wind in Cameron County, 2011 to 2021

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Magnitude (wind speed in knots)	Fatalities	Injuries	Property Damages	Event Details*
October 22, 2021	Thunderstorm Wind	N/A	N/A	50	0	0	$10,000	Thunderstorm winds downed several large tree limbs and felled at least one large mesquite when its base snapped, ripped 3 to 4 pieces of roofing off of a carport, and lofted a trampoline into powerlines.
October 1, 2021	Thunderstorm Wind	N/A	N/A	48	0	0	$500	In addition to widespread flooding, some minor wind damage occurred.
September 30, 2021	Thunderstorm Wind	N/A	N/A	52	0	0	$0	Brownsville/South Padre Island International Airport recorded a wind gust to 52 knots as severe thunderstorms moved through the area.
May 12, 2021	Thunderstorm Wind	N/A	N/A	52	0	0	$4,000	Strong, damaging winds behind the squall line lasted for several hours. Several tree limbs up to 5 inches in diameter snapped off of trees.
August 1, 2020	Thunderstorm Wind	N/A	N/A	52	0	0	$5,000	A large metal awning from a local convenient gas station were severely damaged and partially blown off.
May 16, 2020	Thunderstorm Wind	N/A	N/A	53	0	0	$0	Wind gust of 61 mph reported in eastern Cameron County.
April 29, 2020	Thunderstorm Wind	N/A	N/A	50	0	0	$0	The observation platform at Brazos Santiago recorded a wind gust of 50.54 knots
October 21, 2019	Thunderstorm Wind	N/A	N/A	61-65	0	0	$2,025,000	Downed power lines reported, and at one point all of South Padre Island had lost power due to 31 transmission poles that were taken down by the wind. Widespread tree damage was surveyed, in addition to the destruction of a sunroom on the south side of Bayview. Several large trees were uprooted with numerous large tree branches down.
September 10, 2019	Thunderstorm Wind	N/A	N/A	47	0	0	$2,000	A few power outages and minor tree damage was noted in the Harlingen area.
April 7, 2019	Thunderstorm Wind	N/A	N/A	64	0	0	$10,000	Several reports of wind damage and high wind gusts were observed in the lower Rio Grande Valley.
August 12, 2018	Thunderstorm Wind	N/A	N/A	40-45	0	0	$500,000	Thunderstorm winds knocked down palm fronds and blew unfastened objects around.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Magnitude (wind speed in knots)	Fatalities	Injuries	Property Damages	Event Details*
June 5, 2017	Thunderstorm Wind	N/A	N/A	51-52	0	0	$10,000	Winds lifted a tin roof, knocked down a fence, and damaged an above ground pool at a home in Laguna Heights.
June 4, 2016	Thunderstorm Wind	N/A	N/A	52	0	0	$2,000	Thunderstorm winds uprooted two large trees and broke several large limbs near the Rancho Viejo Country Club Golf Course and in nearby yards.
June 2, 2016	Thunderstorm Wind	N/A	N/A	44	0	0	$5,000	Thunderstorm wind gusts downed a metal awning onto a truck on South Padre Island.
April 18, 2016	Thunderstorm Wind	N/A	N/A	43-52	0	0	$5,000	Three electrical poles were blown down along U.S. Hwy 281.
August 17, 2015	Thunderstorm Wind	N/A	N/A	52-56	0	0	$45,000	Microburst produced winds that flipped a Gulfstream trailer, removed roofs, knocked down telephone poles, and broke hundreds of tree limbs, two of which fell onto a residence and damaged the roof.
May 12, 2015	Thunderstorm Wind	N/A	N/A	52	0	0	$1,000	A utility pole leaning heavily on a palm tree due to thunderstorm wind gusts and a tree blown down.
April 24, 2015	Thunderstorm Wind	N/A	N/A	50-52	0	0	$17,000	Trees blown down, downed utility wires, a tree blown down on a car, and a trampoline blown into a house that caused windows to break.
May 28, 2014	Thunderstorm Wind	N/A	N/A	52-58	0	0	$0	Several one-to-two-foot diameter trees snapped.
May 9, 2014	Thunderstorm Wind	N/A	N/A	50	0	0	$0	Power outages were reported across the southern portion of South Padre Island.
April 28, 2013	Thunderstorm Wind	N/A	N/A	52-56	0	0	$52, 000	Two tin roofs were lifted from old, poorly constructed trailers. Severe water and structural damage occurred at each residence; insulation was peeled from the roofs and some walls had cracked or collapsed. Both structures were uninhabitable. Nine persons were displaced. Power poles were damaged, a communication tower knocked down, and trees uprooted.
May 15, 2012	Thunderstorm Wind	N/A	N/A	48	0	0	$3,000	Winds blew a poorly anchored roof from one mobile home. A few mesquite limbs were also torn from one or two trees near the home.
April 16, 2012	Thunderstorm Wind	N/A	N/A	74	0	0	N/A	Reports from residents indicated two small boats sunk at a bayside dock, two windows

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Magnitude (wind speed in knots)	Fatalities	Injuries	Property Damages	Event Details*
								blown out of shuttle buses, a restaurant awning blown down, a utility pole knocked down at a service station, and lawn furniture strewn around one resident's yard.
June 22, 2011	Thunderstorm Wind	N/A	N/A	57	0	0	$0	The ASOS platform at the Harlingen Valley International Airport recorded a wind gust of 66 miles per hour as a downburst moved through during a thunderstorm during the early afternoon. No damage was reported to the tower or on the field.

Source(s): FEMA 2021; NOAA-NCEI 2022; BPUB HMAP 2015

** Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table*

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, leading to increased rainfall and posing a greater threat of flooding across wide areas (UCAR 2017).

Probability of Future Occurrences

Table 4.3.10-4 summarizes data regarding the probability of occurrences of thunderstorm events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 BPUB HMAP, the NOAA-NCEI Storm Events Database, and FEMA.

Table 4.3.10-4 Probability of Future Occurrence of Thunderstorm Events

Hazard Type	Number of Occurrences Between 2011 and 2021	% chance of occurrence in any given year
Thunderstorm Wind	24	100%

Source: NOAA-NCEI 2022; FEMA 2021; Brownsville HMAP 2015

Note: The total number of occurrences used to calculate the probability of occurrence included events from NOAA-NCEI and FEMA disaster declarations for Cameron County. Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected flood events since 1968. Due to limitations in data, not all thunderstorm wind events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

The Planning Area is expected to continue experiencing the direct and indirect impacts of thunderstorms each year. Twenty-four thunderstorms in ten years were recorded in Cameron County, giving the Planning Area a 100% chance of being impacted by a thunderstorm in any given year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for thunderstorm wind events in the Planning Area is considered 'occasional'.

4.3.10.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the thunderstorm hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a thunderstorm event. The following text evaluates and estimates the potential impact of the thunderstorm hazard in the Planning Area.

Impact on Life, Health and Safety

The most common problems associated with thunderstorms are immobility and loss of utilities. Although the entire population of the Planning Area is exposed to thunderstorms, some populations are more vulnerable. Vulnerable populations include the elderly, low income, linguistically isolated populations, people with life-

threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support. In general, populations who lack adequate shelter during a thunderstorm, those who are reliant on sustained sources of power in order to survive, and those who live in isolated areas with limited ingress and egress options are the most vulnerable.

The impact of thunderstorms on life, health, and safety is dependent upon several factors including the severity of the event and whether adequate warning time was provided to residents. The entire population of the Planning Area (421,017) is assumed to be exposed to this hazard (2015-2019 ACS 5-Year Population Estimate).

People located outdoors (i.e., recreational activities and farming) are considered most vulnerable to hailstorms, thunderstorms, and tornadoes because there is little to no warning, and shelter might not be available. Moving to a lower risk location will decrease a person's vulnerability.

As a result of severe weather events, residents can be displaced or require temporary to long-term sheltering. The HAZUS-MH results for the 100-year and 500-year MRP hurricane wind events are able to show displaced households and people requiring short-term sheltering. Hazus estimates that 3,741 and 23,395 households will be displaced during the 100-year and 500-year wind events, respectively. Hazus also estimates that 4,018 and 27,853 persons will be seeking short-term shelter during the 100-year and 500-year MRP wind events, respectively.

Table 4.3.10-5. Displaced Households and Short-Term Sheltering

Jurisdiction	100-Year Mean Return Period Hurricane		500-Year Mean Return Period Hurricane	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Brownsville (City)	994	1,162	13,067	15,801
BPUB Constituents	3,741	4,018	23,395	27,853

Source: American Community Survey 2019 (5-year estimates 2015-2019), Hazus v4.2
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Economically disadvantaged populations are more vulnerable because they often evaluate evacuation needs and make decisions based on the economic impact to their family. The population over the age of 65 (57,032) is also vulnerable, can physically have difficulty evacuating, and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event (U.S. Census 2019 ACS 5-Year Population Estimate). Section 3 (Community Profile) provides for the statistics for these populations for the Planning Area.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings.

To better understand these risks, Hazus was used to estimate the expected wind-related building damages. Specific types of wind damages are also summarized in Hazus at the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction. Table 4.3.10-6 summarizes the definition of the damage categories.

Table 4.3.10-6. Description of Damage Categories

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
No Damage or Very Minor Damage Little or no visible damage from the outside. No broken windows, or failed roof deck. Minimal loss of roof over, with no or very Limited water penetration.	≤2%	No	No	No	No	No
Minor Damage Maximum of one broken window, door or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.	>2% and ≤15%	One window, door, or garage door failure	No	<5 impacts	No	No
Moderate Damage Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.	>15% and ≤50%	> one and ≤ the larger of 20% & 3	1 to 3 panels	Typically 5 to 10 impacts	No	No
Severe Damage Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water.	>50%	> the larger of 20% & 3 and ≤50%	>3 and ≤25%	Typically 10 to 20 impacts	No	No
Destruction Complete roof failure and/or, failure of wall frame. Loss of more than 50% of roof sheathing.	Typically >50%	>50%	>25%	Typically >20 impacts	Yes	Yes

Source: Hazus v4.2

Table 4.3.9 7 and Table 4.3.9 8 display the estimated building losses caused by the 100-year and 500-year mean return period hurricane wind events.

Table 4.3.10-7. Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Building Replacement Cost Value	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane	Percent of Total	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 100-Year Mean Return Period Hurricane for Commercial Structures Only
Brownsville (City)	$55,730,567,029.96	$1,467,413,022	2.6%	$1,011,342,301	$397,214,525
BPUB Constituents	$174,838,504,517.37	$5,918,899,139	3.4%	$3,969,422,399	$1,775,960,803

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, Hazus v4.2

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.10-8. Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Building Replacement Cost Value	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane	Percent of Total	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Residential Structures Only	Estimated Building Losses Caused by the 500-Year Mean Return Period Hurricane for Commercial Structures Only
Brownsville (City)	$55,730,567,029.96	$7,510,295,843	13.5%	$5,152,750,656	$1,978,790,057
BPUB Constituents (Total)	$174,838,504,517.36	$16,859,469,503	9.6%	$11,413,250,230	$4,753,031,731

Source: CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021, Hazus v4.2

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on Critical Facilities

Overall, all critical facilities in the Planning Area are vulnerable to being affected by thunderstorms. Utility infrastructure could suffer damage from high winds associated with falling tree limbs or other debris, resulting in the loss of power or other utility service. Loss of service can impact residents, critical facilities, and business operations alike. Interruptions in heating or cooling utilities can affect populations, such the young and elderly, who are particularly vulnerable to temperature-related health impacts. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community's ability to effective respond to an event and maintain the safety of its citizens.

Hazus was used to determine the anticipated impacts to critical facilities in the Planning Area from the 100-year and 500-year MRP hurricane wind events. These probabilities can be found in Table 4.3.10-9 and Table 4.3.10-10 by facility type.

Table 4.3.10-9. Estimated Impacts to Critical Facilities for the 100-Year MRP Hurricane Wind Event

Facility Type*	100-Year Mean Return Period Hurricane				
	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
EOC	0	21.0%	13.6%	3.0%	0.0%
Medical Facilities	0 - 2	14.7% - 15.7%	18.8% - 29.9%	1.0% - 4.4%	<0.1% - 0.2%
Police Stations	0	21.0% - 22.7%	13.6% - 23.2%	2.8% - 11.2%	0.0%
Fire Stations/EMS	0	11.8% - 14.4%	7.7% - 21.3%	1.0% - 9.1%	<0.1% - 0.4%
Schools	3 - 17	8.2% - 11.8%	25.4% - 44.5%	1.3% - 10.1%	0.0% - <0.1%

Source: Cameron County Planning Partners 2021; HIFLD 2020, Hazus-MH v4.2

**Facilities shown represent all constituents served by the Brownsville Public Utilities Board services.*

Table 4.3.10-10. Estimated Impacts to Critical Facilities for the 500-Year MRP Hurricane Wind Event

Facility Type*	500-Year Mean Return Period Hurricane

	Loss of Days	Percent-Probability of Sustaining Damage			
		Minor	Moderate	Severe	Complete
EOC	0	14.2%	30.8%	41.2%	<0.1%
Medical Facilities	17 - 35	4.1% - 6.4%	34.3% - 39.7%	31.9% - 40.9%	3.4% - 6.7%
Police Stations	0 - 1	9.2% - 14.2%	25.8% - 30.8%	41.2% - 55.7%	<0.1%
Fire Stations/EMS	0	6.1% - 9.9%	30.0% - 32.5%	25.95% - 39.0%	2.5% - 7.7%
Schools	70 - 168	2.1% - 3.8%	25.8% - 39.6%	38.4% - 56.2%	1.2% - 5.1%

Source: Cameron County Planning Partners 2021; HIFLD 2020, Hazus-MH v4.2

**Facilities shown represent all constituents served by the Brownsville Public Utilities Board services.*

Impact on Economy

Thunderstorm events can impact the economy of the Planning Area. Impacts include loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair or replacement of buildings. Business interruption losses include losses associated with the inability to operate a business because of the wind damage sustained during a storm or the temporary living expenses for those displaced from their home because of an event.

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population.

Hazus estimates the total economic loss associated with each storm scenario (direct building losses and business interruption losses). Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event.

Table 4.3.10-11. Economic Impacts of 100-Year and 500-Year Mean Return Period Hurricane Wind Event

Mean Return Period (MRP)	Income Loss	Relocation Loss	Building Losses	Wages Losses	Rental Losses
100-Year MRP	$69,199,360	$1,162,425,450	$5,918,899,140	$110,825,820	$509,433,200
500-year MRP	$261,166,290	$2,982,028,800	$16,859,469,500	$376,615,100	$1,275,124,160

Source: Hazus v4.2

Debris management can be costly and may also impact the local economy. Hazus estimates the amount of building and tree debris that may be produced as result of the 100- and 500-year MRP wind events. Because the estimated debris production does not include flooding, this is likely a conservative estimate and may be higher if multiple impacts occur. According to the Hazus Hurricane User Manual, estimates of weight and volume of eligible tree debris consist of downed trees that would likely be collected and disposed at public expense. Refer to the User Manual for additional details regarding these estimates. Table 4.3.10-12 and Table 4.3.10-13 summarizes debris production estimates for the 100- and 500-year MRP wind events.

Table 4.3.10-12. Estimated Debris Created During the 100-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Estimated Debris Created During the 100-Year Mean Return Period Hurricane Wind Event*			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Brownsville (City)	234,729	732	0	0
BPUB Constituents	933,673	3,655	0	0

Source: Hazus v4.2

**Debris is based upon census tracts where general building stock is located and excludes results for tracts that do not have buildings.*

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Table 4.3.10-13. Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event

Jurisdiction	Estimated Debris Created During the 500-Year Mean Return Period Hurricane Wind Event*			
	Brick and Wood (Tons)	Concrete and Steel (Tons)	Tree (Tons)	Eligible Tree Volume (Cubic Yards)
Brownsville (City)	1,078,099	7,295	0	0
BPUB Constituents	2,474,777	16,957	0	0

Source: Hazus v4.2

**Debris is based upon census tracts where general building stock is located and excludes results for tracts that do not have buildings.*

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on the Environment

The impact of thunderstorm wind events on the environment varies, but researchers are finding that the long-term impacts of more severe events can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2017). For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Tornadoes can tear apart habitats causing fragmentation across ecosystems. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies (EPA 2022). Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within the Planning Area.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. Areas targeted for potential future growth and development could be potentially impacted by thunderstorms since the entire Planning Area is exposed to the thunderstorm hazard. However, due to increased standards and codes, new development can be less vulnerable to the thunderstorm hazard compared with the aging building stock in the Planning Area.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the thunderstorm hazard.

Climate Change

Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (UCAR 2017). An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (Climate Central 2019). Overall, the Planning Area will continue to remain vulnerable to the thunderstorm hazard.

Changes in Vulnerability Since the 2015 HMAP

Overall, the Planning Area's vulnerability has not changed, and the entire Planning Area will continue to be exposed and vulnerable to thunderstorm wind events. As existing development and infrastructure continue to age, they can be at increased risk to failed utility and transportation systems if they are not properly maintained and do not adapt to the changing environment.

4.3 Hazard Profiles

4.3.11 Tornado

4.3.11.1 Hazard Profile

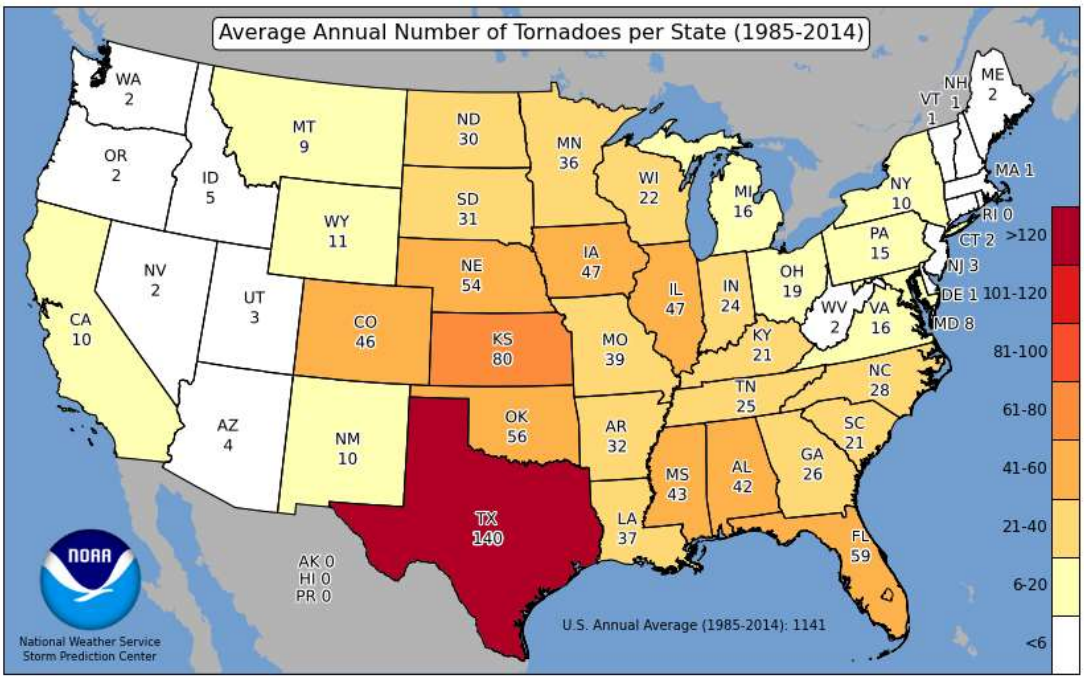
The following section provides the hazard profile and vulnerability assessment for the tornado hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

Hazard Description

A tornado appears as a rotating, funnel-shaped cloud that extends from a thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be greater than 1 mile wide and 50 miles long. Tornadoes typically develop from either a severe thunderstorm or hurricane as cool air rapidly overrides a layer of warm air. Tornadoes typically move at speeds between 30 and 125 mph and can generate combined wind speeds (forward motion and speed of the whirling winds) exceeding 300 mph. Most tornadoes are on the ground for less than 15 minutes (NWS n.d.). Tornadoes can occur at any time of the year, with peak season for Texas from May into early June (NOAA n.d.).

An average of 1,141 tornadoes occur in the United States each year, based on tornadoes recorded between 1985 and 2014. The State of Texas averages 140 tornadoes each year (Center for Climate and Energy Solutions n.d.).

Figure 4.3.11-1 Average Annual Number of Tornadoes, 1985 to 2014

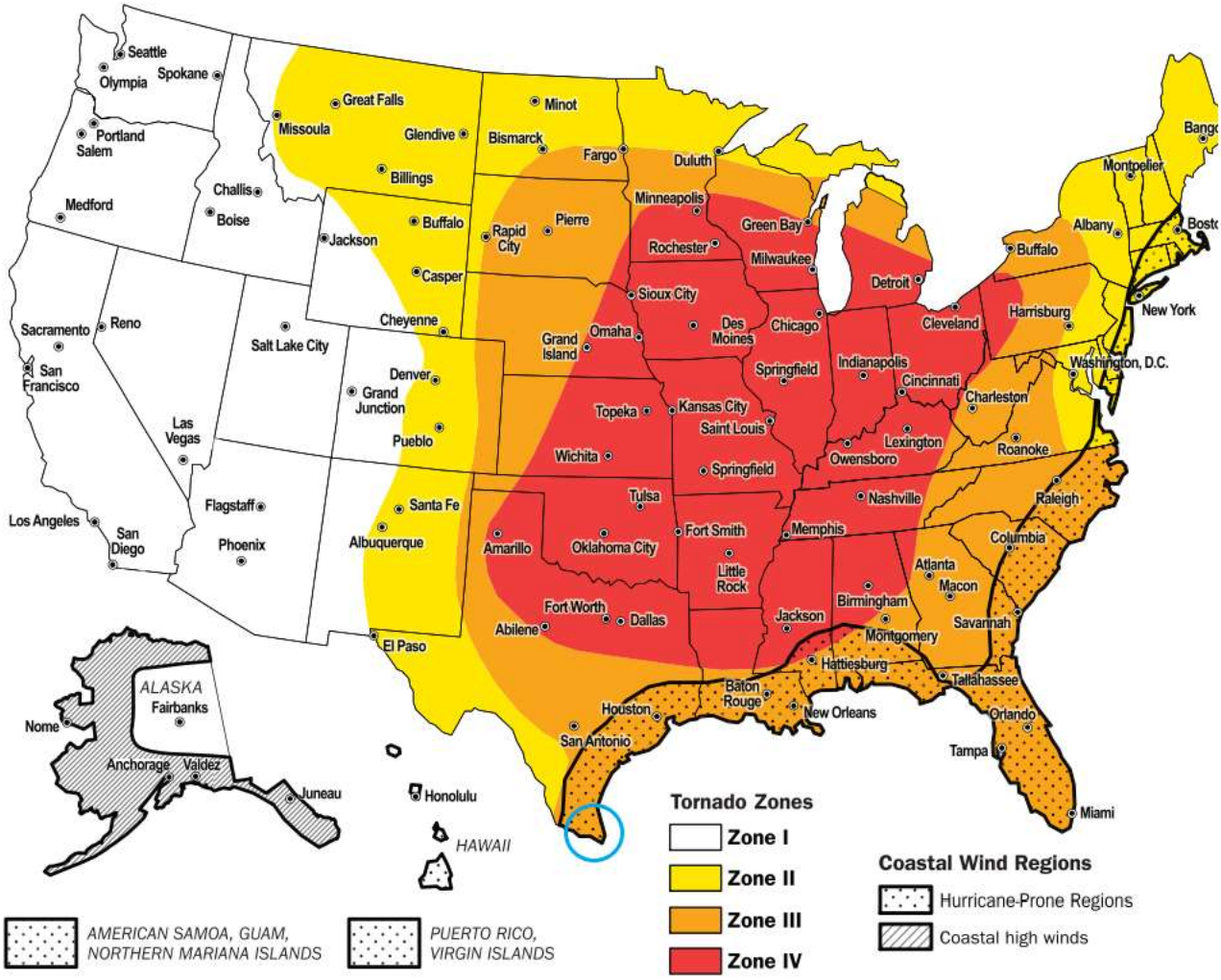


Source: SPC 2021

Location

Similar to that of thunderstorms, tornadoes do not have any specific geographic boundary and can occur anywhere in the Planning Area. According to the FEMA Winds Zones of the United States map, the Planning Area is located in Wind Zone III, where wind speeds can reach up to 200 mph. Additionally, the Planning Area is located in the hurricane-susceptible region. Figure 4.3.11-2 illustrates wind zones across the United States, which indicate the impacts of the strength and frequency of wind activity per region. The information on the figure is based on 70 years of tornado data and 160 years of hurricane data collected by FEMA (FEMA 2021).

Figure 4.3.11-2 Wind Zones in the United States



Source: FEMA 2021
Note: The blue circle indicates the approximate location of the Planning Area.

Extent

Damage from tornadoes can vary from minor damage that break tree limbs to massive damage demolishing homes in its path. The type of damage depends on the intensity, size, and duration of the tornado. The magnitude

or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. Figure 4.3.11-3 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. The Planning Area can experience tornadoes ranking from EF0 to EF4 (FEMA 2021).

Figure 4.3.11-3 Explanation of EF-Scale Ratings

EF Rating	Wind Speeds	Expected Damage	
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.	
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.	
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.	
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.	
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.	
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.	

Source: (NWS n.d.)

The NWS issues tornado watches and warnings. A tornado watch is issued by the SPC in Norman, Oklahoma. They are issued when conditions are favorable for the development of tornadoes in and close to the watch area. Their size can vary depending on the weather situation. Watches are typically issued for a duration of four to eight hours. A tornado warning is issued by the local NWS office and will include where the tornado was located and what municipalities will be in its path. It is issued when a tornado is indicated by a radar or spotters. Warnings are issued for a duration of 30 minutes (NWS 2020). The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly, that little, if any, advance warning is possible (NOAA 2011).

Worst-Case Scenario

A worst-case scenario would be an EF4 tornado crossing through the Planning Area with 3-second wind gusts ranging from 166 to 200 mph, causing extreme damage. A tornado of this magnitude would level well-constructed homes, throw cars considerable distances, and collapse top-story exterior walls of masonry buildings. This could lead to downed utility poles, street signals, and debris on roadways, disrupting normal operations and impacting emergency response times. Critical and essential facilities could also be impacts, resulting in periods of service disruption to residents due to facility damages or lack of back-up power.

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with tornadoes events in the Planning Area. According to NOAA-NCEI Storm Events Database, Cameron County has been impacted by 28 tornado events that caused $385,000 in property damage and $2,000 in crop damage. Of the 28 tornadoes, three included losses in the Planning Area (Table 4.3.11-1).

Table 4.3.11-1 Tornado Events in Cameron County, 1996-2021

Hazard Type	Number of Occurrences Between 1996 and 2019	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Funnel Cloud	3	0	0	$0	$0
Tornado	22	0	0	$385,500	$2,000
TOTAL	25	0	0	$385,500	$2,000

Source: NOAA-NCEI 2021

Between 1953 and 2021, the State of Texas was included in 15 tornado-related FEMA major disaster (DR) or emergency (EM) declarations. Of those declarations, Cameron County was included in three declarations. Table 4.3.11-2 lists FEMA declarations for the Planning Area.

Table 4.3.11-2. Tornado-Related FEMA Declarations for the Planning Area, 1953 to 2021

FEMA Declaration Number	Date(s) of Event	Incident Type	Incident Title
DR-4245	October 22-31, 2015	Severe Storms	Severe Storms, Tornadoes, Straight-Line Winds and Flooding
DR-1439	October 24-November 15, 2002	Severe Storms	Severe Storms, Tornadoes, and Flooding
DR-900	April 5-6, 1991	Severe Storms	Severe Storms, Tornadoes, and Flooding

Source: FEMA 2021

The events listed in Table 4.3.11-1 represent only those that were reported to NOAA-NCEI and the Storm Prediction Center and may not represent all tornado events that have occurred since 1996.

Table 4.3.11-3 Tornado Events in the Planning Area, 1996 to 2021

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages*	Event Details**
October 1, 2021	Funnel Cloud	N/A	N/A	0	0	$0	Tropical funnel cloud near Exit 23A on I-69E in Harlingen.
July 26, 2020	Tornado (EF0)	N/A	N/A	0	0	$250,000	Tornado activity coinciding with Hurricane Hanna. Extensive damage at Brownsville Airport. As the tornado moved to the north northwest, several large tree limbs were snapped and a tree was uprooted. Further north, two homes lost large sections of their roofs with most walls still standing. The brief tornado then lifted with no other tornado damage found. Based on the survey and quality of construction materials surveyed, the tornado was rated EF0 with peak winds of 75 mph.
June 30, 2020	Funnel Cloud	N/A	N/A	0	0	$0	Funnel cloud northeast of Rio Hondo or southwest of Arroyo City
July 26, 2019	Tornado (EF0)	N/A	N/A	0	0	$500	On South Padre Island a waterspout displaced beach umbrellas and tents, with minimal damage.
July 7, 2017	Tornado (EF0)	N/A	N/A	0	0	$0	The combination of outflow boundaries from thunderstorms and a weak sea breeze resulted in the formation of a weak landspout near the Port of Brownsville.
May 11, 2012	Tornado (EF0)	N/A	N/A	0	0	$15,000	A mini-supercell thunderstorms dropped a very brief tornado, containing estimated 80 mph winds (high end EF0 on the Fujita Scale) on top of a single family home, causing considerable damage to property at the well-built structure.
April 20, 2012	Tornado (EF0)	N/A	N/A	0	0	$0	Cameron County emergency manager reported a funnel and touchdown southwest of Highway 77 in Harlingen. Resident reported split tree blown across road and debris in backyard.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages*	Event Details**
August 12, 2010	Tornado (EF0)	N/A	N/A	0	0	$0	Relatively long lived landspout tornado, southwest of Port Isabel in the sand flats. No damage was reported from the tornado.
June 30, 2010	Tornado (EF0)	N/A	N/A	0	0	$14,000	The tornado appeared to begin between Old Military Highway and Mary Lee Court, lifting a few old shingles before knocking down several large limbs. Several trees and a fence were blown down and a trailer was tipped over.
May 18, 2010	Tornado (EF0)	N/A	N/A	0	0	$0	A waterspout briefly moved onshore near Port Isabel.
November 7, 2008	Tornado (EF0)	N/A	N/A	0	0	$1,000	A few medium to large limbs were blown down, as well as turned up aluminum facia on two older, trailer-style mobile homes.
July 23, 2008	Tornado (EF0)	N/A	N/A	0	0	$0	A brief rope tornado was reported by trained Skywarn spotters near the intersection of State Highway 100 and Federal Highway 77.
August 31, 2005	Tornado (F0)	N/A	N/A	0	0	$0	Two short-lived tornadoes touched down in the county.
August 31, 2005	Funnel Cloud	N/A	N/A	0	0	$0	Funnel cloud spotted.
July 20, 2005	Tornado (F0)	N/A	N/A	0	0	$30,000	A mobile home was destroyed by the short-lived tornado.
May 29, 2002	Tornado (F0)	N/A	N/A	0	0	$10,000	Fire and Rescue reported a brief tornado with roof damage east of Rio Hondo
September 9, 2001	Tornado (F0)	N/A	N/A	0	0	$0	Several weak landspout-type tornadoes formed along the leading of a stationary front. The tornadoes were weak, small, and short-lived, with none lasting more than five minutes.
May 31, 2001	Tornado (F0)	N/A	N/A	0	0	$0	An airplane pilot and an emergency technician both sighted a tornado between San Benito and Rancho Viejo.
May 2, 2000	Tornado (F0)	N/A	N/A	0	0	N/A	An F0 tornado touched down briefly on a farmer's home at the intersection of FM2925 and Jaurez

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Fatalities	Injuries	Property and Crop Damages*	Event Details**
							Road. Moderate damage to the property's roof and back fence occurred.
April 26, 1999	Tornado (F0)	N/A	N/A	0	0	$2,000 (crop)	A tornado touched down west southwest of Santa Monica in Willacy County damaging out buildings. The tornado moved south southwest into Cameron County through sorghum and cotton fields before lifting 5.6 miles east northeast of Combes.
November 4, 1998	Tornado (F0)	N/A	N/A	0	0	$20,000	Tornado destroyed mobile home and pump house, and damaged power lines, trees, and a barn.
April 4, 1997	Tornado (F1)	N/A	N/A	0	0	$45,000	Off duty commercial pilot reported tornado on ground with a magnitude F1.
December 31, 1996	Tornado (F0)	N/A	N/A	0	0	$0	F0 tornado spotted in Harlingen
August 23, 1996	Tornado (F0)	N/A	N/A	0	0	$0	F0 tornado spotted in La Feria
August 23, 1996	Tornado (F0)	N/A	N/A	0	0	$0	F0 tornado spotted in Olmito

Source(s):FEMA 2021; NOAA-NCEI 2021; BPUB HMAP 2015

** All damages were property damages, except where noted.*

*** Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table*

Climate Change Projections

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). An increase in storms will produce more wind events and may increase tornado activity. However, the link between tornadoes and climate change is currently unclear (Center for Climate and Energy Solutions n.d.).

Probability of Future Occurrences

Table 4.3.11-4 summarizes data regarding the probability of occurrences of tornado events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based on the 2015 BPUB HMAP, the NOAA-NCEI Storm Events Database, and FEMA.

Table 4.3.11-4 Probability of Future Occurrence of Tornado Events

Hazard Type	Number of Occurrences Between 1996 and 2021	% chance of occurrence in any given year
Funnel Cloud	3	11.54
Tornado (all magnitudes)	22	84.62
TOTAL	**25**	**96.15**

Source: NOAA-NCEI 2022; FEMA 2021; BPUB HMAP 2015

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected flood events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

The Planning Area is expected to continue experiencing the direct and indirect impacts of tornadoes each year. The Planning Area experienced 25 tornado incidents in 24 years, giving the Planning a 96% chance of being impacted by a tornado of any magnitude in any given year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for tornado in the Planning Area is considered 'occasional'.

4.3.11.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the tornado hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a thunderstorm event. The following text evaluates and estimates the potential impact of the tornado hazard in the Planning Area.

Impact on Life, Health and Safety

Impacts of a tornado on life, health, and safety depend on several factors, including severity of the event and whether adequate warning time was provided to residents. All residents in the Planning Area are exposed to the tornado hazard.

Residents impacted by tornadoes may be displaced or require temporary to long-term sheltering. In addition, downed trees, damaged buildings, and debris carried by winds associated with tornadoes can lead to injury or loss of life. Similar to other natural hazards, socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and locations and construction quality of their housing. Economically disadvantaged populations are more vulnerable because they are likely to evaluate their risk and make decisions based on the major economic impact on their family and may not have funds to evacuate. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. The elderly are considered most vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention that may not be available due to isolation during a storm event. Section 3 (Community Profile) presents the statistical information regarding these populations in the Planning Area.

Impact on General Building Stock

The entire Planning Area's building stock is exposed to the tornado hazard. Damage to buildings depends on several factors, including wind speed, storm duration, path of the storm track or tornado, and distance from the tornado funnel.

Manufactured housing (i.e. mobiles homes) is particularly vulnerable to high winds and tornadoes. The U.S. Census Bureau defines manufactured homes as "movable dwellings, 8 feet or wider and 40 feet or more long, design to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without need of a permanent foundation (U. S. Census 2020)." They can include multi-wides and expandable manufactured homes but exclude travel trailers, motor homes, and modular housing. Due to their light-weight and often unanchored design, manufactured housing is extremely vulnerable to high winds and will generally sustain the most damage.

Impact on Critical Facilities

Utility infrastructure could suffer damage from tornadoes associated with falling tree limbs or other debris, resulting in the loss of power or other utility service. Loss of service can impact residents, critical facilities, and business operations alike. Interruptions in heating or cooling utilities can affect populations, such the young and elderly, who are particularly vulnerable to temperature-related health impacts. Loss of power can impact other public utilities, including potable water, wastewater treatment, and communications. In addition to public water services, property owners with private wells might not have access to potable water until power is restored. Lack of power to emergency facilities, including police, fire, EMS, and hospitals, will inhibit a community's ability to effective respond to an event and maintain the safety of its citizens.

Impact on Economy

Tornados also impact the economy, including loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, and wage loss and rental loss due to repair/replacement of buildings. Impacts on transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical

systems) could sustain damage, and impacts could result in loss of power, which can affect business operations and provision of heating or cooling to the population.

Future Changes that May Impact Vulnerability

Understanding future changes that effect vulnerability in the Planning Area can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the tornado hazard because the entire Planning Area is exposed and vulnerable. Residential development, specifically manufactured homes, may be considered more vulnerable to the tornado hazard.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the tornado hazard.

Climate Change

The climate of Texas is changing. Most of the State has warmed between one half and one degree Fahrenheit in the past century. In the eastern two-thirds of the State, average annual rainfall is increasing; however, the soil is becoming drier. Rainstorms are more intense and floods are becoming more severe. In the coming decades, storms are likely to become more severe in Texas (EPA 2016). An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (Climate Central 2018). With an increased likelihood of strong winds and tornado events, all of the Planning Area's assets will experience additional risk for losses as a result of extreme wind events.

Changes in Vulnerability Since the 2015 HMAP

The County's population increased since the last plan; increasing the number of people vulnerable during a tornado. Therefore, the entire Planning Area remains vulnerable to tornado events.

4.3 Hazard Profiles

4.3.12 Wildfire

4.3.12.1 Hazard Profile

The following section provides the hazard profile and vulnerability assessment for the wildfire hazard for the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

Hazard Description

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

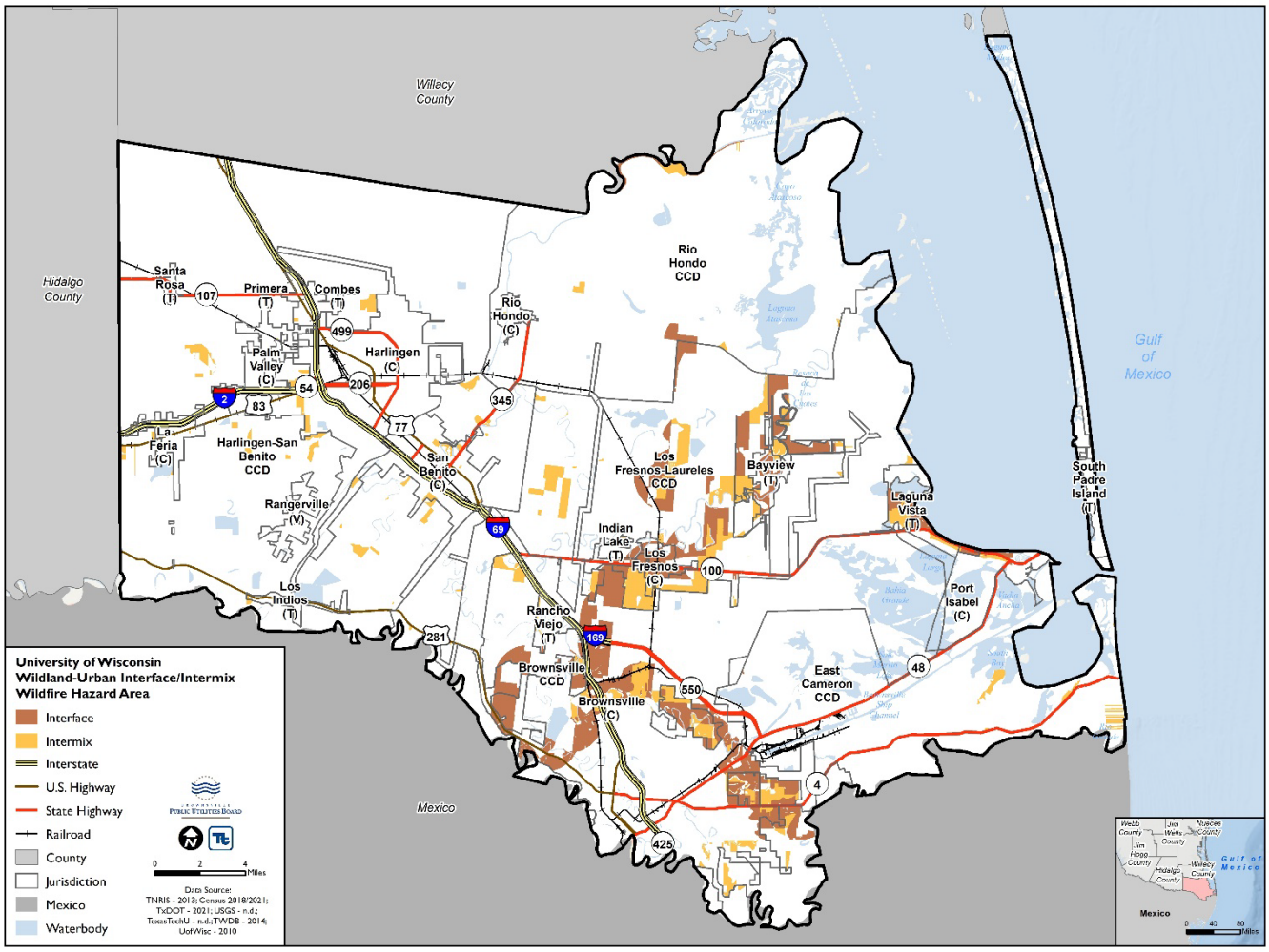
Wildfires can start as slow burning along the forest floor, killing and damaging trees. They often spread more rapidly as they reach the tops of trees, with wind carrying the flames from tree to tree. Usually, dense smoke is the first indication of a fire.

Texas has seen a significant increase in the number of wildfires in the past 35 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 (Brownsville Public Utilities Board 2015).

Location

Wildfires can be a potentially damaging outgrowth of drought. While they are not confined to any specific geographic location, and can vary greatly in terms of size, location, intensity and duration; they are most likely to occur in open grasslands. The threat to people and property is greater in the fringe areas where developed areas meet open grass lands. Figure 4.3.12-1 displays the Wildland Urban Interface/Intermix areas of the Planning Area. It is estimated that 16% of the total population in the Planning Area live within the Wildland Urban Interface and 4.3% of the total population live within the Wildland Urban Intermix areas.

Figure 4.3.12-1 Wildland-Urban Interface/Intermix Wildfire Hazard Area in the Planning Area

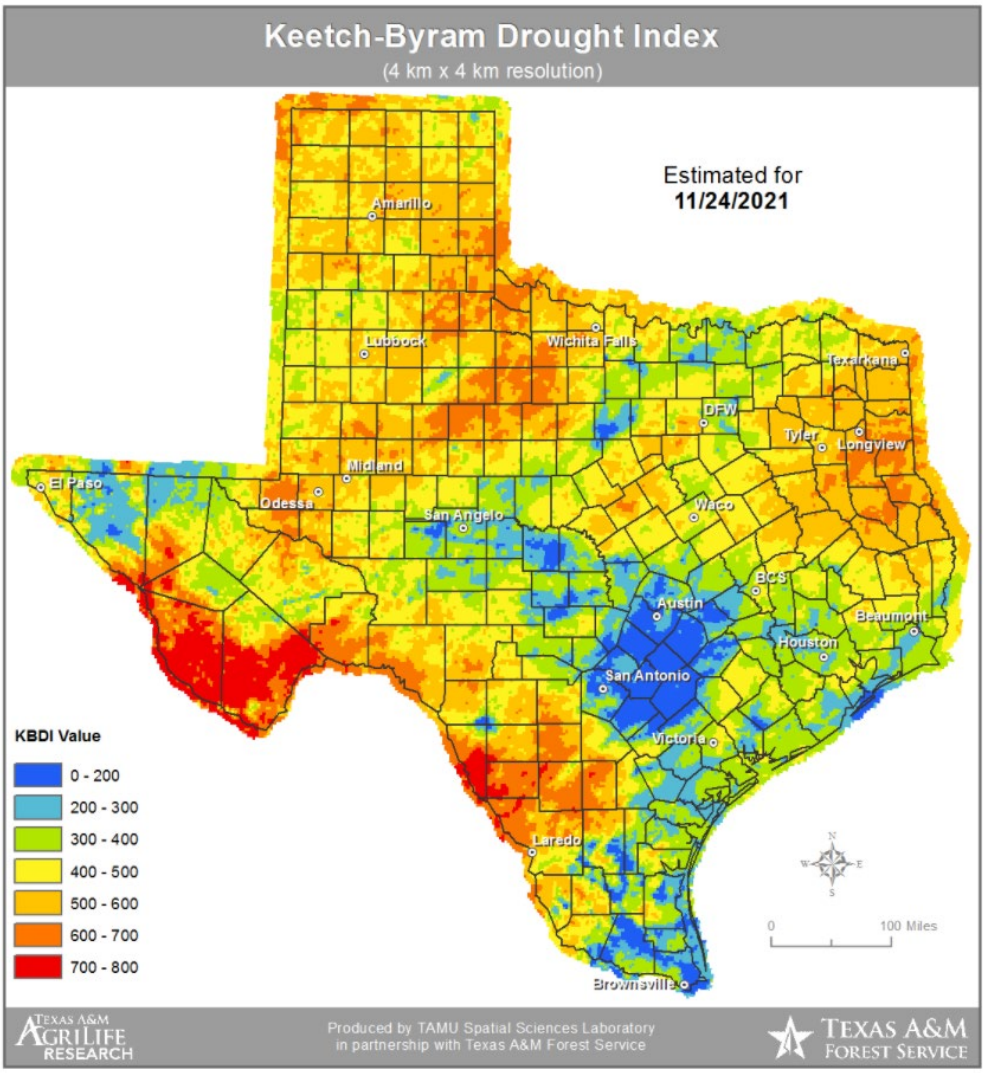


Extent

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

Each color on the map represents the drought index at that location. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible (NOAA NIDIS n.d.).

Figure 4.3.12-2 Keetch-Byram Drought Index for the State of Texas, November 24, 2021



Source: (Texas Weather Connection 2021)

Fire behavior can be categorized at four distinct levels:

- 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 still 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.

Using the KBDI index is a good measure of the readiness of fuels for wildland fire. Caution should be exercised in dryer, hotter conditions, and the KBDI should be referenced as the area experiences changes in precipitation and soil moisture.

The wildfire extent varies throughout the year for the Planning Area, based on the factors in the KBDI index. During wet, cooler weather in the winter months, the Planning Area has a minimum index level of 105, while the level during hot, dry summer months can be near the top of the index at 699. The average annual index for the Planning Area is 375, which represents a low to moderate wildfire hazard (Texas Weather Connection 2022).

Worst-Case Scenario

A worst-case scenario would involve a wildfire during a high wind event, preceded by prolonged elevated temperatures and drought. This type of event would have both a short- and long-term effects on the Planning Area. The fire could burn structures and infrastructure creating power and communication outages. Parts of the Planning area could experience limited ingress and egress as transportation corridors are blocked by fire. Air quality would be affected and could pose serious risks for the elderly and those with compromised respiratory systems.

Previous Occurrences

Between 1988 and 2021, Texas had 250 FEMA disaster declarations for wildfire, however Cameron County was not included in any of those declarations. Likewise, between 1950 and 2021, the NCEI Storm Events Database did not include any wildfire events for the Planning Area. For this HMAP update, there was limited information regarding wildfire events in the Planning Area.

Climate Change Projections

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation.

Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Probability of Future Occurrences

Due to the lack of data on past wildfire events in the Planning Area, the probability of occurrence for wildfire events in the Planning Area is considered zero.

Table 4.3.12-1 Probability of Future Occurrence of Wildfire Events

Hazard Type	Number of Occurrences between 1950 and 2021	% chance of occurrence in any given year
Wildfire	0	0%

In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for wildfire in the Planning Area is considered 'rare'.

4.3.12.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the wildfire hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a wildfire event. The following text evaluates and estimates the potential impact of the wildfire hazard in the Planning Area.

Impact on Life, Health and Safety

All people exposed to the wildfire hazard are potentially vulnerable to wildfire impacts. Smoke and air pollution from wildfires can be a severe health hazard, especially for sensitive populations, including children, the elderly and those with respiratory and cardiovascular diseases. In addition, wildfire may threaten the health and safety of those fighting the fires. First responders are exposed to dangers from the initial incident and after-effects from smoke inhalation and heat stroke. Persons with access and functional needs, the elderly and very young may be especially vulnerable to a wildfire if there is not adequate warning time before evacuation is needed. However, due to the humid climate of the Planning Area, the number of previous occurrences and the potential property at risk, the impact of an event would be minor with few injuries. Roughly 20% of Cameron County's population that is located within the wildfire hazard area (Table 4.3.12-2).

Table 4.3.12-2. Estimated Population Located Within the WUI

Jurisdiction	Total Population (American Community Survey 2015-2019)	Estimated Population Located Within the Wildland-Urban Interface/Intermix (WUI) Wildfire Hazard Areas			
		Number of People in the WUI Interface Wildfire Hazard Area	Percent of Total	Number of People in the WUI Intermix Wildfire Hazard Area	Percent of Total
Brownsville (City)	186,738	44,386	23.8%	5,857	3.1%
BPUB Constituents	**421,017**	**67,195**	**16.0%**	**18,190**	**4.3%**

Source: University of Wisconsin 2010, American Community Survey 2019 (5-year estimates 2015-2019)
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on General Building Stock

All property exposed to the wildfire hazard is vulnerable. Structures that were not constructed to standards designed to protect a building from a wildfire may be especially vulnerable. As of 2008, the International Building code requires minimum standards be met for new buildings in fire hazard severity zones. It is unknown how many

buildings in the Planning Area were built to these standards. However, there is only a small percentage of buildings in the Planning Area that are located in the Wildland-Urban Interface/Intermix wildfire fuel hazard area, thus not many are vulnerable to wildfires (Table 4.3.12-3 and Table 4.3.12-4).

Table 4.3.12-3. Building Stock Located within the Wildland-Urban Interface Wildfire Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total
Brownsville (City)	78,873	$55,730,567,029.96	17,325	22.0%	$7,717,649,083	13.8%
BPUB Constituents	**202,224**	**$174,838,504,517.37**	**31,410**	**15.5%**	**$16,235,033,214**	**9.3%**

Source: University of Wisconsin 2010, CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021

Table 4.3.12-4. Building Stock Located within the Wildland-Urban Intermix Wildfire Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Number of Buildings in the WUI Interface Wildfire Hazard Area	Percent of Total	Total Replacement Cost Value of Buildings Located in the WUI Interface Wildfire Hazard Area	Percent of Total
Brownsville (City)	78873	$55,730,567,029.96	2,271	2.9%	$1,130,423,785	2.0%
BPUB Constituents	**202,224**	**$174,838,504,517.37**	**9,804**	**4.8%**	**$7,410,425,996**	**4.2%**

Source: University of Wisconsin 2010, CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021
Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on Critical Facilities

Critical facilities not built to fire protection standards. Utility poles and lines, and facilities containing hazardous materials are most vulnerable to the wildfire hazard. Most roads and railroads would not sustain damage except in the worst scenarios, although roads and bridges can be blocked by debris or other wildfire-related conditions and become impassable. Table 4.3.12-5 indicates the number of critical facilities located in the wildland-urban interface and intermix (WUI) wildfire hazard areas. If a wildfire reached the following critical facilities, their vulnerability could complicate response and recovery efforts during and following an event:

- **Hazardous Materials and Fuel Storage**—During a wildfire event, these materials could rupture due to excessive heat and act as fuel for the fire, causing rapid spreading and escalating the fire to unmanageable levels. In addition, they could leak into surrounding areas, saturating soils and seeping into surface waters, and have a disastrous effect on the environment.
- **Communication Facilities**—If these facilities are damaged and become inoperable, it would exacerbate already difficult communication in the Planning Area.
- **Fire Stations**—If fire stations were compromised during a wildfire event, it would make fire suppression and support services even more challenging.

Table 4.3.12-5. Estimated Critical Facilitates and Lifelines Located within the Wildland-Urban Interface Wildfire Hazard Area

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Wildland-Urban Interface Wildfire Hazard Area	Number of Lifelines Located in the Wildland-Urban Intermix Wildfire Hazard Area
Communications	42	1	0
Energy	81	1	2
Food, Water, Shelter	233	32	9
Health and Medical	0	1	0
Safety and Security	22	8	0
Transportation	111	2	1
BPUB and City of Brownsville (Total)	**11**	**45**	**12**

Sources: Cameron County Planning Partners 2021; HIFLD 2020, University of Wisconsin 2010

Impact on the Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and can involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires.

Impact on the Environment

Fire is a natural and critical ecosystem process in most terrestrial ecosystems, affecting the types, structure, and spatial extent of native vegetation. However, it also can cause severe environmental impacts:

- **Damaged Fisheries**—Critical fisheries can suffer from increased water temperatures, sedimentation, and changes in water quality.
- **Soil Erosion**—The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.
- **Spread of Invasive Plant Species**—Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.
- **Disease and Insect Infestations**—Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.
- **Destroyed Endangered Species Habitat**—Fire can have negative consequences for endangered species.
- **Soil Sterilization**—Some fires burn so hot that they can sterilize the soil. Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost.
- **Reduced Timber Harvesting**—Timber can be destroyed and lead to smaller available timber harvests.
- **Reduced Agricultural Resources**—Wildfire can have disastrous consequences on agricultural resources, removing them from production and necessitating lengthy restoration programs.

- **Damaged Cultural Resources**—Scenic vistas can be damaged, access to recreational areas can be reduced and destruction of cultural resources may occur.

Future Changes that May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The Planning Area considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As a highly urbanized Planning Area, wildfire risk exposure is low. Urbanization tends to alter the natural fire regime, and can create the potential for the expansion of urbanized areas into wildland areas. The expansion of development toward wildfire hazard areas can be managed with strong land use and building codes. The International Building Code includes minimum standards related to the design and construction of buildings in fire hazard zones. The Planning Area is well equipped with these tools and this planning process has assessed capabilities with regards to the tools. As the Planning Area experiences future growth, it is anticipated that the exposure to this hazard will remain as assessed or even decrease over time due to these capabilities.

Projected Changes in Population

The County experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. The increase in population will expose more people to the wildfire hazard.

Climate Change

Climate change has the potential to affect multiple elements of the wildfire system: fire behavior, ignitions, fire management, and vegetation fuels. Hot dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. Changes in climate patterns may impact the distribution and perseverance of insect outbreaks that create dead trees (increase fuel). When climate alters fuel loads and fuel moisture, forest susceptibility to wildfires changes. Climate change also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Change of Vulnerability Since the 2015 HMAP

For this hazard mitigation plan update, the 2010 Wildland-Urban Interface/Intermix data from the University of Wisconsin was referenced to determine areas within the Planning Area that are vulnerable to wildfires. Population statistics have also been updated using the 5-Year 2015-2019 American Community Survey Population Estimates. Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for the Planning Area.

4.3 Hazard Profiles

4.3.13 Winter Storm

4.3.13.1 Hazard Profile

The following section provides the hazard profile and vulnerability assessment for the winter storm hazard in the Planning Area. Due to the extent of the Brownsville Public Utilities Board infrastructure, all of Cameron County was included when developing this hazard profile. Therefore, when referring to the Planning Area, it includes the Brownsville Public Utilities Board service area (throughout Cameron County) and the City of Brownsville.

Hazard Description

Winter storms bring the threat of snow, freezing rain, and ice storms to the planning area. A winter storm is a weather event in which the main types of precipitation are snow, sleet, or freezing rain. They can be a combination of heavy snow, blowing snow, and dangerous wind chills. According to the National Severe Storms Laboratory, the three basic components needed to make a winter storm include the following:

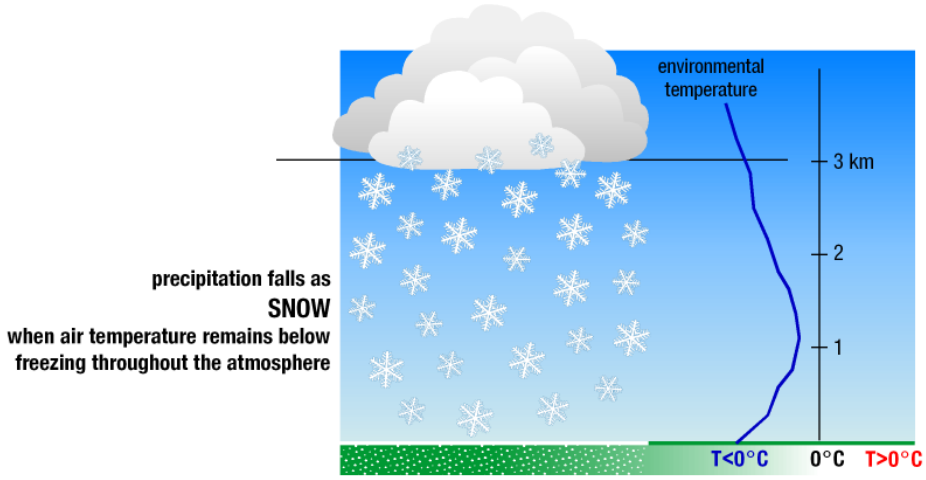
- Below freezing temperatures (cold air) in the clouds and near the ground to make snow and ice.
- Lift, something to raise the moist air to form clouds and cause precipitation, such as warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside (oliographic lifting).
- Moisture to form clouds and precipitation, such as air blowing across a large lake or the ocean.

Some winter storms are large enough to immobilize an entire region while others might only affect a single community. Winter storms typically are accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and blocked roadways, downed utility lines, and power outages. In the Planning Area, winter storms include snowstorms, blizzards, and ice storms. Extreme cold temperatures and wind chills are associated with winter storms.

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 °F) and water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into snow crystals or a snow pellet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Figure 4.3.13-1 depicts snow creation and Figure 4.3.13-2 depicts sleet creation.

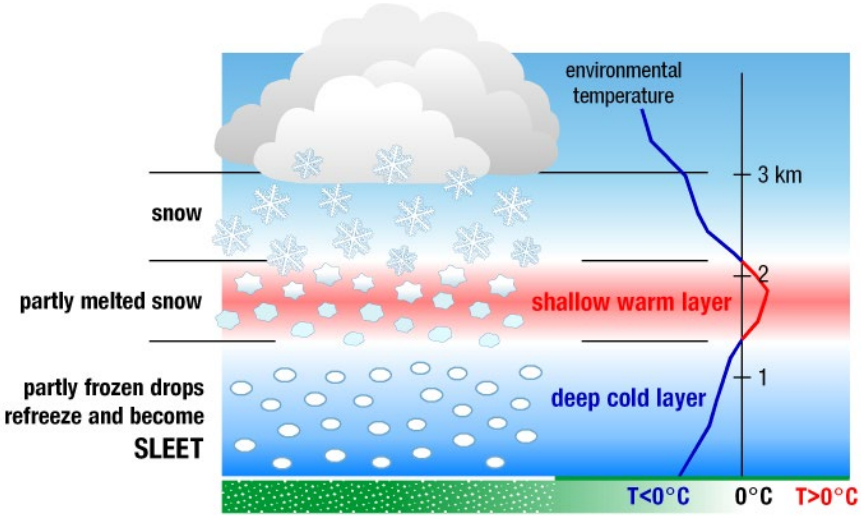
Figure 4.3.13-1 Snow Creation



Source: (NOAA NSSL n.d.)

Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals. Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inches in diameter (NSIDC 2020).

Figure 4.3.13-2 Sleet Creation



Source: (NOAA NSSL n.d.)

Blizzards

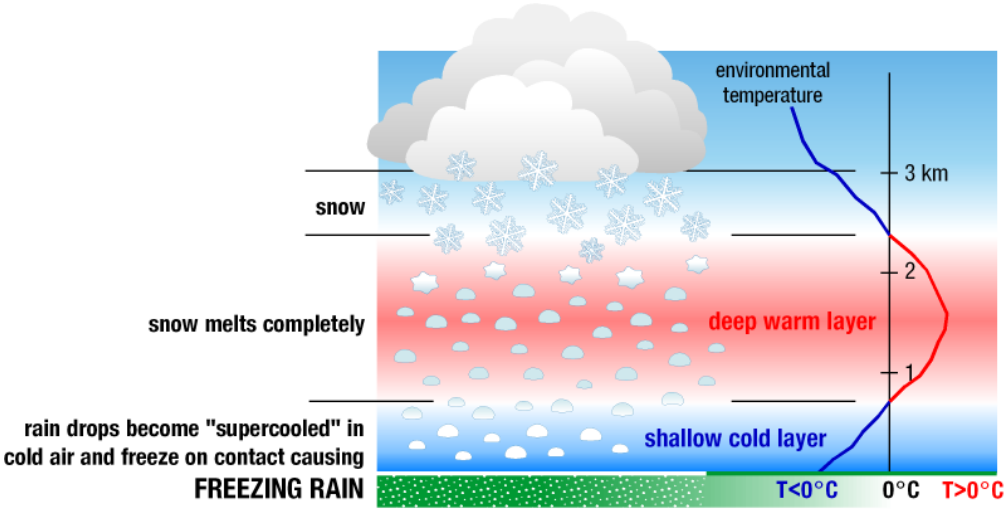
A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile, as the predominant conditions over a 3-hour period. Extremely cold temperatures often are associated with blizzard conditions but are not a

formal part of the definition. The hazard, created by the combination of snow, wind, and low visibility, significantly increases when temperatures are below 20°F. A severe blizzard is categorized as having temperatures near or below 10°F, winds exceeding 45 mph, and visibility reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm, moister air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (NWS n.d.).

Ice Storms

An ice storm describes those events when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations typically are accumulations of 0.25-inches or greater. Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NWS 2018).

Figure 4.3.13-3 Freezing Rain Creation



Source: (NOAA NSSL n.d.)

Location

Winter storms occur on a regional scale and can happen anywhere in the State of Texas; therefore, the entire Planning Area can experience winter storm events.

Extent

The magnitude or severity of a severe winter storm depends on several factors, including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. The National Oceanic and Atmospheric Administration's (NOAA's) National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (currently based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA NCEI n.d.). Table 4.3.13-1 presents the five RSI ranking categories.

Table 4.3.13-1 RSI Ranking Categories for the South Climate Region

Category	Description	RSI Value	Snowfall Thresholds
1	Notable	1–3	<2
2	Significant	3–6	>2
3	Major	6–10	>5
4	Crippling	10–18	>10
5	Extreme	18.0+	>15

Source: (NOAA NCEI n.d.)
Note: RSI = Regional Snowfall Index

The planning area has not experienced a blizzard, or heavy snow. Ice storms can be expected with an accumulation of between 0.1 and 4.0 inches of ice and temperatures between 25 to 50 degrees with winds between 0 and 20 miles per hour during winter weather events.

The NOAA operates a widespread network of observing systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NOAA meteorologists who then write and disseminate forecasts (NOAA 2017).

According to the National Weather Service (part of NOAA), the magnitude of a severe winter storm can be qualified into five main categories by event type:

- Heavy Snowstorm – snowfall accumulating to 4 inches or more in 12 hours or less or snowfall accumulating to six inches or more in 24 hours or less.
- Sleet Storm – Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
- Ice Storm – Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations; significant ice accumulations are usually ¼" or greater.
- Blizzard – sustained winds or frequent gusts of 35 mph or more; considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
- Severe Blizzard – Wind velocity of 45 mph, temperatures of 10°F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

The NWS uses winter weather watches, warnings, and advisories to ensure that people know what to expect in the coming hours and days.

- Watches
  - Blizzard – Conditions are favorable for blizzard conditions to be met in the next 12 to 48 hours.
  - Winter Storm - Issued when sinter storm conditions, defined above, are possible within 24 to 48 hours.
- Warnings
  - Blizzard – Issued when sustained winds or frequent gusts ≥ 35 mph combined with blowing and or falling snow, reducing visibility below 1/4 mile for 3 hours or more, when imminent or expected within the next 36 hours. Temperatures are assumed below 32°F, and snow should accumulate at least one inch in 12 hours.
  - Winter Storm - Issued when the following conditions, capable of producing high impact and potentially life threatening conditions, are occurring or expected to occur within the 36 hours: snow - ≥1 inch in 12 hours; sleet - ≥1/2 inch in 12 hours; and or a combination of snow, sleet, ice with snow or sleet meeting warning criteria
  - Ice Storm - Issued when ≥1/8 inch of ice is expected to accrete on trees, power lines, and bridges/overpasses for the entirety of the event. These conditions are capable of producing high impact and potentially life threatening conditions and are either occurring or expected to occur within the next 36 hours.
- Advisories
  - Winter Weather - Issued when the following conditions, capable of producing significant, but not necessarily life threatening, inconveniences, are occurring or expected to occur within the next 36 hours:
    - Snow: 1/2 to 1 inch in 12 hours
    - Sleet: < 1/2 inch in 12 hours
    - Ice: < 1/8 inch in 12 hours
    - Combination: Snow, sleet, and ice with snow or sleet meeting advisory criteria.

Worst-Case Scenario

A worst-case severe winter storm scenario would be a storm similar to that of the February 2021 ice storm that brought extreme temperature lows and significant buildup of ice on structures and infrastructure including highway overpasses. A storm like this could lead to downed trees and power lines, power outages, closed roadways, and overall impact to the planning area. This would lead to disruption in emergency services and limited access to essentials (e.g. water, heat).

Previous Occurrences

Many sources have provided historical information regarding previous occurrences and losses associated with severe winter storm events in the Planning Area. According to the NOAA-NCEI storm events database, Cameron County has been impacted by seven winter storm events between 1950 and 2021. Table 4.3.13-2 summarizes these statistics.

Table 4.3.13-2 Severe Winter Storm Events 1950-2021

Hazard Type	Number of Occurrences Between 1950 and 2021	Total Fatalities	Total Injuries	Total Property Damage ($)	Total Crop Damage ($)
Blizzard	0	0	0	$0	$0
Heavy Snow	0	0	0	$0	$0
Ice Storm	3	0	0	$15,000	$0
Sleet	0	0	0	$0	$0
Winter Storm	0	0	0	0	0
Winter Weather	4	0	0	$50,000	$0
Total	**7**	**0**	**0**	**$65,000**	**$0**

Source: NOAA-NCEI 2022, FEMA 2021
Note: NOAA-NCEI database includes winter-related events starting in 1996. Events that occurred prior to 1996 are not included in the table.

Between 1953 and November 2021, FEMA included the State of Texas in three winter storm-related major disaster (DR) declarations. Two were classified as severe ice storms; one was classified as a severe storm. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Cameron County was included in one winter storm-related declaration. Table 4.3.13-3 identifies the known winter storm events that impacted the Planning Area between 1950 and November 2021.

Table 4.3.13-3 Severe Winter Storm Events in the Planning Area, 1950 to 2021

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Property Damages	Event Details
February 11-21, 2021	Severe Winter Storms	DR-4586	Yes	N/A	Nights of below-freezing and near-freezing temperatures. At least 0.1 inch of snow.
January 16, 2018	Winter Weather	N/A	N/A	$50,000	High pressure system with northerly winds. Rapid temperature crash and spotty precipitation with freezing drizzle.
December 8, 2017	Winter Weather	N/A	N/A	$0	Cold front brought light rain mixed with sleet and snow before changing to all snow.
January 29, 2014	Ice Storm	N/A	N/A	$0	Widespread freezing temperatures across Cameron County for over six hours.
February 3, 2011	Ice Storm	N/A	N/A	$15,000	Ice buildup of up to 1 ½ inches on exposed surfaces. More than 115 automobile accidents across the region. Rolling power outages.
December 23-24, 2004	Winter Weather and Ice Storm	N/A	N/A	$0	Freezing temperatures and snowfall throughout Cameron County.

Sources: FEMA 2021; NOAA-NCEI 2021; NWS, 2017; TWC, 2021; BPUB HMAP 2015
** Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table*

Climate Change Projections

Changes in climate can affect how much snow falls and influence the timing of the winter snow season. Changes in the amount of snow covering the ground, and changes in how the snow melts in the spring, will affect the water supplies that people use for things like farming and making electricity (NSIDC 2010). With these projections, the Planning Area might not experience an increase in winter storm events, but the lack of snow could impact the water supply.

According to the National Climate Assessment, rising air and water temperatures and changes in precipitation are intensifying droughts, increasing heavy downpours, reducing snowpack, and causing declines in surface water quality, with varying impacts across regions. Future warming will add to the stress on water supplies and adversely impact the availability of water in parts of the United States (USGCRP 2018).

Probability of Future Occurrences

For the 2022 HMAP update, the most up-to-date data was collected to calculate the probability of future occurrence of winter storm events, of all types, for the planning area. Table 4.3.13-4 summarizes data regarding the probability of occurrences of severe winter storm events in the Planning Area based on the historic record. The information used to calculate the probability of occurrences is based solely on NOAA-NCEI storm events database results.

Table 4.3.13-4 Probability of Future Occurrence of Winter Storm Events

Hazard Type	Number of Occurrences Between 1950 and 2021	% chance of occurrence in any given year
Blizzard	0	0%
Heavy Snow	0	0%
Ice Storm	3	4.17%
Sleet	0	0%
Winter Storm	0	0%
Winter Weather	4	5.56%
Total	**7**	**9.72%**

Source: NOAA-NCEI 2022; FEMA 2021
Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected flood events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the number of winter storm events, the Planning Area averages less than one winter storm event each year. A winter storm event has a 9.72% chance of occurring in any given year. In Section 4.4, the identified hazards of concern for the Planning Area were ranked (Table 4.4-3). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for severe winter storm in the Planning Area is considered 'rare'.

4.3.13.2 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The entirety of the Planning Area is exposed and vulnerable to the severe winter storm hazard; therefore, all assets within the Planning Area (population, structures, critical facilities, and lifelines), as described in Section 3 (Community Profile), are potentially vulnerable to a winter storm event. The following text evaluates and estimates the potential impact of the severe winter storm hazard in the Planning Area.

Impact on Life, Health and Safety

For the purposes of this HMAP, the entire population of the Planning Area (421,017) is exposed to winter storm events (U.S. Census 2015-2019 ACS 5-Year Population Estimate). The homeless and elderly are considered most susceptible to this hazard; the homeless due to their lack of shelter and the elderly due to their increased risk of injuries and death from falls and overexertion or hypothermia from attempts to clear snow and ice.

According to the 2019 ACS 5-Year Population Estimate, 13.5 percent of the population in the Planning Area is 65 and over. Winter storm events can reduce the ability of these populations to access emergency services.

Winter storms can immobilize a region and paralyze a city. Additional impacts include stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns (NOAA NSSL n.d.).

Impact on General Building Stock

The entire general building stock inventory in the Planning Area is exposed and potentially vulnerable to the severe winter storm hazard; however, properties in poor condition or in particularly vulnerable locations may be at risk to the most damage. In general, structural impacts include damage to roofs and building frames rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, the percent damage to structures that could result from severe winter storm conditions is considered. This allows planners and emergency managers to select a range of potential economic impact based on an estimate of the percent of damage to the general building stock. **Error! Reference source not found.** summarizes the estimated loss to structures. Given professional knowledge and the currently available information, the potential loss for this hazard is considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place). Therefore, the table's data should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Table 4.3.13-5. General Building Stock Exposure and Estimated Losses from Severe Winter Storm Events

Jurisdiction	Total Replacement Cost Value (RCV)	1-Percent Exposure/Loss	5-Percent Exposure/Loss	10-Percent Exposure/Loss
Brownsville (City)	$55,730,567,029.96	$557,305,670	$2,786,528,351	$5,573,056,703
BPUB Constituents	$174,838,504,517.37	$1,748,385,045	$8,741,925,226	$17,483,850,452

Source: Hazus 4.2, CameronCAD 2021; BPUB 2021; Microsoft Bing 2018; RS Means 2021

Note: The total for BPUB Constituents represents all jurisdictions served by the Brownsville Public Utilities Board services.

Impact on Critical Facilities

Full functionality of critical facilities, such as police, fire, and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles, utility lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice can cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they freeze before other surfaces (NSSL 2006). Winter weather events, such as ice storms, can lead to power outages. Therefore, it is recommended that critical facilities install backup power sources.

Infrastructure at risk for this hazard includes roadways that could be damaged due to salt application and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair might be required.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Impacts on the economy also include commuter difficulties into or out of the area for work or school. The loss of power and closure of roads prevent commuters within the Planning Area.

Future Changes that May Impact Vulnerability

Understanding future changes that impact vulnerability in the Planning Area can assist in planning for future development and ensure that appropriate mitigation, planning, and preparedness measures are in place. The Planning Area considered the following factors to examine potential conditions that can affect hazard vulnerability:

- Potential or projected development.
- Projected changes in population.
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire Planning Area is exposed and vulnerable. The ability of new development to withstand severe winter storm impacts lies in sound land use practices and consistent enforcement of codes and regulations for new construction.

Projected Changes in Population

The County has experienced an increase in population between the 2010 Census (406,220) and the estimated 2015-2019 American Community Survey estimated population of 421,017. The population of the Planning Area is expected to increase over the next few years. With an increase in population, more people will be exposed to

winter storm events. Additionally, the age of the population, changes in their geography, and how climate change could alter the winter weather received (rain versus snow) will be important to continue to assess future changes in vulnerability.

Climate Change

Climate is defined not just as average temperature and precipitation, but also by type, frequency, and intensity of weather events. Both globally and at the local level, climate change can potentially alter prevalence and severity of weather extremes, such as winter storms. While predicting changes in winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (EPA 2022). Based on the projections, the Planning Area can expect to experience more rain than snow during the winter months. In the immediate future, the Planning Area can anticipate continuing to experience the impacts of winter storm events.

Change of Vulnerability Since 2015 HMAP

The Planning Area's population increased since the last plan; increasing the number of people impacted during a winter storm event. Therefore, the entire Planning Area remains vulnerable to severe winter storm events. Furthermore, the 2015 HMAP did not include a quantitative analysis of impacts on building stock, considering it negligible. While winter storms are a rare occurrence, they can occur and cause impacts.

4.4 Hazard Ranking

A comprehensive range of hazards that pose a significant risk to the Planning Area were selected and considered during the development of this plan; see Section 4.2 (Identification of Hazards of Concern). However, each jurisdiction has differing levels of exposure and vulnerability to each of these hazards. It is important for each jurisdiction participating in this plan to recognize those hazards that pose the greatest risk to their jurisdiction and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for BPUB and the City of Brownsville can be found in their jurisdictional annexes in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

To this end, a hazard risk ranking process was conducted for each jurisdiction using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property and economy), adaptive capacity, and changing future conditions (i.e., climate change). Each was assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories are described below.

4.4.1 Hazard Ranking Methodology

Estimates of hazard risk for the Planning Area were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, generated by FEMA's Hazus risk assessment tool, and input from BPUB and the City of Brownsville.

As described in Section 4.2 (Methodology and Tools), three different levels of analysis were used to estimate potential impacts: 1) historic loss/qualitative analysis; 2) exposure analysis; and 3) loss estimation. All three levels of analysis are suitable for planning purposes; however, with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts. Impacts from any hazard event within the Planning Area will vary from the analysis presented here based on the factors described for each hazard of concern; namely location, extent, warning time, and mitigation measures in place at the time of an event.

The hazard ranking methodology for some hazards of concern is based on a scenario event, while others are based on their potential risk to the Planning Area as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgement and subject-matter input; assumptions are included, as appropriate, in the following subsections. The limitations of this analysis are recognized given the scenarios do not have the same likelihood of occurrence; nonetheless, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk. The following categories were considered when evaluating the relative risk of the hazards of concern.

- **Probability of Occurrence** - The probability of occurrence of the scenario evaluated was estimated by examining the historic record and/or calculating the likelihood of annual occurrence. When no scenario

was assessed, an examination of the historic record and judgement was used to estimate the probability of occurrence of an event that will impact the Planning Area.

- **Impact**—The following three hazard impact subcategories were considered: impact to people; impact to buildings; and impact to the economy. The results of the updated risk assessment and/or professional judgement were used to assign the numeric values for these three impact subcategories. A factor was applied to each subcategory, giving impact on population the greatest weight.
    - Population—Numeric value x 3
    - Buildings—Numeric value x 2
    - Economy—Numeric value x 1
- **Adaptive Capacity -** Adaptive capacity describes a jurisdiction's current ability to protect from or withstand a hazard event. This includes capabilities and capacity in the following areas: administrative, technical, planning/regulatory and financial. Mitigation measures already in place increases a jurisdiction's capacity to withstand and rebound from events (e.g. codes/ordinances with higher standards to withstand hazards due to design or location; deployable resources; or plans and procedures in place to respond to an event). In other words, assigning 'weak' for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability; whereas 'strong' adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability. These ratings were assigned using the results of the core capability assessment with subject-matter input from each jurisdiction.
- **Climate Change (Changing Future Conditions)** - Current climate change projections were considered as part of the hazard ranking to ensure the potential for an increase in severity/frequency of the hazard was included. This was important to the Planning Area to include because the hazard ranking helps guide and prioritize the mitigation strategy development, which should have a long-term future vision to mitigate the hazards of concern. The potential impacts climate change may have on each hazard of concern is discussed in Sections 4.3.1 through 4.3.17. The benchmark values in the methodology are similar to confidence levels outlined in the National Climate Assessment 2018.

Hazard Ranking Equation

[Probability of Occurrence x 0.3] + [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x 0.3] + [Adaptive Capacity x 0.3] + [Climate Change x 0.1]

Table 4.4-1 summarizes the categories, benchmark values, and weights used to calculate the risk factor for each hazard. Using the weighting applied, the highest possible risk factor value is 6.9. The higher the number, the greater the relative risk. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows: Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9.

Table 4.4-1. Summary of Hazard Ranking Approach

Category	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence	Unlikely	A hazard event is not likely to occur or is unlikely to occur with less than a 1% annual chance probability.	0	30%
	Rare	Between 1 and 10% annual probability of a hazard event occurring.	1	

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		Occasional	Between 10 and 100% annual probability of a hazard event occurring.	2	
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3	
Impact (Sum of all 3)	Population (Numeric Value x 3)	Low	14% or less of your population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	1	30%
		Medium	15% to 29% of your population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	2	
		High	30% or more of your population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14% or less of the total number of structures for your community.	1	
		Medium	Property exposure is 15% to 29% of the total number of structures for your community.	2	
		High	Property exposure is 30% or more of the total number of structures for your community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9% or less of the total replacement cost for your community.	1	
		Medium	Loss estimate is 10% to 19% of the total replacement cost for your community.	2	
		High	Loss estimate is 20% or more of the total replacement cost for your community.	3	
Adaptive Capacity		Weak	Weak/outdated/inconsistent plans, policies, codes/ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	1	30%
		Moderate	Plans, policies, codes/ordinances in place and meet minimum requirements; mitigation strategies identified but not implemented on a widespread scale; county/jurisdiction can recover but needs outside resources; moderate county/Jurisdiction capabilities.	0	
		Strong	Plans, policies, codes/ordinances in place and exceed minimum requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high.	-1	
Climate Change		Low	No local data is available; modeling projections are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change;	3	

Category	Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
		very high confidence level (strong evidence, well documented and acceptable methods).		

Note: A numerical value of zero is assigned if there is no impact.
**For the purposes of this exercise, "impacted" means exposed for population and property and estimated loss for economy. For non-natural hazards, although they may occur anywhere in the Planning Area, an event will not likely cause areawide impacts; therefore, impact to population was scored using an event-specific scenario.*

In an attempt to summarize the confidence level regarding the input utilized to populate the hazard ranking, a gradient of certainty was developed. A certainty factor of high, medium or low was selected and assigned to each hazard to provide a level of transparency and increased understanding of the data utilized to support the resulting ranking. The following scale was used to assign a certainty factor to each hazard:

- High—Defined scenario/event to evaluate; probability calculated; evidenced-based/quantitative assessment to estimate potential impacts through hazard modeling.
- Moderate—Defined scenario/event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis, no hazard modeling) and qualitative data to estimate potential impacts.
- Low—Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; majority of potential impacts are qualitative.

Table 4.4-2 summarizes the hazard scenario or hazard area evaluated; highlights key impacts to population, buildings/critical assets and the economy; and lists the associated certainty factor assigned for each hazard to convey the level of confidence in the data used. This table is not intended to be a complete and comprehensive list of all hazard impacts determined in the risk assessment and considered for the hazard ranking exercise. Refer to Sections 4.3.1 to 4.3.13 for a complete summary of all estimated impacts for each hazard.

Table 4.4-2. Overview of the Hazard Scenario and Associated Estimated Impacts Considered in the Hazard Ranking

Hazard of Concern	Hazard/ Scenario Area Evaluated	Population		Buildings		Economy[a]		Certainty Factor
Dam and Levee Failure	Partial or complete failure of a dam or levee. There are nine dams and four levees in the Planning Area.	Population impacted is dependent on the location and capacity of the dam or levee, the extent of the failure inundation area and the severity of the failure.		The number of buildings impacted is dependent on the capacity of the dam/levee, the extent of the dam/levee failure inundation area, and the severity of the failure.		Economic impacts include dam/levee/building/infrastructure repairs; debris removal/disposal; utility impacts.		Moderate
Disease Outbreak	Disease Outbreak includes: West Nile Virus and Coronavirus.	Population impacted is dependent on the disease and severity of the outbreak; in some cases, immuno-compromised persons are more vulnerable.		Structural impacts due to a pandemic would be limited.		Economic losses can include financial impacts to monitor/address outbreaks; lost wages or commercial interruptions; depends on the severity and type of disease outbreak.		Moderate
Drought	Prolonged drought event - the Planning Area is primarily supplied by surface water and desalinized brackish groundwater.	Entire population exposed. Population on surface water supplies may be impacted first; water restrictions/contamination; increased wildfire risk.		Droughts are not expected to cause direct damage to buildings.		Losses include aesthetic, landscape/nursery/agricultural industry impacts		Moderate
Erosion	Exposure to the Coastal Erosion Hazard Area	Coastal Erosion Hazard Area:	4,756	Coastal Erosion Hazard Area:	2,692	Coastal Erosion Hazard Area:	$2,231,928,774	Moderate
	Exposure to Inland Erosion Hazard Area	Inland Erosion Hazard Area:	10,657	Inland Erosion Hazard Area:	4,919	Inland Erosion Hazard Area:	$5,579,866,628	
Extreme Heat	Extreme hot temperature events	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		Extreme heat events are not expected to cause direct damage to buildings.		Business and commercial losses due to long-term utility outages.		Moderate
Flood	1% annual chance (100-year) and 0.2% annual chance (500-year)	1% annual chance (100-year)	42,606	1% annual chance (100-year)	21,857	1% annual chance (100-year)	$22,777,018,989	Moderate
		0.2% annual chance (500-year)	78,936	0.2% annual chance (500-year)	40,312	0.2% annual chance (500-year)	$38,142,709,351	
Hail	Hail impacts from severe weather events	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		All buildings are exposed; the degree of impact depends on the scale of the incident and condition of structures.		Economic losses can include building/infrastructure damage; power outages; repairs to utility and power lines		Moderate

Hazard of Concern	Hazard/ Scenario Area Evaluated	Population		Buildings		Economy[a]		Certainty Factor
Hurricane and Tropical Storm	Categories 1-4 Storm Surge Hazard Area	Category 1 Storm Surge:	2,378	Category 1 Storm Surge:	1,429	Category 1 Storm Surge:	$1,520,873,059	Moderate
		Category 2 Storm Surge:	7,250	Category 2 Storm Surge:	5,119	Category 2 Storm Surge:	$7,265,799,928	
		Category 3 Storm Surge:	15,549	Category 3 Storm Surge:	10,637	Category 3 Storm Surge:	$13,725,000,601	
		Category 4 Storm Surge:	55,413	Category 4 Storm Surge:	31,621	Category 4 Storm Surge:	$27,969,467,876	
Lightning	Lightning impacts from severe weather events	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		All buildings are exposed; the degree of impact depends on the scale of the incident and condition of structures.		Economic losses can include building/infrastructure damage; power outages; repairs to utility and power lines		Moderate
Thunderstorm Wind	100-Year and 500-MRP events	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		All buildings are exposed; the degree of impact depends on the scale of the incident and condition of structures.		100-Year MRP Estimated Damages	$5,918,899,139	Moderate
						500-Year MRP Estimated Damages	$16,859,469,503	
Tornado	Tornadoes	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		All buildings are exposed; the degree of impact depends on the scale of the incident and condition of structures.		Economic losses can include building/infrastructure damage; power outages; repairs to utility and power lines		Moderate
Wildfire	Wildland-Urban Interface/Intermix (WUI) Wildfire Fuel Hazard Areas	Population residing in the WUI Interface:	67,195	Number of buildings the WUI Interface:	31,410	Replacement cost value of buildings located in the WUI Interface:	$16,235,033,214	Moderate
		Population residing in the WUI Intermix:	18,190	Number of buildings the WUI Intermix:	9,804	Replacement cost value of buildings located in the WUI Intermix:	$7,410,425,996	
Winter Weather	Blizzard, Snow, Ice	All residents/commuters/visitors are exposed; socially-vulnerable populations may be at increased risk.		All buildings are exposed; the degree of impact depends on the scale of the incident and condition of structures.		The cost of snow and ice removal and repair of roads/infrastructure can impact operating budgets.		Moderate

Notes:

a Estimated loss in replacement cost values as available from HAZUS-MH.

b The impacts and vulnerability from a hazardous materials event are greatly dependent on the material and its physical and chemical properties, the quantity released, weather conditions, micro-meteorological effects of buildings and terrain, maintenance/mechanical failures, and distance and related response time for emergency response teams.

All totals for exposure values include the entire Planning Area.

Exposed = This refers to the number of assets located in the hazard area; all of which may not incur losses as a result of the event.

MRP = Mean Return Period

SFHA = Special flood hazard area (1-percent annual chance flood event)

RCV = Replacement cost value based on 2021 RSMeans

4.4.2 Hazard Ranking Results

Using the process described above, the ranking for the identified hazards of concern was determined for the Planning Area (refer to Table 4.4-3). The hazard ranking is detailed in the subsequent tables that present the stepwise process for the ranking. The Planning Area ranking includes the entire planning area and may not reflect the highest risk indicated for any of the participating jurisdictions. The resulting ranks of each jurisdiction indicate the differing degrees of risk exposure and vulnerability. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each municipality. The participating jurisdictions have applied the same methodology to develop the jurisdictional rankings to ensure consistency in the overall ranking of risk; jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard.

This hazard ranking exercise serves four purposes: 1) to describe the probability of occurrence for each hazard; 2) to describe the impact each would have on the people, property, and economy; 3) to evaluate the capabilities a community has with regards to the hazards of concern; and 4) to consider changing future conditions (i.e., climate change) in the Planning Area.

Table 4.4-3. Ranking for Hazards of Concern for the Planning Area

Hazard of Concern	Probability		Impact												
				Population			Property			Economy			Total		
	Category	Numeric Value	Impact	Numeric Value	Weighted Value (x3)	Impact	Numeric Value	Weighted Value (x2)	Impact	Numeric Value	Weighted Value (x1)	Impact Value	Adaptive Capacity	Climate Change
Dam/Levee Failure	Rare	1	Low	1	1 x 3 = 3	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	8	Medium	Medium
Disease Outbreak	Occasional	2	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Medium	2	2 x 1 = 2	13	Medium	Medium
Drought	Occasional	2	Medium	2	2 x 3 = 6	Low	1	1 x 2 = 2	Medium	2	2 x 1 = 2	10	Medium	High
Erosion	Rare	1	Low	1	1 x 3 = 3	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	6	Medium	High
Extreme Heat	Frequent	3	High	3	3 x 3 = 9	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	14	Medium	High
Flood	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	12	Medium	High
Hail	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	12	Medium	Medium
Hurricane/ Tropical Storm	Occasional	2	High	3	3 x 3 = 9	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	15	Medium	High
Lightning	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	11	Medium	Medium
Thunderstorm Wind	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	11	Medium	High
Tornado	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	12	Medium	Medium
Wildfire	Rare	1	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	11	Medium	Medium
Winter Storm	Rare	1	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Medium	Medium

Table 4.4-4 presents the total calculations for each hazard ranking value for the hazards of concern.

Table 4.4-4. Total Hazard Ranking Values for the Hazards of Concern for the Planning Area

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Changing Future Conditions x 10%	Total Hazard Ranking Value
Dam/Levee Failure	0.3	2.4	0	0.2	2.9
Disease Outbreak	0.6	3.9	0	0.2	4.7
Drought	0.6	3	0	0.3	3.9
Erosion	0.3	1.8	0	0.3	2.4
Extreme Heat	0.9	4.2	0	0.3	5.4
Flood	0.6	3.6	0	0.3	4.5
Hail	0.6	3.6	0	0.2	4.4
Hurricane/ Tropical Storm	0.6	4.5	0	0.3	5.4
Lightning	0.6	3.3	0	0.2	4.1
Thunderstorm Wind	0.6	3.3	0	0.3	4.2
Tornado	0.6	3.6	0	0.2	4.4
Wildfire	0.3	3.3	0	0.2	3.8
Winter Storm	0.3	3.6	0	0.2	4.1

Low = Values less than 3.9; Medium = Values between 3.9 and 4.9; High = Values greater than 4.9

These rankings have been used as one of the bases for identifying the jurisdictional hazard mitigation strategies included in Section 9 (Jurisdictional Annexes) of this plan. The summary rankings for the Planning Area reflect the results of the vulnerability analysis for each hazard of concern and vary from the specific results of each jurisdiction. Jurisdictional ranking results are presented in each local annex in Section 9 (Jurisdictional Annexes) of this plan.

SECTION 5. CAPABILITY ASSESSMENT

According to FEMA's Mitigation Planning How-To Guide #3, a capability assessment is an inventory of a community's missions, programs, and policies and an analysis of its capacity to carry them out. Each jurisdiction has a unique set of capabilities available to accomplish mitigation and reduce long-term vulnerable to future hazard events. Capabilities include authorities, policies, programs, staff, and funding. Reviewing existing capabilities helps identify capabilities that currently implement mitigation and leads to loss reductions or that have the potential to be implemented in the future.

This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current federal, state, and local programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation.

During the original planning process, the Brownsville Public Utilities Board (BPUB) and the City of Brownsville identified and assessed their capabilities in the areas of planning and regulatory, administrative, and technical, and fiscal. By completing this assessment, the Hazard Mitigation Planning Team learned how or whether they would be able to implement certain mitigation actions by determining the following:

- Limitations that could exist on undertaking actions.
- The range of local and state administrative, programmatic, regulatory, financial, and technical resources available to assist in implementing their mitigation actions.
- Actions deemed infeasible, as they are currently outside the scope of capabilities.
- Types of mitigation actions that could be technically, legally (regulatory), administratively, politically, or fiscally challenging or infeasible.
- Opportunities to enhance local capabilities to support long term mitigation and risk reduction.

During the 2022 plan update process, the Planning Team was tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities to integrate hazard mitigation into their plans, programs, and day-to-day operations.

Local capabilities in the areas of planning and regulatory, administrative and technical, and fiscal for BPUB and the City may be found in the Capability Assessment section of their jurisdictional annexes in Section 9 (Jurisdictional Annexes).

5.1 Update Process Summary

The purpose of the capability assessment is to understand the planning, regulatory, administrative, technical, and financial capabilities present at BPUB and the City of Brownsville. This assessment helps BPUB and the City identify strengths and opportunities that can be used to reduce losses from hazard events and reduce risks for both entities throughout the Planning Area.

To complete the capability assessment, the contracted consultant met virtually with the team members from the Brownsville Public Utilities Board and in the City of Brownsville to review the capability assessment from the 2015 HMP and update accordingly. In addition to virtual meetings, the consultant reviewed plans and codes/ordinances to enhance the information provided by the BPUB and the City.

A summary of the various federal, state, and county capabilities available to promote and support mitigation and reduce risk in BPUB service area and the City of Brownsville are presented below. Information provided by both participating entities that are specific to them are presented in Volume II, Section 9 (Jurisdictional Annexes) of this plan update.

5.2 Planning and Regulatory Capability

Planning and regulatory capabilities are based on the implementation of ordinances, policies, local laws and state statutes, and plans and programs that relate to guiding and management growth and development. Planning and regulatory capabilities refer not only to the current plans and regulations, but also to the jurisdiction's ability to change and improve those plans and regulations as needed. The following provides the planning and regulatory capabilities for Cameron County that contribute to the daily operations and safety of the City and the service area of BPUB. Refer to Section 9 (Jurisdictional Annexes) for details on the local capabilities for BPUB and the City.

5.2.1 Planning and Regulatory Capabilities – County and Local

The following table summarizes the planning and regulatory capabilities available to the BPUB and the City of Brownsville, at the county level.

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability		Details
Building Code	**Description:**	Cameron County is governed by the Texas Administrative Code § 5.4008 The 2018 International Building Code (IBC) The 2018 International Residential Code (IRC) NFPA. By using the IRC, IBC and NFPA, the highest standards are assured for County construction occurring in local governmental jurisdictions to reduce the risk of hazards and protect both lives and property
	Responsible Agency:	Texas Department of Insurance
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
Cameron County Subdivision Rules and Regulations - Rules, Regulations and Requirements Relating to the Approval and Acceptance of Improvements in Subdivisions. Adopted by Commissioners Court Order# 2005, Revised Date May 10, 2005, last amended, January 5, 2021	**Description:**	All streets within a V or A flood' zone, as identified on the FEMA Flood Insurance Rate Maps, and where the base flood elevation exceeds the natural ground elevation by more than one foot (1') shall be built with Class A paving. If any part of a plat applies to land intended for residential housing and any part of that land lies floodplain, the Commissioners Court shall not approve the plat unless the plat has a restrictive covenant. The restrictive covenant shall prohibit the construction of residential housing in any area of the subdivision that is in a floodplain unless the housing qualifies for insurance under the National Flood Insurance Act of 1968 (42 U.S.C. Sections 4001 through 4127).
	Responsible Agency:	County Engineer
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Stormwater Management Program – Prepared June 2014 Storm Water MS4 Pollution	**Description:**	Cameron County along with surrounding cities in the Lower Rio Grande Valley, Storm Water Group, have a stormwater management plan (SWMP), which includes best management practices developed for the seven minimum control measures. Stormwater Management reduces the risk of pollutants that may have the potential to endanger local residents through inspection and enforcement of the MS4 regulations. The TCEQ established the Phase II MS4 program in 2003 to extend the Phase I program to include all municipalities in urbanized areas. Urbanized areas are defined as land areas with an overall population density of more than 1,000 people per square mile. The top three concerns identified by the Texas Commission on Environmental Quality (TCEQ) in the Lower Rio Grande Subregion are water quantity, water quality, and illegal dumping of municipal solid waste. The Program includes all selected BMP's for each of the minimum control measures, measurable goals for each BMP, the evaluation method, an implementation schedule, and a rationale statement. The document provides a clear road map for implementing stormwater quality management activities to improve runoff quality and to maintain permit compliance.
	Responsible Agency:	Lower Rio Grande Valley, SWG
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Stormwater Management Plan, Cameron County Texas, February 2008	**Description:**	As an identified small municipal separate storm sewer system (small MS4) operator, Cameron County has initiated the development of a storm water management program with the development of the Cameron County Storm Water Management Plan (SWMP). This purpose of this plan is to implement programs and practices to control polluted storm water runoff through the Texas Commission on Environmental Quality's (TCEQ) Texas Pollution Discharge Elimination System (TPDES) permit program, specifically in accordance with the requirements of TPDES General Permit TXR040000. Under the Cameron County's SWMP, BMPs will be implemented by Cameron County in order to achieve the regulatory standard of reducing pollutants to the Maximum Extent Practicable (MEP). Measurable goals and an implementation schedule

Capability		Details
		for the BMPs are identified within this plan. The effectiveness of the selected BMPs and success in achieving the selected measurable goals will be reviewed annually. The Strategy is to develop and implement programs to reduce or eliminate discharges of pollutants and non-storm water discharges of pollutants and non-storm water discharges entering the Cameron County storm drainage system to the maximum extent practicable, thereby protecting local receiving waters and complying with Federal and State laws and regulations.
	Responsible Agency:	Transportation Department Staff Engineer
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Real Estate Disclosure - Texas Property Code Section § 5.008 - Seller's Disclosure of Property Condition	**Description:**	Real Estate Disclosure ensures that property owners are aware of historical disaster impacts and gives them information necessary to plan for and mitigate future disasters
	Responsible Agency:	Texas Real Estate Commission
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Flood Damage Prevention - Regulations for Cameron County, Texas for Floodplain Management, August 7, 2014	**Description:**	Floodplain regulations reduce risk to lives and property by ensuring mitigation measures are put into place for repetitive loss properties and new construction. The primary flood risks for the County are related to: • Tidal waters of the Gulf of Mexico • The cumulative effect of obstructions in floodplains which cause and increase in flood heights and velocities; and • The occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inappropriately placed and or inadequately elevated, flood-proofed or protected from flood damage.
	Responsible Agency:	Cameron County Commissioners Court
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Emergency Management - Texas Government Code Chapter 418 – Cameron County Emergency Management	**Description:**	Emergency Management requirements provide for the planning, mitigation, preparedness, response and recovery activities necessary for a high impact coastal community. It is the mission of Cameron County Emergency Management Services to support County and local governments in the four the phases of the emergency management cycle: prevention (mitigation), preparedness (emergency planning), response, and recovery regarding man-made/natural disasters or evolving emergencies.
	Responsible Agency:	Texas Division of Emergency Management/Cameron County Emergency Management Services
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
BPUB General Emergency Plan, May 28,2021	**Description:**	This manual of organization, plans and procedures, to be followed in the event of a major emergency, was prepared to provide key personnel with as much information as practical for their general direction in case of a major emergency in Brownsville.
	Responsible Agency:	Brownville Public Utilities Board
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
City of Brownsville, Emergency Operations Plan, November 2021	**Description:**	The Emergency Management Plan presented in the City's Comprehensive Plan consists of both capital improvement projects (CIP) and programmatic elements. The Plan seeks to complement the City's existing emergency management and response plan and identify strategies that would help City staff provide better, more effective, and sustainable services for mitigation,

Capability		Details
		response, and recovery from both natural and man-made disasters. The CIP and programmatic strategies presented address the two major objectives: • Want to control risk and minimize exposure from natural and man-made risks uniformly throughout the community • Want sufficient, reliable, and qualified natural/man-made disaster preparation/ planning and response service capacity to meet current and future demand uniformly throughout the City
	Responsible Agency:	Office of Emergency Management & Homeland Security
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Imagine Brownsville Comprehensive Plan, July 21, 2009	**Description:**	The Brownsville Comprehensive Plan provides a foundation for guiding the future growth and development of the City that is consistent with the vision and goals of the community. The plan consists of core elements and smart growth/ sustainability elements. The four core elements include land use (including public facilities and parks), downtown, economic development, and mobility/infrastructure. The core elements are supported by six smart growth/sustainability elements: Civic, Education, Equity, Healthcare, Emergency Management, and Environment.
	Responsible Agency:	City Commission
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Capital Improvement Plan - Fiscal Year 2022 – Annual Operating Budget	**Description:**	The County encourages departments to submit two to five year capital plans for approval by the Commissioners Court. Approved plans shall be given priority during the annual budget process. Capital spending is reserved for parks, major renovation, building, road and bridge related projects, or the County airport that are planned for the fiscal year.
	Responsible Agency:	Commissioners Court
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Severe Winter Storm, Hurricane, Thunderstorm Wind
Open Space Plan – Cameron County Coastal Parks Master Plan, May 2016	**Description:**	Cameron County, located at the southernmost tip of Texas, operates a system of parks that serve both the residents of the County as well as visitors to the area. The County's park system includes a series of coastal parks that are located along the Gulf of Mexico on South Padre Island, and these parks are among the most popular and heavily used in the entire system. These parks are key elements of the Cameron County Parks System and provide revenue needed to improve and maintain County Parks throughout the County. The Coastal Parks Master Plan (CPMP) prioritizes what improvements are needed in the near term to service our existing park user base, and identifies areas within our coastal parks that present opportunities for improved recreation and related uses would be in the future. This master plan document summarizes the planning process and the recommendations for Cameron County's Coastal Parks. Some of the most important areas in the parks are the natural dunes. They provide protection from storms and it is vital to protect and keep these areas as undisturbed as possible. Much of the design was built around this existing system to preserve natural areas.
	Responsible Agency:	Cameron County Parks Advisory Board/Cameron County Commissioners Court
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Texas Agri-Life Extension Service	**Description:**	Agricultural planning reduces the risk to the animals and community during times of disaster.

Capability		Details
	Responsible Agency:	Cameron County San Benito Annex/Cameron County Commissioners Court
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Hurricane, Severe Winter Storm
Cameron County Emergency Management Plan	**Description:**	The Emergency Management Plan developed independently by Cameron County, is updated every 5 years and incorporates goals, objectives and actions identified in the mitigation plan. The Cameron County Emergency Management Plan details both short-term response and long-term recovery plans that address communications, evacuation, and housing necessary for a variety of hazards that impact the community.
	Responsible Agency:	Cameron County Office of Emergency Management.
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards

5.2.2 Planning and Regulatory Capabilities – Federal and State

The following table summarizes the planning and regulatory capabilities available to the BPUB and the City, at the federal and state level.

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability		Details
Disaster Mitigation Act (DMA)	**Description:**	The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	HMPs designed to meet the requirements of DMA will remain eligible for future FEMA Hazard Mitigation Assistance funds
	Hazard:	All-natural hazards
National Flood Insurance Program (NFIP)	**Description:**	The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages. The Flood Hazard Profile in Section 4.3.6 (Flood) provides information on recent legislation related to reforms to the NFIP. The City of Brownsville participates in the NFIP. As of September 2021, there were 20,446 policies in the County (3,156 policies in the City of Brownsville). 839 claims were made in Brownsville totaling over $9 million.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Full compliance and good standing under the NFIP are application prerequisites for all FEMA grant programs for which participating jurisdictions are eligible under this plan.
	Hazard:	Flood
NFIP Community Rating System (CRS)	**Description:**	As an additional component of the NFIP, CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses, (2) facilitate accurate insurance rating, and (3) promote the awareness of flood insurance. Municipalities,

Capability		Details
		and the county as a whole, could expect significant cost savings on premiums if enrolled in the CRS program. As of October 2021, no communities in Cameron County participate in the CRS program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities.
	Hazard:	Flood
Local Government Code **Title 7. Regulation Of Land Use, Structures, Businesses, and Related Activities** **Subtitle A. Municipal Regulatory Authority** **Chapter 211. Municipal Zoning Authority** **Subchapter A. General Zoning Regulations**	**Description:**	The powers granted under this subchapter are for the purpose of promoting the public health, safety, morals, or general welfare and protecting and preserving places and areas of historical, cultural, or architectural importance and significance. The governing body of a municipality may regulate the size of buildings and other structures, lot coverage, size of open spaces, population density, the location and use of buildings and groundwater use. Zoning regulations must be adopted in accordance with a comprehensive plan and must be designed to: (1) lessen congestion in the streets; (2) secure safety from fire, panic, and other dangers; (3) promote health and the general welfare; (4) provide adequate light and air; (5) prevent the overcrowding of land; (6) avoid undue concentration of population; or (7) facilitate the adequate provision of transportation, water, sewers, schools, parks, and other public requirements. The governing body of a municipality may divide the municipality into districts of a number, shape, and size the governing body considers best for carrying out this subchapter. Within each district, the governing body may regulate the erection, construction, reconstruction, alteration, repair, or use of buildings, other structures, or land. Zoning regulations must be uniform for each class or kind of building in a district, but the regulations may vary from district to district. The regulations shall be adopted with reasonable consideration, among other things, for the character of each district and its peculiar suitability for particular uses, with a view of conserving the value of buildings and encouraging the most appropriate use of land in the municipality.
	Responsible Agency:	State of Texas
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Texas Silver Jackets	**Description:**	Silver Jackets is a program under National Flood Risk Management Program to support agency collaboration and coordination with interagency, state-led flood risk and multiple hazard management teams. Provides resources and develops tools to support information sharing and networking, and promotes implementation of flood risk management efforts that improve flood risk awareness and result in actions to reduce risk. For more information: http://silverjackets.nfrmp.us/
	Responsible Agency:	US Army Corp of Engineers
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Texas General Land Office	**Description:**	The Texas General Land Office (GLO), through the Community Development and Revitalization division, works to rebuild Texas communities by putting Texans back in their homes, restoring critical infrastructure and mitigating future damage through resilient community planning. The GLO is setting a record pace administering both Community Development Block Grant Disaster Recovery (CDBG-DR) and Mitigation (CDBG-MIT) funds from the U.S. Department of Housing and Urban Development (HUD) on behalf of the state of Texas.

Capability		Details
		More than $14 billion have been allocated for recovery and mitigation following Hurricanes Rita, Dolly, and Ike, the 2011 wildfires, the 2015 and 2016 floods, Hurricane Harvey, the 2018 South Texas floods, and the 2019 disasters. These grants can be used for a wide variety of activities including housing redevelopment, infrastructure repair and long-term planning, depending on HUD guidance.
	Responsible Agency:	Texas General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Hurricane, Wildfire
Coastal Erosion Planning and Response Act (CEPRA)	**Description:**	The average erosion rate for the 367 miles of Texas coast is 4.1 feet per year. Sixty-four percent of the Texas coast is eroding at an average rate of about 6 feet per year, with some locations losing more than 30 feet per year. FEMA estimates that every dollar spent on erosion control and mitigation to preserve wetlands and other natural ecosystems, will provide a return on average of $4 in future cost-savings. Since 2000, the GLO's Coastal Erosion Planning and Response Program has received $111.4 million in state-appropriated funding. Project partners (local governments, non-profits, state and federal entities) have contributed $52 million in non-federal matching funds and in-kind contributions, along with $165.2 million in federal funds and in-kind contributions that have resulted in more than 355 coastal erosion response projects.
	Responsible Agency:	General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Hurricane, Erosion
Coastal Management Program (CMP)	**Description:**	Texas receives approximately $2 million annually in grants from National Oceanic and Atmospheric Administration (NOAA) and 90% of the funds are passed through to local governments and entities to address environmental needs and promote sustainable economic development along the coast. Projects must improve the management of the state's coastal resources and ensure long-term ecological and economic productivity. Section 306 administrative funds can be used for non-construction, coastal planning and education, and research. Section 306A improvement funds can be utilized for construction and land acquisition projects and preservation and restoration. CMP funding categories include Coastal Natural Hazards Response, Critical Areas Enhancement, Public Access, Water/Sediment Quantity and Quality Improvements, Waterfront Revitalization and Ecotourism Development, Permit Streamlining/Assistance, Governmental Coordination and Local Government Planning Assistance.
	Responsible Agency:	Texas General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Hurricane
Gulf of Mexico Energy Security Act (GOMESA)	**Description:**	GOMESA significantly enhances oil and gas leasing activities and creates revenue sharing provisions for the oil- and gas-producing states of Alabama, Louisiana, Mississippi, and Texas, and their coastal political subdivisions (CPSs). GOMESA funds are used for coastal conservation, restoration and hurricane protection. The second phase of GOMESA revenue sharing began in Fiscal Year 2017 and expands the definition of qualified Outer Continental Shelf revenues to include receipts from Gulf of Mexico leases subject to withdrawal or moratoria restrictions. A revenue-sharing cap of $500 million per year for the four Gulf producing states, their CPSs and the Land and Water Conservation Fund applies from fiscal years 2016 through 2055. The $500 million cap does not apply to qualified revenues generated in those areas associated with Phase I of the GOMESA program. From 2009 through 2016, the state of Texas received $3,192,269 and its 18 CPSs received $798,036. The goal of GOMESA funding is to conserve, restore, enhance, and protect the diversity, quality, quantity, functions, and values of the state's coastal natural resources. A primary focus for the GLO will be to protect coastal natural resources while facilitating multiple human uses of coastal resources.

Capability		Details
		The GLO's priority for the expenditures of GOMESA funds include: 1. Restoring and enhancing coastal natural resources; 2. Providing hurricane protection for coastal public resources; 3. Improving water quality; 4. Enhancing the balance between the protection of coastal natural resources and public use of those resources; 5. Improving environmental management; and 6. Mitigating coastal erosion and stabilizing shorelines.
	Responsible Agency:	Texas General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Hurricane, Manmade Disasters
U.S. Army Corps of Engineers – Dam Safety Program	**Description:**	The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 1997).
	Responsible Agency:	USACE
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood
Natural Resources Damage Assessment (NRDA)	**Description:**	The natural resource trustees are the designated federal, state and tribal agencies who are responsible for the natural resources impacted by an oil spill or hazardous substance release. They have common interests in sharing information, ideas and expertise necessary to compensate the public for harm to natural resources as a result of oil spills and hazardous substance releases.
	Responsible Agency:	Texas Commission on Environmental Quality
	Provides Funding for Mitigation:	Yes
	Hazard:	Manmade Disasters
Coastal and Estuarine Land Conservation Program (CELCP)	**Description:**	Lands being targeted for protection through TCELCP include coastal and estuarine areas with significant ecologic, conservation, recreation, historic, and aesthetic values. Many of these lands are threatened by conversion from their natural state to other uses. This section describes the geographic extent of the TCELCP boundary, outlines the types of lands and values to be protected, and gives an assessment of their status and trends (when known), functions and values, and potential threats. When NOAA provides funding for CELCP, the GLO provides coastal communities an opportunity to apply for up to three projects per year, with federal grants for any single project not to exceed $3 million.
	Responsible Agency:	NOAA, Texas General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Hurricane
Texas Division of Emergency Management	**Description:**	TDEM is charged with carrying out a comprehensive, all-hazard emergency management program for the state and assisting cities, counties, and state agencies in implementing their own emergency management programs
	Responsible Agency:	
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Community Health and Resource Management (CHARM)	**Description:**	CHARM is directed by the Texas Coastal Watershed Program, a part of Texas A&M AgriLife Extension Service. It is a mapping application that gives local officials, stakeholders, and citizens the power to analyze growth with real-time feedback. Using

Capability		Details
		the weTable tool that transforms an ordinary tabletop into an interactive computer interface, CHARM allows participants to engage the public and gather their input regarding the community's future. The mapping application is supported by a library of data about urbanization, storm surge, conservation, public facilities, and coastal resources. The CHARM application can leverage local knowledge for better long-term planning, and is an ideal tool for communities, watersheds, and environmental projects.
	Responsible Agency:	Texas A&M AgriLife Extension Service.
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Home Program	**Description:**	The Texas Department of Housing and Community Affairs (TDHCA) administers the HOME Program on behalf of the state. The purpose of the program is to expand the supply of 328 State of Texas Hazard Mitigation Plan 2018 |TDEM decent, safe, affordable housing and strengthen public-private housing partnerships between units of local governments, public housing authorities, nonprofits, and for profit entities. TDHCA has set aside funding for Disaster Relief and Persons with Disabilities, among others.
	Responsible Agency:	TDHCA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Texas Water Development Board (TWDB) – Flood Insurance Program	**Description:**	TWDB is the state agency charged with collecting and disseminating water-related data, assisting with regional planning, preparing the State Water Plan, which addresses the development of the state's water resources. The agency also administers cost-effective financial assistance programs for the construction of water supply, wastewater treatment, flood control and agricultural water conservation projects. The TWDB has made great strides in floodplain management since the last update to the 2013 SHMP. Examples include hiring full time staff to manage the State's Cooperating Technical Partner floodplain mapping program, developing a State Flood Plan (see below for information on both), and creating a website to assist citizens and first responders during a flood event (www.TexasFloods.org). The following is a list of programs available which may assist with flooding and the mitigation of Repetitive and Severe Repetitive Loss properties. TWDB's National Flood Insurance Program group conducts Community Assistance Visits (CAV), Community Assistance Contacts (CAC), and floodplain management training to assist communities with maintaining NFIP compliance and sound floodplain management practices. The CAV is a scheduled visit to an NFIP community for the purpose of conducting a comprehensive assessment of the community's floodplain management program and evaluating its knowledge and understanding of the requirements of the NFIP. The purpose of the CAV is also to assist the community in understanding NFIP requirements when program deficiencies are discovered. Floodplain Management 101 workshops are offered to local officials and other interested parties which cover the NFIP and various flood loss reduction techniques and strategies, such as the Community Rating System (CRS). The workshops contain training modules on the Texas Water Code, Elevation Certificates, FEMA requirements, community awareness, map reading, permitting, and ordinance comprehension.
	Responsible Agency:	TWDB
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood
Cooperation Technical Partners (CTP)	**Description:**	TWDB also administers the FEMA Cooperating Technical Partners (CTP) Program, which allows communities, tribal nations, universities, and regional and state agencies to be active partners in FEMA's flood hazard mapping program. The CTP program

Capability		Details
		at the state level aims to produce flood risk information through leveraging state and local funds, updated flood risk products, and coordination between statewide cooperating technical partners.
	Responsible Agency:	TWDB
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Fund Development Program	**Description:**	TWDB also administers the Fund Development Program to provide loans for the planning, design, and construction of water supply, wastewater, and flood control projects. Structural flood protection improvements may include construction of storm water retention basins, the enlargement of stream channels public beach re-nourishment, the control of coastal erosion, and the modification or reconstruction of bridges. Non-structural flood protection improvements may include the acquisition of floodplain properties for use as public open space, the acquisition and removal of buildings and residents located within a floodplain, flood warning systems, and the development of floodplain management plans. The agency conducts an environmental review for all construction projects.
	Responsible Agency:	TWBD
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood
Texas Natural Resources Information System (TNRIS)	**Description:**	The Texas Natural Resources Information System (TNRIS) is a division of TWDB, and is responsible for producing, archiving, and distributing geographic data to agencies, businesses, and the public. TNRIS supports hazard mitigation planning and implementation in three ways: • Provides data to organizations for planning or response activities. • Develops, locates, and prepares data for specific needs and/or projects. • Updates the State Critical Facility Database.
	Responsible Agency:	TWDB
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Texas Flash Flood Coalition	**Description:**	The TFFC is an organization dedicated to decreasing the number of deaths caused by flash flooding in Texas. More than 30 representatives of higher education, media, private industry, local, state and federal governments participate in the coalition. Its strategy is to: • Brainstorm and share ideas, data, resources and best practices • Include a diversity of folks from all levels of education, the public, private entities and academia • Attack the flash flood problem with mitigation, research, technology, education, awareness, warning and communication
	Responsible Agency:	Works with the Texas Floodplain Management Association
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Flash Flood
Community Hazard Analysis and Mitigation Planning Support (CHAMPS)	**Description:**	The CHAMPS reports are summarized descriptions of historical hazard events and future hazard risks for each county in Texas. These have been developed by the Texas Geographic Society in a project funded by FEMA and administered by TDEM. CHAMPS reports have been developed to provide local mitigation planners with data, maps and other information they can use to support the hazard assessment portion of the mitigation planning process. Each report includes information on county populations and built environments, historical losses from multiple hazards, and expected future likelihood of more hazard events. Also included with every hazard is a comparative display showing how the number of hazard events in that county compares with the number of events in other counties for that hazard over the same timeframe.
	Responsible Agency:	Texas Geographic Society
	Provides Funding for Mitigation:	No

Capability	Details	
	Hazard:	All Hazards
Urban Tree Canopy Project – Resilient Landscapes Program	**Description:**	TFS has programs and funding opportunities, such as the Urban Tree Canopy Project, that address mitigation by decreasing impact from summer heat, flooding, and erosion. The Fire-Adapted Communities Program provides cost-share funds to assist in informing and preparing citizens to safely co-exist with wildland fire. The Resilient Landscapes Program provides cost-share reimbursement funds to restore healthy, fire-adapted ecosystems. The Firewise USA Program provides cost-share funds in cooperation with the National Fire Protection Administration to encourage homeowners to take individual responsibility for protecting their homes from the risk of wildfire.
	Responsible Agency:	Texas A&M Forest Service
	Provides Funding for Mitigation:	No
	Hazard:	Wildfires
Texas Department of Licensing and Regulation	**Description:**	Licenses and regulates weather modification programs and hosts the Texas Weather Modification and Advisory Committee meetings. Cloud seeding projects designed to increase rainfall from convective cloud towers are conducted in nearly 31 million acres of Texas. In administering the Texas Weather Modification Act, TDLR's weather modification program issues licenses and permits for projects using specialized aircraft and sophisticated weather radar systems at sites near Amarillo, San Angelo and Pleasanton. TDLR also issues permits for hail suppression projects.
	Responsible Agency:	TDLR
	Provides Funding for Mitigation:	No
	Hazard:	Drought
Texas Department of Transportation	**Description:**	TXDOT incorporates tornado safe rooms into their Safe Rest Stops program through a federally-funded Transportation Enhancement program (See Section 6.3). TXDOT also revises its design manual to include improved guidance on NFIP requirements. The agency supports the effort to certify floodplain managers by encouraging all their personnel to become certified. All engineers in TxDOT's central hydraulics branch are certified.
	Responsible Agency:	TxDOT
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Texas Residential Safe Room Rebate Program	**Description:**	TDEM, through the Hazard Mitigation Assistance (HMA) grants, began offering a rebate incentive for builders and homeowners to build or install residential safe rooms. This program is implemented by local units of government that choose to administer the program through a grant provided through the HMGP or PDM program. TDEM has also published a residential safe room handbook to assist local jurisdictions with the implementation of the program. This program has raised the viability and the visibility of safe rooms in high tornado/windstorm regions of Texas.
	Responsible Agency:	TDEM
	Provides Funding for Mitigation:	Yes
	Hazard:	Tornado, Thunderstorm Wind

5.3 Administrative and Technical Capabilities

Table 6-3 summarizes the administrative and technical capabilities in Cameron County. Detailed information regarding administrative and technical capabilities in the City and for BPUB can be found in their jurisdictional annexes found in Volume II, Section 9 (Jurisdictional Annexes).

Table 5-3. Administrative and Technical Capability – County

Capability		Details
Department of Transportation	**Description:**	The Cameron County Department of Transportation includes several divisions that collectively work together in managing the efficient implementation of all planning, design, construction and maintenance of the roads, bridges, buildings, and traffic control devices within the county. The Department also oversees all mapping, residential and commercial permitting, maintenance and repair of county transportation equipment, and manages and operates the international bridge system. The Department is under the direction of the County Administrator.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Hurricane, Severe Winter Storm
Parks and Recreation Department	**Description:**	The Cameron County Parks System Mission is "To provide safe, quality outdoor recreation opportunities to the citizens and visitors of Cameron County at an affordable price and to develop and protect the County's coastal resources and natural habitats.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Department of Economic Development and Community Affairs	**Description:**	The mission of the Department is to work towards improving the quality of life for the residents of the County through creating better job opportunities, improving the quality of housing, access to adequate utilities, rural neighborhood streetlights, and improved flood protection. The Department's goal is to provide just the right amount of incentives to meet the needs of businesses looking to locate in Cameron County promoting job creation for the residents within the county while still adding to the tax base to support the governmental functions of the county.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Public Health Department	**Description:**	Cameron County Department of Health and Human Services preserves, protects, and promotes the health and well-being of Cameron County residents through the provision of quality care that is accessible and affordable and focuses on disease prevention, community services, and emergency preparedness. It is the Department's vision that Cameron County residents have access to public health and community services so that all live and work in a healthier, safer, and prepared community.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Department of Emergency Management	**Description:**	The Department's mission is to support County and local governments in the four the phases of the emergency management cycle: prevention (mitigation), preparedness (emergency planning), response, and recovery regarding man-made/natural disasters or evolving emergencies.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards

5.4 Fiscal Capabilities

Fiscal capabilities are the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions. The table below provides a list of programs, descriptions, and links for those jurisdictions seeking funding sources. This table is not intended to be a comprehensive list, but rather a tool to help begin identifying potential sources of funding.

Table 5-4. Fiscal Capabilities

Capability		Details
Federal		
Hazard Mitigation Grant Program	**Description:**	The HMGP is a post-disaster mitigation program. It is made available to states by FEMA after each Federal disaster declaration. The HMGP can provide up to 75% funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved Hazard Mitigation Plan (this plan). Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to TDEM and placed in rank order for available funding and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. For additional information regarding HMGP, please refer to: https://www.fema.gov/hazard-mitigation-grant-program
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Flood Mitigation Assistance Program	**Description:**	The FMA program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. For the nom-federal share, at most 25 percent of the total eligible costs must be provided by a non-federal source; of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. TDEM serves as the grantee and program administrator for the FMA program. The FMA program is detailed on the FEMA website: https://www.fema.gov/flood-mitigation-assistance-grant-program.

Capability		Details
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Severe Weather
Building Resilient Infrastructure and Communities Program	**Description:**	Building Resilient Infrastructure and Communities (BRIC) will support states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. For additional information regarding the BRIC program, please refer to: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Extraordinary Circumstances	**Description:**	For PDM and FMA project subawards, the (FEMA) Region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community. For HMGP, PDM, and FMA, extraordinary circumstances exist when a determination is made by the Applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the State (Standard or Enhanced) Mitigation Plan and that the jurisdiction meets at least one of the criteria below. If the jurisdiction does not meet at least one of these criteria, the Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; however, for PDM and FMA the Region must coordinate and seek concurrence prior to granting an exception: •The jurisdiction meets the small, impoverished community criteria (see Part VIII, B.2). •The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline. •The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development. •The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award. •The jurisdiction does not have a mitigation plan for reasons beyond the control of the State, federally-recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or Tribal Mitigation Plan.

Capability		Details
		For HMGP, PDM, and FMA, the Applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency. When an HMGP project funding is awarded under extraordinary circumstances, the Recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements, if a planning subaward is also awarded).
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Individual Assistance	**Description:**	Individual Assistance (IA) provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses could be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals are allowed to borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans could be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Non-profit organizations, such as charities, churches, and private universities are eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster but are restricted by law to small businesses only. IA is detailed on the FEMA website: https://www.fema.gov/individual-disaster-assistance.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Public Assistance	**Description:**	Public Assistance (PA) provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required. PA is detailed on the FEMA website: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Department of Homeland Security Grant Program	**Description:**	The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. In FY 2019, the total amount of funds available under HSGP was $1.095 billion.

Capability		Details
		HSGP is comprised of three interconnected grant programs including the State Homeland Security Program, Urban Areas Security Initiative (UASI), and the Operation Stonegarden. Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. Additional information regarding HSGP is available on the website: https://www.fema.gov/homeland-security-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Fire Management Assistance Grant Program	**Description:**	Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands that threaten such destruction as would constitute a major disaster. Provides a 75% federal cost share and the state pays the remaining 25% for actual cost. Information on this program is available on the website: https://www.fema.gov/fire-management-assistance-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
Assistance to Firefighters Grant Program	**Description:**	The primary goal of the Assistance to Firefighters Grants is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience. Information regarding this grant program is available on the website: https://www.fema.gov/welcome-assistance-firefighters-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
High Hazard Potential Dams Grant Program	**Description:**	The Rehabilitation of High Hazard Potential Dams Grant Program provides technical, planning, design, and construction assistance in the form of grants to non-Federal governmental organizations or nonprofit organizations for rehabilitation of eligible high hazard potential dams. Information regarding this program is available on the website: https://www.grants.gov/web/grants/view-opportunity.html?oppId=316238.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Dam/Levee Failure
Small Business Administration Loan	**Description:**	The Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

Capability		Details
		Homeowners could apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners could borrow up to $40,000 to replace or repair personal property-such as clothing, furniture, cars, and appliances that were damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. Additional information regarding SBA loans is available on the SBA website: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance.
	Responsible Agency:	SBA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Community Development Block Grant Program	**Description:**	CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, and planning and administration. Public improvements could include flood and drainage improvements. In limited instances and during the times of "urgent need" (e.g., post disaster) as defined by the CDBG National Objectives, CDBG funding could be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. Additional information regarding CDBG is available on the website: https://www.hudexchange.info/programs/cdbg-entitlement/.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Federal Highway Administration-Emergency Relief	**Description:**	The Federal Highway Administration (FHWA) Emergency Relief is a grant program through the U.S. Department of Transportation (DOT) that can be used for repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. New Jersey Department of Transportation serves as the liaison between local municipalities and FHWA. Additional information regarding the FHWA Emergency Relief Program is available on the website: https://www.fhwa.dot.gov/programadmin/erelief.cfm.
	Responsible Agency:	U.S. DOT
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Federal Transit Administration - Emergency Relief	**Description:**	The Federal Transit Authority (FTA) Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. DOT and directly allocated to Metropolitan Transit Authority (MTA) and Port Authority, this transportation-specific fund was created as an alternative to FEMA PA. Currently, a total of $5.2 billion has been allocated to New Jersey-related entities. Additional information regarding the FTA Emergency Relief Program is available on the website: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program.

Capability		Details
	Responsible Agency:	U.S. DOT
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Disaster Housing Program	**Description:**	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage and rental assistance available through the U.S. Department of Housing and Urban Development (HUD). Information on this program is available on the website: https://www.hud.gov/program_offices/public_indian_housing/publications/dhap.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
HOME Investment Partnerships Program	**Description:**	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons). Information on this program is available on the website: https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
HUD Disaster Recovery Assistance	**Description:**	Grants to fund gaps in available recovery assistance after disasters (including mitigation). Information on this program is available on the website: https://www.hud.gov/info/disasterresources.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Section 108 Loan Guarantee	**Description:**	Enables states and local governments participating in the CDBG program to obtain federally guaranteed loans for disaster-distressed areas. Information on this program is available on the website: https://www.hudexchange.info/programs/section-108/.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Smart Growth Implementation Assistance program	**Description:**	The Smart Growth Implementation Assistance (SGIA) program through the U.S. Environmental Protection Agency (EPA) focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting. Information on this program is available on the website: https://www.epa.gov/smartgrowth.
	Responsible Agency:	EPA
	Provides Funding for Mitigation:	Yes

Capability		Details
	Hazard:	All Hazards
Partners for Fish and Wildlife	**Description:**	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. Information on this program is available on the website: https://www.fws.gov/partners/.
	Responsible Agency:	U.S. Fish and Wildlife Service
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Transportation Investment Generating Economic Recovery (TIGER)	**Description:**	Investing in critical road, rail, transit and port projects across the nation. Information on this program is available on the website: https://www.transportation.gov/tags/tiger-grants.
	Responsible Agency:	U.S. DOT
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Community Facilities Direct Loan & Grant Program	**Description:**	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings. Information on this program is available on the website: https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program.
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Emergency Loan Program	**Description:**	USDA's Farm Service Agency provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters or quarantine. Information on this program is available on the website: https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index.
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Emergency Watershed Protection program	**Description:**	The Emergency Watershed Protection (EWP) program provides assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences through the Natural Resources Conservation Service. Information on this program is available on the website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/.
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Financial Assistance	**Description:**	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land. Information on this program is available on the website: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/.

Capability		Details
	Responsible Agency:	NRCS
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Emergency Management Performance Grants (EMPG) Program	**Description:**	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities. Information on this program is available on the website: https://www.fema.gov/emergency-management-performance-grant-program.
	Responsible Agency:	U.S. DHS
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Reimbursement for Firefighting on Federal Property	**Description:**	Provides reimbursement only for direct costs and losses over and above normal operating costs. Information on this program is available on the website: https://www.usfa.fema.gov/grants/firefighting_federal_property.html.
	Responsible Agency:	U.S. DHS
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
Land & Water Conservation Fund	**Description:**	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies). Information on this program is available on the website: https://www.nps.gov/subjects/lwcf/index.htm.
	Responsible Agency:	National Park Service
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
State		
Texas Water Development Board Flood Funding	**Description:**	The TWDB offers a variety of cost-effective loan and grant programs that provide for the planning, acquisition, design, and construction of water related infrastructure and other water quality improvements
	Responsible Agency:	Texas Water Development Board
	Provides Funding for Mitigation:	Yes
	Hazard:	Flooding
Texas A&M Forest Service Prescribed Burn Grants	**Description:**	Texas A&M Forest Service offers grants to landowners to complete prescribed fires on private land. Each grant targets landowners in different priority areas across the state.
	Responsible Agency:	Texas A&M Forest Service
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire

Capability		Details
Flood Control Dam Infrastructure Projects - Supplemental Funding	**Description:**	Projects to repair and rehabilitate flood control structures across Texas will now be funded due to a $150 million appropriations bill legislators passed this session.
	Responsible Agency:	Texas State Soil and Water Conservation Board
	Provides Funding for Mitigation:	Yes
	Hazard:	Flooding, Dam Failure
Flood Infrastructure Fund (FIF)	**Description:**	FIF program provides financial assistance in the form of loans and grants for flood control, flood mitigation, and drainage projects
	Responsible Agency:	Texas Water Development Board
	Provides Funding for Mitigation:	Yes
	Hazard:	Flooding
Texas Coastal Management Program Grant	**Description:**	Funding for projects that address environmental concerns and promote economic development within the Texas coastal zone.
	Responsible Agency:	Texas General Land Office
	Provides Funding for Mitigation:	Yes
	Hazard:	Erosion and Flooding
Texas Farm and Ranch Lands Conservation Program (TFRLCP)	**Description:**	Funding conserves natural resources by protecting working lands from fragmentation and development. TFRLCP maintains and enhances the ecological and agricultural productivity of these lands through Agricultural Conservation Easements.
	Responsible Agency:	Texas Parks and Wildlife
	Provides Funding for Mitigation:	Yes
	Hazard:	Flooding

5.5 Plan Integration

Within each annex, BPUB and the City of Brownsville identified integration of hazard risk management into their existing planning, regulatory, and operational/administrative framework ("integration capabilities") and intended integration promotion (integration actions). Volume II, Section 9 (Jurisdictional Annexes) provides details on how BPUB and the City integrate hazard mitigation into their existing capabilities.

5.5.1 Integration Process

Hazard mitigation is a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The Planning Team (BPUB and the City) was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Section 9 (Jurisdictional Annexes) details how this is done for BPUB and the City of Brownsville. During this process, each entity recognized the importance and benefits of incorporating hazard mitigation into future planning and regulatory processes and have added new mitigation actions to support this effort.

The Planning Team will continue to incorporate mitigation planning as an integral component of daily operations. Planning Partnership representatives will continue to work together to integrate the newly adopted hazard mitigation goals and actions into the general operations of BPUB and the City of Brownsville. Further, the sample adoption resolution presented in Appendix A (Plan Adoption) includes a resolution item stating the intent of the governing bodies to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Partnership anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts.
2. The Hazard Mitigation Plan, Master Plan, Emergency Management Plans, and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of Planning Area residents.

Section 7 (Plan Maintenance) provides for additional information on the implementation of the mitigation plan through existing programs.

SECTION 6. MITIGATION STRATEGY

6.1 Introduction

This section presents mitigation actions for BPUB and the City of Brownsville to reduce potential exposure and losses identified as concerns in the Risk Assessment (Section 5). The Planning Team reviewed the risk assessment to identify and develop these mitigation actions, which are presented herein. This section includes:

- Background and Past Mitigation Accomplishments
- General Mitigation Planning Approach
- Strengths, Weaknesses, Obstacles, and Opportunities
- Review and Update of Mitigation Goals and Objectives
- Plan Integration
- Mitigation Strategy Development and Update

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

6.2 Background and Past Mitigation Accomplishments

In accordance with DMA 2000 requirements, a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this HMP. The Planning Team, through previous and ongoing hazard mitigation activities, has demonstrated that it is pro-active in protecting its physical assets and citizens against losses from natural hazards. Examples of previous and ongoing actions, projects and capabilities include the following:

- BPUB participated in the development of the 2015 Mitigation Plan and facilitated the 2022 Update, which included the participation of the City of Brownsville. The current planning process represents the regulatory five-year local plan update process.
- The City of Brownsville participates in the National Flood Insurance Program (NFIP), which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.
- BPUB and the City have participated on a limited basis in available mitigation grant funding opportunities to implement mitigation projects, including the following:
    - Tornado and severe wind safe rooms for public structures
    - BPUB is a recipient of a 2019 HMGP grant for preparation of the 2022 Hazard Mitigation Action Plan
- BPUB and the City have implemented mitigation actions to protect critical facilities and infrastructure throughout the planning area. These actions and others were identified in the 2015 Hazard Mitigation Plan.
- TDEM supports BPUB and the City to reduce their risk and increase their resilience. They provide a comprehensive program to support local jurisdictions as they assess the risks they face, plan to mitigate them, and fund those plans to implement mitigation projects that reduce risk across the Planning Area.

- In 2020, BPUB and the City responded to and worked to mitigate the impacts of the coronavirus pandemic through education of the public, enforcement of local and state social distancing and masking measures, and establishment of best practices to slow the spread of Covid-19.

These past and ongoing activities have contributed to the Planning Team's understanding of its hazard preparedness and future mitigation activity needs, costs, and benefits. These efforts provide an ongoing foundation for the planning partnership to use in developing this HMP update.

6.3 General Mitigation Planning Approach

The overall approach used to update the local hazard mitigation strategies are based on FEMA and State of Texas regulations and guidance regarding local mitigation plan development, including:

- DMA 2000 regulations, specifically 44 CFR 201.6 (local mitigation planning).
- FEMA Local Mitigation Planning Handbook, March 2013.
- FEMA Local Mitigation Plan Review Guide, October 1, 2011.
- FEMA Integrating Hazard Mitigation into Local Planning, March 1, 2013.
- FEMA Plan Integration: Linking Local Planning Efforts, July 2015.
- FEMA Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3), February 2013.
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards, January 2013.

The mitigation strategy update approach includes the following steps that are further detailed in later subsections of this section:

- Section 6.4 – Strengths, Weaknesses, Obstacles, and Opportunities (SWOO) exercise
- Section 6.5 – Review and update mitigation goals and objectives.
- Section 6.6 - Develop and prepare a mitigation strategy, including:
    - Review of the 2017 HMP mitigation actions
    - Identification of progress on previous local mitigation strategies
    - 2022 HMP Mitigation Action Plan
    - Mitigation best practices
    - Mitigation strategy evaluation and prioritization; and
    - Benefit/cost review.

6.4 Strengths, Weaknesses, Obstacles, and Opportunities Exercise

A Strengths, Weakness, Obstacles and Opportunities exercise (SWOO) was completed by the planning partnerships. Participants were asked to fill out the SWOO for each of the hazards of concern for the 2022 HMP update. The Planning Team was asked to begin the exercise by identifying county, local, and stakeholder strengths to mitigate the risk and potential future impacts of the hazards. Next, the weaknesses, challenges and obstacles the planning area faces to reduce each hazard's risk were identified. To conclude the discussion of each high-ranked hazard, the meeting attendees were asked to identify potential opportunities for enhanced mitigation.

The results were compiled and presented to the planning partnership at the risk assessment presentation. The results were also used by the participants to help identify capabilities and potential mitigation actions. The following summarizes the general categories of potential opportunities identified during the exercise:

- Unified public information and outreach for BPUB and the City of Brownsville.
- The need for training for municipal staff.
- Updated flood hazard maps needed.
- Continue to pursue municipal participation in CRS.
- Mutual aid agreements needed between BPUB and the City of Brownsville.

6.5 Review and Update of Mitigation Goals and Objectives

This section documents the efforts to update the guiding principles, and hazard mitigation goals and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.5.1 Goals and Objectives

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." Further, FEMA mitigation planning guidance recommends establishing objectives to better tie mitigation goals to specific mitigation strategies (e.g. projects, activities, and initiatives).

FEMA defines ***Goals*** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines ***Objectives*** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

The goals established in the 2015 Brownsville Public Utilities Board Hazard Mitigation Action Plan were presented to the Planning Team for review and amendment throughout the planning process. This review was made with consideration of the hazard events and losses since the 2015 plan, the updated hazard profiles and vulnerability assessment, and the goals and objectives established in the updated 2018 State HMP.

The Planning Team met on October 7, 2021 to review the 2015 goals and objectives and provided input on updated goals and objectives. These updates were presented to the Planning Team during the January 2022 Mitigation Strategy Workshop. As a result of these efforts, the list below presents BPUB's updated goals and objectives for the 2022 HMP update. *Italicized* text indicates the updates made to the goals and objectives from the 2015 HMP.

6.5.1.1 Goals

- Goal 1: Protect public health and *safety from natural, technological, and human-caused hazard events*
- Goal 2: Protect new and existing *public and private* properties from *natural, technological, and human-caused hazard events*

- Goal 3: Build and support *public, private, and non-profit* partnerships to enhance mitigation to continuously become less vulnerable to hazards.
- Goal 4: Leverage outside funds for investment in hazard mitigation.
- Goal 5: *Enhance and promote hazard mitigation awareness and education to help residents* understand the need for mitigation, and steps they can take to protect people and properties.

6.5.1.2 Objectives

- Objective 1: Maintain *and protect* critical facilities, *community lifelines, and services*.
- Objective 2: Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
- Objective 3: Reduce the danger to, and enhance protection of, high risk areas during hazard events.
- Objective 4: *Retrofit, purchase, or relocate structures in high hazard areas including those known to be repetitively damaged*
- Objective 5: Reduce *the number of* repetitive losses *to properties in* the National Flood Insurance Program (NFIP).
- Objective 6: Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.
- Objective 7: Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
- Objective 8: Build and support local partnerships to continuously become less vulnerable to hazards.
- Objective 9: *Ensure continuity of government operations, emergency services, essential, and lifeline facilities at the local level during and immediately after disaster and hazard events.*
- Objective 10: *Strengthen inter-jurisdiction and inter-agency communication, coordination, and partnerships in all phases of emergency management.*
- Objective 11: Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.
- Objective 12: Build hazard mitigation concerns into the City of Brownsville and Brownsville Public Utilities Board (BPUB) planning and budgeting processes.
- Objective 13: Maximize the use of outside sources of funding.
- Objective 14: Maximize participation of property owners in protecting their properties.
- Objective 15: Maximize insurance coverage to provide financial protection against hazard event.
- Objective 16: Prioritize mitigation projects based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
- Objective 17: Heighten public awareness of the full range of natural and human-made hazards they face.
- Objective 18: Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
- Objective 19: Publicize and encourage the adoption of appropriate hazard mitigation measures.

6.6 Mitigation Strategy Development and Update

As required by FEMA, BPUB and the City completed a comprehensive evaluation of the mitigation strategies and actions from the 2015 HMP and reported on the status of each. Their update may be found in each jurisdictional

annex (Section 9). In addition, the Planning Team was provided the opportunity to include new strategies or actions to include in the 2022 HMP Update. New actions were prioritized to ensure they are cost-effective, environmentally sound, and technically feasible using the methodology outlined below.

6.6.1 Review of the 2017 HMP Mitigation Action Plan

To evaluate progress on local mitigation actions, the planning consultant met with each participant to discuss the status of the mitigation actions identified in the 2015 plan. For each action, the Planning Team was asked to provide the status of each action (*No Progress, In Progress, Ongoing Capability, Discontinue, or Completed*) and provide review comments on each. The Planning Team was requested to quantify the extent of progress and provide reasons for the level of progress or why actions were being discontinued. Each jurisdictional annex in Section 9 (Jurisdictional Annexes) provides a table identifying the jurisdiction's prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as *Complete*, and those actions identified as *Discontinued*, were removed from the updated strategies. Local mitigation actions identified as an *Ongoing Capability* were incorporated into the capability assessment of each jurisdictional annex. Those actions identified as *No Progress* or *In Progress* that remain a priority for the jurisdiction, have been carried forward into the updated mitigation strategy. Actions identified as *Ongoing Capabilities* which are fully integrated into the normal operational and administrative framework of the community have been identified within the capabilities section of each annex, and removed from the updated mitigation strategy.

At the August kick-off meeting and during subsequent local-level planning meetings (phone, email), all participating jurisdictions were requested to identify mitigation activities completed, ongoing, and potential/proposed. As new potential mitigation actions, projects, or initiatives became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process detailed in Section 2 (Planning Process), jurisdictions were made aware of these either through direct communication (local meetings, email, phone), at Planning Team meetings, or via their draft jurisdictional annexes.

> Throughout the planning process, the planning consultant worked directly with each community (phone, email) to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

6.6.2 Identification and Analysis of Mitigation Techniques

Concerted efforts were made to assure that municipalities develop updated mitigation strategies that included activities and initiatives covering the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- **Local Plans and Regulations** - These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- **Structure and Infrastructure Projects** - These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public

or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.

- **Natural Systems Protection** - These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.
- **Education and Awareness Programs** - These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA) and Firewise (NFPA) Communities.

6.6.3 2022 HMP Mitigation Action Plan

To help support the selection of an appropriate, risk-based mitigation strategy, each annex provides a summary of hazard vulnerabilities identified during the plan update process, either directly by municipal representatives, through review of available county and local plans and reports, and through the hazard profiling and vulnerability assessment process.

In January 2022, the planning partnership participated in a mitigation strategy development workshop, supplemented by emails and phone calls between jurisdictions and the contract consultant, for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the Planning Area. These problem statements were intended to provide a detailed description of the problem area, including its impacts to the municipality/jurisdiction; past damages; loss of service; etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements formed a bridge between the hazard risk assessment which quantifies impacts to each community with the development of actionable mitigation strategies.

As discussed within the hazard profiles in Section 4.3 (Risk Assessment), the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards including flood, hurricanes and tropical storm, severe winter weather and wildfire. By way of addressing these climate change-sensitive hazards within their local mitigation strategies and integration actions, communities are working to evaluate and recognize these long-term implications and potential impacts, and to incorporate in planning and capital improvement updates.

To assist with the development of mitigation actions, municipalities were provided with the following:

- 2022 HMP goals and objectives
- 2015 HMP mitigation strategy
- Risk assessment results
- Outcome of the SWOO
- Mitigation catalog
- Stakeholder and public input (e.g. citizen and stakeholder survey results)
- FEMA resources

A strong effort has been made to better focus local mitigation strategies to clearly defined, readily implementable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation actions were eliminated from the updated strategy unless accompanied by discrete actions, projects, or initiatives. Certain continuous or ongoing strategies that represent programs that are fully integrated into the normal operational and administrative framework of the community have been identified within the capabilities section of each annex and removed from the updated mitigation strategy.

Overall, a comprehensive range of specific mitigation initiatives were considered by each plan participant to pursue in the future to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities.

6.6.4 Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use by the Planning Team, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each natural hazard of concern evaluated in this plan; referred to as Appendix F (Mitigation Strategy Supplementary Data). The catalogs present alternatives that are categorized in two ways:

- By whom would have responsibility for implementation:
    - Individuals – personal scale
    - Businesses – corporate scale
    - Government – government scale
- By what each of the alternatives would do:
    - Manipulate the hazard
    - Reduce exposure to the hazard
    - Reduce vulnerability to the hazard
    - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalog, as well as other resources made available to all jurisdictions (i.e., FEMA's Mitigation Ideas). The catalog provides a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the planning partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalog was to provide a list

of what could be considered to reduce risk from natural hazards within the planning area. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible
- The action is already being implemented
- There is an apparently more cost-effective alternative
- The action does not have public or political support.

6.6.5 Mitigation Strategy Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires an action plan describing how the actions identified will be prioritized. Recent FEMA planning guidance (March 2013) identifies a modified STAPLEE (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) mitigation action evaluation methodology that uses a set of 10 evaluation criteria suited to the purposes of hazard mitigation strategy evaluation. This method provides a systematic approach that considers the opportunities and constraints of implementing a particular mitigation action.

Based on this guidance, the Steering Committee has adopted and applied an action evaluation and prioritization methodology which includes an expanded set of 14 criteria to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards.

The 14 evaluation/prioritization criteria used in the 2022 update process are:

1) **Life Safety** – How effective will the action be at protecting lives and preventing injuries?
2) **Property Protection** – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
3) **Cost-Effectiveness** – Are the costs to implement the project or initiative commensurate with the benefits achieved?
4) **Technical** – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
5) **Political** – Is there overall public support for the mitigation action? Is there the political will to support it?
6) **Legal** – Does the municipality have the authority to implement the action?
7) **Fiscal** – Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
8) **Environmental** – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
9) **Social** – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
10) **Administrative** – Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
11) **Multi-hazard** – Does the action reduce the risk to multiple hazards?
12) **Timeline** – Can the action be completed in less than 5 years (within our planning horizon)?
13) **Local Champion** – Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?

14) **Other Local Objectives** – Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

Specifically, for each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

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

Further, jurisdictions were asked to provide a summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results were totaled to assist each jurisdiction in selecting mitigation actions for the updated plan.

As step one in the prioritization process, actions that had a numerical value between 0 and 4 were initially prioritized as low; actions with numerical values between 5 and 9 were initially categorized as medium; and actions with numerical values between 10 and 14 were initially categorized as high. As step two, jurisdictions were then asked to consider the benefits and costs, as well as the desired timeline for implementation and project completion timeline when finalizing each action's priority as high/medium/low. These attributes are included in the mitigation strategy table and for FEMA-eligible projects in the mitigation worksheets (Section 9 – Jurisdictional Annexes).

For the plan update there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include projects and initiatives that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each jurisdiction was asked to develop problem statements. With this process, participating jurisdictions were able to develop action-oriented and achievable mitigation strategies.

6.6.6 Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a cost/benefit review of the proposed projects and their associated costs. Stated otherwise, cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions comprising the overall mitigation strategy.

The benefit/cost review applied in for the evaluation and prioritization of projects and initiatives in this HMP update process was qualitative; that is, it does not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Pre-Disaster Mitigation (PDM) grant programs. For all actions identified in the local strategies, jurisdictions have identified both the costs and benefits associated with project, action or initiative.

Costs are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.

Benefits are the savings from losses avoided attributed to the implementation of the project, and may include life-safety, structure and infrastructure damages, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar value for project costs and associated benefits. Having defined costs and benefits allows a direct comparison of benefits versus costs, and a quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified, or may be impossible to quantitatively assess.

For the purposes of this planning process, jurisdictions were tasked with evaluating project cost-effectiveness with both costs and benefits assigned to "High", "Medium" and "Low" ratings. Where quantitative estimates of costs and benefits were available, ratings/ranges were defined as:

- Low = < $10,000
- Medium = $10,000 to $100,000
- High = > $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings using the following definitions were used:

Table 6-1. Qualitative Cost and Benefit Ratings

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For some of the initiatives identified, the planning partnership may seek financial assistance under FEMA's HMGP or Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application

process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. The planning partnership is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the planning partnership reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this HMP.

SECTION 7. PLAN MAINTENANCE

This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Team maintains their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.	Meet annually or upon major update to comprehensive plan or major disaster declaration	Jurisdictional points of contact identified in Section 8 (Planning Team) and Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 8 (Planning Team) and Section 9 (Jurisdictional Annexes)
Integration	In order for integration of mitigation principles action to become an organic part of the ongoing BPUB and municipal activities, the Planning Area will incorporate the distribution of the safe growth worksheet for annual review and update by all participating jurisdictions.	September each year with interim email reminders to address integration in BPUB and municipal activities.	HMP Coordinator and jurisdictional points of contact identified in Section 8 (Planning Team) and Section 9 (Jurisdictional Annexes)	HMP Coordinator
Evaluation	Review the status of previous actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by October 14 of each year	Planning Team; Plan Maintenance element	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Update	Reconvene the planning partners, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Master Plan or major disaster	BPUB HMP Coordinator	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)

7.1 Monitoring, Evaluating, and Updating the Plan

The procedures for monitoring, evaluating, and updating the plan are provided below. The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the Planning Team and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan.

The Planning Team shall fulfill the monitoring, evaluation and updating responsibilities identified in this section which is comprised of a representative from each participating jurisdiction. Each jurisdiction is expected to maintain a representative on the Planning Team throughout the plan performance period (five years from the date of plan adoption). As of the date of this plan, mitigation planning representatives (points-of-contact) are identified in each jurisdictional annex in Section 9 (Jurisdictional Annexes).

Regarding the composition of the committee, it is recognized that individual commitments change over time, and it shall be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation. The HMP Coordinator will strive to keep the committee makeup as a uniform representation of planning partners and stakeholders within the planning area. Currently, the BPUB HMP Coordinator is designated as:

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7.1.1 Monitoring

The Planning Team will be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, and documenting annual progress. Each year, beginning one year after plan development, the Planning Team will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9) of this plan, by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding; and obstacles or impediments to implementation of actions, the information that Planning Team representatives shall be expected to document, as needed and appropriate include:

- Any grant applications filed on behalf of the participating jurisdictions,
- Hazard events and losses occurring in their jurisdiction,
- Additional mitigation actions believed to be appropriate and feasible,
- Public and stakeholder input, and

7.1.1.1 Integration Process of the HMP into Municipal Planning Mechanisms

Hazard mitigation is sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. Integrating hazard mitigation into a community's existing plans, policies, codes, and programs leads to development patterns that do not increase risk from known hazards or leads to redevelopment that reduces risk from known hazards. The BPUB HMP Planning Team was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Refer to Section 9 (Jurisdictional Annexes) for how this is done for each participating municipality. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes.

The Planning Team will incorporate mitigation planning as an integral component of daily government operations. They will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Appendix A) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Team anticipates that:

1. Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts;
2. The Hazard Mitigation Plan, Comprehensive Plans, Emergency Management/Operations Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of the Planning Area residents.

During the HMP annual review process, each participating municipality will be asked to document how they are utilizing and incorporating the BPUB HMP 2022 update into their day-to-day operations and planning and regulatory processes. Additionally, the Planning Team will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report. The following checklist was adapted from FEMA's Local Mitigation Handbook (2013), Appendix A, Worksheet 4.2. This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, ordinances, and policies. By completing the checklist, it will help the Planning Team identify areas that integrate hazard mitigation currently and where to make improvements and reduce vulnerability to future development. In this manner, the integration of mitigation into municipal activities will evolve into an ongoing culture within the Planning Area.

Table 7-2. Safe Growth Checklist

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
Operating, Municipal and Capital Improvement Program Budgets			
• When constructing upcoming budgets, hazard mitigation actions will be funded as budget allows. Construction projects will be evaluated to see if they meet the hazard mitigation goals.			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
• Annually, during adoption process, the municipality will review mitigation actions when allocating funding.			
• Do budgets limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?			
• Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
• Do budgets provide funding for hazard mitigation projects identified in the BPUB HMP?			
Human Resource Manual			
• Do any job descriptions specifically include identifying and/or implementing mitigation projects/actions or other efforts to reduce natural hazard risk?			
Building and Zoning Ordinances			
• Prior to, zoning changes, or development permitting, the municipality will review the hazard mitigation plan and other hazard analyses to ensure consistent and compatible land use.			
• Does the zoning ordinance discourage development or redevelopment within natural areas including wetlands, floodways, and floodplains?			
• Does it contain natural overlay zones that set conditions			
• Does the ordinance require developers to take additional actions to mitigate natural hazard risk?			
• Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
• Do the ordinances prohibit development within, of filling of, wetlands, floodways, and floodplains?			
Subdivision Regulations			
• Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
• Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?			
• Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
• Do the regulations allow density transfers where hazard areas exist?			
Comprehensive Plan			
• Are the goals and policies of the plan related to those of the BPUB HMP?			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Land Use			
• Does the future land use map clearly identify natural hazard areas?			
• Do the land use policies discourage development or redevelopment with natural hazard areas?			
• Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?			
Transportation Plan			
• Does the transportation plan limit access to hazard areas?			
• Is transportation policy used to guide growth to safe locations?			
• Are transportation systems designed to function under disaster conditions (e.g. evacuation)?			
Environmental Management			
• Are environmental systems that protect development from hazards identified and mapped?			
• Do environmental policies maintain and restore protective ecosystems?			
• Do environmental policies provide incentives to development that is located outside protective ecosystems?			
Grant Applications			
• Data and maps will be used as supporting documentation in grant applications.			
Municipal Ordinances			
• When updating municipal ordinances, hazard mitigation will be a priority			
Economic Development			
• Local economic development group will take into account information regarding identified			

Planning Mechanisms	Do you Do This? Yes	No	Notes: How is it being done or how will this be utilized in the future?
hazard areas when assisting new businesses in finding a location.			
Public Education and Outreach			
• Does the municipality have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events?			

7.1.2 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, if the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs, and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Team, to be held either in person or via teleconference approximately one year from the date of local adoption of this update, and successively thereafter. At least two weeks before the annual plan review meeting, the BPUB HMP Coordinator will advise Planning Team members of the meeting date, agenda and expectations of the members.

The BPUB HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and Soliciting input regarding progress toward meeting plan goals and objectives.. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the HMP and if different or additional resources are now available.
- Actions were cost effective.
- Schedules and budgets are feasible.
- Implementation problems, such as technical, political, legal or coordination issues with other agencies are presents.
- Outcomes have occurred as expected.
- Changes in planning area resources impacted plan implementation (e.g., funding, personnel, and equipment)
- New agencies/departments/staff should be included, including other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Team will review the mitigation goals, objectives, and activities using performance-based indicators, including:

- New agencies/departments
- Project completion
- Under/over spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead/support agency commitment
- Resources
- Feasibility

Finally, the Planning Team will evaluate how other programs and policies have conflicted or augmented planned or implemented measures, and shall identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions ("Implementation of Mitigation Plan through Existing Programs" subsection later in this section discusses this process). Other programs and policies can include those that address:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and/or safety
- Recreation
- Land use/zoning
- Public education and outreach
- Transportation

The Planning Team should refer to the evaluation forms, Worksheets #2 and #4 in the FEMA 386-4 guidance document, to assist in the evaluation process (see Appendix F – Plan Maintenance). Further, the Planning Team should refer to any process and plan review deliverables developed by BPUB as a part of the plan review processes established for prior or existing local HMPs within the Planning Area.

The BPUB HMP Coordinator shall be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local Planning Team members, information presented at the annual Planning Team meeting, and other information as appropriate and relevant. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP on an annual basis, the Planning Team will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report shall be posted on the BPUB's website to keep the public appraised of the plan's implementation (located at https://www.brownsville-pub.com/). Additionally, the website provides details on the HMP update planning process.

The HMP will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damages or if data listed in the Section 4.3 (Hazard Profiles) of this plan has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.1.3 Updating

To facilitate the update process, the BPUB HMP Coordinator, with support of the Planning Team, shall use the second annual meeting to develop and commence the implementation of a detailed plan update program. The BPUB HMP Coordinator shall invite representatives from TDEM to this meeting to provide guidance on plan update procedures. This program shall, at a minimum, establish who shall be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to assure that the update is completed according to regulatory requirements.

At this meeting, the Planning Team shall determine what resources will be needed to complete the update. The BPUB HMP Coordinator shall be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to all planning group members and the State of Texas State Hazard Mitigation Officer.

7.1.4 Grant Monitoring and Coordination

Brownsville Public Utilities Board and the City of Brownsville recognize the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities and identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each municipal partner as part of their annual progress reporting. The BPUB HMP Coordinator will keep the planning partners apprised of FEMA Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Brownsville Public Utilities Board and the City of Brownsville intends to be a resource to the Planning Team in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during open windows for grant applications. As part of grant monitoring and coordination, the Planning Team intends to provide the following:

- Notification to planning partners about impending grant opportunities.
- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration.
- Notification about mitigation priorities for the fiscal year to assist the planning partners in the selection of appropriate projects.

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

7.2 Implementation of Mitigation Plan Through Existing Programs

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the Planning Area there are many existing plans and programs that support hazard risk management, and thus it is critical that this hazard mitigation plan integrate and coordinate with, and complement, those existing plans and programs.

Section 5 (Capability Assessment) provides a summary and description of the existing plans, programs and regulatory mechanisms at all levels of government (federal, state, county and local) that support hazard mitigation within the Planning Area. Within each jurisdictional annex in Section 9 (Jurisdictional Annexes), BPUB and the City of Brownsville identified how each capability reduces risk and how they are integrating hazard risk management into their existing planning, regulatory, and operational/administrative framework. If they are currently not showing this, they indicate how they intend to promote this integration.

It is the intention of Planning Team representatives to continue to incorporate mitigation planning as an integral component of daily government operations. The Planning Team representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. Further, the sample adoption resolution (Appendix A [Adoption Resolutions]) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Team anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts;
- The Hazard Mitigation Plan, Master Plans, Emergency Operations Plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of planning area residents.

Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Emergency operations and response plans;
- Training and exercise of emergency response plans;
- Debris management plans;
- Recovery plans;
- Capital improvement programs;
- Municipal codes;
- Community design guidelines;
- Water-efficient landscape design guidelines;
- Stormwater management programs;
- Water system vulnerability assessments;
- Community Wildfire Protection Plans;
- Comprehensive Flood Hazard Management Plans;

- Resiliency plans;
- Community Development Block Grant-Disaster Recovery action plans; and
- Public information/education plans.

Some action items do not need to be implemented through regulation. Instead, these items can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Team representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

7.3 Continued Public Involvement

BPUB and the City of Brownsville are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on-line: https://www.brownsville-pub.com/

In addition, public outreach and dissemination of the HMP will include:

- Links to the plan on municipal websites of each jurisdiction with capability.
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms. Educate the public via the jurisdictional websites on how these applications can be used in an emergency situation.
- Development of annual articles or workshops on flood hazards to educate the public and keep them aware of the dangers of flooding

The Planning Team and the BPUB HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The BPUB HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. Additional meetings might also be held as deemed necessary by the planning group. The purpose of these meeting would be to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The Planning Team shall be responsible to assure that:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the HMP.

- Appropriate links to the BPUB Hazard Mitigation Plan are included on municipal websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during HMP update cycles.

The BPUB HMP Coordinator shall be responsible to assure that:

- Public and stakeholder comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan are available for review at appropriate planning area facilities along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, are made as appropriate to inform the public of the availability of the plan, particularly during plan update cycles.

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Section 3 – Community Profile

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Section 4.2 – Methodology

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Section 5 – Capability Assessment

Section 6 – Mitigation Strategy

Section 7 – Plan Maintenance

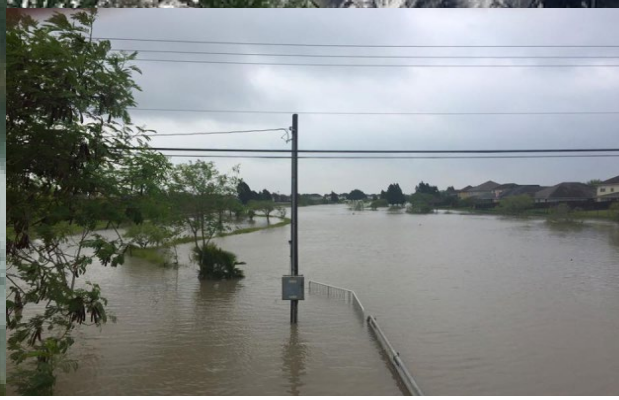
Section 8 – Planning Partnership

Section 9 – Jurisdictional Annexes

Brownsville Public Utilities Board

2022 Hazard Mitigation Action Plan

Participating Planning Partner: City of Brownsville



Agency Review Draft

Appendices

April 2022

TETRA TECH

BROWNSVILLE PUBLIC UTILITIES BOARD

APPENDIX A. ADOPTION RESOLUTIONS

Brownsville Public Utilities Board (BPUB) and the City of Brownsville adoption resolutions will be included in this appendix upon receipt of the Federal Emergency Management Agency (FEMA) Approval Pending Adoption (APA) status. This appendix also includes an example resolution to be submitted by BPUB and the City authorizing adoption of the Brownsville Public Utilities Board Hazard Mitigation Plan Update.

RESOLUTION NO. 2022-080
A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF BROWNSVILLE AUTHORIZING THE ADOPTION OF THE BROWNSVILLE PUBLIC UTILITIES BOARD 2022 HAZARD MITIGATION ACTION PLAN

WHEREAS, all of the Brownsville Public Utilities Board Planning Area has exposure to natural hazards that increase the risk to life, property, environment, and the local economy; and

WHEREAS, pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS, a coalition of Brownsville Public Utilities Board Planning Area stakeholders with like planning objectives has been formed to pool resources and create consistent mitigation strategies to be implemented within each partners identified capabilities, within the Brownsville Public Utilities Board Planning Area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating, and revising this strategy.

NOW, THEREFORE, BE IT RESOLVED that the City of Brownsville:

1) Adopts in its entirety the Brownsville Public Utilities Board 2022 Hazard Mitigation Action Plan.
2) Will use the adopted and approved portions of the Hazard Mitigation Action Plan to guide pre- and post- disaster mitigation of the hazards identified.
3) Will coordinate the strategies identified in the Hazard Mitigation Plan with other planning programs and mechanisms under its jurisdictional authority.
4) Will continue its support of mitigation efforts and continue to participate in the Planning Partnership as described by the Hazard Mitigation Action Plan.
5) Will help to promote and support the mitigation successes of all participants in this Plan.
6) Will incorporated mitigation planning as an integral component of government and partner operations.
7) Will provide an update of the Plan in conjunction with the Planning Partnership no less than every five years.

PASSED AND ADOPTED on this November 15, 2022, by the following vote:

AYES: NOES:

ABSENT: ABSTAIN:

Juan "Trey" Mendez
Mayor

ATTEST: _____
Yolanda Galaraza-Gomez
Interim City Secretary

CITY OF BROWNSVILLE INCORPORATED TEXAS FEBRUARY 7 1853

RESOLUTION No. 2022-1010 (IC-2)

A RESOLUTION AUTHORIZING BROWNSVILLE PUBLIC UTILITIES BOARD ("BPUB") ADOPTION OF THE BPUB 2022 HAZARD MITIGATION ACTION PLAN

WHEREAS, the City of Brownsville, Texas is an incorporated City located within Cameron County, Texas, operating under a home rule Charter adopted pursuant to Article XI, Section 5 of the Texas Constitution, and, pursuant to the City of Brownsville's Home Rule Charter, the City's combined electric, water and wastewater utility system is managed, operated and maintained by the Public Utilities Board of the City of Brownsville, Texas (the "BPUB"); and,

WHEREAS, all of the Brownsville Public Utilities Board Planning Area has exposure to natural hazards that increase the risk to life, property, environment, and the local economy; and

WHEREAS, pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre- and post-disaster hazard mitigation programs; and

WHEREAS, a coalition of Brownsville Public Utilities Board Planning Area stakeholders with like planning objectives has been formed to pool resources and create consistent mitigation strategies to be implemented within each partner's identified capabilities, within the Brownsville Public Utilities Board Planning Area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating, and revising this strategy.

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE PUBLIC UTILITIES BOARD OF THE CITY OF BROWNSVILLE, TEXAS THAT:

Section 1. BPUB adopts in its entirety the Brownsville Public Utilities Board 2022 Hazard Mitigation Action Plan, which replaces the Brownsville Public Utilities Board 2015 Hazard Mitigation Action Plan.

Section 2. BPUB will use the adopted and approved portions of the Hazard Mitigation Action Plan to guide pre- and post- disaster mitigation of the hazards identified.

Section 3. BPUB will coordinate the strategies identified in the Hazard Mitigation Plan with other planning programs and mechanisms under its jurisdictional authority.

Section 4. BPUB will continue its support of mitigation efforts and continue to participate in the Planning Partnership as described by the Hazard Mitigation Action Plan.

Section 5. BPUB will help to promote and support the mitigation successes of all participants in this Plan.

Section 6. BPUB will incorporate mitigation planning as an integral component of government and partner operations.

Section 7. BPUB will provide an update of the Plan in conjunction with the Planning Partnership no less than every five years.

Section 8. The BPUB GM and CEO is authorized and directed to prudently provide such other and further administrative, accounting, legal and other incidental resources required, based upon his responsible discretion, to effectively implement the general intent of this enabling Resolution.

PASSED and APPROVED this 10th day of October 2022.

Sandra A. Saenz
BPUB Board Chairwoman

Attest:

Sandra Lopez-Langley
BPUB Board Secretary

RESOLUTION NO. XXXX-XX
A RESOLUTION OF THE Governing Body OF THE Jurisdiction Name
AUTHORIZING THE ADOPTION OF THE
2022 BROWNSVILLE PUBLIC UTILITIES BOARD HAZARD MITIGATION ACTION PLAN UPDATE

WHEREAS, Brownsville Public Utilities Board and the City of Brownsville have exposure to natural hazards that increase the risk to life, property, environment, and the County and local economy; and

WHEREAS; pro-active mitigation of known hazards before a disaster event can reduce or eliminate long-term risk to life and property; and

WHEREAS, The Disaster Mitigation Act of 2000 (Public Law 106-390) established new requirements for pre and post disaster hazard mitigation programs; and

WHEREAS; a coalition between the Brownsville Public Utilities Board and the City of Brownsville with like planning objectives has been formed to pool resources and create consistent mitigation strategies within the Planning Area; and

WHEREAS, the coalition has completed a planning process that engages the public, assesses the risk and vulnerability to the impacts of natural hazards, develops a mitigation strategy consistent with a set of uniform goals and objectives, and creates a plan for implementing, evaluating and revising this strategy;

NOW, THEREFORE, BE IT RESOLVED that the [**jurisdiction name]**:

1) Adopts in its entirety, the 2022 Brownsville Public Utilities Board Hazard Action Mitigation Plan Update (the "Plan") as the jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions identified in the Plan that pertain to this jurisdiction.

2) Will use the adopted and approved portions of the Plan to guide pre- and post-disaster mitigation of the hazards identified.

3) Will coordinate the strategies identified in the Plan with other planning programs and mechanisms under its jurisdictional authority.

4) Will continue its support of the Planning Team as described within the Plan.

5) Will help to promote and support the mitigation successes of all participants in this Plan.

6) Will incorporate mitigation planning as an integral component of government and partner operations.

7) Will provide an update of the Plan in conjunction with the County no less than every five years.

PASSED AND ADOPTED on this Xst, Xnd, Xrd, Xth day of MONTH, YEAR, by the following vote:

AYES:

NOES:

ABSENT:

ABSTAIN:

_____

Mayor, City/Village of _____

ATTEST: _____

Clerk, City/Village of _____

APPENDIX B. PARTICIPATION MATRIX

The matrix in Appendix B is intended to give a broad overview of FEMA, the State of Texas, county, municipal and stakeholder personnel that participated in the Brownsville Public Utilities Board HMP update planning process. Meeting attendees and input provided are also included. All participants were encouraged to attend the kick-off meeting and mitigation workshop. During the planning process the consultant contacted each participant to offer support, explain the process, and facilitate the submittal and review of critical documents.

Participation is defined as having input to the hazard analysis (providing critical facility, hazard event, vulnerability data), and as having participated in the mitigation workshop or alternate annex meetings as described in the HMP for the purpose of creating a mitigation strategy to be included in each jurisdictional annex in Section 9. A list of participating jurisdictions and representatives is found in Table B-1.

A number of stakeholders were invited to participate in the planning process. Stakeholders were invited to meetings, asked to complete a stakeholder survey, requested to provide input on their involvement in Planning Area, and review and comment on the draft plan. However, due to the limitations on participation posed by the pandemic starting in 2020 and the strains on time and resources for many local governments and other community organizations, participation of stakeholders at the municipal level was limited. In accordance with FEMA guiding principles for inclusive participation at various levels, the planning team will place a high priority on an expanded effort on stakeholder participation with local planning committees in future plan updates. A list of stakeholders and their participation is found in Table B-2.

In preparation for the draft plan public review, each jurisdiction was asked to have their 'mitigation team' review their annex to ensure it was complete and accurate for posting to Brownsville Public Utilities Board HMP website (https://www.brownsvillepub-hmp.com/).

Table B-1. Participation Matrix

Jurisdiction	Name	Title / Position	Attended Pre-Kick Off Meeting (6/30/21)	Attended PT Mtg #1 (08/2/21)	Attended PT Mtg #2 (10/07/21)	Attended City Commission Mtg (10/19/21)	Attended Risk Assessment (12/08/21)	Attended MAW (01/26/22)	Attended Draft Plan Presentation (3/23/22)	Feedback Provided	Planning Team Member
Brownsville PUB	George Rangel	Fiscal Manager	X		X		X	X	X		X
Brownsville PUB	Conrad Taylor	Grants Coordinator	X	X	X		X	X	X		X
Brownsville PUB	Lina Alvarez	Energy Risk Manager		X			X				X
Brownsville PUB	Jose Armando Garza	Water Treatment Manager		X							X
Brownsville PUB	Hazael Becerra	GIS Manager		X			X	X			X
Brownsville PUB	Jaime Estrada	Director Of Operational Support Services									X
Brownsville PUB	Ryan Greenfield	Public Relations Manager					X		X		X
Brownsville PUB	Jacob Galvan	W/WW Operator Chief					X	X	X		X
Brownsville PUB	Ruben Cano	Smart Grid Applications Manager			X						
City of Brownsville	Samantha Cienfuegos	Grant Writer						X			
City of Brownsville	Rene Tabarez Jr.	EM Planner, Brownsville Emergency Management			X		X	X	X		
City of Brownsville	Odee Ann Leal	Emergency Mgt. Director						X	X		X
City of Brownsville	Athena Bournakis	Grant Manager						X			
City of Brownsville	Doroteo Garcia, Jr.	Engineering and Public Works		X				X			X
City of Brownsville	Felipe Romero	Director of Communications and Public Relations			X						
City of Brownsville	Noel Bernal	City Manager			X	X		X	X		X
City of Brownsville	Rick Vasquez	Planning and redevelopment Director									X
City of Brownsville	Tina Garza	GIS		X							X
City of Brownsville	Olga Moya	Grant Manager			X		X	X	X		X
City of Brownsville	Eryka Duberney	Grant Analyst		X			X	X			X
City of Brownsville	Cynthia Vidal	EM Preparedness Coordinator			X			X	X		
City of Brownsville	Brittney Moreno	Communications Specialist			X						
City of Brownsville	Dorene Fourar	Public Engagement Coordinator			X						
Tetra Tech	Heather Apgar	Project Manager	X	X	X	X	X	X	X		
Tetra Tech	Megan Brotherton	Planner		X	X		X	X	X		
Tetra Tech	Kate Long	Lead Planner		X	X						
Tetra Tech	Cynthia Bianco	Planner	X								
Tetra Tech	Chrissie Angeletti	Planner	X								

Table B-2. Stakeholder Participation Matrix

Organization/Title	Stakeholder Type	Notified of Planning Process	Invited to Meetings	Attended Meetings	Invited to Take Survey	Completed Survey	Notified of Posting of Draft Plan
Brownsville Independent School District	Academia	X	X		X		X
Southern Careers Institute – Brownsville Campus	Academia	X	X		X		X
University of Texas Rio Grande Valley - Brownsville	Academia	X	X		X		X
Port of Brownsville	Business	X	X		X	X	X
Brownsville Chamber of Commerce	Business	X	X		X		X
National Weather Service	Government	X	X		X		X
Alta Vista Rehabilitation & Healthcare	Healthcare	X	X		X		X
City of Los Fresnos – Emergency Management	Neighbor	X	X		X		X
City of South Padre Island – Emergency Management	Neighbor	X	X		X		X
City of South Padre Island – Planning Dept.	Neighbor	X	X		X		X
City of San Benito – Emergency Management	Neighbor	X	X		X		X
Cameron County – Emergency Management	Neighbor	X	X		X		X
City of Port Isabel – Public Safety	Neighbor	X	X		X		X
Tip of Texas Family Outreach	Non-Profit	X	X		X		X
B-Metro	Transportation	X	X		X		X
Brownsville South Padre Island International Airport	Transportation	X	X		X		X
Cameron County Drain District #1	Utilities	X	X		X		X
Brownsville Irrigation District	Utilities	X	X		X		X

APPENDIX C. MEETING DOCUMENTATION

Appendix C includes meeting agendas, sign-in sheets and minutes (where applicable and available) for meetings convened during the development of the Brownsville Public Utilities Board Hazard Mitigation Plan Update.

Brownsville Public Utilities Board HMP
Pre-Kick-Off Meeting - Agenda
June 30, 2021

1. **Meeting Goals:** Agree on draft workplan and schedule; determine degree of support for CRS credits; confirm SOW and additional items; agree on areas to expedite; agree on schedule drivers; confirm County and Tt responsibilities

2. **Introductions**

3. **Schedule – 15 month schedule starting June 15, 2021**
    - Overview – Key Milestones
        - Hazards of concern to be addressed by the HMAP Update
        - Establishing goals and objectives for the HMAP Update
        - Defining critical facilities and infrastructure within the BPUB planning area
        - Review of the risk assessment results
        - Implement the public engagement strategy tailored to the capabilities of the BPUB
        - Review and define core capabilities for the BPUB
        - Develop a comprehensive range of mitigation actions and alternatives
        - Confirmation of a maintenance strategy for the HMAP and any future Updates
        - Public review of the draft HMAP Update
        - Adoption of the approved FEMA HMAP Update by the BPUB
    - Core Planning Team (CPT) meetings – Bi-weekly? Monthly?
    - Kick-Off meeting
        - Planning Partnership – BPUB and City of Brownsville
    - Public meetings

4. **Data Collection**
    - Grant agreement from TDEM and FEMA – BPUB provided
        - POP ends January 13, 2024
    - FEMA Plan Review Tool from previous plan
    - Worksheets
        - Because the 2015 plan was not a Tt plan, we suggest using worksheets to obtain information to update the plan (e.g. capabilities, vulnerable areas, etc.)
        - Tetra Tech will provide drafts to BPUB for review/input
    - Critical Facility Inventory – last plan deliverable available?
    - Data Wish List
        - Who should we have our GIS staff reach out to for data?
    - NFIP Data Request
        - BPUB will need to request from FEMA; Tt will provide instructions on how to request
    - FEMA CAV request
        - BPUB will need to request from TDEM; Tt will provide instructions on how to request
    - Dam request – are there dams in Brownsville?
        - If dams, BPUB will need to request data from the State
    - HMP website

- Tt can set up a project-specific website or we can provide content for the BPUB website

5. Hazards of Concern Identification

- BPUB will need to consider all hazards included in the 2019 State HMP; however, if they do not apply to BPUB, we will have a statement that says it is not an identified hazard and will not be profiled.
- For every hazard of concern, a mitigation action is required
- Tt suggests the following (but will confirm with the Planning Partnership during their kick-off meeting):

2015 HMP	2019 State HMP	2021 Cameron County HMP	2021 County HMP Update
Flood	Severe Coastal Flooding	Flood	Flood – riverine, flash, and stormwater
	Riverine Flooding		
Drought	Drought	Drought	Drought
Hurricane	Hurricanes, Tropical Storms and Depressions	Hurricane Wind	Hurricane and Tropical Storms
Extreme Heat	Extreme Heat	Extreme Heat	
Tornado	Tornadoes	Tornado	Tornado
Thunderstorm	High Wind	Thunderstorm Wind	Thunderstorm Wind
Hail	Hailstorms	Hail	Hail
Wildfire	Wildfire	Wildfire	Wildfire
Dam Failure	Dam/Levee Failure	Dam and Levee Failure	Dam and Levee Failure
Winter Storm	Winter Weather	Winter Storm	Winter Weather
Earthquake	Earthquakes	-	Earthquake
-	Extreme Cold	-	-
-	Coastal Erosion	Coastal Erosion	-
-	Inland Erosion	-	-
-	Expansive Soils	-	-
-	Severe Winds	-	*Identified as thunderstorm wind*
-	Lightning	Lightning	Lightning
-	Land Subsidence	-	-
-	-	-	Disease Outbreak/Pandemic

6. Public and Stakeholder Outreach

- Planning Partnership – *please provide contacts for who will be working on the plan*
  - BPUB
  - City of Brownsville
- Stakeholders –
  - Tetra Tech put together a list of potential stakeholders; we will send to the County for review and input
- Overview handout review and approval
  - Social media posts and graphics
  - HMP brochure
  - Website content

7. Work Plan

- Current plan is expired
    - If BPUB wants to submit FMA or BRIC applications in the fall, then they should prepare a letter of extraordinary circumstances and submit to TDEM and FEMA – this needs to be done ASAP
        - Tt will provide draft language
    - If BPUB will not be submitting FEMA applications this year, then no need for the LOE
    - If BPUB will be submitting FEMA applications this year, the plan needs to be reviewed by TDEM by October and approved by FEMA by December.

8. Next Steps

- Will BPUB send out meeting invites, etc. out or would they like Tt to do on their behalf? If Tt will be sending out, BPUB should send out the first email as an introduction.
- Does BPUB have a specific style/format they would like to see the HMP done in?
- Identify project timeline; Tt will put together meeting dates and BPUB will confirm
- Development of a clear outreach strategy to actively engage the public and stakeholders
- Critical Facilities
    - Once we receive data from BPUB, we will put together a list of critical facilities for BPUB to review
    - We can use an online survey (Survey 123) to help identify critical facilities
    - We will use the FEMA Community Lifelines to help align with the *National Response Framework* and future BRIC applications
- Analyze development trends - municipal level
    - Any major development that occurred since 2016
    - Number of new construction permits issued
    - Any proposed development
    - We will use an online survey (Survey 123) to help collect this information
- Create a clear and focused mitigation strategy, including a minimum of two mitigation actions per municipality.
- Streamline plan profiles and annexes, as appropriate.

Purpose of Meeting:	Pre kick-off
Location of Meeting:	Teleconference
Date of Meeting:	May 10, 2021 | 2:00 pm – 3:00 pm

Attendees:
George Rangel, BPUB
Conrad Taylor, BPUB
Heather Apgar, Tetra Tech
Cynthia Bianco, Tetra Tech
Chrissie Angeletti, Tetra Tech

Agenda Summary:

Item No.	Description	Action item(s):
1	Introductions • George Rangel is the fiscal manager for BPUB and oversees accounting and grant management • Conrad Taylor is the grand coordinator for BPUB and develops grant applications and manages grants • Tetra Tech – Heather Apgar, Cynthia Bianco, and Chrissie Angeletti	None
2	Contract • A 2nd addendum will be developed to includes an updated cost and new 2 CFR 200 terms. • Tetra Tech will finalize the addendum to send to BPUB. Once signed, it will begin a 15 month schedule to complete the plan	Tt to finalize contract and send to BPUB

3	Roles and Responsibilities
	• Tetra Tech discussed the different committees that make up the planning partnership
	  ○ Core Planning Team – BPUB and Tetra Tech
	  ▪ Tetra Tech suggested a GIS representative to sit in on a few meetings to get an understanding of information and data needed
	  ○ Steering Committee – BPUB and City of Brownsfield
	  ▪ Departments that should sit on this committee include: OEM, public works, public information officer, planning, engineering, etc.
	  ▪ Local school district may or may not participate; if they choose to join, they can do so later on.
	  ○ Stakeholders should include police, fire, hospitals/health care, non-profits, major employers, schools/universities, TDEM public assistance, Cameron County, etc.
		Tt to provide G. Rangel and C. Taylor a list of people and departments that should be on the steering committee and stakeholders. Tt will provide the different responsibilities of each committee. Tt will provide data wish list to BPUB.

4	Existing Plans • BPUB's last HMP expired in August 2020 and included BPUB and the City	Tt to review 2020 HMP

	• Several of the mitigation actions identified in the last HMP have been completed	
5	Existing Vulnerabilities/Primary Concerns • BPUB wants to pursue BRIC funds this year; in order to do so, the HMP will need to be expedited in order to meet this request. Plan would need to be approved by FEMA before late-January 2022	Once TDEM kick-off meeting with BPUB, Tt will confirm schedule
6	Public Outreach • Public engagement is a key component to the planning process • Tetra Tech has developed several interactive tools to enhance participation while meeting remotely, including project-specific websites, text and graphics for social media, etc.	Tt will send BPUB examples of the website; Tt to set up website for plan
7	Schedule • Once TDEM kick-off meeting with BPUB, Tt will confirm project schedule • The plan will be done on a 15-month schedule; however, if BPUB wants to apply for BRIC funding this year, the schedule will need to expedited. • BPUB has not had a kick-off meeting with TDEM yet • Meetings will be held virtually at this time	BPUB to invite Tt to call with TDEM

Brownsville Public Utilities Board – 2022 Hazard Mitigation Plan Update
Planning Team Meeting #1 | August 12, 2021 | 2:00 pm CST

Virtual Meeting
Join by Computer: https://bit.ly/3iEaVyZ
Or
Dial-in Number (toll): 646-751-8477 | Conference ID: 737 224 551#

1. **Welcome and Introductions**

2. **Benefits of Hazard Mitigation and Overview**
   - Purpose and expected outcomes of the Hazard Mitigation Plan
   - 2022 enhancements

3. **Project Organization**
   - Key Agencies
   - Stakeholders

4. **Planning Team Roles and Responsibilities**

5. **Public and Stakeholder Outreach**
   - Strategy – press releases, social media posts, capture of miscellaneous outreach, HMP website
   - Tracking

6. **Data Collection Status**

7. **Hazards of Concern Identification**

8. **Critical Facilities and Lifelines**

9. **Goals and Objectives**

10. **Schedule**
    - Overview and Milestones
    - Meeting Schedule

11. **Questions / Wrap-Up**

Brownsville Public Utilities Board – 2022 Hazard Mitigation Plan Update
Planning Team Meeting #1 | August 12, 2021

Purpose of Meeting:	Planning Team Meeting #1
Location of Meeting:	Microsoft Teams
Date/Time of Meeting:	August 12, 2021 – 2:00 pm to 3:00 pm

Attendees:	BPUB	City of Brownsville	Tetra Tech
	Conrad Taylor, Grants Coordinator	Doroteo Garcia, Jr., Engineering and Public Works	Heather Apgar
	Lina Alvarez	Tina Garza, GIS	Kate Long
	Jose Armando Garza	Eryka Duberney	Megan Brotherton
	Hazael Becerra, GIS		

Agenda Summary: Introduce Planning Team to the HMP update process, discuss mitigation planning, project organization, roles and responsibilities, data collection, hazards of concern, and schedule of plan.

Item No.	Description	Action By:
1.	**Welcome and Introductions** • Tetra Tech started the meeting by introducing themselves and asking everyone to document their attendance in the meeting chat.	N/A
2.	**Benefits of Hazard Mitigation and Overview** • Hazard mitigation is part of the emergency management cycle – it's any sustained action(s) taken to reduce or eliminate long-term risk to life and property from hazards. • This is the required 5-year update to the 2015 HMP; participating and adopting the HMP allows you to remain eligible for FEMA pre- and post-disaster mitigation funding. • 2022 Update enhancements – annex approach and will work with BPUB and the City to develop their own chapter of the HMP update.	N/A
3.	**Project Organization and Overview** • The planning team is made up of representatives from both BPUB and the City. They will be responsible for providing guidance and leadership throughout the planning process. o Responsibilities also include attending meetings, providing Tetra Tech with information, and reviewing draft sections of the plan. • Stakeholders will be invited to attend meetings, complete surveys, etc. They will help us learn about more specific topics about the planning area and identify potential mitigation actions. • Presented the schedule of the planning process with an approval date of June 2022 (depending on schedule and TDEM/FEMA review). • Since the plan is expired, if BPUB or the City want to submit FEMA HMA grant applications for this year, they will need to prepare a letter of extraordinary circumstances and let TDEM know.	Tt to send the list of stakeholders to the Planning Team for their review and comment
4.	**Public and Stakeholder Outreach** • Public outreach is a key element in the HMP process and one of the requirements of the planning process. • Tetra Tech will be sending social media text and graphics to the Planning Team to post on their websites and social media accounts. A project-specific website is being set up as well.	Tt will send social media text and graphics to the Planning Team

5.	Hazards of Concern Identification • The list of hazards from the last plan was presented to the Planning Team and then the list of suggested hazards for the 2022 update. Tetra Tech will develop a survey to collect input from the Planning Team to finalize the list of hazards of concern.	Tt to send hazard of concern survey; Planning Team to complete survey by 9/8/21
6.	Critical Facilities and Lifelines • Tetra Tech asked the Planning Team what types of facilities should we include as critical facilities. Once the critical facility list is put together, the Planning Team will be asked to review and add facilities as needed.	Planning Team to review critical facility lists after Tt sends out.
7.	Goals and Objectives • The Planning Team will need to review the goals and objectives from the 2015 HMP and update as needed. Tetra Tech will send out a survey to collect input and finalize the goals and objectives for the 2022 update.	Tt to send goals and objectives survey; Planning Team to complete survey by 9/8/21
8.	Schedule • Organize resources August 2021 • Annex training mid-September 2021 • Risk assessment September-November 2021 • Mitigation strategy – January 2022 • Maintenance strategy – February 2022 • Public draft April 2022 • TDEM – May 2022 • FEMA – June 2022 • Adoption – July 2022	N/A
9.	Questions/Wrap Up	N/A

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Brownsville Public Utilities Board Hazard Mitigation Plan – 2022 Update

Planning Team Kick-Off Meeting | August 12, 2021

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2

Agenda

BROWNSVILLE PUBLIC UTILITIES BOARD

- Welcome and Introductions
- Benefits of Hazard Mitigation
- Hazard Mitigation Planning Overview
- Project Organization
- Planning Team Responsibilities
- Public and Stakeholder Outreach
- Update Hazards of Concern and Risk Assessment
- Critical Facilities and Lifelines
- Goals and Objectives
- Schedule
- Questions/Next Steps/Wrap Up

3

Hazard Mitigation – What is it?

Mitigation is a sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event

-or-

Any action taken to reduce future disaster losses

"provides the blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and local ability…" (CFR).

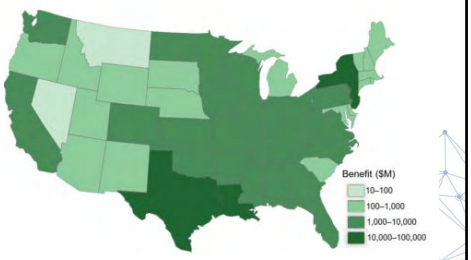
4

Hazard Mitigation Works!

- According to the January 2019 National Institute of Building Sciences Natural Hazard Mitigation Saves: 2018 Interim Report, federal mitigation grants save $6 for every $1 spent!

Mitigation saves in every in state! Texas has saved at least $10 billion in benefits.

National Benefit-Cost Ratio Per Peril *BCR numbers in this study have been rounded	Federally Funded
Overall Hazard Benefit-Cost Ratio	6:1
Riverine Flood	7:1
Hurricane Surge	Too few grants
Wind	5:1
Earthquake	3:1
Wildland-Urban Interface Fire	3:1



5

Why Update?

- To remain eligible for pre- and post-disaster mitigation funding, FEMA requires anyone with an approved HMP to update it every 5 years.
- Updating the plan helps us re-evaluate our risk and identify any new risks or vulnerabilities.
  - New information, data and studies are always coming in – so we will use that to help us update as well (e.g., hazard maps, event history, change in population, etc.)
- The mitigation plan update will:
  - Help Brownsville prepare for and mitigate the effects of hazards
  - Continue to allow Brownsville Public Utilities Board and participating partners to be eligible for pre- and post-disaster mitigation funding
  - Support CRS participation/rating of municipalities

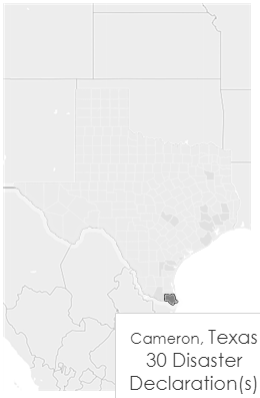
6

What's at Risk?

- FEMA Disaster Declarations

Year of Declaration Date	Declaration Title	Disaster Number
1967	HURRICANE BEULAH	232
1971	HEAVY RAINS, HIGH WINDS & FLOODING	313
1980	HURRICANE ALLEN	627
1984	SEVERE FREEZING WEATHER	696
	SEVERE STORMS & FLOODING	726
1988	HURRICANE GILBERT	816
1990	SEVERE FREEZE	850
1991	SEVERE STORMS, TORNADOES & FLOODING	900
1998	TROPICAL STORM CHARLEY	1239
1999	HURRICANE BRET	1287
2002	SEVERE STORMS, TORNADOES AND FLOODING	1439
2003	LOSS OF THE SPACE SHUTTLE COLUMBIA	3171
2005	HURRICANE KATRINA EVACUATION	3216
	HURRICANE RITA	1606
		3261
2006	EXTREME WILDFIRE THREAT	1624
2007	HURRICANE DEAN	3277
2008	HURRICANE DOLLY	1780
	HURRICANE GUSTAV	3290
	HURRICANE IKE	3294
	WILDFIRES	3284
2010	HURRICANE ALEX	1931
	TROPICAL STORM ALEX	3313
2015	SEVERE STORMS, TORNADOES, STRAIGHT-LINE WINDS, AND..	4245
2016	SEVERE STORMS AND FLOODING	4377
2019	SEVERE STORMS AND FLOODING	4454
2020	COVID-19	3458
	COVID-19 PANDEMIC	4485
	HURRICANE HANNA	3530
	TROPICAL STORMS MARCO AND LAURA	3540

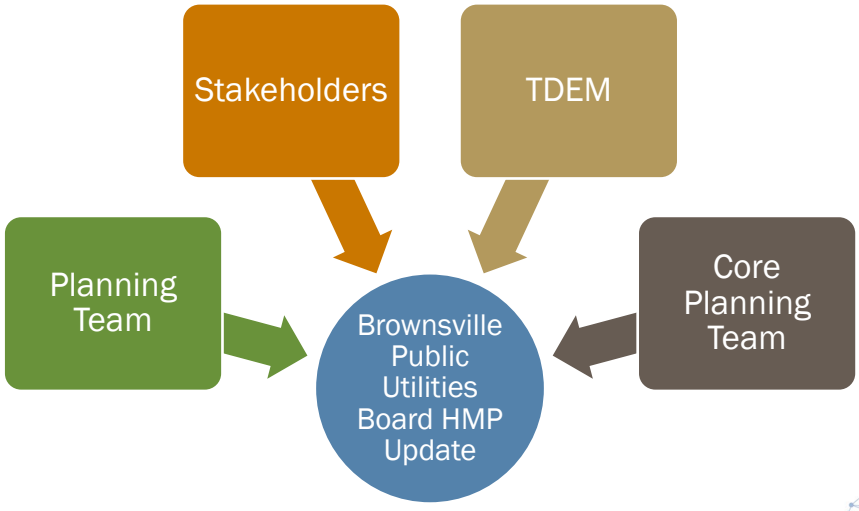
15 Hurricane
4 Flood
4 Severe Storm(s)
2 Biological
2 Fire
2 Freezing
1 Other



Cameron, Texas
30 Disaster Declaration(s)

7

Project Organization



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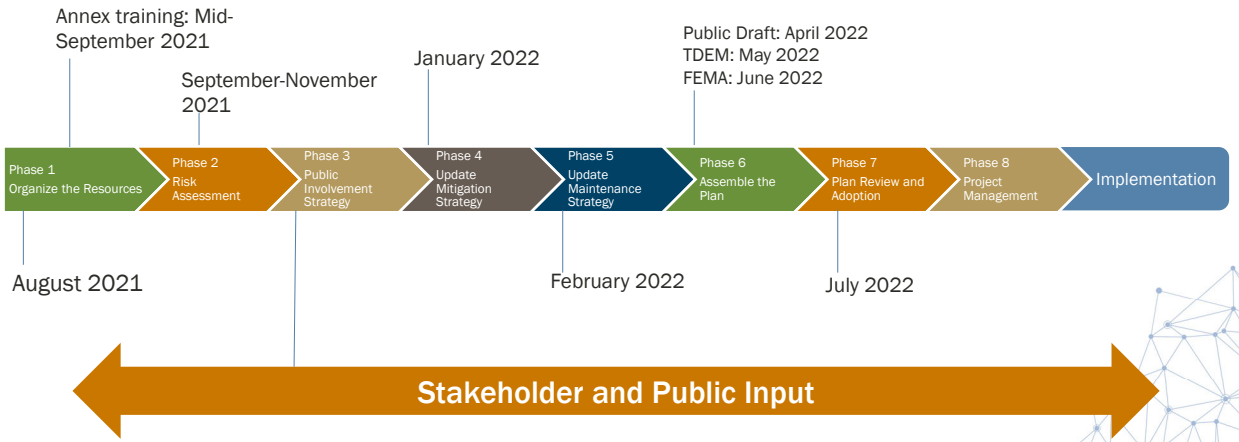
Planning Process Overview



9

Public and Stakeholder Outreach

- We are working on developing a website just for the HMP – once it's up and running, we will send out to everyone
- Social Media – we will provide a series of graphics and text that you can use to help us get the word out about the HMP
- Stakeholder Survey – we will send this to all identified stakeholders to help us get an understanding of how they are involved in hazard mitigation
- Public Survey – this will help us get input and feedback from residents in the area
- Neighboring Community Outreach –
  - Notified of planning process
  - Survey

10

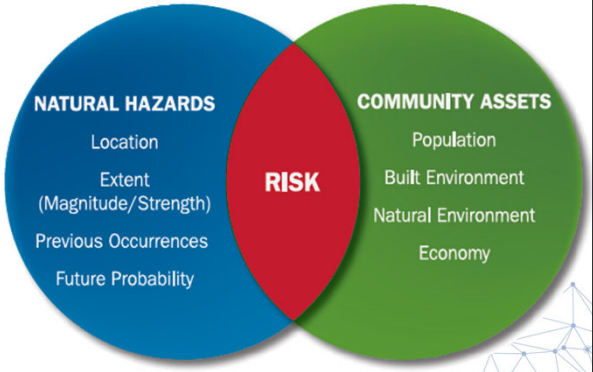
Project Scope

- Update the Risk Assessment – what's at risk?
- Update the Capabilities Assessment – what tools do you have in place that integrate hazard mitigation? What do you have available to help your community in the event of a disaster?
- Update the Mitigation Strategy – review and update previous actions; develop new actions
- Update Other Sections of the HMP
- Submit the HMP for Review
- Adopt the HMP
- Implement the HMP

11

Update Risk Assessment

- Update assets
- Examine previous impacts
- Analyze risks
- Review with Planning Team
- Risk assessment meeting – November/ December 2021



12

2015 Hazards of Concern

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Flood
- Hail
- Hurricane Wind
- Thunderstorm
- Tornado
- Wildfire
- Winter Storm

13

Potential 2022 Hazards of Concern

- Dam and Levee Failure
- Disease Outbreak
- Drought
- Earthquake
- Erosion (coastal and inland)
- Extreme Heat
- Flood (riverine, coastal, flash, stormwater)
- Hail
- Hurricane/Tropical Storm
- Lightning
- Thunderstorm Wind
- Tornado
- Wildfire
- Winter Storm

14

Community Lifelines

- Review 2015 critical facility inventory to ensure complete
- Crosswalk and identify lifelines

Lifelines *provide indispensable service that enables the continuous operation of critical business and government functions, and is critical to human health and safety, or economic security*

Critical Facilities *are those facilities considered critical to the health and welfare of the population and that are especially important following a hazard. As defined for this HMP, critical facilities include essential facilities, transportation systems, lifeline utility systems, high-potential loss facilities, and hazardous material facilities.*

Essential facilities *are a subset of critical facilities that include those facilities that are important to ensure a full recovery following the occurrence of a hazard event. This category is usually defined to include police, fire, EMS, schools/colleges, shelters, senior facilities, and medical facilities.*

15

Community Lifelines

- To be reviewed:
  - 911 Centers
  - Airport
  - Bridges
  - Churches
  - Communication Towers
  - Community Services
  - Detention Centers
  - Emergency Operation Centers
  - Evacuation Routes
  - Fire Stations
  - Government Buildings
  - Heliports
  - Hospitals
  - Nursing Homes
  - Parks
  - Police Stations
  - Ports
  - Public Works
  - Pump Stations
  - Schools
  - Shelters
  - Utilities
  - Wastewater Treatment Facilities
  - Water District Facilities
  - *Any suggestions?*

16

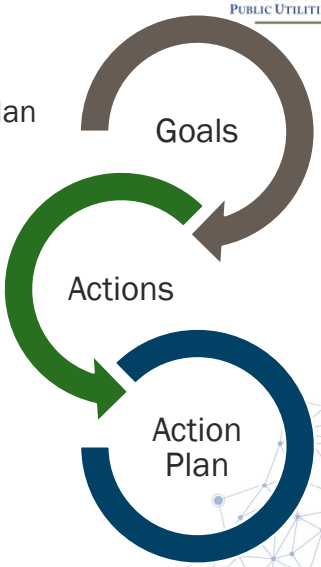
Community Lifelines

- What additional facilities and lifelines should we add? Types to consider:
  - Utility locations – substations, pump stations, treatment plants
  - Critical food establishments – food pantries, grocery stores, senior nutrition
  - COVID-19 locations – testing and vaccination sites
  - Others?

17

Mitigation Strategy

- Review and update the goals and objectives from the last plan
  - What outcomes do you want to achieve?
  - Should we include new goals?
- Determine the status of previous mitigation actions
- Identify new mitigation actions/projects
  - What specific actions will be taken to reduce risk from hazards?
  - Focus on specific, implementable and achievable actions!
- Action Plan
  - How will the actions be prioritized and implemented?



18

Goals and Objectives Review and Update

Goal/ Objective #	2015 HMP Goal Statement
1	**Protect Public Health and Safety**
1.1	Maintain critical facilities
1.2	Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
1.3	Reduce the danger to, and enhance protection of, high risk areas during hazard events.
1.4	Protect critical facilities and services.
2	**Protect new and existing properties**
2.1	Reduce repetitive losses to the National Flood Insurance Program (NFIP).
2.2	Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.
2.3	Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
3	**Build and support partnerships to enhance mitigation to continuously become less vulnerable to hazards.**
3.1	Build and support local partnerships to continuously become less vulnerable to hazards.
3.2	Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.
3.3	Build hazard mitigation concerns into the City of Brownsville and Brownsville Public Utilities Board (BPUB) planning and budgeting processes.

Goal/ Objective #	2015 HMP Goal Statement
4	**Leverage outside funds for investment in hazard mitigation.**
4.1	Maximize the use of outside sources of funding.
4.2	Maximize participation of property owners in protecting their properties.
4.3	Maximize insurance coverage to provide financial protection against hazard event.
4.4	Prioritize mitigation projects based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
5	**Increase the understanding of residents for the need for mitigation, and steps they can take to protect people and properties.**
5.1	Heighten public awareness of the full range of natural and human-made hazards they face.
5.2	Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
5.3	Publicize and encourage the adoption of appropriate hazard mitigation measures.
Additional Goals?	Address Long-Term Vulnerabilities from High Hazard Dams

19

Update Other Sections of the HMP

- Community Profile
  - Taking the previous profile from the last plan and updating it accordingly
- Planning Process
  - Documentation of the update process
- Plan Maintenance
  - Incorporation into other plans as well as identifying way to incorporate other plans into the updated HMP
  - Identify a game plan for annually reviewing and updating the HMP

20

Submit the HMP for Review

- Review Draft with Planning Team
- 14-day Public Comment Period
- Conduct Public Meeting to Review the Draft
- Submit for Texas Division of Emergency Management (TDEM) Review
  - 14 to 28 days
- Submit for Federal Emergency Management Agency (FEMA) Review
  - 45 days
- "Approvable Pending Adoption" Status

21

Adopt the HMP

- Brownsville Public Utilities Board and the City of Brownsville need to adopt the HMP
- Once FEMA approves the plan, adoption can begin
- Adoption deadline – July 2022

Implement the HMP

- Regular Planning Team meetings
- Implement mitigation actions and projects
  - Integrate actions in other areas of your community where appropriate

22

Schedule

- Planning Process
  - Planning Team Kick-Off – TODAY!
  - Annex Training – mid-September
- Update Risk Assessment
  - Data collection is underway
  - Begin vulnerability assessment
  - Planning Team Risk Assessment Meeting: November 2021 to confirm hazard ranking and finalize goals
- Public Involvement Strategy – ongoing throughout the planning process

23

Schedule

- Mitigation Strategy
  - Begin working with the Utilities Board and City in the next two weeks – stay tuned for emails
  - Mitigation Strategy Workshop – February 2022
- Draft Plan to Planning Team in March 2022 (as sections are ready)
- Public Review Period (14 days) – April 2022
- Final draft plan to TDEM by May 2022 and FEMA by June 2022

24

Next Steps

- Take online survey to update goals – to be distributed via email
- Take online survey to determine Hazards of Concern to include in the HMP
- Review Hazard Profiles
- Review Risk Assessment Results
- Identify Problems and Problem Areas; develop Mitigation Strategy
- Review Draft Plan
- Submit Draft Plan for TDEM/FEMA Review
- Adopt FEMA-Approved Plan
- Implement Projects and Maintain the Plan → Increase Resilience!

25

Questions?

26

Brownsville Public Utilities Board Project Contacts	
Conrad Taylor, Grants Coordinator (956) 983-6483|ctaylor@brownsville-pub.com	George Rangel, Fiscal Manager (956) 983-6185| grangel@brownsville-pub.com
Tetra Tech Project Contacts	
Heather Apgar, CFM, Project Manager (973) 630-8046 | heather.apgar@tetratech.com	Kate Long, Lead Planner (607) 216-6852 |kate.long@tetratech.com

Thank You!

Photo Credit: t.ly/8LpX

27

Good Afternoon,
Thank you to all who attended the kick-off meeting on August 12th. We hope you found the meeting informative and we are looking forward to working with all of you over the next few months. The meeting minutes and presentation are attached. Please review the minutes and provide any input to my attention with a copy to Conrad Taylor.

Attachments:

- **Meeting minutes** – please review and let us know if any revisions need to be made
- **Presentation** – the presentation from the August 12th meeting
- **Hazards of Concern** – please complete the following survey (https://forms.gle/uqerg3Gbg3k6oBb98) to review the list of hazards of concern and provide feedback as needed. Please complete by Wednesday, September 8th.
- **Goals and Objectives** – please complete the following survey (https://forms.gle/roPei2XrEoc5aCsg7) to review the goals from the 2015 HMP and identify any edits, additional goals, etc. We will present the final list at our next meeting (date TBD). Please complete by Wednesday, September 8th.

If you have any questions, please reach out.

Thank you!

Brownsville Public Utilities Board – 2022 Hazard Mitigation Plan Update
Planning Team Meeting #2 | October 7, 2021 | 2:00 pm CST

Virtual Meeting
Join by Computer: shorturl.at/fgjBG
Or
Dial-in Number (toll): 646-751-8477 | Conference ID: 700 125 776#

1. **Welcome and Introductions**

2. **Project Schedule and Status Review**
   - Municipal Participation Status Update
   - Data Collection Status Update
   - Stakeholder and Public Outreach Strategy

3. **Hazards of Concern Review**

4. **Critical Facilities and Lifelines**

5. **Confirmation of Goals and Objectives**

6. **Strengths, Weaknesses, Obstacles, and Opportunities (SWOO) Assessment**
   - Purpose and Examples
   - Discussion

7. **Next Steps**
   - Continued public outreach
   - Complete worksheets (due October 8th)
   - Complete surveys (due October 22nd)
     - → Problem Areas – https://arcg.is/qXyvP
     - → New Development – https://arcg.is/9qT5r
     - → Critical Facilities - https://arcg.is/1Hj0L9
   - Risk assessment meeting – date TBD

Brownsville Public Utilities Board – 2022 Hazard Mitigation Plan Update
Planning Team Meeting #2 | October 7, 2021

Purpose of Meeting:	Planning Team Meeting #2
Location of Meeting:	Microsoft Teams
Date/Time of Meeting:	October 7, 2021 – 2:00 pm to 3:00 pm

Attendees:	BPUB	City of Brownsville	Tetra Tech
	Conrad Taylor, Grants Coordinator George Rangel, Fiscal Manager Ruben Cano, Smart Grid Applications Manager	Rene Tabarez, EM Planner Cynthia Vidal, EM Preparedness Coordinator Dorene Fourar, Public Engagement Coordinator Brittney Moreno, Communications Specialist Olga Moya, Grant Manager Noel Bernal, City Manger Felipe Romero, Communications and Marketing Director	Heather Apgar Kate Long Megan Brotherton

Agenda Summary:	Review Planning Process and Project status, discuss finalization of Hazards of Concern, discuss finalization of goals and objectives, present the strengths/weaknesses/obstacles/opportunities exercise.

Item No.	Description	Action By:
1.	**Welcome** • Tetra Tech started the meeting by introducing the agenda and discussion points for the meeting.	N/A
2.	**Project Schedule and Status Review** • Reminder that homework worksheets are due October 14th to Tetra Tech • Update on data collection with GIS staff • Next Step: Review Critical Facilities in the planning area (Tetra Tech will send Survey123 to add new facilities to the list) • Public Involvement – to post citizen survey and information about the plan on municipal websites (Tetra Tech will send social media graphics and links to HMP Webpage) • Draft Plan will be ready by April 2022 • Final Draft to TDEM and FEMA by May 2022	All to review Critical Facility list and add new facilities via online Survey123
3.	**Participation Status** • Annex Development in progress with worksheets due October 14th • New Development and Problem Areas Surveys due by October 22nd • Critical Facility Review due by October 22nd o Responses to critical facility review received after this date will not be included in the risk assessment data analysis • Problem Areas – https://arcg.is/qXyvP • New Development – https://arcg.is/9qT5r • Critical Facilities - https://arcg.is/1Hj0L9	Planning Participants to complete worksheets by October 14 and Surveys by October 22
4.	**Public and Stakeholder Outreach** • Public outreach is a key element in the HMP process and one of the requirements of the planning process. • Tetra Tech will be sending social media text and graphics to the Planning Team to post on their websites and social media accounts. • HMP website: https://www.brownsvillepub-hmp.com/	Tt will send social media text and graphics to the Planning Team to post online

5.	Hazards of Concern Identification • The list of hazards from the last plan was presented to the Planning Team and then the list of suggested hazards for the 2022 update. • Suggestion to add Utility Failure, and Cybersecurity as Hazards of Concern	N/A
6.	Goals and Objectives • Tetra Tech presented suggested changes to the Goals and Objectives	N/A
7.	Strengths, Weaknesses, Obstacles, and Opportunities (SWOO) Assessment • A SWOO assessment will be used to help identify mitigation strategies and capabilities • In relation to the hazards of concern: o Strengths – what do you do well o Weakness – what could you do better o Obstacles – what gets in the way, what prevents you from doing something o Opportunities – what could you do to increase strengths (mitigation actions!)	Tetra Tech will send SWOO survey to Planning Team to complete
8.	Schedule • Risk Assessment Meeting – November (Date TBD) • Mitigation Strategy Workshop – January 2022 • Maintenance Strategy – February 2022 • Public draft April 2022 • TDEM/FEMA – May 2022 • Adoption – July 2022	N/A
9.	Questions/Wrap Up • Noel to send Tetra Tech information and damage assessments from recent severe local rain events • Tetra Tech to send letter of extraordinary circumstances to City/BPUB to send to FEMA • Add Brownsville Drainage District, Port of Brownsville, and BISD to stakeholder list	N/A

TETRA TECH

Brownsville Public Utilities Board Hazard Mitigation Plan – 2022 Update

Planning Team Meeting #2| October 7, 2021

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2

Agenda

BROWNSVILLE PUBLIC UTILITIES BOARD

- Welcome
- Project Schedule and Status Review
- Hazards of Concern
- Confirm Critical Facility Types and Lifelines
- Mission Statement, Goals and Objectives
- Strengths, Weaknesses, Obstacles, and Opportunities
- Next Steps

3

TETRA TECH

Project Schedule

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4

Schedule

BROWNSVILLE PUBLIC UTILITIES BOARD

- Overview and Milestones
  - Planning Process
  - Currently working on reviewing plans, studies, and codes/ordinances
  - Info Gathering Worksheets – due **October 8th**
  - Planning Team Meeting #2 – TODAY!
  - Risk Assessment and Hazard Ranking Meeting – Date TBD (mid-November?)
- Update Risk Assessment
  - Data collection is underway; Confirm building and critical facility inventory
  - Confirm hazards of concern; once confirmed, begin vulnerability assessment for each
- Public Involvement Strategy – ongoing throughout the planning process
  - The HMP website is live! https://www.brownsvillepub-hmp.com/
  - Need your help to get the word out about the HMP
- Mitigation Strategy
  - Mitigation Strategy Workshop with FEMA and TDEM– January 2022
- Draft Plan to Planning Team by April 2022
- Final draft plan to TDEM and FEMA by May 2022

5

Project Status

Data Collection - In Progress

- ✓Plan Collection - Complete
- General Building Stock – Update in Progress
- Critical Facility Inventory - In Progress

(feedback and input needed – stay tuned!)

Risk Assessment - In Progress

- Hazard Profile Drafts – Initiated
- Vulnerability Assessment

Public Involvement - In Progress

- Public Survey - in progress
- Website is LIVE!!
- BPUB and the City must document local outreach

Mitigation Strategy

- Confirm Goals And Objectives - Today
- SWOO - In Progress - Today
- Municipal Annex Updates - In Progress
- Identify Problem Areas - In Progress
- Develop Mitigation Strategy - Pending

Phase 1 Organize the Resources → Phase 2 Risk Assessment → Phase 3 Public Involvement Strategy → Phase 4 Update Mitigation Strategy → Phase 5 Update Maintenance Strategy → Phase 6 Assemble the Plan → Phase 7 Plan Review and Adoption → Phase 8 Project Management → IMPLEMENTATION

6

Participation Status

- Annex updates are in progress
- Info gathering worksheets were sent out to everyone – due **October 8th** (tomorrow)
  - Any questions on completing the worksheets?
  - Document new development using this link: https://arcg.is/9qT5r
  - Document problem areas using this link: https://arcg.is/qXyvP
- Next Steps
  - Review and confirm risk ranking – November 2021
  - Review and identify critical facilities – due **October 22nd**
    - Tetra Tech will be sending out the list of facilities and survey to input new facilities
  - Identify mitigation actions – January 2022

7

Public and Stakeholder Outreach

- Website is live!
  - https://www.brownsvillepub-hmp.com/
- Press Release and Social Media
  - Tetra Tech has provided sample press release and will provide social media posts for the Planning Team to use
- Survey (public and stakeholder)
  - Next step – distribute and advertise survey links and brochure
  - Stakeholders begin to complete survey
  - Municipalities to post an HMP project link and flyer on their website; press release sent to newspapers
- Outreach – present key info on the HMP process at local meetings
  - Tetra Tech can provide some talking points if needed

8

Hazards of Concern

9

Potential 2022 Hazards of Concern

- Dam and Levee Failure
- Disease Outbreak
- Drought
- Earthquake
- Erosion (coastal and inland)
- Extreme Heat
- Flood (riverine, coastal, flash, stormwater)
- Hail
- Hurricane/Tropical Storm
- Lightning
- Thunderstorm Wind
- Tornado
- Wildfire
- Winter Storm

10

Critical Facilities and Lifelines

11

Critical Facilities and Community Lifelines

- To be reviewed:
  - 911 Centers
  - Airport
  - Bridges
  - Churches
  - Communication Towers
  - Community Services
  - Detention Centers
  - Emergency Operation Centers
  - Evacuation Routes
  - Fire Stations
  - Government Buildings
  - Heliports
  - Hospitals
  - Nursing Homes
  - Parks
  - Police Stations
  - Ports
  - Public Works
  - Pump Stations
  - Schools
  - Shelters
  - Utilities
  - Wastewater facilities
  - Water pipelines

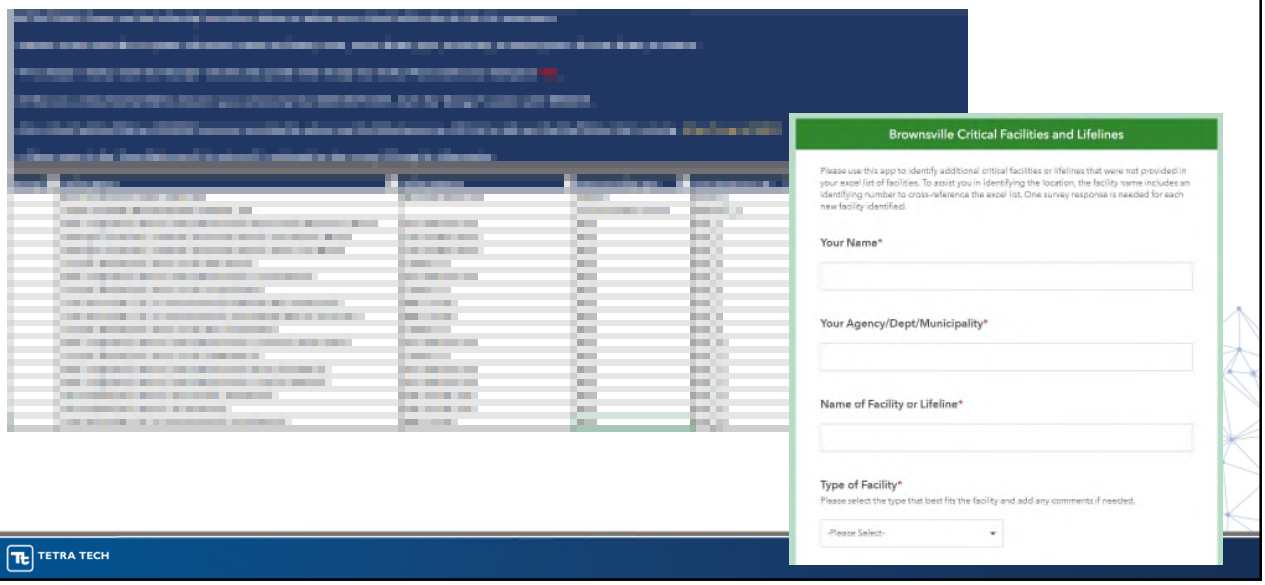
12

Critical Facilities and Lifelines

- **What are lifelines?**
  - A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security.
  - Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
  - When disrupted, decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to stabilize the incident.
- Tetra Tech conducted a preliminary review of the critical facilities and assigned the lifeline categories to each
- We will be distributing a list of facilities for your review and input. We will also be using an online survey to collect new facilities to be included.
  - All input is due **October 22nd**!

13

Critical Facilities and Lifelines



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14

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Goals and Objectives

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15

Compatibility with Other Planning Goals

The HMP update's goals should be compatible with the needs and goals expressed in other available community planning documents as well as the Texas State HMP. These goals and objectives should be reasonably in-line with goals established in other related planning documents and mechanisms including:

- 2018 State of Texas HMP
- 2016 Brownsville Public Utilities Board HMP
- Other local comprehensive and emergency management plans

16

2018 State of Texas HMP

- Goal 1. Saving lives and reducing public risk exposure from natural, technological, and human-caused hazard events.
- Goal 2. Reducing or preventing damage to public and private property from natural, technological, and human-caused hazard events.
- Goal 3. Empowering units of local government to understand and effectively manage public risk exposure through the development of comprehensive mitigation action plans.
- Goal 4. Enhancing the quality of vulnerability and risk assessments through the collection, organization, and analysis of data.
- Goal 5. Reducing adverse environmental, natural resource, and economic impacts from natural, technological, and human-caused hazard events.
- Goal 6. Empowering citizens and businesses to make risk-informed decisions though public education and outreach activities.
- Goal 7. Enhancing coordination between local, state, tribal, and federal agencies by understanding the impact of hazards in Texas and developing policies and strategies to effectively manage risk.
- Goal 8. Reduce the number of Repetitive Loss and Severe Repetitive Loss properties through acquisition of real property from property owner

17

Revisit the 2016 Goals and Update if Needed

- Do the goals and objectives address current and expected conditions?
- Do the goals and objectives reflect current natural hazard risk?
- Did the goals and objectives lead to mitigation projects and/or changes in policy that helped jurisdictions to reduce vulnerability?
- Do the goals and objectives support changes in mitigation priorities?
- Do the goals and objectives reflect updated State goals?
- Do the goals incorporate a focus on resiliency?

What are the basic goals?

- Protect Life?
- Protect Property?
- Protect the Environment?
- Build Partnerships?
- Increase Preparedness?
- Encourage Implementation of Long-Term Mitigation Projects?
- Protect Lifelines?

18

Review Goals

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards."

Goal #	Goal Statement
G-1	Protect public health and safety from natural, technological, and human-caused hazard events
G-2	Protect new and existing public and private properties from natural, technological, and human-caused hazard events
G-3	Build and support public, private, and non-profit partnerships to enhance mitigation to continuously become less vulnerable to hazards.
G-4	Leverage outside funds for investment in hazard mitigation.
G-5	Enhance and promote hazard mitigation awareness and education to help residents understand the need for mitigation, and steps they can take to protect people and properties.
Additional Goals?	

19

Objectives

Objectives are short-term aims which, when combined, form a strategy or course of action to meet a goal. Unlike goals, objectives are specific, and measurable - *they answer the question, "How?"*

Examples include:

- Integrate the recommendations of this plan into existing regional and local programs.
- Implement mitigation actions that enhance the capabilities of the Utilities Board and City to better profile and assess exposure of hazards.

20

Review Objectives

2016 Objective #	2016 HMP Objective Statement
1	Maintain and protect critical facilities, community lifelines, and services.
2	Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
3	Reduce the danger to, and enhance protection of, high risk areas during hazard events.
4	~~Protect critical facilities and services.~~
4	Retrofit, purchase, or relocate structures in high hazard areas including those known to be repetitively damaged
5	Reduce the number of repetitive losses to properties in the National Flood Insurance Program (NFIP).
6	Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.
7	Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
8	Build and support local partnerships to continuously become less vulnerable to hazards.
9	Ensure continuity of government operations, emergency services, essential, and lifeline facilities at the local level during and immediately after disaster and hazard events.
10	Strengthen inter-jurisdiction and inter-agency communication, coordination, and partnerships in all phases of emergency management.
11	Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.
12	Build hazard mitigation concerns into the City of Brownsville and Brownsville Public Utilities Board (BPUB) planning and budgeting processes.
13	Maximize the use of outside sources of funding.
14	Maximize participation of property owners in protecting their properties.
15	Maximize insurance coverage to provide financial protection against hazard event.
16	Prioritize mitigation projects based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
17	Heighten public awareness of the full range of natural and human-made hazards they face.
18	Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
19	Publicize and encourage the adoption of appropriate hazard mitigation measures.
	Additional Objectives?

21

TETRA TECH

Strengths, Weaknesses, Obstacles, and Opportunities (SWOO)

22

Strengths, Weaknesses, Obstacles, and Opportunities

BROWNSVILLE PUBLIC UTILITIES BOARD

The purpose of the SWOO is to identify mitigation strategies and capabilities that will meet the goals and objectives of the plan update. It is also used to develop potential mitigation actions for the participating jurisdictions.

- Strengths – what we do well
- Weaknesses – what could we do better
- Obstacles – things that stand in the way, and either prevents you from doing something or something that need to be overcome
- Opportunities – used to develop mitigation strategies

23

SWOO Exercise

Thinking about the 2016 hazards of concern and any new hazards for this update…what are some strengths, weaknesses, obstacles and opportunities the Planning Area has for each? Complete the online form (https://forms.gle/jXQNS6usBxk3BNe56)

Here are some examples to help brainstorm:

Hazard: Flood	
S	Minimal exposure to flood risk
W	Silt and debris buildup in streams can lead to localized flooding
Ob	Funding for culvert and catch basin maintenance
Opps	Installing stream gages

Hazard: Severe Storms	
S	Tree trimming programs are in place
W	Aging infrastructure; lack of underground utilities
Ob	Cost to retrofit existing utility infrastructure
Opps	Underground utilities; enhance public outreach program

Hazard: Severe Winter Storm	
S	Not a frequent occurrence
W	Not a frequent occurrence and may not have the resources to respond
Ob	Funding; limited staff for prolonged events
Opps	Shared services

2022 SWOO Discussion/Example

Hazard	
Strengths	**Weaknesses**
What do the Planning Area do well in terms of: ➢ Plans and Regulations ➢ Codes, Ordinances, Planning Studies, Comprehensive Plans, Adaptation and Resiliency Plans ➢ Structure and Infrastructure Projects ➢ Natural Systems Protection ➢ Education and Awareness Programs? ➢ Preparedness ➢ Others?	What can the Planning Area do better or what are identified gaps in terms of: ➢ Plans and Regulations ➢ Codes, Ordinances, Planning Studies, Comprehensive Plans, Adaptation and Resiliency Plans ➢ Structure and Infrastructure Projects ➢ Natural Systems Protection ➢ Education and Awareness Programs? ➢ Preparedness ➢ Others?

2022 SWOO Discussion/Example

Hazard	
Obstacles	**Opportunities**

What is preventing the Planning Area to implement:
➢ Plans and Regulations
  ➢ Codes, Ordinances, Planning Studies, Comprehensive Plans, Adaptation and Resiliency Plans
➢ Structure and Infrastructure Projects
➢ Natural Systems Protection
➢ Education and Awareness Programs?
➢ Preparedness
➢ Others?
	What can the Planning Area implement terms of:
	➢ Plans and Regulations
	  ➢ Codes, Ordinances, Planning Studies, Comprehensive Plans, Adaptation and Resiliency Plans
	➢ Structure and Infrastructure Projects
	➢ Natural Systems Protection
	➢ Education and Awareness Programs?
	➢ Preparedness
	➢ Others?

26

Next Steps

27

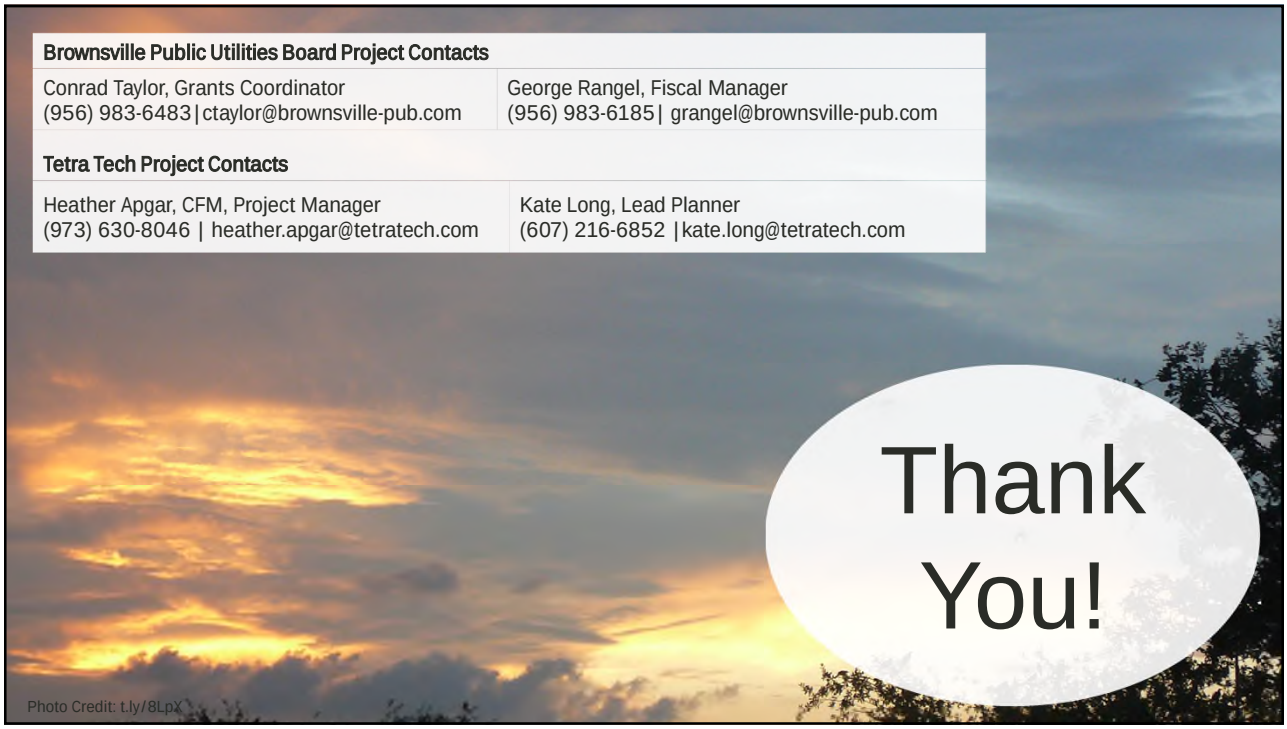
Next Steps

- Review Hazard Profiles
- Review Risk Assessment Results
- Identify Problems and Problem Areas
- Develop Mitigation Strategy
- Review Draft Plan
- Submit Draft Plan for TDEM/FEMA Review
- Adopt FEMA - Approved Plan
- Implement Projects and Maintain the Plan → Increase Resilience!

28

Questions?

29


Brownsville Public Utilities Board Project Contacts
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(956) 983-6483 | ctaylor@brownsville-pub.com
George Rangel, Fiscal Manager
(956) 983-6185 | grangel@brownsville-pub.com
Tetra Tech Project Contacts
Heather Apgar, CFM, Project Manager
(973) 630-8046 | heather.apgar@tetratech.com
Kate Long, Lead Planner
(607) 216-6852 | kate.long@tetratech.com
Thank You!
Photo Credit: t.ly/8LpX

30

Good Afternoon,
Thank you to all who attended the 2nd meeting on October 7th. We hope you found the meeting informative and we are looking forward to working with all of you over the next few months. The meeting minutes and presentation are attached. Please review the minutes and provide any input to my attention with a copy to Conrad Taylor and George Rangel.

Attachments:

- **Meeting minutes** – please review and let us know if any revisions need to be made
- **Presentation** – the presentation from the October 7th meeting
- **Critical Facilities** – please review the attached list of facilities. There are directions on the list on how to make edits. If you want to add facilities, please use this link to do so: https://arcg.is/1Hj0L9
    - Any edits and/or additions must be completed by October 22nd in order for them to be included in the risk assessment.
- **Problem Areas** – please use this link (https://arcg.is/qXyvP) to identify any problem areas associated with the hazards of concern in the planning area. This form needs to be completed by October 22nd
- **New Development** – please use this link (https://arcg.is/9qT5r) to identify any new or anticipated major development within your community. This form needs to be completed by October 22nd
- **SWOO** – please use this survey (https://forms.gle/qMtshUjgcRxoPG6VA) to complete the Strengths, Weaknesses, Obstacles and Opportunities exercise. This will help us understand what are your strengths and weaknesses when it comes to hazards and ultimately help us identify mitigation actions. This survey needs to be completed by October 22nd

We will be sending out a separate email with public outreach materials. Please get this posted as soon as possible to help get the word out about the plan!

Just a reminder that the information gathering worksheets are due back to Tetra Tech by October 14th. If you have any questions on completing them, please let us know.

Thank you!

John F. Cowen, Jr., Commissioner At-large "A"
Nurith Galonsky Pizana, Commissioner District 1
Roy De los Santos, Commissioner District 3

Rose M.Z. Gowen, M.D., Commissioner At-large "B"
Jessica Tetreau, Commissioner District 2
Pedro Cardenas, Commissioner District 4

Trey Mendez, Mayor

NOTICE OF A PUBLIC MEETING OF THE
CITY COMMISSION OF THE CITY OF BROWNSVILLE

Pursuant to Chapter 551, Title 5 of the Texas Government Code, the Texas Open Meetings Act, notice is hereby given that the City Commission of the City of Brownsville, Texas, in accordance with Article V, Section 12, of the Charter of said City, will convene a **Regular Meeting,** on **Tuesday, October 19, 2021**, at 5:00 p.m., at the **Brownsville Public Library-Main Branch, Meeting Room, located at 2600 Central Blvd, Brownsville, Cameron County, Texas, 78520**.

Pursuant to Section 551.127, Texas Government Code, one or more Commissioners or employees may attend this meeting remotely using videoconferencing technology. The video and audio feed of the videoconferencing equipment can be viewed and heard by the public at the address posted above as the location of the meeting.

Members of the Public, Employees, and the City Commission may join via the Webex Teleconference Meeting by logging on at:
https://brownsville.webex.com/brownsville/j.php?MTID=m64ad3f5b5b3502a3d8f1a4c85106aef1

Password: meeting

This Notice and Meeting Agenda are posted online at: https://brownsvilletx.gov/129/Agendas-Minutes

The members of the public wishing to participate in the meeting hosted through Webex Teleconference can join at the following numbers:

Or Join by phone
1-844-992-4726 United States
Toll Free+1-408-418-9388 United States
Access code: 2495 507 7196

Members of the public who submitted a "Public Comment Form" will be permitted to offer public comments as provided by the agenda and as permitted by the presiding officer during the meeting. A recording of the meeting will be made and will be available to the public in accordance with the Open Meetings Act.

CALL TO ORDER

a) ROLL CALL

b) INVOCATION

PLEDGE OF ALLEGIANCE TO UNITED STATES AND TEXAS FLAGS

PROCLAMATION(S)

Proclamation designating the month of October 2021 as **Breast Cancer Awareness Month** in the City of Brownsville. (Mayor T. Mendez, Commissioner J. Cowen, Commissioner R. Gowen, Commissioner N. Galonsky-Pizana, Commissioner J. Tetreau, Commissioner R. De los Santos, Commissioner P. Cardenas)

Proclamation honoring and celebrating **Vera's Backyard Bar-b-que** of Brownsville, Texas, and recognizing their service to the community and their James Beard Foundation "America's Classics Award". (Mayor T. Mendez/Commissioner N. Galonsky-Pizana)

Proclamation honoring the **Gladys Porter Zoo** upon the celebration of the 50th Anniversary. (Mayor T. Mendez/Commissioner R. De los Santos)

PUBLIC COMMENT PERIOD

- **Non-Agenda Items:** Kindly submit a "Public Comment Form" stating the City business or City policy you wish to speak to an hour before the start of the scheduled meeting time with the City Secretary. Forms are not reserved for anyone nor may time be deferred to anyone. PowerPoint presentations may not be accommodated. This period is limited to five (5) speakers with a time limit of three (3) minutes per speaker.
- **Agenda Items:** Kindly submit a "Public Comment Form" stating which item(s) on the agenda you wish to speak to an hour before the start of the scheduled meeting time with the City Secretary. Speakers will be allowed to address the Commission on the agenda item before it is to be considered. The speaker is limited to three (3) minutes.
- **Time Limits:** The City Commission shall have the discretion to modify its regulations regarding time limits on public comment if necessary. For example, the time limit may be shortened to accommodate a lengthy agenda or it could be lengthened to allow additional time for discussion on a complicated matter or if there is a need for an interpreter.

WORK SESSION(S)

As a governmental body, the City Commission will not vote or take any formal action on any items discussed in the work session portion of the agenda.

1) Bus Shelter Improvement Program (Multi-Modal Transportation-Transit)

2) Holiday Project-Brownsville Beautification Committee

3) Government & Community Affairs - Special Projects Update (City Manager's Office)

PRESENTATION(S)

Presentation - Brownsville Public Utilities Board (BPUB) Hazard Mitigation Plan Update

CONSENT AGENDA ITEM(S)

The following are considered to be routine by the City Commission and will be approved by one motion. There will be no separate discussion of these items unless a City Commissioner so requests, in which event the item will be removed from the Consent Agenda and considered in its normal sequence on the Agenda.

1) Approval of the Minutes:

a) Minutes of the October 5, 2021 Regular Meeting

2) Consideration and **ACTION** to approve a Services Agreement between the University of Texas Health Science Center of Houston, on behalf of its Department of Brownsville Regional Campus (University) and City of Brownsville in the amount of $60,000 to hire a Community Health Worker, as budgeted. (Public Health Department)

3) Consideration and **ACTION** to award contract to RM Walsdorf, Inc for the Community Development Block Grant (CDBG) American with Disabilities Act (ADA) Bus Stop Enhancement project as per IFB (BSI-19-0221) in the amount of $188,713.00, as budgeted. (Multimodal Transportation - Transit)

4) Consideration and **ACTION** authorizing the City Manager to enter into a Memorandum of Understanding between Cameron County and the City of Brownsville for the County's financial support in providing public transportation to low income areas. (Multimodal Transportation - Transit)

5) Consideration and **ACTION** on Resolution Number 2021-072 authorizing the filing of the FY 2021 5307 American Rescue Plan Act (ARP) signed into law on March 11, 2021. FTA has apportioned $1,730,939 awarded to Transit Infrastructure to Brownsville Metro to be managed under our Section 5307 Transit Award Management System (TrAMS). (Multimodal Transportation - Transit)

6) Consideration and **ACTION** on Resolution Number 2021-073 authorizing the filing of the FY 2021 5310 American Rescue Plan Act (ARP) signed into law March 11, 2021. FTA has apportioned $28,858 awarded to Transit Infrastructure to Brownsville Metro to be managed under our Section 5310 Transit Award Management System (TrAMS) authorized by 49 USC Chapter 53, Title 23, United States Code. (Multimodal Transportation - Transit)

7) Consideration and **ACTION** on Resolution Number 2021-074 authorizing the filing of the FY 2021 5310 Coronavirus Response and Relief Act (CRRSAA) signed into law December 27, 2020. FTA has apportioned $28,857 awarded to the Enhanced Mobility of Seniors and Individuals with Disabilities to Brownsville Metro to be managed under our section 5310 Transit Award System (TrAMS). (Multimodal Transportation - Transit)

8) Consideration and **ACTION** on Resolution Number 2021-069 authorizing the filing of the FY 2021 Section 5307 Urbanized Area Formula Program grant apportionment in the amount of $2,572,459, with the Federal Transit Administration (FTA), an Operating Administration of the United States Department of Transportation, for Federal Transportation Assistance Authorized by 49 USC Chapter 53, Title 23, United States Code. (Multimodal Transportation - Transit)

9) Consideration and **ACTION** on Resolution Number 2021-070 authorizing the filing of FY 2021 Section 5310 Enhance Mobility of Seniors and Individuals with Disabilities grant apportionment in the amount of $164,030 with the Federal Transit Administration (FTA), an Operating Administration of the United States Department of Transportation, for Federal Transportation Assistance authorized by 49 USC Chapter 53, Title 23, United States Code. (Multimodal Transportation - Transit)

10) Consideration and **ACTION** on Resolution Number 2021-071 authorizing the filing of the FY 2021 Section 5339 Bus and Bus Facilities Program grant apportionment in the amount of $264,312 with the Federal Transit Administration (FTA), an Operating Administration of the United States Department of Transportation, for Federal Transportation assistance authorized by 49 USC Chapter 53, Title 23, United States Code. (Multimodal Transportation - Transit)

11) Consideration and **ACTION** to authorize Change Order #1 to G & G Contractors in the amount of $ 194,253.69 for the Brownville Metro East Side Transfer Station CCSJ Project # 0921-06-304, as budgeted. (Multimodal Transportation - Transit)

12) Consideration and **ACTION** to authorize the City of Brownsville Multimodal Transportation - Brownsville Metro to offer free rides on Sundays during the months of November and December 2021. (Multimodal Transportation-BMetro)

13) Consideration and **ACTION** authorizing the City Manager to approve a 3% Consumer Price Increase (CPI) increase for First Transit, Inc. for the 2021-2022 contract year in the amount of $42,947, as budgeted. (Multimodal Transportation - Transit)

14) Consideration and **ACTION** to award a contract to LB Foster/CXT in the amount of $104,799.00 for the purchase, delivery, and installation of a prefabricated restroom at Linear Park, as budgeted. (Parks and Recreation)

15) Consideration and **ACTION** to award a contract, TIPS contract #200105, for professional services to True North Consulting Group in the amount of $100,000.00, as budgeted. (Enterprise Applications Department)

PUBLIC HEARING(S)

1) Public Hearing and **ACTION** on **FIRST READING** on **Ordinance Number 235-2021-011**, to amend the Zoning Map from Residential Single Family (R-1) to Residential Suburban (R-2) for Lot 8, Block 1, McKenzie Estates Subdivision, Cameron County, Texas, located at 5124 Austin Road, Brownsville, Texas 78521, as shown in Exhibit "A". (District 2) (Planning & Redevelopment Department)

2) Public Hearing and **ACTION** on **FIRST READING** on **Ordinance Number 235-2021-012**, to amend the Zoning Map from Residential Suburban (R-2) to Residential Transition (R-3) for Lot 3, Block 1, San Rafael Subdivision, Cameron County, Texas, located at 2940 North Central Avenue, Brownsville, Texas 78526, as shown in Exhibit "A". (District 2) (Planning & Redevelopment Department)

ITEMS FOR INDIVIDUAL CONSIDERATION(S)

1) Consideration and **ACTION** to adopt the Sidewalk and Trails Master Plan as presented. (Multimodal Transportation - Mobility)

2) Consideration and **ACTION** on the Brownsville Public Utilities Board (BPUB) operating transfer fifty percent (50%) cost-share request related to Bond Ordinance Section 19. (City Manager's Office)

3) Consideration and **ACTION** to approve Program Guidelines for a Cultural and Tourism Fund related to the American Rescue Plan Act (ARPA) funding allocation. (City Manager's Office)

4) Consideration and **ACTION** to procure project management services for certain American Rescue Plan Act (ARPA) and Special Projects to Halff Associates, Inc. in an amount not to exceed three (3) percent of project costs. (City Manager's Office)

5) Consideration and **ACTION** on Fiscal Year 2022 departmental Work Plans. (City Manager's Office)

6) Consideration and **ACTION** to approve **Resolution Number 2021-053** affixing certain Other Post-Employment Benefits by prescribing the health benefits for qualified retirees from the City of Brownsville not governed by a collective bargaining agreement. (City Manager's Office)

BOARD APPOINTMENTS

1) Consideration and **ACTION** on **Resolution Number 2021-077** authorizing the removal and appointment of members to the Brownsville Community Improvement Corporation (BCIC) Board of Directors. (City Manager's Office)

EXECUTIVE SESSION

1) Closed session pursuant to Tex. Gov't Code Sections 551.071 (Consultation with Attorney) and 551.087 (Deliberation Regarding Economic Development Negotiations), all related to Project First. (City Manager's Office)

2) Closed session pursuant to Tex. Gov't Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberation Regarding Real Property) and 551.087 (Deliberation Regarding Economic Development Negotiations), all related to Project Fusion. (City Manager's Office)

3) Deliberation of personnel matters pursuant to Section 551.074(1) of the Texas Government Code, related to the annual performance evaluation for the City Manager, Noel Bernal, as allowed under the existing City Manager's Agreement.

4) Closed session pursuant to Texas Local Government Code section 551.074, personnel matters related to deliberation and selection of a City Attorney.

POSSIBLE ACTION ON ANY ITEM(S) AS DISCUSSED IN EXECUTIVE SESSION

NOTE: The City Commission of the City of Brownsville reserves the right to discuss any items in Executive Session whenever authorized under the Texas Open Meetings Act, Chapter 551 of the Texas Government Code.

1) Consideration and Possible **ACTION** with respect to all matters discussed in Executive Session related to Project First, including to authorize the City Manager to enter into a Chapter 380 Economic Development Agreement and to execute any pertinent documentation for its implementation. (City Manager's Office)

2) Consideration and Possible **ACTION** with respect to all matters discussed in Executive Session related to Project Fusion. (City Manager's Office)

3) Consideration and **ACTION** for the selection of a City Attorney for the City of Brownsville. (Organizational Development & Human Resources Department)

ADJOURNMENT

NOTE: The City of Brownsville does not discriminate on the basis of disability in the admission of, access to, treatment of, or employment in its programs, activities, or public meetings. Any individual with a disability in need of an accommodation is encouraged to contact the Organizational Development & Human Resources Department at 956/548-6037 (voice or Relay TX) by Monday, October 18, 2021, no later than 10:00 A.M., to make proper arrangements.

By: Trey Mendez
Mayor of the City of Brownsville

I certify that a copy of the **October 19, 2021,** Agenda of items to be considered by the Brownsville City Commission was posted on the Bulletin Area at City Hall – Federal Building, on Friday, October 15, 2021. I further certify that the Agenda was posted on the City's website and can be downloaded by accessing: https://brownsvilletx.gov/129/Agendas-Minutes

Laure Morgan, TRMC, CMC, CPM, MPA, City Secretary

TETRA TECH

Brownsville Public Utilities Board Hazard Mitigation Plan – 2022 Update

City Commission Meeting| October 19, 2021

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1

What is Hazard Mitigation?

- Hazard mitigation describes actions taken to help reduce or eliminate long-term risks caused by hazards or disasters.
- There are several steps a community can take to help mitigate hazards – developing a Hazard Mitigation Plan (HMP) is one of them.

"provides the blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and local ability…" (CFR).

TETRA TECH

2

What is a Hazard Mitigation Plan?

- Mitigation is most effective when it is based on a comprehensive, long-term plan that is developed BEFORE a disaster occurs.
- A Hazard Mitigation Plan (HMP) is used to identify policies and actions that can be implemented to reduce risk and future losses from hazards and disasters.
- It is a community-driven, living document that encourages communities to integrate mitigation into their day-to-day operations and decisions.

Public Involvement
- Builds community-wide support
- Gets feedback from those who live and work in the community
- Creates a more resilient community

Risk Assessment
- Looks at hazards that can impact a community
- Estimates the potential losses
- Provides a basis for developing actions to reduce or eliminate damages from a hazard

Mitigation Strategy
- Communities identify projects to mitigate hazards
- Uses public input, risk assessment data, and capabilities to develop projects

3

Why Prepare an HMP?

Plan for the future

Recovery quickly after disasters

Identify mitigation actions

Access to FEMA funding

- An HMP provides a strategy to reduce or eliminate damages from disaster and break the cycle of disasters and damages.
- Reduces the risk to people and property and reduces the cost of disaster recovery.
- Identifies ways communities can become more resilient and disaster-resistant.
- Communities remain eligible for FEMA pre-disaster mitigation funding.

4

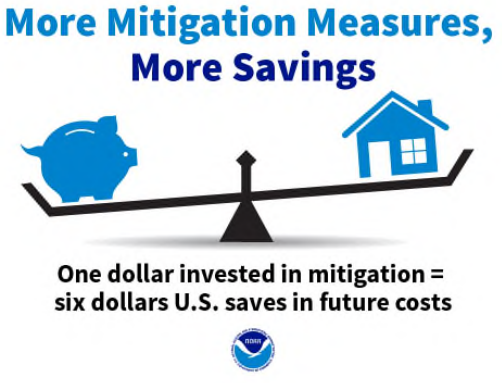
Why Update?

- To remain eligible for pre- and post-disaster mitigation funding, FEMA requires anyone with an approved HMP to update it every 5 years.
- Updating the plan helps us re-evaluate our risk and identify any new risks or vulnerabilities.
  - New information, data and studies are always coming in – so we will use that to help us update as well (e.g., hazard maps, event history, change in population, etc.)
- The mitigation plan update will:
  - Help Brownsville prepare for and mitigate the effects of hazards
  - Continue to allow Brownsville Public Utilities Board and participating partners to be eligible for pre- and post-disaster mitigation funding
  - Support CRS participation/rating of municipalities

5

Hazard Mitigation Works!

- For every $1 spent on hazard mitigation, saves the U.S. $6 in future disaster costs!
- More than just money – it could prevent 600 deaths and 1 million non-fatal injuries!
- The Utilities Board used mitigation funding to create and update the HMP



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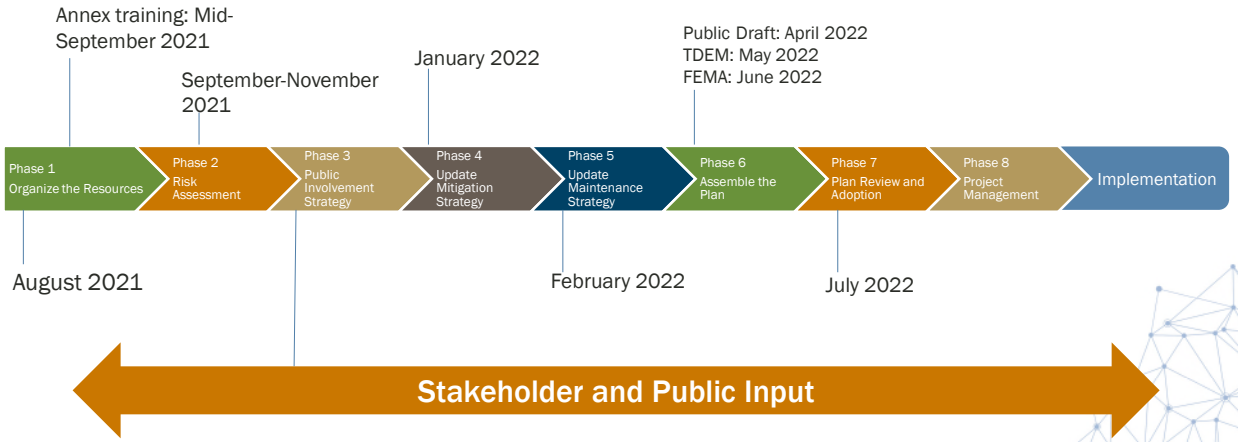
Planning Process Overview



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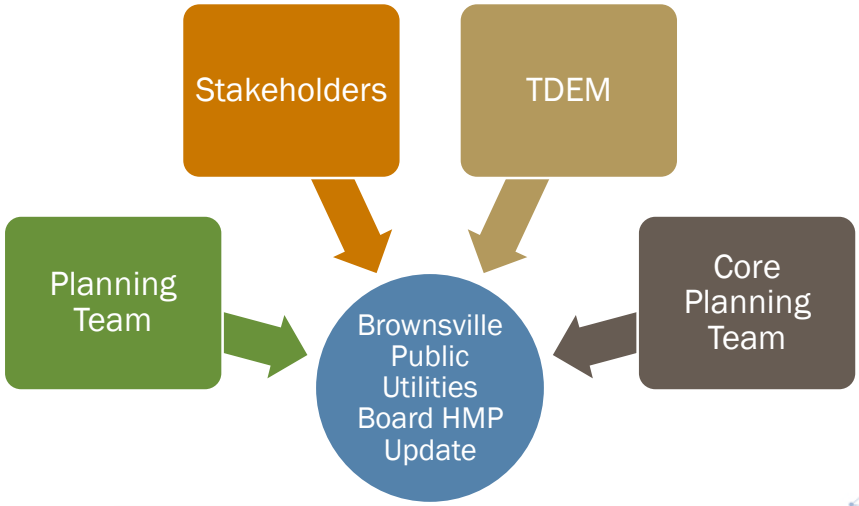
Project Organization



8

HMP Outline/Scope of Work

- Update the Risk Assessment – what's at risk?
- Update the Capabilities Assessment – what tools do you have in place that integrate hazard mitigation? What do you have available to help your community in the event of a disaster?
- Update the Mitigation Strategy – review and update previous actions; develop new actions
- Update Other Sections of the HMP
- Submit the HMP for Review
- Adopt the HMP
- Implement the HMP

9

What are the Hazards of Concern?

- Dam and Levee Failure
- Disease Outbreak
- Drought
- Earthquake
- Erosion (coastal and inland)
- Extreme Heat
- Flood (riverine, coastal, flash, stormwater)
- Hail
- Hurricane/Tropical Storm
- Lightning
- Thunderstorm Wind
- Tornado
- Wildfire
- Winter Storm

10

Providing Input

- We have an HMP website - https://www.brownsvillepub-hmp.com/
- Social Media – we will provide a series of graphics and text that you can use to help us get the word out about the HMP
- Stakeholder Survey –will be distributed to identified stakeholders to collect their input and feedback
- Public Survey – this will help us involve the public and get their views on hazards in the community
  - https://www.surveymonkey.com/r/BPUB_HMP
- Review the draft plan – a draft should be posted by April 2022; check the website for updates

11

What's Next?

- Upcoming Meetings
  - Risk Assessment Presentation – mid-November
  - Mitigation Strategy Workshop – January 2022
- Take the public survey - https://www.surveymonkey.com/r/BPUB_HMP
- Once plan is approved by FEMA, adopt the HMP through a resolution
- Implement Projects and Maintain the Plan → Increase Resilience!

12

Questions?

13

Brownsville Public Utilities Board Project Contacts	
Conrad Taylor, Grants Coordinator (956) 983-6483|ctaylor@brownsville-pub.com	George Rangel, Fiscal Manager (956) 983-6185| grangel@brownsville-pub.com
Tetra Tech Project Contacts	
Heather Apgar, CFM, Project Manager (973) 630-8046 | heather.apgar@tetratech.com	

Thank You!

Photo Credit: t.ly/8LpX

14

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Brownsville Public Utilities Board Hazard Mitigation Plan – 2022 Update

Planning Team Meeting #3| December 8, 2021

Risk Assessment Presentation

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2

Agenda

BROWNSVILLE PUBLIC UTILITIES BOARD

- Welcome
- Project Schedule and Status Review
- Risk Assessment Overview
- Review Calculated Hazard Ranking
- Next Steps

3

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Project Schedule

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Project Schedule Review

BROWNSVILLE PUBLIC UTILITIES BOARD

✓	August 2021	Kick-Off Meeting
✓	July-September 2021	Data Collection
✓	October 7, 2021	Finalize Goals and Objectives
❑	December 7, 2021	Risk Assessment Presentation – TODAY!
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❑	April 2022	Plan Submitted to TDEM
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5

Public and Stakeholder Outreach

- Website is live!
  - https://www.brownsvillepub-hmp.com/
- To date, we have received 54 responses on the public survey!
- Public Engagement – everyone was sent different tools to use to help with public outreach – please continue to share!
  - HMP website
  - Social media – Facebook and Twitter
  - Let Tetra Tech know when you post about the HMP so we can include in the plan

6

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Risk Assessment Overview

7

What is Risk?

Risk is defined as a function of :

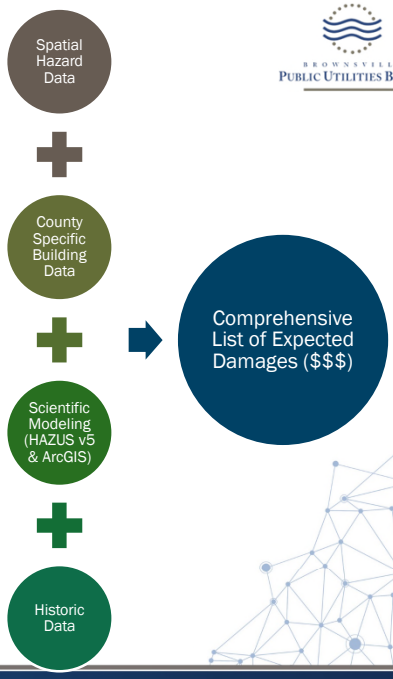
- ✓ Hazard
  - *Source of potential danger or adverse condition*

- ✓ Exposure
  - *Manmade or natural features that are exposed to the hazard*
- ✓ Vulnerability
  - *Damage susceptibility of the exposed features*

8

Purpose of the Risk Assessment

- To get a better understanding of the risks you face
- Initial results based on available data
- Quantitative data (population/structures exposed, structural damages within hazard zones) used when available
- Qualitative community input (such as unmapped flood areas) integrated to adjust results
- Local community input to adjust relative rankings



9

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Ranking the Hazards of Concern

How are the rankings calculated? What is the preliminary ranking?

10

Potential 2022 Hazards of Concern

BROWNSVILLE PUBLIC UTILITIES BOARD

- Dam and Levee Failure
- Disease Outbreak
- Drought
- Earthquake
- Erosion (coastal and inland)
- Extreme Heat
- Flood (riverine, coastal, flash, stormwater)
- Hail
- Hurricane/Tropical Storm
- Lightning
- Thunderstorm Wind
- Tornado
- Wildfire
- Winter Storm

11

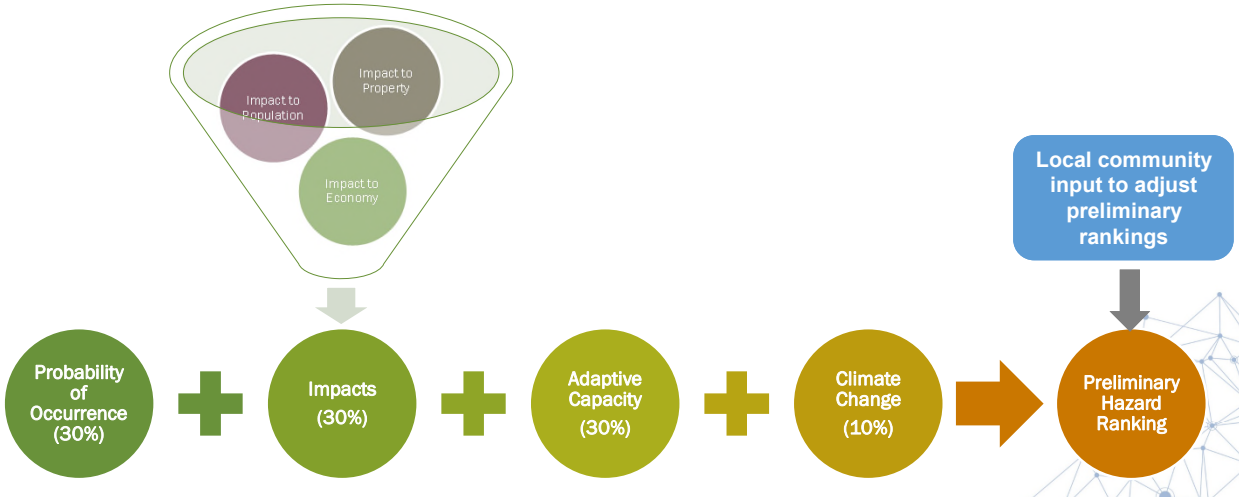
Preliminary Hazard Ranking Methodology

Hazard ranking is determined by quantitative and qualitative factors including:

- The calculated probability of a hazard occurring based on historical data
- *Impacts to people, property, and the economy* based on GIS data and analysis of exposure.
- The degree to which *climate change* will affect future occurrences based on best available data.
- Capability- the ability of your community to respond to the hazard based on ordinances, mitigation strategies and procedures, and readiness.

12

Preliminary Hazard Ranking Formula



13

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Ranking the Hazards of Concern

What information plays a role in determining the risk rankings?

14

Hazard Ranking Input

BROWNSVILLE PUBLIC UTILITIES BOARD

Impact on Population – Function of population exposed

- ✓ Low – 14% or less population exposed
- ✓ Medium – 15%-29% population exposed
- ✓ High – 30%+ population exposed

Impact on property – Function of structures exposed

- ✓ Low – 14% or less structures exposed
- ✓ Medium – 15%-29% structures exposed
- ✓ High – 30%+ structures exposed

Impact on economy – Function of damages to building stock

- ✓ Low – 9% or less loss estimate of total replacement cost
- ✓ Medium – 10%-19% loss estimate of total replacement cost
- ✓ High – 19%+ loss estimate of total replacement cost

Capability – Function of level of planning, policies, enforcement

- ✓ Low – outdated policies; limited to no deployable resources; limited capabilities to respond; long recovery
- ✓ Medium – minimum requirements; mitigation strategies identified but not implemented; moderate county capabilities
- ✓ High – exceed requirements; mitigation/protective measures in place; county/jurisdiction has ability to recover quickly because resources are readily available, and capabilities are high

Climate Change – Function of climate predictions

- ✓ Low - No local data is available; modeling projects are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence)
- ✓ Medium - Studies and modeling projections indicate a potential for exacerbated conditions due to climate change
- ✓ High - Studies and modeling projections indicate exacerbated conditions/increased future risk due to climate change

15

Preliminary Hazard Ranking

Hazard of Concern	2015 Ranking	2022 Preliminary Ranking	
	BPUB and City	Brownsville (C)	BPUB
Dam/ Levee Failure	Low	Low	Low
Disease Outbreak	New to 2022	Low	Low
Drought	Low	Low	Low
Earthquake	Low	Low	Low
Erosion	New to 2022	Low	Low
Extreme Heat	Low	Medium	Medium
Flood	High	Medium	Low
Hail	Medium	Medium	Medium
Hurricane	High	Low	Low
Lightning	Included in Thunderstorm	Medium	Medium
Thunderstorm Wind	Low	Medium	Medium
Tornado	Low	Medium	Medium
Wildfire	Low	High	Medium
Winter Storm	Low	Medium	Medium

16

Dam and Levee Failure

Probability - Rare

Population - Low

Property - Medium

Economy - Low

Capacity – Medium

Climate Change – Medium

Ranking - Low

- 13 dams and levee systems located in the Planning Area
- No reported failures in Planning Area
  - Do you know of any dam or levee failures
- Potential mitigation actions to address dam and/or levee failure?

17

Disease Outbreak

- Includes:
  - West Nile Virus
  - Influenza
  - COVID-19
- Exposure
  - Entire Planning Area is vulnerable
  - Increased vulnerability in highly populated areas, tourists
- Potential mitigation actions to address disease outbreak?

Probability - Occasional

Population - Medium

Property - Low

Economy - Medium

Capacity – Medium

Climate Change – Medium

Ranking - Low

18

Drought

- Previous Events
  - Between 2000 and 2021, 215 reported drought events in Cameron County. The Planning Area most likely experienced these events as well.
- Exposure
  - Entire Planning Area is vulnerable
  - Increased vulnerability to populations at higher risk (65+ / <5 years old)
- Potential impacts:
  - Increased wildfire/brush fire risk
  - Impacts to agriculture/farms
  - Drinking water supply (groundwater and surface water)
- While the overall ranking for BPUB is low, we looked at all communities served by BPUB. Some had an overall ranking of 'Medium'. Should we change the ranking to represent the highest ranking calculated?
- Potential mitigation actions to address drought?

Probability - Occasional

Population - Medium

Property - Low

Economy - Low

Capacity – Medium

Climate Change – High

Ranking - Low

19

Earthquake

Probability - Unlikely	Population - Low
Property - Low	Economy - Low
Capacity – Low	Climate Change – Low
Ranking - Low	

- No history of events
- Not potential impacts to population, property or economy
- Should earthquake remain as a hazard of concern?
  - If it remains in the plan, two mitigation actions for both BPUB and the City will need to be identified.

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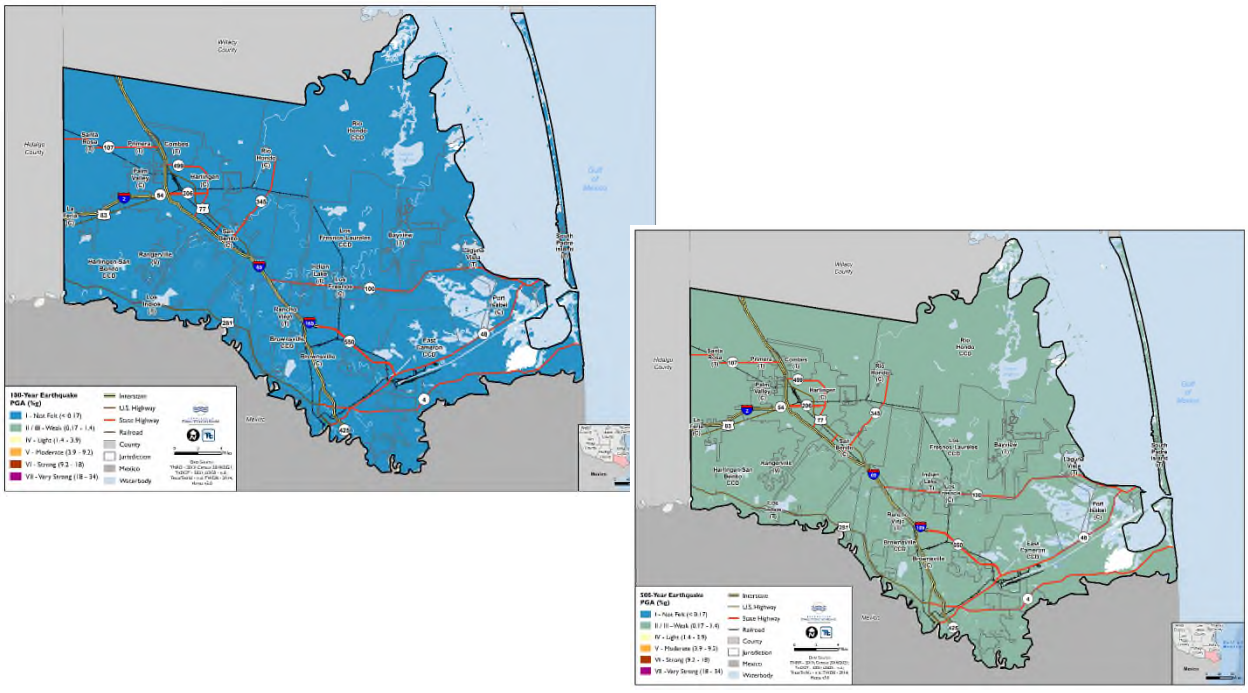

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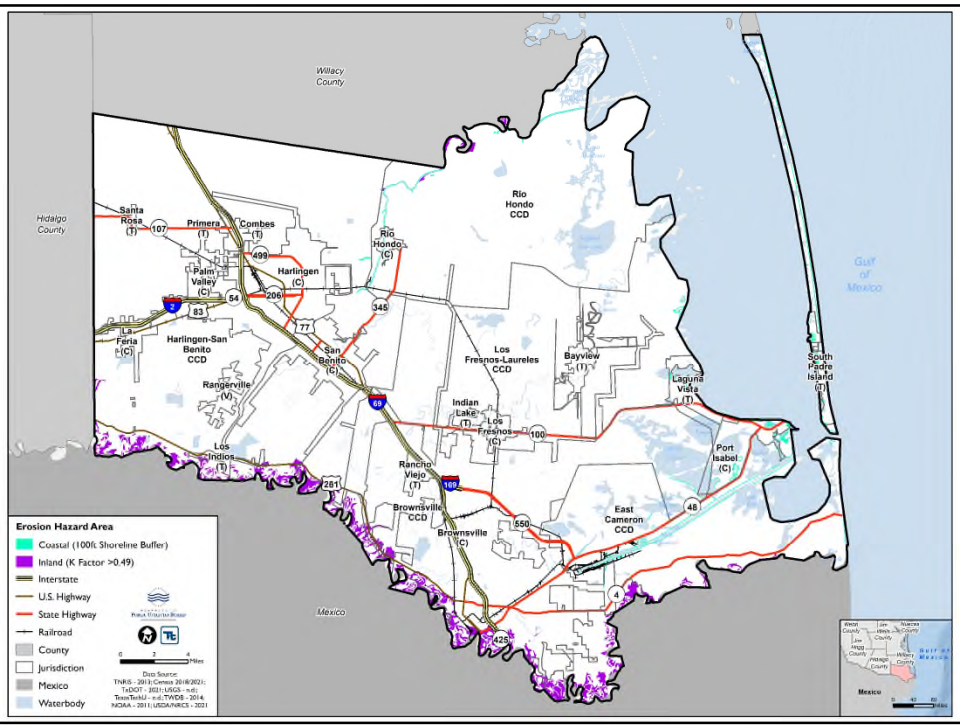
Erosion (Coastal and Inland)

- Looked at both coastal and inland erosion impacts
  - Coastal – 100-ft shoreline buffer
  - Inland – K factor >0.49 (susceptibility to erosion)
- No previous occurrences identified during our research. Are they any specific events in the last five years that we should include?
- While the overall ranking for BPUB is low, we looked at all communities served by BPUB. Some had an overall ranking of 'High' and 'Medium'. Should we change the ranking to represent the highest ranking calculated?
- Potential mitigation actions to address erosion?

Probability - Rare	Population - Low
Property - Low	Economy - Low
Capacity – Medium	Climate Change – High
Ranking - Low	

22



23

Extreme Heat

Probability - Frequent

Population - Medium

Property - Low

Economy - Low

Capacity – Medium

Climate Change – High

Ranking - Medium

- Previous Events
  - Between 2000 and 2021, the Planning Area has experienced 43 days of temperatures over 100°F.
- Exposure
  - Entire Planning Area is vulnerable
  - Increased vulnerability to populations at higher risk (65+ / <5 years old)
- Potential mitigation actions to address extreme heat?

Flood

- Previous Events
  - Looked at riverine, coastal, flash, and stormwater flooding
  - 5 events with reported damages in Brownsville since 2015; 4 FEMA disaster declarations since 1971 specific to flooding
- Exposure
  - People and property located in the 1% annual chance flood area
- While the overall ranking for BPUB is low, we looked at all communities served by BPUB. Some had an overall ranking of 'High' and 'Medium'. Should we change the ranking to represent the highest ranking calculated?
  - The last HMP ranked flood as 'High'
- Potential mitigation actions to address flood?

Probability - Occasional

Population - Low

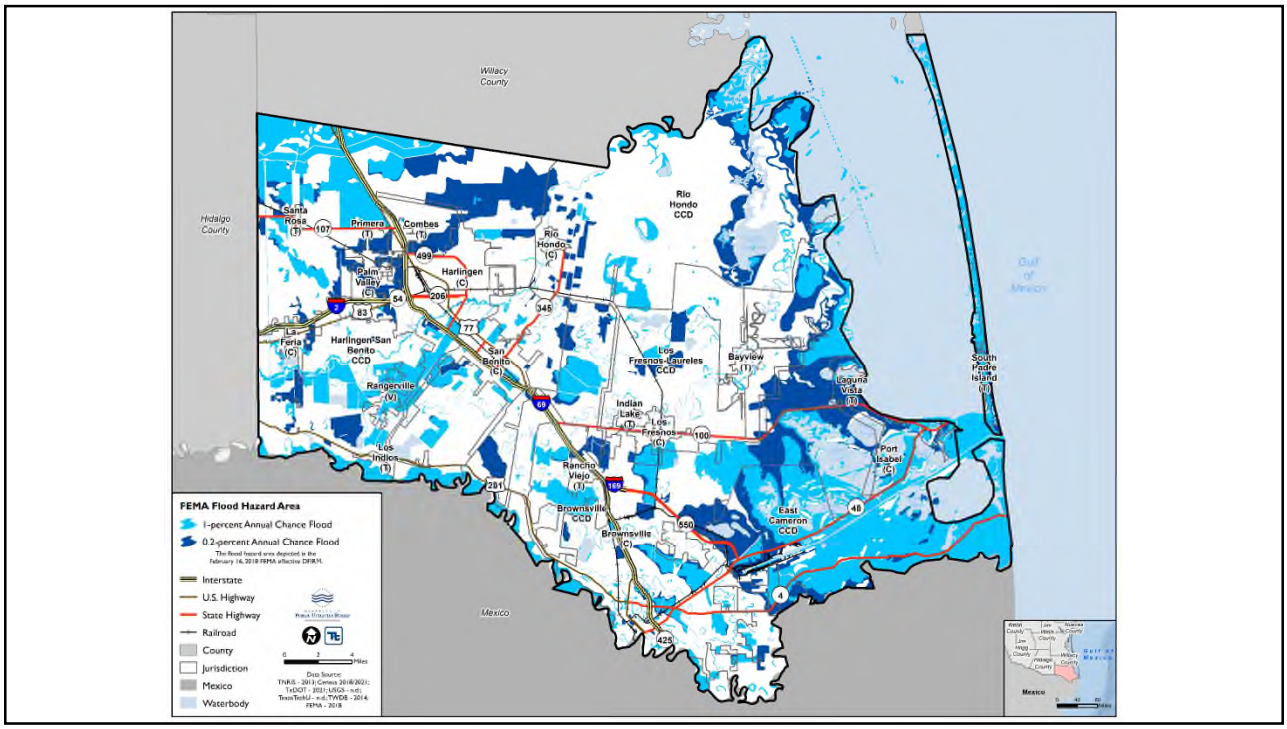
Property - Low

Economy - Medium

Capacity – Medium

Climate Change – High

Ranking - Low



26

Hail

Probability - Occasional

Population - Medium

Property - Medium

Economy - Medium

Capacity – Medium

Climate Change – Medium

Ranking - Medium

- Previous Events
  - No recorded events in Brownsville since 2015.
  - Any events we should include?
- Exposure
  - Entire population and building stock vulnerable
- Should we adjust the ranking?
- Potential mitigation actions for hail?

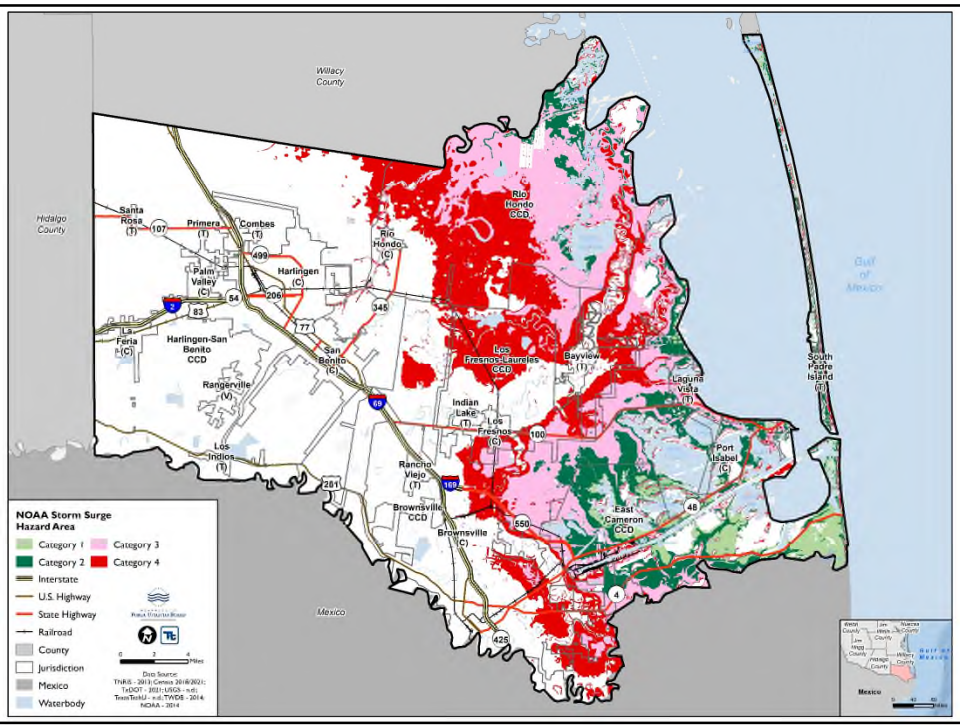
27

Hurricane and Tropical Storm

- Previous Events
  - 6 events since 1996 in Cameron County; 24 FEMA disaster declarations
  - Most recent event to hit Brownsville – Hurricane Hanna
- Exposure
  - Population and property exposed to storm surge
  - Used Category 4 storm surge to develop ranking
- While the overall ranking for BPUB is low, we looked at all communities served by BPUB. Some had an overall ranking of 'High' and 'Medium'. Should we change the ranking to represent the highest ranking calculated?
  - The last HMP ranked flood as 'High'
- Potential mitigation actions for hurricane?

Probability - Occasional	Population - Low
Property - Medium	Economy - Medium
Capacity – Medium	Climate Change – High
Ranking - Low	

28



29

Lightning

Probability - Occasional

Population - Medium

Property - Medium

Economy - Low

Capacity – Medium

Climate Change – Medium

Ranking - Medium

- Previous Events
  - One recorded lightning strike since 2014
  - Any other events we should include?
- Exposure
  - All people and property exposed and vulnerable
- Potential mitigation actions for lightning?

30

Thunderstorm Wind

- Previous Events
  - Wind-related events associated with thunderstorms
  - Only 2 reported events since 2015 – any other events we should include?
- Exposure
  - Looked at population and property exposed to a 500-year event (Category 3 wind gusts – 111-129 mph)
- Potential mitigation actions to address wind?

Probability - Occasional

Population - Medium

Property - Low

Economy - Low

Capacity – Medium

Climate Change – High

Ranking - Medium

31

Tornado

Probability - Occasional

Population - Medium

Property - Medium

Economy - Medium

Capacity – Medium

Climate Change – Medium

Ranking - Medium

- Previous Events
  - 2 reported in Brownsville area since 2015
- Exposure
  - All people and property in the Planning Area exposed and vulnerable
- Potential mitigation actions for tornado?

32

Wildfire

- Previous Events
  - No events identified during our research
  - Any events to include?
- Exposure
  - People and property located in the Wildland-Urban Interface/Intermix (WUI) areas
  - WUI is the area where houses meet or intermingle with undeveloped wildland vegetation.
- Potential mitigation actions for wildfire?

Probability - Rare

Population - Medium

Property - Medium

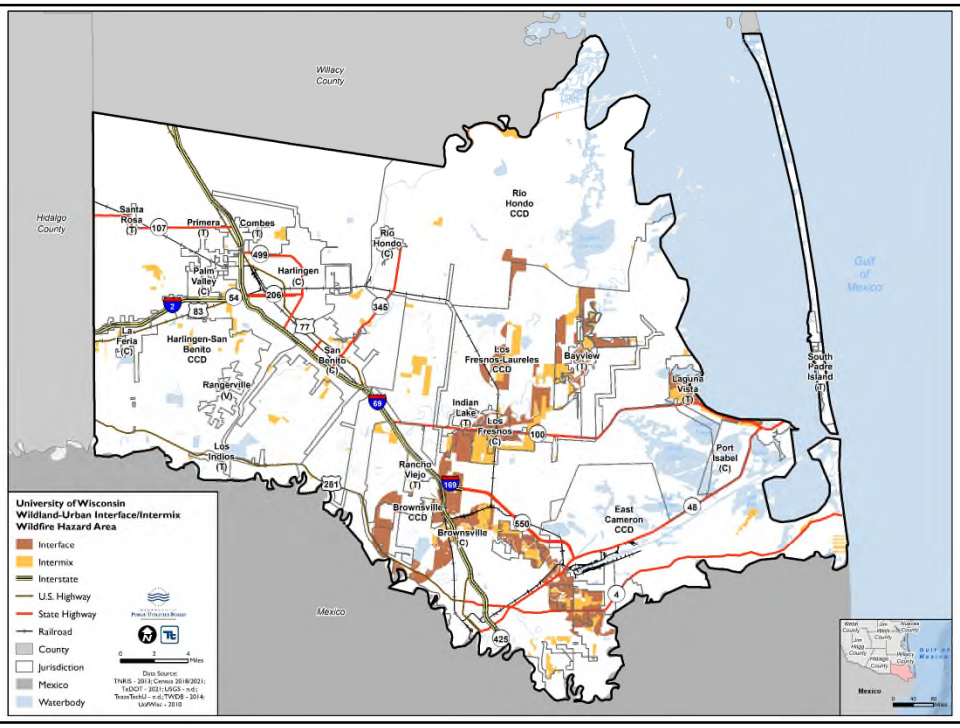
Economy - Medium

Capacity – Medium

Climate Change – Medium

Ranking - Medium

33



34

Winter Storm

BROWNSVILLE PUBLIC UTILITIES BOARD

Probability - Rare	Population - High
Property - Low	Economy - Low
Capacity – Medium	Climate Change – Medium
Ranking - Medium	

- Previous Events
  - Most recent event occurred February 2021 – below-freezing temperatures, power outages
- Exposure
  - All people and property in the Planning Area are vulnerable
  - Populations of 65+ and <5 may be more at risk
- Potential mitigation actions to address winter storm?

35

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Next Steps

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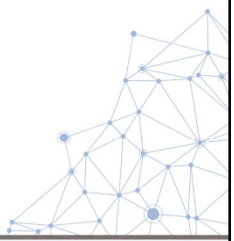
36

Next Steps

BROWNSVILLE PUBLIC UTILITIES BOARD

- Finalize risk assessment – due to Tetra Tech by Wednesday, December 29th
- Conduct Mitigation Strategy Workshop – date TBD
  - Start thinking about your mitigation actions!
  - Need two actions per hazard of concern
- Submit Draft Plan for TDEM/FEMA Review
- Adopt FEMA - Approved Plan
- Implement Projects and Maintain the Plan → Increase Resilience!



37

Questions?

38

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Thank You!

Photo Credit: t.ly/8LpX

39

Purpose of Meeting:	Mitigation Action Workshop
Location of Meeting:	Microsoft Teams
Date/Time of Meeting:	January 26, 2022 – 1:00 pm to 2:00 pm

Attendees:

☒ Rene Tabarez Jr., EM Planner, Brownsville Emergency Management
☒ George Rangel, Fiscal Manager, BPUB
☒ Samantha Cienfuegos, Grant Writer, City of Brownsville
☒ Olga Moya, Grant Manager, City of Brownsville
☒ Conrad Taylor, Grants Coordinator, BPUB
☒ Doroteo Garcia Jr, City Engineer, City of Brownsville
☒ Eryka Duberney, Grant Analyst, City of Brownsville
☒ Odee Ann Leal, EM Administrator, City of Brownsville
☒ Samantha Cienfuegos
☒ Hazael
☒ George
☒ Cynthia Vidal
☒ Francisca Calles
☒ Noel Bernal
☒ Heather Apgar, Tetra Tech
☒ Megan Brotherton, Tetra Tech

Agenda Summary: Identifying mitigation actions

Item No.	Description	Action By:
1.	Welcome	N/A

2.	**Project Overview and Status**
	• What is mitigation?
	  o Mitigation describes actions taken to help reduce or eliminate the long-term risks/damages cause by hazards
	  o Developing an HMP is one of several steps to take to mitigate hazards
	  o Mitigation helps us:
	  ▪ Plan for the future
	  ▪ Recovery quickly after disasters
	  ▪ Identify mitigations
	  ▪ Access FEMA funds
	• Why are we updating the plan?
	  o The HMP needs to be updated every 5 years to:
	  ▪ Prepare for and mitigate the effects of hazards
	  ▪ Allows eligibility for pre disaster funding
	• Schedule
	  o All annex worksheets need to be returned to Tt by February 16th. We will get them send out to you as part of the meeting follow-up. Tt will be available to help you identify projects and complete the worksheets.
	  o Draft plan review with the Steering Committee and Planning Partners will be in March – public review in March and plan submitted to TDEM/FEMA by the end of March
		N/A

3.	**Mitigation Strategy** • Focus on the hazards of highest concern to your community • At least TWO mitigation actions per each hazard of concern	Jurisdictions to begin developing mitigation actions

	○ Dam and Levee Failure ○ Drought ○ Earthquake ○ Erosion ○ Expansive Soils ○ Extreme Temperatures ○ Flood ○ Hail ○ Hurricane and Tropical Storm ○ Land Subsidence ○ Lightning ○ Pandemic ○ Severe Winter Storm ○ Thunderstorm Wind ○ Tornadoes ○ Wildfire • One action may cover all hazards and will count toward one of the two actions for each hazard. • Reduce risk by: ○ Manipulating the hazard – flood control projects, levees ○ Reducing or eliminating exposure – property acquisitions ○ Reducing vulnerability – floodproof structures, elevations, install hurricane shutters ○ Increasing capability – develop plans, codes/ordinances to help address hazards (prevent building in floodplain, increase code requirements for wind) • Risk reduction measures can be turned into mitigation actions • Requirements for the Mitigation Strategy ○ TDEM and FEMA want creative/big projects that would work well under the BRIC grant program ▪ Flood control measures, multi-jurisdictional projects ○ 2015 actions – remove general ones and make them more specific; remove maintenance (this should be an ongoing capability) ○ Minimum of TWO projects per hazard of concern • Mitigation actions to consider: ○ Local debris management plan ○ Tree maintenance program ○ Repetitive loss/severe repetitive loss properties– mitigate through elevations or acquisitions. ○ Public education and outreach programs ○ Heating/cooling centers with backup power ○ Generators at critical facilities • Connect to the Mitigation Strategy ○ The risk assessment, capability assessment, hazards of concern, and problem areas will be used to identify the best projects and actions for your community. ○ Make a clear connection between vulnerability and proposed mitigation actions. ○ The results of the capability assessment may alert you to plans and ordinances that need to be updated. Include an action to update the plan and incorporate the HMP. Or update an ordinance to include higher freeboard for properties in the floodplain.	

	○ Provide a factual basis for the proposed projects and activities in your plan. Tie the actions to vulnerability reduction. • Focus on: ○ Connecting the risk assessment to the mitigation strategy ○ Actions that you can achieve in the next five years – whether you have the funding now or will need grant funding ○ Diverse actions – identify a variety of actions that cover all hazards and action types (structural, natural systems protection, etc.)	
4.	Updating Your Mitigation Strategy • Review goals and objectives - think about how the projects you identify will meet the goals and objectives of the HMP • Start with your problems ○ Turn challenges into mitigation actions ○ Look at your historic impacts – are certain areas always damaged by storm events? ○ Do you have repetitive loss or severe repetitive loss properties? Areas that are always flooding? ○ Do you have stormwater flooding issues? What can be done to reduce or eliminate? ○ Do you have critical facilities that need backup power? Are they located in hazard areas? ○ Have you submitted FEMA grant applications for projects that were not funded? • Use the actions from the last plan that you did not complete as actions for this plan. If needed, modify those to be more specific or address different aspects of the original problem. • Cover at least one of the FEMA mitigation types with each action ○ Plans and regulations ○ Structure and infrastructure ○ Natural systems protection ○ Education and awareness programs • Complete the proposed action table for each action you will be including in the plan, focusing on highlighted areas • Action Worksheet completion ○ Fill in as much as possible, focusing on highlighted sections.	Tt to send proposed action table and instructions Jurisdictions to begin developing mitigation actions
5.	Next Steps • Actions and annexes – identify actions and return worksheets to Tt by 2/16 • Review draft annex before public review	
6.	Questions Q: What are some recommended projects to include in our annex to enable us to leverage current funding? A: All states will receive HMGP COVID funding. Tetra Tech will reach out to TDEM for suggestions. Q: Should we add microgrids to our resiliency strategy. A: Yes. Q: Should the City add an action to become a CRS community? A: Yes	

	Q: Can we mention other Cameron County special districts in our annex who are not planning partners? A: Yes. You can add their projects to your action plan and apply for funding on their behalf.	

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Brownsville Public Utilities Board Hazard Mitigation Plan – 2022 Update

Mitigation Strategy Workshop | January 26, 2022

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2

Agenda

BROWNSVILLE PUBLIC UTILITIES BOARD

- Welcome
- Project Schedule and Status Review
- Development of:
  - Mitigation Strategy/Actions/Projects
  - Action Worksheets using the Mitigation Action Development Worksheets
- Next Steps
- Questions

3

Project Schedule Review

✓	August 2021	Kick-Off Meeting
✓	July-September 2021	Data Collection
✓	October 7, 2021	Finalize Goals and Objectives
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❑	August 2021-March 2022	Plan Development
❑	March/April 2022	Review Draft Plan
❑	April 2022	Plan Submitted to TDEM
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4

Public and Stakeholder Outreach

- Website is live!
  - https://www.brownsvillepub-hmp.com/
- To date, we have received 54 responses on the public survey!
- Public Engagement – everyone was sent different tools to use to help with public outreach – please continue to share!
  - HMP website
  - Social media – Facebook and Twitter
  - Let Tetra Tech know when you post about the HMP so we can include in the plan

5

What is Hazard Mitigation?

- Plan for the future
- Recovery quickly after disasters
- Identify mitigation actions
- Access to FEMA funding

6

Why Update?

- Every five years, FEMA requires that HMPs be updated.
- The mitigation plan update will:
  - Help the Planning Area prepare for and mitigate the effects of disasters
  - Continue to allow the Planning Area to be eligible for pre- and post-disaster mitigation funding

7

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Mitigation Strategy

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8

2022 Hazards of Concern

BROWNSVILLE PUBLIC UTILITIES BOARD

- Dam and Levee Failure
- Disease Outbreak
- Drought
- Earthquake
- Erosion (coastal and inland)
- Extreme Heat
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- Hail
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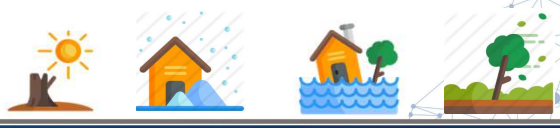

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Using Your Mitigation Strategy to Reduce Risk

- What is a *Mitigation Strategy*?
  - A group of projects or actions to reduce the impacts of the hazards of concern on your community
    - Plans and Regulations
    - Structure and Infrastructure Studies and Projects
    - Natural Systems Protection Studies and Projects
    - Education and Awareness Programs
- Terms to describe the Mitigation Strategy include:
  - Mitigation Action Plan or Action Plan
  - Mitigation Projects or Initiatives or Actions

Your Mitigation Strategy table is included in your annex. We will use action worksheets to collect details on the actions you will include in the 2022 Update.

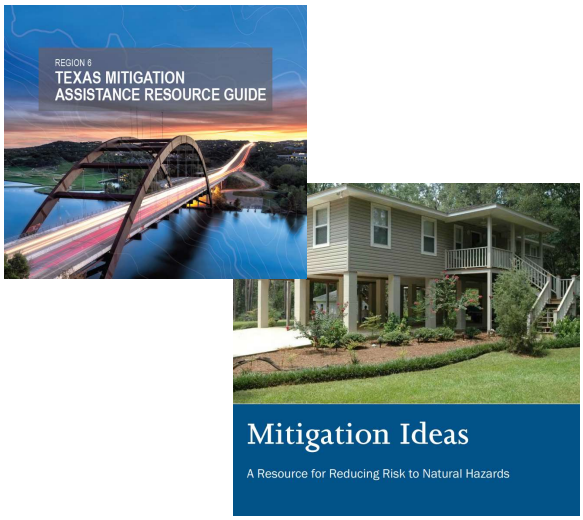
10

Requirements for the Mitigation Strategy Update

- TDEM and FEMA would like to see more creative/big projects that would work well under the BRIC grant program
- 2017 projects
  - If a project is not finished and still a priority, include in 2022 HMP
  - Remove general projects or make more specific
  - Remove routine maintenance
  - Remove ongoing capabilities
- Minimum of 2 mitigation actions for EACH hazard of concern
  - One action can cover multiple hazards and jurisdictions. For example, education program on mitigation technics you can implement – applies to all hazards and all jurisdictions.

11

Other Mitigation Actions to Consider

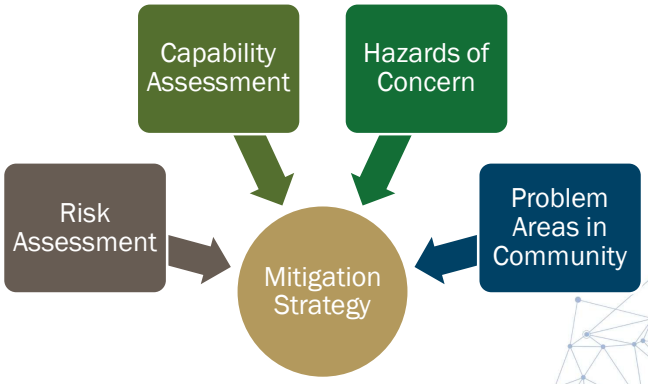


- Local Disaster Debris Management Plans
- Tree maintenance programs
- Public education and outreach programs
- Generators at critical facilities
- Floodproofing critical facilities
- Addressing repetitive and severe repetitive loss properties

12

Connecting to the Mitigation Strategy

- Need a clear connection between vulnerability and proposed mitigation actions.
- Capability assessment provides insight into challenges and opportunities for the mitigation strategy.
- Provides the factual basis for activities proposed in the mitigation strategy.



13

Where do you need to focus?

- Stronger connection between the risk assessment and mitigation strategy
- More specific, achievable actions
  - Specific projects, in specific locations, in a specific timeframe
- Diverse actions
  - You need at least 2 actions per hazard of concern. Think about actions that can cover multiple hazards.
  - Include a variety in the types of actions

14

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Update the Mitigation Strategy

Action Types
Initiative Table – actions and projects

15

Update the Mitigation Strategy

- Review the Goals and Objectives of the HMP
- Start with problems
  - Turn challenges/obstacles/gaps into mitigation actions
  - Examine historic impacts
  - Review the risk and capability assessment results
  - RL/SRL properties
  - Stormwater/urban flooding areas
  - Critical facilities and lifelines located in a hazard area (if feasible)
  - Additional areas of vulnerability
  - Previous FEMA HMA submitted projects – awarded/unawarded
- Identify new Mitigation Actions/Projects/Strategies
- REMEMBER – 2 actions for every hazard of concern!
- Modify 'carry-over' projects from the 2015 HMP
  - More specific or to address different aspects of the original problem

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16

Mitigation Action Types

Plans and regulations include government authorities, policies, or codes that encourage risk reduction, such as building codes and state planning regulations. This may also include planning studies.

Structure and infrastructure projects involve modifying existing structures and infrastructure or constructing new structures to reduce the impact of hazards.

Natural systems protection projects minimize losses while also preserving or restoring the function of natural systems.

Education and awareness programs include long-term, sustained programs to inform and educate citizens and stakeholders about hazards and mitigation options. This category could also include training.

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17

17

Range of Mitigation Actions

- Primary types of mitigation actions to reduce long-term vulnerabilities include:

Local Plans and Regulations	• Zoning codes • Ordinances • Open space plan • Debris management plan
Structural Projects	• Elevation • Drainage improvements • Property acquisitions • Stormwater improvements
Natural Systems Protection	• Stream and wetland restoration • Erosion control • Water quality improvement • Environmental corridors
Education and Outreach	• Public awareness • Education programs • Real estate disclosure • Map information • Environmental education

Proposed Action Table

- Each municipality will need to complete the *Proposed Hazard Mitigation Initiatives* table in your annex
- Each column needs to be filled in. Tetra Tech will assist you with completing each cell.
- Action Worksheets will need to be completed for all projects.

Initiative Number	Mitigation Initiative Name	Description of the Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met
2021-Your Town-001	Repetitive Loss Property Outreach	Problem: There are 100 repetitive loss properties located in the Borough. According to NFIP claims records, these properties have experienced extensive flood damage through the years. Without proper mitigation, the structures will continue to experience flood damages. Solution: Conduct outreach to the property owners to inform them of their repetitive loss designation and provide mitigation options to protect the structures. If the property owners choose elevation or acquisition, the Borough will develop a grant application to fund acquisitions or elevations of the properties.	Existing	Flood, Severe Storm, Hurricanes/ Tropical Storms	All

Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Cost	Timeline	Priority	Mitigation Category	CRS Category
Municipal Floodplain Administrator, Property Owner	Borough Budget for outreach; FEMA FMA or HMGP for mitigation measures	Increase resilience of structure and Borough; decrease flood damages	<$10,000 for outreach; mitigation costs vary depending on project	One year for outreach; 5 years for mitigation measures	High	EAP, SIP	PP, PI

Getting Started…

- If you had all the time and money in the world, what would you do to protect your community from future disasters?
- Ask yourself these questions -
  - What plans or regulations does your municipality need?
  - What information must you provide to your residents and visitors?
  - What property and products can be insured?
  - What additional staff do you need?
  - Where are your problem areas? What can be done about them?
  - What critical facilities need backup power generators?

20

Mitigation Action Examples

- All Hazards
  - Public outreach to increase awareness of hazards and actions people can take
- Disease Outbreak
  - Increase PPE stockpile to distribute as needed
  - Continuity planning
- Drought
  - Emergency plans
  - Schedule to monitor/report conditions
- Earthquake
  - Adopt and enforce updated building codes to reduce earthquake risk
- Extreme Temperatures
  - Establish heating/cooling centers; ensure backup power is at the centers
- Wind damage
  - Tree maintenance programs
  - Retrofit structures
- Steep Slopes
  - Assess property as a whole
  - Retrofit

21

Mitigation Action Examples

- Wildland-Urban Interface
  - Assess property
  - Clear brush from near structure(s)
- Lack of backup power
  - Generators at critical facilities
  - Alternative energy sources
- Dam Failure
  - Assess risk at specific properties
  - Create EAPs for all high hazard dams
  - Adopt special land use codes in dam inundation areas
- Poor water/sewer infrastructure
  - System upgrades
  - Enhance maintenance
- Special Flood Hazard Areas
  - Acquisition/relocation
  - Elevation
  - Fill basements
  - Floodproofing
  - Protect/restore wetlands
  - Enhanced regulations
- Stormwater Management Issues
  - Upgrade culverts, bridges, road drainage
  - Enhanced regulations

How do you fill in the Action Worksheets?

- The entire worksheet needs to be filled in; however, Tetra Tech will assist with this. We ask that each municipality fill in (at least) the highlighted cells.
- We need one worksheet for each action.
- Focus on providing highly detailed:
  - Description of the Problem
  - Description of the Solution

Action Worksheet			
Project Name:			
Project Number:			
Risk / Vulnerability			
Hazard(s) of Concern:			
Description of the Problem:			
Action or Project Intended for Implementation			
Description of the Solution:			
Is this project related to a Critical Facility or Lifeline?	Yes ☐	No ☐	
Estimated Benefits (losses avoided):		Goals Met:	
Estimated Cost:		Mitigation Action Type:	
Plan for Implementation			
Prioritization:		Responsible Organization:	
Estimated Time Required for Project Implementation:		Potential Funding Sources:	

How do you fill in the Action Worksheets?

Action Worksheet			
Project Name:			
Project Number:			
Risk / Vulnerability			
Hazard(s) of Concern:			
Description of the Problem:			
Action or Project Intended for Implementation			
Description of the Solution:			
Is this project related to a Critical Facility or Lifeline?	Yes ☐	No ☐	
Estimated Benefits (losses avoided):		Goals Met:	
Estimated Cost:		Mitigation Action Type:	
Plan for Implementation			
Prioritization:		Responsible Organization:	
Estimated Time Required for Project Implementation:		Potential Funding Sources:	

Action Worksheet			
Project Name:	Engineering Study of Main Street		
Project Number:	2022-BPUB-001		
Risk / Vulnerability			
Hazard(s) of Concern:	Flood, Hurricane/Tropical Storm		
Description of the Problem:	In the Main Street area of the City, stormwater is flowing into the sewer system and it leads to flooding when the system becomes overwhelmed. As a result, roads are closed and properties flood.		
Action or Project Intended for Implementation			
Description of the Solution:	Complete an engineering study to determine the types of upgrades the stormwater system needs in this area. Once identified, the City will seek funding to implement the project.		
Is this project related to a Critical Facility or Lifeline?	Yes ☐	No ☒	
Estimated Benefits (losses avoided):	Reduce/eliminate flooding; increase stormwater capacity; reduce stormwater entering sewer system	Goals Met:	1, 2
Estimated Cost:	$15,000+ for study	Mitigation Action Type:	SIP, NSP
Plan for Implementation			
Prioritization:	Medium	Responsible Organization:	Engineer; Public Works/Road Dept.
Estimated Time Required for Project Implementation:	1-2 years	Potential Funding Sources:	FEMA HMGP and BRIC, Local Budget

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24

24

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Next Steps

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25

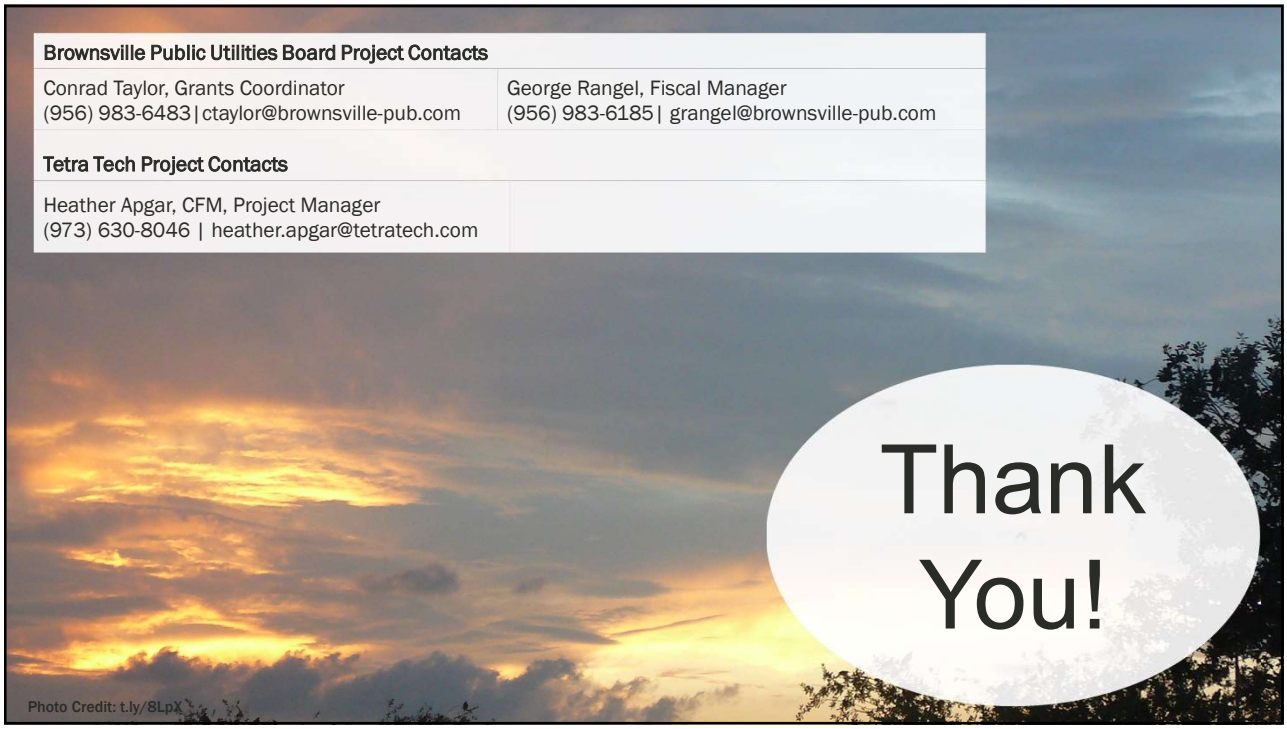
Next Steps

- Actions and Annexes
  - Tetra Tech will reach out to help you with identify mitigation actions
  - We will be sending out a worksheet to help capture additional problem areas. Complete the online survey to identify areas as well.
- Action worksheets need to be returned to Tetra Tech by **Wednesday, February 16th**
- Review your draft annex prior to posting for public review.

26

Questions?

27


Brownsville Public Utilities Board Project Contacts
Conrad Taylor, Grants Coordinator
(956) 983-6483 | ctaylor@brownsville-pub.com
George Rangel, Fiscal Manager
(956) 983-6185 | grangel@brownsville-pub.com
Tetra Tech Project Contacts
Heather Apgar, CFM, Project Manager
(973) 630-8046 | heather.apgar@tetratech.com
Thank You!
Photo Credit: t.ly/8LpX

28

APPENDIX D. PUBLIC AND STAKEHOLDER OUTREACH

This appendix provides documentation of public and stakeholder outreach. Stakeholder involvement in this planning process was broad and productive as discussed and further documented in Section 2 (Planning Process). Public and stakeholder input has been incorporated throughout this HMP as appropriate, as identified in Section 2 and the References section.

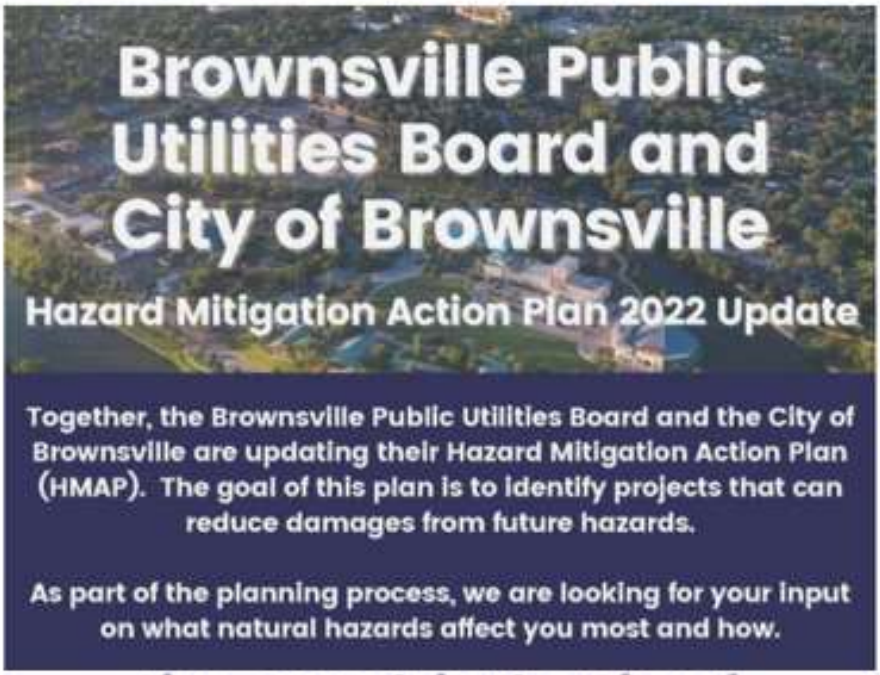
D.1 Website and Social Media Posts

The following provides screenshots of websites, news articles, and social media posts.

City of Brownsville, TX - Municipal Government
November 10, 2021 ·

The Brownsville Utilities Board along with the City of Brownsville need your input! Please fill out the survey located on the flyer. #brownsvilletx

https://www.surveymonkey.com/r/BPUB_HMP



8 1 Comment 8 Shares

Like Comment Share

Most relevant

Brownsville Public Utilities Board
November 15, 2021 ·

The Brownsville Public Utilities Board is updating their Hazard Mitigation Plan. This plan enables BPUB and the City of Brownsville to continue to be eligible for federal funding to rebuild stronger after disasters have struck. Please visit the website and take the citizen preparedness survey: https://www.brownsvillepub-hmp.com/

2 2 Shares

Like Comment Share

BROWNSVILLE PUBLIC UTILITIES BOARD HAZARD MITIGATION PLAN 2022 UPDATE

Brownsville Public Utilities Board Hazard Mitigation Plan Update

Welcome to the Brownsville Public Utilities Board (BPUB) Hazard Mitigation Plan (HMP) Website. This website provides project updates, resources, and links to hazard mitigation in support of the HMP update.

The goal of the project is to save lives and property through the reduction of hazard vulnerability for BPUB and the City of Brownsville. During the course of this planning project, county and local leaders and the community will work in tandem to identify risks, assess capabilities, and formulate a strategy to reduce disaster vulnerability.

Public participation and feedback is a vital part of the hazard mitigation planning process. The BPUB Hazard Mitigation Planning Team has developed a Mitigation Survey to assist in providing the public an outlet to contribute to the BPUB HMP update. This survey will be used to develop portions of the HMP.

Keep checking back regularly for information on upcoming events, to take our public survey, and to review and comment on the draft plan. If you would like to get in touch with the project team, please fill out the form at the end of the page and someone will be in touch shortly.

Upcoming Meetings

Events in March 2022–February 2023

List March Go Month Week Day

SUN	MON	TUE	WED	THU	FRI	SAT

https://www.brownsvillepub-hmp.com/[3/2/2022 5:14:21 PM]

Table D-1. Website and Social Media Posts

Date of Post	Jurisdiction	Format
11/10/2021	City of Brownsville	Facebook
11/15/2021	Brownsville Public Utilities Board	Facebook
11/15/2021	Brownsville Public Utilities Board	Twitter
2021	Brownsville Public Utilities Board	Website

D.2 Stakeholder Surveys

This section contains information and results gathered from the Brownsville Public Utilities Board HMP Stakeholder Survey. Unlike steering committee or planning partnership members, stakeholders may not be involved in all stages of the planning process, but they may have information or input to provide. In order to gather that information, the surveys were sent to the following stakeholders that provide various services to the Planning Area (emergency services, academic/research, public works, utility providers, business/commerce, hospitals/medical services, and transportation). Results of the surveys are provided below, with personal information redacted.

D.2.1 Stakeholder Survey Results

The stakeholder survey was designed to help identify general needs for hazard mitigation and resiliency within Brownsville Public Utilities Board from its perspective, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including the various county and municipal departments and agencies in the county. As of January 28, 2022, one stakeholder completed the survey, representing the business/commerce sector.

The respondent said the buildings/facilities/structures they have worked in and/or are responsible for have been impacted by a hazard. Those that experienced damage stated that the structures damage due to inclement weather, flooding, and structural damage from severe winds. When asked what areas are most vulnerable to hazards in the Planning Area, answers included low lying areas that impede access to roadways and key structural assets. The respondent indicated that their infrastructure and facilities are equipped to handle disasters and damages.

The respondent stated that the have the following plans in place: Emergency Operations Plan, Business Continuity Plan, and an Energy Restoration Plan.

D.2.2 Neighbor Survey

The neighbor survey was sent to the surrounding municipalities of the City of Brownsville due to their proximity to and because effects of hazard events that impact the Planning Area would be similar to that of their neighbors. As of March 15, 2022, no responses have been received.

D.3 Public Survey Results

This section contains information and results gathered from the Brownsville Public Utilities Board Public Survey. The main objective of this survey was to gather information from citizens regarding their level of knowledge regarding hazard vulnerability and knowledge of hazard mitigation information for their local communities. Fifty-four respondents completed this survey over a period of four months during the planning process. The survey was available on BPUB HMP website (https://www.brownsvillepub-hmp.com/) and participants posted a link to the survey through their social media accounts. Full survey responses are provided at the end of the appendix.

D.4.1 Public Survey Results

Demographically, survey respondents were from the City of Brownsville, with 60% having lived in the city for 20 years or more, and the majority (74.5%) in their own home. The most common (29.6%) age of respondents were between the ages of 31 and 40. Residents were asked the ways in which they receive their information concerning a natural disaster. The majority (77.4%) of respondents rely on the internet to receive information concerning natural disasters. Three-quarters of respondents (74.1%) receive information through TV news and just over half (61.2%) receive information through social media.

Survey respondents were asked how concerned they were about 21 different hazards, on a scale of not concerned to extremely concerned. Respondents were most concerned (reporting "concerned", "very concerned", or "extremely concerned") about hurricanes/tropical storms, flooding, extreme temperatures, and severe storms.

About 56.6% of respondents' properties are not located in the floodplain, with 16.6% within a floodplain and 26.6% are unsure. Nearly half of those do not have flood insurance (48.3%), 38.7% do have flood insurance, and 12.9% are unsure if they have flood insurance. Residents were then asked what types of projects they believe local, county, state, or federal government agencies could be doing in order to reduce the damage and disruption of disasters in the Planning Area including:

- Improve and strengthen infrastructure, such as elevating roadways and improving drainage systems (100%)
- Work on improving the damage resistance of utilities (electricity, communications, water/wastewater facilities etc.) (78.2%)
- Install or improve protective structures, such as bulkheads, floodwalls or levees to protect against flooding (43.4%)
- Strengthen codes, ordinances and plans to require higher hazard risk management standards and/or provide greater control over development in high hazard areas (34.7%)
- Assist vulnerable property owners with securing funding to mitigate their properties (30.4%)
- Improve and strengthen critical facilities such as police, schools, hospitals (26%)
- Inform property owners of ways they can mitigate damage to their properties (26%)
- Provide better information about hazard risks and high-hazard areas (26%)
- Enhance dune restoration and beach nourishment projects/programs (17.3%)
- Replace inadequate or vulnerable bridges and causeways (13%)

- Buy out flood prone properties and maintain as open-space (8.7%)

APPENDIX E. MITIGATION STRATEGY SUPPLEMENTARY DATA

This appendix summarizes additional activities and resources provided to plan participants to support the update of the mitigation strategy.

E.1 2015 Goals and Objectives Review

Brownsville Public Utilities Board and the City of Brownsville's planning documents and recent policies changes were reviewed and discussed with the Planning Team to help inform the review and update of the goals and objectives. Table E-1 and Table E-2 summarizes the Planning Team review and evaluation of the 2015 HMP goals and objectives. Table E-3 and Table E-4 summarize the goals and objectives for the 2022 HMP update.

Table E-1. 2015 Goals Evaluation

2015 Goal	2022 Goal Evaluation (Keep as is? Change? Add another goal?)
Goal 1: Protect public health and safety.	Change
Goal 2: Protect new and existing properties.	Change
Goal 3: Build and support partnerships to enhance mitigation to continuously become less vulnerable to hazards.	Change
Goal 4: Leverage outside funds for investment in hazard mitigation.	Keep as is
Goal 5: Increase the understanding of residents for the need for mitigation, and steps they can take to protect people and properties.	Change

Table E-2. 2015 Objectives Evaluation

2015 Objective	2022 Objective Evaluation (Keep as is? Change? Add another objective?)
1.1: Maintain critical facilities.	Change
1.2: Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.	Keep as is
1.3: Reduce the danger to, and enhance protection of, high risk areas during hazard events.	Keep as is
1.4: Protect critical facilities and services.	Change
2.1: Reduce repetitive losses to the National Flood Insurance Program (NFIP).	Change
2.2: Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.	Keep as is
2.3: Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.	Keep as is
3.1: Build and support local partnerships to continuously become less vulnerable to hazards.	Keep as is
3.2: Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.	Keep as is
3.3: Build hazard mitigation concerns into the City of Brownsville and Brownsville Public Utilities Board (BPUB) planning and budgeting processes.	Keep as is
4.1: Maximize the use of outside sources of funding.	Keep as is

2015 Objective	2022 Objective Evaluation (Keep as is? Change? Add another objective?)
4.2: Maximize participation of property owners in protecting their properties.	Keep as is
4.3: Maximize insurance coverage to provide financial protection against hazard event.	Keep as is
4.4: Prioritize mitigation projects based on cost-effectiveness, and starting with those sites facing the greatest threat to life, health and property.	Keep as is
5.1: Heighten public awareness of the full range of natural and human-made hazards they face.	Keep as is
5.2: Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.	Keep as is
5.3: Publicize and encourage the adoption of appropriate hazard mitigation measures.	Keep as is

Table E-3. 2022 Goals

2022 Goals
Goal 1 - Protect public health and safety from natural, technological, and human-caused hazard events
Goal 2 - Protect new and existing public and private properties from natural, technological, and human-caused hazard events
Goal 3 - Build and support public, private, and non-profit partnerships to enhance mitigation to continuously become less vulnerable to hazards.
Goal 4 - Leverage outside funds for investment in hazard mitigation.
Goal 5 - Enhance and promote hazard mitigation awareness and education to help residents understand the need for mitigation, and steps they can take to protect people and properties.

Table E-4. 2022 Objectives

2022 Objectives
Objective 1: Maintain and protect critical facilities, community lifelines, and services.
Objective 2: Maximize the utilization of the latest technology to provide adequate warning, communication, and mitigation of hazard events.
Objective 3: Reduce the danger to, and enhance protection of, high risk areas during hazard events.
Objective 4: Retrofit, purchase, or relocate structures in high hazard areas including those known to be repetitively damaged
Objective 5: Reduce the number of repetitive losses to properties in the National Flood Insurance Program (NFIP).
Objective 6: Use the most cost-effective approach to protect existing buildings and public infrastructure from hazards.
Objective 7: Enact and enforce regulatory measures to ensure that development will not put people in harm's way or increase threats to existing properties.
Objective 8: Build and support local partnerships to continuously become less vulnerable to hazards.
Objective 9: Ensure continuity of government operations, emergency services, essential, and lifeline facilities at the local level during and immediately after disaster and hazard events.
Objective 10: Strengthen inter-jurisdiction and inter-agency communication, coordination, and partnerships in all phases of emergency management.
Objective 11: Build a cadre of committed volunteers to safeguard the community before, during and after a disaster.
Objective 12: Build hazard mitigation concerns into the City of Brownsville and Brownsville Public Utilities Board (BPUB) planning and budgeting processes.
Objective 13: Maximize the use of outside sources of funding.
Objective 14: Maximize participation of property owners in protecting their properties.

2022 Objectives
Objective 15: Maximize insurance coverage to provide financial protection against hazard event.
Objective 16: Prioritize mitigation projects based on cost-effectiveness and starting with those sites facing the greatest threat to life, health and property.
Objective 17: Heighten public awareness of the full range of natural and human-made hazards they face.
Objective 18: Educate the public on actions they can take to prevent or reduce the loss of life or property from all hazards.
Objective 19: Publicize and encourage the adoption of appropriate hazard mitigation measures.

E.2 MITIGATION STRATEGY WORKSHOP RESOURCES

On January, 26, 2022 a Mitigation Strategy Workshop was held for all plan participants. The workshop was held virtually due to coronavirus restrictions and was led by the contract consultant, supplemented by emails and phone calls between Brownsville Public Utilities Board, The City of Brownsville and the contract consultant, for all participants to support the development of focused problem statements based on the impacts of natural hazards in the county and their communities. These problem statements were intended to provide a detailed description of the problem area, including its impacts to the municipality/jurisdiction; past damages; loss of service; etc. An effort was made to include the street address of the property/project location, adjacent streets, water bodies, and well-known structures as well as a brief description of existing conditions (topography, terrain, hydrology) of the site. These problem statements formed a bridge between the hazard risk assessment which quantifies impacts to each community with the development of actionable mitigation strategies. Resources available at the workshop and follow up discussions included the following to assist with the identification of mitigation alternatives and the development of the mitigation strategy workshops found in Section 9 (Annexes).

1. FEMA Local Mitigation Handbook
2. Public survey results
3. FEMA Mitigation action types (Table E-5)
4. FEMA Mitigation Ideas
5. FEMA Project Useful Life factsheet
6. Mitigation funding sources at the federal, state and local levels (Table E-6)
7. FEMA Region 6 Funding Sources for Texas
8. FEMA Ecosystem Services

E.2.1 Types of Mitigation Actions

A mitigation action is a specific action, project, activity, or process taken to reduce or eliminate long-term risk to people and property from hazards and their impacts. Implementing mitigation actions helps achieve the plan's mission and goals. The actions to reduce vulnerability to threats and hazards form the core of the plan and are a key outcome of the planning process.

The primary types of mitigation actions to reduce long-term vulnerability are:

- Local Plans and Regulations (LPR)
- Structure and Infrastructure Projects (SIP)

- Natural Systems Protection (NSP)
- Education and Awareness Programs (EAP)

Table E-5. FEMA Mitigation Action Types

Mitigation Type	Description	Examples
Local Plans and Regulations	These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.	• Comprehensive plans • Land use ordinances • Subdivision regulations • Development review • Building codes and enforcement • NFIP Community Rating System • Capital improvement programs • Open space preservation • Stormwater management regulations and master plans
Structure and Infrastructure Projects	These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards. Many of these types of actions are projects eligible for funding through the FEMA Hazard Mitigation Assistance program.	• Acquisitions and elevations of structures in flood prone areas • Utility undergrounding • Structural retrofits • Floodwalls and retaining walls • Detention and retention structures • Culverts • Safe rooms
Natural Systems Protection	These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.	• Sediment and erosion control • Stream corridor restoration • Forest management • Conservation easements • Wetland restoration and preservation
Education and Awareness Programs	These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady or Firewise Communities. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions.	• Radio or television spots • Websites with maps and information • Real estate disclosure • Presentations to school groups or neighborhood organizations • Mailings to residents in hazard-prone areas • StormReady • Firewise Communities

E.2.2 Potential Mitigation Funding Sources

While it is important to recognize the mitigation strategies for Brownsville Public Utilities Board and the City of Brownsville to help achieve the mitigation goals and objectives of the HMP, it is also important to provide sources for funding to implement these strategies. The table below provides a list of programs, descriptions, and links for those seeking funding sources. Please note that this table is not intended to be a comprehensive list, but rather a starting point to help identify potential sources of funding for the identified mitigation strategies.

Table E-6. Texas Mitigation Funding Sources

Program	Description	Lead Agency	Website
Federal			
Hazard Mitigation Assistance (HMA)	Grants to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages – includes FMA, HMGP, PDM	FEMA	https://www.fema.gov/hazard-mitigation-assistance
Flood Mitigation Assistance (FMA)	Program Grants to States and communities for pre-disaster mitigation planning and projects to help reduce or eliminate the long-term risk of flood damage to structures insurable under the National Flood Insurance Program	FEMA	https://www.fema.gov/flood-mitigation-assistance-grant-program
Hazard Mitigation Grant Program (HMGP)	Grants to States and communities for planning and projects providing long-term hazard mitigation measures following a major disaster declaration	FEMA	https://www.fema.gov/hazard-mitigation-grant-program
Building Resilient Infrastructure and Communities (BRIC)	Supports states, local communities, tribes and territories to undertake hazard mitigation projects by reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the existing Pre-Disaster Mitigation (PDM) program.	FEMA	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
Public Assistance: Hazard Mitigation Funding Under Section 406	Hazard mitigation discretionary funding available under Section 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act following a Presidentially declared disaster	FEMA	https://www.fema.gov/news-release/2017/05/03/4309/fema-hazard-mitigation-grants-404-and-406
Assistance to Firefighters Grant Program	The primary goal of the Assistance to Firefighters Grants (AFG) is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated Emergency Medical Services organizations, and State Fire Training Academies. This funding is for critically needed resources to equip and train emergency	FEMA	https://www.fema.gov/welcome-assistance-firefighters-grant-program

Program	Description	Lead Agency	Website
	personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience.		
High Hazard Potential Dams (HHPD) Rehabilitation Grant	The Rehabilitation of High Hazard Potential Dams Grant Program (HHPD provides technical, planning, design, and construction assistance in the form of grants to non-Federal governmental organizations or nonprofit organizations for rehabilitation of eligible high hazard potential dams.	FEMA	https://www.grants.gov/web/grants/view-opportunity.html?oppId=316238
Fire Management Assistance Grant Program	Assistance for the mitigation, management, and control of fires on publicly or privately-owned forests or grasslands that threaten such destruction as would constitute a major disaster. Provides a 75% Federal cost share and the State pay the remaining 25% for actual cost.	FEMA	https://www.fema.gov/fire-management-assistance-grant-program
Disaster Housing Program	Emergency assistance for housing, including minor repair of home to establish livable conditions, mortgage and rental assistance	HUD	https://www.hud.gov/program_offices/public_indian_housing/publications/dhap
HOME Investment Partnerships Program	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons)	HUD	https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/
HUD Disaster Recovery Assistance	Grants to fund gaps in available recovery assistance after disasters (including mitigation)	HUD	https://www.hud.gov/info/disasterresources
Section 108 Loan Guarantee	Enables states and local governments participating in the Community Development Block Grant (CDBG) program to obtain federally guaranteed loans for disaster-distressed areas	HUD	https://www.hudexchange.info/programs/section-108/
Smart Growth Implementation Assistance (SGIA) program	The SGIA program focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under 4 categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design or medical and social service facilities siting.	EPA	https://www.epa.gov/smartgrowth
Partners for Fish and Wildlife	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats	U.S. Fish and Wildlife Service	https://www.fws.gov/partners/

Program	Description	Lead Agency	Website
FHWA Emergency Relief Program	Fund for the repair or reconstruction of Federal-aid highways that have suffered serious damage as a result of (1) natural disasters or (2) catastrophic failures from an external cause	U.S. Department of Transportation (DOT)	https://www.fhwa.dot.gov/programadmin/erelief.cfm
Transportation Investment Generating Economic Recovery (TIGER)	Investing in critical road, rail, transit and port projects across the nation	U.S. DOT	https://www.transportation.gov/tags/tiger-grants
Community Facilities Direct Loan & Grant Program	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.	USDA	https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
Emergency Loan Program	USDA's Farm Service Agency (FSA) provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters or quarantine	USDA	https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index
Emergency Watershed Protection (EWP) program	Provide assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/
Financial Assistance	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands and non-industrial private forest land	NRCS	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/
Emergency Management Performance Grants (EMPG) Program	Assist local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities	U.S. DHS	https://www.fema.gov/emergency-management-performance-grant-program
Reimbursement for Firefighting on Federal Property	Provides reimbursement only for direct costs and losses over and above normal operating costs.	U.S. DHS	https://www.usfa.fema.gov/grants/firefighting_federal_property.html
Department of Homeland Security Grant Program (HSGP)	HSGP is composed of three interconnected grant programs including the State Homeland Security Program (SHSP), Urban Areas Security Initiative (UASI), and the Operation Stonegarden (OPSG). Together, these competitive grant programs fund a range	U.S. DHS	https://www.dhs.gov/homeland-security-grant-program-hsgp

Program	Description	Lead Agency	Website
	of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration.		
Land & Water Conservation Fund	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies)	National Park Service	https://www.nps.gov/subjects/lwcf/index.htm
Land and Water Conservation Fund	Funding to states, local and conservation organizations for outdoor recreational development, renovation, land acquisition, and planning.	U.S. Department of the Interior	https://www.doi.gov/lwcf
USSBA	Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.	Small Business Administration (SBA)	https://www sba.gov/funding-programs/disaster-assistance
State			
Clean Water State Revolving Fund (CWSRF) Loan Program	The Clean Water State Revolving Fund, authorized by the Clean Water Act, provides low-cost financial assistance for planning, acquisition, design, and construction of wastewater, reuse, and stormwater infrastructure	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/CWSRF/index.asp
Drinking Water State Revolving Fund (DWSRF) Loan Program	The Drinking Water State Revolving Fund, authorized by the Safe Drinking Water Act, provides low-cost financial assistance for planning, acquisition, design, and construction of water infrastructure.	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/DWSRF/index.asp
Rural Water Assistance Fund (RWAF) Program	The Rural Water Assistance Fund (RWAF) is designed to assist small rural utilities to obtain low-cost financing for water and wastewater projects. The RWAF offers tax-exempt equivalent interest rate loans with long-term finance options.	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/RWAF/index.asp
State Participation-Regional Water and Wastewater Facilities	The State Participation Program enables the TWDB to provide funding and assume a temporary ownership interest in a regional water, wastewater, or flood control project when the local sponsors are unable to assume debt for an optimally sized facility. The program is intended to encourage the optimum regional development of projects by funding excess capacity for future use where the benefits can be documented, and where such	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/SPP/index.asp

Program	Description	Lead Agency	Website
	development is unaffordable without state participation. The goal is to allow for the "right sizing" of projects in consideration of future needs.		
Flood Infrastructure Fund (FIF)	FIF rules allow for a wide range of flood projects, including structural and nonstructural projects as well as nature-based solutions.	Texas Water Development Board	https://www.twdb.texas.gov/financial/programs/FIF/index.asp#:~:text=Passed%20by%20the%20Legislature%20and,flood%20mitigation%2C%20and%20drainage%20projects.
Texas Water Development Fund (DFund)	The Water Development Fund (DFund) is a state funded loan program that does not receive federal subsidies and is not subject to federal crosscutters. The DFund enables the Board to fund multiple eligible components in one loan to our borrowers, e.g. an application for funding of water and wastewater components can be processed in a single loan.	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/TWDF/index.asp
Economically Distressed Areas Program (EDAP)	The Economically Distressed Areas Program (EDAP) provides financial assistance for projects serving economically distressed areas where water or sewer services do not exist or systems do not meet minimum state standards.	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/EDAP/index.asp
Agricultural Water Conservation Grants Program	The Agricultural Water Conservation Grants Program offers grants to state agencies and political subdivisions – a county, city, or other body politic or corporate of the state, including any district or authority created under Article III, Section 52 or Article XVI, Section 59 of the Texas Constitution and including any interstate compact commission to which the state is a party and any nonprofit water supply corporation created and operating under Chapter 67 – for projects that: • support agricultural irrigation conservation strategies in alignment with the state water plan, and • demonstrate agricultural water conservation best management practices	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/AWCG/index.asp
Agricultural Water Conservation Loan Program	Conservation projects that 1) improve water use efficiency of water delivery and application, or 2) prepare irrigated land for conversion to dry land farming, or 3) prepare dry land for more efficient use of natural precipitation, or 4) purchase and install on public or private property devices designed to indicate the amount of water withdrawn for irrigation use, or 5) brush control activities	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/AWCL/index.asp

Program	Description	Lead Agency	Website
	conducted under Chapter 203 of Agriculture Code, or 6) other conservation projects defined by TWDB rules.		
Groundwater Conservation District Loan Program (GDLP)	The GDLP provides loans to finance the start-up costs of Groundwater Conservation Districts. The program is authorized under Water Code Chapter 36, Subchapter L, and governed by TWDB rules Chapter 363 Subchapter H	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/GDLP/index.asp
State Water Implementation Fund for Texas (SWIFT)	Affordable, ongoing financial assistance for projects in the state water plan. Passed by the Legislature and approved by Texas voters through a constitutional amendment, the SWIFT program helps communities develop and optimize water supplies at cost-effective rates. The program provides low-interest loans, extended repayment terms, deferral of loan repayments, and incremental repurchase terms for projects with state ownership aspects.	Texas Water Development Board	http://www.twdb.texas.gov/financial/programs/SWIFT/index.asp
Regional Flood Planning Grants	Studies to evaluate and recommend the most feasible alternatives to meet regional (two or more participating entities or service areas) water supply and wastewater facility needs, estimate the costs associated with implementing the recommendations, and identify any institutional arrangements that may be necessary to provide regional water supply and wastewater services. Regional systems often have inherent operational advantages or economies of scale over stand-alone systems.	Texas Water Development Board	http://www.twdb.texas.gov/flood/planning/index.asp
Coastal Erosion Planning and Response Act (CEPRA)	Since 2000, the Texas General Land Office's Coastal Erosion Planning and Response Program has received $62 million in state funding and another $62 million in matching funds from federal and local governments, funding more than 200 coastal erosion projects.	Texas General Land Office	https://www.glo.texas.gov/coast/grant-projects/funding/index.html
Coastal Impact Assistance Program (CIAP)	Will provide more than $168 million to Texas. Funding comes from the federal government as compensation for damages caused by drilling in federal waters in the Gulf of Mexico.	Texas General Land Office	https://www.glo.texas.gov/coast/grant-projects/funding/index.html
Coastal Management Program (CMP)	Awards approximately $2 2 million annually in grants. CMP goal is to ensure the long-term environmental and economic health of the Texas coast.	Texas General Land Office	https://www.glo.texas.gov/coast/grant-projects/funding/index.html
Beach Maintenance Reimbursement Fund	Administered by the Texas General Land Office, typically allocates $750,000 per year to help communities maintain beaches.	Texas General Land Office	https://www.glo.texas.gov/coast/grant-projects/funding/index.html

Program	Description	Lead Agency	Website
The Agricultural Management Assistance (AMA)	The Agricultural Management Assistance (AMA) helps agricultural producers manage financial risk through diversification, marketing or natural resource conservation practices. NRCS administers the conservation provisions while Agricultural Marketing Service and Risk Management Agency implement the production diversification and marketing provisions.	Natural Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ama/#
The Agricultural Water Enhancement Program (AWEP)	The Agricultural Water Enhancement Program (AWEP) is a voluntary conservation initiative that provides financial and technical assistance to agricultural producers to implement agricultural water enhancement activities on agricultural land to conserve surface and ground water and improve water quality.	Natural Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/awep/?cid=nrcs143_008334
Conservation Innovation Grants (CIG)	Conservation Innovation Grants (CIG) is a competitive program that supports the development of new tools, approaches, practices, and technologies to further natural resource conservation on private lands. Through creative problem solving and innovation, CIG partners work to address our nation's water quality, air quality, soil health and wildlife habitat challenges, all while improving agricultural operations.	Natural Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/cig/?cid=nrcs143_008205
The Environmental Quality Incentives Program (EQIP)	The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers and non-industrial forest managers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion and sedimentation, improved or created wildlife habitat, and mitigation against drought and increasing weather volatility.	Natural Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/
The Wildlife Habitat Incentive Program (WHIP)	The Wildlife Habitat Incentive Program (WHIP) is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and tribal land.	Natural Resources Conservation Service (NRCS)	https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/whip/?cid=nrcs143_008423
Community Development Block Grant (TxCDBG) Program for Rural Texas	The primary objective of the Community Development Block Grant program is to develop viable communities by providing decent housing and suitable living environments, and expanding economic opportunities principally for persons of low- to moderate-income.	Texas Department of Agriculture (TDA)	https://www.texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant(CDBG).aspx

Program	Description	Lead Agency	Website
HOME	The HOME and Homelessness Programs Division awards funds to assist units of general local governments, public housing authorities, nonprofits, and local agencies in the provision of assistance to low-income Texans with a focus on housing and housing-related assistance and service	Texas Department Housing and Community Affairs (TDHCA)	http://www.tdhca.state.tx.us/home-division/
Nonpoint Source Grant Program		Texas Center for Environmental Quality (TCEQ)	https://www.tceq.texas.gov/waterquality/nonpoint-source/grants/grant-pgm.html
Nonpoint Source Management Program	The TCEQ and the Texas State Soil and Water Conservation Board (TSSWCB) administer federal grants for activities that prevent or reduce nonpoint source pollution. Grants are awarded annually and fund projects for up to three years. The TCEQ usually solicits grants in the summer of each year. Opportunities to apply are published on this Web page and Electronic State Business Daily The grants are made available through a federal program authorized under Section 319 of the Clean Water Act. See descriptions of active projects funded through the TCEQ's Nonpoint Source Program (NPS). Congress enacted CWA §319(h) in 1987, establishing a national program to control NPS water pollution. Through §319(h), federal funds are provided annually through the EPA to states for the implementation of each state's NPS Management Program. Based on Congressional appropriations, EPA allocates 319(h) funds by formula to the states. The §319(h) funding in Texas is divided equally between the TCEQ and the TSSWCB. Each agency independently administers its portion of the grant. Each agency annually solicits projects from collaborating entities across the state. Each agency identifies priority areas and activities and ranking criteria for each funding cycle based on this Management Program, the most recent IR, and the WAP process.	Texas Center for Environmental Quality (TCEQ)	https://www.tceq.texas.gov/assets/public/comm_exec/pubs/sfr/068_12.pdf

BROWNSVILLE PUBLIC UTILITIES BOARD

2015 Mitigation Actions (not completed)

- Install hail guards for HVAC systems on critical facilities
- Install quick connect systems on all critical facilities with emergency generators
- Conduct analysis of BPUB utilities located in SFHAs and elevate utilities to prevent flooding in the event of upstream dam failure

Potential New Actions

- Installation of underground fiber optic cable in a looped communication system between water wells and the process systems within the SRWA plant.
- Implementation of Advanced Metering Infrastructure
- Transformer replacement project

Critical Facilities in the Floodplain

Facility Name	Address	Critical Facility Type
[redacted]		

Facility Name	Address	Critical Facility Type
[redacted]	[redacted]	[redacted]

Public Survey Feedback:

- Better planning before storms to eliminate flooding. Better electrical system where we are not without electricity for days!!!
- Canal maintenance
- Fix the drainage issue.
- Reduce surcharge on electricity bill for folks that are trying to conserve
- improve the drainage sewer system in flood prone areas.
- More police presence during severe flooding as drivers will drive very fast causing damaging waves to neighborhoods and business. Maybe be fined or arrested for causing large waves across the street.
- Strengthening light poles to avoid damage from harsh weather that can cause utility outage.
- Working in drainages around Boca Chica area.
- Prioritize fixing flooding issues and fix the electricity grid..thus preventing us from being without electricity for days. This should be a priority!
- Ruben Torres between Quail Trail and Military Highway floods a lot. Also Boca Chica Blvd from I69 to International Blvd.
- Quail Hollow drive is very floodprone and needs to be addressed immediately
- Price rd. And Bernard and price and tropical. Frontage and 802.

- Morrison street gets flooded, streets near valley Baptist get quickly flooded
- Flood prone areas and lack of backup power
- Extreme flooding on Boca Chica Blvd., Paredes Line Rd., Robindale, Old Port Isabel Rd., Ruben Torres Blvd.
- Elma Street, Central Avenue, Austin Road
- Draper dr storm drains Are water French clogged and or nonfunctional.
- Dana St north of FM 802 is in dire need of drainage and sidewalks. Kids from the Harmony school are practically walking in the middle of the street when wet.
- Cross country trails and the stagecoach street as well as Dennet flood terribly and they have for many years.
- Boca chica road
- Boca chica is one of the most affected all the time with any type of rain.
- Boca Chica Blvd and security dr and Boca Chica Blvd and Old Port Isabel rd
- Boca Chica Los Ebanos /price road Parkwood place, when rains the water stays on street, does not drain
- Alley flooding impacts backyards/homes in the 1600 block of Harvard Ave, particularly my residence 1647 Harvard Ave. Street flooding at the end of Harvard Ave and Woodruff.
- The entire Valley has flood issues
- Flooding in the cities of San Benito, and Harlingen
- Elma St, Central Ave,
- Dana St north of the Brownsville city limits all the way to Hugh Emerson (alton gloor)

Identified Issues/Problem Areas/Potential Projects

- City is interested in the CRS program due to flooding issues throughout city
- Update/maintain flood management plan
- Stream flooding

2015 Mitigation Actions (not completed/no status provided)

- Install system of weather stations
- Work with neighboring communities and South Padre Island to implement an evacuation plan for the proposed bridge connecting the mainland to South Padre Island
- Construct a second bridge connecting the mainland to South Padre Island
- Develop program to annually remove buildup of silt in area Resacas that become cutoff from the river and contribute to flooding during severe flood or hurricane event
- Secure Memorandum of Understanding (MOU) with Lower Rio Grande Flood Control agency to implement structural drainage measures to mitigate potential dam and levee failure of upstream flood control system
- Conduct a public education program for evacuating residents downstream of the Lower Rio Grande Flood Control system in the event of dam or levee failure
- Construct retaining walls to alleviate flooding problems – City of Brownsville Golf Course
- Install shutters on City critical facility buildings
- Install 24" drainage pipes to improve conveyance of storm waters
- Construct Gate Valve and attach to the crossbar at IWC Levee
- Dredge Rotary Park Resacas to expand and improve storage of storm water
- Construct Detention Pond to reduce flooding - Price Road
- Construct detention pond to reduce flooding - Old Port Isabel Rd
- Construct detention pond to reduce flooding
- Conduct analysis of critical facility locations relative to SFHAs and elevate critical structure(s) to prevent flooding in the event of upstream dam failure
- Improve drainage by constructing new culverts, levees, and drainage features into the Port of Brownsville from the north Brownsville area to mitigate potential major flooding during severe weather event
- Improve drainage and replace or upgrade gutters at City Plaza buildings
- Integrate stand pipes into existing drain structures
- Purchase generator for City Fuel Station System
- Construct alternate Emergency Operations Center to protect critical system operations
- Implement a GIS (geographical information system) model of the Brownsville Storm Sewer System to create a chronological list of common activities associated with the development of a storm water GIS
- Develop a Drought Protection Plan to include adoption of FIREWISE community actions for water conservation and xeriscaping program
- Develop and implement a Tree Management Master Plan to remove downed trees due to winter storm and ice
- Construct a weir to prevent flood risk from the overflow of canals located on the North side of Brownsville

- Construct and/or expand culverts on rural roads and main stream outlets 1) Central Ave to Martinelle 2) Robindale to Old Place 3) Dana 802 to High Emerson 4) Pablo Kisel from Morrison to Alton Gloor
- Purchase and install portable pumps as back-up during severe weather and flood events
- Conduct a public education campaign to educate residents on reducing water consumption during drought conditions
- Install quick connect systems on all critical facilities with emergency generators
- Install emergency generators on all critical facilities
- Install temporary cooling stations at City park facilities to aid low income and elderly residents during extreme heat conditions
- Construct dual-purpose animal shelter
- Install hail guards for HVAC systems on critical facilities including nursing homes, hospitals, courthouse, and fire stations
- Identify existing flood-prone structures and repetitive flood loss properties for FEMA Buyout Program
- Upgrade and increase culverts at specific locations in City in order to adequately convey storm water

Critical Facilities in the Floodplain

Facility Name	Address	Critical Facility Type
[redacted]		

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Public Survey Feedback:

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- The entire Valley has flood issues
- Flooding in the cities of San Benito, and Harlingen
- Elma St, Central Ave,
- Dana St north of the Brownsville city limits all the way to Hugh Emerson (alton gloor)
- Potential properties to be mitigated (elevation/acquisition) as per survey response:
    - 2830 Parkview Lane
    - 538 Rey Juan Carlos
    - 2644 Old Port Isabel
    - 6932 Austrian pine
    - 112 Country Club Rd.
    - 219 Boise Court
    - 1175 Quail Hollow
    - 145 Windwood Way
    - 130 Draper Dr

BUILDING RESILIENT INFRASTRUCTURE AND COMMUNITIES (BRIC)

FY 2021 Priorities:

- Incentivize natural hazard risk reduction activities that mitigate risk to public infrastructure and disadvantaged communities as referenced in EO 14008
- Mitigate risk to one or more community lifelines
- Incorporate nature-based solutions
- Enhance climate resilience and adaptation
- Increase funding to applicants that facilitate the adoption and enforcement of the latest published editions of building codes

Mitigation Project Examples:

- Green stormwater infrastructure to reduce flood losses
- Retrofit of vulnerable structures (e.g., hospitals) to withstand hurricane-force winds
- Microgrids and renewable energy sources to support continuity of operations at critical infrastructure
- Floodplain/stream restoration and floodwater storage to reduce flood impacts
- Projects that promote/utilize nature-based solutions to mitigate natural hazard risk
- Structural/Nonstructural seismic retrofits
- Living shoreline program to reduce storm surge
- Defensible space and hazardous fuels reduction to mitigate wildfire
- Green infrastructure to mitigate extreme temperatures
- Tsunami evacuation shelter
- Landslide mitigation retention wall

FLOOD MITIGATION ASSISTANCE (FMA)

FY 2021 Priorities:

- Project scoping - develop Community Flood Mitigation Projects and/or individual flood mitigation projects that will subsequently reduce flood claims against the NFIP
- Community flood mitigation projects - projects that address community flood risk for the purpose of reducing NFIP flood claim payments
- Technical assistance – maintain a viable FMA program over time
- Flood hazard mitigation planning – flood hazard component of state, local, territory, and tribal HMPs and HMP updates
- Individual flood mitigation projects - Projects that mitigate the risk of flooding to individual NFIP insured structures (e.g., acquisitions, elevations, floodproofing)

Mitigation Project Examples:

- Localized flood control
- Floodwater storage and diversion
- Floodplain and stream restoration

- Stormwater management
- Wetland restoration/creation

HAZARD MITIGATION GRANT PROGRAM (HMGP)

General Requirements for Projects:

- Solves a problem by preventing or substantially reducing hazard consequences and future risks.
- Has a beneficial impact by providing long-term meaningful and definable risk reduction benefits.
- Is cost effective with a project cost that is less than the loss from potential future damages.
- Is environmentally sound, creating no negative impacts on the environment, impoverished or minority populations, or surrounding communities.
- Complies with all state and federal laws, rules, and administrative requirements

Mitigation Project Examples:

- Property acquisition and structure demolition/relocation
- Structure elevation
- Mitigation reconstruction
- Dry floodproofing historical structures
- Generators
- Flood risk reduction projects
- Retrofitting of existing buildings and structures
- Safe room construction
- Wind retrofit for family residences
- Infrastructure retrofit
- Soil stabilization
- Wildfire mitigation
- Post-disaster code enforcement
- Hazard Mitigation Plans

Mitigation Ideas

A Resource for Reducing Risk to Natural Hazards

January 2013

FEMA

01024.13

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Table of Contents

Introduction

The purpose of this document is to provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters.

The focus of this document is mitigation, which is action taken to reduce or eliminate long-term risk to hazards. Mitigation is different from preparedness, which is action taken to improve emergency response or operational preparedness.

Ideas for mitigation actions are presented for the following natural hazards:

- Drought
- Earthquake
- Erosion
- Extreme temperatures
- Flood
- Hail
- Landslide
- Lightning
- Sea level rise
- Severe wind
- Severe winter weather
- Storm surge
- Subsidence
- Tornado
- Tsunami
- Wildfire

Examples of mitigation actions are planning and zoning, floodplain protection, property acquisition and relocation, or public outreach projects.

Examples of preparedness actions are installing disaster warning systems, purchasing radio communications equipment, or conducting emergency response training.

Actions that may mitigate multiple hazards are presented in the last section, entitled "Multiple Hazards."

The suggested mitigation actions are summarized into four types: (1) Local Planning and Regulations, (2) Structure and Infrastructure Projects, (3) Natural Systems Protection, and (4) Education and Awareness Programs. Examples of activities that can be used to accomplish each mitigation goal are identified, as well as the relevant FEMA publications or resources, if applicable.

This document is intended to be a starting point for gathering ideas and should not be used as the only source for identifying actions. Communities should seek innovative and different ideas for reducing risk that meet their unique needs. The actions listed are not necessarily eligible for Federal assistance programs. Users should review specific program guidance and contact their State Hazard Mitigation Officer (SHMO) or regional FEMA office for more information.

Drought

A drought is a period of unusually constant dry weather that persists long enough to cause deficiencies in water supply (surface or underground). Droughts are slow-onset hazards, but, over time, they can severely affect crops, municipal water supplies, recreational resources, and wildlife. If drought conditions extend over a number of years, the direct and indirect economic impacts can be significant. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. In addition, human actions and demands for water resources can accelerate drought-related impacts.

Local Planning and Regulations

D-1 Assess Vulnerability to Drought Risk

To better understand and assess local vulnerability to drought, consider actions such as:

- Gathering and analyzing water and climate data to gain a better understanding of local climate and drought history.
- Identifying factors that affect the severity of a drought.
- Identifying available water supplies.
- Determining how the community and its water sources have been impacted by droughts in the past.

D-2 Monitor Drought Conditions

Monitoring drought conditions can provide early warning for policymakers and planners to make decisions through actions including:

- Identifying local drought indicators, such as precipitation, temperature, surface water levels, soil moisture, etc.
- Establishing a regular schedule to monitor and report conditions on at least a monthly basis.

D-3 Monitor Water Supply

Monitoring the water supply and its functions can save water in the long run through actions such as:

- Regularly checking for leaks to minimize water supply losses.
- Improving water supply monitoring.

D-4 Plan for Drought

Plan for future drought events in your area through actions such as:

- Developing a drought emergency plan.
- Developing criteria or triggers for drought-related actions.
- Developing a drought communication plan and early warning system to facilitate timely communication of relevant information to officials, decision makers, emergency managers, and the general public.
- Developing agreements for secondary water sources that may be used during drought conditions.
- Establishing an irrigation time/scheduling program or process so that all agricultural land gets the required amount of water. Through incremental timing, each area is irrigated at different times so that all water is not consumed at the same time. Spacing usage may also help with recharge of groundwater.

D-5 Require Water Conservation During Drought Conditions

Require mandatory water conservation measures during drought emergencies, including:

- Developing an ordinance to restrict the use of public water resources for non-essential usage, such as landscaping, washing cars, filling swimming pools, etc.
- Adopting ordinances to prioritize or control water use, particularly for emergency situations like fire fighting.

D-6 Prevent Overgrazing

Prevent overgrazing, which has been linked to drought vulnerability, through actions such as:

- Establishing a grazing policy or permitting program to prevent overgrazing.
- Reducing the number of animals and improving range management.

Structure and Infrastructure Projects

D-7 Retrofit Water Supply Systems

Improve water supply and delivery systems to save water through actions such as:

- Designing water delivery systems to accommodate drought events.
- Developing new or upgrading existing water delivery systems to eliminate breaks and leaks.

Natural Systems Protection

D-8 Enhance Landscaping and Design Measures

Encourage drought-tolerant landscape design through measures such as:

- Incorporating drought tolerant or xeriscape practices into landscape ordinances to reduce dependence on irrigation.
- Providing incentives for xeriscaping.
- Using permeable driveways and surfaces to reduce runoff and promote groundwater recharge.

Education and Awareness Programs

D-9 Educate Residents on Water Saving Techniques

Encourage citizens to take water-saving measures, such as the following:

- Installing low-flow water saving showerheads and toilets.
- Turning water flow off while brushing teeth or during other cleaning activities.
- Adjusting sprinklers to water the lawn and not the sidewalk or street.
- Running the dishwasher and washing machine only when they are full.
- Checking for leaks in plumping or dripping faucets.
- Installing rain-capturing devices for irrigation.
- Encouraging the installation of graywater systems in homes to encourage water reuse.

D-10 Educate Farmers on Soil and Water Conservation Practices

Encourage farmers to implement soil and water conservation practices that foster soil health and improve soil quality to help increase resiliency and mitigate the impacts of droughts. Potential conservation practices include the following:

- Rotating crops by growing a series of different types of crops on the same fields every season to reduce soil erosion.
- Practicing contour farming by farming along elevation contour lines to slow water runoff during rainstorms and prevent soil erosion, allowing the water time to absorb into the soil.
- Using terracing on hilly or mountainous terrain to decrease soil erosion and surface runoff.
- Planting "cover crops," such as oats, wheat, and buckwheat, to prevent soil erosion.
- Using zero and reduced tillage to minimize soil disturbance and leave crop residue on the ground to prevent soil erosion.
- Constructing windbreaks to prevent evaporation from reclaiming salt-affected soil.
- Collecting rainwater and using natural runoff to water plants.

D-11 Purchase Crop Insurance

Preserve economic stability during a drought by encouraging agricultural interests to obtain crop insurance to cover potential losses due to drought.

FEMA Resources/Publications
FEMA 20, P-85, 361, 453

Other drought-related mitigation actions may also apply to other hazards. See the sections entitled "Extreme Temperatures" and "Multiple Hazards" for other possible ideas.

Earthquake

An earthquake is a sudden release of energy that creates a movement in the earth's crust. Most earthquake-related property damage and deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the extent and duration of the shaking. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (in mountain regions and along hillsides), and liquefaction.

Local Planning and Regulations

EQ-1 Adopt and Enforce Building Codes

FEMA Resources/Publications
FEMA 83, 224, 232, 254, 266, 313, 349, P-749, P-750

Building codes reduce earthquake damage to structures. Consider actions such as:

- Adopting and enforcing updated building code provisions to reduce earthquake damage risk.
- Adopting the International Building Code (IBC) and International Residential Code (IRC).

EQ-2 Incorporate Earthquake Mitigation into Local Planning

FEMA Resources/Publications
FEMA 83, 224, 254, 266, 313, 349

Earthquake risk can be reduced through local planning, codes, and ordinances, including:

- Creating a seismic safety committee to provide policy recommendations, evaluate and recommend changes in seismic safety standards, and give an annual assessment of local and statewide implementation of seismic safety improvements.
- Developing and distributing guidelines or passing ordinances that require developers and building owners to locate lifelines, buildings, critical facilities, and hazardous materials out of areas subject to significant seismic hazards.
- Incorporating structural and non-structural seismic strengthening actions into ongoing building plans and activities in the capital improvement plan to ensure that facilities remain operational for years to come.
- Supporting financial incentives, such as low interest loans or tax breaks, for home and business owners who seismically retrofit their structures.

EQ-3 Map and Assess Community Vulnerability to Seismic Hazards

FEMA Resources/Publications
FEMA 83, 154, 366, ROVER

To better understand and assess local vulnerability to earthquakes, consider actions such as:

- Developing an inventory of public and commercial buildings that may be particularly vulnerable to earthquake damage, including pre-1940s homes and homes with cripple wall foundations.
- Collecting geologic information on seismic sources, soil conditions, and related potential hazards.
- Creating an earthquake scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community to develop earthquake mitigation priorities.
- Using Hazus to quantitatively estimate potential losses from an earthquake.
- Maintaining a database to track community vulnerability to earthquake risk.
- Using GIS to map hazard areas, at-risk structures, and associated hazards (e.g., liquefaction and landslides) to assess high-risk areas.

EQ-4 Conduct Inspections of Building Safety

FEMA Resources/Publications

FEMA 154, 155, 202, 221, 224, 225, 226, 233, 306, 307, 395, ROVER

Inspections can be used to assess earthquake risk, such as:

- Establishing a school survey procedure and guidance document to inventory structural and non-structural hazards in and around school buildings.
- Using rapid visual screening to quickly inspect a building and identify disaster damage or potential seismic structural and non-structural weaknesses to prioritize retrofit efforts, inventory high-risk structures and critical facilities, or assess post-disaster risk to determine if buildings are safe to re-occupy.
- Consulting industry standard publications such as American Society of Civil Engineers (ASCE) 31 - *Seismic Evaluation of Existing Buildings*, ASCE 41 - *Seismic Rehabilitation of Existing Buildings*, and Applied Technology Council (ATC) 20 - *Procedures for Postearthquake Safety Evaluation of Buildings.*

EQ-5 Protect Critical Facilities and Infrastructure

Reduce potential damage to critical facilities and infrastructure from future seismic events through actions such as:

- Conducting seismic retrofitting for critical public facilities most at risk to earthquakes.
- Requiring bracing of generators, elevators, and other vital equipment in hospitals.
- Identifying and hardening critical lifeline systems (i.e., critical public services such as utilities and roads) to meet "Seismic Design Guidelines and Standards for Lifelines" or equivalent standards such as American Lifelines Alliance (ALA) guidance. This may distinguish a manageable earthquake from a social and economic catastrophe.
- Reviewing construction plans for all bridges to determine their susceptibility to collapse and retrofitting problem bridges.
- Using flexible piping when extending water, sewer, or natural gas service.
- Installing shutoff valves and emergency connector hoses where water mains cross fault lines.

EQ-6 Implement Structural Mitigation Techniques

FEMA Resources/Publications
FEMA 307, 320, 345, 356, 361, 395, 396, 412, 453, 547, P-774

Use structural mitigation measures to reduce damage from future seismic events, such as:

- Strengthening and retrofitting non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking.
- Retrofitting building veneers to prevent failure.
- Building a safe room to provide protection during an earthquake.
- Installing window film to prevent injuries from shattered glass.
- Anchoring rooftop-mounted equipment (i.e., HVAC units, satellite dishes, etc).
- Constructing masonry chimneys greater than 6 feet above a roof with continuous reinforced steel bracing.

EQ-7 Increase Earthquake Risk Awareness

FEMA Resources/Publications
FEMA E-74, 474, 526, 527, 528, 529, 530, P-811; EMI IS-22

There are many ways to increase awareness of earthquake risk, including:

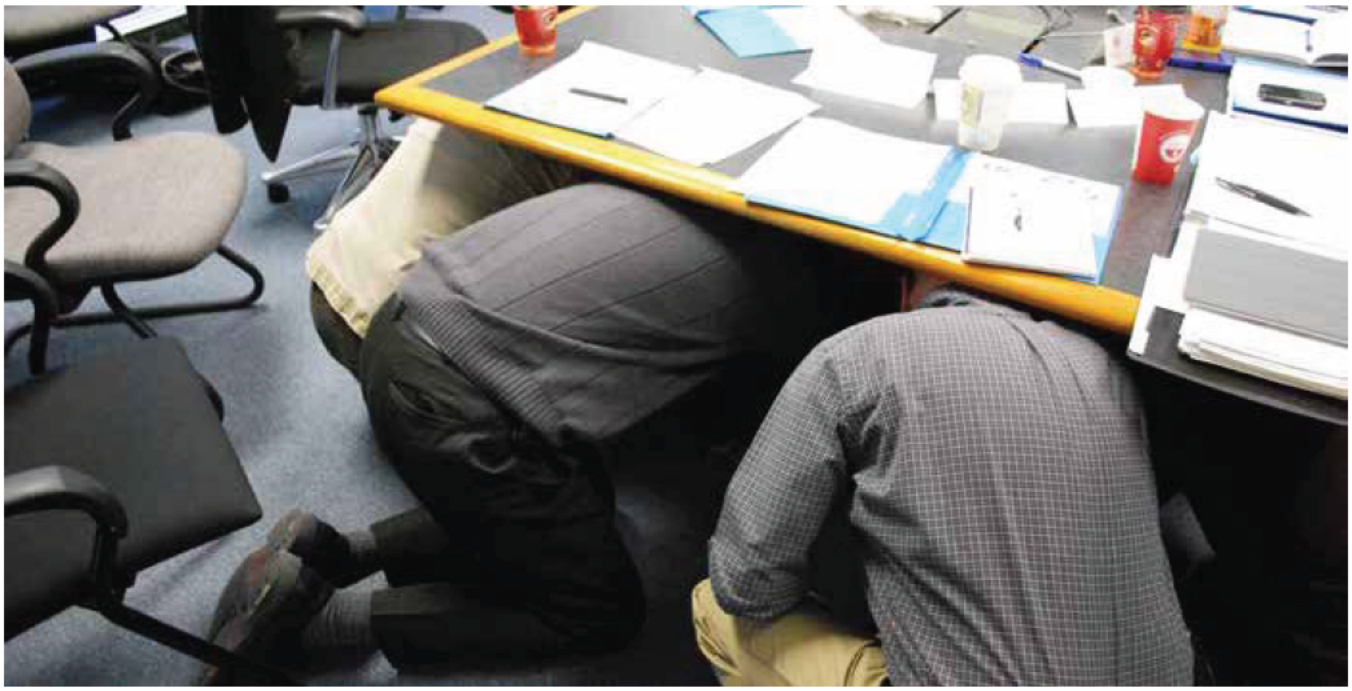
- Working with insurance industry representatives to increase public awareness of the importance of earthquake insurance. Residential structural improvements can be factored into the process of obtaining insurance coverage or reduced deductibles.
- Developing an outreach program about earthquake risk and mitigation activities in homes, schools, and businesses.
- Educating homeowners on safety techniques to follow during and after an earthquake.
- Offering GIS hazard mapping online for residents and design professionals.

EQ-8 Conduct Outreach to Builders, Architects, Engineers, and Inspectors

FEMA Resources/Publications
FEMA 232, 313, 389, P-420, 454

Building susceptibility to earthquake damage can be improved if design professionals are made aware of proper design and building requirements. Outreach activities include:

- Conducting information sessions or other forms of outreach on seismic code provisions for new and existing buildings to enhance code use and enforcement by local architects, engineers, contractors, and code enforcement personnel.
- Training building department staff and officials on Form ATC-20 for post-earthquake building evaluation. The ATC-20 report and addendum, prepared by the Applied Technology Council, provide procedures and guidelines for making on-the-spot evaluations and decisions regarding continued use and occupancy of earthquake-damaged buildings.



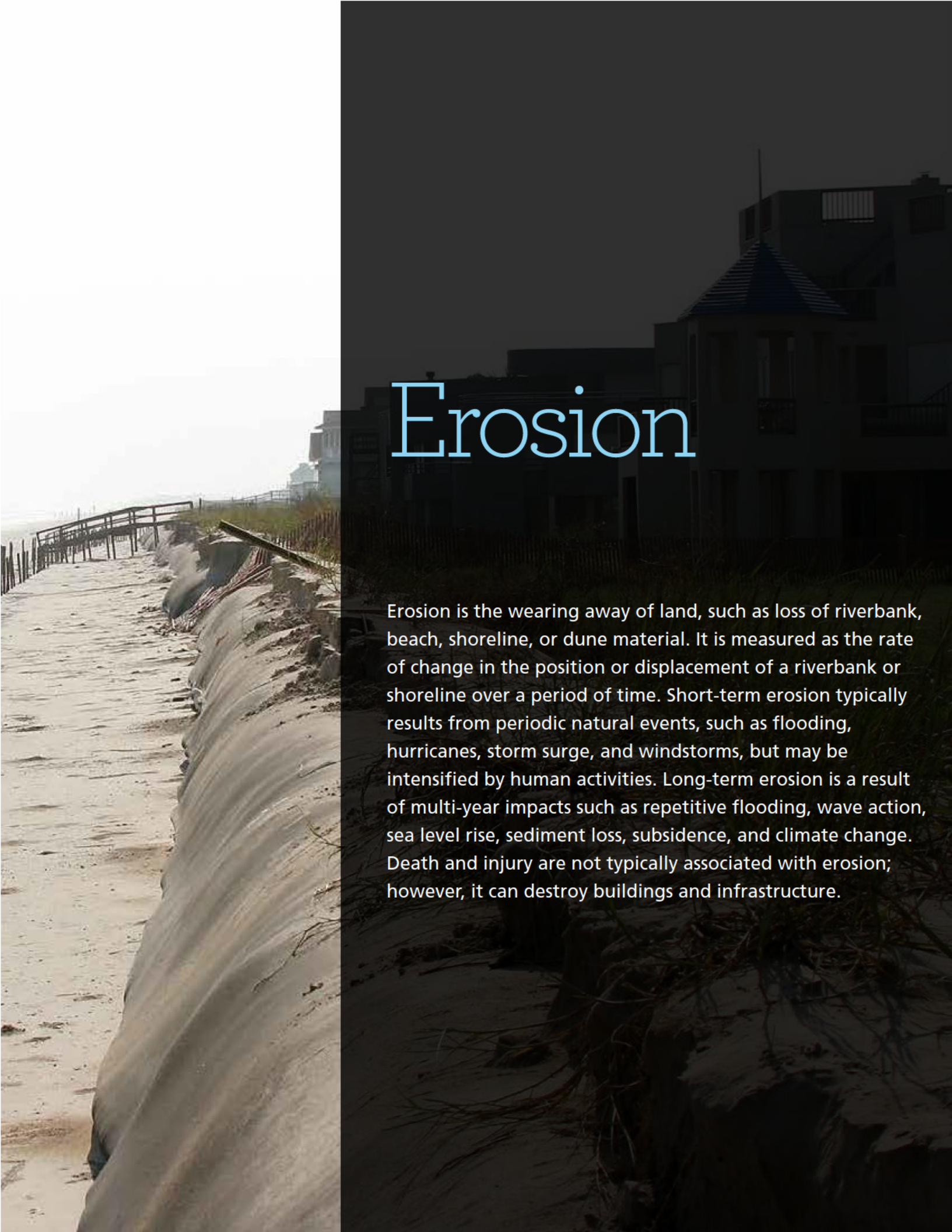
EQ-9 Provide Information on Structural and Non-Structural Retrofitting

FEMA Resources/Publications
FEMA E-74, 412, 413, 414, 530, 547

Property owners can retrofit existing structures to reduce damage from seismic events. Potential actions include the following:

- Educating homeowners about structural and non-structural retrofitting of vulnerable homes and encouraging retrofit.
- Developing a technical assistance information program for homeowners. Teaching them how to seismically strengthen their houses can be an effective mitigation activity. The program can include providing local government building departments with copies of existing strengthening and repair information for distribution.
- Developing an outreach program to encourage homeowners to secure furnishings, storage cabinets, and utilities to prevent injuries and damage. Examples include anchoring tall bookcases and file cabinets, installing latches on drawers and cabinet doors, restraining desktop computers and appliances, using flexible connections on gas and water lines, mounting framed pictures and mirrors securely, and anchoring and bracing propane tanks and gas cylinders.
- Establishing a library of technical documents on structural and non-structural mitigation options as well as model ordinances and procedures that have been used by other jurisdictions to reduce earthquake risk.

Other earthquake-related mitigation actions may also apply to other hazards. See the section entitled "Multiple Hazards" for other possible ideas.



Erosion

Erosion is the wearing away of land, such as loss of riverbank, beach, shoreline, or dune material. It is measured as the rate of change in the position or displacement of a riverbank or shoreline over a period of time. Short-term erosion typically results from periodic natural events, such as flooding, hurricanes, storm surge, and windstorms, but may be intensified by human activities. Long-term erosion is a result of multi-year impacts such as repetitive flooding, wave action, sea level rise, sediment loss, subsidence, and climate change. Death and injury are not typically associated with erosion; however, it can destroy buildings and infrastructure.

Local Planning and Regulations

ER-1 Map and Assess Vulnerability to Erosion

Erosion risk can be better assessed and monitored with mapping techniques, including the following:

- Using GIS to identify and map erosion hazard areas.
- Developing and maintaining a database to track community vulnerability to erosion.
- Using GIS to identify concentrations of at-risk structures.
- Improving mapping of hazard areas to educate residents about unexpected risks.

ER-2 Manage Development in Erosion Hazard Areas

Erosion damage can be mitigated by regulating how development occurs in hazard areas, such as the following:

- Adopting sediment and erosion control regulations.
- Adopting zoning and erosion overlay districts.
- Developing an erosion protection program for high hazard areas.
- Employing erosion control easements.
- Prohibiting development in high-hazard areas.
- Developing and implementing an erosion management plan.
- Requiring mandatory erosion surcharges on homes.
- Locating utilities and critical facilities outside of areas susceptible to erosion to decrease the risk of service disruption.

ER-3 Promote or Require Site and Building Design Standards to Minimize Erosion Risk

Development can be designed to minimize damage due to erosion using the following techniques:

- Constructing open foundation systems on buildings to minimize scour.
- Constructing deep foundations in erosion hazard areas.
- Clustering buildings during building and site design.
- Designing and orienting infrastructure to deter erosion and accretion.

Structure and Infrastructure Projects

ER-4 Remove Existing Buildings and Infrastructure from Erosion Hazard Areas

To prevent damage to buildings and infrastructure from erosion, consider acquiring and demolishing or relocating at-risk buildings and infrastructure and enforcing permanent restrictions on development after land and structure acquisition.

FEMA Resources/Publications

FEMA P-55

ER-5 Stabilize Erosion Hazard Areas

To stabilize slopes susceptible to erosion, consider options such as:

- Preventing erosion with proper bank stabilization, sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.
- Stabilizing cliffs with terracing or plantings of grasses or other plants to hold soil together.
- Prohibiting removal of natural vegetation from dunes and slopes.
- Planting mature trees in the coastal riparian zone to assist in dissipation of the wind force in the breaking wave zone.
- Using a hybrid of hard/soft engineering techniques (i.e., combine low-profile rock, rubble, oyster reefs, or wood structures with vegetative planting or other soft stabilization techniques).
- Implementing marine riparian habitat reinstatement or revegetation.
- Using a rock splash pad to direct runoff and minimize the potential for erosion.
- Using bioengineered bank stabilization techniques.

ER-6 Increase Awareness of Erosion Hazards

Consider ways to help citizens become more aware of specific erosion risks in your area, such as:

- Notifying property owners located in high-risk areas.
- Disclosing the location of high-risk areas to buyers.
- Developing a brochure describing risk and potential mitigation techniques.
- Offering GIS hazard mapping online for residents and design professionals.

Other erosion-related mitigation actions may also apply to other hazards. See the sections entitled "Subsidence," "Landslide," and "Multiple Hazards" for other possible ideas.

Extreme Temperatures

Extreme heat and extreme cold constitute different conditions in different parts of the country. Extreme cold can range from near freezing temperatures in the southern United States to temperatures well below zero in the northern states. Similarly, extreme heat is typically recognized as the condition where temperatures consistently stay ten degrees or more above a region's average high temperature for an extended period. Fatalities can result from extreme temperatures, as they can push the human body beyond its limits (hyperthermia and hypothermia).

Local Planning and Regulations

ET-1 Reduce Urban Heat Island Effect

As urban areas develop and buildings and roads replace open land and vegetation, urban regions become warmer than their rural surroundings, forming an "island" of heat. Several methods for reducing heat island effects include:

- Increasing tree plantings around buildings to shade parking lots and along public rights-of-way.
- Encouraging installation of green roofs, which provide shade and remove heat from the roof surface and surrounding air.
- Using cool roofing products that reflect sunlight and heat away from a building.

Education and Awareness Programs

ET-2 Increase Awareness of Extreme Temperature Risk and Safety

The impacts of extreme temperatures on public health can be lessened if citizens know how to prepare and protect themselves. Ideas for increasing awareness include the following:

- Educating citizens regarding the dangers of extreme heat and cold and the steps they can take to protect themselves when extreme temperatures occur.

ET-3 Assist Vulnerable Populations

Measures should be taken to ensure vulnerable populations are adequately protected from the impacts of extreme temperatures, such as:

- Organizing outreach to vulnerable populations, including establishing and promoting accessible heating or cooling centers in the community.
- Requiring minimum temperatures in housing/landlord codes.
- Encouraging utility companies to offer special arrangements for paying heating bills, if not already required by state law.
- Creating a database to track those individuals at high risk of death, such as the elderly, homeless, etc.

ET-4 Educate Property Owners About Freezing Pipes

Extreme cold may cause water pipes to freeze and burst, which can cause flooding inside a building. Ideas for educating property owners include the following:

- Educating homeowners and builders on how to protect their pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls.
- Informing homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting.

Other extreme temperature-related mitigation actions may also apply to other hazards. See the sections entitled "Severe Winter Weather," "Drought," and "Multiple Hazards" for other possible ideas.

Flood

A flood is the partial or complete inundation of normally dry land. The various types of flooding include riverine flooding, coastal flooding, and shallow flooding. Common impacts of flooding include damage to personal property, buildings, and infrastructure; bridge and road closures; service disruptions; and injuries or even fatalities.

Local Planning and Regulations

F-1 Incorporate Flood Mitigation in Local Planning

FEMA Resources/Publications
FEMA 100, 268, 473

Comprehensive planning and floodplain management can mitigate flooding by influencing development. Strategies include:

- Determining and enforcing acceptable land uses to alleviate the risk of damage by limiting exposure in flood hazard areas. Floodplain and coastal zone management can be included in comprehensive planning.
- Developing a floodplain management plan and updating it regularly.
- Mitigating hazards during infrastructure planning. For example, decisions to extend roads or utilities to an area may increase exposure to flood hazards.
- Adopting a post-disaster recovery ordinance based on a plan to regulate repair activity, generally depending on property location.
- Passing and enforcing an ordinance that regulates dumping in streams and ditches.
- Establishing a "green infrastructure" program to link, manage, and expand existing parks, preserves, greenways, etc.
- Obtaining easements for planned and regulated public use of privately-owned land for temporary water retention and drainage.

F-2 Form Partnerships to Support Floodplain Management

Partnerships between local, state, and regional entities help expand resources and improve coordination. Consider the following actions:

- Developing a stormwater committee that meets regularly to discuss issues and recommend projects.
- Forming a regional watershed council to help bring together resources for comprehensive analysis, planning, decision-making, and cooperation.
- Establishing watershed-based planning initiatives to address the flood hazard with neighboring jurisdictions.
- Forming a citizen plan implementation steering committee to monitor progress on local mitigation actions. Include a mix of representatives from neighborhoods, local businesses, and local government.

F-3 Limit or Restrict Development in Floodplain Areas

FEMA Resources/Publications
FEMA 100, 268, 473

Flooding can be mitigated by limiting or restricting how development occurs in floodplain areas through actions such as:

- Prohibiting or limiting floodplain development through regulatory and/or incentive-based measures.
- Limiting the density of developments in the floodplain.
- Requiring that floodplains be kept as open space.
- Limiting the percentage of allowable impervious surface within developed parcels.
- Developing a stream buffer ordinance to protect water resources and limit flood impacts.
- Prohibiting any fill in floodplain areas.

F-4 Adopt and Enforce Building Codes and Development Standards

FEMA Resources/Publications
FEMA 100, 268, P-762

The use of building codes and development standards can ensure structures are able to withstand flooding. Potential actions include:

- Adopting the International Building Code (IBC) and International Residential Code (IRC).
- Adopting ASCE 24-05 *Flood Resistant Design and Construction*. ASCE 24 is a referenced standard in the IBC that specifies minimum requirements and expected performance for the design and construction of buildings and structures in the flood hazard areas to make them more resistant to flood loads and flood damage.
- Adding or increasing "freeboard" requirements (feet above base flood elevation) in the flood damage ordinance.
- Prohibiting all first floor enclosures below base flood elevation for all structures in flood hazard areas.
- Considering orientation of new development during design (e.g., subdivisions, buildings, infrastructure, etc.).
- Setting the design flood elevation at or above the historical high water mark if it is above the mapped base flood elevation.
- Using subdivision design standards to require elevation data collection during platting and to have buildable space on lots above the base flood elevation.
- Requiring standard tie-downs of propane tanks.

F-5 Improve Stormwater Management Planning

Rainwater and snowmelt can cause flooding and erosion in developed areas. Stormwater management practices to prevent this include:

- Completing a stormwater drainage study for known problem areas.
- Preparing and adopting a stormwater drainage plan and ordinance.
- Preparing and adopting a community-wide stormwater management master plan.
- Regulating development in upland areas in order to reduce stormwater run-off through a stormwater ordinance.
- Linking flood hazard mitigation objectives with EPA Stormwater Phase II initiatives.
- Developing engineering guidelines for drainage from new development.
- Requiring a drainage study with new development.
- Encouraging the use of Low Impact Development techniques

F-6 Adopt Polices to Reduce Stormwater Runoff

In addition to stormwater management, techniques to reduce rain runoff can prevent flooding and erosion, such as:

- Designing a "natural runoff" or "zero discharge" policy for stormwater in subdivision design.
- Requiring more trees be preserved and planted in landscape designs to reduce the amount of stormwater runoff.
- Requiring developers to plan for on-site sediment retention.
- Requiring developers to construct on-site retention basins for excessive stormwater and as a firefighting water source.
- Encouraging the use of porous pavement, vegetative buffers, and islands in large parking areas.
- Conforming pavement to land contours so as not to provide easier avenues for stormwater.
- Encouraging the use of permeable driveways and surfaces to reduce runoff and increase groundwater recharge.
- Adopting erosion and sedimentation control regulations for construction and farming.

F-7 Improve Flood Risk Assessment

FEMA Resources/Publications
FEMA 416, 467-1, B-797

Heighten awareness of flood risk with the following:

- Incorporating the procedures for tracking high water marks following a flood into emergency response plans.
- Conducting cumulative impact analyses for multiple development projects within the same watershed.
- Conducting a verification study of FEMA's repetitive loss inventory and developing an associated tracking database.
- Regularly calculating and documenting the amount of flood-prone property preserved as open space.
- Requiring a thorough watershed analysis for all proposed dam or reservoir projects.
- Developing a dam failure study and emergency action plan.
- Using GIS to map areas that are at risk of flooding.
- Obtaining depth grid data and using it to illustrate flood risk to citizens.
- Incorporating digital floodplain and topographic data into GIS systems, in conjunction with Hazus, to assess risk.
- Developing and maintaining a database to track community exposure to flood risk.
- Revising and updating regulatory floodplain maps.

F-8 Join or Improve Compliance with NFIP

FEMA Resources/Publications
FEMA 100, 209, FIA-15A,
NFIP Technical Bulletins

The National Flood Insurance Program (NFIP) enables property owners in participating communities to purchase insurance protection against flood losses. Actions to achieve eligibility and maintain compliance include:

- Participating in NFIP.
- Adopting ordinances that meet minimum Federal and state requirements to comply with NFIP.
- Conducting NFIP community workshops to provide information and incentives for property owners to acquire flood insurance.
- Designating a local floodplain manager and/or CRS coordinator who achieves CFM certification.
- Completing and maintaining FEMA elevation certificates for pre-FIRM and/or post-FIRM buildings.
- Requiring and maintaining FEMA elevation certificates for all new and improved buildings located in floodplains.

F-9 Manage the Floodplain Beyond Minimum Requirements

FEMA Resources/Publications
FEMA 100, 209, 213, 268, 480;
FIA-15A

In addition to participation in NFIP, implementing good floodplain management techniques that exceed minimum requirements can help minimize flood losses. Examples include:

- Incorporating the ASFPM's "No Adverse Impact" policy into local floodplain management programs.
- Revising the floodplain ordinance to incorporate cumulative substantial damage requirements.
- Adopting a "no-rise" in base flood elevation clause for the flood damage prevention ordinance.
- Extending the freeboard requirement past the mapped floodplain to include an equivalent land elevation.
- Including requirements in the local floodplain ordinance for homeowners to sign non-conversion agreements for areas below base flood elevation.
- Establishing and publicizing a user-friendly, publicly-accessible repository for inquirers to obtain Flood Insurance Rate Maps.
- Developing an educational flyer targeting NFIP policyholders on increased cost of compliance during post-flood damage assessments.
- Annually notifying the owners of repetitive loss properties of Flood Mitigation Assistance funding.
- Offering incentives for building above the required freeboard minimum (code plus).

F-10 Participate in the CRS

FEMA Resources/Publications
FEMA 100, 209, 213, 268, 480;
FIA-15A

The Community Rating System (CRS) rewards communities that exceed the minimum NFIP requirements. Depending upon the level of participation, flood insurance premium rates are discounted for policyholders. Potential activities that are eligible to receive credit include:

- Advising the public about the local flood hazard, flood insurance, and flood protection measures.
- Enacting and enforcing regulations that exceed NFIP minimum standards so that more flood protection is provided for new development.
- Implementing damage reduction measures for existing buildings such as acquisition, relocation, retrofitting, and maintenance of drainageways and retention basins.
- Taking action to minimize the effects of flooding on people, property, and building contents through measures including flood warning, emergency response, and evacuation planning.

F-11 Establish Local Funding Mechanisms for Flood Mitigation

Potential methods to develop local funding sources for flood mitigation include:

- Using taxes to support a regulatory system.
- Using impact fees to help fund public projects to mitigate impacts of land development (e.g., increased runoff).
- Levying taxes to finance maintenance of drainage systems and capital improvements.

F-12 Remove Existing Structures from Flood Hazard Areas

Communities may remove structures from flood-prone areas to minimize future flood losses by acquiring and demolishing or relocating structures from voluntary property owners and preserving lands subject to repetitive flooding.

F-13 Improve Stormwater Drainage System Capacity

Rainwater and snowmelt can cause flooding and erosion in developed areas. Structural stormwater management projects that prevent this include:

- Installing, re-routing, or increasing the capacity of a storm drainage system.
- Increasing drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection.
- Increasing capacity of stormwater detention and retention basins.
- Increasing dimensions of drainage culverts in flood-prone areas.
- Using stream restoration to ensure adequate drainage and diversion of stormwater.
- Requiring developers to construct on-site retention basins for excessive stormwater and as a firefighting water source.
- Providing grassy swales along roadsides.

F-14 Conduct Regular Maintenance for Drainage Systems and Flood Control Structures

Regular maintenance will help drainage systems and flood control structures continue to function properly. Potential activities include:

- Performing regular drainage system maintenance, such as sediment and debris clearance, as well as detection and prevention of discharges into stormwater and sewer systems from home footing drains, downspouts, or sewer pumps.
- Implementing an inspection, maintenance, and enforcement program to help ensure continued structural integrity of dams and levees.
- Routinely cleaning debris from support bracing underneath low-lying bridges.
- Routinely cleaning and repairing stormwater drains.
- Regularly clearing sediment build-up on riverbanks near aerial lines.
- Inspecting bridges and identifying if any repairs or retrofits are needed to prevent scour.
- Incorporating ice jam prevention techniques as appropriate.

F-15 Elevate or Retrofit Structures and Utilities

FEMA Resources/Publications
FEMA 54, P-85, 114, P-259, 347, P-348, P-499

Structures and utilities can be elevated to reduce flood damage, including:

- Elevating structures so that the lowest floor, including the basement, is raised above the base flood elevation.
- Raising utilities or other mechanical devices above expected flood levels.
- Elevating and anchoring manufactured homes or, preferably, keeping manufactured homes out of the floodplain.
- Relocating utilities and water heaters above base flood elevation and using tankless water heaters in limited spaces.

F-16 Floodproof Residential and Non-Residential Structures

FEMA Resources/Publications
FEMA P-55, 114, P-259

Floodproofing techniques may protect certain structures from flood damage, including:

- Wet floodproofing in a basement, which may be preferable to attempting to keep water out completely because it allows for controlled flooding to balance exterior and interior wall forces and discourages structural collapse.
- Encouraging wet floodproofing of areas above base flood elevation.
- Using water resistant paints or other materials to allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure.
- Dry floodproofing non-residential structures by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls to keep water out.

F-17 Protect Infrastructure

FEMA Resources/Publications
FEMA P-259, 345, 543, B-797

Mitigation techniques can be implemented to help minimize losses to infrastructure from flood events, such as:

- Elevating roads and bridges above the base flood elevation to maintain dry access. In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage, but also stabilization or armoring of vulnerable shoulders or embankments.
- Raising low-lying bridges.
- Floodproofing wastewater treatment facilities located in flood hazard areas.
- Floodproofing water treatment facilities located in flood hazard areas.
- Depending on its infrastructure capabilities, using check valves, sump pumps, and backflow prevention devices in homes and buildings.
- Using bioengineered bank stabilization techniques.

F-18 Protect Critical Facilities

FEMA Resources/Publications
FEMA P-259, 345, 543, B-797

Techniques to protect critical facilities from flood events include:

- Requiring that all critical facilities including emergency operations centers (EOC), police stations, and fire department facilities be located outside of flood-prone areas.
- Requiring all critical facilities to meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation.
- Installing/upgrading stormwater pumping stations.
- Raising electrical components of sewage lift stations above base flood elevation.
- Raising manhole openings using concrete pillars.
- Installing watertight covers or inflow guards on sewer manholes.
- Installing flood telemetry systems in sewage lift stations.
- Installing back-up generators for pumping and lift stations in sanitary sewer systems along with other measures (e.g., alarms, meters, remote controls, and switchgear upgrades).
- Building earthen dikes around flood-threatened critical facilities.
- Using bioengineered bank stabilization techniques.

F-19 Construct Flood Control Measures

Small flood control structures can be built to prevent flood damage. Examples include:

- Using minor structural projects that are smaller and more localized (e.g., floodwalls or small berms) in areas that cannot be mitigated through non-structural activities or where structural activities are not feasible due to low densities.
- Using revetments (hardened materials placed atop existing riverbanks or slopes) to protect against floods.
- Using bioengineered bank stabilization techniques.

Natural Systems Protection

F-20 Protect and Restore Natural Flood Mitigation Features

FEMA Resources/Publications
FEMA 100, 268

Natural resources provide floodplain protection, riparian buffers, and other ecosystem services that mitigate flooding. It is important to preserve such functionality with the following:

- Protecting and enhancing landforms that serve as natural mitigation features (i.e., riverbanks, wetlands, dunes, etc.).
- Using vegetative management, such as vegetative buffers, around streams and water sources.
- Protecting and preserving wetlands to help prevent flooding in other areas.
- Establishing and managing riparian buffers along rivers and streams.
- Retaining natural vegetative beds in stormwater channels.
- Retaining thick vegetative cover on public lands flanking rivers.

F-21 Preserve Floodplains as Open Space

FEMA Resources/Publications
FEMA 100, 268

Preserving natural areas and vegetation benefits natural resources while also mitigating potential flood losses. Techniques include:

- Developing an open space acquisition, reuse, and preservation plan targeting hazard areas.
- Developing a land banking program for the preservation of the natural and beneficial functions of flood hazard areas.
- Using transfer of development rights to allow a developer to increase densities on another parcel that is not at risk in return for keeping floodplain areas vacant.
- Compensating an owner for partial rights, such as easement or development rights, to prevent a property from being developed.

F-22 Increase Awareness of Flood Risk and Safety

Ideas for increasing flood risk awareness include the following:

- Encouraging homeowners to purchase flood insurance.
- Annually distributing flood protection safety pamphlets or brochures to the owners of flood-prone property.
- Educating citizens about safety during flood conditions, including the dangers of driving on flooded roads.
- Using outreach programs to advise homeowners of risks to life, health, and safety.
- Offering GIS hazard mapping online for residents and design professionals.
- Establishing a Program for Public Information (PPI) with a PPI committee (as suggested by Activity 332 of the CRS Coordinator's Manual).

F-23 Educate Property Owners about Flood Mitigation Techniques

FEMA Resources/Publications
FEMA Building Code Tool Kit (FEMA CD)

Educate property owners regarding options for mitigating their properties from flooding through outreach activities such as:

- Using outreach activities to facilitate technical assistance programs that address measures that citizens can take or facilitate funding for mitigation measures.
- Encouraging homeowners to install backflow valves to prevent reverse-flow flood damages.
- Encouraging residents in flood-prone areas to elevate homes.
- Educating the public about securing debris, propane tanks, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if picked up and washed away by floodwaters.
- Asking residents to help keep storm drains clear of debris during storms (not to rely solely on Public Works).

Other flooding-related mitigation actions may also apply to other hazards. See the sections entitled "Storm Surge," "Erosion," and "Multiple Hazards" for other possible ideas.

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Hail

Hailstorms are a potentially damaging outgrowth of severe thunderstorms. Hailstorms frequently accompany thunderstorms, so their locations and spatial extents overlap. Hail can cause substantial damage to vehicles, roofs, landscaping, and other areas of the built environment. U.S. agriculture is typically the area most affected by hail storms, which cause severe crop damage even during minor events.

Structure and Infrastructure Projects

HA-1 Locate Safe Rooms to Minimize Damage

FEMA Resources/Publications
FEMA 320, 453

Locate tornado safe rooms inside or directly adjacent to houses to prevent hail-induced injuries that may occur when taking shelter during a severe thunderstorm.

HA-2 Protect Buildings from Hail Damage

For new construction as well as retrofitting existing buildings, techniques to minimize hail damage include:

- Including measures such as structural bracing, shutters, laminated glass in window panes, and hail-resistant roof coverings or flashing in building design to minimize damage.
- Improving roof sheathing to prevent hail penetration.
- Installing hail resistant roofing and siding.
- Contacting the Insurance Institute for Business and Home Safety (IBHS) to learn more about the most appropriate type of roof covering for your geographic region.

Education and Awareness Programs

HA-3 Increase Hail Risk Awareness

Conduct outreach activities to increase public awareness of hail dangers, including:

- Mailing safety brochures with monthly water bills.
- Posting warning signage at local parks, county fairs, and other outdoor venues.
- Teaching school children about the dangers of hail and how to take safety precautions.

Other hail-related mitigation actions may also apply to other hazards. See the section entitled "Multiple Hazards" for other possible ideas.

Landslide

The movement of a mass of rock, debris, or earth down a slope by force of gravity is considered a landslide. Landslides occur when the slope or soil stability changes from stable to unstable, which may be caused by earthquakes, storms, volcanic eruptions, erosion, fire, or additional human-induced activities. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. Potential impacts include environmental disturbance, property and infrastructure damage, and injuries or fatalities.

Local Planning and Regulations

LS-1 Map and Assess Vulnerability to Landslides

Improve data and mapping on specific landslide risks in the community by:

- Studying areas where riparian landslides may occur.
- Completing an inventory of locations where critical facilities, other buildings, and infrastructure are vulnerable to landslides.
- Using GIS to identify and map landslide hazard areas.
- Developing and maintaining a database to track community vulnerability to landslides.
- Assessing vegetation in wildfire-prone areas to prevent landslides after fires (e.g., encourage plants with strong root systems).

LS-2 Manage Development in Landslide Hazard Areas

Landslide risk can be mitigated by regulating development in landslide hazard areas through actions such as:

- Creating a plan to implement reinforcement measures in high-risk areas.
- Defining steep slope/high-risk areas in land use and comprehensive plans and creating guidelines or restricting new development in those areas.
- Creating or increasing setback limits on parcels near high-risk areas.
- Locating utilities outside of landslide areas to decrease the risk of service disruption.
- Restricting or limiting industrial activity that would strip slopes of essential top soil.
- Incorporating economic development activity restrictions in high-risk areas.

LS-3 Prevent Impacts to Roadways

To prevent roadway damage and traffic disruptions from landslides, consider options such as:

- Implementing monitoring mechanisms/procedures (i.e., visual inspection or electronic monitoring systems).
- Applying soil stabilization measures, such as planting soil-stabilizing vegetation on steep, publicly-owned slopes.
- Using debris-flow measures that may reduce damage in sloping areas, such as stabilization, energy dissipation, and flow control measures.
- Establishing setback requirements and using large setbacks when building roads near slopes of marginal stability.
- Installing catch-fall nets for rocks at steep slopes near roadways.

LS-4 Remove Existing Buildings and Infrastructure from Landslide Hazard Areas

To help mitigate landslide hazards, communities can acquire and demolish or relocate at-risk buildings and infrastructure and enforce permanent restrictions on development after land and structure acquisition.

FEMA Resources/Publications
FEMA 182

Other landslide-related mitigation actions may also apply to other hazards. See the sections entitled "Erosion," "Subsidence," and "Multiple Hazards" for other possible ideas.

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Lightning

Lightning is a discharge of electrical energy that results from the buildup of positive and negative charges in a thunderstorm, which creates a "bolt" when the buildup of charges becomes strong enough. On average, 55 people are killed and hundreds are injured each year by lightning strikes in the United States. Lightning can strike communications equipment (e.g., radio or cell towers, antennae, satellite dishes, etc.) and hamper communication and emergency response. Lightning strikes can also cause significant damage to buildings, critical facilities, and infrastructure, largely by igniting a fire. Lightning can also ignite a wildfire.

Structure and Infrastructure Projects

L-1 Protect Critical Facilities and Equipment

Protect critical facilities and infrastructure from lighting damage with the following measures:

- Installing lightning protection devices and methods, such as lightning rods and grounding, on communications infrastructure and other critical facilities.
- Installing and maintaining surge protection on critical electronic equipment.

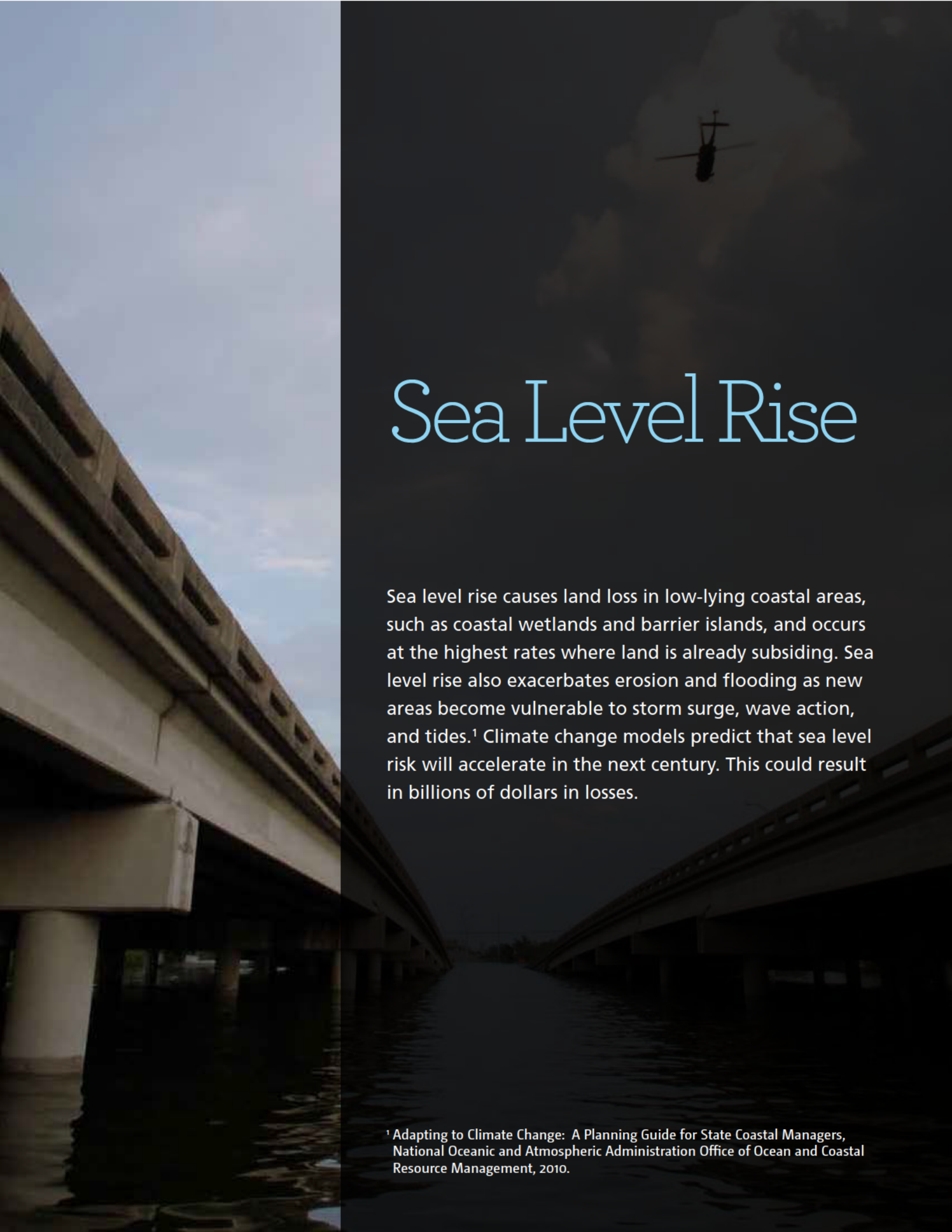
Education and Awareness Programs

L-2 Conduct Lightning Awareness Programs

Use outreach programs to promote awareness of lightning dangers. This could include ideas such as:

- Developing a lightning brochure for distribution by recreation equipment retailers or outfitters in mountainous areas.
- Mailing safety brochures with monthly water bills.
- Posting warning signage at local parks.
- Teaching school children about the dangers of lightning and how to take safety precautions.

Other lightning-related mitigation actions may also apply to other hazards. See the section entitled "Multiple Hazards" for other possible ideas.



Sea Level Rise

Sea level rise causes land loss in low-lying coastal areas, such as coastal wetlands and barrier islands, and occurs at the highest rates where land is already subsiding. Sea level rise also exacerbates erosion and flooding as new areas become vulnerable to storm surge, wave action, and tides.[1] Climate change models predict that sea level risk will accelerate in the next century. This could result in billions of dollars in losses.

[1] Adapting to Climate Change: A Planning Guide for State Coastal Managers, National Oceanic and Atmospheric Administration Office of Ocean and Coastal Resource Management, 2010.

Local Planning and Regulations

SLR-1 Map and Assess Vulnerability to Sea Level Rise

To better understand and assess local vulnerability to sea level rise, consider actions such as:

- Modeling various "what-if" scenarios to estimate potential vulnerabilities in order to develop sea level rise mitigation priorities.
- Using GIS to map hazard areas, at-risk structures, and associated hazards (e.g., flood and storm surge) to assess high-risk areas.
- Developing an inventory of public buildings and infrastructure that may be particularly vulnerable to sea level rise.
- Adding future conditions hydrology and areas that may be inundated by sea level rise to Digital Flood Insurance Rate Maps (DFIRM).

SLR-2 Manage Development in High-Risk Areas

Local governments can mitigate future losses resulting from sea level rise by regulating development in potential hazard areas through land use planning, including:

- Using zoning, subdivision regulations, and/or a special sea level rise overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas.
- Promoting conservation and management of open space, wetlands, and/or sea level rise boundary zones to separate developed areas from high-hazard areas.
- Prohibiting the redevelopment of areas destroyed by storms or chronic erosion in order to prevent future losses.
- Encouraging compact community design in low-risk areas.
- Establishing setbacks in high-risk areas that account for potential sea level rise.

SRL-3 Prevent Infrastructure Expansion in High-Risk Areas

Future development can be protected from damage resulting from sea level rise through the following:

- Setting guidelines for annexation and service extensions in high-risk areas.
- Locating utilities and critical facilities outside of areas susceptible to sea level rise to decrease the risk of service disruption.
- Requiring all critical facilities to be built 1 foot above the 500-year flood elevation (considering wave action) or the predicted sea level rise level, whichever is higher.

Structure and Infrastructure Projects

SRL-4 Protect Buildings and Infrastructure

Existing structures, infrastructure, and critical facilities can be protected from sea level rise through the following:

- Acquiring and demolishing or relocating structures located in high-risk areas.
- Retrofitting structures to elevate them above potential sea level rise levels.
- Retrofitting critical facilities to be 1 foot above the 500-year flood elevation (considering wave action) or the predicted sea level rise level, whichever is higher.
- Replacing exterior building components with more hazard-resistant materials.

Natural Systems Protection

SLR-5 Preserve High-Hazard Areas as Open Space

Preserve open space to benefit natural resources and to reduce risk to structures from potential sea level rise. Techniques include:

- Developing an open space acquisition, reuse, and preservation plan targeting hazard areas.
- Developing a land banking program for the preservation and management of the natural and beneficial functions of flood hazard areas.
- Adopting rolling easements along the shoreline to promote natural migration of shorelines.
- Using transfer of development rights to allow a developer to increase densities on another parcel that is not at risk in return for keeping floodplain areas vacant.
- Compensating an owner for partial rights, such as easement or development rights, to prevent a property from being developed.

SLR-6 Protect and Restore Natural Buffers

Natural resources provide floodplain protection, riparian buffers, and other ecosystem services that mitigate sea level rise. It is important to preserve such functionality with the following:

- Examining the appropriate use of beach nourishment, sand scraping, dune-gap plugs, etc., for coastal hazards.
- Implementing dune restoration, plantings (e.g., sea oats), and use of natural materials.
- Examining the appropriate use of sediment-trapping vegetation, sediment mounds, etc., for coastal hazards.
- Planting sediment-trapping vegetation to buffer the coast against coastal storms by collecting sediment in protective features such as dunes or barrier islands.
- Performing sand scraping—using bulldozers to deposit the top foot of sand above the high-tide line—to reinforce the beach without adding new sand.
- Using sediment mounds to act as artificial dunes or plugs for natural dune gaps in order to slow the inland progress of storm-related wind and water.

Education and Awareness Programs

SLR-7 Increase Awareness of Sea Level Rise

Improve public awareness of risks due to sea level rise through outreach activities such as:

- Encouraging homeowners to purchase flood insurance.
- Using outreach programs to facilitate technical assistance programs that address measures that citizens can take or facilitate funding for mitigation measures.
- Annually distributing flood protection safety pamphlets or brochures to the owners of property in high-risk areas.
- Educating citizens about safety during flood conditions, including the dangers of driving on flooded roads.
- Using outreach programs to advise homeowners of risks to life, health, and safety.
- Offering GIS hazard mapping online for residents and design professionals.
- Disclosing the location of possible sea level rise areas to potential buyers.

Other sea level rise-related mitigation actions may also apply to other hazards. See the sections entitled "Flood," "Storm Surge," "Erosion," and "Multiple Hazards" for other possible ideas.

Climate change is likely to exacerbate the effects of other hazards as well. See the other sections for possible ideas.

Severe Wind

Severe wind can occur alone, such as during straight-line wind events and derechos, or it can accompany other natural hazards, including hurricanes and severe thunderstorms. Severe wind poses a threat to lives, property, and vital utilities primarily due to the effects of flying debris or downed trees and power lines. Severe wind will typically cause the greatest damage to structures of light construction, particularly manufactured homes.

SW-1 Adopt and Enforce Building Codes

FEMA Resources/Publications
FEMA P-85, P-804

Adopt regulations governing residential construction to prevent wind damage. Examples of appropriate regulations are:

- Adopting the International Building Code (IBC) and International Residential Code (IRC).
- Adopting standards from International Code Council (ICC)-600 *Standard for Residential Construction in High-Wind Regions*.
- Reviewing building codes and structural policies to ensure they are adequate to protect older structures from wind damage.
- Requiring or encouraging wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles.
- Requiring tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes.
- Prohibiting the use of carports and open coverings attached to manufactured homes.
- Requiring the use of special interlocking shingles designed to interlock and resist uplift forces in extreme wind conditions to reduce damage to a roof or other structures.
- Improving nailing patterns.
- Requiring building foundation design, braced elevated platforms, and protections against the lateral forces of winds and waves.
- Requiring new masonry chimneys greater than 6 feet above a roof to have continuous reinforced steel bracing.
- Requiring structures on temporary foundations to be securely anchored to permanent foundations.

SW-2 Promote or Require Site and Building Design Standards to Minimize Wind Damage

FEMA Resources/Publications
FEMA P-499, 550

Damage associated with severe wind events can be reduced or prevented if considered during building and site design. Examples include the following:

- Using natural environmental features as wind buffers in site design.
- Incorporating passive ventilation in the building design.
- Incorporating passive ventilation in the site design. Passive ventilation systems use a series of vents in exterior walls or at exterior windows to allow outdoor air to enter the home in a controlled way.
- Encouraging architectural designs that limit potential for wind-borne debris.
- Improving architectural design standards for optimal wind conveyance.
- Encouraging wind-resistant roof shapes (e.g., hip over gable).

SW-3 Assess Vulnerability to Severe Wind

In order to better understand and assess local vulnerability to severe wind, consider actions such as:

- Developing and maintaining a database to track community vulnerability to severe wind.
- Using GIS to map areas that are at risk to the wind hazard associated with different hurricane conditions (e.g., Category 1, 2, 3, etc.) and to identify concentrations of at-risk structures.
- Creating a severe wind scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community to develop severe wind mitigation priorities.
- Using Hazus to quantitatively estimate potential losses from hurricane wind.

SW-4 Protect Power Lines and Infrastructure

The regular maintenance and upkeep of utilities can help prevent wind damage. Possible strategies are:

- Establishing standards for all utilities regarding tree pruning around lines.
- Incorporating inspection and management of hazardous trees into the drainage system maintenance process.
- Preemptively testing power line holes to determine if they are rotting.
- Inspecting utility poles to ensure they meet specifications and are wind resistant.
- Burying power lines to provide uninterrupted power after severe winds, considering both maintenance and repair issues.
- Upgrading overhead utility lines (e.g., adjust utility pole sizes, utility pole span widths, and/or line strength).
- Avoiding use of aerial extensions to water, sewer, and gas lines.
- Using designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
- Installing redundancies and loopfeeds.

SW-5 Retrofit Residential Buildings

FEMA Resources/Publications
FEMA 320, 361, 453, P-499, P-804

The following types of modifications or retrofits to existing residential buildings can reduce future wind damage:

- Improving the building envelope.
- Installing hurricane shutters or other protective measures.
- Retrofitting gable end walls to eliminate wall failures in high winds.
- Replacing existing non-ductile infrastructure with ductile infrastructure to reduce their exposure to hazardous events.
- Retrofitting buildings with load-path connectors to strengthen the structural frames.
- Installing safe rooms.
- Reinforcing garage doors.
- Inspecting and retrofitting roofs to adequate standards to provide wind resistance.

SW-6 Retrofit Public Buildings and Critical Facilities

FEMA Resources/Publications
FEMA 361, P-499, 550

Public buildings and critical facilities can be retrofitted to reduce future wind damage with the following actions:

- Improving roof coverings (e.g., no pebbles, remove ballast roof systems).
- Anchoring roof-mounted heating, ventilation, and air conditioning units.
- Retrofitting buildings with load-path connectors to strengthen the structural frames.
- Retrofitting or constructing the emergency operations center to FEMA 361 standards.
- Avoiding placing flag poles or antennas near buildings.
- Upgrading and maintaining existing lightning protection systems to prevent roof cover damage.
- Requiring upgrading of reused buildings that will house critical facilities.
- Protecting traffic lights and other traffic controls from high winds.
- Converting traffic lights to mast arms.

SW-7 Increase Severe Wind Risk Awareness

FEMA Resources/Publications
FEMA P-431, P-804

Improve public awareness of severe wind through outreach activities such as:

- Informing residents of shelter locations and evacuation routes.
- Educating homeowners on the benefits of wind retrofits such as shutters, hurricane clips, etc.
- Ensuring that school officials are aware of the best area of refuge in school buildings.
- Instructing property owners on how to properly install temporary window coverings before a storm.
- Educating design professionals to include wind mitigation during building design.

Other severe wind-related mitigation actions may also apply to other hazards. See the sections entitled "Multiple Hazards" and "Tornadoes" for other possible ideas.

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Severe Winter Weather

Severe winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Severe winter weather can down trees, cause widespread power outages, damage property, and cause fatalities and injuries.

Local Planning and Regulations

WW-1 Adopt and Enforce Building Codes

Buildings and infrastructure can be protected from the impacts of winter storms with the following regulations:

- Adopting the International Building Code (IBC) and International Residential Code (IRC).
- Ensuring the development and enforcement of building codes for roof snow loads.
- Discouraging flat roofs in areas that experience heavy snows.

Structure and Infrastructure Projects

WW-2 Protect Buildings and Infrastructure

Buildings and infrastructure can be protected from the impacts of winter storms with the following techniques:

- Adding building insulation to walls and attics.
- As buildings are modified, using new technology to create or increase structural stability.
- Retrofitting public buildings to withstand snow loads and prevent roof collapse.

WW-3 Protect Power Lines

Power lines can be protected from the impacts of winter storms with the following techniques:

- Establishing standards for all utilities regarding tree pruning around lines.
- Burying overhead power lines.
- Using designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
- Installing redundancies and loopfeeds.

WW-4 Reduce Impacts to Roadways

The leading cause of death during winter storms is from automobile or other transportation accidents, so it is important to consider ways to lessen roadway impacts. Potential strategies include:

- Planning for and maintaining adequate road and debris clearing capabilities.
- Using snow fences or "living snow fences" (e.g., rows of trees or other vegetation) to limit blowing and drifting of snow over critical roadway segments.
- Installing roadway heating technology to prevent ice/snow buildup.

WW-5 Conduct Winter Weather Risk Awareness Activities

Public awareness of severe winter storms can be improved through the following efforts:

- Informing the public about severe winter weather impacts.
- Producing and distributing family and traveler emergency preparedness information about severe winter weather hazards.
- Including safety strategies for severe weather in driver education classes and materials.
- Encouraging homeowners to install carbon monoxide monitors and alarms.
- Educating citizens that all fuel-burning equipment should be vented to the outside.

WW-6 Assist Vulnerable Populations

Protect vulnerable populations from the impacts of severe winter storms through the following efforts:

- Identifying specific at-risk populations that may be exceptionally vulnerable in the event of long-term power outages.
- Organizing outreach to vulnerable populations, including establishing and promoting accessible heating centers in the community.

Other winter weather-related mitigation actions may also apply to other hazards. See the sections entitled "Extreme Temperatures" and "Multiple Hazards" for other possible ideas.

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Storm Surge

A storm surge is a large dome of water, often 50 to 100 miles wide, that rises anywhere from 4 to 5 feet in a Category 1 hurricane and up to more than 30 feet in a Category 5 storm. Storm surge arrives prior to a hurricane's landfall, and the greater the hurricane's intensity, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing flooding, severe beach erosion, and property damage along the immediate coast. Furthermore, water can rise very rapidly due to storm surge, posing a serious threat to people remaining in inundation areas.

Local Planning and Regulations

SS-1 Adopt Building Codes and Development Standards

Building codes and development standards can be established to mitigate storm surge damage. Possible regulations include:

- Adopting the International Building Code (IBC) and International Residential Code (IRC).
- Adopting ASCE-24-05 *Flood Resistant Design and Construction*. ASCE 24, created by the American Society of Civil Engineers, is a referenced standard in the IBC that specifies minimum requirements and expected performance for the design and construction of buildings and structures in flood hazard areas to make them more resistant to flood loads and flood damage.
- Establishing design standards for buildings located in areas susceptible to storm surge.
- Implementing V-zone construction requirements for new development located in coastal A-zones.
- Adopting building requirements for higher elevation in inundation zones.
- Requiring open foundations (e.g., piles or piers) in coastal areas.
- Requiring deep foundations in order to avoid erosion and scour.

SS-2 Improve Land Use Planning and Regulations

Land uses should be planned and regulated to minimize the impact of storm surge. Possible measures to implement include:

- Developing and maintaining a beach management plan.
- Adopting shoreline setback regulations and establishing coastal setback lines.
- Adopting coastal zone management regulations.
- Eliminating all obstructions in areas along the coast subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves (also known as the V-zone).
- Planning for future storm surge heights due to sea level rise.
- Limiting or prohibiting development in areas along the coast subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves (referred to as the V-zone on Flood Insurance Rate Maps).
- Adopting coastal A-zones, areas of special flood hazard that extend inland and are subject to breaking waves between 1.5 and 3 feet, and ensuring that they are mapped accurately.
- Adopting and enforcing coastal A-zones in A-zones.

SS-3 Minimize Risk to New Facilities and Infrastructure

FEMA Resources/Publications

FEMA P-55, P-499, B-797

Infrastructure and critical facilities can be protected from storm surge damage through the following:

- Locating future critical facilities outside of areas susceptible to storm surge.
- Requiring that all critical facilities meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation (considering wave action).

SS-4 Map and Assess Vulnerability to Storm Surge

Storm surge risk can be better assessed and monitored with mapping techniques, including the following:

- Using GIS to map areas that are at risk to inundation by storm surge.
- Developing and maintaining a database to track community vulnerability to storm surge.

Structure and Infrastructure Projects

SS-5 Construct Structural Control Techniques

Structural controls can be used to lessen the impact of storm surge. Examples include the following:

- Constructing groins to capture material along the shoreline in order to trap and retain sand.
- Installing geotextile sand tubes to trap sand or protect beachfront properties.
- Building a coastal berm to absorb waves and protect the shoreline from erosion.
- Building a storm berm to keep rock protection in place and provide a slow supply of sediment to the coastal system.

SS-6 Protect Infrastructure and Critical Facilities

FEMA Resources/Publications
FEMA P-55, P-499, B-797

Infrastructure and critical facilities can be protected from damage by storm surge through the following:

- Reorienting near-shore roads so they are parallel (not perpendicular) to the beach to prevent the channelization of storm surge and wind inland.
- Constructing seawalls or other structures to protect critical facilities located on the shoreline.
- Relocating existing vulnerable critical facilities outside of high-risk areas.

Natural Systems Protection

SS-7 Protect and Restore Natural Buffers

Natural resources provide floodplain protection, riparian buffers, and other ecosystem services that mitigate storm surge risk. It is important to preserve such functionality with the following:

- Examining the appropriate use of beach nourishment, sand scraping, dune-gap plugs, etc., for coastal hazards.
- Implementing dune restoration, plantings (e.g., sea oats), and use of natural materials.
- Evaluating the appropriate use of sediment-trapping vegetation, sediment mounds, etc., for coastal hazards.
- Planting sediment-trapping vegetation to make the coast more resistant to coastal storms by collecting sediment in protective features such as dunes or barrier islands.
- Performing sand scraping—using bulldozers to deposit the top foot of sand above the high-tide line—to reinforce the beach without adding new sand.
- Using sediment mounts to act as artificial dunes or plugs for natural dune gaps in order to slow the inland progress of storm-related wind and water.

Education and Awareness Programs

SS-8 Provide Information on High-Risk Areas

Increase public awareness of storm surge risk through the following actions:

- Offering GIS hazard mapping online for residents and design professionals.
- More accurately mapping problem areas to educate residents about unanticipated risks. Upgrading maps provides a truer measure of risks to a community.
- Educating property owners in high-risk areas about mitigation options.
- Educating the public about risks, preparedness measures, and evacuation procedures.

Other storm surge-related mitigation actions may also apply to other hazards. See the sections entitled "Flood" and "Multiple Hazards" for other possible ideas.

Subsidence

Subsidence is the gradual settling or sudden sinking of the Earth's surface due to subsurface movement of earth materials. The level of subsidence ranges from a broad lowering to collapse of land surface. Most causes of subsidence are human-induced, such as groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost. Areas located above or adjacent to karsts topography have a greater risk of experiencing subsidence. Sudden collapses of surface areas can damage and destroy buildings and infrastructure.

Local Planning and Regulations

SU-1 Map and Assess Vulnerability to Subsidence

Some areas with subsidence risk may not be fully identified in your community. Consider actions such as:

- Using GIS to map areas that are susceptible to subsidence.
- Identifying and mapping old mining areas or geologically unstable terrain so that development can be prevented or eliminated.
- Using ground-penetrating radar to detect lava tubes and map their location.
- Supporting mapping efforts to identify areas of existing permafrost.
- Improving accuracy of hazard area maps to educate residents about unanticipated risks. Upgrading maps provides a truer measure of risks to a community.

SU-2 Manage Development in High-Risk Areas

Development regulations should consider areas with poor soil conditions, including the following:

- Prohibiting development in areas that have been identified as at-risk to subsidence.
- Restricting development in areas with soil that is considered poor or unsuitable for development.

SU-3 Consider Subsidence in Building Design

If subsidence is considered during building design, future damage may be prevented. Potential actions include:

- Educating design professionals about where to locate information on subsidence rates and maps.
- Incorporating structural designs that can resist loading associated with subsidence.
- Adopting an ordinance promoting permafrost sensitive construction practices.
- Including potential subsidence in freeboard calculations for buildings in flood-prone areas.

SU-4 Monitor Subsidence Risk Factors

Several risk factors can be monitored to help predict subsidence, such as the following:

- Monitoring areas at risk to subsidence by remaining aware of changes in groundwater levels.
- Monitoring areas where natural resources are removed from underground.
- Filling or buttressing subterranean open spaces, as with abandoned mines, to prevent or alleviate collapse.

Structure and Infrastructure Projects

SU-5 Remove Existing Structures from Subsidence Hazard Areas

To prevent property loss, acquire and demolish or relocate buildings and infrastructure in high-risk areas.

FEMA Resources/Publications
FEMA 20, P-85, 361, 453

Education and Awareness Programs

SU-6 Educate Residents about Subsidence

Increase residents' knowledge of subsidence through the following:

- Promoting community awareness of subsidence risks and impacts.
- Offering GIS hazard mapping online for residents and design professionals.

Other subsidence-related mitigation actions may also apply to other hazards. See the sections entitled "Landslide," "Erosion," and "Multiple Hazards" for other possible ideas.

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Tornado

A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction, including residential dwellings and particularly manufactured homes. Tornadoes are more likely to occur during the months of March through May and tend to form in the late afternoon and early evening.

Local Planning and Regulations

T-1 Encourage Construction of Safe Rooms

FEMA Resources/Publications
FEMA 20, P-85, 320, 361, P-431, 453

Promote the construction and use of safe rooms by:

- Requiring construction of safe rooms in new schools, daycares, and nursing homes.
- Encouraging the construction and use of safe rooms in homes and shelter areas of manufactured home parks, fairgrounds, shopping malls, or other vulnerable public structures.
- Encouraging builders and homeowners to locate tornado safe rooms inside or directly adjacent to houses to prevent injuries due to flying debris or hail.
- Developing a local grant program to assist homeowners who wish to construct a new safe room.
- Consulting guidance from FEMA P-320 - *Taking Shelter From the Storm*: Building a Safe Room For Your Home or Small Business and International Code Council (ICC)-500 *Standard for the Design and Construction of Storm Shelters.*

T-2 Require Wind-Resistant Building Techniques

FEMA Resources/Publications
FEMA P-804

Require or encourage wind engineering measures and construction techniques that may include the following:

- Structural bracing
- Straps and clips
- Anchor bolts
- Laminated or impact-resistant glass
- Reinforced pedestrian and garage doors
- Window shutters
- Waterproof adhesive sealing strips
- Interlocking roof shingles

Also, improve the selection of building materials so that wind-resistant materials are more readily available to the public. Consult guidance from ICC-600 S*tandard for Residential Construction in High-Wind Regions.*

Education and Awareness Programs

T-3 Conduct Tornado Awareness Activities

FEMA Resources/Publications
FEMA 182

Conduct outreach activities to increase awareness of tornado risk. Activities could include the following:

- Educating citizens through media outlets.
- Conducting tornado drills in schools and public buildings.
- Teaching school children about the dangers of tornadoes and how to take safety precautions.
- Distributing tornado shelter location information.
- Supporting severe weather awareness week.
- Promoting use of National Oceanic and Atmospheric Administration (NOAA) weather radios.

Other tornado wind-related mitigation actions may also apply to other hazards. See the sections entitled "Severe Wind" and "Multiple Hazards" for other possible ideas.

Tsunami

A tsunami is a series of great waves that are created by undersea disturbances, such as earthquakes or volcanic eruptions. As opposed to typical waves that crash at the shoreline, tsunamis bring a continuously flowing "wall of water" that has the potential to cause devastating damage in coastal areas immediately along the shore. Areas at greatest risk are less than 50 feet above sea level and within 1 mile of the shoreline. Most deaths that occur during a tsunami result from drowning. Associated risks include flooding, polluted water supplies, and damaged gas lines.

Local Planning and Regulations

TSU-1 Map and Assess Vulnerability to Tsunami

FEMA Resources/Publications
FEMA P-646, 646-A

Tsunami risk can be better assessed and monitored with mapping techniques, including the following:

- Using GIS to map areas that are vulnerable to inundation by tsunamis.
- Developing and maintaining a database to track community vulnerability to tsunamis.
- Offering GIS hazard mapping online for residents and design professionals.
- Educating map users on the appropriate uses and limitations of maps.
- More accurately mapping problem areas to educate residents about unanticipated risks. Upgrading maps provides a truer measure of risks to a community.

TSU-2 Manage Development in Tsunami Hazard Areas

FEMA Resources/Publications
FEMA P-55

Planning and regulations can mitigate tsunami damage in many ways, such as:

- Adopting and enforcing building codes and design standards that contain requirements for tsunami-resistant design.
- Limiting new development in tsunami run-up areas.
- Encouraging new development that is configured to minimize tsunami losses by using site planning strategies that slow water currents, steer water forces, and block water forces.

TSU-3 Protect Against Fire Following Tsunami

Communities can encourage wildfire mitigation measures (i.e., tree breaks) in tsunami-prone areas to reduce impacts of fires that may occur after a tsunami hits the coastline.

Structure and Infrastructure Projects

TSU-4 Build Tsunami Shelters

Ensure the population is adequately protected from tsunami inundation by constructing tsunami shelters.

TSU-5 Protect Buildings and Infrastructure

FEMA Resources/Publications
FEMA P-646, 646-A

Ensure buildings and infrastructure are adequately protected from tsunami inundation with the following:

- Requiring coastal structures to be built to standards that allow for proper vertical evacuation and to be specially designed and constructed to resist both tsunami and earthquake loads.
- Locating new and relocating existing infrastructure and critical facilities outside of the tsunami hazard area.
- Elevating existing buildings above the inundation level.
- Relocating fire-prone infrastructure such as electrical lines or case tanks.

Education and Awareness Programs

TSU-6 Increase Public Awareness of Tsunami Hazard

FEMA Resources/Publications
FEMA P-646, 646-A

Improve public awareness and better prepare citizens for evacuation during a tsunami by the following:

- Educating citizens regarding the dangers of tsunami and inform them of emergency procedures and routes to use should a tsunami warning be issued.
- Conducting tsunami drills.
- Designating tsunami inundation zones and marking evacuation routes.
- Developing maps showing possible tsunami inundation areas and steering developers away from high-risk areas.
- Participating in NOAA's TsunamiReady Community program.

Other tsunami-related mitigation actions may also apply to other hazards. See the sections entitled "Flood," "Storm Surge," and "Multiple Hazards" for other possible ideas.

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Wildfire

A wildfire is any outdoor fire that is not controlled, supervised, or arranged. Wildfire probability depends on local weather conditions; outdoor activities such as camping, debris burning, and construction; and the degree of public cooperation with fire prevention measures. Wildfires can result in widespread damage to property and loss of life.

Local Planning and Regulations

WF-1 Map and Assess Vulnerability to Wildfire

FEMA Resources/Publications
FEMA P-754

The first step in local planning is to identify wildfire hazard areas and assess overall community vulnerability. Potential actions include:

- Using GIS mapping of wildfire hazard areas to facilitate analysis and planning decisions through comparison with zoning, development, infrastructure, etc.
- Developing and maintaining a database to track community vulnerability to wildfire.
- Creating a wildfire scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community to develop wildfire mitigation priorities.

WF-2 Incorporate Wildfire Mitigation in the Comprehensive Plan

Communities can review comprehensive plans to ensure wildfire mitigation has been addressed. The comprehensive plan may include the following:

- Recognizing the existence of wildfire hazards and identifying areas of risk based on a wildfire vulnerability assessment.
- Describing policies and recommendation for addressing wildfire risk and discouraging expansion in the wildland-urban interface.
- Including considerations of wildfire hazards in land use, public safety, and other elements of the comprehensive plan.

WF-3 Reduce Risk through Land Use Planning

Local governments can mitigate future losses by regulating development in wildfire hazard areas through land use planning, including:

- Using zoning and/or a special wildfire overlay district to designate high-risk areas and specify the conditions for the use and development of specific areas.
- Addressing density and quantity of development, as well emergency access, landscaping and water supply.
- Promoting conservation of open space or wildland-urban boundary zones to separate developed areas from high-hazard areas.
- Setting guidelines for annexation and service extensions in high-risk areas.

WF-4 Develop a Wildland-Urban Interface Code

Communities can develop regulations for safer construction and incorporate mitigation considerations into the permitting process. Potential actions include:

- Developing specific design guidelines and development review procedures for new construction, replacement, relocation, and substantial improvement in wildfire hazard areas.
- Addressing fire mitigation through access, signage, fire hydrants, water availability, vegetation management, and special building construction standards.
- Involving fire protection agencies in determining guidelines and standards and in development and site plan review procedures.
- Establishing wildfire mitigation planning requirements for large scale developments or planned unit developments.

WF-5 Require or Encourage Fire-Resistant Construction Techniques

FEMA Resources/Publications
FEMA P-737, P-754

A local government can encourage fire-resistant construction or may choose to require it through local regulations. Examples include:

- Encouraging the use of non-combustible materials (i.e., stone, brick, and stucco) for new construction in wildfire hazard areas.
- Using fire resistant roofing and building materials in remodels, upgrades, and new construction.
- Enclosing the foundations of homes and other buildings in wildfire-prone areas, rather than leaving them open and potentially exposing undersides to blown embers or other materials.
- Prohibiting wooden shingles/wood shake roofs on any new development in areas prone to wildfires.
- Encouraging the use of functional shutters on windows.

Structure and Infrastructure Projects

WF-6 Retrofit At-Risk Structures with Ignition-Resistant Materials

Existing structures in wildfire hazard areas can be protected through the use of non-combustible materials and technologies, including:

- Installing roof coverings, sheathing, flashing, skylights, roof and attic vents, eaves, and gutters that conform to ignition-resistant construction standards.
- Installing wall components that conform to ignition-resistant construction standards.
- Protecting propane tanks or other external fuel sources.
- Purchasing and installing external, structure-specific water hydration systems (sprinklers); dedicated power sources; and dedicated cisterns if no water source (e.g., lake, river, or swimming pool) is available.

WF-7 Create Defensible Space Around Structures and Infrastructure

Local governments can implement defensible space programs to reduce risk to structures and infrastructure, including:

- Creating buffers around residential and non-residential structures through the removal or reduction of flammable vegetation, including vertical clearance of tree branches.
- Replacing flammable vegetation with less flammable species.
- Creating defensible zones around power lines, oil and gas lines, and other infrastructure systems.

WF-8 Conduct Maintenance to Reduce Risk

Local governments can implement maintenance procedures to reduce wildfire risk, including:

- Performing arson prevention cleanup activities in areas of abandoned or collapsed structures, accumulated trash or debris, and with a history of storing flammable materials where spills or dumping may have occurred.
- Preventing or alleviating wildfires by proper maintenance and separation of power lines as well as efficient response to fallen power lines.
- Routinely inspecting the functionality of fire hydrants.
- Requiring and maintaining safe access for fire apparatus to wildland-urban interface neighborhoods and properties.

Natural Systems Protection

WF-9 Implement a Fuels Management Program

A fuels management program may be implemented to reduce hazardous vegetative fuels on public lands, near essential infrastructure, or on private lands by working with landowners. The program can include the following:

- Performing maintenance including fuel management techniques such as pruning and clearing dead vegetation, selective logging, cutting high grass, planting fire-resistant vegetation, and creating fuel/fire breaks (i.e., areas where the spread of wildfires will be slowed or stopped by the removal of fuels).
- Using prescribed burning to reduce fuel loads that threaten public safety and property.
- Identifying and clearing fuel loads created by downed trees.
- Cutting firebreaks into public wooded areas in the wildland-urban interface.
- Sponsoring local “slash and clean-up days” to reduce fuel loads along the wildland-urban interface.
- Linking wildfire safety with environmental protection strategies (i.e., improving forest ecology, wildlife habitat, etc.).
- Developing a vegetation management plan.

Education and Awareness Programs

WF-10 Participate in Firewise Program

The Firewise program provides a series of steps that individual residents and their neighbors can take to keep their homes and neighborhoods safer from fire. Consider actions such as:

- Joining the "Firewise Communities/USA" recognition program sponsored by the National Wildlife Coordinating Group (firewise.org).
- Sponsoring Firewise workshops for local officials, developers, civic groups, and neighborhood/homeowners' associations.
- Consulting Firewise guidance and encouraging or requiring best practices in your community.

WF-11 Increase Wildfire Risk Awareness

Education and outreach programs can target citizens, businesses, developers, landscapers, and insurers among others to increase awareness of wildfire risk and strategies for protecting homes and infrastructure. Consider actions such as:

- Offering GIS hazard mapping online for residents, developers, and design professionals.
- Organizing a local fire department tour to show local elected officials and planners the most vulnerable areas of the community's wildland-urban interface and increase their understanding of risks.
- Working with insurance companies, utility providers, and others to include wildfire safety information in materials provided to area residents.
- Developing partnerships with neighborhood groups, homeowners' associations, and others to conduct outreach activities.
- Using local fire departments to conduct education programs in schools.
- Informing the public about proper evacuation procedures.
- Forming a citizen plan implementation steering committee to monitor progress of local mitigation actions. Include a mix of representatives from neighborhoods, local businesses, and local government.

WF-12 Educate Property Owners about Wildfire Mitigation Techniques

Educate property owners on actions that they can take to reduce risk to property, such as the following:

- Installing fire mitigation systems such as interior and exterior sprinkler systems.
- Performing safe disposal of yard and household waste rather than open burning.
- Removing dead or dry leaves, needles, twigs, and combustibles from roofs, decks, eaves, porches, and yards.
- Creating a defensible space or buffer zone cleared of combustible materials around property.
- Installing and maintaining smoke detectors and fire extinguishers on each floor of their homes or other buildings.
- Safely using and storing necessary flammable materials, including machine fuels. Approved safety cans should be used for storing gasoline, oily rags, and other flammable materials. Firewood should be stacked at least 100 feet away and uphill from homes.
- Keeping flammables, such as curtains, secured away from windows or using heavy fire-resistant drapes.

Other wildfire-related mitigation actions may also apply to other hazards. See the section entitled "Multiple Hazards" for other possible ideas.

Multiple Hazards

The actions presented here are general actions that mitigate multiple hazards.

Local Planning and Regulations

MU-1 Assess Community Risk

FEMA Resources/Publications
FEMA 366, 543

Understanding community vulnerability and level of risk is important to identify and prioritize mitigation alternatives. Improve risk assessment through the following:

- Obtaining local data including tax parcels, building footprints, critical facility locations, and other information for use in risk analysis.
- Developing and maintaining a database to track community vulnerability (i.e., exposure in known hazard areas).
- Establishing a process to coordinate with state and Federal agencies to maintain up-to-date hazard data, maps, and assessments.
- Keeping aerial photography current, especially in rapidly developing areas.
- Identifying the most at-risk critical facilities and evaluating potential mitigation techniques.

MU-2 Map Community Risk

Maps are an important tool for communicating risk. Consider the following for developing GIS capabilities:

- Developing a coordinated GIS Department. Find out who uses GIS, determine how it is used, and identify other potential uses.
- Incorporating a GIS system/management plan for tracking permitting, land use patterns, etc.
- Obtaining hazard data and using GIS to map risk for various hazards.

MU-3 Prevent Development in Hazard Areas

FEMA Resources/Publications
FEMA 476

Limit or prohibit development in high-hazard areas through the following types of actions:

- Encouraging clustering of residential lots outside of hazard areas in subdivision design/review.
- Prohibiting or limiting public expenditures for capital improvements in known hazard areas.
- Organizing a managed retreat from very high-risk areas.
- Purchasing the "right of first refusal" for hazard-prone parcels targeted for public acquisition.
- Purchasing land and title in the name of a local governing body to remove structures and enforce permanent restrictions on development.
- Acquiring and using easements (e.g., conservation) to prevent development in known hazard areas.
- Using conservation easements to protect environmentally significant portions of parcels from development.
- Acquiring hazardous areas for conservation or restoring as functional public parks.
- Acquiring safe sites for public facilities (e.g., schools, police/fire stations, etc.).
- Prohibiting new facilities for persons with special needs/mobility concerns in hazard areas.
- Prohibiting animal shelters in known hazard areas.

MU-4 Adopt Development Regulations in Hazard Areas

Regulate development in hazard areas. Examples include:

- Using subdivision and development regulations to regulate development in hazard-prone areas.
- Evaluating the use of performance/impact zoning to set risk-based standards for land development.
- Requiring setbacks from delineated hazard areas (e.g., shorelines, wetlands, steep slopes, etc.).
- Requiring conditional/special use permits for the development of known hazard areas.
- Offering expanded development rights to developers/businesses for performing mitigation retrofits.
- Incorporating restrictive covenants on properties located in known hazard areas.
- Designating high-risk zones as special assessment districts (to fund necessary hazard mitigation projects).

MU-5 Limit Density in Hazard Areas

Limit the density of development in the hazard areas through the following techniques:

- Increasing minimum lot size for development in known hazard areas.
- Designating "agricultural use districts" in the zoning ordinance to limit densities in known hazard areas.
- Ensuring the zoning ordinance encourages higher densities only outside of known hazards areas.
- Requiring clustering for planned unit developments (PUD) in the zoning ordinance to reduce densities in known hazard areas.
- Establishing a local transfer of development rights (TDR) program for risk in known hazard areas.
- Establishing a process to use floating zones to reduce densities in damaged areas following a disaster event.

MU-6 Integrate Mitigation into Local Planning

Hazard mitigation can be integrated into local planning efforts through the following:

- Incorporating risk assessment and hazard mitigation principles into comprehensive planning efforts.
- Incorporating a stand-alone element for hazard mitigation into the local comprehensive (land use) plan.
- Incorporating hazard mitigation into broader growth management (i.e., Smart Growth) initiatives.
- Incorporating a hazard risk assessment into the local development and subdivision review process.
- Adding hazard mitigation measures to existing adequate public facilities (APF) tests and programs.
- Ensuring natural hazards are considered in all land suitability analyses (LSA).
- Determining and enforcing acceptable land uses to alleviate the risk of damage by limiting exposure in such hazard areas.
- Developing a post-disaster reconstruction plan to facilitate decision making following a hazard event.
- Involving citizens in comprehensive planning activities that identify and mitigate hazards.

MU-7 Strengthen Land Use Regulations

FEMA Resources/Publications
FEMA 100, 268

Land use regulations can reduce hazard risk through the following:

- Using bonus/incentive zoning to encourage mitigation measures for private land development.
- Using conditional use zoning to require or exact mitigation measures for private land development.
- Establishing a process to use overlay zones to require mitigation techniques in high-hazard districts.
- Adopting a post-disaster recovery ordinance based on a plan to regulate repair activity, generally depending on property location.
- Adopting environmental review standards.
- Incorporating proper species selection, planting, and maintenance practices into landscape ordinances.

MU-8 Adopt and Enforce Building Codes

FEMA Resources/Publications
FEMA 421,P-762

Building codes and inspections help ensure buildings can adequately withstand damage during hazard events. Effective actions include:

- Adopting the International Building Code (IBC) and International Residential Code (IRC).
- Increasing the local Building Code Effectiveness Grading Schedule (BCEGS) classification through higher building code standards and enforcement practices.
- Incorporating higher standards for hazard resistance in local application of the building code.
- Providing advanced training to local building inspectors.
- Considering orientation of new development during design (e.g., subdivisions, buildings, infrastructure, etc.)
- Requiring standard tie-downs of propane tanks.
- Requiring tie-downs for all manufactured housing.
- Establishing moratorium procedures to guide the suspension of post-disaster reconstruction permits.
- Revising fire codes to limit hotel room occupancy to ensure timely evacuation of high-use and multi-floor structures.
- Establishing "value-added" incentives for hazard-resistant construction practices beyond code requirements.

MU-9 Create Local Funding Mechanisms for Hazard Mitigation

Local funding resources can be developed through the following measures:

- Establishing a local reserve fund for public mitigation measures.
- Using impact fees to help fund public hazard mitigation projects related to land development (i.e., increased runoff).
- Requiring a development impact tax on new construction to mitigate the impacts of that development.
- Recruiting local financial institutions to participate in "good neighbor" lending for private mitigation practices.
- Providing local match to Federal funds that can fund private mitigation practices.

MU-10 Incentivize Hazard Mitigation

Incentives and disincentives can be used to promote hazard mitigation through the following measures:

- Using special tax assessments to discourage builders from constructing in hazardous areas.
- Using insurance incentives and disincentives (i.e., incentives for best practices).
- Providing tax incentives for development of low-risk hazard parcels.
- Waiving permitting fees for home construction projects related to mitigation.
- Using tax abatements, public subsidies, and other incentives to encourage private mitigation practices.
- Reducing or deferring the tax burden for undeveloped hazard areas facing development pressure.
- Encouraging infill development through tax incentives, streamlined approval processes, etc.

MU-11 Monitor Mitigation Plan Implementation

Monitoring the implementation of the local mitigation plan can ensure that mitigation actions are being completed through:

- Forming a plan implementation steering committee to monitor progress on local mitigation actions. Include a mix of representatives from neighborhoods, local businesses, and local government.
- Preparing a plan implementation monitoring schedule and outlining roles for those responsible for monitoring (i.e., local departments, agencies, and committees).
- Preparing and submitting an annual plan implementation progress report to the local elected body.

Structure and Infrastructure Projects

MU-12 Protect Structures

FEMA Resources/Publications

FEMA 577, P-798

Damage to structures can be prevented through the following actions:

- Acquiring or relocating structures located in hazard areas.
- Moving vulnerable structures to a less hazardous location.
- Relocating or retrofitting public buildings located in high-hazard areas.
- Relocating or retrofitting endangered public housing units in high-hazard areas.
- Retrofitting fire and police stations to become hazard resistant.
- Identifying and strengthening facilities to function as public shelters.

MU-13 Protect Infrastructure and Critical Facilities

FEMA Resources/Publications
FEMA 345, 476

Infrastructure and critical facilities can be protected from damage by the following:

- Incorporating hazard mitigation principles into all aspects of public-funded building.
- Incorporating mitigation retrofits for public facilities into the annual capital improvements program.
- Engineering or retrofitting roads and bridges to withstand hazards.
- Relocating or undergrounding electrical infrastructure.
- Designing and building water tanks or wells for use in times of water outage.
- Installing quick-connect emergency generator hook-ups for critical facilities

Education and Awareness Programs

MU-14 Increase Hazard Education and Risk Awareness

FEMA Resources/Publications
EMI IS-22

Hazard education and awareness activities that address multiple hazards include:

- Developing and implementing a multi-hazard public awareness program.
- Providing information on all types of hazards, preparedness and mitigation measures, and responses during hazard events.
- Establishing a "hazard awareness week" in coordination with the media to promote hazard awareness (seasonal).
- Establishing an interactive website for educating the public on hazard mitigation and preparedness measures.
- Annually hosting a public hazards workshop or exposition for all residents.
- Establishing hazard information centers.
- Creating a speakers bureau for disaster-related topics that focus on mitigation and preparedness measures.
- Enhancing hazard awareness of the private sector, particularly lenders, insurance agents, and realtors.
- Scheduling an annual "what's new in mitigation" briefing for the local governing body (possibly with SHMO, etc.).

MU-15 Improve Household Disaster Preparedness

FEMA Resources/Publications
EMI IS-22

Educate the public on how to prepare for hazards and disasters, including the following:

- Encouraging property owners to purchase hazard insurance not as an alternative to mitigation, but rather to add financial protection if damage does occur.
- Encouraging residents to prepare by stocking up the necessary items and planning for how family members should respond during a disaster. Publicized information about household preparedness can be found at www.ready.gov.
- Providing hazard vulnerability checklists for homeowners to conduct their own inspections.
- Promoting the purchase and use of NOAA weather radios by residents.
- Encouraging citizens to secure loose items (i.e., patio furniture).
- Participating in Nation Weather Service StormReady Program.
- Purchasing and installing NOAA weather radios in schools, government buildings, parks, etc.
- Storing digital or hard copies of public records in low-risk, offsite locations.

MU-16 Promote Private Mitigation Efforts

FEMA Resources/Publications
EMI IS-22

Encourage private mitigation efforts that address multiple hazards through the following:

- Using outreach programs to: 1) advise homeowners of risks to life, health, and safety; 2) facilitate technical assistance programs that address measures that citizens can take; or 3) facilitate funding for mitigation measures.
- Establishing, maintaining, and publicizing a library section on hazard mitigation techniques for local residents.
- Identifying and recruiting civic groups and volunteer agencies for community mitigation projects.
- Establishing a network for a business-to-business mitigation mentoring program.
- Offering hazard susceptibility audits of local small businesses.
- Completing a "demonstration model" showing use of hazard mitigation techniques for public display.
- Establishing a technical assistance program for residents to access data or resources for mitigation purposes.
- Educating the public on tradeoffs associated with multi-hazard design.

FEMA Resources/ Publications

Protecting Buildi
Utilities From Fl
Damage

Principles and Practices for the Desigr
Flood Resistant Building Utility Syster

FEMA P-348, Edition 1 / November 1999

FEMA

Engineering Princi
and Practices

for Retrofitting Flood-Prone Residential

FEMA P-259 / January 2012

FEMA

FEMA Publications
Catalog

FEMA P-20 / February 2009

FEMA 306

EVALUATION OF EARTHQUAKE DAMAGED
CONCRETE AND MASONRY WALL BUILDINGS

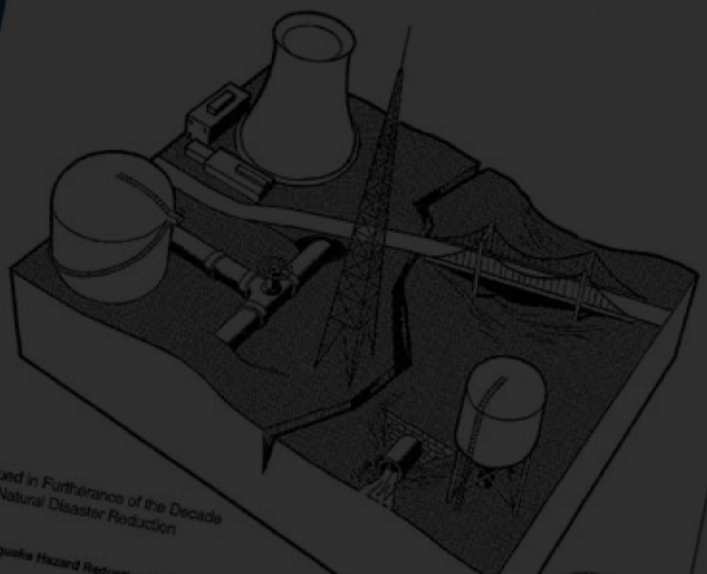
Basic Procedures Manual

Prepared by:

Federal Emergency Management Agency

FEMA 224 / September 1991

Seismic Vulnerability and
Impact of Disruption of
Lifelines in the
Conterminous United States



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1. **FEMA 20** FEMA Publications Catalog
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2894
2. **FEMA 54** Elevated Residential Structures
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1670
3. **FEMA P-55** Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas (4th ed.)
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1671
4. **FEMA E-74** Reducing the Risks of Nonstructural Earthquake Damage: A Practical Guide. Fourth Edition
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4626
5. **FEMA 83** Seismic Considerations for Communities at Risk
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1575
6. **FEMA P-85** Protecting Manufactured Homes from Floods and Other Hazards
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1577
7. **FEMA 100** Unified National Program for Floodplain Management
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1626
8. **FEMA 114** Design Manual for Retrofitting Flood-prone Residential Structures
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1414
9. **FEMA 154** Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook. Second Edition
   http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3556
10. **FEMA 155** Rapid Visual Screening of Buildings for Potential Seismic Hazards: Supporting Documentation. Second Edition
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3557
11. **FEMA 182** Landslide Loss Reduction: A Guide for State and Local Government Planning
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1417
12. **FEMA 202** Earthquake Resistant Construction of Electric Transmission and Telecommunication Facilities Serving the Federal Government
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1635
13. **FEMA 209** Flood: Are You Protected From the Next Disaster
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1726
14. **FEMA 213** Answers to Questions About Substantially Damaged Buildings
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1636
15. **FEMA 221** Collocation Impacts on the Vulnerability of Lifelines during Earthquakes with Applications to the Cajon Pass, California: Study Overview
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1637
16. **FEMA 224** Seismic Vulnerability and Impact of Disruption of Lifelines in the Conterminous United States
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1518
17. **FEMA 225** Inventory of Lifelines in the Cajon Pass, California
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1746
18. **FEMA 226** Collocation Impacts on the Vulnerability of Lifelines during Earthquakes with Applications to the Cajon Pass, California
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1748
19. **FEMA 232** Homebuilders' Guide to Earthquake-Resistant Design and Construction
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2103
20. **FEMA 233** Earthquake Resistant Construction of Gas and Liquid Fuel Pipeline Systems Serving or Regulated by the Federal Government
    http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1639

21. **FEMA 254** Seismic Retrofit Incentive Programs: A Handbook for Local Governments
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1523

22. **FEMA P-259** Engineering Principles and Practices of Retrofitting Flood-prone Residential Structures, Third Edition
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1645

23. **FEMA 266** Creating a Seismic Safety Advisory Board: A Guide to Earthquake Risk Management
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1646

24. **FEMA 268** Protecting Floodplain Resources - A Guidebook for Communities
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1419

25. **FEMA 306** Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings: Basic Procedures Manual
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1651

26. **FEMA 307** Evaluation of Earthquake Damaged Concrete and Masonry Wall Buildings: Technical Resources
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1652

27. **FEMA 313** Promoting the Adoption and Enforcement of Seismic Building Codes: A Guidebook for State Earthquake and Mitigation Managers
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1421

28. **FEMA 320 FEMA P-320 -** Taking Shelter From the Storm: Construction Plans and Specifications
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=5788

29. **FEMA 345** Hazard Mitigation Grant Program Brochure-Desk Reference
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1472

30. **FEMA 347** Above the Flood: Elevating your Flood-prone House
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1424

31. **FEMA P-348** Protecting Building Utilities from Flood Damage
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1750

32. **FEMA 349** Action Plan for Performance Based Seismic Design
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1656

33. **FEMA 356** Prestandard and Commentary for the Seismic Rehabilitation of Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1427

34. **FEMA 361** Design and Construction Guidance for Community Safe Rooms
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1657

35. **FEMA 366** HAZUS-MH Estimated Annualized Earthquake Losses for the United States
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3265

36. **FEMA 389** Communicating with Owners and Managers of New Buildings on Earthquake Risk
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1431

37. **FEMA 395** Incremental Seismic Rehabilitation of School Buildings (K-12) : Providing Protection to People and Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1980

38. **FEMA 396** Incremental Seismic Rehabilitation of Hospital Buildings : Providing Protection to People and Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1981

39. **FEMA 412** Installing Seismic Restraints for Mechanical Equipment
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1557

40. **FEMA 413** Installing Seismic Restraints for Electrical Equipment
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1436

41. **FEMA 414** Installing Seismic Restraints for Duct and Pipe
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1437

42. **FEMA 416** Using GIS to Demonstrate Successful Floodplain Management
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1850

43. **FEMA P-420** Engineering Guideline for Incremental Seismic Rehabilitation
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3792

44. **FEMA 421** Planning for Post-Disaster Recovery and Reconstruction
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1558

45. **FEMA P-431** Tornado Protection: Selecting Refuge Area in Buildings, Second Edition
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1563

46. **FEMA 453** Safe Rooms and Shelters - Protecting People Against Terrorist Attacks
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1910

47. **FEMA 454** Designing for Earthquakes: A Manual for Architects
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2418

48. **FEMA 467-1** Floodplain Management Bulletin on the Elevation Certificate
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1727

49. **FEMA 473** Technical Manual for Dam Owners: Impacts of Animals on Earthen Dams
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1441

50. **FEMA 474** Promoting Seismic Safety: Guidance for Advocates
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1662

51. **FEMA 476** Preparing for Disaster for People with Disabilities and other Special Needs
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1442

52. **FEMA 480** National Flood Insurance Program, Floodplain Management Requirements, A Study Guide and Desk Reference for Local Officials, Federal Emergency Management Agency
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1443

53. **FEMA P-499** Home Builder's Guide to Coastal Construction
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2138

54. **FEMA 526** Earthquake Safety Checklist
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1664

55. **FEMA 527** Earthquake Safety Activities for Children and Teachers
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1665

56. **FEMA 528** Earthquake Home Hazard Hunt Poster
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1666

57. **FEMA 529** Drop, Cover and Hold Poster
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1667

58. **FEMA 530** Earthquake Safety Guide for Homeowners
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1449

59. **FEMA 543** Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2441

60. **FEMA 547** Techniques for the Seismic Rehabilitation of Existing Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2393

61. **FEMA 550** Recommended Residential Construction for Coastal Areas: Building on Strong and Safe Foundations
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1853

62. **FEMA 577** Design Guide for Improving Hospital Safety in Earthquakes, Floods, and High Winds: Providing Protection to People and Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2739

63. **FEMA 646-A** Vertical Evacuation from Tsunamis: A Guide for Community Officials
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3808

64. **FEMA P-646** Guidelines for Design of Structures for Vertical Evacuation from Tsunamis
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3463

65. **FEMA P-737** Home Builder's Guide to Construction in Wildfire Zones
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3646

66. **FEMA P-749** Earthquake-Resistant Design Concepts: An Introduction to the NEHRP Recommended Seismic Provisions for New Buildings and Other Structures
http://www.fema.gov/library/viewRecord.do;jsessionid=8BCBB8D4C6C901175A81648298D5380E.WorkerLibrary?fromSearch=fromsearch&id=4711

67. **FEMA P-750** NEHRP Recommended Seismic Provisions for New Buildings and Other Structures. 2009 Edition
http://www.fema.gov/library/viewRecord.do;jsessionid=8BCBB8D4C6C901175A81648298D5380E.WorkerLibrary?fromSearch=fromsearch&id=4103

68. **FEMA P-754** Wildfire Hazard Mitigation Handbook for Public Facilities (P-754)
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3723

69. **FEMA P-762** Local Officials Guide for Coastal Construction
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=3647

70. **FEMA P-774** Unreinforced Masonry Buildings and Earthquakes: Developing Successful Risk Reduction Programs
http://www.fema.gov/library/viewRecord.do;jsessionid=8BCBB8D4C6C901175A81648298D5380E.WorkerLibrary?fromSearch=fromsearch&id=4067

71. **FEMA B-797** Hazard Mitigation Field Book - Roadways
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4271

72. **FEMA P-798** Natural Hazards and Sustainability for Residential Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4347

73. **FEMA P-804** Wind Retrofit Guide for Residential Buildings
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4569

74. **FEMA P-811** QuakeSmart Toolkit
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4958

75. **FEMA NFIP** Technical Bulletins
http://www.fema.gov/national-flood-insurance-program-2/nfip-technical-bulletins

76. **FEMA ROVER** Rapid Observation of Vulnerability and Estimation Risk (ROVER) Tool
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=4616

77. **FIA-15A** National Flood Insurance Program Community Rating System Coordinator's Manual
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1741

78. **EMI IS-22** Are You Ready? An In-Depth Guide to Citizen Preparedness
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=2314

79. **HMA EHP at-a-Glance Guide:** Project Planning with Considerations for EHP Compliance
http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=5904

80. **Building Code Tool Kit** (FEMA CD, available in December 2012)
http://www.fema.gov/earthquake

FEMA Contacts

Federal Emergency Management Agency (FEMA)

U.S. Department of Homeland Security
500 C Street SW
Washington, DC 20472
General Operator: (202) 646-2500

Website: http://www.fema.gov/

FEMA Region I

99 High Street
6th Floor
Boston, MA 02110

Phone: (617) 223-9540

FEMA Region II

26 Federal Plaza
Suite 1337
New York, NY 10278

Phone: (212) 225-7209

FEMA Region III

615 Chestnut Street
Philadelphia, PA 19106

Phone: (215) 931-5608

FEMA Region IV

3003 Chamblee-Tucker Road
Atlanta, GA 30341

Phone: (770) 220-5200

FEMA Region V

536 South Clark Street
Chicago, IL 60605

Phone: (312) 408-5500

FEMA Region VI

Federal Regional Center
800 North Loop 288
Denton, TX 76209

Phone: (940) 898-5399

FEMA Region VII

2323 Grand Boulevard
Suite 900
Kansas City, MO 64108

Phone: (816) 283-7061

FEMA Region VIII

Building 710
Box 25267
Denver, CO 80225

Phone: (303) 235-4800

FEMA Region IX

1111 Broadway
Suite 1200
Oakland, CA 94607

Phone: (510) 627-7100

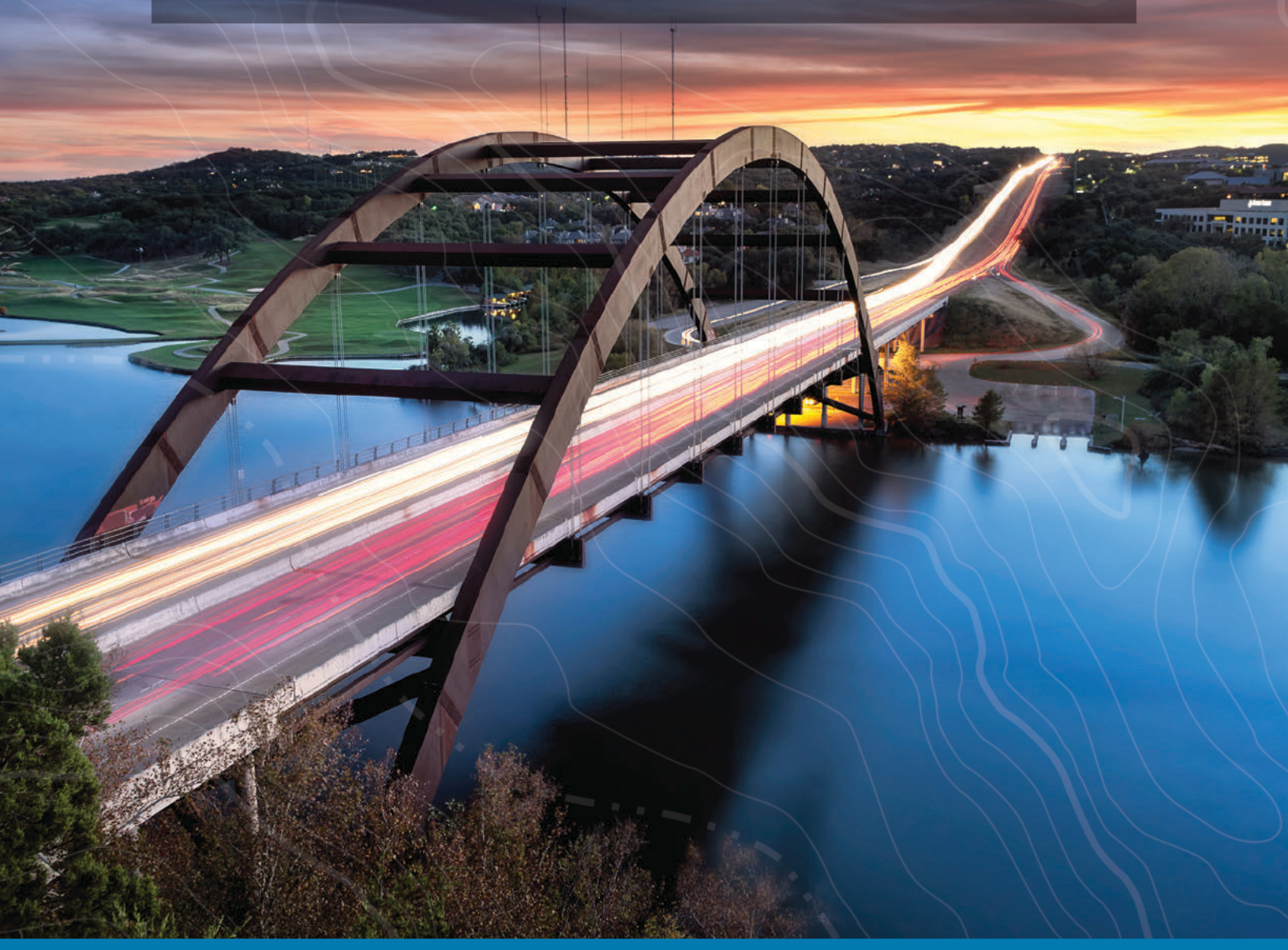
FEMA Region X

130 228th Street SW
Bothell, WA 98021

Phone: (425) 487-4600

REGION 6

TEXAS MITIGATION ASSISTANCE RESOURCE GUIDE



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FEMA

About the Texas Mitigation Assistance Resource Guide

PURPOSE OF THE GUIDE

According to the National Institute of Building Sciences 2019 Natural Hazard Mitigation Saves report, every federal grant dollar invested in mitigation results in $6 saved, on average, during disaster recovery. However, finding those initial dollars to invest, and determining the best way to spend them, can pose a challenge for communities across the nation. Many resources exist, but they can be difficult to access and may not fit the needs of the community.

This guide aims to fill that gap by providing an initial list of federal and state resources, including grants, technical assistance, loans, and other means of support. It will help state, local and tribal officials determine a possible source(s) of funding and technical assistance for their potential mitigation projects. For more information on available federal grants, visit grants.gov.

DEVELOPMENT OF THE GUIDE

The federal assistance resources were compiled by a FEMA contract provider. The information was verified from each agency/organization's website. The state-specific resources are referenced in the State Hazard Mitigation Plan.

GUIDE ORGANIZATION

This guide provides information about federal and state resources that are currently available in Texas. The guide is organized alphabetically by agency/department.

HOW TO USE THIS GUIDE

Each resource includes information such as the name of the program, resource type, hazards addressed, and type of mitigation, as well as practical details on cost-sharing and eligibility requirements. The guide also provides state-specific information on where to find the next steps for applying and additional details.

The icons at the top of each page display key information:

RESOURCE TYPE

Grants

Resources that provide financial support, often with a cost-share requirement

Loans

Resources that provide initial financial support, often for low or no interest

Technical Assistance

Resources that provide guidance and key information for success

MITIGATION TYPE

Education and Outreach

Sustained programs to educate residents and community leaders about risks, vulnerabilities, and mitigation opportunities

Planning and Regulations

Policies or codes that influence the way land is developed and buildings are constructed

Natural Systems Protection

Actions that minimize damage and losses through preservation or restoration of natural systems

Structure and Infrastructure

Actions modifying existing structures/infrastructure to remove them from a vulnerable area, or construction of new structures to protect existing development

FEDERAL, STATE, AND PRIVATE / NOT-FOR-PROFIT RESOURCES

Some of the resources are funded by the federal government, some by the state, and others are a combination. A small sample of not-for-profit resources, at the national level, are included in this guide. The “Next Steps” section for each resource provides information about how to access the resource.

QUESTIONS?

Communities are generally encouraged to contact their State Hazard Mitigation Officer for hazard mitigation assistance. They may also contact their FEMA regional office or find contact information for each program through the websites included in this guide.

FEMA Region 6 Office: https://www.fema.gov/about/organization/region-6

Table of Contents

Conservation Reserve Program (CRP)	
Grant	
Department or Organization	Farm Service Agency (FSA), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Generally, to be eligible for CRP enrollment, a farmer must have owned or operated the land for at least 12 months prior to the previous CRP sign-up period. The land must be either be: cropland (including field margins) that was planted to an agricultural commodity for 4 of the previous 6 crop years, and which is physically and legally capable of being planted in a normal manner to an agricultural commodity; or certain marginal pastureland that is suitable for use as a riparian buffer or for similar water quality purposes.
Funding Available	Variable annually
Cost Sharing	The rental payment does not require a cost share.
Restrictions	See eligible applicants
Website	fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA conservation programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The Conservation Reserve Program (CRP) is a voluntary program for agricultural landowners to receive rental payments when they convert marginal farmlands to vegetated cover. Participants enroll in CRP contracts for 10 to 15 years. This reduces soil erosion, supports farmers, reduces sedimentation and pollution in water sources, and establishes wildlife habitat. The wetland enhancement, shoreline protection, and riparian buffer practices enhance resilience by reducing downstream flooding during storm events.

One effort of the CRP is the Floodplain Wetlands Initiative, which restores the functions and values of wetland ecosystems that had been devoted to agricultural use. Wetland restoration reverses the degradation of the wetland areas on what is often marginal soil. For farmers and landowners facing crop damage from flooding, restoring wetlands to receive floodwaters can also increase flood storage capacity – while significantly reducing farming risks.

Conservation Stewardship Program (CSP)	
Grant, Technical Assistance	
Department or Organization	Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All

Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Applicants may include individuals, legal entities, joint operations, or tribes that meet the stewardship threshold for at least two priority resource concerns when they apply. They must also agree to meet or exceed the stewardship threshold for at least one additional priority resource concern by the end of the contract. Producers must have effective control of the land for the term of the proposed contract.
Funding Available	Payment rates vary by state
Cost Sharing	Farmers receive a payment for conservation practices.
Restrictions	Unknown
Website	nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The Conservation Stewardship Program (CSP) helps agricultural producers maintain and improve their existing conservation systems and adopt additional conservation activities to address priority resource concerns. CSP pays participants for conservation performance— the higher the performance, the higher the payment. Many conservation practices (riparian forest buffers, cover crops, etc.) reduce runoff and erosion, reducing flooding downstream.

CSP provides two possible types of payments through 5-year contracts: annual payments for installing new conservation activities and maintaining existing practices, and supplemental payments for adopting a resource-conserving crop rotation.

Emergency Watershed Protection Program (EWPP)

Grant, Technical Assistance

Department or Organization	Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	*EWP - Recovery*: Applicants may include individuals, legal entities, joint operations, or tribes that meet the stewardship threshold for at least two priority resource concerns when they apply. They must also agree to meet or exceed the stewardship threshold for at least one additional priority resource concern by the end of the contract. Producers must have effective control of the land for the term of the proposed contract. *EWP - Floodplain Easements*: Landowners can apply directly for assistance at the local NRCS office when project funding for floodplain easements become available.
Funding Available	Variable depending on the scope of the project

Cost Sharing	NRCS can pay up to 75% of the cost for eligible emergency recovery projects. Local sponsors must acquire the remaining 25% in cash or in-kind services. Contact NRCS for more information for funding of floodplain easement projects.
Restrictions	The EWP Program cannot be used: • To address problems that existed prior to the disaster. • To improve the level of protection above the existing level at the time of the disaster. • For projects' operation and maintenance. • To repair private or public transportation facilities or utilities. • To install non-essential restoration work that will not reduce or eliminate adverse impacts from the natural disaster. • To restore projects installed by another federal agency.
Website	nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

Congress established the Emergency Watershed Protection (EWP) program to respond to emergencies created by natural disasters. The EWP program offers technical and financial assistance to help local communities mitigate imminent hazards to life and property caused by floods, fires, windstorms, and other natural occurrences that impair a watershed. The Natural Resources Conservation Service (NRCS) administers the EWP program, which consists of two options: EWP – Recovery, and EWP – Floodplain Easement (FPE).

NRCS offers financial and technical assistance for various activities under EWP – Recovery, including:

- Removing debris from stream channels, road culverts, and bridges.
- Reshaping and protecting eroded streambanks.
- Correcting damaged or destroyed drainage facilities.
- Establishing vegetative cover on critically eroding lands.
- Repairing levees and structures.
- Repairing conservation practices.

In addition to recovery projects, NRCS may purchase EWP floodplain easements instead of trying to recover damaged floodplain lands if it proves to be more cost-effective than recovery.

Environmental Quality Incentives Program (EQIP)

Grant, Technical Assistance

Department or Organization	Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Agricultural producers, owners of non-industrial private forestland, and tribes are eligible to apply for EQIP. Eligible land includes cropland,

	rangeland, pastureland, non-industrial private forestland, and other farm or ranch lands. Socially disadvantaged, beginning and limited resource farmers, tribes, and veterans are eligible for an increased payment rate and may receive an advance payment of up to 50% to purchase the materials and services needed to implement the conservation practices included in their EQIP contract.
Funding Available	Varies by state
Cost Sharing	75% federal, 90% in certain cases (socially disadvantaged, veterans, beginning farmers, etc.)
Restrictions	Applicants must: • Control or own eligible land. • Comply with adjusted gross income limitation (AGI) provisions. • Comply with the highly erodible land and wetland conservation requirements. • Develop an NRCS EQIP plan of operations. Additional restrictions and program requirements may apply.
Website	nrcs.usda.gov/wps/portal/nrcs/detail/sc/programs/financial/eqip/?cid=nrcseprd1384284
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion, and sedimentation, or improved or created wildlife habitat.

While not designed to be an emergency response or hazard mitigation program, EQIP can play a vital role in helping producers prevent the worst impacts of and recover from natural disasters like floods, hurricanes, wildfires, and drought. Through EQIP, NRCS provides financial assistance to repair and prevent the excessive soil erosion caused or affected by natural disasters. These practices include activities like stream bank restoration, grassed waterways, and buffers. NRCS-funded conservation practices protect the land from erosion, support disaster recovery, and repair, and can help mitigate loss from future natural disasters.

Forest Legacy Program (FLP)

Other- Purchase

Department or Organization	Forest Service, United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	A proposed project is eligible if it meets federal requirements as well as minimum eligibility: • It is within, or partially within, a designated forest legacy area.

	• It has a minimum of 75% forestland or a documented plan that includes sufficient landowner capacity to reforest to at least 75% forestland. • It can be managed in ways consistent with the purpose for which it was acquired by FLP. • The landowner is willing to sell or donate the interest in perpetuity. • The landowner acknowledges that the conservation easement will be held by a government entity if federal funds are used for the acquisition.
Funding Available	States can submit up to three projects which cannot exceed $10 million, or $7 million for individual projects.
Cost Sharing	At least 25% of the total project cost
Restrictions	Project selection is based on national priorities
Website	fs.fed.us/managing-land/private-land/forest-legacy/program
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The purpose of the Forest Legacy Program is to identify and conserve environmentally important forest areas that are threatened by conversion to non-forest uses. Providing economic incentives to landowners to keep their land as forests encourage sustainable forest management and supports strong markets for forest products. Forest protection can be a valuable tool for natural resource conservation and can reduce flooding and hazard risk downstream within a watershed.

Landowners may participate in the Forest Legacy Program by either selling their property outright or by retaining ownership and selling only a portion of the property's development rights; both are held by state agencies or another unit of government. The use of a conservation easement, a legal agreement between a landowner and a non-profit land trust or governmental agency allows the land to remain in private ownership while ensuring that its environmental values are retained.

Forest Stewardship Program Technical Assistance	
Department or Organization	Forest Service, United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Non-industrial private forest landowners
Funding Available	N/A
Cost Sharing	N/A
Restrictions	Participants must agree to manage their property following an approved Forest Stewardship Management Plan
Website	fs.fed.us/managing-land/private-land/forest-stewardship
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The Forest Stewardship Program encourages long-term stewardship of important state and private forest landscapes by helping landowners more actively manage their forest and related resources. Protected forests can reduce flooding and hazard risk downstream within a watershed, and well-managed forests can reduce wildfire risk. The program provides assistance to owners of forest land and other lands where good stewardship, including agroforestry applications, will enhance and sustain the long-term productivity of multiple forest resources, and produce healthy, resilient forest landscapes. Special attention is given to landowners in landscape areas identified by State Forest Action Plans and those new to, or in the early stages of, managing their land in a way that embodies multi-resource stewardship principles. The program provides landowners with the professional planning and technical assistance they need to keep their land in a productive and healthy condition. Assistance offered through the Forest Stewardship Program also provides landowners with enhanced access to other USDA conservation programs, forest certification programs, and forest product and ecosystem service markets.

Housing Preservation Grants

Grant	
Department or Organization	Rural Development, United States Department of Agriculture (USDA)
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State, tribal, and local governments, and nonprofit organizations. Eligible areas include rural towns with 20,000 or fewer people and federally recognized tribal lands.
Funding Available	$15.3 million in 2020
Cost Sharing	Up to 100% federal
Restrictions	Applicants must have the necessary background and experience, with a proven ability to perform the repair and rehabilitation of low-income housing.
Website	rd.usda.gov/programs-services/housing-preservation-grants
Next Steps for Texas Communities	Contact your local USDA representative to get started on applying for the grant. Their information can be found at: rd.usda.gov/contact-us/state-offices

About the Resource

The Housing Preservation Grant (HPG) program provides grants to sponsoring organizations for the repair or rehabilitation of low- and very low-income housing. The grants are competitive and are made available in areas where there is a concentration of need. Those assisted must own very-low- or low-income housing, either as homeowners, landlords, or members of a cooperative. Very low income is defined as below 50% of the area median income (AMI); low income is between 50 and 80% of AMI.

Applicants provide grants or low-interest loans to repair or rehabilitate housing for low- and very-low-income homeowners. Rental property owners may also receive assistance if they agree to make units available to low- and very-low-income families.

Eligible expenses include:

- Repairing or replacing electrical wiring, foundations, roofs, insulation, heating systems, and water/waste disposal systems.
- Accessibility features.

- Labor and materials.
- Administrative expenses.

Eligible homeowners can apply for funding to repair damages caused by natural hazards or to harden their structures against future hazard events.

Source Water Protection Program (SWPP)	
Technical Assistance	
Department or Organization	Farm Service Agency (FSA), United States Department of Agriculture (USDA)
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Open; producers in participating states are encouraged to take part in SWPP by using suggested conservation practices and becoming a member of the local team responsible for developing the SWPP
Funding Available	N/A. This a technical assistance program.
Cost Sharing	N/A. This a technical assistance program.
Restrictions	Must be in a participating state. Contact your local FSA office for more information.
Website	fsa.usda.gov/programs-and-services/conservation-programs/source-water-protection/index
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The Source Water Protection Program (SWPP) is a joint project of the U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) and the National Rural Water Association (NRWA), a non-profit water and wastewater utility membership organization. The SWPP is designed to help prevent pollution of surface and groundwater used as the primary source of drinking water by rural residents. Water quality projects often meet flood mitigation goals and vice versa. SWPP funds can be used for flood mitigation when the projects also improve water quality.

USDA Disaster Assistance Programs	
Grant	
Department or Organization	Farm Service Agency (FSA), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Eligible applicants vary depending on the specific sub-program

Funding Available	Amount of funding available varies based on sub-program
Cost Sharing	Cost-sharing requirements vary depending on the sub-program.
Restrictions	Restrictions vary based on sub-program
Website	fsa.usda.gov/programs-and-services/disaster-assistance-program/index
Next Steps for Texas Communities	This is a federal program, administered by local offices. Find your local USDA representative's contact information here: farmers.gov/service-center-locator

About the Resource

The Farm Service Agency provides several disaster assistance programs. These include the Emergency Conservation Program, Emergency Forest Restoration Program, Emergency Loan Program, and Tree Assistance Program, as well as a mix of other programs aimed at specific agricultural sectors. While focused on recovery, many of these programs provide funding for conservation practices that enhance resilience.

Water and Environmental Programs

Grant, Technical Assistance

Department or Organization	Rural Development, United States Department of Agriculture (USDA)
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	Details vary by program, but most programs are open to state, local, and federally recognized tribes
Funding Available	Amount of funding available varies based on sub-program
Cost Sharing	Cost-sharing requirements vary depending on the sub-program.
Restrictions	Restrictions vary based on sub-program
Website	rd.usda.gov/programs-services/all-programs/water-environmental-programs
Next Steps for Texas Communities	Your local USDA representative can help you apply for this program. Find their contact information here: farmers.gov/service-center-locator. Additional USDA programs can be found at nrcs.usda.gov/wps/portal/nrcs/main/national/programs/.

About the Resource

The USDA's Rural Development Water and Environmental Programs (WEP) provide technical assistance, loans, grants, and loan guarantees for drinking water, sanitary sewer, solid waste, and storm drainage facilities in rural areas and cities and towns of 10,000 or less. WEP also makes grants to non-profit organizations to provide technical assistance and training to help rural communities with their water, wastewater, and solid waste problems. Water quality projects often meet flood mitigation goals and vice versa.

WEP includes Emergency Community Water Assistance Grants, Grants for Rural and Native Alaskan Villages, Water & Waste Disposal Loans & Grants, and more.

Wetland Mitigation Banking Program	
Other - Credit	
Department or Organization	Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA)
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Operational Coordination
Eligible Applicants	• City or township governments. • Public and State-controlled institutions of higher education. • Nonprofits that do not have a 501(c)(3) status with the IRS, other than institutions of higher education. • Federally recognized tribal governments. • State governments. • Special district governments. • County governments. • Private institutions of higher education. • For-profit organizations other than small businesses.
Funding Available	$5 million (2020 round)
Cost Sharing	Banking programs that are strictly In-Lieu Fee are not eligible for the NRCS Wetland Mitigation Banking Program.
Restrictions	There are no specific restrictions for this program
Website	nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/farmbill/?cid=nrcseprd362686
Next Steps for Texas Communities	Applications for this federal program can be submitted at Grants.gov during the open application period.

About the Resource

The Wetlands Mitigation Banking Program helps establish wetland mitigation banks to help producers meet their wetland conservation compliance responsibilities. Producers must comply to maintain eligibility for many USDA programs administered by the FSA and NRCS and to maintain eligibility for the federal crop insurance premium subsidy administered by the Risk Management Agency.

This program assists with establishing the banks, not with securing the wetlands.

Climate Adaptation Knowledge Exchange	
Technical Assistance	
Department or Organization	Climate Adaptation Knowledge Exchange
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Threats and Hazard Identification
Eligible Applicants	N/A – this is a technical assistance resource. Anyone can access the materials, which are targeted to local governments and organizations.
Funding Available	N/A

Cost Sharing	N/A
Restrictions	Available to all
Website	cakex.org
Next Steps for Texas Communities	This not for profit resource is an international online forum to share information. Access the website to learn more.

About the Resource

The Climate Adaptation Knowledge Exchange is the world's largest and most used source of climate adaptation case studies and resources. The materials can be filtered by scale (community to national/international); sector addressed (conservation, land use planning, infrastructure, etc.); hazards (flood, erosion, sea level rise, etc.); region; and more. Refer to the materials or upload your own to share lessons, ideas, and opportunities with others in the field.

Coastal and Marine Habitat Restoration Grants

Grant

Department or Organization	National Oceanic and Atmospheric Administration, Department of Commerce
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure, Education and Outreach
Hazard Addressed	Erosion, Sea Level Rise, Storm Surge, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Institutions of higher education, non-profits, commercial (for profit) organizations, U.S. territories, and state, local, and tribal governments.
Funding Available	$4 million in Community-based Restoration Program funding available for coastal and marine habitat restoration in 2020.
Cost Sharing	None is required, but applicants are encouraged to demonstrate a 1:1 non-federal match for the NOAA funds requested to conduct the proposed project.
Restrictions	The FY2020 funding opportunity required a pre-proposal application and an invitation-only proposal application. Land acquisition and marine debris removal are ineligible.
Website	fisheries.noaa.gov/grant/coastal-and-marine-habitat-restoration-grants
Next Steps for Texas Communities	Application information for this federal program is available on the website. Application periods will include explanatory webinars.

About the Resource

The National Oceanic and Atmospheric Administration (NOAA) Community-Based Restoration Program recognizes that habitat protection and restoration are essential elements of a strategy for sustainable commercial and recreational fisheries. Investing in habitat restoration projects leads to real, lasting differences for communities, businesses, and the environment. The program grants support restoration projects that use a habitat-based approach to rebuild productive and sustainable fisheries, contribute to the recovery and conservation of protected resources, and promote healthy ecosystems and resilient communities.

Restoration includes activities that return degraded or altered marine, estuarine, coastal, and freshwater, migratory fish habitats to functioning conditions, and techniques that return NOAA trust species to their historic habitats. These projects support economic recovery. They can also prevent future hazards and hazard losses by protecting natural resources in critical areas of the coastal floodplain.


Coastal Resilience Grants	
Grant	
Department or Organization	National Oceanic and Atmospheric Administration, Department of Commerce
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Erosion, Sea Level Rise, Storm Surge, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Institutions of higher education, nonprofit, and for-profit organizations, U.S. territories and states, tribes, and local governments including counties, municipalities, and cities
Funding Available	In 2018, NOAA granted roughly $9 million
Cost Sharing	Federal funds awarded under this program must be matched with non-federal funds at a 2:1 ratio. For a project requesting $500,000 in federal funding, for example, the award recipient would need to provide $250,000 in non-federal matching contributions, for a total project budget of $750,000.
Restrictions	Past funding opportunities have included a pre-proposal application and an invitation-only proposal application.
Website	fisheries.noaa.gov/grant/noaa-coastal-resilience-grants
Next Steps for Texas Communities	Application information for this federal program is available on the website. Application periods will include explanatory webinars.

About the Resource

The NOAA Coastal Resilience Grants program, jointly administered by NOAA's National Ocean Service and NOAA Fisheries, implements projects that build resilient U.S. coastal communities and ecosystems.

Resilience is the ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events such as extreme weather or long-term changing environmental conditions. This program is intended to build resilience through projects that conserve and restore sustainable ecosystem processes and functions and reduce the vulnerability of coastal communities and infrastructure from the impacts of extreme weather events, climate hazards, and changing ocean conditions.


Disaster Loan Assistance	
Loan	
Department or Organization	Small Business Administration, Department of Commerce
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Businesses, private non-profit organizations, homeowners, and renters
Funding Available	Businesses may borrow up to $2 million. Homeowners may borrow up to $200,000 to repair/replace a disaster-damaged private residence or $40,000 for a homeowner or renter to repair/replace damaged personal property.

Cost Sharing	Loan
Restrictions	Varies by applicant type
Website	disasterloan.sba.gov/ela/Information/Index
Next Steps for Texas Communities	Decisions are made based on individual disaster declarations. Refer to the SBA website for more information.

About the Resource

The Small Business Administration (SBA) provides low-interest disaster loans to businesses of all sizes, private non-profit organizations, homeowners, and renters. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets.

EDA Disaster Recovery

Grant

Department or Organization	Economic Development Administration, Department of Commerce
Type of Mitigation Action	Structure and Infrastructure, Education and Outreach
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Varies by disaster
Funding Available	Varies by disaster $587 million was available in FY 2019.
Cost Sharing	Up to 80% federal
Restrictions	Varies by disaster
Website	eda.gov/programs/disaster-recovery
Next Steps for Texas Communities	This federal program is administered through the state. More information can be found on the Texas EDC website at texasedc.org

About the Resource

The Economic Development Administration (EDA) has a long history of successfully supporting disaster recovery and resiliency efforts. EDA's role in disaster recovery is to facilitate the timely and effective delivery of federal economic development assistance to support long-term community economic recovery planning and project implementation, redevelopment, and resiliency. EDA coordinates regional disaster recovery efforts in partnership with its extensive network of Economic Development Districts (EDDs), University Centers, institutions of higher education, and other partners in designated impact areas.

EDA Disaster Supplemental Funding

Grant

Department or Organization	Economic Development Administration, Department of Commerce
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Varies by disaster
Funding Available	Varies by disaster
Cost Sharing	Varies by disaster
Restrictions	Varies by disaster

Website	eda.gov/disaster-recovery/supplemental
Next Steps for Texas Communities	This federal program is administered through the state. More information can be found on the Texas EDC website at texasedc.org

About the Resource

Congress often appropriates supplemental funds for economic recovery after significant disasters. Between Fiscal Years 2018 and 2019, EDA received $1.2 billion in supplemental disaster appropriations ($600 million each year) from Congress to help regions recover from the economic harm and distress resulting from natural disasters in 2017-2019. With the support of these funds, American regions and communities hard hit by major disasters are rebuilding stronger, more resilient economies.

Continuing Authorities Program

Technical Assistance

Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Erosion, Flood, Sea Level Rise, Storm Surge
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State, regional, and local governments, tribes, and other non-federal public agencies
Funding Available	Varies by sub-program
Cost Sharing	Varies by sub-program, but many programs follow the following guidelines: Feasibility Study: 100%/0% for initial $100,000; 50%/50% remaining cost Implementation: 75% federal
Restrictions	Varies by sub-program (streambank and shoreline protection, hurricane and storm damage reduction projects, and flood damage reduction projects)
Website	nae.usace.army.mil/Missions/Public-Services/Continuing-Authorities-Program
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations

About the Resource

The Continuing Authorities Program (CAP) allows the USACE to plan, design, and implement certain types of water resources projects without additional project-specific congressional authorization. Under CAP, the USACE can plan and implement projects of limited size, cost, scope, and complexity. Projects include streambank and shoreline protection, hurricane and storm damage reduction projects, and flood damage reduction projects.

All projects in this program include a feasibility phase and an implementation phase.

Ecosystem Restoration Technical Assistance	
Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Communities and local governments
Funding Available	Variable by project type
Cost Sharing	Variable with project type, but generally: Feasibility: 100%/0% for initial $100,000; 50%/50% remaining cost ($100,000 limit does not apply for dredging projects) Implementation: 75% federal for project modifications; 65% federal for dredging and aquatic ecosystem restoration projects
Restrictions	$10 million federal project limit
Website	nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations

About the Resource

Ecosystem Restoration is one of the primary missions of the USACE. The purpose of the USACE ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts involve examining the problems contributing to the system degradation and developing alternative means to solve these problems. The intent of restoration is to partially or fully re-establish the attributes of a natural, functioning, self-regulating system. Restoration opportunities associated with wetlands, riparian, and other floodplain and aquatic systems are likely to be most appropriate for USACE involvement.

The three ecosystem restoration authorities within the program are Project Modifications for Improvements to the Environment, Beneficial Use of Dredged Materials, and Aquatic Ecosystem Restoration.

Emergency Operations Technical Assistance	
Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Operational Coordination
Eligible Applicants	State and local governments
Funding Available	N/A
Cost Sharing	N/A
Restrictions	Disaster response and recovery program

Website	swg.usace.army.mil/Business-With-Us/Emergency-Management-Office
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations

About the Resource

Emergency preparedness and response are primarily state and local responsibilities. However, when the nature of the disaster exceeds the capabilities of state and local interests, the USACE may provide help to save human life, prevent immediate human suffering, or mitigate property damage.

The USACE participates in the National Response Framework as the primary agency for planning, preparedness, and response under Emergency Support Function (ESF) #3, Public Works and Engineering. The purpose of ESF #3 is to provide lifesaving or life-protecting assistance to augment efforts of the affected state(s) and local response efforts following a major or catastrophic disaster.

The USACE's Rehabilitation and Inspection Program provides the inspection of flood control projects, the rehabilitation of damaged flood control projects, and the rehabilitation of federally authorized and constructed hurricane or shore protection projects.

Floodplain Management Services (FPMS) Program

Technical Assistance

Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State, regional, and local governments, tribes, and other non-federal public agencies
Funding Available	N/A
Cost Sharing	None. State and local governments can receive technical assistance free of charge.
Restrictions	This program provides studies only. Design and construction are not included.
Website	nae.usace.army.mil/Missions/Public-Services/Flood-Plain-Management-Services
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations

About the Resource

The USACE provides the full range of technical services and planning guidance needed to support effective floodplain management. General technical assistance efforts under this program include determining site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. The types of studies conducted under the FPMS program include floodplain delineation/hazard, dam failure analyses, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, flood-proofing, and inventories of flood-prone structures.

Inspection of Completed Works Program	
Technical Assistance	
Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Communities with critical infrastructure completed by the USACE
Funding Available	Not applicable. This is a technical assistance program.
Cost Sharing	N/A
Restrictions	Only for previously completed projects
Website	mvp.usace.army.mil/Missions/Civil-Works/Programs-Project-Management/District-Programs/Inspection-of-Completed-Works
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations
About the Resource	

The USACE's Inspection of Completed Works Program is designed to ensure that non-federal owners of federally built critical infrastructure, such as a flood damage reduction project, perform essential maintenance in accordance with the operation and maintenance manuals. Annual compliance inspections identify maintenance deficiencies, operational problems, and corrective actions. When necessary, the USACE provides technical assistance before, during, and after each flood emergency. Through these compliance inspections, the USACE ensures that the project will operate and function as designed.

Silver Jackets	
Technical Assistance	
Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Structure and Infrastructure, Education and Outreach
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Operational Coordination
Eligible Applicants	N/A. The Silver Jackets offer technical assistance to communities.
Funding Available	N/A. The Silver Jackets offer technical assistance to communities.
Cost Sharing	N/A
Restrictions	There are no restrictions.
Website	silverjackets.nfrmp.us
Next Steps for Texas Communities	Learn more about the Texas Silver Jackets at silverjackets.nfrmp.us/State-Teams/Texas
About the Resource	

Silver Jackets teams across the United States bring together multiple state, federal, and sometimes tribal and local agencies, to learn from one another about reducing the risk of floods and other natural disasters. The collaboration, shared knowledge, and relationships enhance response and recovery efforts when hazard events do occur. Each state Silver Jackets team is unique. Common state agency

participants include those with mission areas of hazard mitigation, emergency management, floodplain management, natural resources management or conservation, etc. Federal participation typically includes the USACE, FEMA, and often others such as the National Weather Service and the U.S. Geological Survey.

Small Flood Control Technical Assistance	
Department or Organization	U.S. Army Corps of Engineers (USACE), Department of Defense
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State and local governments
Funding Available	N/A. This a technical assistance program.
Cost Sharing	Feasibility Study: 100%/0% for initial $100,000; 50%/50% remaining cost Design and implementation: 65% federal/35% non-federal. At least 5% must be in cash; the rest may be in kind.
Restrictions	Projects must pass a cost/benefit analysis
Website	mvp.usace.army.mil/Missions/Civil-Works/Programs-Project-Management/District-Programs/Small-Flood-Control-Projects
Next Steps for Texas Communities	There are 4 USACE districts that cover Texas, the Dallas District, the Fort Worth District, the Galveston District, and the Albuquerque District. Find your district here: swf.usace.army.mil/Locations

About the Resource

Under the Small Flood Control Program, the USACE works with communities to plan, design, and construct certain small flood control projects that have not already been specifically authorized by Congress. Both structural (levees, channels, or dams, for instance) and nonstructural (floodproofing or evacuation, for example) solutions are considered. Studies are required to evaluate potential projects. Each project selected must be economically justified; that is, the benefits resulting from a project must exceed the cost incurred to construct the project. It also must be environmentally acceptable and complete within itself. In addition, each separate project is limited to a total federal cost of not more than $10 million, including studies, design, and implementation.

Brownfields Program Grant Funding	
Grant, Technical Assistance	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Communities
Funding Available	Amount available varies based on the funding program.
Cost Sharing	Cost-sharing varies depending on the funding program.
Restrictions	Grant programs are available for assessment, cleanup, environmental job training, and more. Restrictions vary based on the specific grant program.
Website	epa.gov/brownfields/types-brownfields-grant-funding
Next Steps for Texas Communities	Grant applications for these federal programs vary based on the sub-grant. Detailed information is available on the website.
About the Resource	

The EPA's Brownfields Program provides direct funding for brownfields assessment, cleanup, revolving loans, and environmental job training, and it provides technical information on brownfields financing matters. Separate grant programs are available for assessment, cleanup, environmental job training, and more. While not envisioned as a mitigation program, brownfield cleanup can prevent toxic materials from spreading during a hazard event.

Clean Water State Revolving Loan Fund	
Loan	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Funding is provided to states, and states distribute it to local communities. Tribal and territorial funding is also available.
Funding Available	Varies by state
Cost Sharing	Loan
Restrictions	Varies by state
Website	epa.gov/cwsrf
Next Steps for Texas Communities	This federal program is administered by the state. More information can be found at twdb.texas.gov/financial/programs/CWSRF/index.asp
About the Resource	

The EPA's Clean Water State Revolving Fund (CWSRF) program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. CWSRF can fund a wide variety of water quality protection efforts. The

program's flexibility and broad range of project eligibilities enable states to target CWSRF funds to their specific water quality priorities. Water quality projects often meet flood mitigation goals and vice versa.

States are responsible for the operation of their CWSRF program. Under the CWSRF, states may provide various types of assistance, including loans, refinancing, purchasing, or guaranteeing local debt and purchasing bond insurance. States may also set specific loan terms, including interest rates from 0% to market rate and repayment periods of up to 30 years. States have the flexibility to target financial resources to their specific community and environmental needs.

Drinking Water State Revolving Fund	
Loan	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Funding is provided to states, and states distribute it to local communities. Tribal and territorial funding is also available.
Funding Available	Varies by state
Cost Sharing	Loan
Restrictions	Varies by state
Website	epa.gov/drinkingwatersrf
Next Steps for Texas Communities	This federal program is administered by the state. More information can be found at twdb.texas.gov/financial/programs/DWSRF/index.asp

About the Resource

Under the Drinking Water State Revolving Fund (DWSRF), the EPA provides grants to all 50 states plus Puerto Rico to capitalize state DWSRF loan programs. The states contribute an additional 20% to match the federal grants. The program also provides direct grant funding for the District of Columbia, U.S. Virgin Islands, American Samoa, Guam, and the Commonwealth of Northern Marianas. Water quality projects often meet flood mitigation goals and vice versa.

The 51 DWSRF programs function like infrastructure banks by providing low-interest loans to eligible recipients for drinking water infrastructure projects. As money is paid back into the state's revolving loan fund, the state makes new loans to other recipients. These recycled repayments of loan principal and interest earnings allow the state's DWSRF to "revolve" over time.

States are responsible for operating their DWSRF programs. Under the DWSRF, states may provide various types of assistance, including:

- Loans.
- Refinancing.
- Purchasing.
- Guaranteeing local debt.
- Purchasing bond insurance.

States may also set specific loan terms, including interest rates from 0% to the market rate, and repayment periods of up to 30 years.

Environmental Finance Centers	
Technical Assistance	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	States, tribes, local governments, and the private sector
Funding Available	N/A
Cost Sharing	N/A
Restrictions	N/A Technical assistance
Website	epa.gov/waterfinancecenter/efcn
Next Steps for Texas Communities	The Region VI Water Finance Center is housed at the University of New Mexico: southwestefc.unm.edu

About the Resource

The EPA's Environmental Finance Centers (EFCs) deliver targeted technical assistance to, and partner with states, tribes, local governments, and the private sector in providing innovative solutions to manage the costs of environmental financing and program management. Potential environmental projects may include hazard mitigation projects.

Environmental Justice Grants and Technical Assistance	
Grant	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	Incorporated non-profit organizations— including, but not limited to, environmental justice networks, faith-based organizations and those affiliated with religious institutions; federally recognized tribal governments—including Alaska Native Villages and tribal organizations
Funding Available	$1.5 million in 2019
Cost Sharing	None. The grant is 100% federal.
Restrictions	1-year projects
Website	epa.gov/environmentaljustice/environmental-justice-grants-funding-and-technical-assistance
Next Steps for Texas Communities	Grant opportunities for this federal program are posted on grants.gov. Refer to EPA's website for more information about application periods and requirements.

About the Resource

The EPA's Environmental Justice Small Grants (EJSG) program awards grants that support community-driven projects designed to engage, educate, and empower communities to better understand local

environmental and public health issues and develop strategies for addressing those issues, building consensus in the community, and setting community priorities. The grants can be used for education and outreach about hazard mitigation efforts.

Greening America's Communities	
Technical Assistance	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Cities and towns
Funding Available	Technical assistance provided in kind
Cost Sharing	Unknown
Restrictions	Technical assistance
Website	epa.gov/smartgrowth/greening-americas-communities
Next Steps for Texas Communities	Grant opportunities for this federal resource are posted on grants.gov. Refer to EPA's website for more information about application periods and requirements.

About the Resource

Greening America's Communities (formerly known as Greening America's Capitals) is an EPA program that helps cities and towns develop an implementable vision of environmentally friendly neighborhoods that incorporates innovative green infrastructure, hazard mitigation, and other sustainable/resilient design strategies. EPA provides design assistance to help support sustainable communities that protect the environment, economy, and public health and to inspire local and state leaders to expand this work elsewhere.

Nonpoint Source Water Quality (Section 319) Grants	
Grant	
Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Funding is provided to states, and states distribute to local communities. Tribal 319 funding is also available.
Funding Available	Varies by state; total funds in 2019: $165.4 million
Cost Sharing	Each state receives different funding per year
Restrictions	Varies by state
Website	epa.gov/nps
Next Steps for Texas Communities	This federal program is administered through the state. More information can be found at tceq.texas.gov/waterquality/nonpoint-source/grants.

About the Resource

Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Water quality projects often meet flood mitigation goals and vice versa.

Each year, EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA developed in consultation with the states. Tribal funding is also available under Clean Water Act Section 319(h).

Smart Growth Support

Grant, Technical Assistance

Department or Organization	Office of Sustainable Communities, Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations, Education and Outreach
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Planning
Eligible Applicants	Eligible applicants vary depending on the specific sub-program
Funding Available	Amount of funding available varies based on sub-program
Cost Sharing	Cost-sharing requirements vary depending on the sub-program
Restrictions	Restrictions vary based on sub-program
Website	epa.gov/smartgrowth/about-smart-growth
Next Steps for Texas Communities	Grant opportunities are posted on grants.gov. Refer to EPA's website for more information about application periods and requirements.

About the Resource

The Environmental Protection Agency's (EPA) Office of Community Revitalization works on smart growth issues by:

- Conducting research.
- Producing reports and other publications.
- Providing examples of outstanding smart growth communities and projects.
- Working with tribes, states, regions, and communities through grants and technical assistance.

Smart growth can incorporate elements of green infrastructure and/or land preservation and can create more resilient communities.

Water Infrastructure and Resiliency Finance Center

Technical Assistance

Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	Erosion, Flood, Sea Level Rise, Storm Surge
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience

Eligible Applicants	Communities
Funding Available	N/A. This a technical assistance program.
Cost Sharing	N/A. This a technical assistance program.
Restrictions	Technical Assistance
Website	epa.gov/waterfinancecenter
Next Steps for Texas Communities	N/A - no application necessary

About the Resource

The Water Finance Center provides financing information to help local decision-makers make informed decisions about drinking water, wastewater, and stormwater infrastructure, to protect human health and the environment. Water quality projects often meet flood mitigation goals and vice versa.

Wetlands Protection Program Development Grants

Grant

Department or Organization	Environmental Protection Agency
Type of Mitigation Action	Local Planning and Regulations, Education and Outreach
Hazard Addressed	Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Funding is provided through each EPA region
Funding Available	Variable by EPA region
Cost Sharing	75% federal
Restrictions	Variable by EPA region
Website	epa.gov/wetlands/wetland-program-development-grants-and-epa-wetlands-grant-coordinators
Next Steps for Texas Communities	Application information is available at epa.gov/wetlands/region-6-wetland-program-development-grant-request-applications

About the Resource

Wetlands Protection Development Grants (WPDGs) provide eligible applicants an opportunity to conduct projects to strengthen wetland protection programs. Eligible projects promote the coordination and acceleration of research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of water pollution. Wetland protection is an important type of natural resource protection hazard mitigation project.

Georgetown Adaptation Resources

Technical Assistance

Department or Organization	Georgetown Climate Center
Type of Mitigation Action	Local Planning and Regulations, Education and Outreach
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Threats and Hazard Identification
Eligible Applicants	Technical assistance is available to all
Funding Available	N/A

Cost Sharing	N/A
Restrictions	None
Website	georgetownclimate.org/adaptation/featured.html
Next Steps for Texas Communities	More resources are available at the website

About the Resource

The Georgetown Climate Center provides resources to policymakers and others helping communities adapt to climate change.

Building Resilient Infrastructure and Communities (BRIC)

Grant

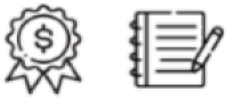
Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Structure and Infrastructure, Natural Systems Protection, Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	States and territories that have had a major disaster declaration under the Stafford Act in the 7 years prior to the annual application period start date are eligible to apply to FEMA for federal assistance under BRIC as applicants. Local governments and tribes are elibible to apply to states and territories as subapplicants.
Funding Available	On an annual basis, FEMA will assess the amount of funding set aside for BRIC and determine what portion of that amount will be available during the following application period for the BRIC program. FEMA will announce its determination in the annual Notice of Funding Opportunity for the BRIC program.
Cost Sharing	Unknown at this time. Cost sharing requirements will be provided with the annual Notice of Funding Opportunity.
Restrictions	More information on ineligible activities can be found in the HMA Guidance, located here: fema.gov/media-library-data/1424983165449-38f5dfc69c0bd4ea8a161e8bb7b79553/HMA_Guidance_022715_508.pdf
Website	fema.gov/grants/mitigation/building-resilient-infrastructure-communities
Next Steps for Texas Communities	The first NOFO will be available in fall 2020. States, territories, and federally recognized tribes are potential applicants. Local governments, tribal governments, state agencies, and tribal agencies are potential sub-applicants. The State Hazard Mitigation Officer can provide more information.

About the Resource

BRIC supports states, local communities, tribes, and territories in pre-disaster mitigation projects to reduce long-term risk from natural hazards. The BRIC program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency.

BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the Pre-Disaster Mitigation (PDM) program and is a result of amendments made to Section 203 of the Robert T. Stafford Disaster

Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the Disaster Recovery Reform Act of 2018 (DRRA). The Notice of Funding Opportunity for the first funding round is anticipated in fall 2020.



Emergency Management Performance Grants	
Grant	
Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	States or territories. May make available to subgrantee communities.
Funding Available	$350 million (FY19)
Cost Sharing	The recipient's contribution can be cash (hard match) or third-party in-kind (soft match). Eligible EMPG program applicants agree to make available non-federal funds to carry out an EMPG award in an amount not less than 50% of the total project cost.
Restrictions	Grant funds may not be used for: • Prohibited equipment. • Weapons systems and ammunition. • Costs to support the hiring of sworn public safety officers for the purposes of fulfilling traditional public safety duties or to supplant traditional public safety positions and responsibilities. • Activities and projects unrelated to the completion and implementation of the EMPG Program.
Website	fema.gov/grants/preparedness/emergency-management-performance
Next Steps for Texas Communities	Reach out to your State Hazard Mitigation Officer for more information.

About the Resource

The purpose of the Emergency Management Performance Grant (EMPG) Program is to provide federal funds to states to assist state, local, territorial, and tribal governments in preparing for all hazards. Title VI of the Stafford Act authorizes the Federal Emergency Management Agency (FEMA) to make grants for providing a system of emergency preparedness for the protection of life and property in the United States from hazards. It vests responsibility for emergency preparedness jointly in the federal government, states, and their political subdivisions. The federal government, through the EMPG Program, provides the necessary direction, coordination, guidance, and assistance to support a comprehensive all-hazards emergency preparedness system. The EMPG Program will provide federal funds to assist state, local, tribal, and territorial emergency management agencies to obtain the resources required to support the National Preparedness Goal's associated mission areas and core capabilities.

Flood Mitigation Assistance Program	
Grant	
Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Applicants must be states, U.S. territories, or federally recognized tribes. Local governments may apply as sub-applicants under their states or territories.
Funding Available	$210 million (FY19)
Cost Sharing	Federal funding is available for up to 75% of the eligible activity costs.
Restrictions	Applying communities must be members of the National Federal Insurance Program.
Website	fema.gov/grants/mitigation/floods
Next Steps for Texas Communities	This federal program is administered through the state. Tribes can apply directly. More information can be found at twdb.texas.gov/flood/grant/fma.asp

About the Resource

The goal of FEMA's Flood Mitigation Assistance (FMA) Program is to reduce or eliminate claims under the National Flood Insurance Program (NFIP). FMA provides funding to states, territories, federally recognized tribes, and local communities for projects and planning that reduce or eliminate the long-term risk of flood damage to structures insured under the NFIP. FMA funding is also available for management costs. Funding is appropriated by Congress annually.

Hazard Mitigation Grant Program	
Grant	
Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	In general, individuals, businesses, and private nonprofits via local governments, can apply for HMGP funding. Individuals must be sponsored through an appropriate subapplicant such as a local government, state agency, tribe or tribal agency, or private nonprofit. Applications are submitted to the state, eligible tribe, or territory, which receives HMGP funds from FEMA.
Funding Available	The available funding is determined based upon the disaster declaration.
Cost Sharing	Matching requirements are up to 75% for a federal match and a minimum of 25% for a non-federal match. Note that funding from other

	federal sources cannot be used for the 25% share with one exception: funding provided to states, tribes, or territories under the Community Development Block Grant (CDBG) program from the Department of Housing and Urban Development (HUD) can be used to meet the non-federal share requirement.
Restrictions	To be considered for funding under HMGP, a project must: • Conform with the approved state and local mitigation plan • Benefit the disaster area • Conform with environmental regulations • Solve a problem and be technically feasible • Meet all applicable state and local codes and standards • Demonstrate cost-effectiveness • Consider a range of alternatives
Website	fema.gov/grants/mitigation/hazard-mitigation
Next Steps for Texas Communities	This federal program is administered through the state. Tribes can apply directly. More information can be found at tdem.texas.gov/hazard-mitigation

About the Resource

The purpose of the Hazard Mitigation Grant Program (HMGP) is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters. The primary guidance document for this program is the Hazard Mitigation Assistance Guidance. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act.

National Dam Safety Program

Grant, Technical Assistance

Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Non-federal dams that (i) are in a state or territory with a state or territorial dam safety program; (ii) are classified as having "high hazard potential" by the dam safety agency in the dam's state or territory ; (iii) have an emergency action plan approved by the state or territory's dam safety agency; and (iv) the state or territory in which the dam is located determines either of these criteria – the dam fails to meet minimum dam safety standards public. An "eligible high hazard potential dam" does not include: (i) a licensed hydroelectric dam; or (ii) a dam built under the federal authority of the Secretary of Agriculture.
Funding Available	$10 million
Cost Sharing	Non-federal cost share requirement of not less than 35%, which may be partially or fully in-kind.
Restrictions	Dams on tribal lands are not eligible to receive HHPD grant funding. The Indian Dam Safety Act of 1994 establishes a Dam Safety Maintenance and Repair Program within the Bureau of Indian Affairs.
Website	fema.gov/emergency-managers/risk-management/dam-safety

Next Steps for Texas Communities	Grant funds go to states. Technical assistance is available to everyone.

About the Resource

For 30 years, the federal government has used the National Dam Safety Program (NDSP) to protect Americans from dam failure. The NDSP is a partnership of states, federal agencies, and other stakeholders that encourages and promotes the establishment and maintenance of effective federal and state dam safety programs to reduce the risks to human life, property, and the environment from dam-related hazards.

Public Assistance 404 and 406 Programs

Grant

Department or Organization	Federal Emergency Management Agency, Department of Homeland Security
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Eligible applicants include states, federally recognized tribal governments (including Alaska Native villages and organizations, as long as they are not privately owned), U.S. territories, local governments, and certain organizations.
Funding Available	Mitigation funding limits are determined based on a benefit-cost analysis or as a sage of the damaged facility's repair cost.
Cost Sharing	The federal share of assistance is not less than 75% of the eligible cost.
Restrictions	Mitigation funding is generally only available for eligible disaster-damaged facilities. Projects must directly reduce the potential of similar damage to the facility and must be cost-effective, technically feasible, and compliant with environmental and historic preservation laws, regulations, and Executive Orders.
Website	fema.gov/assistance/public
Next Steps for Texas Communities	Contact your State Hazard Mitigation Officer for more information.

About the Resource

The FEMA Public Assistance (PA) program provides grants to state, local, tribal, and territorial governments, and certain types of private non-profit (PNP) organizations, so that communities can quickly respond to and recover from major disasters or emergencies declared by the President.

Through the program, FEMA provides supplemental federal disaster grant assistance for debris removal; life-saving emergency protective measures; and the repair, replacement, or restoration of disaster-damaged publicly owned facilities, and the facilities of certain PNP organizations. The PA program also encourages protection of these damaged facilities from future events by providing assistance for cost-effective hazard mitigation measures during the recovery process.

Community Development Block Grant - Disaster Recovery Grant	
Department or Organization	Department of Housing and Urban Development
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State and local governments act as grantees. Those who receive funding include state agencies, non-profit organizations, economic development agencies, citizens, and businesses.
Funding Available	Varies depending on the disaster
Cost Sharing	Varies depending on the cost type More information on costs can be found here: hudexchange.info/resources/documents/CDBG-DR-Cost-Types-Summary.pdf
Restrictions	Each activity must be CDBG-eligible, address a disaster-related impact in a Presidentially declared county, and meet a national objective. Eligible grantees are states, units of general local government, tribes, and insular areas.
Website	hudexchange.info/programs/cdbg-dr/ hudexchange.info/programs/cdbg-dr/cdbg-dr-grantee-contact-information/#all-disasters
Next Steps for Texas Communities	More information can be found at: texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant(CDBG).aspx

About the Resource

The Department of Housing and Urban Development (HUD) provides flexible grants to help cities, counties, and states recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. In response to Presidentially declared disasters, Congress may appropriate additional funding for the CDBG Program as Disaster Recovery grants, to rebuild the affected areas and provide crucial seed money to start the recovery process. Since this Disaster Recovery assistance may fund a broad range of recovery activities, HUD can help communities and neighborhoods that otherwise might not recover due to limited resources.

Community Development Block Grant - Mitigation Grant	
Department or Organization	Department of Housing and Urban Development
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	See CDBG-DR
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	States
Funding Available	Variable by year and opportunity
Cost Sharing	Variable by year and opportunity

Restrictions	Restrictions may vary, depending on the specific opportunity.
Website	hudexchange.info/programs/cdbg-mit
Next Steps for Texas Communities	This federal resource is administered through the state. More information can be found at: texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/RuralCommunityDevelopmentBlockGrant(CDBG).aspx

About the Resource

The Community Development Block Grant- Mitigation Program is designed to provide assistance to areas affected by recent disasters through funding high-impact activities aimed at reducing future losses from natural hazards.

Section 108 Loan Guarantee Program

Loan

Department or Organization	Department of Housing and Urban Development
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	States, metropolitan, cities, and urban counties (i.e., CDBG entitlement recipients), non-entitlement communities that are assisted in the submission of applications by states that administer the CDBG program, non-entitlement communities eligible to receive CDBG funds under the HUD-administered small cities CDBG program. The public entity may be the borrower, or it may designate a public agency as the borrower. Activities eligible under Section 108 include: • Acquisition of real property. • Rehabilitation of publicly owned real property. • Housing rehabilitation eligible under CDBG. • Construction, reconstruction, or installation of public facilities (including street, sidewalk, and other site improvements). • Related relocation, clearance, and site improvements. • Loan to for-profit businesses for economic development purposes. • Payment of interest on the guaranteed loan and issuance costs of public offerings. • Debt service reserves. • Finance fees. • Public works and site improvements. • In limited circumstances, affordable housing construction.
Funding Available	Current availability of funding can be found here: hudexchange.info/resource/5197/current-availability-of-section-108-financing-cdbg-entitlement-and-State-grantees/
Cost Sharing	N/A
Restrictions	All projects must benefit low-moderate income persons, aid in the elimination of slums and blight, or meet the urgent needs of the community.
Website	hudexchange.info/programs/section-108

Next Steps for Texas Communities	More information can be found at: texasagriculture.gov/GrantsServices/RuralEconomicDevelopment/TexasAgriculturalFinanceAuthority/AgriculturalLoanGuaranteeProgram.aspx

About the Resource

The Section 108 Loan Guarantee Program (Section 108 of the Housing and Community Development Act of 1974) provides communities with financing for economic development, housing rehabilitation, public facilities, and other physical development projects, including improvements to increase their resilience against natural disasters. The flexibility of the program makes it one of the most important public investment tools that HUD offers to state and local governments. Section 108 offers state and local governments the ability to transform a small portion of their CDBG funds into federally guaranteed loans large enough to pursue physical and economic revitalization projects capable of revitalizing entire neighborhoods.

Disaster Recovery Grants

Grant

Department or Organization	National Park Service, Department of Interior
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Dependent on Congressional authorization specific to disaster; must be affected by specific disaster
Funding Available	Varies depending on the disaster
Cost Sharing	N/A
Restrictions	Must be affected by specific disaster
Website	nps.gov/preservation-grants/disaster-recovery/index.html
Next Steps for Texas Communities	Funds are made available for specific disasters. Refer to the NPS website for more information.

About the Resource

Congress responds to some major disasters by appropriating Emergency Supplemental funding from the Historic Preservation Fund (ESHPF) for recovery, allowing state and tribal Historic Preservation Offices to work on various recovery projects, including compliance activities, survey and inventory of historic resources in areas impacted by the disaster, recovery, and repair of historic properties damaged during the disaster, and other activities related to disaster recovery, as approved by the National Park Service (NPS). All funded repair work must substantially mitigate the threat and include steps to mitigate future damages.

Housing Improvement Program

Grant

Department or Organization	Bureau of Indian Affairs, Department of Interior
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	No

National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Member of a federally recognized tribe or an Alaska Native; live in an approved tribal service area; have an income that does not exceed 150% of the U.S. Department of Health and Human Services (DHHS) Poverty Guidelines; have present housing that is substandard, as defined by the regulations; have no other resource for housing assistance; and have not acquired the present housing through a federally sponsored housing program that includes such housing assistance.
Funding Available	Interim Improvements: Provides up to $7,500 in housing repairs for conditions that threaten the health and/or safety of the occupants. Repairs and Renovation: Provides up to $60,000 in repairs and renovation to improve the condition of a homeowner's dwelling to meet applicable building code standards. Replacement Housing: Provides a modest replacement home if a homeowner's dwelling cannot be brought to applicable building code standards. New Housing: Provides a modest new home. People who do not own a home may be eligible if they own or lease land suitable for housing and the lease is for not less than 25 years when assistance is received.
Cost Sharing	No cost-share required
Restrictions	Consult the eligibility guidelines found here: bia.gov/bia/ois/dhs/housing-improvement-program
Website	bia.gov/bia/ois/dhs/housing-improvement-program
Next Steps for Texas Communities	Contact your local BIA representative. Their information can be found at: bia.gov/sites/bia.gov/files/assets/bia/ois/Region%20Contact%20list%20rev%205.1.20.docx

About the Resource

The Housing Improvement Program (HIP) is a home repair, renovation, replacement and new housing grant program administered by the Bureau of Indian Affairs (BIA) and by federally recognized tribes. It is aimed at American Indians and Alaska Native (AI/AN) individuals and families who have no immediate resources for standard housing. Repairs can include those required as part of recovery or to reinforce the structure.

National Coastal Wetlands Conservation Grants

Grant

Department or Organization	Fish and Wildlife Service, Department of Interior
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Flood, Sea Level Rise, Storm Surge
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	State agencies, coastal states only
Funding Available	$20 million in 2019
Cost Sharing	Open to applicants who have established a fund that is used for acquiring coastal wetlands, other natural areas, or open space, at a 75% grant share of total project costs, up to the maximum award of $1,000,000. Open to others at a 50% cost
Restrictions	Must meet cost-share
Website	fws.gov/coastal/CoastalGrants/index.html

Next Steps for Texas Communities	Contact the Southeast Region of the US Fish and Wildlife Service: fws.gov/southeast/about/

About the Resource

The National Coastal Wetlands Conservation Grants (NCWCG) program annually provides grants of up to $1 million to coastal and Great Lakes states and territories to protect, restore, and enhance coastal wetland ecosystems and associated uplands. The grants are funded through the Sport Fish Restoration and Boating Trust Fund, which is supported by excise taxes on fishing equipment and motorboat fuel. Wetland conservation is an important type of natural resource protection hazard mitigation project.

North American Wetland Conservation Fund

Grant

Department or Organization	Fish and Wildlife Service, Department of Interior
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	A list of eligible and ineligible activities can be found in Eligibility Criteria & Processes: fws.gov/migratorybirds/pdf/grants/EligibilityCriteria.pdf
Funding Available	$23.9 million in 2019
Cost Sharing	1:1 matching.
Restrictions	According to the NAWCA website, projects must provide long-term conservation for wetlands-associated migratory birds and other wetlands-associated wildlife. Coastal Wetlands Planning, Protection and Restoration Act-derived funds eligible for NAWCA projects may be used only in U.S. coastal wetlands ecosystems.
Website	fws.gov/birds/grants/north-american-wetland-conservation-act.php
Next Steps for Texas Communities	Contact the Southeast Region of the US Fish and Wildlife Service: fws.gov/southeast/about/

About the Resource

The North American Wetland Conservation Fund Program provides matching grants to wetlands conservation projects in the United States, Canada, and Mexico. It includes a Standard Program and a Small Grants Program. Wetland conservation is an important type of natural resource protection hazard mitigation project.

Tribal Resilience Program

Grant

Department or Organization	Bureau of Indian Affairs, Department of Interior
Type of Mitigation Action	Local Planning and Regulations, Education and Outreach
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Federally recognized tribes

Funding Available	$8,731,454 awarded in FY2019
Cost Sharing	Not required
Restrictions	Proposals should be for projects that can be completed within 2 years. Because funding is limited, awards shall not exceed $150,000 for any one proposal for Categories 1-2, 4, and 7 (training, planning, ocean and coastal management, relocation); $15,000 for any one proposal in Categories 3 and 5 (travel); and $65,000 for any one proposal in Category 6 (capacity-building support for scoping efforts).
Website	bia.gov/bia/ots/Tribal-resilience-program
Next Steps for Texas Communities	This is a federal program. Apply to the BIA during open Request for Proposal windows.

About the Resource

The BIA's Tribal Resilience Program (TRP) provides grants to tribes to build capacity and resilience for tribally designed resilience training, adaptation planning, vulnerability assessments, supplemental monitoring, capacity building, and youth engagement.

WaterSMART Programs

Grant, Technical Assistance

Department or Organization	Bureau of Reclamation, Department of Interior
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Drought, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	States, tribes, and local entities in western states
Funding Available	Between $1,000 and $20,000,000
Cost Sharing	Not required
Restrictions	Western states: Washington, Oregon, Idaho, Montana, North Dakota, South Dakota, Nebraska, Wyoming, California, Nevada, Utah, Colorado, Kansas, Oklahoma, Texas, New Mexico, and Arizona
Website	usbr.gov/watersmart
Next Steps for Texas Communities	Information can be found on the USBR website, and applications may be submitted during open application periods through grants.gov.

About the Resource

Through WaterSMART, the Bureau of Reclamation will continue to work with states, tribes, and local entities as they plan for and implement actions to increase their water supply through investments to modernize existing infrastructure and attention to local water conflicts. WaterSMART is an umbrella for a variety of programs, including water and energy efficiency grants, drought planning grants, and watershed management planning grants.

Firewise	
Technical Assistance	
Department or Organization	National Fire Prevention Association
Type of Mitigation Action	Education and Outreach
Hazard Addressed	Wildfire
Specific to Recovery	No
National Mitigation Framework Core Capability	Public Information and Warning
Eligible Applicants	Communities
Funding Available	N/A
Cost Sharing	N/A
Restrictions	None
Website	nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA
Next Steps for Texas Communities	More resources from this non-profit organization are available at the website

About the Resource

Firewise USA is a voluntary program that provides a framework to help neighbors get organized, find direction and take action to increase the ignition resistance of their homes and community.

Five Star and Urban Waters Restoration Grant Program	
Grant	
Department or Organization	National Fish and Wildlife Foundation
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	Local governments or organizations
Funding Available	Awards range from $20,000 to $50,000 with an average size of $30,000 and 40-50 grants awarded per year
Cost Sharing	Matching required
Restrictions	All projects must have: • On-the-ground activities such as wetland, river, or coastal habitat restoration and/or targeted green infrastructure creation and monitoring. • Community partners united to achieve ecological and educational outcomes. • Integrated education, outreach, and training on the restoration project through broad community engagement activities or participation and integration with K-12 environmental curriculum. • Measurable ecological, educational, and community benefits.
Website	nfwf.org/fivestar/Pages/home.aspx
Next Steps for Texas Communities	More information on this not for profit resource is available at the website

About the Resource

The Five Star and Urban Waters Restoration Program seeks to develop nationwide-community stewardship of local natural resources, preserving these resources for future generations and enhancing habitat for local wildlife. Projects seek to address water quality issues in priority watersheds, such as erosion due to unstable streambanks, pollution from stormwater runoff, and degraded shorelines caused by development.

National Coastal Resilience Fund	
Grant	
Department or Organization	National Fish and Wildlife Foundation
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	Storm Surge
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Eligible applicants include non-profit 501(c) organizations, state and territorial government agencies, local governments, municipal governments, tribal governments, educational institutions, or commercial (for-profit) organizations. Tribal governments include both federally recognized tribes and tribes that are not federally recognized.
Funding Available	$30 million (2019)
Cost Sharing	Matching required
Restrictions	Financial Assistance
Website	nfwf.org/programs/national-coastal-resilience-fund
Next Steps for Texas Communities	More information on this not for profit resource is available at the website

About the Resource

The National Coastal Resilience Fund restores, increases, and strengthens natural infrastructure to protect coastal communities while also enhancing habitats for fish and wildlife. Established in 2018, the National Coastal Resilience Fund invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities., The National Coastal Resilience Fund restores, increases, and strengthens natural infrastructure to protect coastal communities while also enhancing habitats for fish and wildlife. Established in 2018, the National Coastal Resilience Fund invests in conservation projects that restore or expand natural features such as coastal marshes and wetlands, dune and beach systems, oyster and coral reefs, forests, coastal rivers and floodplains, and barrier islands that minimize the impacts of storms and other naturally occurring events on nearby communities. The National Coastal Resilience Fund is supported by NOAA, Shell Oil Company, and TransRe.


Resilient Communities Program	
Grant	
Department or Organization	National Fish and Wildlife Foundation
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	Local governments or organizations
Funding Available	$12 million, plus additional local funding to $24 million
Cost Sharing	Matching required
Restrictions	Grants will be offered once a year to support priority projects in select states and communities
Website	nfwf.org/resilientcommunities/Pages/home.aspx
Next Steps for Texas Communities	More information on this not for profit resource is available at the website
About the Resource	

The program focuses on water quality and quantity declines, forest health concerns, and sea-level rise. The program will emphasize community inclusion and assistance to traditionally underserved populations in vulnerable areas.


Forest Management	
Technical Assistance	
Department or Organization	Forest Service, Texas A&M
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-term Vulnerability Reduction
Eligible Applicants	Texas A&M Forest Service provides technical assistance to landowners and communities throughout the state.
Funding Available	N/A
Cost Sharing	N/A
Restrictions	None identified
Website	https://tfsweb.tamu.edu/LandownerAssistance/
Next Steps for Texas Communities	More information on this state resource is available on the website.
About the Resource	

The Forest Service provides technical assistance to landowners and communities to better manage their forests, protect water resources, and prevent the worst impacts of wildfire.


Water Resources Outreach and Training Program	
Technical Assistance	
Department or Organization	Texas Water Resources Institute, Texas A&M
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	The Water Resources Outreach and Training Program is targeted at interested citizens, students, and water professionals.
Funding Available	N/A
Cost Sharing	N/A
Restrictions	None identified
Website	twri.tamu.edu/
Next Steps for Texas Communities	More information on this state resource is available on the website.
About the Resource	

The Water Resources Outreach and Training Program provides workshops and technical resources for citizens, students, and water professionals. One popular course is the Texas Watershed Planning Program, which trains attendees in sustainable, proactive approaches to managing water quality throughout the state. Water quality projects can often mitigate against flooding.


Wetland Restoration Program	
Technical Assistance	
Department or Organization	AgriLife Extension, Texas A&M
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	The Wetlands Restoration Program focuses on public lands. Education classes are also provided for adults and children.
Funding Available	N/A – Restoration services are provided directly.
Cost Sharing	N/A
Restrictions	None identified
Website	tcwp.tamu.edu/wetland-restoration/
Next Steps for Texas Communities	More information on this state resource is available on the website and in the weekly newsletter
About the Resource	

The Wetlands Restoration Program is focused on providing resources to the Houston-Galveston region by helping to restore wetlands to their natural state and by providing hands-on education to students and adults through volunteer experiences. Restoring these wetlands can support flood risk reduction.

Texas Coastal Management Program	
Grant	
Department or Organization	Coast, Texas General Land Office
Type of Mitigation Action	Natural Systems Protection, Local Planning and Regulations
Hazard Addressed	Coastal
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Cities, counties, state agencies, public universities, regional governments, and nonprofit organizations
Funding Available	The amount available depends on the project type.
Cost Sharing	Construction and administrative projects require a 40% applicant match. Projects of special merit do not require a match.
Restrictions	Projects must be in the coastal zone. The program requires a competitive pre-application and then a full application by invitation only.
Website	glo.texas.gov/coast/grant-projects/funding/index.html
Next Steps for Texas Communities	More information on this state resource is available on the website.

About the Resource

The Texas Coastal Management Program grants are designed to address environmental concerns in the coastal zone. Project types include public access enhancement, data collection, coastal hazard and resiliency planning, coastal resource improvement or enhancement, and projects of special merit. Projects must implement a previously approved local, regional, state, or federal plan.

Water Quality and Flood Control Programs	
Grant, Technical Assistance	
Department or Organization	Texas State Soil and Water Conservation Board
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure
Hazard Addressed	Flood, Drought
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Varies by program. Reach out to your local Soil and Water Conservation District for more information.
Funding Available	Varies by program
Cost Sharing	Varies by program
Restrictions	Varies by program
Website	tsswcb.texas.gov/index.php/programs
Next Steps for Texas Communities	More information on this state resource is available on the website or through your local Soil and Water Conservation District.

About the Resource

The Texas State Soil and Water Conservation Board maintains water-related programs, including the Flood Control Program, which funds dam construction and maintenance; Water Quality Management Planning Program, which funds site-specific water quality planning; Texas Nonpoint Source Management

Program to protect water pollution from nonpoint sources; and the Water Supply Enhancement Program, which assists with water management given drought.

Agricultural Water Conservation Grants Program	
Grant	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure, Local Planning and Regulations, Education and Outreach
Hazard Addressed	Drought, Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience (may vary based on annual solicitation criteria)
Eligible Applicants	State agencies and political subdivisions
Funding Available	Varies; current program funding authorization is $1,200,000 per fiscal year
Cost Sharing	Varies; local match is always encouraged and sometimes required
Restrictions	Funding is only available for agricultural water conservation projects and programs, as defined by statute. Funding may also be restricted to projects within regional water planning areas that have identified Irrigation Conservation as a goal in their regional water plans.
Website	twdb.texas.gov/financial/programs/AWCG/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the grant website.

About the Resource

The grant program offers funding to state agencies and local communities to support agricultural irrigation conservation and water conservation. Types of fundable projects include technical assistance, demonstrations and technology transfer, equipment cost share, and research and education.

Agricultural Water Conservation Loan Program	
Loan	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure, Local Planning and Regulations, Education and Outreach
Hazard Addressed	Drought, Erosion, Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience (may vary)
Eligible Applicants	Political subdivisions
Funding Available	Varies; contact TWDB staff to determine funding availability
Cost Sharing	N/A
Restrictions	Funding is only available for agricultural water conservation projects and programs, as defined by statute.
Website	twdb.texas.gov/financial/programs/AWCL/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the grant website

About the Resource

The loan program allows for conservation projects or programs, including those that fund political subdivisions or individual persons.

Flood Infrastructure Fund	
Grant, Loan	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure, Education and Outreach
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Community Resilience
Eligible Applicants	Cities, counties, and any district or authority created under Article III, Section 52 or Article XVI, Section 59 of the Texas Constitution
Funding Available	Varies
Cost Sharing	Structure of financial assistance can be found in the Flood Intended Use Plan.
Restrictions	See program website for specific requirements
Website	http://www.twdb.texas.gov/financial/programs/FIF/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the website.

About the Resource

The Flood Infrastructure Fund provides grants and loans to cities, counties, and other governmental districts and authorities for a wide range of flood mitigation projects. The projects include structural, nonstructural, and nature-based projects. Funding is available for planning/engineering and construction/rehabilitation phases, as well as education and outreach, stream guages, and warning systems.

Regional Water Plans/Planning Group Grants	
Grant	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Local Planning and Regulations, Education and Outreach
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Planning
Eligible Applicants	Regional Water Planning Groups. These groups include individuals representing at least 12 interest groups.
Funding Available	Varies
Cost Sharing	N/A
Restrictions	Funds may not be used for activities which the Board determines sufficient data exist, activities related to the preparation of applications for permits or other approvals, administration costs, or cost/benefit analysis.

Website	twdb.texas.gov/financial/programs/RWPG/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the grant website

About the Resource

The Planning Group Grants allows for communities in a regional group to develop a water plan, including determining water needs, supplies available during drought conditions, sites for reservoir construction, regulatory/legislative recommendations for improving water management, and other elements. The plan will contain specific water management strategies, including conservation, identified needs with no feasible solutions, and alternative strategies. The plans address concerns around drought and may also relate to other hazards, such as floods.

State Participation Program

Other

Department or Organization	Texas Water Development Board
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Flood
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Political subdivisions of the state and non-profit water supply corporations
Funding Available	Funding is dependent on legislative appropriations. No maximum funding limit.
Cost Sharing	N/A
Restrictions	Program funding dependent upon legislative appropriations or available funds. Water supply projects must be consistent with the current state water plan. Reservoir funding must be segmented or phased; permitting is required prior to a construction commitment. Limited to funding of excess capacity portion; up to 80% of total water project costs and 50% for wastewater costs. Entities receiving assistance greater than $500,000 must adopt a water conservation and drought contingency plan. U.S. Iron and Steel requirements. No maximum funding limit.
Website	twdb.texas.gov/financial/programs
Next Steps for Texas Communities	Twice-a-year funding cycle (February 1/August 1); includes a prioritization process. For specific questions on the program, please contact Financial_Assistance@twdb.texas.gov.

About the Resource

The State Participation Program assists local communities by allowing the state to take on a temporary ownership interest in a regional water, wastewater, or flood control project.

State Water Implementation Fund for Texas (SWIFT)	
Loan	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	Drought
Specific to Recovery	No
National Mitigation Framework Core Capability	Planning
Eligible Applicants	Political subdivisions and nonprofit water supply corporations with a project included in the state water plan
Funding Available	No maximum funding limit
Cost Sharing	N/A
Restrictions	Projects must be recommended water management strategies included in the state water plan. Communities must complete an Infrastructure Financing Survey and meet other requirements.
Website	twdb.texas.gov/financial/programs/SWIFT/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the website

About the Resource

This program helps communities develop cost-effective water supplies with low-interest loans. Eligible projects include conservation and reuse, desalinating groundwater and seawater, building new pipelines, developing reservoirs and well fields, and purchasing water rights, as well as numerous other strategies. Projects may incorporate hazard mitigation elements, especially around flood and drought.

Texas Water Development Fund (DFund)	
Loan	
Department or Organization	Texas Water Development Board
Type of Mitigation Action	Natural Systems Protection, Structure and Infrastructure
Hazard Addressed	Flood, Drought
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Political subdivisions and nonprofit water supply corporations
Funding Available	No maximum funding limit
Cost Sharing	N/A
Restrictions	Water supply projects must be consistent with the current state water plan, and entities receiving assistance greater than $500,000 must adopt a water conservation and drought contingency plan. There may be other requirements specific to different project types.
Website	twdb.texas.gov/financial/programs/TWDF/index.asp
Next Steps for Texas Communities	Applications for this state resource can be found on the website

About the Resource

The loan program offers assistance for water supply, wastewater, and flood control. Flood control may include both structural and nonstructural protection solutions and improvement, including modifying stream channels and flood warning systems.

Emergency Relief Program	
Grant	
Department or Organization	Federal Highway Administration, Department of Transportation
Type of Mitigation Action	Structure and Infrastructure
Hazard Addressed	All
Specific to Recovery	Yes
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	States may request ER funds, which can be used for either "emergency repairs" or "permanent repairs."
Funding Available	$100 million is authorized annually under 23 U.S.C. 125. Congress has periodically provided additional funds for the ER program through supplemental appropriations. MAP-21 eliminated the cap of $100 million per state event.
Cost Sharing	For Interstate highways, the federal share is 90%. For all other highways, the federal share is 80%. The federal share for permanent ER repairs may amount to 90% if the combined eligible ER expenses incurred by the state in a federal fiscal year exceeds the annual apportionment of the state under 23 U.S.C. section 104 for the fiscal year in which the disasters or failures occurred.
Restrictions	Must be in affected disaster areas
Website	fhwa.dot.gov/programadmin/erelief.cfm
Next Steps for Texas Communities	States apply to FHWA. Contact the Texas Department of Transportation for more information.

About the Resource

The Federal Highway Administration's (FHWA) Emergency Relief (ER) Program provides grants for the repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of either natural disasters or catastrophic failures from an external cause. The program supplements the commitment of resources by states, their political subdivisions, or other federal agencies to help pay for unusually heavy expenses resulting from extraordinary conditions. The applicability of the ER program to a natural disaster is based on the extent and intensity of the disaster. Damage to highways must be severe, occur over a wide area, and result in unusually high expenses to the highway agency. Applicability of ER to a catastrophic failure due to an external cause is based on the criteria that the failure was not the result of an inherent flaw in the facility, but was sudden, caused a disastrous impact on transportation services, and resulted in unusually high expenses to the highway agency.

Disaster Assistance and Emergency Relief for Individuals and Businesses	
Other - Tax Relief	
Department or Organization	Internal Revenue Service, Department of Treasury
Type of Mitigation Action	Local Planning and Regulations
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	U.S. taxpayers, including individuals and businesses affected by federally declared disasters
Funding Available	N/A (tax relief)
Cost Sharing	N/A
Restrictions	Varies by specific program; must be affected by disaster
Website	irs.gov/businesses/small-businesses-self-employed/disaster-assistance-and-emergency-relief-for-individuals-and-businesses
Next Steps for Texas Communities	Decisions are made based on individual disaster declarations. Refer to the IRS website for more information about your community's situation.

About the Resource

Special tax law provisions may help taxpayers and businesses recover financially from the impact of a disaster, especially when the federal government declares their location to be a major disaster area. Depending on the circumstances, the Internal Revenue Service (IRS) may grant additional time to file returns and pay taxes. Both individuals and businesses in a federally declared disaster area can get a faster refund by claiming losses related to the disaster on the tax return for the previous year, usually by filing an amended return. The IRS also offers audio presentations on planning for disaster. These presentations discuss business continuity planning, insurance coverage, record keeping, and other tips to stay in business after a major disaster.

Climate Adaptation Fund	
Grant	
Department or Organization	Wildlife Conservation Society
Type of Mitigation Action	Natural Systems Protection
Hazard Addressed	All
Specific to Recovery	No
National Mitigation Framework Core Capability	Long-Term Vulnerability Reduction
Eligible Applicants	Conservation nonprofits
Funding Available	The WCS Climate Adaptation Fund provides a total of $2.5 million in grant awards (between $50,000 and $250,000 each) to conservation non-profit organizations each year.
Cost Sharing	Unknown
Restrictions	Project proposals must: • Focus on the functionality of ecosystems, rather than conserving individual species.

	• Be designed for long-term conservation impact. • Create the potential for impact at a landscape scale. • Use strategic, targeted communication activities to amplify adaptation outcomes. • Be designed with climate adaptation for wildlife and ecosystems as a core goal or outcome of the work. • Propose conservation goals and actions that are grounded in the best available science. • Conduct on-the-ground implementation, not research, planning, or tool development.
Website	wcsclimateadaptationfund.org/program-information
Next Steps for Texas Communities	More resources from this nonprofit program are available at the website.

About the Resource

The Wildlife Conservation Society's (WCS) Climate Adaptation Fund provides grant awards to conservation non-profits across the United States to catalyze innovative, science-driven projects responding to the impacts of climate change on wildlife and people.

FEMA

APPENDIX F. PLAN MAINTENANCE

This appendix includes tools and worksheets to facilitate plan maintenance and review by the Brownsville Public Utilities Board Steering and Planning Committees.

In the first year of the performance period, an online performance progress reporting system, the BATool[SM] will provide representatives direct access to their mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, add or delete projects to maintain mitigation project implementation. This online program will capture information and roll all input into a report to summarize mitigation strategy progress.

The FEMA 386-4 guidance worksheets are also available to assist with progress reporting. These worksheets are provided below for ease of access to the HMP Coordinator and Planning Partnership to maintain the 2022 HMP throughout its period of performance.

Mitigation Action Progress Report Form

Progress Report Period	From Date:	To Date:
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	❑ Project completed ❑ Project canceled ❑ Project on schedule ❑ Anticipated completion date:_____ ❑ Project delayed Explain _____	

Summary of Project Progress for this Report Period

1. What was accomplished for this project during this reporting period?

_____

_____

2. What obstacles, problems, or delays did the project encounter?

_____

_____

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

_____

_____

4. Other comments

_____

_____

Worksheet 7.1
Mitigation Action Progress Report Form

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Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Planning Process	Should new jurisdictions and/or districts be invited to participate in future plan updates?	
	Have any internal or external agencies been invaluable to the mitigation strategy?	
	Can any procedures (e.g., meeting announcements, plan updates) be done differently or more efficiently?	
	Has the Planning Team undertaken any public outreach activities?	
	How can public participation be improved?	
	Have there been any changes in public support and/or decision- maker priorities related to hazard mitigation?	
Capability Assessment	Have jurisdictions adopted new policies, plans, regulations, or reports that could be incorporated into this plan?	
	Are there different or additional administrative, human, technical, and financial resources available for mitigation planning?	
	Are there different or new education and outreach programs and resources available for mitigation activities?	
	Has NFIP participation changed in the participating jurisdictions?	
Risk Assessment	Has a natural and/or technical or human-caused disaster occurred?	
	Should the list of hazards addressed in the plan be modified?	
	Are there new data sources and/or additional maps and studies available? If so, what are they and what have they revealed? Should the information be incorporated into future plan updates?	
	Do any new critical facilities or infrastructure need to be added to the asset lists?	
	Have any changes in development trends occurred that could create additional risks?	
	Are there repetitive losses and/or severe repetitive losses to document?	

Worksheet 7.2
Plan Update Evaluation Worksheet

Plan Section	Considerations	Explanation
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimates accurate?	
	Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or eliminated from the plan?	
	Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update?	
	Are there new funding sources to consider?	
	Have elements of the plan been incorporated into other planning mechanisms?	
Plan Maintenance Procedures	Was the plan monitored and evaluated as anticipated?	
	What are needed improvements to the procedures?	

STATE AND LOCAL MITIGATION PLANNING
how-to guide

Bringing the Plan to Life

implementing the hazard mitigation plan

FEMA

August 2003
FEMA 386-4

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STATE AND LOCAL MITIGATION PLANNING
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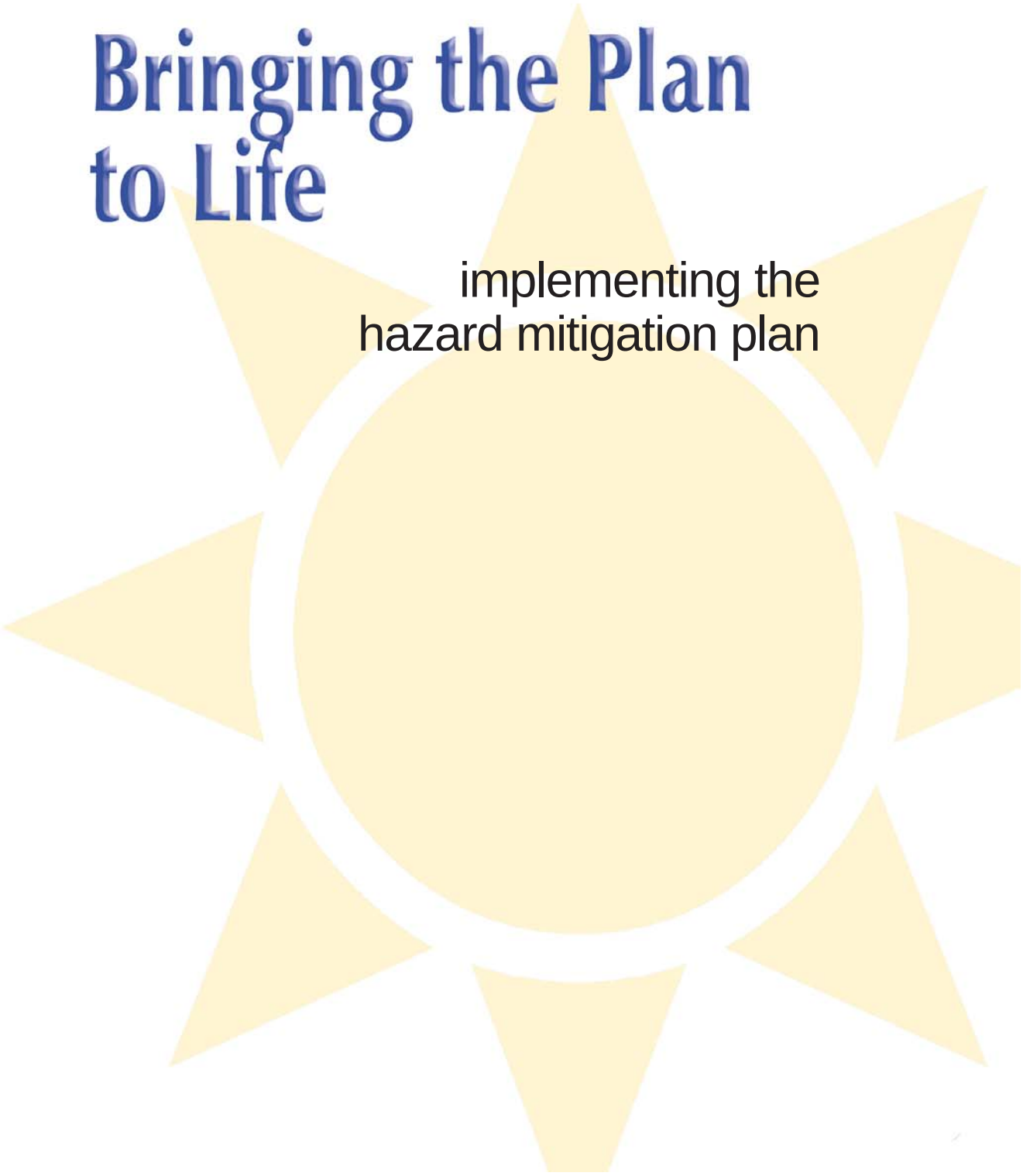


Contents

the hazard mitigation planning process

Hazard mitigation planning is the process of determining how to reduce or eliminate the loss of life and property damage resulting from natural and manmade hazards. As shown in this diagram, the hazard mitigation planning process consists of four basic phases.

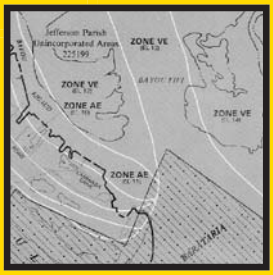
For illustration purposes, this diagram portrays a process that appears to proceed sequentially. However, the mitigation planning process is rarely a linear process. It is not unusual that ideas developed while assessing risks should need revision and additional information while developing the mitigation plan, or that implementing the plan may result in new goals or additional risk assessment.

organize resources

From the start, communities should focus on the resources needed for a successful mitigation planning process. Essential steps include identifying and organizing interested members of the community as well as the technical expertise required during the planning process.

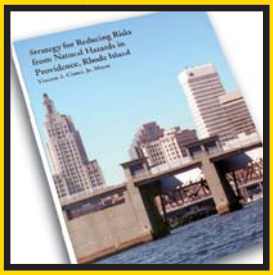
assess risks

Next, communities need to identify the characteristics and potential consequences of hazards. It is important to understand how much of the community can be affected by specific hazards and what the impacts would be on important community assets.



develop a mitigation plan

Armed with an understanding of the risks posed by hazards, communities need to determine what their priorities should be and then look at possible ways to avoid or minimize the undesired effects. The result is a hazard mitigation plan and strategy for implementation.



implement the plan and monitor progress

Communities can bring the plan to life in a variety of ways ranging from implementing specific mitigation projects to changes in the day-to-cay operation of the local government. To ensure the success of an on-going program, it is critical that the plan remains relevant. Thus, it is important to conduct periodic evaluations and make revisions as needed.

foreword

foreword

The Federal Emergency Management Agency (FEMA) has developed this series of mitigation planning "how-to" guides to assist states, tribes, and communities in enhancing their hazard mitigation planning capabilities.

These guides are designed to provide the type of information states, tribes, and communities need to initiate and maintain a planning process that will result in safer and more disaster-resistant communities. These guides are applicable to states, tribes, and communities of various sizes and varying ranges of financial and technical resources.

This how-to series is not intended to be the last word on any of the subject matter covered; rather, it is meant to provide easy to understand guidance for the field practitioner. In practice, these guides may be supplemented with more extensive technical data and the use of experts when necessary.

mit-i-gate\ 1: to cause to become less harsh or hostile; **2:** to make less severe or painful.

As defined by DMA 2000—

hazard mitigation\ : any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

plan-ning\ : the act or process of making or carrying out plans; *specif:* the establishment of goals, policies and procedures for a social or economic unit.

DMA

The Disaster Mitigation Act of 2000

In the past, federal legislation has provided funding for disaster relief, recovery, and some hazard mitigation planning. The Disaster Mitigation Act of 2000 (DMA 2000) is the latest legislation to improve the hazard mitigation planning process. DMA 2000 (Public Law 106-390) was signed by the President on October 30, 2000. The new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur. As such, DMA 2000 establishes a pre-disaster hazard mitigation program and new requirements for the national post-disaster Hazard Mitigation Grant Program (HMGP).

Section 322 of DMA 2000 specifically addresses mitigation planning at the state and local levels. This section identifies new requirements that allow HMGP funds to be used for planning actions, and increases the amount of HMGP funds available to states that have developed a comprehensive, enhanced mitigation plan prior to a disaster. States, tribes, and communities must have an approved mitigation plan in place before receiving HMGP funds. Local and tribal mitigation plans must demonstrate that their proposed mitigation actions are based on a sound planning process that accounts for the risk to and the capabilities of the individual communities.

State governments have certain responsibilities for implementing Section 322, including:

- Preparing and submitting a standard or enhanced state mitigation plan;
- Reviewing and updating the state mitigation plan every three years;
- Providing technical assistance and training to local governments to assist them in developing local mitigation plans and applying for HMGP grants; and
- Reviewing and approving local plans if the state has an approved enhanced plan and is designated a managing state.

DMA 2000 is intended to facilitate cooperation between state and local authorities. It encourages and rewards local, tribal, and state pre-disaster planning and promotes sustainability as a strategy for disaster resistance. This enhanced planning network will better enable local, tribal, and state governments to articulate their needs for mitigation, resulting in faster allocation of funding and more effective risk reduction projects. To implement the new DMA 2000 requirements, FEMA prepared an Interim Final Rule, published in the Federal Register on February 26, 2002, at 44 CFR Parts 201 and 206, which establishes planning and funding criteria for states, tribes, and local communities.

The how-to guides cover the following topics:

- Getting started with the mitigation planning process, including important considerations for how you can organize your efforts to develop an effective mitigation plan (FEMA 386-1);
- Identifying hazards and assessing losses to your community, tribe, or state (FEMA 386-2);
- Setting mitigation priorities and goals for your community, tribe, or state and writing the plan (FEMA 386-3);
- Implementing the mitigation plan, including project funding and maintaining a dynamic plan that changes to meet new developments (FEMA 386-4);
- Evaluating and prioritizing potential mitigation actions through the use of benefit-cost analysis and other techniques (FEMA 386-5);
- Incorporating special considerations into hazard mitigation planning for historic structures and cultural resources (FEMA 386-6);
- Incorporating mitigation considerations for manmade hazards into hazard mitigation planning (FEMA 386-7);
- Using multi-jurisdictional approaches to mitigation planning (FEMA 386-8); and
- Finding and securing technical and financial resources for mitigation planning (FEMA 386-9).

Why should you spend the time to read these guides?

- It simply costs too much to address the effects of disasters only after they happen;
- State and federal aid is usually insufficient to cover the extent of physical and economic damages resulting from disasters;
- You can prevent a surprising amount of damage from hazards if you take the time to anticipate where and how they occur, and then take the appropriate action to minimize damages;
- You can lessen the impact of disasters and speed the response and recovery process for both natural and manmade hazards; and

- The most meaningful steps in avoiding the impacts of hazards are taken at the state, tribal, and local levels by officials and community members who have a personal stake in the outcome and the ability to follow through on a sustained process of planning and implementation.

The guides show how mitigation planning:

- Can help your community become more *sustainable and disaster resistant* through selecting the most appropriate mitigation actions, based on the knowledge you gained in the hazard identification and loss estimation process;
- Can be incorporated as an *integral component* of daily government business;
- Allows you to *focus your efforts on the hazard areas most important to you* by determining and setting priorities for mitigation planning efforts; and
- Can *save you money* by providing a forum for engaging in partnerships that provide the technical, financial, and staff resources in your effort to reduce the effects, and hence the costs, of natural and manmade hazards.

These guides present a range of approaches to preparing a hazard mitigation plan. There is no one right planning process; however, there are certain central themes to planning, such as engaging citizens, developing goals and objectives, and monitoring progress. Select the approach that works best for your state, tribe, or community.

The process used to develop a successful hazard mitigation plan is just as important as the plan itself. This how-to guide focuses on the fourth phase of the hazard mitigation planning process and will help you develop a mitigation plan that meets DMA 2000 requirements.

introduction

introduction

Your community now has a plan that is a result of the planning team's effort and work with stakeholders concerned about reducing losses from hazards in your community. This plan resulted from a process that included a risk assessment, capability assessment, and the development of a mitigation strategy that features prioritized mitigation actions based upon your goals and objectives. The **implementation process** puts your planning team's hard work into motion and focuses on the actions necessary to establish and maintain the effectiveness of the plan as a fundamental tool for risk reduction.

An added benefit of having a plan is that its printed form is familiar, even reassuring, to citizens who have been part of a comprehensive planning process or, even more importantly, have suffered losses due to a hazard. In addition, those new to the community, as well as non-residents, will have easy access to this information as well. The text and accompanying graphics concisely and coherently document the hazards faced by the community, their location and extent, previous losses, actions to mitigate future hazards, and goals for a sustainable future. The development of the plan by community members increases the likelihood of hazard mitigation becoming, like transportation and education, one of the standard considerations in the evolution and growth of the community.

Once the plan has been adopted and the recommendations implemented, your accomplishments, issues, programs, policies, and project results should be accurately documented. This documentation will be very useful when it is time to evaluate, update, or revise the plan. Plans are living documents that require adjustments to maintain their relevance. You and the planning team prepared the mitigation plan to articulate your community's values and strategies at a particular point in time, but like every other plan, it must be reviewed periodically to remain a useful tool to guide growth and change in your community.

Updates and revisions may be necessary to incorporate changes in your community or tribe, new hazard information, new tribal, community, or state priorities, or lessons learned as mitigation projects are completed. It is recommended, but not required, that you com-

This series of guides shows how to identify, plan, and implement cost-effective actions through a comprehensive approach known as **Hazard Mitigation Planning.**

The process consists of four basic phases:

- **Organize resources** involves organizing resources, mobilizing the community, and getting started with the planning process;
- **Assess risks** identifies hazards and estimates the losses associated with these hazards;
- **Develop a mitigation plan** describes how to identify, plan, and initiate cost-effective actions; and
- **Implement the plan and monitor progress,** the topic of this guide—*Bringing the Plan to Life: Implementing the Hazard Mitigation Plan* (FEMA 386-4)—leads communities and states through the formal adoption of the plan and discusses how to implement, monitor, and evaluate the results of mitigation actions to keep the mitigation plan relevant over time.

The implementation and evaluation processes ensure that you accomplish the mitigation actions in a timely way and provide the foundation for an ongoing mitigation program. This allows you to:

- Ensure that the mitigation strategy is implemented in an effective manner;
- Provide for the long-term institutionalization and monitoring of hazard mitigation practices so that the plan remains relevant in the face of change;
- Establish new protocols. The planning process educates community officials on their roles (and those of their departments) in reducing risks. Local officials will need to develop protocols for integrating mitigation principles into their daily job responsibilities; and
- Maintain momentum. The implementation phase is a good time to renew the spirit of cooperation among all partners in the planning process, particularly now that actions to reduce risk are imminent.

States should continually work with local jurisdictions to ensure that local plans are in conformance with state guidelines and complement the goals and strategies outlined in the state hazard mitigation plan, particularly as state priorities change.

plete an internal review of the plan annually and revisit your plan after all hazard events. DMA 2000 regulations require updates every three years for state plans, and every five years for local plans, in order for states, tribes, and communities to remain eligible for disaster-related grants and assistance. This guide will help you determine when and how to review and revise your mitigation plan.

How do you use this how-to guide?

This guide will help you address the following questions:

1. How can we make sure the plan is officially recognized?

Proof of formal adoption is required under DMA 2000 regulations. Getting the plan adopted ensures the support and approval of the governing authority in your jurisdiction. Step 1, *Adopt the Mitigation Plan*, discusses ways of securing the adoption of the plan by your governing body.

2. What is the most effective mechanism to implement each recommendation? What resources are available? How can we keep the public informed and actively involved now that initiatives are underway?

Your mitigation strategy probably contains various short- and long-term recommendations. While you identified potential sources of funding in the plan, the actual sources of funding, staff time, and staffing needs may change before project implementation gets underway. The planning team always must be on the lookout for alternative sources of funding, new opportunities, and new partnerships through which to carry out the recommendations.

Determining who will bear responsibility for implementing planned actions is key to getting the implementation phase off to a successful start. Ensuring that there are appropriate authorities to implement actions is covered in Step 2, *Implement the Plan Recommendations*.

3. How will we know if our mitigation strategy is working?

Monitoring and evaluating the outcomes of the mitigation actions are essential to knowing whether to stay the course or change it. Step 3, *Evaluate Your Planning Results,* discusses how to determine whether or not the planned course of action has had the desired effect. The successes and limitations of your efforts should be documented as part of the evaluation process.

Celebrating successes, and keeping citizens actively involved and informed of the progress of the hazard mitigation initiatives, are

just as important in the adoption, implementation, and revision phases as in any other phase. Keeping everyone up to date on progress also will help sustain support for mitigation as a local, tribal, or state priority. During the implementation phase, the media will become an especially important tool in communicating the progress of the mitigation plan.

4. When should we reexamine the plan?

As has been noted throughout the how-to series, the community and its assets are constantly changing, requiring the mitigation plan to be updated periodically. While DMA 2000 regulations require a formal review and revision of the community plan once every five years for local jurisdictions and every three years for states, the planning team should reevaluate its implementation strategy as new opportunities, unforeseen challenges, and disasters arise. Additionally, as mitigation issues are resolved, the plan should be reexamined to determine whether there is a need to reprioritize, add, or reconfigure actions in light of what has been accomplished. Step 4, *Revise the Plan*, addresses how to incorporate new knowledge about the community, tribe, or state and ongoing mitigation efforts into your strategy.

Be sure to allow sufficient time to complete Phase 4. If you decide to revise the plan, or if you are required to revise it as described under DMA 2000, consider the time it will take to do the following:

- Include the public and identify any new stakeholders in the evaluation process;
- Gather and evaluate data;
- Brief the public and political leadership;
- Incorporate changes into planning documents; and
- Adopt the new plan.

Type of information found in the how-to series

The how-to series contains a wide variety of information, some of which is highlighted with icons. Additional information can be found in Appendix B, *Library*. To illustrate how the guide can be used, newspaper articles from the fictional Town of Hazardville are provided.

Icons

Guidance focused solely on the role of **states and tribes** that serve as grantees under HMGP is identified as a sidebar with the **"States"** icon. Tribes that choose to serve as grantees under HMGP should follow the state icons. Although much of the information will be the same for local, tribal, and state governments, there are different requirements for state and local mitigation plans. Furthermore, states have additional responsibilities to assist local entities in their planning efforts. For tribes that choose to serve as subgrantees under HMGP, guidance focusing on local governments applies to these entities as well.

Under DMA 2000 regulations, local governments may be defined in many different ways. A local government may be defined by a political boundary, such as an incorporated city, county, parish, or township, or it may not have a distinct political boundary, for example, a watershed or metropolitan region. "Local government" is formally defined in 44 CFR §201.2 of DMA regulations.

The **"Advanced"** icon indicates an additional step you can take or when specialists may be needed.

The **"Caution"** icon alerts you to important information and ways to avoid sticky situations later in the planning process.

The **"DMA"** icon provides information relating to the mitigation planning requirements outlined in the Disaster Mitigation Act of 2000 (DMA 2000).

The **"Glossary"** icon identifies terms and concepts for which a detailed explanation is provided in the Glossary included in Appendix A.

The **"Tips"** icon identifies helpful hints and useful information that can be used in the planning process.

Library

A mitigation planning **"Library"** has been included in Appendix B. This library has a wealth of information, including Web addresses, reference books, and other contact information to help get you started. All of the Web sites and references listed in the how-to guide are included in the library.

Town of Hazardville articles

Applications of the various steps in the mitigation planning process are illustrated through a fictional community, the Town of Hazardville, located in the State of Emergency. Hazardville, a small community with limited resources and multiple hazards, is in the process of developing a multi-hazard mitigation plan. Newspaper accounts illustrate the various steps in the mitigation planning process.

Worksheets

Finally, to help track your progress, worksheets have been developed that correspond with the structure of this guide. Worksheets have been completed with Hazardville examples to illustrate the

type of information to include. Blank worksheets are included in Appendix C. You can photocopy the worksheets to record your progress as you undertake the processes of implementing and evaluating the mitigation plan.

The Hazardville Post

Vol. CXIII No. 28 Tuesday, January 28, 2003

Public Responds to Hazardville Mitigation Plan

[Hazardville, EM] The Town of Hazardville Organization for Risk Reduction (THORR) has received over 50 comments regarding the Hazardville Mitigation Plan. The plan was created to help reduce the community's risk to hazards such as flooding, earthquakes, and other natural hazards.

Joe Norris, lead planner for THORR, said the team has been working closely with citizens, businesses, and other community representatives to develop a plan that would create a safer, more resilient Hazardville. THORR was committed to having community input throughout the planning process. "At first, we had a hard time getting the community interested. The citizens didn't know what to expect," Norris said.

Many in the community were skeptical of exactly what the plan was supposed to accomplish. Riley Howard, an advocate for the town's less privileged citizens in the Raging River Views Park was perhaps the most outspoken opponent of the plan. At first, Howard worried that the benefits of this plan might not help the people he felt needed it the most.

"I have tried for years to get the community to help the poor residents in the low-income neighborhood who get flooded out every spring when the snow begins to melt. The town never knew how they could help the residents other than to assist in clean-up and debris removal. The residents could not afford to relocate on their own. All of the houses that are affected year after year were identified in the hazard identification and risk assessment as being in a 10-year flood zone, and are very vulnerable to any sort of flash floods or even a heavy rain." (A 10-year flood has a 10 percent chance of occurring in any one year.)

"While I was deeply saddened by this information," Howard said, "I was relieved to see that it turned out to be a good thing after all. Once the town and the Council learned what a dangerous area that was, the entire neighborhood was prioritized for buyouts, which will allow these residents to get fair market value for their home and help them move out of harm's way."

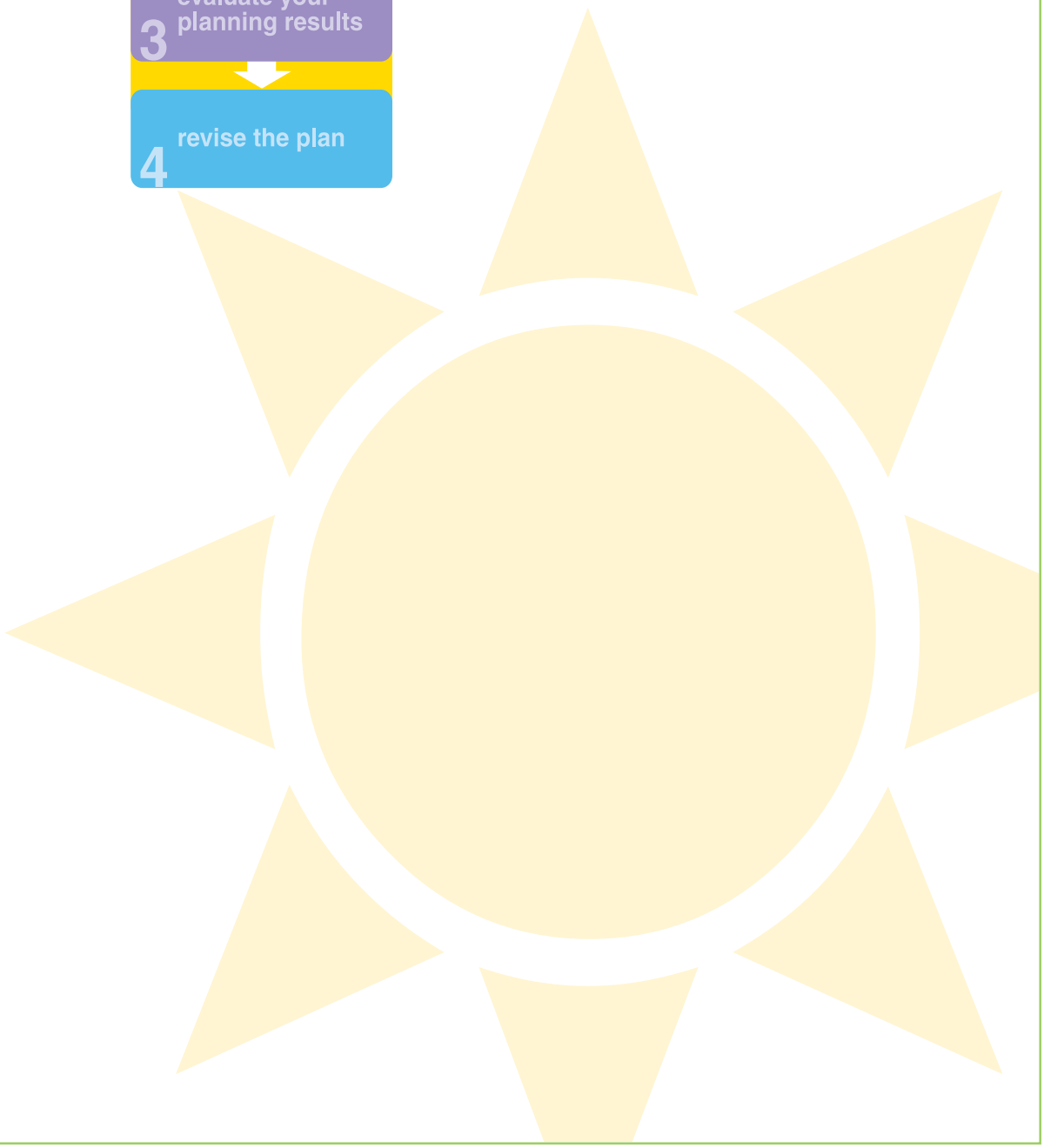
In an interview, THORR's outreach coordinator, Charity Jones, who works for the Hazardville Department of Health and Human Services, said, "The citizens of Hazardville should feel good about what they did to develop this plan. I know I am proud of all the work that THORR and Hazardville community members have put into its creation. This is truly a plan driven by the community's concerns and needs."

step 1 adopt the mitigation plan

2 implement the plan recommendations

3 evaluate your planning results

4 revise the plan



1 adopt the mitigation plan

Overview

Congratulations! You have reached Phase 4 of the planning process. After organizing resources, assessing risks, and developing a mitigation plan, you are now ready to take the first step in Phase 4—guiding the plan through a formal adoption process. Completion of this step will establish the plan's authority and legitimacy. In order to meet DMA 2000 regulations, your jurisdiction's governing body must formally adopt the plan in accordance with state and local laws. Their involvement and support of the process all along should help gain approval, as you will see below. Local plans are adopted by the lead governing body (City Council, Board of Supervisors, etc.) and state plans are usually submitted to the state director of emergency management for approval and signature. Adopting the mitigation plan is the final challenge for the planning team before plan implementation can begin. The relationships you have already established with stakeholders, elected officials, and government agencies, as well as the thorough nature of your work thus far, will be important assets during the adoption process.

In addition to being required by DMA 2000, adoption of the plan is necessary because:

- It lends authority to the plan to serve as a guiding document for all local and state government officials;
- It gives legal status to the plan in the event it is challenged in court;
- It certifies to program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and the jurisdiction's citizens; and
- It helps ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

Linking the plan's policies to those in other land development tools ensures that development decisions are made in consideration of the loss reduction goals of the community. Formal adoption of the plan lets public or private funding sources know that the plan has the support of citizens, elected officials, and business owners. For example, land developers should use the adopted plan to make informed decisions about their ventures with respect to mitigation policies and potential hazards.

Before you seek adoption of the plan, check with your State Hazard Mitigation Officer (SHMO) on administrative procedures for reviewing plans under DMA 2000 requirements. The SHMO may have established a procedure with the FEMA Regional Office to review the draft plan to make sure you included all elements for meeting the DMA 2000 or other program requirements. This may include reviewing the planning process and your documentation before you ask the governing body to adopt the plan, a step to ensure that you have to submit the plan only once to the governing body for formal adoption. A tribal jurisdiction that submits a plan as a state-level entity works directly with the appropriate FEMA Regional Office.

Ensuring Plan Adoption

The planning team has already performed activities that will help ease passage of the plan:

Recognizing the Committee. As described in *Getting Started* (FEMA 386-1), the team is formally recognized by the community's governing body as the local authority on mitigation, and has been entrusted to make recommendations about mitigation on behalf of the community. This formal recognition by elected officials extends to the planning team's scope of work as well.

Garnering Public Input. As covered in *Getting Started* (FEMA 386-1) and *Developing the Mitigation Plan* (FEMA 386-3), the planning team identified stakeholders to join the planning team, briefed elected officials, informed the public of the team's progress and findings, and involved the public in its work. By including the citizens of the community throughout the planning process, you can expect that the adoption and implementation of the plan will be broadly supported by the public and elected officials.

Communicating Information. By keeping citizens involved in the planning process and informed of progress, the planning team can maintain the community's interest in mitigation. The community now knows and understands that there is a significant risk of losing assets because of hazards, that several alternatives are being considered, and that projects and initiatives will soon be underway.

Partners in Mitigation

Citizens, businesses, and technical experts in southwest Tulsa are partnering with the City of Tulsa and the National Park Service in the development of a greenway plan for a local creek (Mooser Creek). Flood mitigation, preservation of natural resources, recreation, and sustainable development are part of a community vision shared by both citizens and government. Community leaders got involved by forming committees and identifying issues important to them. The Mooser Creek Greenway Citizens and Technical Committees agreed upon a vision statement in an effort to preserve the natural functions and beauty of Mooser Creek and to create recreational and educational opportunities.

Procedures & Techniques

Task A. Brief local leadership.

An excellent way to facilitate adoption of the plan is to periodically brief community decision makers and elected officials on the progress of your planning efforts. This is a great opportunity to demonstrate to the governing body that the plan is sound and has broad support. Plan adoption should not be difficult if the planning team has conducted activities throughout the planning process that have lent credibility to the team, the plan, and the planning process. The briefings will also allow you to address any concerns of elected officials, and to obtain their input. Having the planning team recognized, garnering public input, and communicating the progress and successes of the team will help get the plan adopted.

Task B. Demonstrate the support of partner organizations.

One way to ensure the credibility and eventual passage of the mitigation plan is to present the adopting body with letters of support from organizations and agencies on the planning team, as well as those not on the team. The community's governing body may view the plan more favorably if it has the support of neighborhood and civic organizations. Some organizations may show their commitment to implementing the plan by passing a resolution supporting it and outlining specific responsibilities that they will assume. Furthermore, supporting organizations should be encouraged to provide testimony if the plan will be adopted at a public hearing. This testimony should provide specific information on the benefits that the mitigation plan will bring to the organization's constituencies. Such testimony becomes part of the public record of the hearing.

For example, if a member of a community watershed advocacy group was part of the planning team, that group might review the plan and give its full support to the plan by outlining the group's commitment to sponsor an annual watershed clean-up day or to plant native vegetation in the open space that resulted from the acquisition of flood-prone structures. See *Getting Started* (FEMA 386-1) for more details on garnering community support.

Task C. Have the plan adopted by the proper legislative or executive authorities.

The mitigation plan will be adopted through your government's normal legal process. Depending on the laws in your state and jurisdiction, adoption of the plan will give the jurisdiction legal authority to enact ordinances, policies, or programs to reduce hazard losses and to implement other mitigation actions. Generally, most local governing bodies will adopt a hazard mitigation plan by resolution.

Build time into your planning schedule to meet federal and state deadlines for submitting the plan. Make sure you allow sufficient time for formal adoption procedures. Your local governing body may meet only once a month and may require agenda items to be submitted well ahead of time.

Task D. Submit your plan for approval.

Once your local governing body has approved the plan, it must be submitted to the State Hazard Mitigation Officer (SHMO). The SHMO should already be familiar with your plan because he or she should have reviewed a draft to determine if the plan meets DMA 2000 and other state program requirements. Someone should be designated as the point of contact with the state to answer any questions about the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted by its respective governing body. The SHMO is responsible for forwarding the plan to the FEMA Regional Office for review.

Task E. Publicize the adoption and approval of the plan.

Once the plan has been approved, stakeholders should be informed of your success. You may want to package the message differently to reach various audiences. This can be accomplished by sending a press release to your local newspaper, holding a press conference with important civic leaders, sending a mailing, or posting a notice on the community's Web site. You may also want to celebrate your success by beginning a project immediately. For example, after the plan is approved, you may request that the governing body vote on a resolution or ordinance that is important to accomplishing your mitigation goals, or to authorize funding to undertake a highly visible project, such as flood-proofing City Hall or some other important public facility.

DMA

44 CFR §201.4(c)(6) and §201.6(c)(5) of the Interim Final Rule require plans to be adopted before being submitted to FEMA for formal review and final approval. A copy of the resolution of adoption must be included with the plan.

Resolutions are expressions of a governing body's opinion, will, or intention and can be legally binding or not. Most planning documents must undergo a legally binding council resolution, which, in order to be adopted, must be supported by an official vote of the majority of members.

Formal adoption of the state plan will vary according to state protocols. Generally, states should obtain the signature of the state emergency management director as approval of the plan. The plan also can be distributed to members of the state legislature to broaden support for the plan and to potentially pave the way for any new legislation or budget items that may be necessary to carry out the plan recommendations. States must submit plans to their FEMA Regional Office for review and approval. Depending upon regional procedures, states also may opt to submit the results of the risk assessment or draft plan to FEMA for an informal review before officially adopting it and sending it to FEMA for official review and approval. Once any necessary changes have been made, the state can proceed with formal adoption and final FEMA review. If a tribal organization has developed a state-level plan, it should be submitted directly to the FEMA Regional Office.

Consider developing an executive summary of the plan for use in publicizing it with other government agencies or partners. A brochure may be appropriate for citizens while you also make the executive summary or entire plan available to them.

Summary

By the time you finish Step 1, you will have a plan that has the support of the community, state, tribe, and elected officials. Adoption of the plan gives the plan greater authority, fulfills certain FEMA program eligibility requirements, and will ease implementation of your mitigation actions. Once the mitigation plan has been adopted, your state, tribe, or community is ready to begin implementing the mitigation strategy.

The Hazardville Post

Vol. CXIII No. 45 Friday, February 14, 2003

Town of Hazardville Adopts THORR's Plan

(Part 1 of a 4-Part Series on the Hazard Mitigation Implementation Process)

[Hazardville, EM] The Hazardville Town Council adopted the Hazardville Hazard Mitigation Plan on Thursday by resolution (included below) to serve as the town's guide in reducing risks to citizens and property. Marion Jackson, Chairperson of the Town Council, announced that "in light of the community's involvement and obvious support for the plan, indicated by citizen turnout at the hearing and letters of support submitted for the record by respected community organizations, the Council unanimously voted to adopt the Hazardville Hazard Mitigation Plan as an official plan of the Town of Hazardville." The plan will take effect immediately.

The Town of Hazardville Organization for Risk Reduction (THORR) was instrumental in developing the plan and marshaled its forces to support adoption of the plan through written support from the community. "This plan is one of the few community initiatives that is relatively unopposed, no doubt due to THORR's diligent public outreach efforts," Jackson said.

Resolution #2003-53

WHEREAS the Town of Hazardville has experienced severe damage from hurricanes, flooding, earthquakes, wildfires, landslides, and tornadoes on many occasions in the past century, resulting in property loss, loss of life, economic hardship, and threats to public health and safety;

WHEREAS a *Hazard Mitigation Plan* (the Plan) has been developed after more than one year of research and work by the Town of Hazardville Organization for Risk Reduction and the people of the Hazardville community;

WHEREAS the Plan recommends many hazard mitigation actions that will protect the people and property affected by the natural hazards that face Hazardville;

WHEREAS a public meeting was held to review the Plan as required by law;

NOW THEREFORE BE IT RESOLVED by the Mayor and Town Council of the Town of Hazardville that:

1. The *Hazard Mitigation Plan* is hereby adopted as an official plan of Hazardville.
2. The respective town officials identified in the strategy of the Plan are hereby directed to implement the recommended actions assigned to them. These officials will report quarterly on their activities, accomplishments, and progress to the Town of Hazardville Organization for Risk Reduction.
3. The Town of Hazardville Organization for Risk Reduction will provide annual progress reports on the status of implementation of the plan to the Mayor and Town Council. This report shall be submitted to the Town Council by February 28th of each year.

PASSED by the Town Council of Hazardville, this 13th day of February 2003.

Marion Jackson
Council Chairperson

APPROVED by me this 13th day of February 2003.

Mayor

ATTESTED and FILED in my office this 13th day of February 2003.

Mary Landers
Clerk

step 2


1
adopt the mitigation plan
implement the plan recommendations
3
evaluate your planning results
4
revise the plan

2

implement the plan recommendations

Overview

Citizens and officials who participated in creating the plan will expect to see results from their hard work and effort. This step describes how to place the recommendations of the plan within the administrative framework of your state, tribe, or community. The section presents ideas on how the planning team can get the recommendations implemented on schedule and, over time, integrate mitigation actions into the day-to-day operations of government agencies. It will also show how to bring action items within the mitigation strategy to fruition through creative use of available resources.

When implementing the plan, various stakeholders will have distinct roles and responsibilities:

The Planning Team. During the implementation of the mitigation strategy, the planning team's role may change to one of overseer. As the developers of the mitigation plan, the planning team should also regularly monitor its progress. The planning team can help ensure that the spirit of the plan is not sidetracked by political or personal concerns, and keep the community energized so citizens can hold the government accountable for the legitimate performance of the plan. The team can also alert officials to issues that may affect emergency management and hazard mitigation.

Elected Officials and Local Administrators. The executive or delegated administrator may be a likely candidate for keeping all participating local agencies or departments on track. Elected officials play a unique role in the implementation of the plan. They will be pressured by those opposed to the plan as well as those who expect to see it enacted as intended. Furthermore, elected officials have the capacity and responsibility to distribute resources among competing interests. The planning team will have identified supportive elected officials not only when organizing to prepare the plan (Phase 1, *Getting Started*, FEMA 386-1), but also when evaluating the relevant political factors of potential mitigation actions (see *Developing the Mitigation Plan*, FEMA 386-3, Step 2).

Elected officials and local administrators should provide:

- **Oversight.** Officials not only can assign staff and provide incentives to implement planning initiatives, they also can support the hard work of the professional staff and volunteers.
- **Visibility.** Community leaders must keep the spotlight on the identified hazard-related problems and opportunities and make sure that problems are not overlooked by any relevant department or office—community planning, emergency services, zoning, public service, and economic development, for example.
- **Budgets.** Elected officials and local administrators must ensure that the community's annual budget includes funding to implement previously adopted long-term actions. This includes commitments that the community has made to cost-share, maintain, operate, repair, or otherwise bear the burden for activities that may have been undertaken with outside assistance.

(continued on page 2-2)

(continued from page 2-1)

Partners–Nonprofit Organizations and Businesses. Throughout implementation of the plan, the planning team should consider innovative ways for its partners to facilitate the implementation of projects. The nonprofit and private sectors can help in a number of ways, including lending expertise, discounted materials, staff or volunteer time, or meeting space. The planning team can, in turn, offer the private organizations an opportunity for greater public exposure, and thus greater name recognition. The planning team can also offer tips and expertise in mitigation; businesses often do not realize the danger that their property or sources of income face from hazards. The planning team can inform partners about the hazards they potentially face, the ways they can mitigate these hazards, and how their staff can mitigate hazards at home.

Citizens. Citizens have an ongoing role to play in project implementation. The planning team should actively seek volunteers to help implement programs and activities. Knowledgeable citizens also can be recruited to provide expertise in specific subject areas. The more you involve people in implementing the plan, the greater the support it will receive.

State Agencies. State agencies can lend their time, expertise, and funds to the implementation of hazard mitigation projects. Make sure your list of state contacts is very broad, as the resources of one state agency may be unknown to another.

Academic Institutions. Colleges and universities can provide technical expertise to projects that may require Geographic Information System (GIS), engineering, planning, or other technical assistance. They can also provide meeting space, laboratories, and other logistical support.

In the third phase of the planning process, the planning team identified mitigation actions and implementation strategies that included target dates for the completion of projects and assigned responsibilities to agencies, departments, organizations, or specific people (see Steps 2 and 3 of *Developing the Mitigation Plan,* FEMA 386-3). This information should help the planning team meet the objectives of the plan on time and provide indicators by which the implementation will be monitored and evaluated.

It is important to decide how success will be determined before implementation and evaluation occur. From an administrative standpoint, success may be simply a measure of whether the project was finished on time, and within budget. On the other hand, even projects that are well thought out and executed may not be completed for a long period of time due to the nature of the project, the lack of available funding, or other reasons beyond the control of the community. In this case, it is important to identify successes in the short-term, even if completion is not in sight. For example, if a community decides to pursue zoning changes in flood hazard areas, the actual changes may not occur for years due to administrative procedures that must be followed within the context of local and state zoning and land use law. However, successes (in the form of completion of milestones) can and should be identified along the timeline that is appropriate for that type of mitigation action. In this zoning example, short-term successes can include key meetings or briefings held to present risk information to support zoning changes.

In Step 3, you will also measure the effectiveness of your mitigation actions. It will be therefore important in Step 2 to establish indicators of effectiveness.

The planning team should also determine the manner in which plan implementation will be monitored. In any incorporated community, there are elected or appointed officials who have the ultimate responsibility for carrying out specific community policies and programs. The planning team should continue to serve as a resource to the community by helping its leaders identify, measure, and publicize successes, and mobilize community members to contribute and participate where appropriate. The planning team can also work to secure funding to implement the plan.

Your team may decide that frequent meetings are no longer practical. It may consider an alternative, such as periodically issuing a memorandum to keep team members informed of progress in implementing the plan. An annual internal review of progress by the planning team is also a good monitoring method. Keep in mind that the need for maintaining sustained communication is more important than the form of communication selected.

Procedures & Techniques

Task A. Confirm and clarify responsibilities.

In Step 3 of *Developing the Mitigation Plan* (FEMA 386-3), the planning team identified who would be involved in implementation of the mitigation actions. Now is the time to revisit those assignments and confirm that the responsible parties understand their duties. One way to communicate your expectations to public agencies and other organizations with specific responsibilities is to draw up a Memorandum of Agreement (MOA) among the different agencies and organizations. An MOA is a non-binding statement that defines the duties, responsibilities, and commitment of the different parties or individuals as established by the hazard mitigation strategy developed in Phase 3. It provides a clear statement of values, principles, and community hazard mitigation goals, and establishes an organizational structure to assist in measuring and evaluating the plan's progress.

The MOA should include:

- A vision or goal statement;
- An organizational structure to maintain the effort over time;

- A statement that specifies the duration of the MOA and how it will be reviewed or revised;
- A statement indicating how decisions will be made to continue the MOA;
- A statement describing the circumstances under which partners should consult each other;
- A statement requiring the organization to submit periodic or annual reports on the progress of its projects or programs;
- A statement regarding responsibility for actions; and
- A resource commitment statement on the staffing, technical resources, and funding that the department, agency, or organization is expected to provide.

Example of a Memorandum of Agreement

Agreement is made this 4th day of March 2003 by these parties:

The Town of Hazardville (the Town) and its local corporate and nonprofit partners, and the State of Emergency and its partners

WHEREAS the parties:

Strive to create sustainable communities that are resistant to the human and economic costs of disasters;

Recognize that actions taken in advance of disasters are effective in reducing losses; that partnerships among government agencies, private companies, voluntary and professional associations, educational institutions, and community organizations are essential for the success of these efforts;

Recognize that vulnerable conditions exist in public and private facilities, and the utility and transportation systems that serve them; that increasing population growth and diversity, escalating disaster costs, and other factors increase the Town's vulnerability to disaster;

Recognize that financial support is necessary to enable the expansion and integration of public and private mitigation efforts;

Agree to continue to receive and encourage the input of stakeholders with the State, Town, businesses and nonprofit organizations in Hazardville, neighboring communities, citizens, and other appropriate partners;

NOW, THEREFORE, it is mutually agreed that the parties voluntarily enter into this non-binding Agreement to establish the Town of Hazardville Partnership for Disaster Mitigation (the Partnership).

The principal objective of this Agreement is to further develop private, volunteer, and public-sector capabilities (people, policies, resources, working relationships, long-term plans, and a schedule for accomplishments) necessary to carry out projects that will reduce vulnerability to risk and minimize losses.

1. **MEMBERSHIP.** Membership in the Partnership is open and can be expanded to include new (additional) partners in the future. The Partnership will work together to advise the Town and participate in the implementation of the Town of Hazardville Hazard Mitigation Plan to further mutual loss-reduction goals subject to the terms and conditions recited below.
2. **TERM.** The respective duties, responsibilities, and commitments of the parties hereto shall commence on the date this Agreement is signed by the parties and may be periodically renewed or revised at the option of the parties.

(continued on page 2-5)

(continued from page 2-4)

3. **CONSULTATIONS.** The Partners shall make their representatives available to consult with the Town of Hazardville on ways in which the Hazard Mitigation Initiative (see Appendix A below) can be improved and applied successfully. The Partners, in consultation and conjunction with other public-sector entities and related community-wide initiatives, shall consult with each other on:
   - Identification and delineation of natural and manmade hazards within the Town;
   - Assessment of risk to and vulnerability of buildings, facilities, utilities, communications, and transportation systems in the public and private sectors;
   - Techniques to plan for, reduce, and manage expected losses; and
   - Technical and financial assistance and incentives to facilitate loss reduction projects.
4. **ANNUAL EVALUATION.** The parties shall annually review the Partnership created by this Agreement to determine and document successes achieved over the past year and discuss actions to be undertaken in the following year. The Partnership will prepare an Annual Report describing accomplishments resulting from the Hazardville Hazard Mitigation Initiative and implementation of the Hazardville Hazard Mitigation Plan. The Partnership shall also make recommendations for improving this Agreement and other disaster mitigation/recovery strategies.
5. **RESOURCE COMMITMENT.** The parties will consider committing human, technical, and financial resources, coordinate with current and future partners, and carry out the fundamental actions of this voluntary, non-binding Agreement.
6. **THE HAZARD MITIGATION INITIATIVE.** This Agreement includes two Appendices. Appendix A offers an overview of the Hazardville Hazard Mitigation Initiative. Appendix B lists commitments made by the parties to be included as part of the Hazardville Hazard Mitigation Plan that will be acted upon after execution of this Agreement. These actions will constitute steps toward accomplishing the loss-reduction goal. The period of time for completing defined actions will be set and reported by the Partnership.

IN WITNESS WHEREOF, each party has caused this Agreement to be executed by its duly authorized representatives on the date first mentioned above.

Appendix A – Hazardville Hazard Mitigation Initiative – Proposed Actions:

The Hazardville Hazard Mitigation Initiative is an element of this Memorandum of Agreement. In summary, the Initiative addresses the following:

A. **Reducing flood hazards to low-income, residential structures.** The Town of Hazardville Emergency Management Agency, the Hazardville Department of Planning, and the Hazardville Habitat for Humanity are working to acquire flood-prone, low-income housing in the manufactured-housing park and other low-income areas in the floodplain, and to find appropriate, affordable housing for displaced residents.

B. **Establishing public education and outreach projects.** The Partnership will cooperate to inform the public about the accomplishments of the Hazardville Hazard Mitigation Initiative, progress of projects, and upcoming public planning efforts. Working with Hazardville Hardware, the Partnership will also educate the public on insurance, family disaster preparedness planning, and other safety tips to protect houses from natural and technological hazards.

C. **Strengthening the community's resistance to seismic and landslide hazards by retrofitting vulnerable structures.** This project component will strengthen the community's housing stock to resist damage from earthquakes by (1) developing a consistent, sustainable retrofit capability among local builders, contractors, and homeowners; (2) seismically retrofitting vulnerable structures in the downtown business district; and (3) incorporating standardized retrofit practices into home and downtown commercial rehabilitation programs.

   Under this component, the Partnership will also strive to find additional funding to complete the retrofit of the Town's lighthouse, threatened by coastal erosion.

Appendix B – Hazardville Hazard Mitigation Initiative – Resource Commitments:

The Town of Hazardville will:

1. Provide leadership for the Partnership and serve as the point of contact for the Hazardville Hazard Mitigation Initiative.

(continued on page 2-6)

(continued from page 2-5)

2. Provide financial management of the grant funds provided to the Town for hazard mitigation projects, including Hazard Mitigation Grant Program funds, Flood Mitigation Assistance funds, Pre-Disaster Mitigation funds, etc.
3. Procure the support and assistance of appropriate Town departments and agencies to further the objectives of the Hazardville Hazard Mitigation Initiative.
4. Supply meeting space and other logistical support for Partnership meetings.

The State of Emergency will:

1. Supply peer review of plans, planning processes, and project implementation to identify potential problems, recommend solutions, or procure appropriate State support.
2. Attend project review meetings to meet with partners implementing the projects.
3. Facilitate Federal grants applied for by the Town and the Partnership.

Hazardville Department of Planning will:

1. Supervise the acquisition and demolition of vulnerable structures in the floodplain.
2. Designate the resultant publicly owned open space as an area precluded from future development.

Hazardville Department of Housing will:

1. Support the acquisition and demolition of the flood-prone houses of low-income residents by providing additional funding for replacement housing in non-hazardous areas.

Hazardville Habitat for Humanity will:

1. Solicit its corporate and other partners to supply building materials for new, affordable housing.
2. Organize volunteers to build new, affordable housing in non-hazard areas for current residents of the manufactured home park and other low income areas in the floodplain.

Hazardville Hardware will:

1. Design and fund public education brochures advising the public about hazard mitigation for homeowners, safety during hazard events, and the importance of purchasing insurance.
2. Develop a marketing display for the Hazardville Hardware store advertising hazard mitigation for homeowners and related products that can be purchased at the store.

Capability Assessment Results

In completing your capability assessment in Phase 3 of the planning process, you identified policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions. Consider developing an implementation strategy that addresses recommendations that can be easily implemented first, followed by those that need to be modified, and last, those that require the adoption of new regulations or policies or infusion of outside funding sources for implementation.

Task B. Begin to integrate mitigation actions throughout government operations.

The planning team should work with chief administrative officials to begin to integrate the newly adopted hazard mitigation goals and actions into the general operations of its government and partner organizations. By initially working within existing administrative mechanisms, communities and states can quickly and efficiently implement and finance their hazard mitigation projects and programs, and incorporate them into their governing systems. The following sections discuss several options to consider.

1. Use processes that already exist.

A good initial strategy is to take advantage of tools and procedures that were identified in your capability assessment in Step 2 of

Developing the Mitigation Plan, FEMA 386-3. Your research of Social, Technical, Administrative, Legal, Economic, and Environmental (STAPLEE) criteria for mitigation activity should have uncovered information on the administrative, financial, or legal mechanisms in your state, tribe, or community. These mechanisms are already in use and familiar to the governmental departments and organizations. This will give the planning implementation phase a strong initial boost, especially if your plan calls for expanding existing agency mandates or departmental funds, or creating new programs later on.

Administrative

- **Departmental or organizational work plans, policy, and procedural changes.** Updating the work plans, policies, or procedures to include hazard mitigation concepts and activities can help integrate the plan into daily operations. These changes can include how major development projects and subdivision reviews are addressed in hazard-prone areas or ensure that hazard mitigation concerns are considered in the approval of major capital improvement projects.
- **Job descriptions.** Working with department or agency heads to revise job descriptions of government staff to include mitigation-related duties could further institutionalize hazard mitigation. This change would not necessarily result in great financial expenditures or programmatic changes.

Budgetary

- **Capital and operational budgets.** Instead of solely relying on funding from hazard mitigation programs or other external sources of grant monies, states, tribes, and communities might consider a line item for mitigation project funding in their capital or operational budgets. Having a line item in these budgets may not guarantee funding every year, but it is certainly easier to get the money allocated if it is already there. Examples include a revolving fund to finance a buyout program or a low-interest program to fund retrofits.

Examples of using existing resources to accomplish mitigation:

- The Department of Public Works could adopt more rigorous procedures for inspecting and cleaning debris from streams and ditches. Instead of cleaning only after storms or complaints from citizens, the Department could require inspections of streams and ditches at least semi-annually.
- The Planning Department could add hazard vulnerability to subdivision and site plan review criteria and incorporate any necessary actions at the planning stage.
- A community conservation society or other interested voluntary organization could perform inventories of historic sites in hazard areas that might require special treatment to protect them from specific hazards.

You may want to add

some or all of the following language into job descriptions for a community planner, floodplain manager, emergency manager, building code official, or water resources engineer in the Public Works Department:

Knowledge, Skills, and Abilities

Knowledge. Knowledge of the principles of emergency management, specifically hazard mitigation. Knowledge of the principles and practices of sustainable development and how it is incorporated into hazard mitigation planning. Knowledge of FEMA's pre- and post-disaster mitigation programs, as well as other federal agency programs (HUD, EPA, SBA) that provide technical and/or financial assistance for implementing pre- or post-disaster mitigation planning. Knowledge of private/non-governmental programs that can support reconstruction and mitigation strategies.

Skills. Consensus building and team building, communication (verbal and written)/interpersonal skills.

Abilities. Ability to apply planning principles and tools to the goals of hazard loss reduction.

See *Developing the Mitigation Plan* (FEMA 386-3) for more information on using the following implementation tools for hazard mitigation:

- Building Codes
- Zoning Ordinances
- Subdivision Ordinances
- Special Hazard Area Regulations

Integrating Hazard Elements into Comprehensive Planning

- For guidance on what to include in a local hazard element, see the American Planning Association's *Growing Smart Legislative Guidebook* at www.planning.org/growingsmart.
- In July 2002, the Institute for Business & Home Safety (IBHS) published a report entitled *Summary of State Land Use and Natural Hazards Planning Laws*. This report focused on the relationship between state planning laws and other statutes that addressed natural hazards and their effect on local-level comprehensive planning and land-use regulations. More information about the results of this report is available at http://www.ibhs.org/research_library/view.asp?id=302.
- Oregon has long been recognized as a pioneer in local planning for natural hazards. In 1969, Oregon adopted Senate Bill 10, which required every city and county in the state to have comprehensive land use plans that met state requirements. This mandate, however, did not grant any authority to enforce the requirement or provide for any technical support or training to the communities. Subsequently, Senate Bill 100 was passed to address these issues, creating the Land Conservation and Development Commission (LCDC). Among its responsibilities, the LCDC was charged with establishing statewide planning goals that were to be congruent with regional, county, and city concerns; preparing statewide planning guidelines, model ordinances, and regulations; and ensuring widespread citizen involvement and input throughout all phases of the planning process.

  One of the state planning goals requires Oregon communities to inventory known natural hazards and to implement appropriate safeguards for development in hazard areas. On behalf of the LCDC, the Department of Land Conservation and Development (DLCD) developed *Planning for Natural Hazards: Oregon Technical Resource Guide* to help communities appraise and potentially improve the effectiveness of the natural hazard planning element in their comprehensive plans. The guide also provides useful information on how to identify and plan for a variety of natural hazards, and implement programs to address them. The publication is available online at http://www.lcd.state.or.us/hazhtml/Guidehome.htm.

Regulatory

- **Executive Orders, ordinances, and other directives.** The governing body or local executive often has the authority to issue directives to require departments and agencies to carry out certain hazard mitigation actions. Using one of these mechanisms, the governing body or executive can direct department heads to provide progress reports to the planning team on the hazard mitigation initiatives that the departments are responsible for carrying out.
- **Comprehensive planning.** Adding a hazard element to the comprehensive plan is one of the most effective mechanisms to institutionalize hazard mitigation for new construction. For communities with a comprehensive plan, *Getting Started* (FEMA 386-1) listed several reasons why a community should integrate mitigation planning and comprehensive planning. A primary benefit of combining these processes is that they both influence the location, type, and characteristics of physical growth, specifically buildings and infrastructure. While planning in and of itself may not be regulatory, it uses regulatory mechanisms (zoning, development ordinances, etc.) for implementing goals and objectives. Additionally, in many parts of the country, the comprehensive planning process is an established activity that is already familiar to the public, and it usually generates a great deal of interest and public participation.

2. Secure traditional sources of financing.

In Phase 3 of the planning process, potential sources of funding to implement the priorities in your mitigation strategy were identified. Now that the plan has been adopted, you have a strong basis for obtaining these resources. Communities and states have a range of tools to finance projects. Use of fees, taxes, bonds, and loans to finance projects are options if there is proper state enabling legislation, local author-

ity, and enough political will. Once the plan has been adopted, there is a legitimate basis for initiating the process required to use these financial tools.

All of your plan's mitigation recommendations probably cannot be implemented using local funding sources. Furthermore, it may take some time to work through the legal and administrative processes to use proceeds from bond issues and similar vehicles. To supplement local funds, communities can apply for grants from federal or state governments, nonprofit organizations, and foundations, as well as seek funding from other private sources. The advantage of applying for grants is that they do not have to be paid back or generate long-term debt; however, most federal grants require state and/or local governments to provide some matching funds.

State and federal grants are a logical source of funding for some of the larger, more costly mitigation initiatives. Many federal grant mechanisms allow local "in-kind services" as a match for federal dollars, as well as the possibility of using state grant funds to meet the local match requirements. Review your capability assessment from Phase 3 and consider looking to regional planning agencies, universities, or economic development districts, if present and active in your state, for research or grant-writing technical assistance. The adjacent sidebar describes three major FEMA mitigation grant programs. Don't forget the potential of other federal grant programs for community development, even if they are not specifically disaster or mitigation related—the U.S. Department of Housing and Urban Development's Community Development Block Grant (CDBG), for example. For more on funding sources, see *Planning for a Sustainable Future: The Link Between Hazard Mitigation and Sustainability* (FEMA 364), and the *Mitigation Resources for Success CD* (FEMA 372).

3. Develop creative partnerships, funding, and incentives.

Incentives that minimize financial or administrative burden can stimulate momentum to undertake mitigation initiatives. For example, states and communities can provide tax rebates for code upgrades, offer reduced property taxes and insurance premiums for citizens and businesses that take steps to lower their exposure to hazards, or provide low interest loans for retrofit projects.

Some states, tribes, and communities have developed creative ways to get things done without spending a lot of their money. These

Three FEMA programs that provide funding for hazard mitigation actions are the **Pre-Disaster Mitigation Program (PDM), Flood Mitigation Assistance Program (FMA), and the Hazard Mitigation Grant Program (HMGP).** Web access to information on these programs is available at www.fema.gov/fima/.

- PDM, authorized under DMA 2000, provides pre-disaster funding to states, tribal, and local governments, and tribal organizations for mitigation planning and projects through a competitive process. A FEMA- approved mitigation plan is required to receive project funding. Check with your FEMA Regional Office or SHMO for the latest information on availability of funds.
- FMA provides annual grants to communities, tribes, and states to reduce the risk of flood damage to structures with flood insurance coverage. This funding is available for mitigation planning, implementation of mitigation actions, and technical assistance. An approved flood mitigation plan is required to receive project grants, but is not required for planning or technical assistance grants. Interim final regulations implementing this program can be found at 44 CFR Part 78.
- HMGP provides post-disaster grants to states, tribes, and local governments to implement long-term hazard mitigation actions after a major disaster declaration. FEMA can fund up to 75% of the eligible costs of each project, and up to 7% of HMGP funds available per state may be used for planning. An approved mitigation plan is required to receive project funding. See Interim Final Rules at 44 CFR §201 and §206.

governments have engaged untapped resources by developing relationships with businesses, nonprofit organizations, and volunteers. Time spent earlier in the planning process developing relationships with citizens, businesses, and other communities can really pay off at this point in the process (see *Getting Started*, FEMA

Some examples of different types of partnerships that can provide funding or other resources to implement hazard mitigation actions are provided below. See *Mitigation Resources for Success* (FEMA 372) for additional examples and a more detailed discussion of funding mitigation actions.

Public-Private Partnerships. Partnership agreements between local governments and businesses or organizations can be advantageous for all parties involved. Private organizations and businesses routinely offer discounted or free goods and services to local governments in exchange for publicity or other benefits. In the end, the governments, organizations, businesses, and the public can all benefit from working together. Examples of successful public/private partnerships include the following:

- In Houston, Texas, FEMA and two prominent home improvement stores teamed up to provide information and advice on cleaning up and rebuilding after flooding caused by Tropical Storm Allison. FEMA Hazard Mitigation Teams staffed booths at both stores for three days, providing information on mitigation methods and techniques and the importance of flood insurance. By providing space, the stores played an important role in promoting community awareness of flooding hazards and helped foster public involvement in recovery.
- In Kinston, North Carolina, affordable housing was disproportionately affected by Hurricanes Fran and Floyd. The Permanent Housing Initiative, a partnership between the North Carolina Division of Emergency Management, the North Carolina Department of Corrections, and private sector home improvement companies, was formed to help address the housing shortage and subsequent housing acquisitions. Using a Habitat for Humanity housing model, energy efficient and hazard-resistant affordable housing was constructed in already established neighborhoods. Homes were constructed by volunteers using prefabricated wall panels (made by prison labor experienced in construction) and other donated tools and materials. The foundation, electrical system, and ductwork were done by certified professionals.
- In an effort to promote awareness of hurricanes and flooding in the coastal community of Virginia Beach, Virginia, the city held a Home Safety and Preparedness Exposition that included a section devoted to building disaster-resistant communities. More than 20 local businesses and organizations and the Virginia Department of Emergency Management sponsored the event. In return, sponsors were given display booths at the event to promote their goods and services.

Community Volunteers. State and local governments rely upon their citizens to perform work that might otherwise have to be paid for by money from government coffers. Some governments have institutionalized volunteerism by requiring students to contribute volunteer hours to local and regional initiatives. Others have partnered with nonprofit agencies, organizations, schools, and businesses to give their time and energy to help further community goals.

- Citizen Corps is a program within the USA Freedom Corps that promotes several initiatives to engage volunteers in Homeland Security efforts, including mitigation actions, across the country. These community-based efforts include Community Emergency Response Teams (CERTs), Neighborhood Watch, Volunteers in Police Service, Operation TIPS, and the Medical Reserve Corps.
- Following flooding in 1993, the City of Petersburg, Illinois, bought out riverfront property that had been flooded and engaged a group of high school students, the Community Problem Solvers (CmPS), to formulate a creative solution for rehabilitating the area as perpetual open space. The CmPS developed a garden and a preschool playground, a solution that was responsive to the needs of the neighborhood, city government requests, and federal government requirements. To fund the project, the CmPS team applied the same initiative and creativity that they had used to design it. The team organized a "Decorate an Abe" contest in honor of former Petersburg resident Abraham Lincoln. Area businesses sponsored and decorated Abe silhouettes, and residents paid to vote for their favorites. The "Abes" were later auctioned off to raise additional funds. In addition, the team designed and sold Historic Petersburg placemats. Volunteers from civic organizations donated funds to sponsor specific pieces of playground equipment, and a local business donated Lincoln Bears to be sold. Preschool children participated in a clean-up day at the site. Overall, many Petersburg residents

contributed their funds, talents, and energy to make the project successful. The CmPS members not only helped minimize its community's vulnerability to flooding, they did it in a way that promoted community pride and civic involvement.

- Oakland, California, developed a community partnership called Safety and Future Empowerment (SAFE). Two initiatives, the Week of Caring and Spring Break, brought together city firefighters, corporate employees, students, the California Office of Emergency Services, and AmeriCorps members to make homes in the community safer and less vulnerable to earthquakes and fire. Four volunteer teams spread out across the city for a week to make the homes of elderly and low-income residents more disaster resistant. The teams installed smoke alarms and cupboard latches, strapped water heaters and free-standing cabinets to house frames, and rigged safety releases on window security bars. Local businesses donated or provided supplies at reduced costs in support of the effort.

State cooperation. Local governments often underestimate the wealth of resources that their states can provide. States are excellent sources of funding, support, and technical assistance. State geological surveys, water resources agencies, and departments of planning or natural resources often have useful data related to hazard identification and risk assessments. Your state may also have a GIS department that can provide data and support.

Unfortunately, localities sometimes pay for studies that have already been conducted by the state. You can avoid these duplications by inviting your state officials to participate in the planning process to help ensure that studies or reports can be compiled from readily available sources.

State fairs and other state-sponsored events can be great places for displays on hazard reduction techniques and hazard awareness campaigns. States can further help publicize awareness and generate interest by declaring a Hazard Awareness Week and promoting related local events on their Web sites.

In-kind resources. Federal or state grants often require the awarded locality to provide matching funds to cover a percentage of hazard mitigation project costs. In-kind resources, however, substitute monetary outlay with services that the community can perform. For example, HMGP pays up to 75% of the eligible costs of a hazard mitigation project, but the remaining amount must also be contributed to the project by non-federal sources. A municipality without sufficient resources can ask the state to help fund the match through state or Community Development Block Grant funds, or it can use in-kind resources. In-kind resources can be labor or salaries contributed toward the implementation of the project (such as technical or administrative support from community officials and personnel). The dollar value of the resource must be calculated, and those costs must be allowable under the grant. Communities can have quite a bit of leeway in developing sources of in-kind resources; however, your state's specific program requirements must be verified first. Federal regulations regarding in-kind matches for FEMA's grant programs can be found at 44 CFR §13.24.

386-1). For more details on funding and creatively using planning resources, see FEMA 372, *Mitigation Resources for Success.*

Task C. Monitor and document the implementation of your projects and actions.

As mentioned earlier, the planning team must continuously monitor and document the progress of the plan's recommended actions. This documentation is essential for determining the progress made on the hazard mitigation initiatives.

The planning team may decide to ask the agencies, departments, organizations, or people with duties identified in the mitigation strategy to periodically submit a work progress report on those projects being implemented. This report will come in handy at evaluation time. If there is a problem with the project or program, the planning team will be better able to pinpoint where the prob-

lem lies. An example of the report agencies could use should include the following information:

- The hazard mitigation action's objectives;
- Who the lead and supporting agencies responsible for implementation are;
- How long the project should take, including a delineation of the various stages of work along with timelines (milestones should be included);
- Whether the resources needed for implementation, funding, staff time, and technical assistance are available, or if other arrangements must be made to obtain them;
- The types of permits or approvals necessary to implement the action;
- Details on the ways the actions will be accomplished within the organization, and whether the duties will be assigned to agency staff or contracted out; and
- Current status of the project, identifying any issues that may hinder implementation.

Requiring the responsible parties to explain exactly how and when the project or programs will be carried out helps determine the extent of the project's progress. It also helps break the implementation process into smaller, more manageable tasks. The responsible agency, department, or organization can decide the particulars of incorporating these additional considerations into their daily operations, while the planning team will know what to expect and when to expect it. See **Worksheet #1: Progress Report** to help you monitor progress.

Task D. Establish indicators of effectiveness or success.

In Step 3, you will measure or evaluate the effectiveness of your mitigation project and initiatives. It will be important to establish measurable indicators of effectiveness now so that those involved in the projects understand how their actions contribute to the success of the projects. Indicators should be tied to the goals and objectives of the plan and its projects. They are often expressed as numerical representations of planning objectives.

For example, if an objective of the planning process is to increase community participation in risk reduction, and a related initiative includes an outreach program to introduce new partners to

Worksheet #1 Progress Report step 2

Progress Report Period: October 1, 2003 (date) to December 31, 2003 (date)

Project Title: Raging River Views Park Flood Acquisition Project Project ID#: HVMP-2003-01

Responsible Agency: Hazardville Department of Planning

Address: 1909 Burnham Way

City/County: Hazardville, Emergency

Contact Person: Eunice Euclid Title: Grants Administrator

Phone #(s): (555) 555-8473 email address: eeuclid@town.hazardville.em

List Supporting Agencies and Contacts:

Hazardville Department of Housing: Noah Hudson (555) 555-8465

Hazardville Habitat for Humanity: Carter Goodman (555) 555-9432

Total Project Cost: $360,000

Anticipated Cost Overrun/Underrun: $N/A

Date of Project Approval: July 21, 2003 Start date of the project: November 15, 2003

Anticipated completion date: Summer 2005

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase):

Acquire and demolish 14 structures located at the Raging River Views Park. Work with Habitat for Humanity and the Department of Housing to construct new housing or rehabilitate existing housing for displaced low-income residents. The Department of Housing will also provide funds for temporary housing to displaced residents.

Milestones	Complete	Projected Date of Completion
Conduct surveys of ground and first-floor elevations	✓	
Obtain Notices of Intent by owners	✓	
Conduct structure appraisals	✓	
Send letters of offer to homeowners		1/31/04
Perform title work		3/30/04
Acquire structures		6/30/04
Begin construction of new housing or reconstruction of existing housing for relocated residents		6/30/04
Send payment for relocation to renters		9/30/04
Finalize contract for demolition		1/12/05
Demolish structures		4/26/05
Landscape open parcels		6/30/05

Plan Goal(s)/Objective(s) Addressed:

Goal: Minimize losses to existing and future structures within hazard areas.

Objective: Reduce potential damages to the manufactured home park in the floodplain.

Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

Losses Avoided. After a major flood (100-year), the Department of Economic Development will assist the Planning Department in calculating the losses avoided.

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

- [x] Project on schedule
- [ ] Project completed
- [ ] Project delayed*

*explain: _____

_____

- [ ] Project canceled

Project Cost Status

- [x] Cost unchanged
- [ ] Cost overrun*

*explain: _____

_____

- [ ] Cost underrun*

*explain: _____

_____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

The Department of Planning contacted the owners of the properties vulnerable to floods to determine their willingness to sell their properties. Of the 14 property owners contacted, 10 agreed to have their homes acquired. An appraiser contracted by the Department of Planning estimated the value of the 10 properties.

B. What obstacles, problems, or delays did you encounter, if any?

The owners of four properties refused to sell. There has been some limited neighborhood opposition to various suggestions for the community open space created by the acquisitions.

C. How was each problem resolved?

The Department of Planning has proposed to the residents a design charrette to develop alternatives for the open space that would be created, with the understanding that no permanent structures can be constructed on the open parcels after acquisition and demolition has been completed. Recreational activities will be limited to passive uses such as trails and bike paths.

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

1. Send offer letters to homeowners.
2. Do title work.
3. Work with the Department of Housing and Habitat for Humanity to identify existing housing for rehabilitation and viable vacant parcels to construct new housing for the displaced residents.

Other comments:

None

Adapted from the North Carolina HMGP Progress Report Form at http://www.dem.dcc.state.nc.us/mitigation/document_index.htm.

mitigation, an indicator could be the number of organizations that are on the planning team.

Task E. Celebrate success.

It is important to maintain community support throughout the implementation process. One particularly effective technique is to simply keep the community informed about the incremental progress and success of the program. Sharing the findings of progress reports with interested organizations, neighborhood groups, elected officials, and citizens keeps stakeholders up-to-date on your accomplishments and possible setbacks. Posting these findings on your local Web site or including them in your newsletter will help everyone stay informed of your progress. Consider holding events to recognize key milestones to keep the public interested. Step 3 contains more information about how to maintain this important part of the overall effort.

Summary

Implementation is the culmination of the initial planning process. Monitoring progress and maintaining momentum is key to ensuring success of the planning process. Through the implementation of your plan, you will draw upon the diverse resources of your state, tribe, or community. While many of the tools you use already exist in one form or another, your team should try to use as much creativity and resourcefulness as possible to advance your plan's goals and objectives.

The Hazardville Post

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Hazardville Partnership Completes First Home

(Part 2 of a 4-Part Series on the Hazard Mitigation Implementation Process)

[Hazardville, EM] "Yep, that's my new house," Susan Harris grinned. "I can't believe how great it looks!" As Mrs. Harris showed off the interior of the nearly completed house, she noted where her furniture would go. "I would have put my mother's sideboard over here," frowning as she pointed to a spot in the dining room, "but it was ruined in the flood in 2002. It had been passed down from her mother, and I had wanted to pass it down to my daughter."

Mrs. Harris is just one of the residents of Hazardville affected by flooding in 2002. She and nine of her neighbors have had their homes bought by the town and are working with town, state, and federal officials to build new homes out of the floodplain. "My house really wasn't worth very much, and I don't have enough income to handle a big mortgage payment," Mrs. Harris said, "but the town has been working with the Hazardville Habitat for Humanity to help me build a new one."

Habitat for Humanity requires contributions of "sweat equity" in order to be eligible for participation in their program. Mrs. Harris claims that thanks to her contribution she is now quite capable of fixing just about everything in her new home. "Since my husband passed away almost 10 years ago, I have had to rely on my friends to help out with even simple repairs. Now that I have helped with the construction of several of my neighbor's houses I am very comfortable using all kinds of tools!" Mrs. Harris is so comfortable with her new skills that she is thinking about building her own shed after she gets settled.

"The process is working!" beamed Joe Norris, lead planner for Hazardville. Norris, referring to the hazard mitigation plan adopted by the town in 2003, pointed to the emphasis the Town of Hazardville Organization for Risk Reduction (THORR) had placed on reducing flooding and disaster-related damages to existing structures while recognizing the needs of residents with limited resources. Part of that emphasis was on creating and following through with community partnerships.

The Town of Hazardville Partnership for Disaster Mitigation is a partnership of nonprofits, businesses, and local, state, and federal agencies. The Partnership is an initiative that Hazardville established in 2003, following adoption of the hazard mitigation plan. Each partner contributed something to the effort. Funding from the FMA program was used to purchase ten repetitive loss structures. Local businesses contributed to the project by donating building materials and supplies. Community volunteers worked throughout the summer to make this a reality for Mrs. Harris and the other homeowners.

step 3


1
adopt the mitigation plan
2
implement the plan recommendations
evaluate your planning results
4
revise the plan

3 evaluate your planning results

Overview

The evaluation step of the planning process allows the planning team to review the plan, the planning process, and the results of implemented actions. The evaluation assesses whether the planning process and actions have been effective, if the community's goals are being reached, and whether changes are needed. The planning team should periodically evaluate the community's progress in implementing the plan. Regular evaluation keeps the community informed of the plan's status and, ideally, keeps those responsible for implementing the mitigation actions motivated. These periodic evaluations may reveal the need for small changes that may not be necessary to incorporate into the plan annually, but that accumulate over time until large-scale revision to the plan is needed (see Step 4, *Revise the Plan*).

Communities that commit to conducting periodic evaluations give themselves the opportunity to determine the effectiveness of their procedures and recommendations, identify new areas of concern, and renew enthusiasm for the cause of hazard mitigation. This step will show you how to keep the planning team, the planning process, and the implementation actions effective. The result is a hazard mitigation process that people have confidence in, and are willing to support.

What you learn in this evaluation will be used to determine whether or not to revise the plan document, to be described in Step 4. By looking impartially at what took place the previous year, the planning team will create a foundation on which to base its revision of the plan and a trigger to re-invigorate the cause for hazard mitigation in the community.

DMA

DMA 2000 requires communities to evaluate their hazard mitigation plan at least every five years. The way in which this is to be done must also be documented in the plan. By including a provision in the adoption mechanism to evaluate the plan and the implementation process, you have a built-in mechanism to institutionalize and sustain the mitigation initiative beyond the creation of the original document.

Communities that want credit for their hazard mitigation plan under the Community Rating System (CRS) must evaluate their plan annually.

The plan should also be evaluated and revised following disasters, to determine if the recommended actions are appropriate given the impact of the event. The risk assessment should also be revisited to see if any changes are necessary based on the pattern of disaster damages.

According to DMA 2000 requirements, states that want to be eligible for the 20% share of HMGP funds must develop a process to assess the effectiveness of a mitigation activity after its completion.

The evaluation phase should not be anticipated with anxiety. If the planning team, citizens, government, and other stakeholders have diligently implemented the recommendations, the evaluation phase will give the community reasons to celebrate the success of its mitigation efforts.

Procedures & Techniques

Task A. Evaluate the effectiveness of the planning process.

To evaluate the results of your planning efforts, begin by stepping back and looking at the big picture. Governments must be highly accountable to their citizens and able to defend their decisions. Evaluating the planning process is a good way to discover if the plan is working for the good of your state, tribe, or community. A review of the planning process will give you an idea of how successfully mitigation has been integrated into your normal administrative processes so far, and what procedural areas may need to be refined or changed.

DMA 2000 regulations do not require annual evaluations. The recommendations presented here will help you to meet the five-year local update requirements.

The first year of the planning process is the most critical because you are beginning to implement the plan. While the energy and momentum generated during this phase of planning are still present, your state, tribe, or community may have established an annual review process at the time of adoption to address the unanticipated problems that may affect the success of your planning efforts. An annual review is also a good opportunity to reflect on whether certain relationships developed during the process should be enhanced, and to initiate new partnerships based on experiences from developing and implementing the plan. The planning team should take this opportunity to reflect on the processes used so far to engage partners and the public, to develop loss reduction priorities, and to finance projects.

1. Reconvene the planning team.

The first step in evaluating the plan is to reconvene the planning team. Ideally, the planning team was established as a permanent working group within your state, tribe, or community to oversee the development and implementation of the mitigation strategy. Even after the plan is adopted, the planning team should meet at least semi-annually to review the progress of the mitigation planning efforts.

At this point, however, your team may want to think about inviting new stakeholders to join during the evaluation. These meetings are a good opportunity to bring new members up to speed on the planning team's history, mitigation strategy, and planning process. Use **Worksheet #2: Evaluate Your Planning Team** to assist you in this task.

Worksheet #2 Evaluate Your Planning Team step 3

When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		✓
Comments/Proposed Action: NA		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?	✓	
Comments/Proposed Action: Hazardville Habitat for Humanity has been invaluable in assisting the relocation of former Raging River Views Park residents. The organization should be invited to participate in THORR.		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?	✓	
Comments/Proposed Action: It is essential that the Department of Public Works be represented at each meeting because so many mitigation actions involve them. However, representatives from the department have been unable to attend meetings consistently since the development of the plan. THORR will work with the departments director to find consistent, active representation.		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?	✓	
Comments/Proposed Action: Again, the Department of Public Works has been unable to provide timely progress reports of its mitigation actions. Administrative duties and paperwork have fallen through the cracks since the department has been assigned numerous new duties in Hazardville's mitigation efforts. Perhaps the department, in partnership with THORR, should approach the Town Council for funding for more department staff.		
Are there ways to gain more diverse and widespread cooperation?	✓	
Comments/Proposed Action: THORR members believe that better publicity about mitigation actions will garner more interest from the public, affected/interested organizations, and state agencies.		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?	✓	
Comments/Proposed Action: THORR has learned about new PDM funding. The state has asked that local jurisdictions submit applications for brick and mortar projects and risk assessments studies.		

If the planning team determines the answer to any of these questions is "yes," some changes may be necessary.

2. Review your planning process.

One of the first areas for the planning team to assess is the planning process itself. With a year of hindsight, you can now step back and see what you would have done differently had you known what you know today. Look at each of the key elements of your planning process, such as building the planning team, engaging the public, gathering data to conduct your risk and capability assessments, and coordinating with other agencies, and determine how well they worked. The following are some suggested questions to ask:

a. Building the Planning Team. In continually building your planning team, have you left anyone out? Are there roles that need to be clarified or better defined? Has the planning team met as agreed upon? Have meetings been productive? Are procedures for implementing, monitoring, and evaluating the plan being followed? Are the lead agency and staff still able to play the lead? Again, Worksheet #2 will help with this task.

b. Engaging the Public. When looking at public involvement, you may need to conduct a survey to gauge how the public perceived your planning effort. Determine whether stakeholders and citizens felt that they had enough opportunities to provide input; the extent to which they are now aware of their hazards and are willing to support your efforts; what they think of the progress you are making; and whether outreach efforts—public meetings, workshops, Web site, newspaper notices, etc. were effective. Ask them what they would like to see done differently to involve them or keep them informed. In many cases, this may be a matter of simply asking residents if they now understand what hazards they are susceptible to, and what "hazard mitigation" means to them.

c. Data Gathering and Analysis. Are data gathering procedures working? Did someone follow up with the local university or other agencies to obtain research findings or reports that were not available during the planning process? Have team members provided copies of studies that their agencies or organizations completed? Are there more efficient methods of collecting data and maintaining up-to-date information from established sources?

Evaluating Public Involvement in Hazard Mitigation

Surveys are a good tool to assess how well your public education and outreach projects are working, how the community perceives your hazard mitigation planning efforts, and to obtain feedback on proposed mitigation actions. Following are a few sample questions to ask:

- Do you have a greater understanding of the hazards to which you are susceptible? On a scale of 1-5 (1=very little; 5=a great deal), how much more do you know than you knew before planning efforts began?
- Do you now have a greater understanding of what you and your community can do to lessen the effects of natural hazards? (1=very little; 5=a great deal)

d. Coordinating with other Agencies. How well did coordination work? Did agencies have sufficient notice for meetings? Did they have enough time to review the draft plan? Have agreements been followed? Do MOAs need to be revised, due to changes in funding, priorities, staffing, or other events?

Look at what worked and what didn't as you prepared and implemented the plan, and identify ways to improve the process.

Task B. Evaluate the effectiveness of your actions.

Measuring the effectiveness of your programs, policies, practices, and projects is another important element of your evaluation. If your plan called for strategies with a relatively short implementation time frame, their overall success can be evaluated if they have been completed. Additionally, you can assess actual losses avoided as a result of projects implemented following a disaster. Most mitigation projects, however, are done gradually, as resources and conditions allow. The progress to date of these projects can therefore be evaluated by reviewing whether the project is on time, in line with the budget, and moving ahead as planned. Now is the time to gather data to assess your progress toward meeting your objectives, and ultimately meeting your plan goals. This is also a good time to pull together the progress reports agencies submitted to you periodically. These will enable you to answer the questions that follow and help your planning team evaluate how effective the mitigation projects and actions have been. Use **Worksheet #3: Evaluate Your Project Results** to assist you in completing this task.

1. What were the results of the implemented actions? Did the results achieve the goals/objectives outlined in the plan? Did the actions have the intended results?

Review the goals and objectives of your plan. Be able to show how (or whether) the project met the objective it was designed to achieve. This is where you can measure the results of the project against the identified indicator of success.

Sometimes projects have unintended results, which can be good if they provide an extra benefit to the state or community, or not as good if they did not achieve or protect everything to the extent planned. Examples of unintended results can extend to environmental, social, or economic impacts.

If you received federal funds for the project, you have been submitting quarterly reports to the responsible agency on its progress. These quarterly reports will be very helpful in showing the project's current status, such as percentage complete, total project costs obligated versus amount spent, problems with implementation, and anticipated completion date.

Worksheet #3 Evaluate Your Project Results step 3

Project Name and Number:

Raging River Views Park Flood Acquisition Project (HVMP-2003-01)

Project Budget:

$360,000

Project Description:

Acquisition and demolition of 14 flood-prone structures

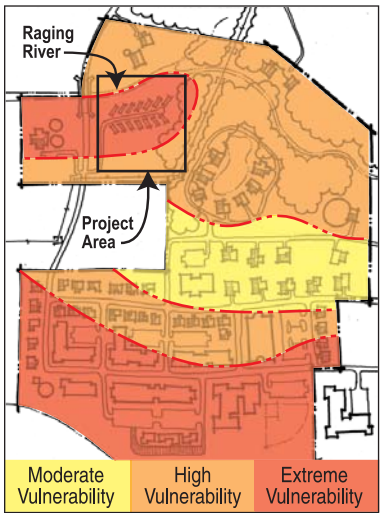
Associated Goal and Objective(s):

Goal: Minimize losses to existing and future structures within hazard areas

Objective: Reduce potential damages to the manufactured home park in the floodplain

Indicator of Success (e.g., losses avoided):

Losses avoided by acquisition and demolition of flood-prone structures



Town of Hazardville Composite Loss Map developed previously during risk assessment (see FEMA 386-2).

Was the action implemented? ☑ **YES** ☐ **NO**

IF NO

Why not?	**YES**	**NO**
Was there political support for the action?	☐	☐
Were enough funds available?	☐	☐
Were workloads equitably or realistically distributed?	☐	☐
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	☐	☐
Was the estimated time of implementation reasonable?	☐	☐
Were sufficient resources (for example staff and technical assistance) available?	☐	☐

IF YES

What were the results of the implemented action?

Of the 14 proposed properties, 10 were acquired. The benefit-cost ratio is 2.19, based on project benefits of $789,000 and costs of $360,274. Benefits are based on the net present value of the avoided damages over the project life. Furthermore, about 40 people are no longer in the path of a potential flood, making emergency rescue operations in that area less likely and evacuation easier.

	YES	NO
Were the outcomes as expected? If No, please explain:		✓
The project originally set out to acquire 14 properties. Four of the 14 owners did not want to participate in the buyout program.		
Did the results achieve the goal and objective(s)? Explain how:	✓	
Despite four properties still in harm's way, the objective has been largely met. See additional comments.		
Was the action cost-effective? Explain how or how not:	✓	
The FEMA Limited Data module was used to perform the benefit-cost analysis. Data for the analysis was collected from historical flood data and used as benchmarks in the before mitigation section of the analysis. The damages after mitigation section was left blank, due to the properties being permanently acquired, and the economic risk removed completely. The analysis resulted in a benefit-cost ratio of 2.19, with benefits totaling $789,000 for 10 properties.		
What were the losses avoided after having completed the project?		
Total avoided losses are $789,000 over the lifetime of the project (estimated at 100 years).		
If it was a structural project, how did it change the hazard profile?		
N/A		
Additional comments or other outcomes:		
The Planning Department has agreed to work with the remaining four homeowners in evaluating other flood-proofing options.		

Date: October 12, 2005

Prepared by: Hazardville Department of Economic Development

Hazardville Department of Planning

Sample Indicators to Measure Progress in Reducing Risk

There are a variety of ways to measure effectiveness of mitigation actions. You can look at dollar amounts in losses avoided, both expected (prior to implementing a project) and actual (following a disaster). You can also look at how the mitigation actions have changed the number of households, businesses, critical facilities, and environmental assets that are at risk. Some other indicators are listed below.

For more on indicators, see the publication *Hazard Mitigation in North Carolina: Measuring Success*, Chapter 6 available online at http://www.dem.dcc.state.nc.us/Mitigation/Library/Success_Stories/Measuring_Success_Vol2/Chapter6.pdf.

Housing	**Business**
Number of households living in unsafe areas.	Number of businesses in unsafe areas.
Number of households living in structures that are vulnerable to natural hazards.	Number of businesses in unsafe structures.
Number of repetitively damaged houses.	Number or percentage of businesses that have purchased adequate insurance to cover property casualty, fire, liability, loss of revenue, and flood damage.
Losses avoided as a result of the implementation of acquisitions.	
Losses avoided as a result of the implementation of elevations-in-place.	Number or percent of businesses that have conducted a business impact analysis, and have developed and implemented a business risk reduction plan.
Infrastructure and Critical Facilities	**Environment**
Number of infrastructure elements – water supply, roads, bridges, sewerage, telecommunications, port facilities – that are located in areas that are hazard-prone.	Number of unsafe land use activities that take place in the 100-year floodplain or in environmentally sensitive areas.
Number of repetitively damaged infrastructure elements.	
Number of critical facilities – hospitals, emergency operations centers, police and fire stations, schools – that are located in areas that are hazard-prone.	Number of commercial or industrial facilities in the 100-year floodplain that have undertaken structural or non-structural mitigation measures.
Number of repetitively damaged critical facilities.	

Source: Hazard Mitigation in North Carolina: Measuring Success, February 2000.

2. Were the actions cost-effective? Did (or would) the project result in the reduction of potential losses?

It is not always enough to say whether an action was generally effective or not, especially when considering publicly funded projects. This is particularly true for mitigation actions that may require a subsequent hazard event to truly determine effectiveness. Absent an event, the potential losses avoided can be estimated for most "brick and mortar" mitigation projects. The term "brick and mortar" mitigation actions in this context refers to projects such as retrofit, acquisition, demolition, or relocation, and flood works such as levees, dams, and floodwalls.

One of the most important indicators to evaluate the effectiveness of mitigation actions undertaken by the state, tribe, or community is **Losses Avoided**. This indicator provides a dollar value estimate of the structural, content, and displacement costs that would have occurred if the mitigation action were not taken. The losses avoided are most easily estimated for structural mitigation actions. Surveys and qualitative statements may have to suffice as indicators for educational or regulatory actions and to address other objectives that may be associated with specific mitigation actions.

If the cost-effectiveness of the hazard mitigation projects implemented was originally determined by benefit-cost analyses (BCA), the planning team may consider reviewing the old BCA to determine whether the costs and benefits were close to what was estimated, or whether there were unforeseen costs or benefits. The point of revisiting the BCA is to re-calculate what losses would actually be reduced if the event were to occur. If possible, repeat relevant portions of the risk assessment to see if the project reduced potential losses. If HAZUS was used to develop the initial loss estimate, you may want to re-run it using the post-project results.

An initiative that did not have a BCA performed still can be objectively evaluated for its cost-effectiveness. Projects that do not lend themselves to benefit-cost analyses (e.g., education and outreach campaigns) or those projects where public values and ethical considerations ended up weighing more heavily on the final selection of an action than the results of a BCA, may require other methods, such as surveys, to gauge their effectiveness.

Whether you used BCA or other defensible methods to determine the cost-effectiveness of your actions, remember to document your results. Citizens, as well as state, local, and federal officials, will want to know of the losses avoided or benefits gained from your

Displacement Costs

The dollar amount it would cost for a function (business or service) to be relocated to another structure because of a hazard event. In the case of residents, this would be the cost to relocate individuals or families to temporary housing.

Cost-effectiveness is a key evaluation criterion for federal grant programs. Cost-effectiveness has several possible definitions, although for grant-making purposes FEMA defines a cost-effective project as one whose long-term benefits exceed its costs. An easier way to say this is that a project should prevent more expected damages over the course of its effective "life" than it costs to fund the effort. This is done to ensure that limited public funds are used in the most efficient manner possible. Benefit-cost analysis is one way to illustrate that a project is meritorious and deserves funding.

Be sure to stay in touch with your state on a regular basis to ensure that you remain aware of any changes to state mitigation goals or priorities. Similarly, states must communicate such changes to all localities.

implemented actions. Let them know that their tax dollars are being well spent.

3. Document actions that were slow to get started or not implemented.

It is important to include a discussion of why certain actions were slow in getting underway, never finished, or didn't get started at all. The project may have been delayed or removed from the list of actions because of an unforeseen problem with the implementation. In the case of an elevation, acquisition, or relocation project, for example, the voluntary nature of the program gives the homeowner or business the right to change their minds *at any time*, all the way up to just before the physical work on the project begins or any financial compensation has been received.

Task C. Determine why the actions worked (or did not work).

After verifying that an action was or was not implemented and its overall results, the planning team should try to document why the action worked or did not work. If a mitigation activity or project was unsuccessful, it is important to ascertain why so that more appropriate alternatives can be developed next time. If a mitigation project ends up being only partially implemented, it is important to get to the root cause, such as exceeding the budget. On the other hand, be sure to evaluate and document what did work successfully, and why. Understanding the factors that contributed to the success of a project, program, or policy is particularly important when you want to replicate or expand it. Use **Worksheet #3** to complete this task.

Several considerations to examine include:

- Availability of resources;
- The political or popular support for or against the action;
- The availability of funds;
- The workloads of the responsible parties; and
- The actual time necessary to implement the actions.

Be sure to publicize this information to other communities within the state. Don't be shy about it, either—let other states and FEMA know about your successes! If possible, also communicate caveats and warnings as a result of less positive outcomes. Everyone will benefit from lessons learned.

After a Disaster Strikes

If a disaster strikes after you have completed your hazard mitigation plan, don't let the document sit on the shelf—it is a valuable resource for the long-term recovery and reconstruction of your community. The initial period following a disaster can be very chaotic. So many issues require attention that any thoughts of long-term recovery are crowded out by immediate recovery efforts. Critical life and safety issues come first: search and rescue operations, treating the injured, re-establishing vital public services, and providing emergency shelter. But once the task of clearing debris is well underway, community decision-makers need to shift their attention to long-term recovery. This is the opportunity to reconvene the mitigation planning team and evaluate the list of hazard mitigation priorities in light of the recent disaster.

Critical policy issues that emerge following disasters require local governments to make difficult decisions about how best to rebuild. Disaster victims have an inherent desire to rebuild rapidly and return to normal—to the way things were before the disaster. Communities, however, must balance this need against the objective of building back better and stronger, and use the opportunity of the disaster to improve the community's disaster resilience. Pressure to restore normalcy can be so strong that safety, hazard mitigation, and community improvement goals can be compromised or abandoned. Communities have a very short period of time to introduce, and gain acceptance of, new approaches to reconstruction. The mitigation plan will provide an excellent foundation for introducing these new approaches.

The diagram on the following page shows how a disaster triggers the need to re-evaluate all aspects of the mitigation planning process to determine if changes are now warranted.

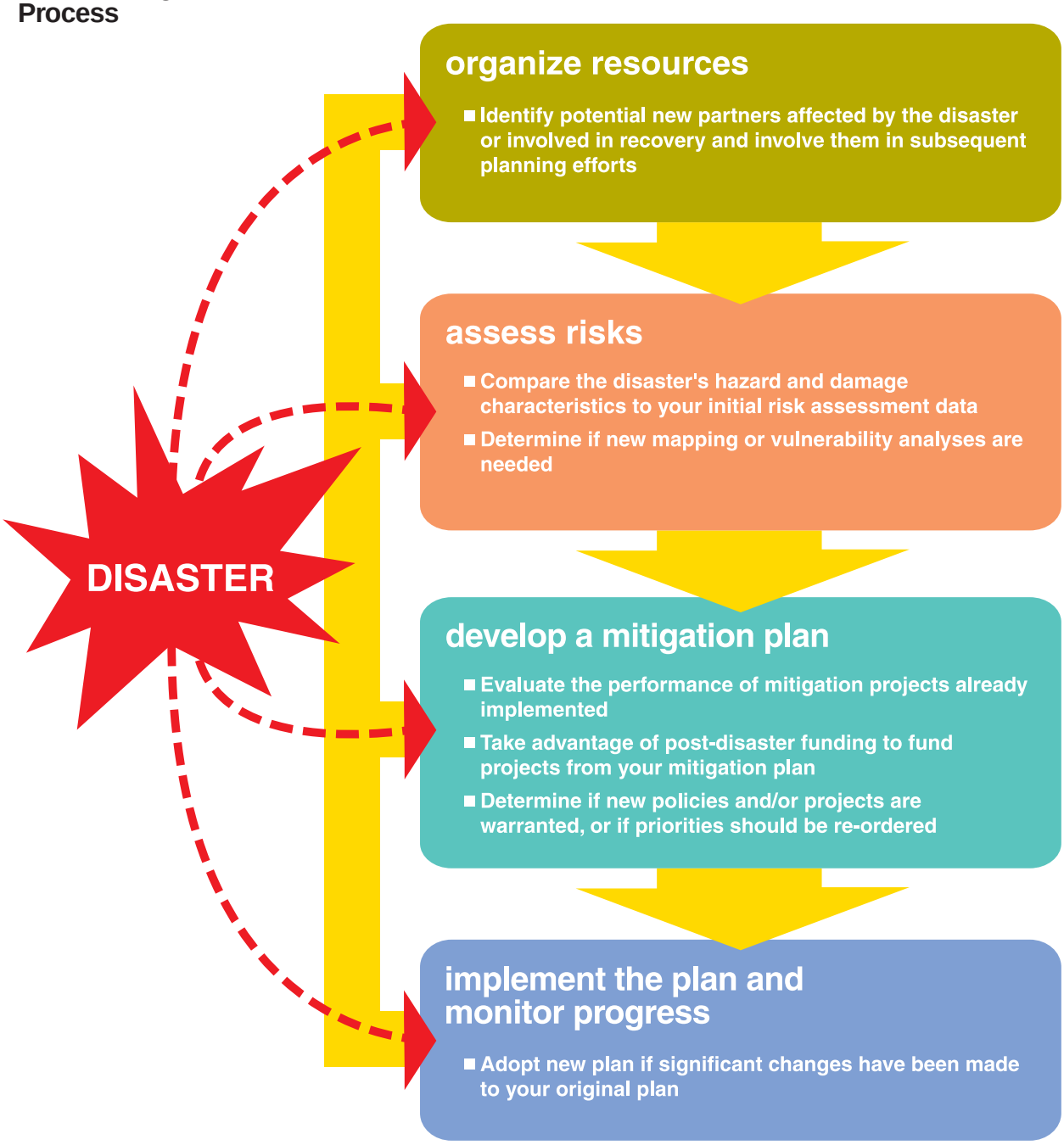
1. What opportunities for hazard mitigation are presented in light of the disaster damages?

If the hazard mitigation plan included a post-disaster recovery and reconstruction component to the implementation strategy, this section of the plan should be the initial focus for the recovery task force. Did the plan anticipate the type and intensity of disaster damages that actually occurred? Are there "off-the-shelf" mitigation actions that are relevant for this recovery effort? Are there other priority hazard mitigation actions that have not been implemented due to a lack of available resources?

(continued on page 3-13)

Identifying potential mitigation projects in a post-disaster scenario is the highest priority task for the planning team or recovery task force and the most time sensitive one. In a major disaster that has a presidential declaration, make sure that the SHMO and FEMA mitigation staff working out of the Disaster Field Office (DFO) have a copy of the hazard mitigation plan and have a clear understanding of community priorities for potential mitigation actions. State and federal mitigation planning staff can provide technical assistance to your community if necessary.

After a Disaster: Re-evaluate Your Mitigation Plan and the Planning Process



Applying for HMGP Funding

The purpose of the HMGP is to reduce the loss of life and property from natural disasters and enable mitigation actions to be implemented during the recovery process following a presidential disaster declaration.

Eligibility. Individual homeowners and businesses are not eligible, but a community may apply on their behalf. State governments, tribes and other tribal organizations, and certain nonprofit organizations are eligible, in addition to local governments.

Project possibilities. All eligible projects must provide a long-term mitigation solution. Additionally, a project's potential savings must be more than the cost of implementation. Funds may be used to protect either public or private property. Examples of possible projects include, but are not limited to: property acquisition and relocation/demolition, retrofitting of structures to minimize damage from natural hazards, elevation of flood-prone structures, and development and initial implementation of vegetative management programs. In addition, hazard mitigation planning initiatives are also eligible.

States prioritize and select project applications; however, all potential projects must meet certain minimum criteria addressing five issues:

1. Does the project conform to your State's Hazard Mitigation Plan?
2. Will the project beneficially impact the disaster area?
3. Does the application meet federal environmental requirements?
4. Does the project solve a problem independently?
5. Is the project cost-effective?

After a disaster declaration, the state will advertise the availability of HMGP funding and provide guidance on eligibility criteria. If you are interested in applying, you should contact the SHMO to find out about the application deadline and about the state's funding priorities.

Choosing a project and submitting your application. Consider your list of potential projects, and then choose the project that conforms to the state's priorities, meets all of the minimum criteria, and can be adequately funded (25% of the total cost). For additional information, contact your SHMO or the FEMA Mitigation Division in your Region, or visit FEMA's Web site at http://www.fema.gov/fima/hmgp. FEMA 345 (*Hazard Mitigation Grant Program Desk Reference*) contains more information as well.

Federal and state agencies may have collected enough information from various sources to determine the reoccurrence interval for the recent event. This indicates the severity or degree of magnitude of the event. Technical assistance may be available to survey high-water marks (in the case of flooding) or to conduct a building performance assessment. Knowing the reoccurrence interval for the hazard will help you reevaluate the accuracy of the hazard information in the current plan. To do this for a flood, for example, you would compare the extent of the actual flooding to existing flood maps to determine whether the maps accurately portray the true hazard scenario.

(continued from page 3-11)

2. Following the initial recovery phase, re-evaluate the hazard profiles and vulnerability assessment.

Did the hazard information presented in the plan reflect the location, intensity, and duration of the recent event? There may be a need to collect additional data regarding the event and incorporate that information into the vulnerability assessment.

3. Following a disaster is a good time to evaluate the results of implemented projects.

How well did your mitigation actions perform? The best time to measure losses avoided is in the aftermath of a recent disaster, when you can actually see the difference that mitigation actions made. For example, if a house was protected from a flood because it was elevated above the Base Flood Elevation (BFE) before a disaster occurred, it should be relatively easy to obtain the actual flood height and determine what kind of damages would have occurred if the house had not been raised. Louisa County, Iowa, and Long Beach, Mississippi, illustrate the losses avoided due to flood mitigation actions implemented after floods in 1993 and 1998, respectively.

(continued on page 3-15)

Louisa County, Iowa

In 1993, a severe flood occurred in Louisa County, located along the Mississippi River, resulting in damage to more than 275 homes and the evacuation of nearly 200 families. Following this flood event, the County used both acquisition and relocation of affected properties to mitigate future flooding problems. In May 2001, the flood pattern of 1993 repeated itself, and the Mississippi River and its tributaries flooded Louisa County yet again. By comparing calculated damages from the 1993 flood to the 2001 flood, the effectiveness of the acquisition and relocation program could be measured. As shown in Tables 1 and 2 below, significant reductions in emergency shelter, family assistance, and public assistance expenditures were realized in 2001 as a result of the acquisitions and housing relocations that occurred in the aftermath of the 1993 flooding.

Furthermore, Table 3 shows the losses avoided as a result of the housing acquisitions that occurred. If Louisa County had chosen not to take any action following the 1993 flood, potential property damage to these structures in the 2001 flood would have exceeded one million dollars. Calculation of reduction in public assistance expenditures and losses avoided as a result of proactive mitigation can further highlight the value of hazard mitigation planning efforts to concerned citizens, local and federal governments, and potential funding agencies.

Table 1. Emergency Shelter and Family Assistance in Louisa County

	1993	2001
Number of families evacuated and temporarily sheltered due to displacement	200	11
Number of Red Cross cases (individuals requesting post-disaster assistance)	800	3
Disaster Housing Assistance (FEMA)	**$742,500**	**$0**

Source: Hazard Mitigation in Iowa: Measuring Success, FEMA 2003 (unpublished)

Table 2. Public Assistance Expenditures, 1993 and 2001 (2001 values)

		1993	2001
A	**Debris Clearance**	$542,215	$0
B	**Emergency Protective Measures**	$44,367	$0
C	**Roads and Bridges, Culverts, Ditches**	$2,941	$0
D	**Water Control Facilities & Levees**	$0	$0
E	**Public Buildings & Contents**	$0	$0
F	**Utility Distribution Systems**	$0	$0
G	**Public Parks**	$0	$0
H	**Total Public Assistance**	**$589,523**	**$0**

Source: Hazard Mitigation in Iowa: Measuring Success, FEMA 2003 (unpublished)

Table 3. Losses Avoided from Acquisition of Flood-Prone Properties in Louisa County, Aggregated by Building, Contents, Displacement, and Total for the Spring, 2001 Flood (DR-1367)

Depth of Flooding (Feet)	Avoided Losses to Buildings	Avoided Losses to Contents	Avoided Displacement Costs	Total
0	$24,672	$11,103	$0	$35,775
1	$319,533	$143,790	$82,500	$545,823
2	$386,880	$174,096	$126,500	$687,476
Total	**$731,085**	**$328,989**	**$209,000**	**$1,269,074**

Source: Hazard Mitigation in Iowa: Measuring Success, FEMA 2003 (unpublished)

Long Beach, Mississippi

Located along the Gulf of Mexico, the coastal city of Long Beach, Mississippi, has been affected by seven hurricanes and repetitive flooding, often as a result of spring storms. In addition to its vulnerability to flooding because of its coastal location, the City also suffered from poor drainage, resulting from three poorly maintained drainage channels. While these channels were better managed in the 1980s, the City, and particularly the areas around the canals, is still plagued by poor drainage. Following Hurricane Georges in 1998, the City began to take a proactive approach to flood damages, and identified 95 properties, many of them repetitive loss properties located adjacent to the canals, for an acquisition and demolition program. This long-term acquisition project had an estimated cost of $7.7 million (see Table 1), with a portion of the funding coming from the Hazard Mitigation Grant Program. In 2001, midway through the acquisition and demolition project, Tropical Storm Allison struck the Gulf Coast. The storm caused an overflow from the drainage system, which flooded the neighborhoods located near the canals. Because 44 homes had already been purchased and demolished prior to the storm, the losses avoided from this single flood event were estimated to be $690,033 (see Table 2). This figure only represents the losses avoided to houses, their contents, and displacement costs. It does not include the additional savings to the local government in emergency services and disaster assistance costs that would have been incurred had families remained in the floodplain. By combining much-needed improvements to its drainage system with the acquisition of many repetitive loss properties, the City of Long Beach shows that mitigation projects can lead to substantial savings for the local government and affected communities.

Table 1: Estimated Costs for Acquisition of 95 Properties in the City of Long Beach for the Master Watershed Plan

Item	Total Cost
Acquisition of Properties	$6,578,924
Relocation Pay to Tenants	$ 52,000
Demolition of Properties	$ 918,065
Fees for Appraisals and Legal Assistance	$ 171,000
Total	**$7,719,989**

Source: Hazard Mitigation in Mississippi: Measuring Success, FEMA 2003 (unpublished)

Table 2: Losses Avoided during Tropical Storm Allison from Acquisition of 44 Flood-Prone Properties in the City of Long Beach, MS

Item	Total Cost
Estimated Avoided Losses to Buildings	$502,917
Estimated Avoided Losses to Contents	$ 85,826
Estimated Avoided Displacement Costs	$101,290
Total	**$690,033**

Source: Hazard Mitigation in Mississippi: Measuring Success, FEMA 2003 (unpublished)

(continued from page 3-13)

4. Depending upon the severity of the recent disaster, it may be necessary to re-evaluate the range and priority given to specific hazard mitigation actions.

Should the priority ranking of mitigation actions be re-evaluated given the type and intensity of the recent event? If the hazard event was not anticipated or given a low priority as a goal or objective, there may be a need to go through another round of identifying and prioritizing hazard mitigation actions for your community.

5. Consider including a special section in your mitigation plan devoted to post-disaster issues.

Many mitigation policies or projects are not politically or economically viable until after a disaster. Thinking through post-disaster operational and policy issues in the pre-disaster time frame enables your community to delve into these often emotional subjects in the relative luxury of a non-disaster scenario. FEMA 321, *Planning for Post-Disaster Recovery and Reconstruction*, provides more details.

Task D. Keep the community updated and involved, and celebrate your successes.

Project implementation brings the community's hard work to fruition. The planning team should be sure to keep all stakeholders in the community informed of the progress of the projects. Ways to engage the community may include staging events to showcase your accomplishments or taking advantage of media opportunities to publicize the completion or significant steps of specific projects. Refer to *Getting Started* (FEMA 386-1) for additional ways to communicate your success to the community.

Local and state agencies should keep in contact with each other about the progress of their mitigation actions. Each entity should update its risk assessment data using this information. Agencies responsible for maintaining the state and local plans should update their plans accordingly, as well.

Methods of communicating with constituents during implementation of the recommended projects and programs include:

- Write a newsletter to provide details on projects;
- Create 15- or 30-second public service announcements and send them to local broadcasters;
- Work with your local news or public access cable station feature a news story about your efforts;
- Hold an annual event honoring local people who have contributed to hazard mitigation projects;
- Develop a Web site to post news articles, meeting notices, and event notices; and
- Establish a speaker's bureau to talk to schools, business groups, and other organizations about mitigation.

Summary

The evaluation phase of the planning process helps your planning team determine whether its planning process and recommendations have been effective, and if your community's goals are being reached. Systematically evaluating the plan keeps your community informed and hopefully motivates those responsible for implementing the mitigation actions.

After you have evaluated your actions to determine what worked and did not work, go to Step 4, *Revise the Plan,* in which you will use the evaluation results to revise the hazard mitigation plan.

The Hazardville Post

Vol. CXVI No. 272 Friday, September 29, 2006

Town Hall Retrofit Called a "Money Pit"

(Part 3 of a 4-Part Series on the Hazard Mitigation Implementation Process)

[Hazardville, EM] In response to a complaint about the progress of the seismic retrofit project of the historic Hazardville Town Hall, the Hazardville Board of Supervisors recently held an informal hearing on the matter. The retrofit, begun under Hazardville's initiative to become more disaster resistant and overseen by the Town of Hazardville Organization for Risk Reduction (THORR), is now estimated to have cost taxpayers about double the original projected cost.

When asked about the escalating costs, Joe Norris, lead planner of THORR, commented that the overruns could be attributed to misjudgments THORR had made about the extent of repairs that the building needed. "We didn't realize the extent of work that would have to be done to bring the building up to current code, much less to be seismically resistant." Norris explained that much of the work had nothing to do with seismic standards. "Not only did the contractor discover asbestos-based insulation and ceiling tiles on the first floor where most of the work was to be done, but he also found lead-based paint on pipes that had not been removed during renovation in the late 1960s. These factors were not considered in our original project estimates, but they had to be addressed in the retrofit in order to comply with local, state, and federal laws," Norris said.

Board of Supervisors Chairperson Seymour Hale likened the building retrofit to a "money pit," saying that THORR should have done its homework. Norris agreed, "As soon as we found out about these unexpected costs for the project, we began to re-evaluate all of our other projects to keep this from happening again. It seems that we placed a huge amount of work on our local building inspector. He had a tremendous work load, and did not have enough time to do in-depth investigation into some of the buildings before work began." When asked how THORR planned to remedy this problem, Norris replied, "We are still in the process of evaluating our other hazard mitigation projects and will submit our findings to the Board by the end of the month."

step 4


1
adopt the mitigation plan
2
implement the plan recommendations
3
evaluate your planning results
4
revise the plan

4

revise the plan

Overview

The final step in the mitigation planning process is to determine whether you need to make changes to the planning process or the mitigation plan. You will start with an evaluation of the factual underpinnings of the mitigation strategy: the risk assessment and the capability assessment. Using the results of the evaluations of the process and projects completed in Step 3, and taking into consideration the factors to be discussed under Task A below, you will determine whether you need to revise or update your mitigation plan or planning process.

The frequency of conducting a plan evaluation depends upon the speed and the intensity at which changes are occurring. For example, if your community is experiencing significant growth, or if you have experienced recent or frequent hazard or disaster events, this evaluation may have to be conducted more frequently. *Keep in mind, however, that DMA 2000 regulations require that local plans be reviewed and updated at least every five years, and state plans at least every three years, for a state or jurisdiction to remain eligible for assistance.*

Procedures & Techniques

Planning is an ongoing process, and your plan should be treated as a living document that must grow and adapt in order to keep pace with the community's growth and change as these issues affect hazard vulnerability, and with changes that may be external to the community but that affect the planning process. An annual "scan of the horizon" should be done, so that emerging trends in data availability or collection, land use and development, technology, and other factors can be documented. Just prior to the three- or five-year point, these annual observations should be evaluated to determine what types of changes should be made to your planning process and to the plan document. The results of your evaluations should be re-programmed back into each phase of the planning process and should yield decisions on how (or whether) to update each section of your plan.

Task A. Review those factors that affect your community's planning context.

Evaluating the following factors will help you determine what changes to the plan document are warranted. Extensive or widespread changes in any one of these categories may signal a need to reconsider some or all of your plan's fundamental assumptions.

1. Revisit the risk assessment to incorporate updated estimates of cost of living and replacement costs, new scientific data on hazard areas, the effect of hazards on the community, changes in growth patterns, and, particularly, reductions in vulnerability due to completion of projects.

Use **Worksheet #4: Revisit Your Risk Assessment** to complete this task. See *Understanding Your Risks* (FEMA 386-2) to review information on hazards and estimating losses.

- **Shifts in development.** The planning team should determine whether there are changes in development patterns that could influence the effects of hazards in your community or create additional risks. One common example of this is when upstream growth in a given watershed affects flood characteristics downstream in your community. For example, in Hazardville, coastal development caused the Planning Department to undertake a coastal development plan. The effects of erosion, wave action, and tidal surge hazards will be considered in this development plan, and corresponding policies and/or mitigation projects should be considered.
- **Areas affected by recent disasters.** Recent hazard events or disasters can provide new information about the ways in which your community can be affected. Compare the effects of the event against what the loss estimation analysis led you to expect.
- **New studies or technologies.** What have recent hydrologic, watershed, traffic, or demographic studies revealed about your community? Studies such as these may provide additional information about your community. You already should be continually researching mitigation techniques to discover whether new technologies or methods are being used.

- **Re-estimate losses.** For projects that have not yet been implemented, any new information the planning team has gathered should be used to recalculate losses or revise the benefit-cost analysis originally prepared. See *Understanding Your Risks* (FEMA 386-2) for the methodologies and considerations used to estimate losses.

2. Revisit your capability assessment to determine changes in laws, authorities, community and state resources, and availability of financial and technical tools that may affect what you can do.

Additionally, political will and priorities can change with the election cycle. See *Developing the Mitigation Plan* (FEMA 386-3) for more information on how to update your capability assessment.

- **Changes in community, state, or federal laws, policies, plans, or funding.** The strengthening, relaxing, or addition of land use, environmental, or other government regulations may present additional challenges or opportunities to the community.
- **Changes in the socioeconomic fabric of the community.** Broad social transformations often have repercussions on the community's sequence of mitigation priorities and the implementation of projects. Recessions, booming economies, cost of living increases, changes in the political climate, demographic shifts, or environmental justice issues may have some influence on the way mitigation is executed in your community. On a smaller scale, changes within the community, such as the departure of a large employer, may alter the socioeconomic balance.
- **Other changing conditions.** Have the successes achieved over the past few years created a political environment that may allow the planning team to propose a new mitigation initiative that would not have had the political support necessary earlier?

The review process can be easier if you keep up with annual reports.

Worksheet #4 Revisit Your Risk Assessment step 4

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?		✓	
Profile hazard events	Are new historical records available?		✓	
	Are additional maps or new hazard studies available?	✓		Recently completed maps and studies showing vulnerability of the new coastal development to erosion and tidal surge are available.
	Have chances of future events (along with their magnitude, extent, etc.) changed?		✓	
	Have recent and future development in the community been checked for their effect on hazard areas?	✓		
Inventory assets	Have inventories of existing structures in hazard areas been updated?	✓		
	Is future land development accounted for in the inventories?	✓		The Planning Department is preparing a coastal development plan to ensure that any future development is set back far enough to be outside the erosion zones and the coastal high hazard areas. Current and future road configurations will also be studied to ensure adequate evacuation times before hurricane events.
	Are there any new special high-risk populations?	✓		Coastal residents and business owners.
Estimate losses	Have loss estimates been updated to account for recent changes?	✓		

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.

Task B. Analyze your findings and determine whether to revise your planning process or mitigation strategy.

The planning team should use its new knowledge to identify the areas of the plan or planning process that should be changed. Some aspects of the planning process may warrant a briefer treatment the second time around, while others, because of additional knowledge or more readily available technical assistance, may warrant a more in-depth treatment.

Consider updating the goals, objectives, and actions in the plan. One of the most important steps in plan revision is to update or refine the community's goals, objectives, and actions, particularly in light of experiences gained from implementing mitigation actions in the current plan. The planning team has undoubtedly learned something new about the state or community, the administration of government, or the value that the community places on certain objectives—all of which need to be included in a reevaluation of the strategies. As with every step in the planning process, updating goals and strategies should use consensus building and community-driven prioritization methods, which are explained in *Getting Started* (FEMA 386-1) and *Developing the Mitigation Plan* (FEMA 386-3).

Using the information gleaned in Step 3, and your results from Task B, the planning team should discuss what actions should be undertaken, reconsidered, or even eliminated, to further the plan's goals. This discussion should result in a preliminary list of alternative mitigation actions to incorporate into the update of the plan. As in any other step of the planning process, the community should be engaged in reviewing these alternatives. The planning team may choose to present these alternatives in a public forum at this stage or as part of the plan review process discussed in Task C. For more details on researching alternatives, see Phase 3, Step 2 of *Developing the Mitigation Plan* (FEMA 386-3).

Important questions to discuss with the team include the following:

1. Are the goals and objectives still applicable? Have any changes in the state or community made the goals or objectives obsolete or irrelevant?

Review the findings of changes in the community, including changes that your mitigation initiatives have brought, to determine whether you have met your goals and if they remain consistent with current conditions. If you determine that you need to add new

goals to the plan, see Phase 3, Step 1 of *Developing the Mitigation Plan* (FEMA 386-3) for formulating goal statements.

2. Do the plan's priorities correspond with state priorities?

Where applicable, make sure your actions are consistent with any changes to state priorities. You will continue to be aligned with state goals and priorities by doing this.

3. Do existing actions need to be reprioritized for implementation?

Now that you have implemented some of the actions, learned what works and doesn't, developed new actions, and discovered that some aspects of your community may have changed, you may need to reprioritize your actions. See *Developing the Mitigation Plan* (FEMA 386-3) for prioritizing methods.

4. Are actions appropriate for available resources?

Make sure that the community or state has enough resources to carry out the actions. You probably will have to research to find out what is currently available. Are past sources of funds still available? Are there new sources of funding that can be tapped? Are there new partnerships with nonprofit organizations or businesses that can be developed? What creative ways of implementing similar actions have other communities used? *Securing Resources for Mitigation Planning* (FEMA 386-9) covers these topics in greater detail.

Task C. Incorporate your findings into the plan.

Include your most recent findings about the community, tribe, or state, your hazards and vulnerabilities, as well as the applicable original actions of the plan, into a revised plan. Update your description of the planning process to include the steps you took to revise the plan document and how you involved the public. Update the implementation strategy to identify who will be responsible for the new or revised actions, the time frame, and funding sources.

The revised plan must be reviewed by all stakeholders in the community for its validity, and proceed through a formal adoption process as required by local or state laws.

Use **Worksheet #5: Revise the Plan** to help you keep track of where the plan document may require revisions.

DMA

In order to remain eligible for disaster related funding, your updated local plan must be re-submitted to your state and/or FEMA Regional Office for review and approval every five years. State plans must be re-submitted to the FEMA Regional Office for review and approval every three years.

Worksheet #5 Revise the Plan step 4

Prepare to update the plan.

When preparing to update the plan:	*Check the box when addressed:*
1. Gather information, including project evaluation worksheets, progress reports, studies, related plans, etc.	✔
Comments: THORR must work with the Department of Public Works to update their progress reports and stream maintenance plans. While the department has been effectively conducting their new duties, it has been unable to attend to administrative paperwork such as preparing progress reports and formally updating its standard operating procedures.	
2. Reconvene the planning team, making changes to the team composition as necessary (see results from Worksheet #2).	✔
Comments: Invited Habitat for Humanity to participate in THORR.	

Consider the results of the evaluation and new strategies for the future.

When examining the community consider:	*Check the box when addressed:*
1. The results of the planning and outreach efforts.	✔
Comments: All but one of the the Raging River Views Park residents attended the design charette put on by the Department of Planning. *[Note: The information here only pertains to the one project highlighted in this guide. When actually completing the worksheet, you will reflect on all projects.]*	
2. The results of the mitigation efforts.	✔
Comments: The mitigation efforts have gone as planned, except the team was unable to obtain the cooperation of the remaining Raging River Views Park residents. *[Note: The information here only pertains to the one project highlighted in this guide. When actually completing the worksheet, you will reflect on all projects.]*	

3. Shifts in development trends.	✓
Comments: The continued unwillingness of the Council to adopt hazard-based zoning will continue to be an issue. The reauthorization and funding of the economic development program encourages development in hazard areas. Recent development along the coast has not taken into account coastal storm hazards.	
4. Areas affected by recent disasters.	✓
Comments: Coastal windstorms have continued to erode the hillside surrounding the lighthouse.	
5. The recent magnitude, location, and type of the most recent hazard or disaster.	✓
Comments: The spring coastal storm of 2002 was estimated by NOAA to have a 25-year recurrence interval and accelerated beach erosion in several areas.	
6. New studies or technologies.	✓
Comments: THORR is currently conducting a study to determine best mitigation methods for retrofitting historic structures in the downtown district.	
7. Changes in local, state, or federal laws, policies, plans, priorities, or funding.	✓
Comments: See #3.	

8. Changes in the socioeconomic fabric of the community.	✔
Comments: Most new residents along the coast are retired professionals and are new to the area.	
9. Other changing conditions.	✔
Comments: None	

Incorporate your findings into the plan.

When examining the plan consider: *Check the box when addressed:*

1. Revisit the risk assessment. *(See Worksheet #4)*	✔
Comments: Acquisition of structures in the Raging River Views Park decreases the potential flood losses. Vulnerability assessment and loss data will be incorporated into the plan.	
2. Update your goals and strategies.	✔
Comments: N/A	
3. Recalculate benefit-cost analyses of projects to prioritize action items.	✔
Comments: N/A	

Use the following criteria to evaluate the plan:

Criteria	YES	NO	Solution
Are the goals still applicable?	✓		
Have any changes in the state or community made the goals obsolete or irrelevant?		✓	
Do existing actions need to be reprioritized for implementation?	✓		Staffing at the Department of Public Works is a high priority.
Do the plan's priorities correspond with state priorities?	✓		
Can actions be implemented with available resources?		✓	Need to identify funding for additional staff at the Department of Public Works.

Comments:

None

Summary

In order for the plan to remain a viable tool for your state, tribe, or community, you must regularly review your planning process and mitigation strategy. Communities are rarely static and new challenges will arise during every revision of the plan. Disasters also present a window of opportunity to evaluate the relative success of the mitigation plan. States, tribes, and communities should take advantage of funding that becomes available as a result of these events.

Revising the plan ensures it remains up-to-date and relevant, providing a good return on the time and resources invested in developing it.

The Hazardville Post

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The Hazard Mitigation Planning Cycle Set to Begin Again

(Part 4 of a 4-Part Series on the Hazard Mitigation Implementation Process)

[Hazardville, EM] A strategic planning meeting to update the Hazardville Hazard Mitigation Plan was held Wednesday at the Town Hall. The Town of Hazardville Organization for Risk Reduction (THORR), continuing in its planning capacity, led the strategy session by explaining to the community the changes the town has undergone since the initial adoption of the plan in 2003.

The first meeting was to review the results of the community perception survey and to discuss the status of the mitigation actions that were prioritized in the town's mitigation plan. "Overall, our residents now seem to be more aware of the hazards to which the town is vulnerable, and a large majority of the survey respondents knew what they could do to reduce their own vulnerability," said Joe Norris, lead planner for THORR. "With the exception of the Town Hall seismic retrofit project, we are proud to inform the community that our projects are all progressing as scheduled and under budget."

"We promised to make this community a safer place to live and work, and we will continue to strive to achieve this for our community," Mayor McDonald said at a press briefing yesterday. "That promise means we must diligently prepare for and mitigate against the many hazards our community is vulnerable to. Accountability and diligence are key to making this a reality."

afterword

afterword

You have a mitigation plan. Now what?

The first plan your state, tribe, or community adopts establishes a baseline from which to measure progress. As you implement and evaluate actions, your knowledge of hazards and how to best reduce your vulnerabilities increases tremendously. In order to effectively monitor your progress, it is important to take advantage of the worksheets provided in the how-to series. Over time, new partners will become involved in the planning process, providing additional reservoirs of experience and support. Since the political and social arenas, as well as the natural environment, are continually changing, you must periodically revisit and update your plan. As your plan evolves over time, you should see a corresponding improvement in your state, tribe, or community's resilience to the damaging effects of disasters.

appendices

appendix a
glossary

Acquisition of hazard-prone structures
Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

Base Flood Elevation (BFE)
Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as a standard for the National Flood Insurance Program.

Benefit
Net project outcomes, usually defined in monetary terms. Benefits may include direct and indirect effects. For the purposes of conducting a benefit-cost analysis of proposed mitigation measures, benefits are limited to specific, measurable risk reduction factors, including a reduction in expected property losses (building, contents, and function) and protection of human life.

Benefit-Cost Analysis (BCA)
A systematic, quantitative method of comparing the projected benefits to projected costs of a project or policy. It is used as a measure of cost-effectiveness.

Building
A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheel and axles carry no weight.

Capability assessment
An assessment that provides a description and analysis of a community or state's current capacity to address the threats associated with hazards. The capability assessment attempts to identify and evaluate existing policies, regulations, programs, and practices that positively or negatively affect the community or state's vulnerability to hazards or specific threats.

Coastal zone
The area along the shore where the ocean meets the land as the surface of the land rises above the ocean. This land/water interface includes barrier islands, estuaries, beaches, coastal wetlands, and land areas with direct drainage to the ocean.

Community Emergency Response Team (CERT)
CERT is the mechanism to establish, train and maintain a local cadre of residents to act as first responders in the event of an emergency. A CERT team is especially critical in the first three days following a disaster when conditions may prevent access by emergency response personnel.

Community Rating System (CRS)
CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of these policyholders in communities are reduced.

Comprehensive plan — A document, also known as a "general plan," covering the entire geographic area of a community and expressing community goals and objectives. The plan lays out the vision, policies, and strategies for the future of the community, including all of the physical elements that will determine the community's future development. This plan can discuss the community's desired physical development, desired rate and quantity of growth, community character, transportation services, location of growth, and siting of public facilities and transportation. In most states, the comprehensive plan has no authority in and of itself, but serves as a guide for community decision-making.

Cost-effectiveness — Cost-effectiveness is a key evaluation criterion for federal grant programs. Cost- effectiveness has several possible definitions, although for grant-making purposes FEMA defines a cost-effective project as one whose long-term benefits exceed its costs. That is, a project should prevent more expected damages than it costs initially to fund the effort. This is done to ensure that limited public funds are used in the most efficient manner possible. Benefit-cost analysis is one way to illustrate that a project is cost-effective.

Critical facilities — Facilities vital to the health, safety, and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Debris — The scattered remains of assets broken or destroyed in a hazard event. Debris transported by a wind or water hazard event can cause additional damage to other assets.

Disaster Mitigation Act of 2000 (DMA 2000) — DMA 2000 (Public Law 106-390) is the latest legislation to improve the planning process. Signed into law on October 30, 2000, this legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

Earthquake — A sudden motion or trembling caused by a release of strain accumulated within or along the edge of the earth's tectonic plates.

Elevation of structures — Raising structures above the base flood elevation to protect structures located in areas prone to flooding.

Emergency response services — The actions of first responders such as firefighters, police, and other emergency services personnel at the scene of a hazard event. The first responders take appropriate action to contain the hazard, protect property, conduct search and rescue operations, provide mass care, and ensure public safety.

Federal Emergency Management Agency (FEMA) — Agency created in 1979 to provide a single point of accountability for all federal activities related to disaster mitigation and emergency preparedness, response, and recovery. FEMA is now part of the Department of Homeland Security.

Flood Hazard Area — The area on a map shown to be inundated by a flood of a given magnitude.

Flood Insurance Rate Map (FIRM) — Map of a community, prepared by FEMA, which shows both the special flood hazard areas and the risk premium zones applicable to the community under the National Flood insurance Program.

Flood Mitigation Assistance (FMA) Program — A program created as part of the National Flood Insurance Reform Act of 1994. FMA provides funding to assist communities and states in implementing actions that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other NFIP insurable structures, with a focus on repetitive loss properties.

Floodplain — Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Flood-proofing — Actions that prevent or minimize future flood damage. Making the areas below the anticipated flood level watertight or intentionally allowing floodwaters to enter the interior to equalize flood pressures are examples of flood-proofing.

Flood Zone — A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

Goals — General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Hazard — A source of potential danger or adverse condition.

Hazard event — A specific occurrence of a particular type of hazard.

Hazard identification — The process of identifying hazards that threaten an area.

Hazard information center — Information booth, publication kiosk, exhibit, etc. that displays information to educate the public about hazards that affect the jurisdiction and hazard mitigation activities people can undertake.

Hazard mitigation — Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Mitigation Grant Program (HMGP) — Authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, HMGP is administered by FEMA and provides grants to states, tribes, and local governments to implement hazard mitigation actions after a major disaster declaration. The purpose of the program is to reduce the loss of life and property due to disasters and to enable mitigation activities to be implemented as a community recovers from a disaster.

Hazard profile — A description of the physical characteristics of hazards and a determination of various descriptors, including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

HAZUS, HAZUS-MH — A GIS-based, nationally standardized, loss estimation tool developed by FEMA. HAZUS-MH is the new multi-hazard version that includes earthquake, wind, hurricane, and flood loss estimate components.

Hurricane An intense tropical cyclone, formed in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles per hour or more and blow in a large spiral around a relatively calm center or "eye." Hurricanes develop over the north Atlantic Ocean, northeast Pacific Ocean, or the south Pacific Ocean east of 160°E longitude. Hurricane circulation is counter-clockwise in the northern hemisphere and clockwise in the southern hemisphere.

Infrastructure Refers to the public facilities of a community that have a direct impact on the quality of life. Infrastructure includes communication technology, such as phone lines or Internet access; vital services, such as public water supplies and sewer treatment facilities; and an area's transportation system: airports, heliports, highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, drydocks, piers, and regional dams.

Landslide Downward movement of a slope and materials under the force of gravity.

Loss estimation Forecasts of human and economic impacts and property damage from future hazard events, based on current scientific and engineering knowledge.

Memorandum of Agreement (MOA) A non-binding statement that defines the duties, responsibilities, and commitment of the different parties or individuals; provides a clear statement of values, principles, and goals; and establishes an organizational structure to assist in measuring and evaluating progress.

Mitigate To cause something to become less harsh or hostile; to make less severe or painful.

Mitigation actions Activities or projects that help achieve the goals and objectives of a mitigation plan.

Mitigation plan The document that articulates results from the systematic process of identifying hazards and evaluating vulnerability, identifying goals, objectives, and actions to reduce or eliminate the effects of identified hazards, and an implementation plan for carrying out the actions.

National Flood Insurance Program (NFIP) Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations found in 44 CFR §60.3.

Objectives Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Open space preservation Preserving undeveloped areas from development through any number of methods, including low-density zoning, open space zoning, easements, or public or private acquisition. Open space preservation is a technique that can be used to prevent flood damage in flood-prone areas, land failures on steep slopes or liquefaction-prone soils, and can enhance the natural and beneficial functions of floodplains.

Ordinance A term for a law or regulation adopted by a local government.

Planning The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Policy A course of action or specific rule of conduct to be followed in achieving goals and objectives.

Post-disaster mitigation Mitigation actions taken after a disaster has occurred, usually during recovery and reconstruction.

Post-disaster recovery ordinance An ordinance authorizing certain governmental actions to be taken during the immediate aftermath of a hazard event to expedite implementation of recovery and reconstruction actions identified in a pre-event plan.

Post-disaster recovery planning The process of planning those steps the jurisdiction will take to implement long-term reconstruction with a primary goal of mitigating its exposure to future hazards. The post-disaster recovery planning process can also involve coordination with other types of plans and agencies, but it is distinct from planning for emergency operations.

Preparedness Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Probability A statistical measure of the likelihood that a hazard event will occur.

Public education and outreach programs Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Recovery The actions taken by an individual or community after a catastrophic event to restore order and lifelines in a community.

Regulation Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Regulatory power Local jurisdictions have the authority to regulate certain activities in their jurisdiction. With respect to mitigation planning, the focus is on such things as regulating land use development and construction through zoning, building codes, subdivision regulations, design standards, and floodplain regulations.

Relocation out of hazard areas A mitigation technique that features the process of demolishing or moving a building to a new location outside the hazard area.

Resources Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Response The actions taken during and immediately after an event to address immediate life and safety needs and to minimize further damage to properties.

Resolutions Expressions of a governing body's opinion, will, or intention that can be executive or administrative in nature. Most planning documents must undergo a council resolution, which must be supported in an official vote by a majority of representatives to be adopted. Other methods of making a statement or announcement about a particular issue or topic include proclamations and declarations.

Risk The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Stafford Act The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most federal disaster response activities, especially as they pertain to FEMA and its programs.

Stakeholder Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

State Hazard Mitigation Officer (SHMO) The state government representative who is the primary point of contact with FEMA, other state and federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structural retrofitting Modifying existing buildings and infrastructure to protect them from hazards.

Subdivision The division of a tract of land into two or more lots for sale or development.

Subdivision and development regulations Regulations and standards governing the division of land for development or sale. Subdivision regulations can control the configuration of parcels, set standards for developer-built infrastructure, and set standards for minimizing runoff, impervious surfaces, and sediment during development. They can be used to minimize exposure of buildings and infrastructure to hazards.

Tornado A violently rotating column of air extending from a thunderstorm to the ground.

Vulnerability Describes how exposed or susceptible an asset is to damage. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power—if an electric substation is flooded, it not only affects the substation but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability assessment The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address the effects of hazard events on the existing and future built environment.

Wildfire An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Zoning The division of land within a local jurisdiction by local legislative regulation into zones of allowable types and intensities of land uses.

Zoning ordinance Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.

appendix b
library

General Contact Information

Federal Emergency Management Agency (FEMA)	http://www.fema.gov FEMA Headquarters: 500 C Street, SW, Washington, D.C. 20472 202-646-4600
FEMA Publications Warehouse	800-480-2520
FEMA Mitigation Publications Library	http://www.fema.gov/library/prepandprev.shtm

Web sites

American Planning Association (APA)	http://www.planning.org
APA, *Growing Smart Legislative Guidebook,* 2002	http://www.planning.org/growingsmart
Catalog of Federal Domestic Assistance Programs	http://www.cfda.gov
Community Rating System	http://www.fema.gov/nfip/crs.shtm
Developing the Implementation Strategy	http://www.pro.gov.uk/recordsmanagement/eros/framework.pdf http://www.allhandsconsulting.com/ERI_books.htm http://www.esri.com/news/arcuser/0100/firetools.html http://www.atlantahighered.org/memberservices/shelter/literature.asp http://www.pmel.noaa.gov/~bernard/hazard3.pdf
Emergency Management Institute	http://training.fema.gov/EMIWeb
Federal Emergency Management Agency Individual Assistance Program	http://www.fema.gov/rrr/inassist.shtm
FEMA Mitigation Planning	http://www.fema.gov/fima/planning.shtm
FEMA Public Assistance Program	http://www.fema.gov/rrr/pa

Flood Mitigation Assistance Program	http://www.fema.gov/fima/planfma.shtm
Habitat for Humanity	http://www.habitat.org/
Hazard Mitigation Grant Program	http://www.fema.gov/fima/hmgp
Hazard Mitigation in North Carolina: Measuring Success	http://www.dem.dcc.state.nc.us/Mitigation/Library/Success_Stories/Measuring_Success_Vol2/Chapter6.pdf
HAZUS and HAZUS-MH	http://www.fema.gov/hazus/index.shtm
HMGP Progress Report Form	http://www.dem.dcc.state.nc.us/mitigation/document_index.htm
Institute for Business & Home Safety (IBHS), Summary of State Land Use and Natural Hazards Planning Laws	http://www.ibhs.org/research_library/view.asp?id=302
Institute for Local Self Government	http://www.ilsg.org/
Mitigation Success Stories	http://www.fema.gov/fima/success.shtm
Multi-hazard Mapping Initiative	http://www.hazardmaps.gov/atlas.php
National Association of Regional Councils	http://www.narc.org
National Flood Insurance Program	http://www.fema.gov/nfip
National League of Cities	http://www.nlc.org
North Carolina Division of Emergency Management, Tools and Techniques for Mitigating the Effects of Natural Hazards	http://www.dem.dcc.state.nc.us/mitigation/Library/Full_Tools_and_Tech.pdf
Oregon Department of Land Conservation and Development (DLCD), Planning for Natural Hazards—Oregon Technical Resource Guide	http://www.lcd.state.or.us/hazhtml/Guidehome.htm
Pre-Disaster Mitigation Program	http://www.fema.gov/fima/pdm
Small Business Administration	http://www.sba.gov/disaster_recov/index.html
State Guidebook for Developing Partnerships	http://www.ibhs.org/research_library/downloads/280.pdf
U.S. Army Corps of Engineers	http://www.usace.army.mil
U.S. Department of Agriculture	http://disaster.fsa.usda.gov
U.S. Department of Agriculture, Natural Resources Conservation Service	http://www.nrcs.usda.gov

U.S. Department of Housing and Urban Development	http://www.hud.gov/offices/cpd/communitydevelopment/programs/dri/driquickfacts.cfm
U.S. Department of Transportation	http://www.fhwa.dot.gov/programadmin/erelief.html
U.S. Environmental Protection Agency	http://www.epa.gov
U.S. State and Local Government Gateway	http://www.firstgov.gov/Government/State_Local.shtml

NOTE: The World Wide Web is an ever-changing source of information. Web addresses and the information they contain can change over time.

Publications

American Planning Association

Capital Improvement Programming, PAS Report No. 151, 1961.

Capital Improvements Programs: Linking Budgeting and Planning, PAS Report No. 442, 1993.

Selecting and Retaining a Planning Consultant: RFPs, RFQs, Contracts, and Project Management, PAS Report No. 443, 1993.

Federal Register

44 CFR Parts 201 and 206 (The Disaster Mitigation Act of 2000), February 26, 2002.

FEMA

Developing the Mitigation Plan: Identifying mitigation actions and implementation strategies (FEMA 386-3), 2003.

Getting Started: Building support for mitigation planning (FEMA 386-1), 2002.

Hazard Mitigation Grant Program Desk Reference (FEMA 345), 1999.

Hazard Mitigation in Iowa: Measuring Success, 2003, unpublished to date.

Hazard Mitigation in Mississippi: Measuring Success, 2003, unpublished to date.

Integrating Historic Property and Cultural Resource Considerations into Mitigation Planning (FEMA 386-6), unpublished to date.

Integrating Human-Caused Hazards into Mitigation Planning (FEMA 386-7), 2002.

Mitigation Resources for Success (FEMA 372), 2000.

Multi-jurisdictional Approaches to Mitigation Planning (FEMA 386-8), unpublished to date.

Planning for a Sustainable Future: The Link Between Hazard Mitigation and Livability (FEMA 364), 2003.

Rebuilding for a More Sustainable Future: An Operational Framework (FEMA 365), 2000.

Securing Resources for Mitigation Planning (FEMA 386-9), unpublished to date.

*Understanding Your Risks: Identifying hazards and estimating losses (*FEMA 386-2), 2001.

Using Benefit-Cost Analysis in Mitigation Planning (FEMA 386-5), unpublished to date.

Gianakis, Gerasimos A. and McCue, Clifford P., 1999 — *Local Government Budgeting: A Managerial Approach.*

Schwab, Jim et al., 1998 — *Planning for Post-Disaster Recovery and Reconstruction,* PAS Report Nos. 483/484.

Tyler Norris Associates, 1997 — *Community Indicators Handbook: Measuring Progress Toward Healthy and Sustainable Communities.*

appendix c
worksheets

Worksheet #1	Progress Report
Worksheet #2	Evaluate Your Planning Team
Worksheet #3	Evaluate Your Project Results
Worksheet #4	Revisit Your Risk Assessment
Worksheet #5	Revise the Plan

Worksheet #1 Progress Report step 2

Progress Report Period: _____ to _____
(date) (date)

Project Title: _____ Project ID#: _____

Responsible Agency: _____

Address: _____

City/County: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

_____

_____

_____

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): _____

_____

_____

Milestones	Complete	Projected Date of Completion

Plan Goal(s)/Objective(s) Addressed:

Goal: _____

Objective: _____

Indicator of Success (e.g., losses avoided as a result of the acquisition program):

In most cases, you will list losses avoided as the indicator. In cases where it is difficult to quantify the benefits in dollar amounts, you will use other indicators, such as the number of people who now know about mitigation or who are taking mitigation actions to reduce their vulnerability to hazards.

_____

_____

Status (Please check pertinent information and provide explanations for items with an asterisk. For completed or canceled projects, see Worksheet #2 — to complete a project evaluation):

Project Status

☐ Project on schedule

☐ Project completed

☐ Project delayed*

*explain: _____

_____

☐ Project canceled

Project Cost Status

☐ Cost unchanged

☐ Cost overrun*

*explain: _____

_____

☐ Cost underrun*

*explain: _____

_____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

_____

_____

_____

_____

B. What obstacles, problems, or delays did you encounter, if any?

_____

_____

_____

C. How was each problem resolved?

_____

_____

_____

Next Steps: What is/are the next step(s) to be accomplished over the next reporting period?

Other comments:

Adapted from the North Carolina HMGP Progress Report Form at http://www.dem.dcc.state.nc.us/mitigation/document_index.htm.

Worksheet #2 Evaluate Your Planning Team step 3

When gearing up for the plan evaluation, the planning team should reassess its composition and ask the following questions:	YES	NO
Have there been local staffing changes that would warrant inviting different members to the planning team?		
Comments/Proposed Action:		
Are there organizations that have been invaluable to the planning process or to project implementation that should be represented on the planning team?		
Comments/Proposed Action:		
Are there any representatives of essential organizations who have not fully participated in the planning and implementation of actions? If so, can someone else from this organization commit to the planning team?		
Comments/Proposed Action:		
Are there procedures (e.g., signing of MOAs, commenting on submitted progress reports, distributing meeting minutes, etc.) that can be done more efficiently?		
Comments/Proposed Action:		
Are there ways to gain more diverse and widespread cooperation?		
Comments/Proposed Action:		
Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?		
Comments/Proposed Action:		

If the planning team determines the answer to any of these questions is "yes," some changes may be necessary.

Worksheet #3 Evaluate Your Project Results step 3

Project Name and Number: _____

_____

Project Budget: _____

_____

Project Description: _____

_____

_____

Associated Goal and Objective(s): _____

_____

_____

Indicator of Success (e.g., losses avoided): _____

_____

_____

Insert location map.

Include before and after photos if appropriate.

Was the action implemented? ☐ **YES** ☐ **NO**

IF NO

Why not?	**YES**	**NO**
Was there political support for the action?	☐	☐
Were enough funds available?	☐	☐
Were workloads equitably or realistically distributed?	☐	☐
Was new information discovered about the risks or community that made implementation difficult or no longer sensible?	☐	☐
Was the estimated time of implementation reasonable?	☐	☐
Were sufficient resources (for example staff and technical assistance) available?	☐	☐

IF YES

What were the results of the implemented action? _____

_____

_____

_____

_____

_____

_____

	YES	NO
Were the outcomes as expected? If No, please explain:		
Did the results achieve the goal and objective(s)? Explain how:		
Was the action cost-effective? Explain how or how not:		
What were the losses avoided after having completed the project?		
If it was a structural project, how did it change the hazard profile?		
Additional comments or other outcomes:		

Date: _____

Prepared by: _____

Worksheet #4 Revisit Your Risk Assessment step 4

Risk Assessment Steps	Questions	YES	NO	COMMENTS
Identify hazards	Are there new hazards that can affect your community?			
Profile hazard events	Are new historical records available?			
	Are additional maps or new hazard studies available?			
	Have chances of future events (along with their magnitude, extent, etc.) changed?			
	Have recent and future development in the community been checked for their effect on hazard areas?			
Inventory assets	Have inventories of existing structures in hazard areas been updated?			
	Is future land development accounted for in the inventories?			
	Are there any new special high-risk populations?			
Estimate losses	Have loss estimates been updated to account for recent changes?			

If you answered "Yes" to any of the above questions, review your data and update your risk assessment information accordingly.

Worksheet #5 Revise the Plan step 4

Prepare to update the plan.

When preparing to update the plan:	*Check the box when addressed:*
1. Gather information, including project evaluation worksheets, progress reports, studies, related plans, etc.	
Comments:	
2. Reconvene the planning team, making changes to the team composition as necessary (see results from Worksheet #2).	
Comments:	

Consider the results of the evaluation and new strategies for the future.

When examining the community consider:	*Check the box when addressed:*
1. The results of the planning and outreach efforts.	
Comments:	
2. The results of the mitigation efforts.	
Comments:	

3. Shifts in development trends.	
Comments:	
4. Areas affected by recent disasters.	
Comments:	
5. The recent magnitude, location, and type of the most recent hazard or disaster.	
Comments:	
6. New studies or technologies.	
Comments:	
7. Changes in local, state, or federal laws, policies, plans, priorities, or funding.	
Comments:	

8. Changes in the socioeconomic fabric of the community.	
Comments:	
9. Other changing conditions.	
Comments:	

Incorporate your findings into the plan.

When examining the plan consider: *Check the box when addressed:*

1. Revisit the risk assessment. *(See Worksheet #4)*	
Comments:	
2. Update your goals and strategies.	
Comments:	
3. Recalculate benefit-cost analyses of projects to prioritize action items.	
Comments:	

Use the following criteria to evaluate the plan:

Criteria	YES	NO	Solution
Are the goals still applicable?			
Have any changes in the state or community made the goals obsolete or irrelevant?			
Do existing actions need to be reprioritized for implementation?			
Do the plan's priorities correspond with state priorities?			
Can actions be implemented with available resources?			

Comments:

_____

_____

_____

_____

_____

_____

_____

_____

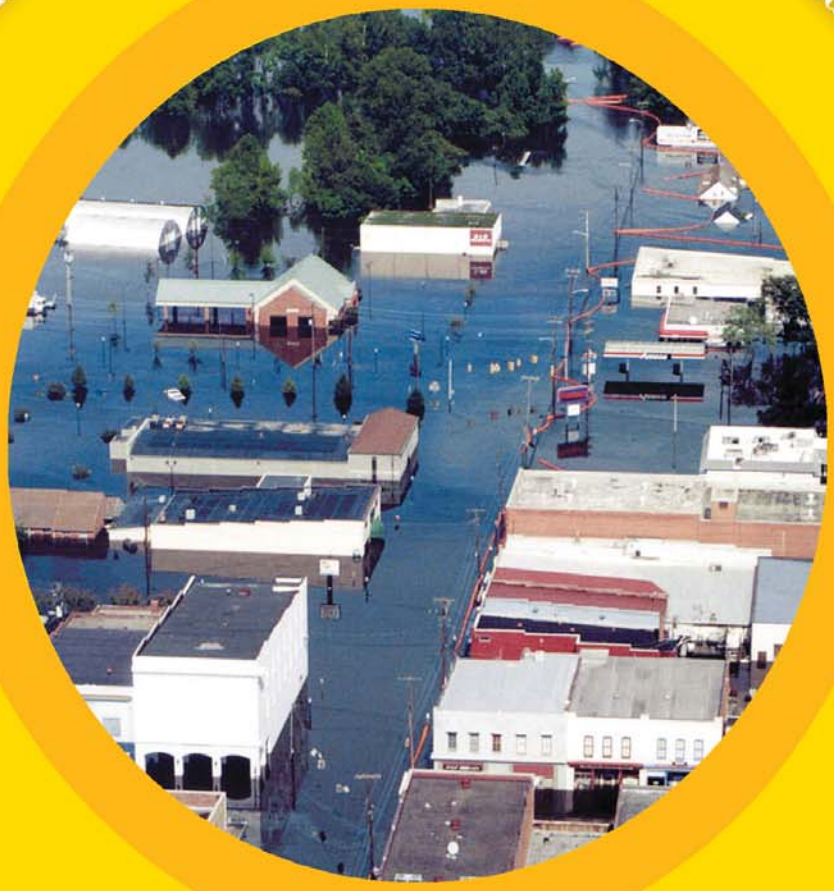
_____

_____

_____

Those who cannot remember the past are condemned to repeat it

George Santayana



FEMA

August 2003
FEMA 386-4

APPENDIX G. CRITICAL FACILITIES

Due to the sensitive nature of this information, details of each have been redacted for the public document. A full list of critical facilities identified for the vulnerability analysis is available at the Brownsville Public Utilities Board (BPUB). Contact the Grants Coordinator, Conrad Taylor, to view the list.

APPENDIX H. LINKAGE PROCEDURES

This Appendix contains the linkage procedures for the Brownsville Public Utilities Board (BPUB) Hazard Mitigation Action Plan 2022 Update.

H.1 Administrative Process for "Linkage" to the BPUB Hazard Mitigation Action Plan

The 2022 BPUB Hazard Mitigation Action Plan (HMAP) update (the Plan) included 2 planning partners and not all eligible local governments within the defined planning area are included in this plan. Completed jurisdictional annexes are presented in Section 9. Any non-participating local governments and other local jurisdictions such as Fire Districts, Utility Districts, School Districts and any other eligible local government as defined in 44 CFR 201.2 within the BPUB planning area can join this plan as a participating jurisdiction and to ultimately achieve approved status by following the linkage procedures defined in this appendix.

It is assumed that some or all these non-participating local governments may choose to "link" to the Plan at some point in time to gain eligibility for programs under the DMA. In addition, some of the current partnership may not continue to meet eligibility requirements due to the lack of active participation as prescribed by the plan. These "linkage" procedures will define the requirements established by the BPUB HMAP Planning Team for dealing with the increase or decrease in planning partners linked to this plan. It should be noted that currently non-participating jurisdictions within the defined planning area are not obligated to link to this plan. These jurisdictions can choose to do their own "complete" plan that addresses all required elements of section 201.6 of 44CFR.

H.1.1 Increasing the Partnership Through Linkage

H.1.1.1 Eligibility

Eligible jurisdictions located in the planning area may link to this plan at any point during the plan's performance period. Eligible jurisdictions located in the planning area may link to this plan at any point during the plan's performance period (5 years after final approval). Eligibility will be determined by the following factors:

- The linking jurisdiction is a local government as defined by the Disaster Mitigation Act.
- The boundaries or service area of the linking jurisdiction is completely contained within the boundaries of the planning area established during the 2022 Hazard Mitigation Action Plan development process.
- The linking jurisdiction's critical facilities were included in the critical facility and infrastructure risk assessment completed during the 2022 Plan development process.

H.1.1.2 Requirements

It is expected that linking jurisdictions will complete the requirements outlined below and submit their completed template to the lead agency Brownsville Public Utilities Board for review within six months of beginning the linkage process:

1. The BPUB HMP Planning Team has established an annual window for which linkage to the plan can occur. Linking jurisdictions are instructed to complete the following procedures during this time frame.

2. The current non-participating jurisdiction contacts the BPUB Hazard Mitigation Planning Coordinator for the Plan and requests a "Linkage Package". The BPUB Hazard Mitigation Project Contact is:

   Conrad Taylor, Grants Coordinator
   Brownsville Public Utilities Board
   956-983-6483 | ctaylor@brownsville-pub.com

3. The BPUB Hazard Mitigation Planning Coordinator will provide a linkage packages that includes:

   - Copy of Volume 1 and 2 of the Plan (CD-ROM or flash drive).
   - Planning Partner's Expectations Sheet.
   - A Sample "Letter of Intent" to Link to the Plan.
   - A Jurisdictional Annex Template and Instructions.
   - Catalog of Hazard Mitigation Alternatives or the Mitigation Catalog.
   - A copy of Section 201.6 of Chapter 44, the Code of Federal Regulations (44CFR), which defines the federal requirements for a local hazard mitigation plan.

4. The new jurisdiction will be required to review both volumes of the Plan which includes the following key components for the planning area:

   - The BPUB HMP risk assessment;
   - The plan's goals and objectives;
   - Plan implementation and maintenance procedures; and
   - Catalog of potential mitigation actions

Once this review is complete, the jurisdiction will complete its specific jurisdictional annex by following the template and its instructions for completion provided by the BPUB Hazard Mitigation Planning Coordinator. Technical assistance can be provided upon request by completing the request for technical assistance (TA) form provided in the linkage package. This TA may be provided by the BPUB Hazard Mitigation Planning Coordinator or any other resource within the Planning Team. The BPUB Hazard Mitigation Planning Coordinator will determine who will provide the TA and the possible level of TA based on resources available at the time of the request.

5. The new jurisdiction will also be required to develop a public involvement strategy that ensures their public's ability to participate in the plan development process. At a minimum, the new jurisdiction must

try to solicit public opinion on hazard mitigation at the onset of this linkage process and a minimum of one public meeting to present their draft jurisdiction specific annex for comment, prior to adoption by the governing body. The Planning Partnership will have available resources to aid in the public involvement strategy such as the Plan website. However, it will be the new jurisdiction's responsibility to implement and document this strategy for incorporation into their annex.

It should be noted that the Jurisdictional Annex templates do not include a section for the description of the public process. This is because the original partnership was covered under a uniform public involvement strategy that covered the operational area that is described in volume 1 of the plan. Since the new partner was not addressed by that strategy, they will have to initiate a new strategy, and add a description of that strategy to their annex. For consistency, new partners are encouraged to follow the public involvement format utilized by the initial planning effort as described in Volume I of the Plan.

6. Once their public involvement strategy is completed and they have completed their template, the new jurisdiction will submit the completed package to the BPUB Hazard Mitigation Planning Coordinator for a pre-adoption review to ensure conformance with the regional plan format.

7. The BPUB Hazard Mitigation Planning Coordinator will review for the following:

   - Documentation of public involvement and mitigation action development strategies;
   - Conformance of template entries with guidelines outlined in instructions;
   - Chosen actions are consistent with goals, objectives, and mitigation catalog of BPUB Hazard Mitigation Plan; and
   - Designated point of contact.

The BPUB Hazard Mitigation Planning Coordinator may utilize members of the HMP Planning Team or other resources to complete this review. All proposed linked annexes will be submitted to the HMP Planning Team for their review and comment prior to submittal to the TDEM.

8. Plans approved and accepted by the HMP Planning Committee will then be forwarded to TDEM for review with cover letter stating the forwarded plan meets local approved plan standards and whether the plan is submitted with local adoption or for criteria met/plan not adopted review.

9. The TDEM will review plans for state and federal compliance. Non-compliant plans are returned to the jurisdiction for correction. Compliant plans are forwarded to FEMA Region VI office for review with annotation as to the adoption status.

10. FEMA Region VI reviews the new jurisdiction's plan in association with the approved plan to ensure DMA compliance. Region VI notifies new jurisdiction of results of review with copies to the TDEM and approved planning authority.

11. New jurisdiction corrects plan's shortfalls (if necessary) and resubmits to the TDEM through the approved plan lead agency.

12. Region VI Director notifies new jurisdiction governing authority of plan approval.

The new jurisdiction plan is then included with the BPUB HMAP 2022 update, and the linking jurisdiction is committed to participate in the ongoing plan implementation and maintenance identified in Volume 1 of the HMP.

Brownsville Public Utilities Board

2022 Hazard Mitigation Action Plan

Participating Planning Partner: City of Brownsville

FINAL

Volume 2

August 2022

TETRA TECH

BROWNSVILLE PUBLIC UTILITIES BOARD

TABLE OF CONTENTS

Volume II

SECTION 8. PLANNING TEAM

This section provides a description of the Brownville Public Utilities Board (BPUB) HMP update Planning Team, their responsibilities throughout the planning process, and the jurisdictional annexes developed as a result of their plan update efforts.

8.1 Plan Maintenance Procedures

The Federal Emergency Management Agency (FEMA) encourages multi-jurisdictional planning for hazard mitigation. All participating jurisdictions must meet the requirements of Chapter 44 of the Code of Federal Regulations (44 CFR):

"Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process and has officially adopted the plan" [Section 201.6a(4)]

Members of the Planning Team have the expertise to develop the plan and have their jurisdiction's authority to implement the mitigation strategy developed during the planning process. The Planning Team is responsible for developing and reviewing draft sections of the plan, updating their respective annex, creating the mitigation strategy for their jurisdiction, and adopting the final plan.

For the BPUB HMP update, a Planning Team was formed to leverage resources and to meet requirements for the federal Disaster Mitigation Action of 2000 (DMA) for as many eligible governments as possible. Members of the Planning Team consisted of representatives from each jurisdiction. The DMA defines a local government as follows:

Any county, municipality, city, town, township , public authority, school district, special district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity.

Each participating planning partner has prepared a jurisdictional annex to this plan. These annexes, as well as information on the process by which they were created, are contained in this volume.

8.2 Initial Solicitation and Letters of intent

Brownsville Public Utilities Board and the City of Brownsville participated in the update process and have met the minimum requirements of participation as established by BPUB and the Planning Team.

8.3 Planning Partner Expectations

The Planning Partners agreed to the following planning partner expectations, which were outlined in the letter sent by the Brownsville Public Utilities Board on July 26, 2021 and confirmed at the kick-off meeting held on August 12, 2021 (see Appendix C [Meeting Documentation] for details):

- Provide representation at regular planning group meetings and workshops.
- Be responsible for providing data and information as requested.
- Review and comment on data and information compiled by the contract consultant relevant to their jurisdiction.
- Be responsible for completing plan documents specific to your municipality, using provided templates with guidance and assistance by the contract consultant.
- Assist with the identification of stakeholders within your community that should be informed and potentially involved with the planning process.
- Facilitate public outreach efforts with residents and local stakeholders within your community using materials provided by the contract consultant.
- Assist with the identification of strengths, weaknesses, opportunities and obstacles to implementing natural hazard mitigation within your community.
- Assist with the identification of past, ongoing and appropriate future mitigation strategies and activities within your municipality.
- Review and comment on plan documents, specifically the draft and final plans prior to submission to TDEM and FEMA.

As described in Section 7 (Plan Maintenance), the Planning Team is intended to remain active beyond the regulatory update to support plan maintenance. Regarding the composition of the Planning Team, it is recognized that individual commitments change over time, and it will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation.

8.4 Jurisdictional Annex Preparation Process

New to the 2022 HMP, jurisdictional annexes were used to provide a unique, stand-alone guide to mitigation planning for each participating jurisdiction. The BPUB HMP Update is organized so that there is an annex for BPUB and the City of Brownsville. Section 9 (Jurisdictional Annexes) includes an annex for both participants.

8.4.1 Data Collection

Each jurisdiction was paired with a contract consultant mitigation planner to work with the mitigation team to update their annexes. Each jurisdiction was asked to participate in a municipal kick-off meeting, held on August 18, 2021 to review participant expectations and the updated information needed to support the annex update. It was made clear that the annexes are sections of the plan that can be enhanced if more information is available to further customize any and all aspects of mitigation planning.

8.4.2 Hazard Ranking Exercise

The presentation of the risk assessment and hazard ranking for each jurisdiction was conducted December 8, 2021. At this meeting, the consultant presented the overall risk assessment for the hazards of concern and distributed jurisdiction-specific handouts with risk assessment results relevant to each plan participant. In addition, each planning partner was asked to review the ranked hazards specific for its jurisdiction. Refer to

Section 4.4 (Hazard Ranking) for the methodology of the hazard ranking process. The calculated ranking was presented to each jurisdiction and they were asked to review the ranking and revise based on history of events, probability of occurrence, and the potential impact on people, property, and the economy. In addition, each jurisdiction was asked to rank their adaptive capacity for each hazard. Refer to Appendix B (Participation Matrix) for the input submitted by each municipality. The objectives of this exercise were to familiarize the partnership with how to use the risk assessment as a tool to support other planning and hazard mitigation processes and to help prioritize types of mitigation actions that should be considered. Hazards that were ranked as "high" for each jurisdiction as a result of this exercise were considered to be priorities for identifying appropriate mitigation actions, although jurisdictions also identified actions to mitigate "medium" or "low" ranked hazards as appropriate.

8.4.3 Strengths Weaknesses Obstacles and Opportunities (SWOO) Exercise

A Strengths, Weakness, Obstacles and Opportunities exercise (SWOO) was completed by the planning partnerships. Participants were asked to fill out the SWOO for each of the hazards of concern for the 2022 HMP update. The Planning Team was asked to begin the exercise by identifying county, local, and stakeholder strengths to mitigate the risk and potential future impacts of the hazards. Next, the weaknesses, challenges and obstacles the planning area faces to reduce each hazard's risk were identified. To conclude the discussion of each high-ranked hazard, the meeting attendees were asked to identify potential opportunities for enhanced mitigation. The results were compiled and presented to the planning partnership at the risk assessment presentation. The results were also used by the participants to help identify capabilities and potential mitigation actions. The following summarizes the general categories of potential opportunities identified during the exercise:

- Unified public information and outreach for BPUB and the City of Brownsville.
- The need for training for municipal staff.
- Updated flood hazard maps needed.
- Continue to pursue municipal participation in CRS.
- Mutual aid agreements needed between BPUB and the City of Brownsville.

8.4.4 Mitigation Strategy Workshop

A mitigation strategy workshop was conducted by the contracted planning consultant on January 26, 2021, for all participants to support the development of the updated mitigation strategy. To assist with the identification of implementable and action-oriented mitigation actions, the participating jurisdictions were provided with tools to help identify mitigation strategies: public survey responses, potential mitigation actions for each jurisdiction, and FEMA *Mitigation Ideas.* The purpose of this workshop was to guide the Planning Team in completing this portion of the planning process and discuss how projects that are well developed and documented are more quickly identifiable for selection when grants become available.

At the workshop, the Planning Team focused on developing problem statements based on the impacts of hazards in the Planning Area. The results of the updated risk assessment, challenges and opportunities identified during the capability assessment update and SWOO sessions, and information gathered from the public survey were used

to develop mitigation strategies. As a result, a mitigation workbook was compiled with potential mitigation actions for the Planning Team. This workbook helped form a bridge between the hazard risk assessment, which quantifies impacts to each community, with the development of achievable mitigation strategies. Mitigation development worksheets were filled out by each municipality to identify additional problem statements and draft action worksheets were developed.

8.4.5 Municipal Support Conference Calls

In addition to the municipal kick-off meeting, municipal support conference calls were held throughout the planning process. During these calls, the consultant worked one-on-one with the planning partners to complete their jurisdictional annexes. Each section of the annex was discussed to ensure accuracy and completeness. This included, but not limited to, the following:

- Reviewing the calculated hazard ranking for the jurisdiction and provide input to adjust the ranking as necessary.
- Updating information regarding the jurisdiction's capabilities and past integration of hazard mitigation concepts.
- Identify mitigation initiatives that have reasonable potential to be accomplished within the lifespan of the multi-jurisdictional HMP (five years), including both FEMA-eligible projects and those projects using funds from non-FEMA sources.

8.4.6 Jurisdictional Annexes

While the jurisdictional annex format is designed to document and assure local compliance with the DMA 2000 regulations, its greater purpose and function includes:

- Providing a locally-relevant synthesis of the overall mitigation plan that can be readily presented, distributed, and maintained;
- Facilitating local understanding of the community's risk to natural hazards;
- Facilitating local understanding of the community's capabilities to manage natural hazard risk, including opportunities to improve those capabilities;
- Facilitating local understanding of the efforts the community has taken, and plans to take, to reduce their natural hazard risk;
- Facilitating the implementation of mitigation strategies, including the development of grant applications;
- Providing a framework by which the community can continue to capture relevant data and information for future plan updates.

It is recognized that each jurisdiction's annex is a "living" document and will continue to be improved as resources permit. As such, its design is intended to promote and accommodate continued efforts to maintain the annex to be current and to improve the effectiveness of the annex as the key tool, reference and guiding document by which the jurisdiction will implement hazard mitigation locally.

The following provides a description of the various elements of the jurisdictional annex.

Section 9.X.1: Hazard Mitigation Planning Team: Identifies the hazard mitigation planning team who provided input during the planning process. Further detail is provided in Section 2 (Planning Process) and Appendix B (Participation Matrix).

Section 9.X.2: Jurisdictional Profile: Provides an overview and profile of the jurisdiction, including an identification of areas of known and anticipated future development and the vulnerability of those areas to the hazards of concern.

Section 9.X.3: Jurisdictional Capability Assessment and Integration: This subsection provides an inventory and evaluation of the jurisdiction's tools, mechanisms and resources available to support hazard mitigation and natural hazard risk reduction. Within the municipal annexes, tables provide an inventory of the municipality's planning and regulatory, administrative and technical, and fiscal, capabilities, respectively. Further, another table identifies the municipality's level of participation in state and federal programs designed to promote and incentivize local risk reduction efforts. Further information regarding Federal, State and local capabilities may be found in the Capability Assessment portion of Section 5.

Section 9.X.4: National Flood Insurance Program (NFIP) Compliance: A tabular summary of the specific information on the management and regulation of the regulatory floodplain, including current and future compliance with the NFIP.

Section 9.X.5: Growth/Development Trends: Identifies of areas of known and anticipated future development and the vulnerability of those areas to the hazards of concern.

Section 9.X.6: Jurisdictional Risk Assessment:

- ***Hazard Extent and Location:*** Each annex includes a map (or series of maps) illustrating identified hazard zones and critical facilities. Further, these maps show areas of known or anticipated future development, as available and provided by the jurisdiction.
- ***Hazard Event History:*** Identifies hazard events that have caused significant impacts within the jurisdiction, including a summary characterization of those impacts as identified by the jurisdiction. The documentation of events and losses is critical to supporting the identification and justification of appropriate mitigation actions, including providing critical data for benefit-cost analysis. It is recognized that this "inventory" of events and losses is a work-in-progress and may continue to be improved as resources permit. As such, the lack of data or information for a specific event does not necessarily mean that the jurisdiction did not suffer significant losses during that event.
- ***Hazard Ranking and Vulnerabilities:*** This subsection provides information regarding each plan participant's vulnerability to the identified hazards. Full data and information on the hazards of concern, the methodology used to develop the vulnerability assessments, and the results of those assessments that serve as the basis of these local risk rankings may be found in Section 4 (Risk Assessment).

Section 9.X.7: Mitigation Strategy and Prioritization: This section discusses and provides the status of past mitigations actions and status, describes proposed hazard mitigation initiatives, and prioritization.

- ***Past Mitigation Initiative Status:*** Where applicable, a review of progress on the jurisdiction's prior mitigation strategy is presented, identifying the disposition of each prior action, project or initiative in the jurisdiction's updated mitigation strategy. Other completed or on-going mitigation activities that were not specifically part of a prior local mitigation strategy may be included in this sub-section as well.
- ***Additional Mitigation Efforts:*** Other completed or on-going mitigation activities that were not specifically part of a prior local mitigation strategy may be included in this subsection as well.
- ***Proposed Hazard Mitigation Initiatives for the Plan Update:*** Table 9.X-15 presents the jurisdiction's updated mitigation strategy. As indicated, applicable mitigation actions, projects and initiatives are further documented on an Action Worksheet which provides details on the project identification, evaluation, prioritization and implementation process. Table 9.X-16 provides a summary of the local mitigation strategy prioritization process discussed in Section 6 (Mitigation Strategy).

8.4.7 Annex Review

Workshops and additional meetings (via email and/or teleconference) to complete the jurisdictional annexes were held with the Planning Team throughout the planning process. In preparation for the draft plan public review, each jurisdiction was asked to have their 'mitigation team' review their annex to ensure it was complete and accurate for posting to the BPUB HMP website (https://www.brownsvillepub-hmp.com/).

In summary, BPUB and the City completed the planning partner expectations and annex-preparation process. Details regarding these meetings are described further in Section 2 (Planning Process) and Section 6 (Mitigation Strategy). Completed jurisdictional annexes are presented in Section 9 (Jurisdictional Annexes).

8.5 Coverage Under the Plan

BPUB and the City met the participation requirements specified by the Planning Team. Any non-participating local jurisdiction within the Planning Area can "dock" to this plan in the future following the linkage procedures defined in Appendix H (Linkage Procedures).

Table 8-1 lists the status of each participating jurisdiction and their ultimate status in this plan update. Refer to Appendix B (Participation Matrix) and Appendix C (Meeting Documentation) for details on participation and meeting attendance.

Table 8-1. Jurisdictional Status

Municipality	Attended Workshops and/or Meetings and Project Calls	Provided Update on Past Projects	Submitted Mitigation Actions for Current Plan	Seeking Approval for Adoption (meets all previous requirements)
Brownsville Public Utilities Board	X	X	X	X
Brownsville (C)	X	X	X	X

9.1 Brownsville Public Utilities Board

This section presents the jurisdictional annex for the Brownsville Public Utilities Board (BPUB) and includes resources and information to assist public and private sectors with reducing losses from future hazard events. This annex is not intended as guidance for actions to take during a disaster. Rather, this annex provides actions that can be implemented prior to a disaster to reduce or eliminate damage to property and people. The annex includes a general overview of the municipality and who in the Utilities Board participated in the planning process, an assessment of the Brownsville Public Utilities Board's risk and vulnerability, the different capabilities used in the Utilities Board, and an action plan that will be implemented to achieve a more resilient jurisdiction.

9.1.1 Hazard Mitigation Planning Team

The Brownsville Public Utilities Board followed the planning process described in Section 2 (Planning Process) in Volume I of this plan update and developed the annex over the course of several months with input from many Utilities Board departments as summarized in the table below. The primary and alternate points of contact represented the community on the Planning Team and supported the local planning process requirements by securing input from persons with specific knowledge to enhance the plan. All departments were asked to contribute to the annex development through reviewing and contributing to the capability assessment, reporting on the status of previously identified actions, and participating in action identification and prioritization.

The coronavirus pandemic resulted in a strain on local resources that limited some participation, but every effort was made to connect with staff and stakeholders and gain diverse input. Due to safety precautions, all meetings were held virtually.

The following table summarizes municipal officials that participated in the development of the annex and in what capacity. Additional documentation on the jurisdiction's planning process through Planning Partnership meetings is included in Section 2 (Planning Process) and Appendix C (Meeting Documentation).

Table 9.1-1. Hazard Mitigation Planning Team

Name	Title	Method of Participation
George Rangel	Fiscal Manager	Attended meetings
Conrad Taylor	Grants Coordinator	Attended meetings; updated hazard event history; provided information on capabilities; identified mitigation actions
Lina Alvarez	Area Manager	Attended meetings
Jose Armando Garza	Chief W/WW Operator	Attended meetings
Hazael Becerra	GIS Manager	Attended meetings
Jaime Estrada	Director of Operational Support Services	Attended meetings
Ryan Greenfield	Communications and Public Relations Manager	Attended meetings
Jacob Galvan	Chief W/WW Operator	Attended meetings

9.1.2 Jurisdictional Profile

For more than a century, Brownsville utilities have been part of Brownsville's growth and future. In 1904, the utility that would become BPUB was created by a unanimous vote under the city's Home Rule Charter.

The Brownsville Public Utilities Board (BPUB) was formally chartered by the city of Brownsville in 1960 to provide electrical, water and wastewater services to its customers in the southernmost part of Texas.

Under the charter, management, operation and control of the city's combined water, wastewater and electric utility systems were delegated to the BPUB Board of Directors. The Board is composed of seven members: six appointed by the City Commission to four-year terms and the city's mayor serves as the seventh member (ex-officio).

By delivering exceptional electric, water and wastewater services to the Brownsville area, BPUB has set the standard as a customer-focused, municipally owned utility (MOU) offering reliable services the community can depend on. Today, BPUB is ranked as one of the largest MOUs in the state and country.

In this leadership role, BPUB has built its reputation on providing quality electric, water and wastewater services for a community with an estimated population of 176,000 and some customers outside city limits. BPUB provides 46,000 industrial, commercial and residential customers with electric service, about 47,000 with water service, and about 47,000 with sewer service both inside and outside the city's corporate boundaries and to the Port of Brownsville and its industries.

9.1.3 Jurisdictional Capability Assessment and Integration

The Brownsville Public Utilities Board performed an inventory and analysis of existing capabilities, plans, programs, and policies that enhance its ability to implement mitigation strategies. Section 5 (Capability Assessment) describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of planning, legal and regulatory capabilities.
- Development and permitting capabilities.
- An assessment of administrative and technical capabilities
- An assessment of fiscal capabilities.
- An assessment of education and outreach capabilities.
- Classification under various community mitigation programs.
- The community's adaptive capacity to withstand hazard events.

9.1.3.1 Planning, Legal, and Regulatory Capability

BPUB has several planning, legal, and regulatory capabilities to protect the public health, safety, and welfare of those their utilities serve. A majority of the planning, legal, and regulatory capabilities are performed at the municipal level. Refer to the City of Brownsville's annex (Section 9.2). BPUB has the following capabilities:

- BPUB Water Master Plan
- 2021 - 2022 BPUB General Emergency Plan (May 28, 2021) - This manual of organization, plans and procedures, to be followed in the event of a major emergency, was prepared to provide key personnel with as much information as practical for their general direction in case of a major emergency in Brownsville.

9.1.3.2 Development and Permitting Capability

The table below summarizes the capabilities of the Brownsville Public Utilities Board to oversee and track development.

Table 9.1-2. Development and Permitting Capability

Indicate if your jurisdiction implements the following	Yes/No	Comment
Do you issue development permits? -If yes, what department is responsible? -If no, what is your process for development?	N/A	Performed at the municipal level (City of Brownsville)
Are permits tracked by hazard area? (For example, floodplain development permits.)	N/A	-
Do you have a buildable land inventory? -If yes, describe. -If no, quantitatively describe the level of buildout in the jurisdiction.	N/A	-

9.1.3.3 Administrative and Technical Capability

The table below summarizes potential staff and personnel resources available to the Brownsville Public Utilities Board and their current responsibilities which contribute to hazard mitigation.

Table 9.1-3. Administrative and Technical Capabilities

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Administrative Capability		
Planning Board	N/A	-
Zoning Board of Adjustments	N/A	-
Planning Department	N/A	-
Mitigation Planning Committee	Yes	Hazard Mitigation Planning Team for the HMP updates
Environmental Board/Commission	No	-
Open Space Board/Committee	No	-

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Economic Development Commission/Committee	No	-
Public Works/Highway Department	N/A	-
Construction/Building/Code Enforcement/Engineering Department	No	-
Emergency Management/Public Safety Department	No	-
Warning Systems / Services (mass notification system, outdoor warning signals)	Yes	Outage notifications
Maintenance programs to reduce risk (stormwater maintenance, tree trimming, etc.)	Yes	Ongoing by staff
Mutual aid agreements	Yes	Not Currently
Human Resources Manual - Do any job descriptions specifically include identifying or implementing mitigation projects or other efforts to reduce natural hazard risk?	Yes	HR
Other	No	-
Technical/Staffing Capability		
Planners or engineers with knowledge of land development and land management practices	No	-
Engineers or professionals trained in building or infrastructure construction practices	No	-
Planners or engineers with an understanding of natural hazards	Yes	On staff
Staff with expertise or training in benefit/cost analysis	Yes	On staff
Professionals trained in conducting damage assessments	No	Only available to conduct vehicle assessments following hazard events. (Fleet)
Personnel skilled or trained in GIS and/or Hazards United States (HAZUS) – Multi-Hazards (MH) applications	Yes	Available staff: Trained in GIS only.
Scientist familiar with natural hazards	No	-
Surveyor(s)	No	-
Emergency Manager	No	-
Grant writer(s)	Yes	BPUB uses data and maps from the current HMP to support documentation when developing grant applications.
Resilience Officer	No	-
Other (this could include stormwater engineer, environmental specialist, etc.)	No	-

9.1.3.4 Fiscal Capability

The table below summarizes financial resources available to the Brownsville Public Utilities Board.

Table 9.1-4. Fiscal Capabilities

Financial Resources	Are these accessible or eligible to use for mitigation? (Yes/No) If yes, please describe. If no, can this be used to support in the future?
Community development Block Grants (CDBG, CDBG-DR)	Yes, BPUB has applied for CDBG funding in the past.
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	No
User fees for water, sewer, gas or electric service	Yes
Impact fees for homebuyers or developers of new development/homes	Yes
Stormwater utility fee	No
Incur debt through general obligation bonds	Yes, Bonds Outstanding
Incur debt through special tax bonds	No
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	No
Other federal or state funding programs	Yes, through Texas Water Development Board
Open Space Acquisition funding programs	No
Other (for example, Clean Water Act 319 Grants [Nonpoint Source Pollution])	N/A

9.1.3.5 Education and Outreach Capability

The table below summarizes the education and outreach resources available to the Brownsville Public Utilities Board.

Table 9.1-5. Education and Outreach Capabilities

Outreach Resources	Available? (Yes/No)	Does the jurisdiction have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events? If yes, please describe.
Public information officer or communications office	Yes	BPUB has an officer of public information
Personnel skilled or trained in website development	Yes	BPUB maintains a website (https://www.brownsville-pub.com/)
Hazard mitigation information available on your website	Yes	The website has a 'newsroom' where information is posted related to outages, weather events, etc.
Social media for hazard mitigation education and outreach	Yes	Facebook, Twitter, and YouTube
Citizen boards or commissions that address issues related to hazard mitigation	N/A	-
Other programs already in place that could be used to communicate hazard-related information	No	-
Warning systems for hazard events	No	-
Natural disaster/safety programs in place for schools	N/A	-
Other	No	-

9.1.3.6 Community Classifications

The table below summarizes classifications for community programs available to the Brownsville Public Utilities Board.

Table 9.1-6. Community Classifications

Program	Participating? (Yes/No)	Classification (if applicable)	Date Classified (if applicable)
Community Rating System (CRS)	N/A	-	-
Building Code Effectiveness Grading Schedule (BCEGS)	N/A	-	-
Public Protection (ISO Fire Protection Classes 1 to 10)	N/A	-	-
Storm Ready Certification	N/A	-	-
Firewise Communities classification	N/A	-	-
Other	N/A	-	-

Note:
N/A Not applicable
NP Not participating
- Unavailable

9.1.3.7 Adaptive Capacity

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or respond to consequences" (IPCC 2014). In other words, it describes a jurisdiction's current capabilities to adjust to, protect from, or withstand a future hazard event, future conditions, and changing risk. The table below summarizes the adaptive capacity for each hazard of concern and the jurisdiction's rating.

Table 9.1-7. Adaptive Capacity

Hazard	Preliminary Ranking
Dam and Levee Failure	Moderate
Disease Outbreak	Moderate
Drought	Moderate
Erosion	Moderate
Extreme Heat	Moderate
Flood	Moderate
Hail	Moderate
Hurricane/Tropical Storm	Moderate
Lightning	Moderate
Thunderstorm Wind	Moderate
Tornado	Moderate
Wildfire	Moderate
Winter Storm	Moderate

**Strong = Capacity exists and is in use, Moderate = Capacity may exist; but is not used or could use some improvement, Weak = Capacity does not exist or could use substantial improvement.*

9.1.4 National Flood Insurance Program (NFIP) Compliance

NFIP compliance is performed at the municipal level. Refer to the City of Brownsville's annex (Section 9.2) for details on the NFIP in the City.

9.1.5 Growth/Development Trends

BPUB has a Capital Budget Plan reflecting general and administrative utility projects, along with design, updates, and implementation of future projects based on proposed economic growth and an expanded population. Projects will include identifying land for new construction of utility systems and rehabilitation of outdated facilities in order to meet future economic development needs in a fast-growing area.

9.1.6 Jurisdictional Risk Assessment

The hazard profiles in Section 5 (Risk Assessment) provide detailed information regarding each plan participant's vulnerability to the identified hazards. Section 5.1 (Hazards of Concern), Section 5.2 (Methodology and Tools), and Section 5.3 (Hazard Ranking) provide a detailed summary for the Brownsville Public Utilities Board's risk assessment results, and data used to determine the hazard ranking are discussed later in this section.

Hazard area extent and location maps provided below illustrate the probable areas impacted within the jurisdiction. These maps are based on the best available data at the time of the preparation of this plan and are adequate for planning purposes. Maps were only generated for those hazards that can be clearly identified using mapping techniques and technologies and for which the Brownsville Public Utilities Board has significant exposure. The maps also show the location of potential new development, where available.

Figure 9.1-1. Brownsville Public Utilities Board Area Extent and Location Map – Flood

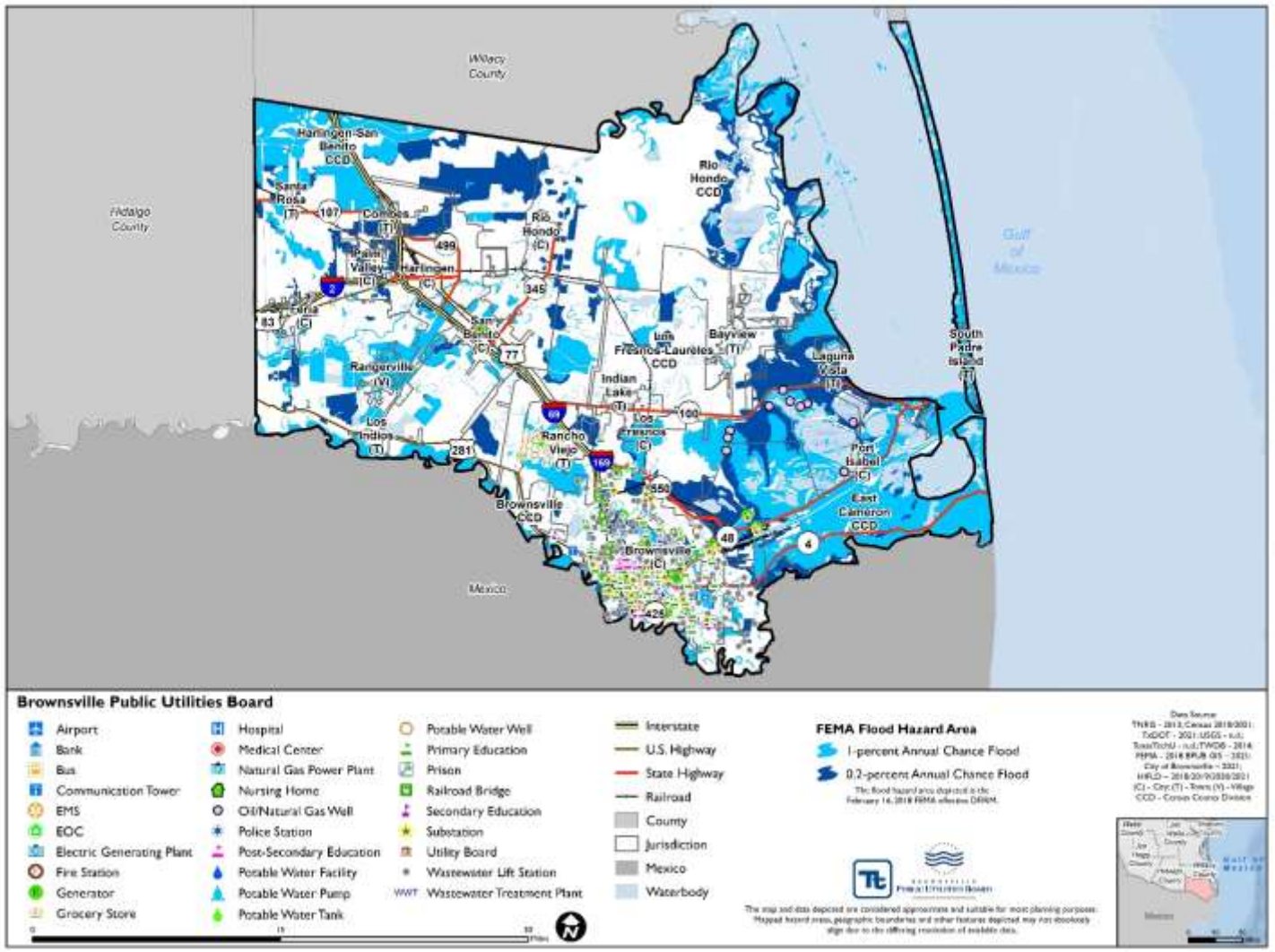


Figure 9.1-2. Brownsville Public Utilities Board Area Extent and Location Map – SLOSH

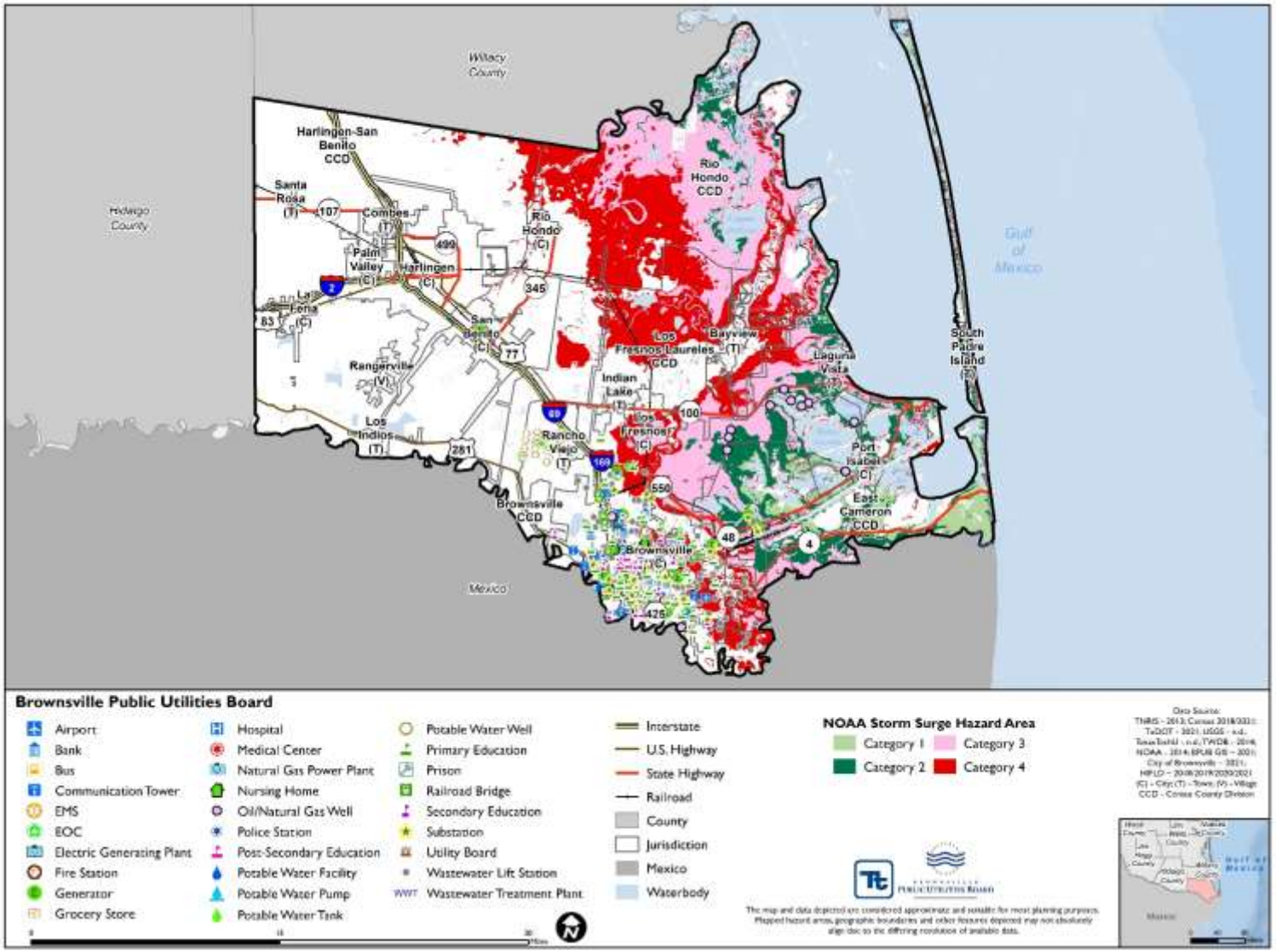


Figure 9.1-3. Brownsville Public Utilities Board Area Extent and Location Map – Sea Level Rise

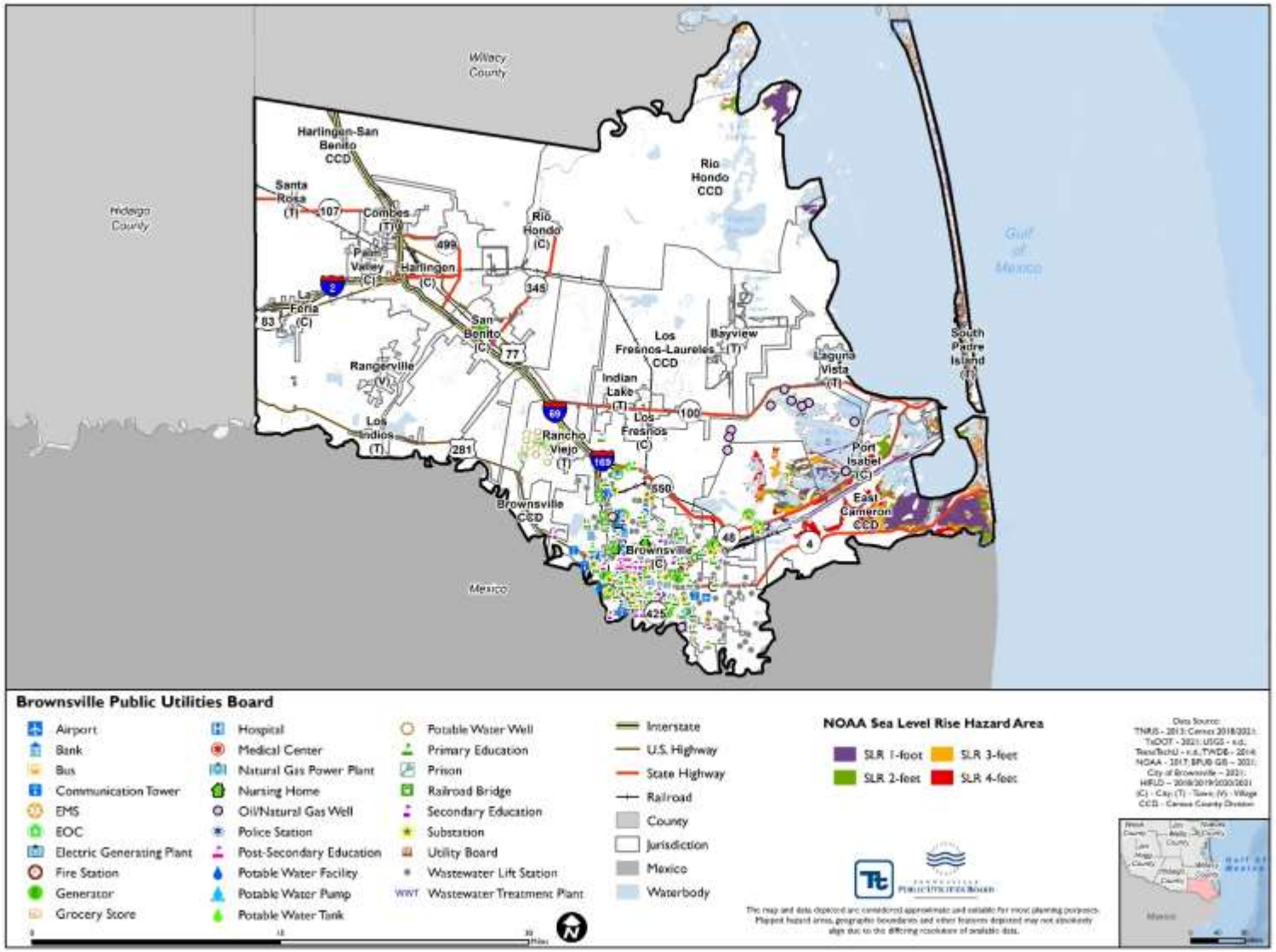
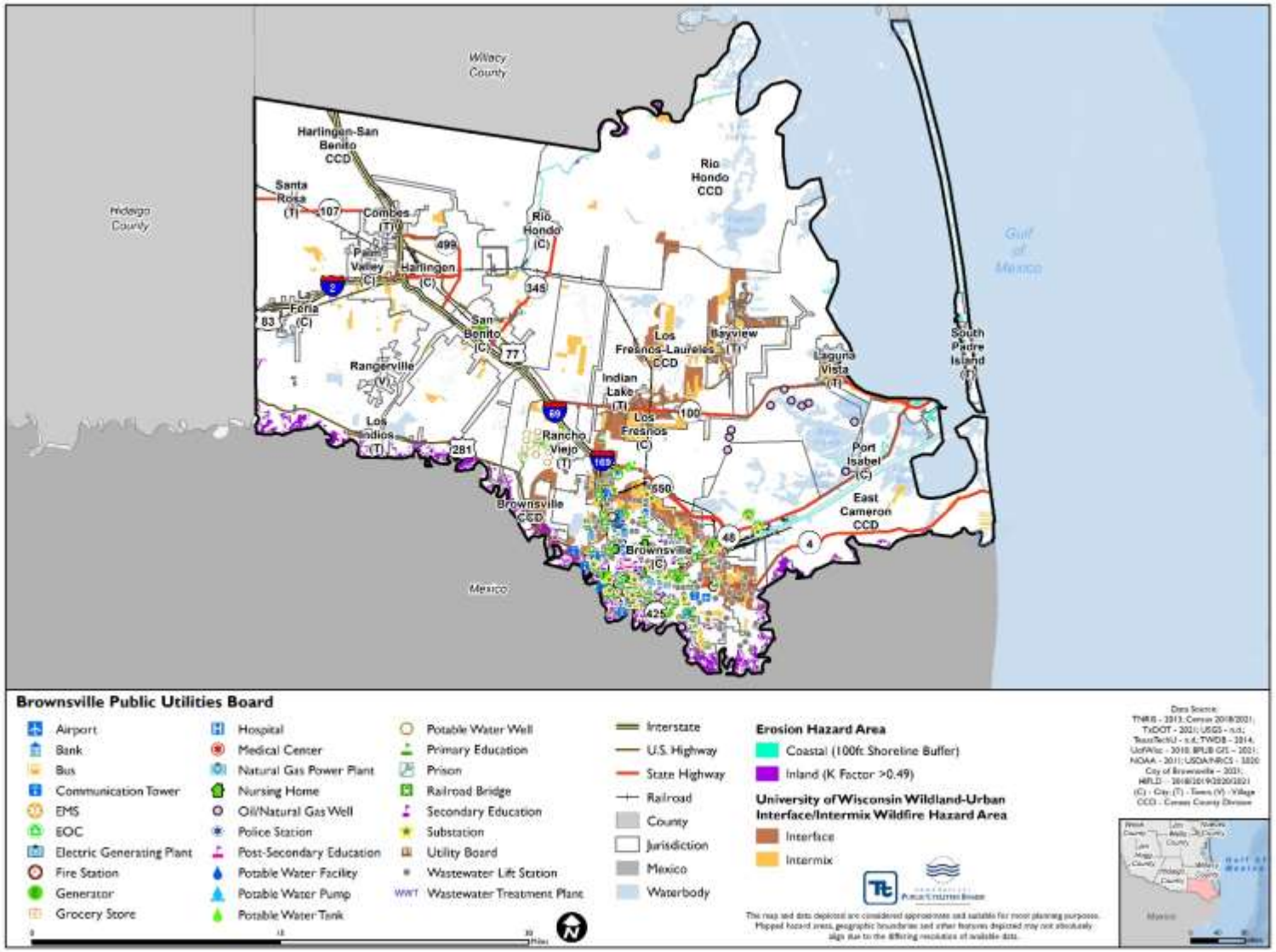


Figure 9.1-4. Brownsville Public Utilities Board Area Extent and Location Map – Wildfire and Erosion



9.1.6.1 Hazard Event History

The planning area has a history of natural hazard events as detailed in Section 5 (Risk Assessment) of this plan. A summary of historical events is provided in each of the hazard profiles and includes a chronology of events that have affected the planning area.

The Brownsville Public Utilities Board's history of federal declarations (as presented by FEMA) and significant hazard events (as presented in NOAA-NCEI) is consistent with that of the planning area. The table below provides details regarding municipal-specific loss and damages the Utilities Board experienced during hazard events since the last hazard mitigation plan update. Information provided in the table below is based on reference material or local sources.

Table 9.1-8. Hazard Event History

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Summary of Damages and Losses
October 30, 2015	Flash Flood / Heavy Rain (DR-4245)	Yes	Heavy and persistent rain fell across the City of Brownsville, mainly from downtown east towards the Port of Brownsville, and including all of the neighborhoods in Southmost, which took the brunt of the heavy rainfall. Within an hour, feet of water were inundating some roads and by three hours later up to 5 feet of water covered one of the most prone areas of town the Four Corners area where State Road 4 (International Blvd.) intersects State Road 48 (Boca Chica Blvd./Padre Island Highway). Neighborhood roads in Southmost were inundated with two to three feet of water, and dozens of homes and businesses flooded due to a combination of high water that filtered into homes and vehicles that created waves of water which surged into them. At Brownsville/South Padre Island International Airport, the 6.55 inches of rainfall was reported.	An estimated $100,000 in property damages was reported in the area.
January 11, 2018	Strong Wind	No	A surge of strong winds behind the dry front late on January 11th produced peak gusts between 44 and 54 mph during the mid-evening. The gusty winds at Brownsville/ South Padre Island International Airport (50 mph at 8:40 PM) sparked a brief fire on the airport grounds when a transformer blew near Iowa Avenue.	An estimated $15,000 in property damages was reported.
June 20, 2018	Flash Flood / Heavy Rain (DR-4377)	Yes	In Cameron County, between 12 and 18 inches of rainfall fell, inundating several thousands of homes and businesses with 18 inches to three feet of water, and hundreds of rescues of persons and pets were common.	An estimated $20 million in damages in Cameron County alone was reported.
August 12, 2018	Thunderstorm Wind	No	A rapidly developing line of thunderstorms raced northward through Cameron County east of US 77, creating gusts over 40 mph and causing minor damage to a few tree limbs, unfastened lawn furniture, and a few power lines.	An estimated $500,000 in property damages was reported.

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Summary of Damages and Losses
July 25, 2020	Tropical Storm / Hurricane Hanna (EM-3530)	Yes	Hurricane Hanna, the 2020 Atlantic season's first Hurricane, made landfall along the unpopulated Padre Island National Seashore on the mid-Kennedy County coastline as a Category 1 storm at around 5 PM Central Time Saturday, July 25th, carrying sustained 90 mph winds with gusts over 100 mph in a small portion of the inner eye wall. At the storm's peak, an estimated 50 thousand electric customers were without power. An EF0 tornado was also reported, touching down 2.3 miles south of the Brownsville Airport, moving north. Crop damage was also significant, with sugar cane snapped in many fields and young fruit being blown off citrus trees, which also sustained damage.	Estimated property damages in Cameron County were upwards of $1.88 million. Tornado damages were estimated at $250,000 in property damages. Estimated crop dollar value loss based on reports from Texas AgriLife in late summer was $25.9 million in Cameron County.
February 14, 2021	Front/Freeze (EM-3554)	Yes	A strong cold front moved through Deep South Texas and the Rio Grande Valley on February 12th, followed then by a strong Arctic High building into the area on February 13th. The Arctic High ushered in very cold air, with subsequent cold air damming leading to an extended period of anomalously cold temperatures. Cameron County sustained heavy crop losses. Soon after temperatures fell below freezing, light rain turned to a mix of light freezing rain and sleet, which created a thin coating of ice on trees and plants. Icing was also noted along elevated roads, requiring some closures.	Estimated property damages in Cameron County were over $32,000. Cameron County crop losses estimated at $46 million.

9.1.6.2 Hazard Ranking and Vulnerabilities

The hazard profiles in Section 5.1 (Hazards of Concern) of this plan have detailed information regarding each plan participant's vulnerability to the identified hazards. The following summarizes the Brownsville Public Utilities Board's risk assessment results and data used to determine the hazard ranking.

Hazard Ranking

This section provides the community specific identification of the primary hazard concerns based on identified problems, impacts and the results of the risk assessment as presented in Section 5 (Risk Assessment) of the plan. The ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property, and the economy as well as community capability and changing future climate conditions. This input supports the mitigation action development to target those hazards with highest level of concern.

As discussed in Section 5.3 (Hazard Ranking), each participating jurisdiction can have differing degrees of risk exposure and vulnerability. The table below summarizes the hazard risk/vulnerability rankings of potential natural hazards for the Brownsville Public Utilities Board. The Brownsville Public Utilities Board reviewed the hazard risk/vulnerability risk ranking table to reflect the relative risk of the hazards of concern to the jurisdiction.

During the review of the hazard/vulnerability risk ranking, the Utilities Board agreed with all the calculated rankings, except for Earthquake which had a low ranking. BPUB chose to remove the earthquake hazard from this update as there is no exposure to population or building stock.

Table 9.1-9. Hazard Ranking Input

Dam & Levee Failure	Disease Outbreak	Drought	Erosion	Extreme Heat	Flood	Hail
Low	Medium	Medium	Low	High	Medium	Medium

Hurricane & Tropical Storm	Lightning	Thunderstorm Wind	Tornado	Wildfire	Winter Weather
High	Medium	Medium	Medium	Low	Medium

Note: The scale is based on the hazard rankings established in Section 5.3 (Hazard Ranking) and modified as appropriate during review by the jurisdiction.

9.1.6.3 Identified Issues

After review of the Brownsville Public Utilities Board's hazard event history, hazard rankings, jurisdiction specific vulnerabilities, hazard area extent and location, and current capabilities, the Brownsville Public Utilities Board has not identified additional vulnerabilities within their community.

Specific areas of concern based on resident response to the citizen survey include:

- Flooding in the following areas:
  - Stagecoach Trail and Dennet Road
  - Price Road, Bernard Road, Tropical Drive, Frontage Road, FM 802
  - Boca China Boulevard
  - Dana Avenue north of FM 802
  - Quail Hollow Drive
  - Los Ebanos Boulevard and Price Road
  - Parkwood Place
  - Harvard Avenue and alleys
  - Harvard Avenue and Woodruff Avenue
  - Ruben Torres Boulevard between Quail Trail and Military Highway
  - Elma Street, Central Avenue, Austin Road
  - Paredes Line Road, Robindale Road, Old Port Isabel Road, Ruben Torres Boulevard
  - Draper Drive
  - Morrison Street near Valley Baptist

9.1.7 Mitigation Strategy and Prioritization

This section discusses past mitigations actions and status, describes proposed hazard mitigation initiatives, and their prioritization.

9.1.7.1 Past Mitigation Initiative Status

The following table indicates progress on the community's mitigation strategy identified in the 2017 HMP. Actions that are carried forward as part of this plan update are included in the following subsection in its own table with prioritization. Previous actions that are now on-going programs and capabilities are indicated as such in the following table and are discussed in the 'Capability Assessment' presented previously in this annex.

Table 9.1-10. Status of Previous Mitigation Actions

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB – 1	Improve information technology including replicating software in conjunction with Disaster Recovery objectives	Information Technology	Ongoing Capability Funding Source: Capital Budget/Grants	Yes (as 2022-BPUB-012)	Hazards: Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Earthquake Location: BPUB Service Area	Information Technology
BPUB – 2	Install emergency generators on all critical facilities	Facilities Maintenance	Ongoing Capability Funding Source: Capital Budget/HMA Grants	Yes (as 2022-BPUB-013)	Reduced damage to critical infrastructure reduced risk to public health, safety, and welfare; continue essential utility operations. Hazards: Flood, Thunderstorm, Hurricane Wind, Earthquake, Winter Storm, Extreme Heat Location: BPUB service area	Facilities Maintenance
BPUB – 3	Replace sub-standard or outdated fire hydrants	Water/WW Operations & Construction	Completed Cost: $599,734.46	No	-	-

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB – 4	Construct dome shelter in the event of tornado or hurricane wind in Brownsville planning area	Emergency Management, Grants coordinator	Completed by City of Brownsville	No	-	-
BPUB – 5	Install hail guards for HVAC systems on critical facilities	Energy Risk Management	No Progress	Yes (as 2022-BPUB-014)	Location: BPUB service area Hazards: Hail	Energy Maintenance
BPUB – 6	Install quick connect systems on all critical facilities with emergency generators	Engineering	No Progress	Yes (as 2022-BPUB-015)	Location: BPUB service area Hazards: Tornado, Thunderstorm, Flood, Extreme Heat, Hail, Winter Storm, Hurricane Wind, Dam Failure, Earthquake	Engineering
BPUB – 7	Conduct analysis of BPUB utilities located in SFHAs and elevate utilities to prevent flooding in the event of upstream dam failure	Engineering	No Progress	Yes (as 2022-BPUB-016)	Locations: BPUB service area Hazards: Flood, Dam Failure	Engineering
BPUB – 8	Develop program to annually remove buildup of silt in area Resacas that become cutoff from the river and contribute to flooding during severe flood or hurricane event	Engineering	Ongoing Capability	Yes (as 2022-BPUB-017)	Location: BPUB service area Hazards: Flood, Drought	BPUB: Resaca Maintenance

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB – 9	Install cooling stations at BPUB facilities to aid residents during extreme heat events	Engineering	No Progress	No		
BPUB – 10	Install xeriscape plantings at all BPUB utility locations	Maintenance	Ongoing Capability (Internal)	No	-	-
BPUB and City of Brownsville – 1	Secure Memorandum of Understanding (MOU) with Lower Rio Grande Flood Control agency to implement structural drainage measures to mitigate potential dam and levee failure of upstream flood control system	Lower Rio Grande Valley Flood Control	N/A – City of Brownsville	No	Hazards: Dam Failure, Flood Location: City of Brownsville, BPUB service area	Lower Rio Grande Valley Flood Control
BPUB and City of Brownsville – 2	Conduct a public education program for evacuating residents downstream of the Lower Rio Grande Flood Control system in the event of dam or levee failure	Lower Rio Grande Valley Flood Control	N/A – City of Brownsville	No	Hazards: Dam Failure, Flood Location: City of Brownsville	Lower Rio Grande Valley Flood Control
BPUB and City of Brownsville – 3	Implement the FIREWISE Program to minimize dangers of wildfire in extreme heat and drought conditions	Fire Department	N/A – City of Brownsville	No	Hazards: Wildfire, Extreme Heat, Drought Location: City of Brownsville, BPUB	Fire Department
BPUB and City of Brownsville – 4	Work with neighboring communities and South Padre Island to implement an evacuation plan for the proposed bridge connecting the mainland to South Padre Island	Emergency Management	N/A – City of South Padre Island	No	Hazards: Hurricane, Flood Location: City of Brownsville, BPUB	Emergency Management

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB and City of Brownsville – 5	Construct a second bridge connecting the mainland to South Padre Island	Emergency Management	Ongoing Capability – City of South Padre Island	No	Hazards: Hurricane, Flood Location: N/A	Emergency Management
BPUB and City of Brownsville – 6	Construct dome shelter in the event of tornado or hurricane wind in Brownsville planning area	Emergency Management, Grants coordinator	Completed by the City of Brownsville	No	-	-
BPUB and City of Brownsville – 7	Install system of weather stations	Emergency Management	N/A – City of Brownsville	No	Hazards: Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake Location: City of Brownsville	Emergency Management
BPUB and City of Brownsville – 8	Install emergency alert system such as I-Info that includes notification in real time alerts	Emergency Services	N/A – City of Brownsville	No	Hazards: Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake Location: City of Brownsville	Emergency Services

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB and City of Brownsville – 9	Conduct public education on tones and signals associated with area-wide emergency alert system	Emergency Services	N/A – City of Brownsville	No	Hazards: Dam Failure, Drought, Extreme Heat, Flood, Hail, Hurricane Wind, Thunderstorm, Tornado, Wildfire, Winter Storm, Earthquake Location: City of Brownsville	Emergency Services

9.1.7.2 Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy

The Brownsville Public Utilities Board has identified the following mitigation projects/activities that have also been completed but were not identified in the previous mitigation strategy in the 2015 HMP:

- Installation of underground fiber optic cable in a looped communication system between water wells and the process systems within the SRWA plant.
    - Location: Southmost Regional Water Authority (SRWA)
    - Est. Cost: $1.4 million
    - Hazards Addressed: Winter Storm, Hurricane/Tropical Storm
    - Agency: Engineering (BPUB)
- Implementation of Advanced Metering Infrastructure (AMI)
    - Location: BPUB service area
    - Est Cost: $26 million
    - Hazards Addressed: Winter Storm, Hurricane/Tropical Storm
    - Agency: Customer & Information Services (BPUB)
    - Hazards Addressed: Winter Storm, Extreme Heat, Hurricane/Tropical Storm
- Transformer replacement project
    - Location: BPUB service area
    - Est. Cost: $1.5 million
    - Hazards Addressed: Winter Storm, Extreme Heat
    - Agency: Substations & Relaying (BPUB)

9.1.7.3 Proposed Hazard Mitigation Initiatives for the HMP Update

The Brownsville Public Utilities Board participated in a mitigation action workshop in August 2021 and was provided the following FEMA publications to use as a resource as part of their comprehensive review of all possible activities and mitigation measures to address their hazards: FEMA 551 'Selecting Appropriate Mitigation Measures for Floodprone Structures' (March 2007) and FEMA 'Mitigation Ideas – A Resource for Reducing Risk to Natural Hazards' (January 2013).

The table below indicates the range of proposed mitigation action categories.

Table 9.1-11. Analysis of Mitigation Actions by Hazard and Category

Hazard	FEMA					CRS				
	LPR	SIP	NSP	EAP	PR	PP	PI	NR	SP	ES
Dam and Levee Failure		X		X		X	X			X
Disease Outbreak		X		X			X			X
Drought		X	X	X		X	X			X
Erosion		X	X	X		X	X			
Extreme Heat		X		X		X	X			X
Flood		X	X	X		X	X			X

Hazard	FEMA					CRS				
	LPR	SIP	NSP	EAP	PR	PP	PI	NR	SP	ES
Hail		X		X		X	X			X
Hurricane/Tropical Storm		X		X		X	X			X
Lightning		X		X		X	X			X
Thunderstorm Wind		X		X		X	X			X
Tornado		X		X		X	X			X
Wildfire		X		X		X	X			X
Winter Storm		X		X		X	X			X

Note: Section 6 (Mitigation Strategy) provides for an explanation of the mitigation categories.

The table below (Table 9.1-12) summarizes the comprehensive range of specific mitigation initiatives the Brownsville Public Utilities Board would like to pursue in the future to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities. Both the four FEMA mitigation action categories and the six CRS mitigation action categories are listed in the table below to further demonstrate the wide-range of activities and mitigation measures selected.

As discussed in Section 6 (Mitigation Strategy), 14 evaluation/prioritization criteria are used to complete the prioritization of mitigation initiatives. For each new mitigation action, a numeric rank is assigned (-1, 0, or 1) for each of the 14 evaluation criteria to assist with prioritizing your actions as 'High', 'Medium', or 'Low.' Table 9.1-13 provides a summary of the prioritization of all proposed mitigation initiatives for the HMP update.

Table 9.1-12. Proposed Hazard Mitigation Initiatives and Associated Priority

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-BPUB-001	HVAC Ionization Project	Problem: As employees return to the workplace, the risk for disease/virus outbreak impacts productivity due to shared workspace. Solution: Installation of air ionization technology into HVAC systems at BPUB facilities reduces risk of disease/virus outbreak.	Existing	Disease Outbreak	1	1-2 Years	Facilities Maintenance	Local Budget, Grants	Reduce risk of disease/virus outbreak; increase workplace productivity	$50,000	Medium	SIP	ES
2022-BPUB-002	SRWA Backup Generator Project	Problem: During inclement weather events, outages to the wellfield water pumps results in loss of treated water and reduced production capacity. Solution: Installation of local generation at SRWA pump stations will allow for continued production of water in the event of extended SRWA pump station outage.	Existing	Drought, Hurricane/ Tropical Storm, Winter Storm	1, 2	1-2 Years	Engineering	Local Budget, FEMA Grant Funding (HMGP, BRIC)	Reduced outages; reduced treated water losses; increased production capacity	$300,000	High	SIP	PP
2022-BPUB-003	SRWA Wellfield Expansion Project	Problem: Short-term drought-related water shortages are often the result of both decreased water supply due to below normal rainfall and increased water demand, which can speed the depletion of water supplies. SRWA will make efforts to assist member entities with reducing projected surface water demands. Solution: Additional production could possibly be acquired by increasing pump capacities in existing wells, developing the Primary Zone or through the lateral expansion of the Secondary Zone well field.	Existing	Drought	1, 2	2-3 Years	SRWA	BRIC, HMGP, BOR, Local Budget	Expanded production capacity	$1,500,000	Medium	SIP	NRP
2022-BPUB-004	SRWA Underground Fiber Installation	Problem: Currently, any loss of SCADA communication to the SRWA raw water wells causes disruption to the reverse osmosis (RO) treatment process, as	Existing	Hurricane/ Tropical Storm, Thunderstorm Wind, Tornado,	2	2-3 Years	Electrical Engineering	HMGP	Mitigate communication lapses, reduction in	$1,907,472	High	SIP	PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		operations is unable to view and control raw water pumps. Disruptions that can occur the inability to increase/decrease raw water flow, the inability to shut down all pumps in case of an emergency, undesired RO plant shutdown, and the Inability to restart the plant upon a shutdown. Solution: The installation of underground fiber in the looped communication route will mitigate loss of communication between the SRWA Water Treatment Facility and the Raw Water Wells as communication will no longer become reliant on maintained radio frequencies.		Wildfire, Winter Storm					treated water losses				
2022-BPUB-005	Advanced Metering Infrastructure Procurement Project	Problem: Aging and malfunctioning manual read meters result in communication lapses during outages. Current read times are conducted on an hourly basis leading to increased truck rolls in order to diagnose cause of outages/blackout. Solution: The replacement of manual read meters with new, reliable meters equipped with communication modules that will send data to gateways, communication networks and ultimately back to the utility. With this information, BPUB can identify leaks, metering tampering, spikes in demand, and trend consumption necessary for proactive improvement.	Existing	Hurricane/ Tropical Storm, Thunderstorm Wind, Winter Storm	1, 2	2 Years	Customer Service and Information Technology	Grants, Local Budget	Increased reporting of consumption; theft identification; reduced truck rolls; reduction in outages/blackouts	$25,547,445	High	SIP	PP
2022-BPUB-006	Transformer Replacement Project	Problem: Existing single-faced transformers experience load management failure during extreme inclement weather events as power is restored causing subsequent outages/damages.	Existing	Winter Storm, Thunderstorm Wind, Hurricane/ Tropical Storm	1, 2	Phased	Electrical Engineering	FEMA Grant Funding (HMGP, BRIC)	Reduced truck rolls; reduced outages/system overloads	$11,410,000	Medium	SIP	PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: The replacement of residential, single-faced transformers to allow for proper overload protection during inclement weather events.											
2022-BPUB-007	Variable Frequency Drive Installation	Problem: Natural gas fuel must be compressed to a higher pressure to facilitate full load operation of a 50-megawatt generating unit at the BPUB, Silas Ray Power Plant. Without this compression equipment, generation is limited to less than 20% of full load capacity; furthermore, unless the compression equipment is in operation, reserve capacity cannot be assured when needed. Thus, gas compressor full load operation at part unit load dispatching frequently results in down time and a reduction in generating capacity. Solution: Variable frequency drive equipment can be used to control gas compressor motor speed and in so doing regulate fuel gas flow to the generating unit according to demand. Wear and tear cycling of the unit can then be reduced while keeping pace with the dispatching of generation load. Reduced operating and repair cost coupled with increased reliability and generating unit availability would be realized.	Existing	Extreme Heat, Winter Storm	2	1-2 Years	Power Production	Local Budget, FEMA Grant Funding (HMGP, BRIC)	($375,000 - 425,000) / occurrence/year	$175,000	High	SIP	PP
2022-BPUB-008	Natural Gas Infrastructure Improvement	Problem: The hazard of completely losing or reducing generation capacity during an extreme weather event can; expose the public to the hardships of severe temperatures, threaten critical care facilities, cripple essential services and hinder disaster recovery efforts. Many of these affects were reported as	Existing	Extreme Heat, Winter Storm	1, 2	2-4 years	Power Production	Local Budget, FEMA Grant Funding (HMGP, BRIC)	($5.7 Million) in a 24-Hour period.	$3.5 Million (Highly Speculative)	High	SIP	PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		in the case of Winter Storm "Uri" which conversely impacted energy providers and their respective customers economically with the high cost of energy. This one event alone clearly illustrated an impact by weather on energy that left a vast majority of Texans with no escape. Availability and scheduling of firm natural gas to supply electric power generation has become increasingly more difficult in the advent of recent gas pipeline expansion and the development of a gas export market in Texas. Planning in this respect, especially for critical weather events, is exacerbated by price speculation, unreliable or unwilling supplier commitments and again, unabated gas exports. Without the ability to mitigate fuel costs, production and end user pricing of energy cannot be controlled. Solution: Locate, assess and potentially recover appropriately sized orphan gas wells for the development of reserve ground storage capacity of natural gas. Such well facilities would preferably be more local the point of use to better facilitate control and maintainability. Gas can then be stock piled at a lesser cost to mitigate extreme energy price fluctuations. Existing point-of use or new gas compression equipment can be re-tasked for charging and forwarding of fuel gas stock to generation facilities in sufficient volume and pressure to mitigate possible fuel curtailments which may occur during extreme weather emergencies.											

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-BPUB-009	Lift Station Rehabilitation Project (Various)	Problem: Lift station is beyond its service life. Its structural, mechanical, and electrical condition is deteriorated and has made the lift station unsafe, unreliable, and inefficient. Lift Station discharge piping, pump base ells, and valves are corroded. Concrete structures such as its wet well are obsolete and in poor condition. Electrical components such as the pump controls are obsolete and unreliable. Other aspects of the lift station site also need safety, security, and accessibility improvements such as a new perimeter fence, entrance driveway, etc. to bring the lift station into compliance with current specifications and regulations. Solution: Complete lift station rehabilitation including: wet well rehabilitation/ replacement, replacement of corroded piping, fittings, valves, pumps, pump base ells, guide rails, wet well hatch, electrical controls, installation of new perimeter fence and concrete driveway.	Existing	Flood	1, 2	4-5 Years	BPUB W/WW Engineering	Local Budget, FEMA Grant Funding (FMA, HMGP, BRIC)	O&M cost savings are expected after the project is complete. After the lift station is rehabilitated considerably less frequent equipment breakdowns are expected, as well as minimum repair costs would be normally required to bring the station back online after a break down.	$5,797,178	Medium	SIP	PP
2022-BPUB-010	Brownsville North Regional Force Main	Problem: Based on the Master Plan study, the predominance of future growth in the BPUB service area is expected in the northwest portion of the service area. Wastewater flow from this area is currently bottlenecked through a series of force mains and lift stations along major arterials that serve other areas and were not designed to serve the northwest area. These force mains and lift stations are overloaded and cannot accommodate flow from additional growth.	Both	Flood	1, 2	6 Months	BPUB W/WW Engineering	Local Budget, FEMA Grant Funding (FMA, HMGP, BRIC)	This project will increase the efficiency of the existing lift stations, resulting in reduced maintenance and reduced SSOs.	$25,423,037.25	High	SIP	PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: The North Regional Lift Stations and Force Main System project includes construction of four regional lift stations and a major trunk force main across the north side of BPUB's service area connecting the system directly to the Robindale North Wastewater Treatment Plant.											
2022-BPUB-011	Robindale WWTP Road Upgrade	Problem: During adverse weather conditions, heavy equipment, (i.e., vacuum trucks, cranes, portable generators, etc.) cannot access treatment units to respond to equipment failures using the plant's existing caliche roads. Solution: Upgrading roads from caliche to concrete around plant will improve accessibility around treatment units during adverse weather.	Existing	Flood, Hurricane/ Tropical Storm	1	9 months	SRWA	FEMA Grant Funding (FMA, HMGP, BRIC)	Reduced outages and downtimes; reduced treated water losses	$700,000	Medium	SIP	PP
2022-BPUB-012	IT Improvements	Problem: Outdated IT Solution: Improve information technology including replicating software in conjunction with Disaster Recovery objectives	Existing	Dam and Levee Failure, Drought, Extreme Heat, Flood, Hail, Hurricane/ Topical Storm, Earthquake, Wildfire	2	Ongoing	Information Technology	Capital Budget, FEMA Grant Funding (HMGP, BRIC)	Efficient disaster recovery organization	Medium	Medium	SIP	ES
2022-BPUB-013	Emergency Generators	Problem: Critical facilities lack backup power Solution: Install emergency generators on all critical facilities	Existing	Flood, Thunderstorm, Hurricane/ Tropical Storm, Earthquake, Hail, Lightning, Winter Storm, Extreme Heat, Tornado	2	Ongoing	Facilities Maintenance	Capital Budget, FEMA Grant Funding (HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	PP, ES
2022-BPUB-014	Hail Guard Installation	Problem: Hailstorms cause damage to HVAC systems Solution: Install hail guards for HVAC systems on critical facilities	Existing	Hail	2	1-5 Years	Energy Maintenance	Capital Budget, FEMA Grant Funding	Protection of structures and critical infrastructure	Medium	Medium	SIP	PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
								(HMGP, BRIC)					
2022-BPUB-015	Quick-connect system installation	Problem: Many critical facilities do not have an efficient way to connect to emergency generators. Solution: Install quick connect systems on all critical facilities with emergency generators	Existing	Tornado, Thunderstorm Wind, Flood, Extreme Heat, Hail, Winter Storm, Hurricane/ Tropical Storm, Lightning, Dam Failure, Earthquake	2	1-5 Years	Engineering	Capital Budget, FEMA Grant Funding (HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	Medium	SIP	PP, ES
2022-BPUB-016	Conduct Utility Study and Elevate Utilities	Problem: BPUB utilities may be located in the dam/levee inundation zone Solution: Conduct analysis of BPUB utilities located in SFHAs and elevate utilities to prevent flooding in the event of upstream dam failure	Existing	Flood, Dam and Levee Failure	2	1-5 Years	Engineering	Capital Budget, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	Medium	SIP	PP
2022-BPUB-017	Resaca Silt Removal Program (Coordinates with 2022-City of Brownsville-017)	Problem: Erosion and silt buildup in area Resacas contribute to flooding. Solution: Develop a program to annually remove buildup of silt in area Resacas that become cutoff from the river.	Both	Erosion, Flood, Drought	1, 2	Ongoing	BPUB: Resaca Maintenance	Capital Budget, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP, NSP	PP
2022-BPUB-018	Public Information and Outreach (Coordinates with 2022-City of Brownsville-029)	Problem: Lack of hazard mitigation information and education for citizen preparedness. Solution: Add or increase website content and use other outreach methods such as mailers and flyers for suggested homeowner mitigation strategies and hazard preparedness information.	Both	Dam and Levee Failure, Disease Outbreak, Drought, Earthquake, Erosion, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado,	1, 5	Ongoing	BPUB, City of Brownsville	FEMA Grant Funding (FMA, HMGP), Staff Time	Greater understanding of mitigation suggestions and awareness of hazards will enable citizens to protect their properties and prepare for hazard events. Critical information received at the right time will help	Medium	High	EAP	PI

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
				Wildfire, Winter Storm					protect lives and property.				

Notes:
Not all acronyms and abbreviations defined below are included in the table.

Acronyms and Abbreviations:

CAV	*Community Assistance Visit*
CRS	*Community Rating System*
DPW	*Department of Public Works*
EHP	*Environmental Planning and Historic Preservation*
FEMA	*Federal Emergency Management Agency*
FPA	*Floodplain Administrator*
HMA	*Hazard Mitigation Assistance*
N/A	*Not applicable*
NFIP	*National Flood Insurance Program*
OEM	*Office of Emergency Management*

Potential FEMA HMA Funding Sources:

FMA	*Flood Mitigation Assistance Grant Program*
HMGP	*Hazard Mitigation Grant Program*
BRIC	*Building Resilient Infrastructure and Communities Program*

Timeline:
The time required for completion of the project upon implementation

Cost:
The estimated cost for implementation.

Benefits:
A description of the estimated benefits, either quantitative and/or qualitative.

Mitigation Category:

- *Local Plans and Regulations (LPR) – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.*
- *Structure and Infrastructure Project (SIP) - These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.*
- *Natural Systems Protection (NSP) – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.*
- *Education and Awareness Programs (EAP) – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.*

CRS Category:

- *Preventative Measures (PR) - Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.*
- *Property Protection (PP) - These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.*
- *Public Information (PI) - Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.*
- *Natural Resource Protection (NR) - Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.*

- *Structural Flood Control Projects (SP) - Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.*
- *Emergency Services (ES) - Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities.*

Table 9.1-13. Summary Evaluation and Action Priority

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-BPUB-001	HVAC Ionization Project	1	0	1	1	1	1	1	0	1	0	-1	1	1	0	8	Medium
2022-BPUB-002	SRWA Backup Generator Project	0	0	1	1	1	1	1	1	0	1	1	1	1	0	10	High
2022-BPUB-003	SRWA Wellfield Expansion Project	0	0	0	1	0	1	0	1	1	1	0	1	1	1	8	Medium
2022-BPUB-004	SRWA Underground Fiber Installation	0	0	1	1	1	1	0	1	1	1	1	1	1	1	11	High
2022-BPUB-005	Advanced Metering Infrastructure Procurement Project	0	0	1	1	0	1	1	1	1	1	1	1	1	1	11	High
2022-BPUB-006	Transformer Replacement Project	0	1	0	0	0	1	0	0	1	1	1	1	0	1	7	Medium
2022-BPUB-007	Variable Frequency Drive Installation	0	0	1	1	1	1	1	1	1	1	1	1	1	1	12	High
2022-BPUB-008	Natural Gas Infrastructure Improvement	0	1	1	1	0	1	1	1	0	0	0	1	1	1	9	High
2022-BPUB-009	Lift Station Rehabilitation Project (Various)	0	0	1	1	0	1	0	1	1	1	-1	1	1	1	8	Medium
2022-BPUB-010	Brownsville North Regional Force Main	0	0	1	1	0	1	1	1	1	1	-1	1	1	1	9	High
2022-BPUB-011	Robindale WWTP Road Upgrade	0	1	1	1	0	1	-1	1	0	1	1	1	1	0	8	Medium
2022-BPUB-012	IT Improvements	0	0	0	1	0	1	1	0	1	1	1	1	0	0	7	Medium

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-BPUB-013	Emergency Generators	0	1	1	1	0	1	1	1	1	1	1	1	1	0	11	High
2022-BPUB-014	Hail Guard Installation	0	1	1	1	0	1	1	1	1	1	-1	1	0	0	8	Medium
2022-BPUB-015	Quick-connect system installation	0	0	1	0	0	1	1	1	1	1	1	1	0	0	8	Medium
2022-BPUB-016	Conduct Utility Study and Elevate Utilities	0	1	0	1	0	1	0	1	1	1	1	1	0	0	8	Medium
2022-BPUB-017	Resaca Maintenance	0	1	1	1	0	1	1	1	1	1	1	1	1	1	12	High
2022-BPUB-018	Public Information and Outreach	1	1	0	1	1	0	0	1	1	0	1	1	1	0	9	High

Note: Section 6 (Mitigation Strategy), which conveys guidance on prioritizing mitigation actions. Low (0-4), Medium (5-8), High (9-14).

9.2 City of Brownsville

This section presents the jurisdictional annex for the City of Brownsville (City) and includes resources and information to assist public and private sectors with reducing losses from future hazard events. This annex is not intended as guidance for actions to take during a disaster. Rather, this annex provides actions that can be implemented prior to a disaster to reduce or eliminate damage to property and people. The annex includes a general overview of the municipality and who in the City participated in the planning process, an assessment of the City of Brownsville's risk and vulnerability, the different capabilities used in the City, and an action plan that will be implemented to achieve a more resilient jurisdiction.

9.2.1 Hazard Mitigation Planning Team

The City of Brownsville followed the planning process described in Section 2 (Planning Process) in Volume I of this plan update and developed the annex over the course of several months with input from many City departments as summarized in the table below. The primary and alternate points of contact represented the community on the Planning Team and supported the local planning process requirements by securing input from persons with specific knowledge to enhance the plan. All departments were asked to contribute to the annex development through reviewing and contributing to the capability assessment, reporting on the status of previously identified actions, and participating in action identification and prioritization.

The coronavirus pandemic resulted in a strain on local resources that limited some participation, but every effort was made to connect with staff and stakeholders and gain diverse input. Due to safety precautions, all meetings were held virtually.

The following table summarizes municipal officials that participated in the development of the annex and in what capacity. Additional documentation on the jurisdiction's planning process through Planning Partnership meetings is included in Section 2 (Planning Process) and Appendix C (Meeting Documentation).

Table 9.2-1. Hazard Mitigation Planning Team

Name	Title	Method of Participation
Odee Ann Leal	Emergency Management Administrator	Attended meetings; coordinated mitigation actions
Noel Bernal	City Manager	Attended meetings
Rick Vasquez	Planning and Redevelopment Director	Attended meetings
Doroteo Garcia, Jr.	Engineering Manager	Attended meetings; provided information on capabilities; identified mitigation actions
Tina Garza	GIS Coordinator	Attended meetings
Olga Moya	Grant Manager	Attended meetings
Eryka Duberney	Grant Analyst	Attended meetings

9.2.2 Jurisdictional Profile

The City of Brownsville is located in and is the county seat of Cameron County. Located on the southernmost tip of Texas, on the northern bank of the Rio Grande, the City of Brownsville is a bustling area of international trade

and commerce. Across the Rio Grande lies Brownsville's sister city, Matamoros, Tamaulipas, Mexico. Brownsville has a rich history as it has served as a site for several battles in the American Civil War, the Mexican American War, and the Texas Revolution. Today, Brownsville acts as an important trade link between the United States and Mexico.

Brownsville has a council-manager government. The mayor and a six-member city commission are selected in nonpartisan elections. Four members are elected from geographic districts; the remaining two members are elected at-large.

According to the U.S. Census, the April 2020 population of Brownsville is 186,738 which represents a 6.7 percent population increase from the 2010 Census.

9.2.3 Jurisdictional Capability Assessment and Integration

The City of Brownsville performed an inventory and analysis of existing capabilities, plans, programs, and policies that enhance its ability to implement mitigation strategies. Section 5 (Capability Assessment) describes the components included in the capability assessment and their significance for hazard mitigation planning. This section summarizes the following findings of the assessment:

- An assessment of planning, legal and regulatory capabilities.
- Development and permitting capabilities.
- An assessment of administrative and technical capabilities
- An assessment of fiscal capabilities.
- An assessment of education and outreach capabilities.
- Classification under various community mitigation programs.
- The community's adaptive capacity to withstand hazard events.

For a community to succeed in reducing long-term risk, hazard mitigation must be integrated into the day-to-day local government operations. Annex development included reviewing planning and policy documents and surveying each jurisdiction to obtain a better understanding of their progress in plan integration and how risk reduction is supported. Areas with current mitigation integration are summarized in this jurisdictional Capability Assessment (Section 9.2.3). The updated mitigation strategy includes opportunities the City of Brownsville identified for integration of mitigation concepts to be incorporated into municipal procedures.

9.2.3.1 Planning, Legal, and Regulatory Capability

Section 9.2.3 (Capability Assessment) provides an overview of the planning, legal, and regulatory capabilities. The table below summarizes the regulatory tools that are available to the City of Brownsville, what is present in the jurisdiction, and code citation and date.

Table 9.2-2. Planning, Legal, and Regulatory Capability

	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible
Codes, Ordinances, & Regulations					
Building Code	Yes	Yes	Chapter 18 – Buildings and Building Regulations	State and Local	Permitting Director/Building Official
How does this reduce risk? By using the highest standards, City construction will reduce the risk of hazards and protect both lives and property.					
Zoning/Land Use Code	Yes	No	Chapter 348 – Zoning	Local	Building Inspector
How does this reduce risk?					
Subdivision Ordinance	Yes	No	Chapter 332 – Subdivisions	Local	Plat Administrator
How does this reduce risk?					
Site Plan Ordinance	No	No	-	Local and County	-
Stormwater Management Ordinance	Yes	Yes	Chapter 308 – Flood Damage and Prevention	Local	
How does this reduce risk? Stormwater Management reduces the risk of pollutants that may have the potential to endanger local residents.					
Post-Disaster Recovery/ Reconstruction Ordinance	No	No	-	-	-
How does this reduce risk? Not applicable					
Real Estate Disclosure	Yes	Yes	-	State	-
How does this reduce risk? Real Estate Disclosure ensures that property owners are aware of historical disaster impacts and gives them information necessary to plan for and mitigate future disasters.					
Growth Management	No	No	-	Local	-
Environmental Protection Ordinance	Yes	Yes	Chapter 46 – Environment	Local	-
How does this reduce risk? Provides guidance to reduce risk to lives, property and the environment by setting standards for pollution control and impact mitigation.					
Flood Damage Prevention Ordinance	Yes	Yes	Chapter 308 – Flood Damage and Prevention	Federal, State, County and Local	Planning and Redevelopment Services
How does this reduce risk? Floodplain regulations reduce risk to lives and property by ensuring mitigation measures are put into place for repetitive loss properties and new construction.					
Wellhead Protection	No	No	-	-	-
How does this reduce risk? Not applicable					
Emergency Management Ordinance	No	No	-	-	-
How does this reduce risk? Not applicable					
Climate Change Ordinance	No	No	-	-	-
How does this reduce risk? Not applicable					
Other	No		-	-	-
Planning Documents					
Comprehensive Plan	Yes	No	Imagine Brownsville Comprehensive Plan – 2009	Local	Planning and Redevelopment Services
How does this reduce risk? Risk reduction to new development.					
Capital Improvement Plan	Yes	No	Consolidate Plan 2015-19	Local	Office of Strategic Initiatives
How does this reduce risk? Presents mitigation projects to be funded.					

	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible
Disaster Debris Management Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Floodplain Management or Watershed Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Stormwater Management Plan	Yes	No	Stormwater Management Plan 2019-2024	Local	Engineering and Public Works – Stormwater & Environment
How does this reduce risk? Stormwater Management reduces the risk of pollutants that may have the potential to endanger local residents.					
Open Space Plan	Yes	No	Parks and Open Space Master Plan 2008	Local	Parks & Recreation
How does this reduce risk?					
Urban Water Management Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Habitat Conservation Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Economic Development Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Shoreline Management Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Community Wildfire Protection Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Community Forest Management Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Transportation Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Agriculture Plan	Yes	Yes	Texas Agri-Life Extension Service	County	Cameron County Agricultural Extension
How does this reduce risk? Agricultural planning reduces the risk to the animals and community during times of disaster.					
Climate Action/ Resiliency/Sustainability Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Tourism Plan	Yes	No	Lower Rio Grande Valley Active Transportation & Active Tourism Plan 2015	Local	Parks & Recreation
How does this reduce risk? Informs visitors of risk.					
Business/ Downtown Development Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Other	No	No	-	-	-
Response/Recovery Planning					
Comprehensive Emergency Management Plan	Yes	Yes	City of Brownsville Emergency Operations Plan November 2021	Local	Emergency Management
How does this reduce risk? Details both short-term response and long-term recovery plans that address communications, evacuation, and housing necessary for a variety of hazards that impact the community.					
Continuity of Operations Plan	No	No	-	-	-

	Jurisdiction has this? (Yes/No)	Required by State? (Yes/No)	Code Citation and Date (code chapter, name of plan, date of plan)	Authority (local, county, state, federal)	Individual / Department / Agency Responsible
How does this reduce risk? Not applicable					
Strategic Recovery Planning Report	No	No	-	-	-
How does this reduce risk? Not applicable					
Threat & Hazard Identification & Risk Assessment (THIRA)	Yes	Yes	2021 Threat and Hazard Identification and Risk Assessment (THIRA) Lower Rio Grande Valley Development council COG-1	Local	Emergency Management
How does this reduce risk? By coordinating on a regional THIRA, the City reduces the risks of hazards and threats that potentially impact the entire region.					
Post-Disaster Recovery Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Public Health Plan	No	No	-	-	-
How does this reduce risk? Not applicable					
Other	No	-	-	-	-

9.2.3.2 Development and Permitting Capability

The table below summarizes the capabilities of the City of Brownsville to oversee and track development.

Table 9.2-3. Development and Permitting Capability

Indicate if your jurisdiction implements the following	Yes/No	Comment
Do you issue development permits? -If yes, what department is responsible? -If no, what is your process for development?	Yes	Building Permits and Inspections Division
Are permits tracked by hazard area? (For example, floodplain development permits.)	No	-
Do you have a buildable land inventory? -If yes, describe. -If no, quantitatively describe the level of buildout in the jurisdiction.	No	The City is 80 percent built-out.

9.2.3.3 Administrative and Technical Capability

The table below summarizes potential staff and personnel resources available to the City of Brownsville and their current responsibilities which contribute to hazard mitigation.

Table 9.2-4. Administrative and Technical Capabilities

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
Administrative Capability		
Planning Board	Yes	Planning & Zoning Commission
Zoning Board of Adjustments	Yes	The City of Brownsville's Zoning Division is responsible for upholding the zoning and platting regulations

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
		according to the local development code and state regulations. Zoning is a regulatory tool that cities use in order to ensure stable property value and an adequate mix of uses while protecting the health, safety, and welfare of the general public.
Planning Department	Yes	Planning and Redevelopment Services
Mitigation Planning Committee	No	-
Environmental Board/Commission	No	-
Open Space Board/Committee	No	-
Economic Development Commission/Committee	No	-
Public Works/Highway Department	Yes	The Public Works Department is tasked with providing core community services and infrastructure maintenance that are key to the growth, health, safety and quality of life for the City of Brownsville. Divisions include: • Building Maintenance • Concrete Construction (sidewalk, curb and gutter maintenance) • Greens (forestry, mowing, tree maintenance, resaca maintenance, BBC maintenance, curb maintenance, and emergency standby) • Landfill (solid waste handling and disposal, and waste minimization) • Administration • Street Maintenance (street pavement management and alleyway maintenance) • Drainage/Stormwater (City ditch maintenance, storm sewer system management, MS4 management).
Construction/Building/Code Enforcement Department	Yes	The Building Permits and Inspections Division's mission is to ensure compliance with adopted City building, zoning, fire, health and sanitation codes on all residential and commercial structures in order to protect the health, safety, and general welfare of the public. In order to facilitate this responsibility we provide a full range of plan review and construction inspection services to support enforcement of the International Building Codes.
Emergency Management/Public Safety Department	Yes	The Brownsville Office of Emergency Management and Homeland Security (OEMHS) is the City of Brownsville department responsible for overall emergency planning and preparedness within the City of Brownsville, and for maintenance of the City's comprehensive all-hazards preparedness program. Reporting directly to the City Manager's Office and the Mayor, the department oversees the Brownsville Emergency Operations Center (EOC) and coordinates local response and recovery efforts with appropriate local, county, regional, state, and federal agencies, as

Resources	Available? (Yes/No)	Comments (available staff, responsibilities, support of hazard mitigation)
		well as with the private sector and volunteer organizations. OEMHS staff continues working hard to continue its overall planning and preparedness efforts. From distributing preparedness information, to continuing to work with FEMA on recovery funds, to reviewing emergency plans for local businesses, the small department continues its tradition of working towards making Brownsville and its residents better prepared.
Warning Systems / Services (mass notification system, outdoor warning signals)	Yes	Emergency Alert Brownsville
Maintenance programs to reduce risk (stormwater maintenance, tree trimming, etc.)	Yes	See Public Works Department
Mutual aid agreements	No	-
Human Resources Manual - Do any job descriptions specifically include identifying or implementing mitigation projects or other efforts to reduce natural hazard risk?	No	-
Other	No	-
Technical/Staffing Capability		
Planners or engineers with knowledge of land development and land management practices	No	-
Engineers or professionals trained in building or infrastructure construction practices	No	-
Planners or engineers with an understanding of natural hazards	No	-
Staff with expertise or training in benefit/cost analysis	No	-
Professionals trained in conducting damage assessments	No	-
Personnel skilled or trained in GIS and/or Hazards United States (HAZUS) – Multi-Hazards (MH) applications	No	-
Scientist familiar with natural hazards	No	-
Surveyor(s)	No	-
Emergency Manager	Yes	Emergency Management Administrator
Grant writer(s)	Yes	
Resilience Officer	No	-
Other (this could include stormwater engineer, environmental specialist, etc.)	No	-

9.2.3.4 Fiscal Capability

The table below summarizes financial resources available to the City of Brownsville.

Table 9.2-5. Fiscal Capabilities

Financial Resources	Are these accessible or eligible to use for mitigation? (Yes/No) If yes, please describe. If no, can this be used to support in the future?
Community development Block Grants (CDBG, CDBG-DR)	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
User fees for water, sewer, gas or electric service	No
Impact fees for homebuyers or developers of new development/homes	No
Stormwater utility fee	No
Incur debt through general obligation bonds	No
Incur debt through special tax bonds	No
Incur debt through private activity bonds	No
Withhold public expenditures in hazard-prone areas	No
Other federal or state funding programs	Yes
Open Space Acquisition funding programs	No
Other (for example, Clean Water Act 319 Grants [Nonpoint Source Pollution])	No

9.2.3.5 Education and Outreach Capability

The table below summarizes the education and outreach resources available to the City of Brownsville.

Table 9.2-6. Education and Outreach Capabilities

Outreach Resources	Available? (Yes/No)	Does the jurisdiction have any public outreach mechanisms / programs in place to inform citizens on natural hazards, risk, and ways to protect themselves during such events? If yes, please describe.
Public information officer or communications office	Yes	Communications & Marketing Department
Personnel skilled or trained in website development	No	-
Hazard mitigation information available on your website	No	-
Social media for hazard mitigation education and outreach	Yes	Facebook, Twitter
Citizen boards or commissions that address issues related to hazard mitigation	No	-
Other programs already in place that could be used to communicate hazard-related information	No	-
Warning systems for hazard events	Yes	Emergency Alert Brownsville
Natural disaster/safety programs in place for schools	No	-
Other	No	-

9.2.3.6 Community Classifications

The table below summarizes classifications for community programs available to the City of Brownsville.

Table 9.2-7. Community Classifications

Program	Participating? (Yes/No)	Classification (if applicable)	Date Classified (if applicable)
Community Rating System (CRS)	No	-	-
Building Code Effectiveness Grading Schedule (BCEGS)	No	-	-
Public Protection (ISO Fire Protection Classes 1 to 10)	Yes	2	2022
Storm Ready Certification	Yes	-	2009
Firewise Communities classification	No	-	-

Note:
N/A Not applicable
NP Not participating
- Unavailable

9.2.3.7 Adaptive Capacity

Adaptive capacity is defined as "the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or respond to consequences" (IPCC 2014). In other words, it describes a jurisdiction's current capabilities to adjust to, protect from, or withstand a future hazard event, future conditions, and changing risk. The table below summarizes the adaptive capacity for each hazard of concern and the jurisdiction's rating.

Table 9.2-8. Adaptive Capacity

Hazard	Adaptive Capacity - Strong/Moderate/Weak*
Dam and Levee Failure	Moderate
Disease Outbreak	Moderate
Drought	Moderate
Erosion	Moderate
Extreme Heat	Moderate
Flood	Moderate
Hail	Moderate
Hurricane/Tropical Storm	Moderate
Lightning	Moderate
Thunderstorm Wind	Moderate
Tornado	Moderate
Wildfire	Moderate
Winter Storm	Moderate

**Strong = Capacity exists and is in use, Moderate = Capacity may exist; but is not used or could use some improvement, Weak = Capacity does not exist or could use substantial improvement.*

9.2.4 National Flood Insurance Program (NFIP) Compliance

Th table below provides specific information on the management and regulation of the regulatory floodplain, including current and future compliance with the NFIP.

Table 9.2-9. NFIP Summary

NFIP Topic	Comments
Flood Vulnerability Summary	
Describe areas prone to flooding in your jurisdiction. • Do you maintain a list of properties that have been damaged by flooding?	The most common type of flooding is stream flooding which is triggered by heavy rains. Occasionally the City may see effects of coastal flooding or River flooding, usually during hurricanes. Yes. Emergency Management Office maintains a list of properties.
Do you maintain a list of property owners interested in flood mitigation? • How many homeowners and/or business owners are interested in mitigation (elevation or acquisition)?	At this time, the City does not have a list. In the past we have offered acquisitions for repetitive flood properties.
Are any RiskMAP projects currently underway in your jurisdiction? • If so, state what projects are underway.	Not at this time.
How do you make Substantial Damage determinations? • How many were declared for recent flood events in your jurisdiction?	Not in the last year.
How many properties have been mitigated (elevation or acquisition) in your jurisdiction? • If there are mitigation properties, how were the projects funded?	None in the last year.
Do your flood hazard maps adequately address the flood risk within your jurisdiction? • If not, state why.	No. Many of the maps don't accurately depict areas along special flood hazard areas.
NFIP Compliance	
What local department is responsible for floodplain management?	Engineering and Public Works
Are any certified floodplain managers on staff in your jurisdiction?	Yes
Do you have access to resources to determine possible future flooding conditions from climate change?	Yes, through the EPA Strategies for Climate Change Adaption.
Does your floodplain management staff need any assistance or training to support its floodplain management program? • If so, what type of assistance/training is needed?	Training is always needed. FEMA Floodplain management training opportunities currently in use.
Provide an explanation of NFIP administration services you provide (e.g. permit review, GIS, education/outreach, inspections, engineering capability)	Building permits provides the initial request or determination of sites needing a permit. Then they are transferred to the City's Engineering office for permit review.

NFIP Topic	Comments
	For Land development (e.g., subdivisions), the City reviews during the plat review. The City utilizes GIS flood hazard layers almost daily; inspections are as needed. For outreach, the City has an annual meeting to reach out to the community during hurricane awareness week This is also included as part of the Stormwater Pollution Prevention Plan outreach. Prior to Covid, the City would attend various school career days.
How do you determine if proposed development on an existing structure would qualify as a substantial improvement?	Based on FEMA, it would be any improvement over 50% of the value. The City refers to appraisal district valuations for this.
What are the barriers to running an effective NFIP program in the community, if any?	Additional help to properly tract the paperwork and participate in the CRS program and gradually increase levels to provide additional discount benefits to residents.
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed? • If so, state the violations.	None, the City is currently going through a Community Assistance Visit.
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	Currently going through a Community Assistance Visit.
What is the local law number or municipal code of your flood damage prevention ordinance? • What is the date that your flood damage prevention ordinance was last amended?	With New UDC 12/1/2020 Link to our files https://twdb-my.sharepoint.com/:f:/g/personal/luz_ballesterosgonzalez_twdb_texas_gov/EhHn9fb97y1DrZtbRxDXB1cBsYs0WURUtnD6Df0VeJPV1g?e=B9UJcN
Does your floodplain management program meet or exceed minimum requirements? • If exceeds, in what ways?	Exceed. The City indirectly requires 1' freeboard. Most subdivision roads are built to BFE (Base Flood Elevation) and the City ordinance requires buildings be built a minimum of 1' above curb, therefore the City indirectly has a 1' freeboard. On new developments for commercial over ½ acre, the City requires detention ponds, therefore reducing the existing runoff in most cases.
Are there other local ordinances, plans or programs (e.g. site plan review) that support floodplain management and meeting the NFIP requirements? For instance, does the planning board or zoning board consider efforts to reduce flood risk when reviewing variances such as height restrictions?	Site plan review process for commercial developments. Subdivision review for land development and the building department oversees the residential development.
Does your jurisdiction participate in CRS? • If yes, is your jurisdiction interested in improving its CRS Classification? • If no, is your jurisdiction interested in joining the CRS program?	No. The City is in the process of beginning this once the CAV is complete. Meetings will be scheduled with a FEMA regional office to discuss this and then present a proposal to management.

Note: RL—Repetitive Loss; SRL—Severe Repetitive Loss; NA—Not applicable

9.2.5 Growth/Development Trends

Understanding how past, current, and projected development patterns have or are likely to increase or decrease risk in hazard areas is a key component to understanding a jurisdiction's overall risk to its hazards of concern. The table below summarizes recent and expected future development trends, including major residential/commercial development and major infrastructure development.

Table 9.2-10. Recent and Expected Future Development

Type of Development	2015*		2016*		2017*		2018*		2019*		2020*	
Number of Building Permits for New Construction Issued Since the Previous HMP (within regulatory floodplain/ outside regulatory floodplain)												
	Total	**Within SFHA**	**Total**	**Within SFHA**	**Total**	**Within SFHA**	**Total**	**Within SFHA**	**Total**	**Within SFHA**	**Total**	**Within SFHA**
Single Family	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multi-Family	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other (commercial, mixed-use, etc.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total Permits Issued	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Property or Development Name	Type of Development	# of Units / Structures	Location (address and/or block and lot)	Known Hazard Zone(s)*	Description / Status of Development
Recent Major Development and Infrastructure from 2015 to Present					
N/A	N/A	N/A	N/A	N/A	N/A
Known or Anticipated Major Development and Infrastructure in the Next Five (5) Years					
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A	N/A	N/A

SFHA Special Flood Hazard Area (1% annual chance flood event)

** Note: The information for this table was unavailable for the planning effort.*

9.2.6 Jurisdictional Risk Assessment

The hazard profiles in Section 5 (Risk Assessment) provide detailed information regarding each plan participant's vulnerability to the identified hazards. Section 5.1 (Hazards of Concern), Section 5.2 (Methodology and Tools), and Section 5.3 (Hazard Ranking) provide a detailed summary for the City of Brownsville's risk assessment results, and data used to determine the hazard ranking are discussed later in this section.

Hazard area extent and location maps provided below illustrate the probable areas impacted within the jurisdiction. These maps are based on the best available data at the time of the preparation of this plan and are adequate for planning purposes. Maps were only generated for those hazards that can be clearly identified using mapping techniques and technologies and for which the City of Brownsville has significant exposure. The maps also show the location of potential new development, where available.

Figure 9.2-1. City of Brownsville Northwest Area Extent and Location Map-Flood

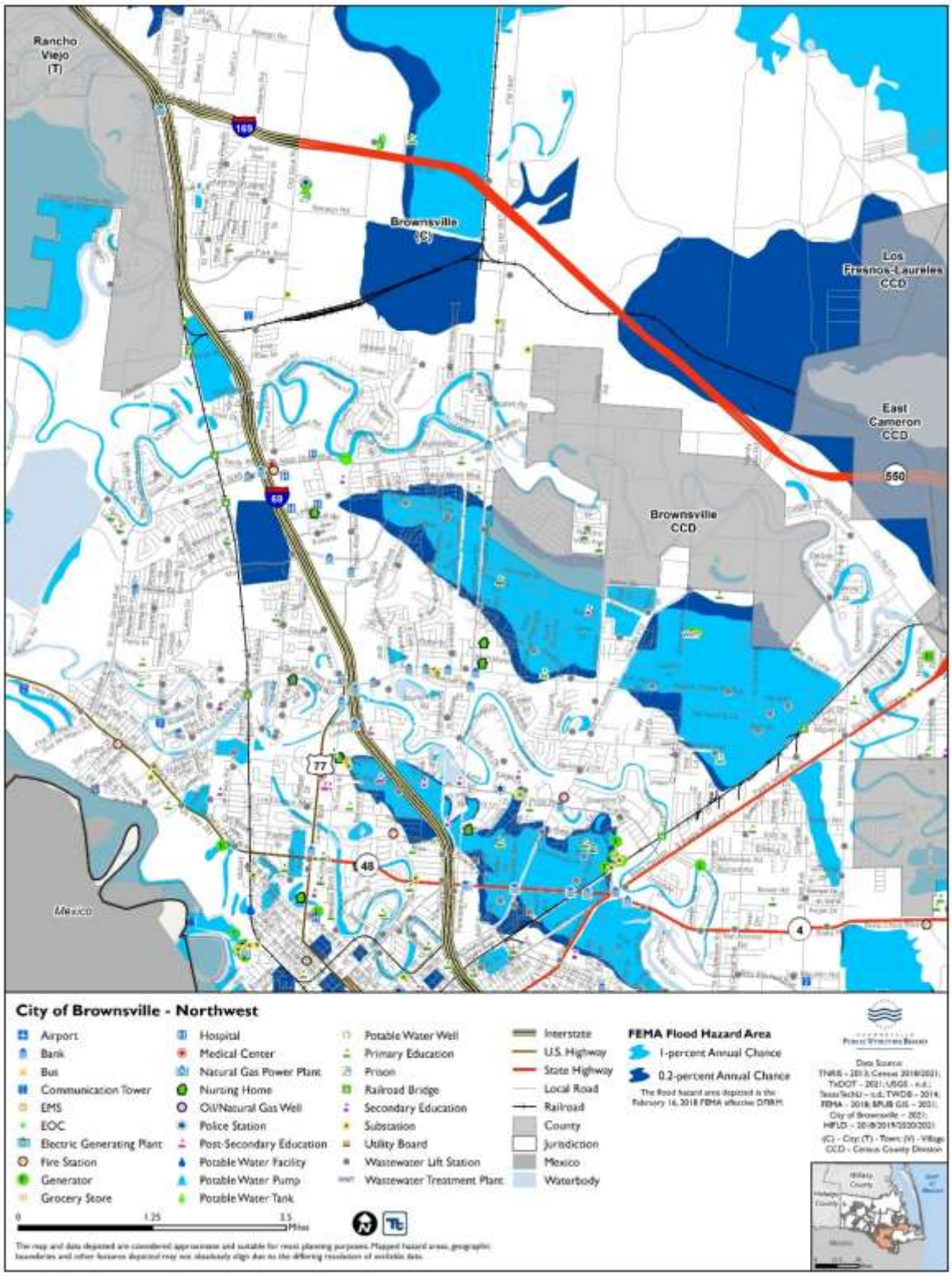


Figure 9.2-2. City of Brownsville Southeast Area Extent and Location Map-Flood

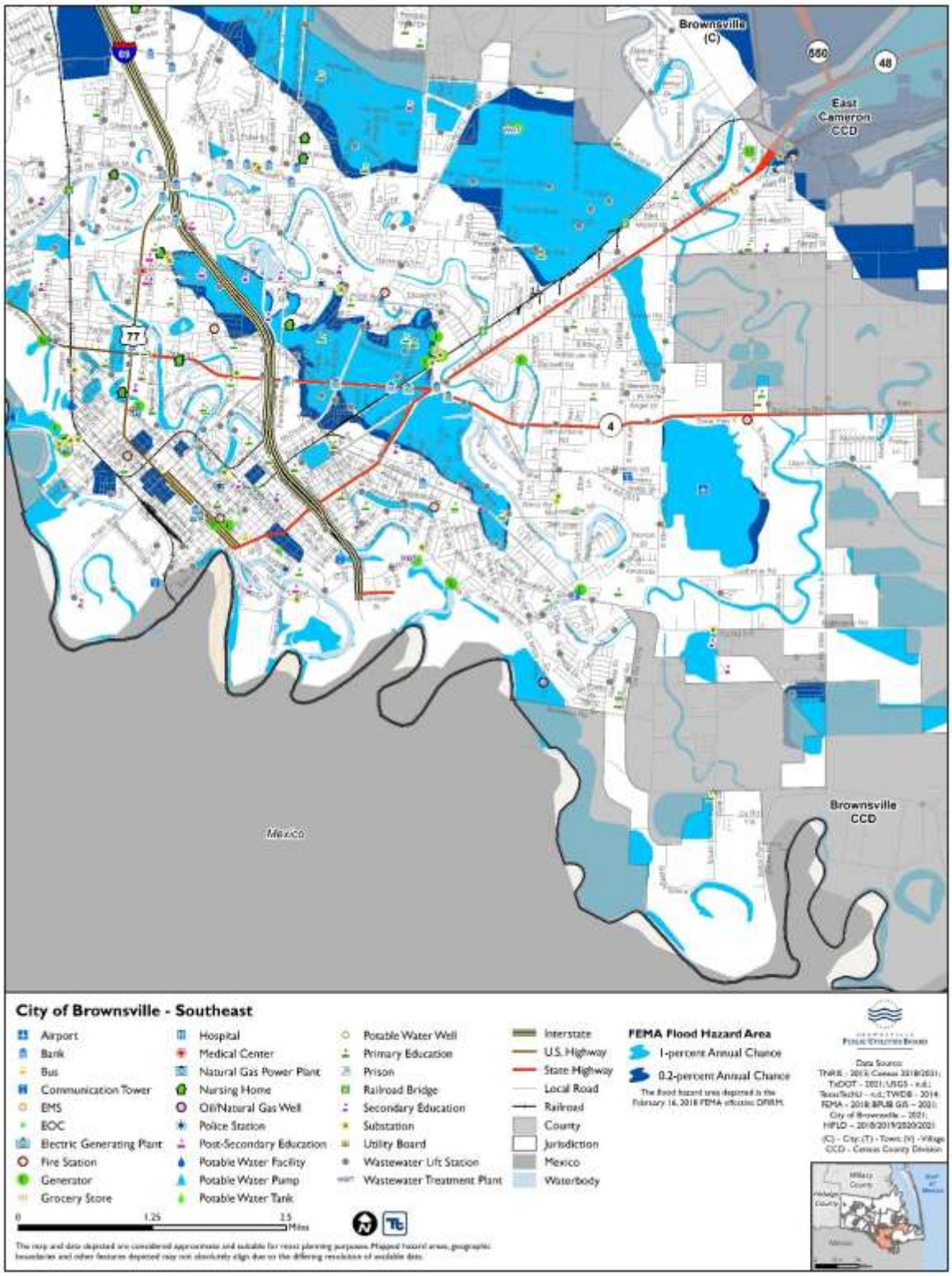


Figure 9.2-3. City of Brownsville Northwest Area Extent and Location Map-SLOSH

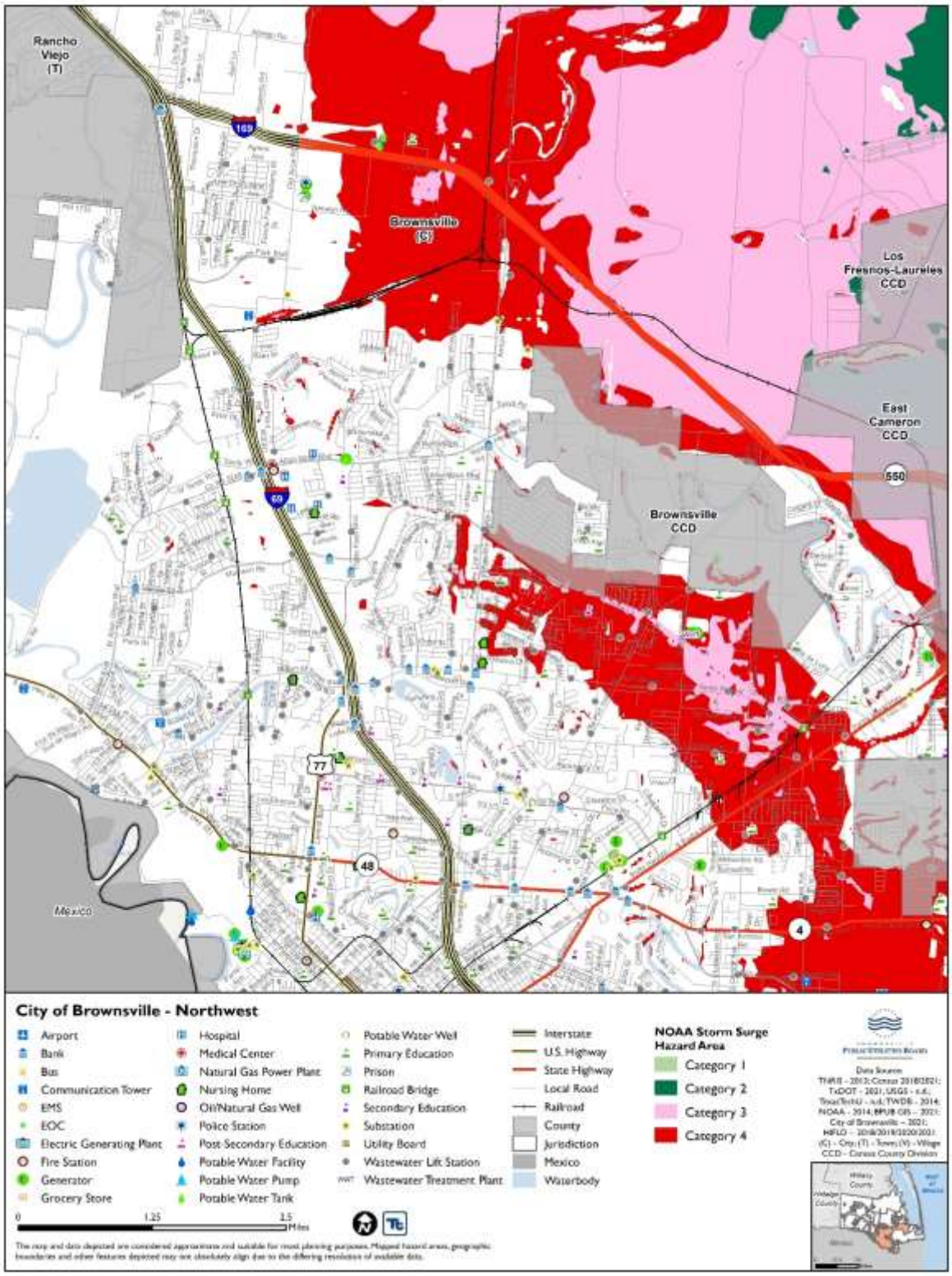


Figure 9.2-4. City of Brownsville Southeast Area Extent and Location Map-SLOSH

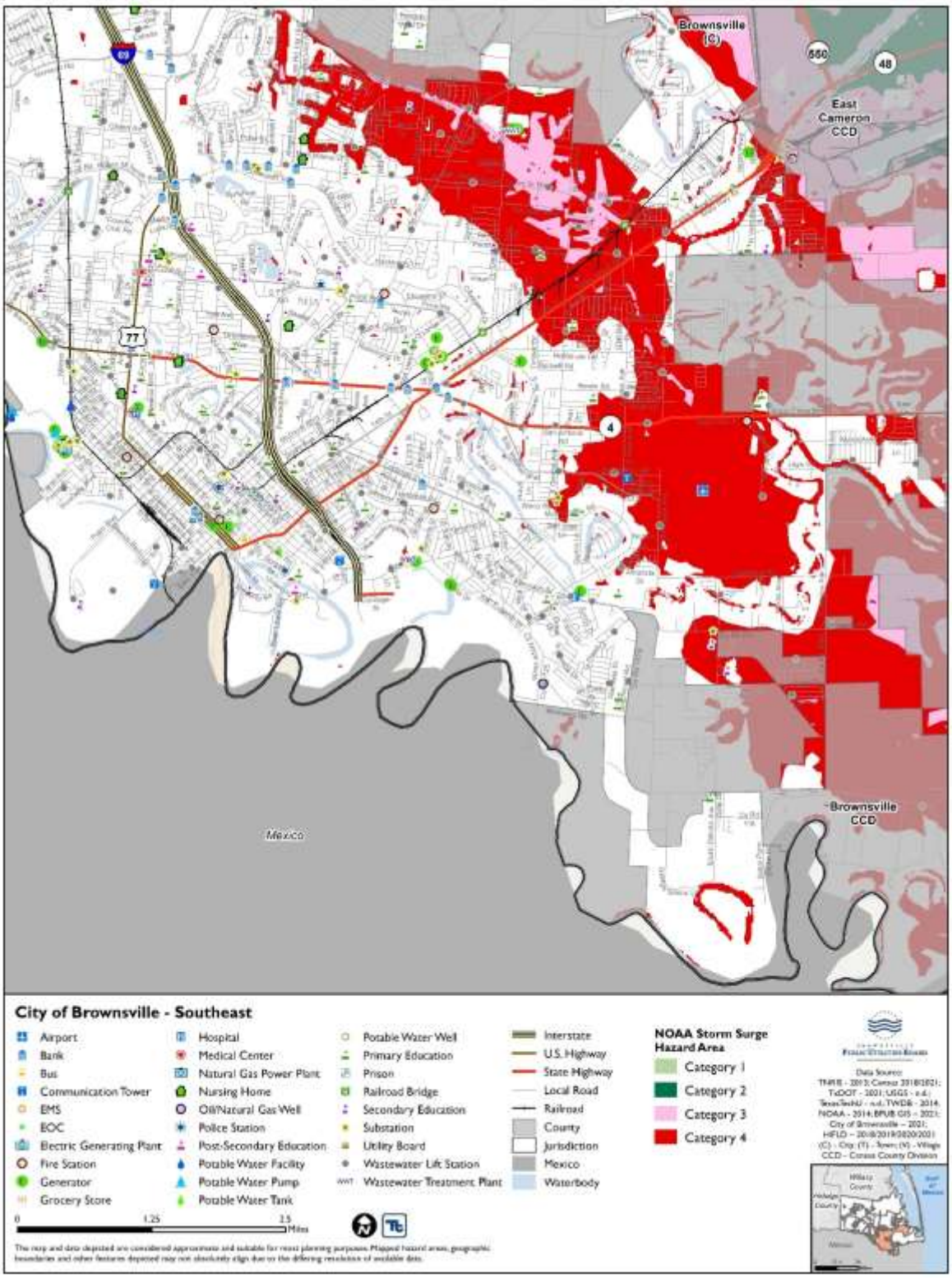


Figure 9.2-5. City of Brownsville Northwest Area Extent and Location Map-Sea Level Rise

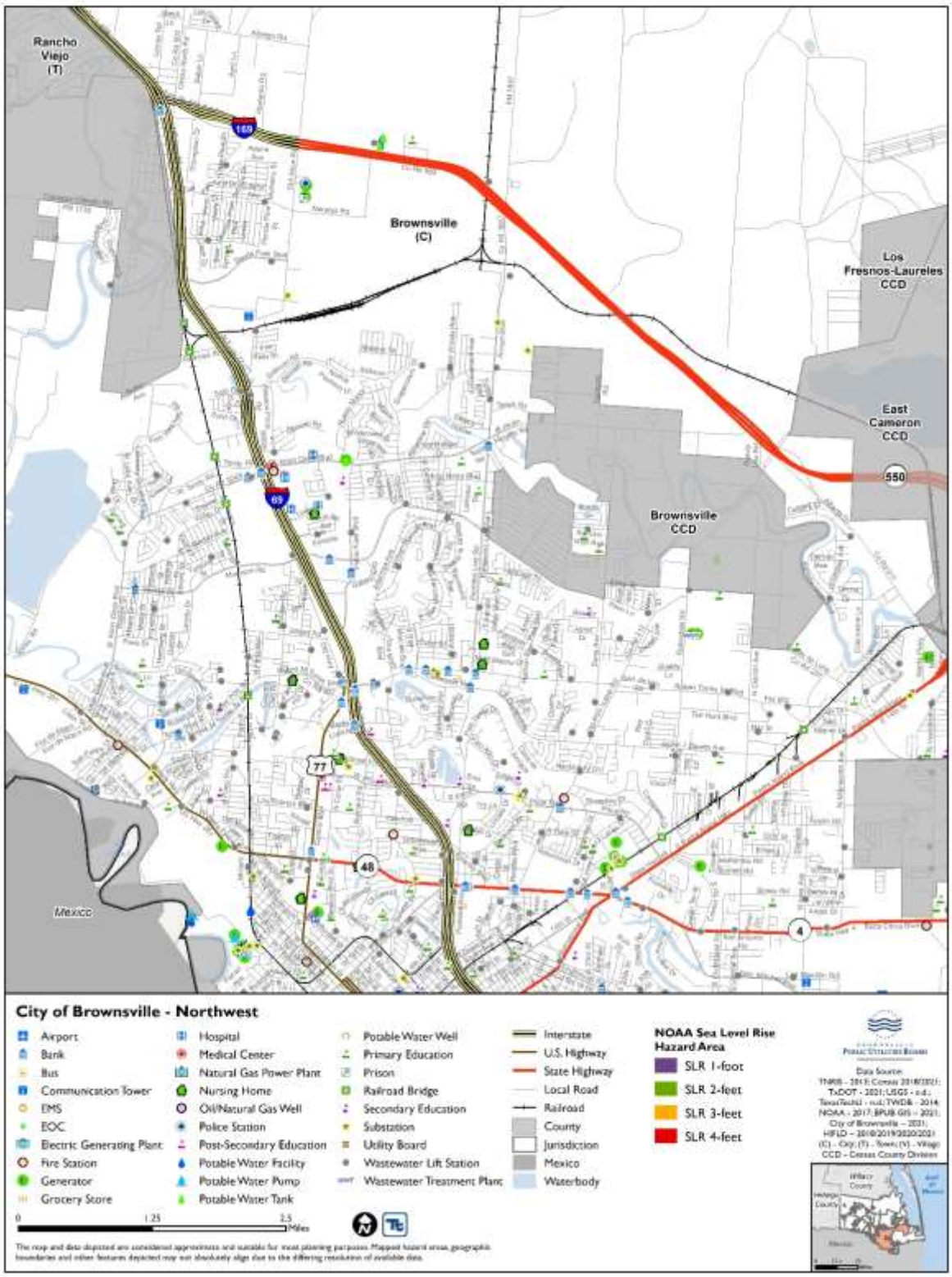


Figure 9.2-6. City of Brownsville Southeast Area Extent and Location Map-Sea Level Rise

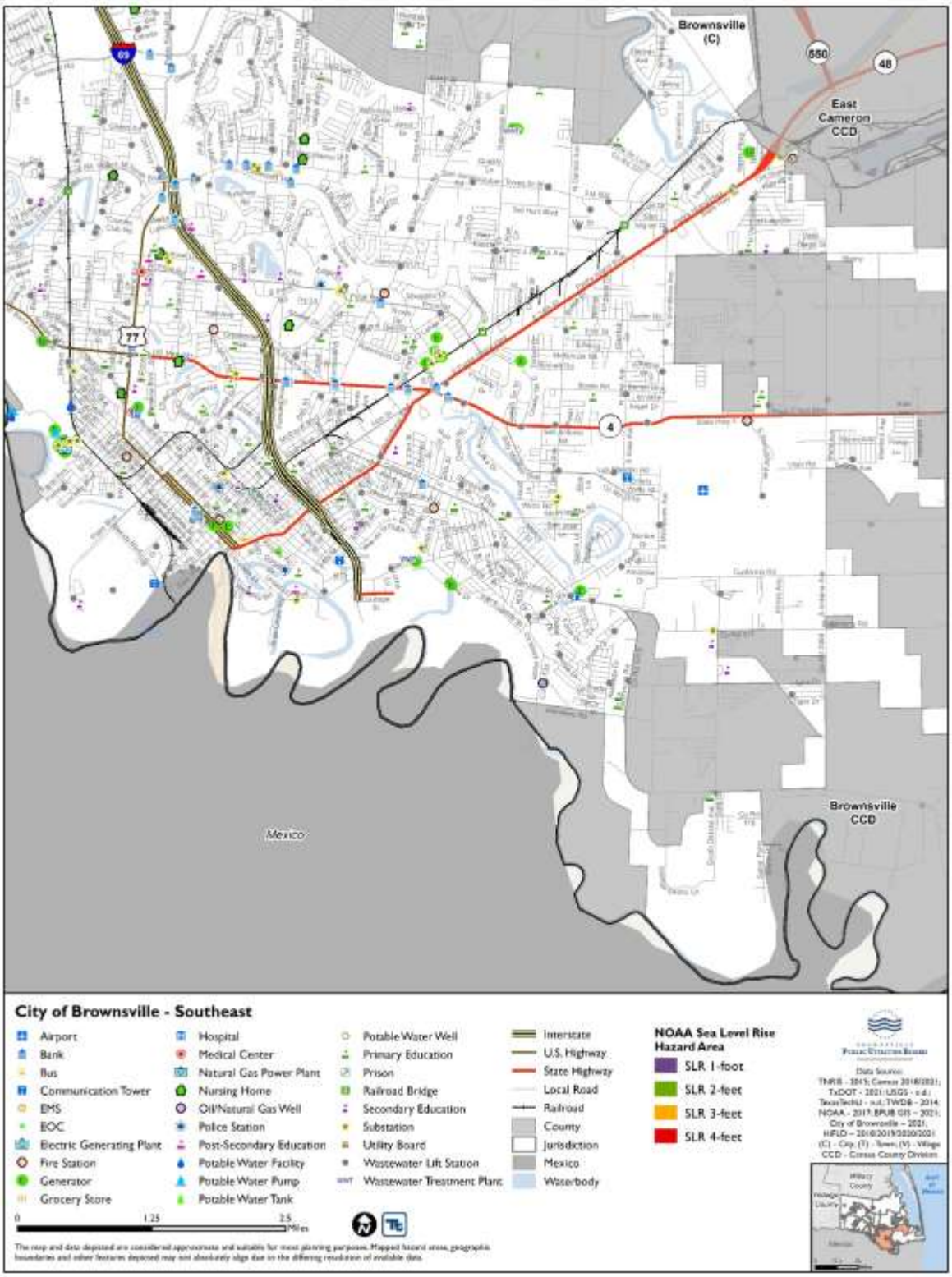


Figure 9.2-7. City of Brownsville Northwest Area Extent and Location Map-Wildfire and Erosion

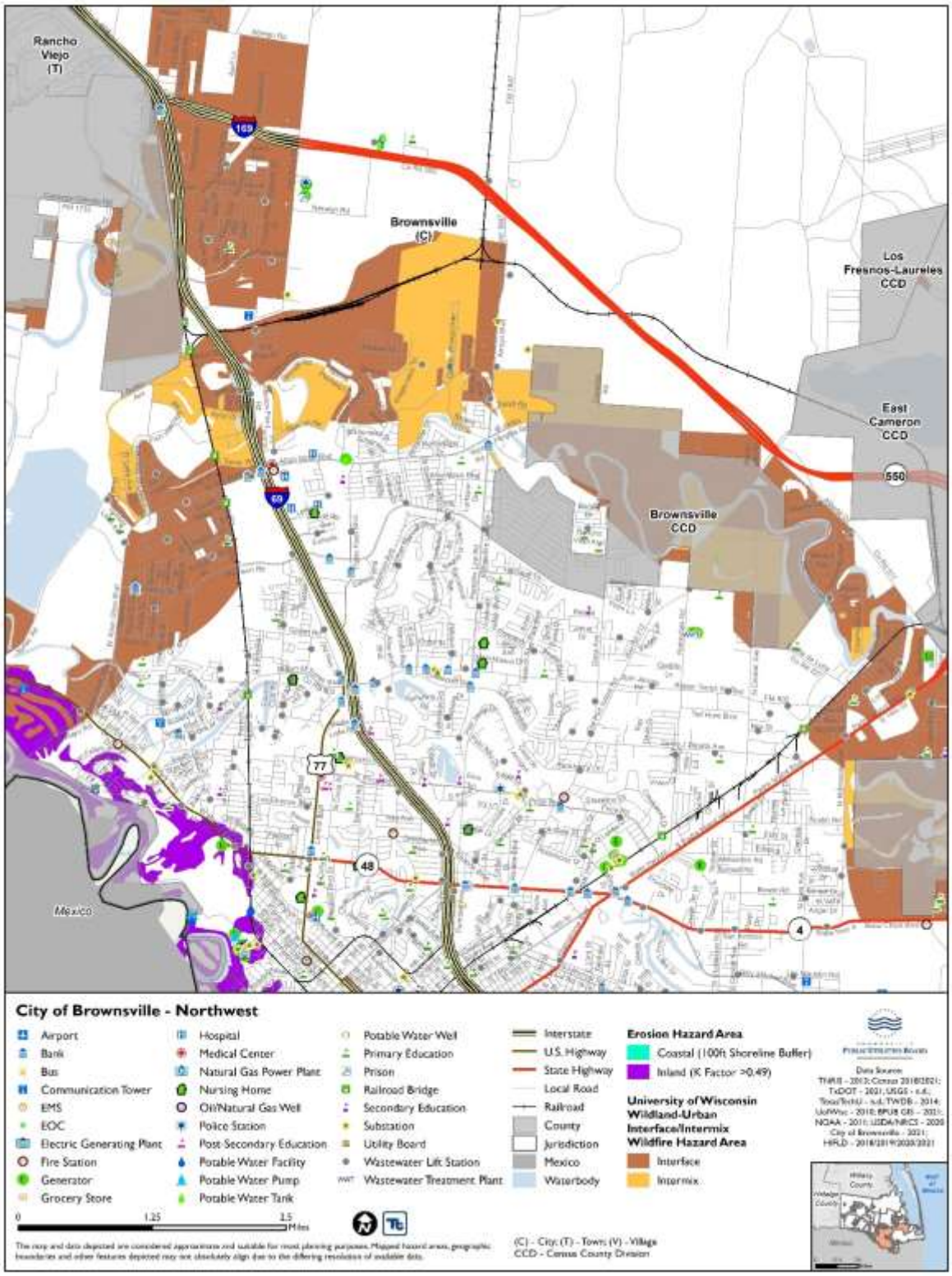
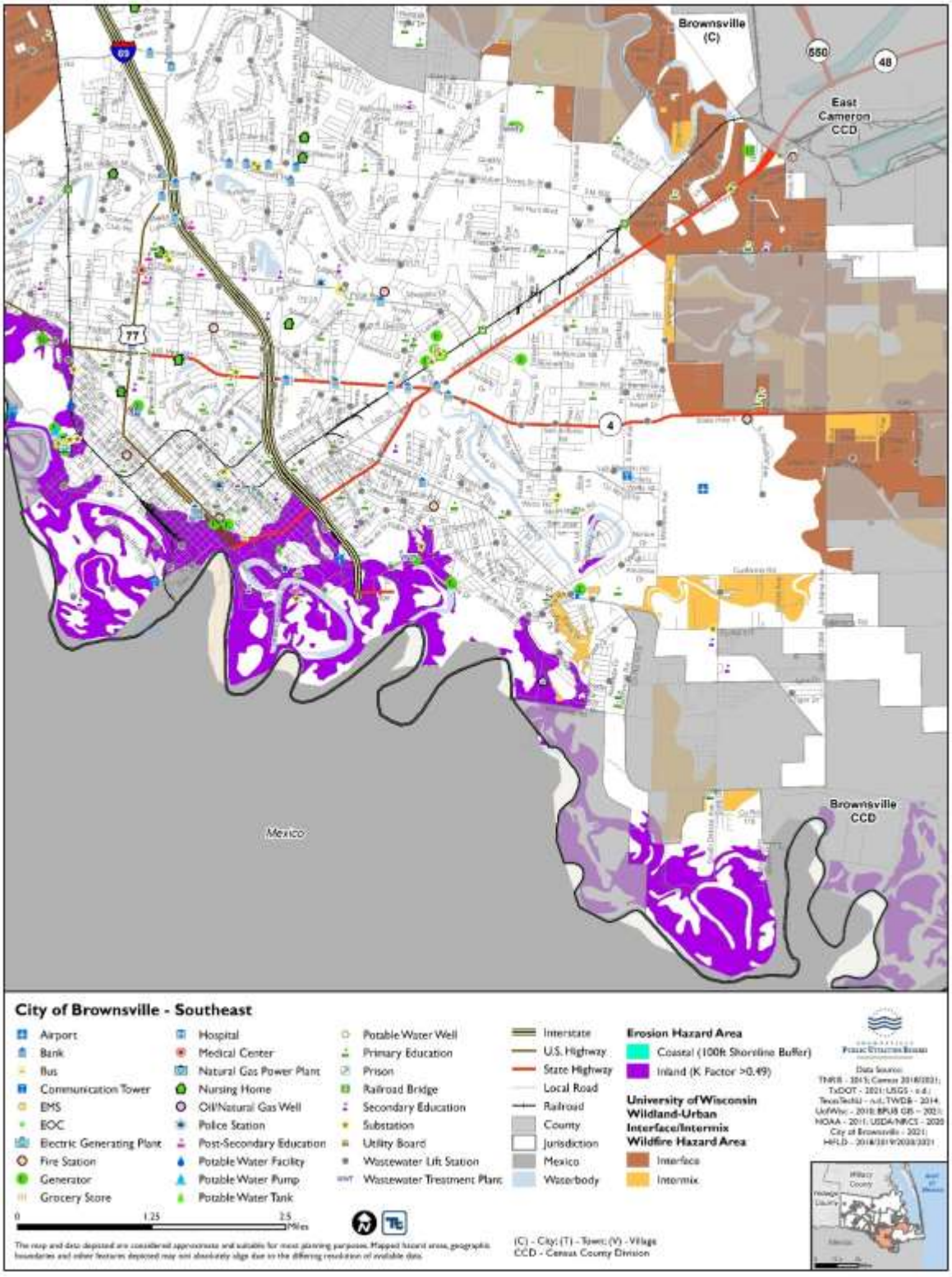


Figure 9.2-8. City of Brownsville Southeast Area Extent and Location Map-Wildfire and Erosion



9.2.6.1 Hazard Event History

The planning area has a history of natural hazard events as detailed in Section 5 (Risk Assessment) of this plan. A summary of historical events is provided in each of the hazard profiles and includes a chronology of events that have affected the planning area.

The City of Brownsville's history of federal declarations (as presented by FEMA) and significant hazard events (as presented in NOAA-NCEI) is consistent with that of the planning area. The table below provides details regarding municipal-specific loss and damages the City experienced during hazard events since the last hazard mitigation plan update. Information provided in the table below is based on reference material or local sources.

Table 9.2-11. Hazard Event History

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Municipal Summary of Damages and Losses
October 30, 2015	Flash Flood / Heavy Rain (DR-4245)	Yes	Heavy and persistent rain fell across the City of Brownsville, mainly from downtown east towards the Port of Brownsville, and including all of the neighborhoods in Southmost, which took the brunt of the heavy rainfall. Within an hour, feet of water were inundating some roads and by three hours later up to 5 feet of water covered one of the most prone areas of town the Four Corners area where State Road 4 (International Blvd.) intersects State Road 48 (Boca Chica Blvd./Padre Island Highway). Neighborhood roads in Southmost were inundated with two to three feet of water, and dozens of homes and businesses flooded due to a combination of high water that filtered into homes and vehicles that created waves of water which surged into them. At Brownsville/South Padre Island International Airport, the 6.55 inches of rainfall was reported.	An estimated $100,000 in property damages was reported.
January 11, 2018	Strong Wind	No	A surge of strong winds behind the dry front late on January 11th produced peak gusts between 44 and 54 mph during the mid-evening. The gusty winds at Brownsville/ South Padre Island International Airport (50 mph at 8:40 PM) sparked a brief fire on the airport grounds when a transformer blew near Iowa Avenue.	An estimated $15,000 in property damages was reported.
June 20, 2018	Flash Flood / Heavy Rain (DR-4377)	Yes	In Cameron County, between 12 and 18 inches of rain fell, inundating several thousands of homes and businesses with 18 inches to three feet of flood water, and	An estimated $20 million in damages in Cameron County was reported. City damage estimates are unavailable.

Dates of Event	Event Type (Disaster Declaration if applicable)	County Designated?	Summary of Event	Municipal Summary of Damages and Losses
			hundreds of rescues of persons and pets were common.	
August 12, 2018	Thunderstorm Wind	No	A rapidly developing line of thunderstorms raced northward through Cameron County east of US 77, creating gusts over 40 mph and causing minor damage to a few tree limbs, unfastened lawn furniture, and a few power lines. An estimated $500,000 in property damages was reported.	An estimated $500,000 in property damages in Cameron County was reported. City damage estimates are unavailable.
July 25, 2020	Tropical Storm / Hurricane Hanna (EM-3530)	Yes	Hurricane Hanna, the 2020 Atlantic season's first Hurricane, made landfall along the unpopulated Padre Island National Seashore on the mid-Kennedy County coastline as a Category 1 storm at around 5 PM Central Time Saturday, July 25th, carrying sustained 90 mph winds with gusts over 100 mph in a small portion of the inner eye wall. At the storm's peak, an estimated 50 thousand electric customers were without power. An EF0 tornado was also reported, touching down 2.3 miles south of the Brownsville Airport, moving north. Crop damage was also significant, with sugar cane snapped in many fields and young fruit being blown off citrus trees, which also sustained damage.	$1.88 million in property damage countywide. Estimated dollar value loss based on reports from Texas AgriLife in late summer was $25.9 million in Cameron County. The EF0 tornado resulted in $250,000 in property damages. City damage estimates are unavailable.
February 14, 2021	Front/Freeze (EM-3554)	Yes	A strong cold front moved through Deep South Texas and the Rio Grande Valley on February 12th, followed then by a strong Arctic High building into the area on February 13th. The Arctic High ushered in very cold air, with subsequent cold air damming leading to an extended period of anomalously cold temperatures. Cameron County sustained heavy crop losses. Soon after temperatures fell below freezing, light rain turned to a mix of light freezing rain and sleet, which created a thin coating of ice on trees and plants. Icing was also noted along elevated roads, requiring some closures.	Countywide property damages were over $32,000. The City on incurred payroll costs for this event. Cameron County crop losses were estimated at $46 million

9.2.6.2 Hazard Ranking and Vulnerabilities

The hazard profiles in Section 4.1 (Hazards of Concern) of this plan have detailed information regarding each plan participant's vulnerability to the identified hazards. The following summarizes the City of Brownsville's risk assessment results and data used to determine the hazard ranking.

Hazard Ranking

This section provides the community specific identification of the primary hazard concerns based on identified problems, impacts and the results of the risk assessment as presented in Section 4 (Risk Assessment) of the plan. The ranking process involves an assessment of the likelihood of occurrence for each hazard, along with its potential impacts on people, property, and the economy as well as community capability and changing future climate conditions. This input supports the mitigation action development to target those hazards with highest level of concern.

As discussed in Section 4.3 (Hazard Ranking), each participating jurisdiction can have differing degrees of risk exposure and vulnerability. The table below summarizes the hazard risk/vulnerability rankings of potential natural hazards for the City of Brownsville. The City of Brownsville reviewed the hazard risk/vulnerability risk ranking table to reflect the relative risk of the hazards of concern to the community.

During the review of the hazard/vulnerability risk ranking, the City agreed with all the calculated rankings, except for Earthquake which had a low ranking. The City chose to remove the earthquake hazard from this update as there is no exposure to population or building stock.

Table 9.2-12. Hazard Ranking Input

Dam & Levee Failure	Disease Outbreak	Drought	Erosion	Extreme Heat	Flood	Hail
Low	Low	Low	Low	Medium	Low	Medium

Hurricane & Tropical Storm	Lightning	Thunderstorm Wind	Tornado	Wildfire	Winter Weather
Low	Medium	Medium	Medium	Medium	Medium

Note: The scale is based on the hazard rankings established in Section 5.3 (Hazard Ranking) and modified as appropriate during review by the jurisdiction.

9.2.6.3 Identified Issues

After review of the City of Brownsville's hazard event history, hazard rankings, jurisdiction specific vulnerabilities, hazard area extent and location, and current capabilities, the City of Brownsville has not identified additional vulnerabilities within their community.

Specific areas of concern based on resident response to the citizen survey include:

- Flooding in the following areas:
  - Stagecoach Trail and Dennet Road
  - Price Road, Bernard Road, Tropical Drive, Frontage Road, FM 802

- Boca China Boulevard
- Dana Avenue north of FM 802
- Quail Hollow Drive
- Los Ebanos Boulevard and Price Road
- Parkwood Place
- Harvard Avenue and alleys
- Harvard Avenue and Woodruff Avenue
- Ruben Torres Boulevard between Quail Trail and Military Highway
- Elma Street, Central Avenue, Austin Road
- Paredes Line Road, Robindale Road, Old Port Isabel Road, Ruben Torres Boulevard
- Draper Drive
- Morrison Street near Valley Baptist

9.2.7 Mitigation Strategy and Prioritization

This section discusses past mitigations actions and status, describes proposed hazard mitigation initiatives, and their prioritization.

9.2.7.1 Past Mitigation Initiative Status

The following table indicates progress on the community's mitigation strategy identified in the 2015 HMP. Actions that are carried forward as part of this plan update are included in the following subsection in its own table with prioritization. Previous actions that are now on-going programs and capabilities are indicated as such in the following table and are discussed in the 'Capability Assessment' presented previously in this annex.

Table 9.2-13. Status of Previous Mitigation Actions

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
City of Brownsville – 1	Upgrade and increase culverts at specific locations in City in order to adequately convey storm water	Public Works	No Progress	Yes (as 2022-City of Brownsville-001)	Undersized culverts located throughout the City and lead to roadway flooding	Engineering and Public Works
City of Brownsville – 2	Join the Community Rating System program to reduce risk and flood insurance premiums to residents	City	No Progress	Yes (as 2022-City of Brownsville-024)	History of flooding and properties damaged during flood events.	Engineering and Public Works
City of Brownsville – 3	Implement an NFIP public education program to increase the number of flood insurance policies by promoting availability of flood insurance including the Preferred Risk Policy for non-SFHA's	City	No Progress	Yes (as 2022-City of Brownsville-026)	NFIP insurance policies could be increased.	Office of Emergency Management
City of Brownsville – 4	Identify existing flood-prone structures and repetitive flood loss properties for FEMA Buyout Program	City Engineer	No Progress	Yes (as 2022-City of Brownsville-002)	Floodprone properties throughout the City; many need to be mitigated to provide further protection	Planning and Redevelopment
City of Brownsville – 5	Remove downed trees to decrease fire fuels in undeveloped and remote areas	Parks & Recreation	No Progress	Yes (as 2022-City of Brownsville-007)	No tree management master plan	Engineering and Public Works
City of Brownsville – 6	Construct dual-purpose animal shelter	Health Dept.	No Progress. No longer feasible.	No	-	-

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
City of Brownsville – 7	Install hail guards for HVAC systems on critical facilities including nursing homes, hospitals, courthouse, and fire stations	City	In Progress. The majority of HVAC units have hail guards. The City will continue to evaluate the units and the need for more hail guards.	Yes (as 2022-City of Brownsville-003)	Hail damage to critical facilities due to lack of hail guards	Internal Services
City of Brownsville – 8	Conduct a Public Education Campaign to address dangers associated with extreme heat and preventative measures for working outdoors	Emergency Management Office	Ongoing Capability	No	-	-
City of Brownsville – 9	Conduct a public education campaign in the event of a necessary evacuation due to dam failure from upstream flood control system	Emergency Management Office	No Progress Lacked capacity to do a specific dam failure education campaign for the previous plan	Yes (as 2022-City of Brownsville-019)	Need evacuation education for dam and levee failure	Office of Emergency Management
City of Brownsville – 10	Conduct a public education campaign to educate residents on reducing water consumption during drought conditions	BPUB	No Progress.	Yes (as 2022-City of Brownsville-004)	The City currently does not have an education campaign that focuses on water consumption during drought conditions.	Communications
City of Brownsville – 11	Install quick connect systems on all critical facilities with emergency generators	Engineering	No Progress. No longer needed.	No	-	-
City of Brownsville – 12	Install emergency generators on all critical facilities	Engineering	Complete. Critical facilities have permanent generators. City Hall, both libraries, pump stations, and PD buildings.	No	-	-
City of Brownsville – 13	Install temporary cooling stations at City park facilities to aid low income and elderly residents during extreme heat conditions	Engineering	No Progress.	Yes (as 2022-City of Brownsville-005)	During periods of extreme heat, not all residents have proper air	Engineering and Public Works

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
					conditioning in their homes.	
City of Brownsville – 14	Develop a Drought Protection Plan to include adoption of Firewise community actions for water conservation and xeriscaping program	Fire Dept.	No Progress	Yes (as 2022-City of Brownsville-006)	No drought protection plan	Fire Department
City of Brownsville – 15	Develop and implement a Tree Management Master Plan to remove downed trees due to winter storm and ice	Public Works	No Progress	Yes (as 2022-City of Brownsville-007)	No tree management master plan	Engineering and Public Works
City of Brownsville – 16	Construct a weir to prevent flood risk from the overflow of canals located on the North side of Brownsville	Engineering	No Progress	Yes (as 2022-City of Brownsville-031)	Flooding of canals on the north side of the City	Engineering and Public Works
City of Brownsville – 17	Construct and/or expand culverts on rural roads and main stream outlets 1) Central Ave to Martinelle 2) Robindale to Old Place 3) Dana 802 to High Emerson 4) Pablo Kisel from Morrison to Alton Gloor	Public Works	No Progress	Yes (as 2022-City of Brownsville-001)	Undersized culverts along the rural roads and main stream outlets	Engineering and Public Works
City of Brownsville – 18	Purchase and install portable pumps as back-up during severe weather and flood events	Public Works		Yes (as 2022-City of Brownsville-008)	Lack of backup pumps to use during severe weather and flood events	
City of Brownsville – 19	Purchase 5 generators and quick connects for Emergency service buildings and city facilities to support	Public Works, Emergency	In Progress. Internal Services COB.	Yes (as 2022-City of	Emergency service buildings and other facilities require	Public Works, Emergency

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
	power outage. 1) West 5th and Saint Charles 2) Cottonwood and Old Alice 3) El Tapiz Building 4) City Hall 5) City Plaza	Management, Fire, Internal Services		Brownsville-030)	mobile generators and quick connects to preserve continuity of services during power outages	Management, Fire, Internal Services
City of Brownsville – 20	Construct alternate Emergency Operations Center to protect critical system operations	MIS	No Progress	Yes (as 2022-City of Brownsville-009)	Need an alternate location for an EOC in the event of flooding or power outages	Office of Emergency Management
City of Brownsville – 21	Implement a GIS (geographical information system) model of the Brownsville Storm Sewer System to create a chronological list of common activities associated with the development of a storm water GIS	Public Works and Engineering	No Progress. Capabilities do not exist to implement this action	No	-	-
City of Brownsville – 22	Revise the structural standards in the International Building Code to strengthen codes for new construction	Building Inspection	Complete	No	-	-
City of Brownsville – 23	Conduct annual training for Code Enforcement Officers in order to effectively enforce revised structural Building Code standards	Building Inspection	In Progress	No	-	-
City of Brownsville – 24	Improve drainage and replace or upgrade gutters at City Plaza buildings	Public Works	In Progress. All facilities are going through a facility assessment. The city will evaluate at that time the need for improved drainage and gutters.	Yes (as 2022-City of Brownsville-010)	Drainage in the area of City Plaza buildings is inadequate and tends to flood during heavy rain events	Internal Services

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
City of Brownsville – 25	Integrate stand pipes into existing drain structures	Fire Department	No Progress	No	-	-
City of Brownsville – 26	Purchase generator for City Fuel Station System	Public Works, Brownsville Police Department, Brownsville Fire Department. Multi-modal department	No Progress	Yes (as 2022-City of Brownsville-011)	No backup power at the City fuel station	Engineering and Public Works
City of Brownsville – 27	Conduct public education for residents pertaining to flood and hurricane disasters by distributing brochures and other materials at city-wide events	Fire department, Emergency Management, health, public works	In Progress	Yes (as 2022-City of Brownsville-029)	Lack of hazard mitigation information and education for citizen preparedness.	Office of Emergency Management, BPUB
City of Brownsville – 28	Conduct public education for residents pertaining to the City's participation in the National Flood Insurance Program and flood insurance availability	Fire department, Emergency Management, health, public works	Ongoing Capability	No	-	-
City of Brownsville – 29	Improve drainage by constructing new culverts, levees, and drainage features into the Port of Brownsville from the north Brownsville area to mitigate potential major flooding during severe weather event	Public Works	No Progress	Yes (as 2022-City of Brownsville-001)	Inadequate drainage in the Port of Brownsville from the north Brownsville area.	Engineering, Public Works
City of Brownsville – 30	Conduct large-scale Firewise education program for safe burning	Fire Department	No Progress.	Yes (as 2022-City of Brownsville-020)	Need a program to help mitigate fire hazards	Fire Department
City of Brownsville – 31	Construct retaining walls to alleviate flooding problems – City of Brownsville Golf Course	Public Works	No Progress	Yes (as 2022-City of	Flooding in and around the City's golf course	Parks & Recreation

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
				Brownsville-012)		
City of Brownsville – 32	Install shutters on City critical facility buildings	Public Works	In Progress. All facilities are going through a facility assessment. The City will evaluate at that time the need for storm shutters.	Yes (as 2022-City of Brownsville-013)	Crews board up the critical facilities before severe storm events. Facility assessment is not yet complete to determine which buildings need storm shutters.	Internal Services
City of Brownsville – 33	Install 24" drainage pipes to improve conveyance of storm waters	Public Works	No Progress	No. Other actions more specifically address this issue	-	-
City of Brownsville – 34	Construct Gate Valve and attach to the crossbar at IWC Levee	Public Works	No Progress	Yes (as 2022-City of Brownsville-014)	A Gate Valve is needed at the IWC Levee	Engineering and Public Works
City of Brownsville – 35	Dredge Rotary Park Resacas to expand and improve storage of storm water	Public Works	No Progress	Yes (as 2022-City of Brownsville-015)	Rotary Park Resacas is in need of sediment removal and dredging to increase capacity	Engineering and Public Works, BPUB: Resaca Maintenance
City of Brownsville – 36	Construct Detention Pond to reduce flooding - Price Road	Engineering	No Progress	Yes (as 2022-City of	Price Road is prone to flooding and leads to road closures	Engineering and Public Works

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
				Brownsville-001)		
City of Brownsville – 37	Construct detention pond to reduce flooding - Old Port Isabel Rd	Engineering	No Progress	Yes (as 2022-City of Brownsville-001)	Old Port Isabel Road is prone to flooding and leads to road closures	Yes (as 2022-City of Brownsville-001)
City of Brownsville – 38	Construct detention pond to reduce flooding	Engineering	In Progress	Yes (as 2022-City of Brownsville-001)	Lack of detention ponds leads to flooding	Yes (as 2022-City of Brownsville-001)
City of Brownsville – 39	Conduct analysis of critical facility locations relative to SFHAs and elevate critical structure(s) to prevent flooding in the event of upstream dam failure	Engineering, Public Works	No Progress	Yes (as 2022-City of Brownsville-016)	Need to identify facilities vulnerable to flooding in the event of a dam failure	Engineering and Public Works
City of Brownsville – 40	Buildup of silt in area Resacas can lead to flooding	Engineering	No Progress	Yes (as 2022-City of Brownsville-017)	Buildup of silt in area Resacas can lead to flooding	Engineering and Public Works, BPUB: Resaca Maintenance
BPUB and City of Brownsville – 1	Secure Memorandum of Understanding (MOU) with Lower Rio Grande Flood Control agency to implement structural drainage measures to mitigate potential dam and levee failure of upstream flood control system	Lower Rio Grande Valley Flood Control	No Progress	Yes (as 2022-City of Brownsville-018)	Need structural measures to mitigate dam and levee failure	Engineering and Public Works

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB and City of Brownsville – 2	Conduct a public education program for evacuating residents downstream of the Lower Rio Grande Flood Control system in the event of dam or levee failure	Lower Rio Grande Valley Flood Control	No Progress	Yes (as 2022-City of Brownsville-019)	Need evacuation education for dam and levee failure.	Office of Emergency Management
BPUB and City of Brownsville – 3	Implement the Firewise Program to minimize dangers of wildfire in extreme heat and drought conditions	Fire Department	No Progress	Yes (as 2022-City of Brownsville-020)	Need a program to help mitigate fire hazards.	Fire Department
BPUB and City of Brownsville – 4	Work with neighboring communities and South Padre Island to implement an evacuation plan for the proposed bridge connecting the mainland to South Padre Island	Emergency Management	No Progress	No. Not within the City's jurisdiction.	-	-
BPUB and City of Brownsville – 5	Construct a second bridge connecting the mainland to South Padre Island	Emergency Management	No Progress	No. Not within the City's jurisdiction.	-	-
BPUB and City of Brownsville – 6	Construct dome shelter in the event of tornado or hurricane wind in Brownsville planning area	Emergency Management, Grants coordinator	Completed	No	-	-
BPUB and City of Brownsville – 7	Install system of weather stations	Emergency Management	No progress	Yes (as 2022-City of Brownsville-021)	Slow notifications of impending severe weather events	Office of Emergency Management
BPUB and City of Brownsville – 8	Install emergency alert system such as I-Info that includes notification in real time alerts	Emergency Management	In Progress	Yes (as 2022-City of Brownsville-022)	Coordinated emergency alerts are needed	Office of Emergency Management

Project #	Project	Responsible Party	What is the status? (e.g., In Progress, No Progress, Ongoing Capability, or Completed) If in progress or completed, please describe the funding source, cost and who is implementing.	If you did not complete the action, should the action be included in the 2022 HMP (i.e., there is still a need, this is still a priority)?		
				Yes/No	If Yes, please describe the original problem (i.e., hazard, location, historic losses)	If Yes, identify the responsible department/person to implement the project.
BPUB and City of Brownsville – 9	Conduct public education on tones and signals associated with area-wide emergency alert system	Emergency Management	In Progress	Yes (as 2022-City of Brownsville-023)	Public does not know what the alerts mean and how to react to them	Office of Emergency Management

9.2.7.2 Completed Mitigation Initiatives Not Identified in the Previous Mitigation Strategy

The City of Brownsville has not identified additional mitigation projects/activities that may have been completed but were not identified in the previous mitigation strategy in the 2015 HMP.

9.2.7.3 Proposed Hazard Mitigation Initiatives for the HMP Update

The City of Brownsville participated in a mitigation action workshop in August 2021 and was provided the following FEMA publications to use as a resource as part of their comprehensive review of all possible activities and mitigation measures to address their hazards: FEMA 551 'Selecting Appropriate Mitigation Measures for Floodprone Structures' (March 2007) and FEMA 'Mitigation Ideas – A Resource for Reducing Risk to Natural Hazards' (January 2013).

The table below indicates the range of proposed mitigation action categories.

Table 9.2-14. Analysis of Mitigation Actions by Hazard and Category

Hazard	FEMA				CRS					
	LPR	SIP	NSP	EAP	PR	PP	PI	NR	SP	ES
Dam and Levee Failure	X	X		X	X	X	X		X	X
Disease Outbreak	X			X	X		X			
Drought	X	X	X	X	X		X	X		
Erosion	X	X	X	X	X		X	X	X	
Extreme Heat	X	X		X	X		X			X
Flood	X	X	X	X	X	X	X	X	X	X
Hail	X	X		X	X	X	X	X		X
Hurricane/Tropical Storm	X	X	X	X	X	X	X	X	X	X
Lightning	X	X		X	X		X	X		X
Thunderstorm Wind	X	X		X	X	X	X	X		X
Tornado	X	X		X	X	X	X	X		X
Wildfire	X	X		X	X		X	X		X
Winter Storm	X	X		X	X	X	X	X		X

Note: Section 6 (Mitigation Strategy) provides for an explanation of the mitigation categories.

Table 9.2-15 summarizes the comprehensive range of specific mitigation initiatives the City of Brownsville would like to pursue to reduce the effects of hazards. Some of these initiatives may be previous actions carried forward for this plan update. These initiatives are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in municipal priorities. The four FEMA mitigation action categories and the six CRS mitigation action categories are listed in the table below to further demonstrate the wide-range of activities and mitigation measures selected.

As discussed in Section 6 (Mitigation Strategy), 14 evaluation/prioritization criteria are used to complete the prioritization of mitigation initiatives. For each new mitigation action, a numeric rank is assigned (-1, 0, or 1) for each of the 14 evaluation criteria to assist with prioritizing your actions as 'High', 'Medium', or 'Low.'

Table 9.2-16 provides a summary of the prioritization of all proposed mitigation initiatives for the HMP update.

Table 9.2-15. Proposed Hazard Mitigation Initiatives and Associated Priority

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-City of Brownsville-001	Culvert Upgrades and Detention Ponds	Problem: Undersized culverts located throughout the City and lack of detention ponds lead to roadway flooding. Solution: Upgrade and increase culverts and build detention ponds at specific locations in City in order to adequately convey storm water and reduce flooding.	Both	Dam and Levee Failure, Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Engineering, Public Works	CIP Funds, TDOT, TWDB, GLO, FEMA Grant Funding (FMA, HMGP, BRIC)	Improve drainage to alleviate flooding; protection of structures and critical infrastructure	Medium	High	SIP	SP
2022-City of Brownsville-002	RL Property Identification	Problem: Flood-prone properties throughout the City; many need to be mitigated to provide further protection. Solution: Identify existing flood-prone structures and repetitive flood loss properties for FEMA Buyout Program.	Existing	Dam and Levee Failure, Flood, Hurricane/ Tropical Storm	1, 2	Ongoing	Planning and Redevelopment	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	PP
2022-City of Brownsville-003	Hail Guard Installation	Problem: Hail damage to critical facilities due to lack of hail guards. Solution: Install hail guards for HVAC systems on critical facilities including nursing homes, hospitals, courthouse, and fire stations.	Existing	Hail	2	1-5 Years	Internal Services	General Funds, FEMA Grant Funding (HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	PP
2022-City of Brownsville-004	Water Conservation Campaign	Problem: The City currently does not have an education campaign that focuses on water consumption during drought conditions.	Both	Drought	1, 5	Ongoing	Communications	General Funds, FEMA Grant Funding	Protect natural resources	Medium	High	NSP, EAP	PI

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: Conduct a public education campaign to educate residents on reducing water consumption during drought conditions.						(HMGP, BRIC)					
2022-City of Brownsville-005	Cooling Stations	Problem: During periods of extreme heat, not all residents have proper air conditioning in their homes. Solution: Install temporary cooling stations at City park facilities to aid low income and elderly residents during extreme heat conditions.	Both	Extreme Heat	1	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (HMGP, BRIC)	Life safety and protection	Medium	High	SIP	ES
2022-City of Brownsville-006	Develop a Drought Protection Plan	Problem: No drought protection plan. Solution: Develop a Drought Protection Plan to include adoption of Firewise community actions for water conservation and xeriscaping program.	Both	Drought	1, 5	Ongoing	Fire Department	General Funds, FEMA Grant Funding (HMGP, BRIC)	Protect natural resources	Medium	High	LPR	NR
2022-City of Brownsville-007	Develop a Tree Management Master Plan	Problem: No tree management master plan. Solution: Develop and implement a Tree Management Master Plan to remove downed trees due to severe weather events.	Both	Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 2	Ongoing	Engineering and Public Works	General Funds, FEMA Grant Funding (HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	LPR	NR

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-City of Brownsville-008	Backup Pumps	Problem: Lack of backup pumps to use during severe weather and flood events. Solution: Purchase and install six portable pumps as back-up during severe weather and flood events.	Both	Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Winter Storm	1, 2	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	ES
2022-City of Brownsville-009	Alternate EOC	Problem: Need an alternate location for an EOC in the event of flooding or power outages. Solution: Construct alternate Emergency Operations Center to protect critical system operations.	Existing	Dam and Levee Failure, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 2	1-5 Years	Office of Emergency Management	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	SIP	ES
2022-City of Brownsville-010	City Plaza Drainage Upgrades	Problem: Drainage in the area of City Plaza buildings is inadequate and tends to flood during heavy rain events. Solution: After facilities assessment is complete, improve drainage and replace or upgrade gutters at identified City Plaza buildings.	Both	Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Internal Services	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	SP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-City of Brownsville-011	City Fuel Station Backup Power	Problem: No backup power at the City Fuel Station. Solution: Purchase generator for City Fuel Station System.	Existing	Dam and Levee Failure, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 2	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	SIP	ES
2022-City of Brownsville-012	Golf Course Retaining Walls	Problem: Flooding and erosion in and around the City's golf course. Solution: Construct retaining walls to alleviate erosion and flooding problems – City of Brownsville Golf Course.	Existing	Erosion, Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Parks & Recreation	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	SP
2022-City of Brownsville-013	Storm Shutter Installation	Problem: Crews board up the critical facilities before severe storm events. Facility assessment is not yet complete to determine which buildings need storm shutters. Solution: Install shutters on identified City critical facility buildings.	Existing	Hail, Hurricane/ Tropical Storm, Thunderstorm Wind, Tornado, Winter Storm	1, 2	1-5 Years	Internal Services	General Funds, FEMA Grant Funding (HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	SIP	PP
2022-City of Brownsville-014	Levee Gate Valve Construction	Problem: A Gate Valve is needed at the IWC Levee.	Existing	Dam and Levee Failure, Flood,	1, 2	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant	Life safety and protection of structures and	Medium	High	SIP	SP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: Construct Gate Valve and attach to the crossbar at IWC Levee according to the Drainage Master Plan.		Hurricane/ Tropical Storm				Funding (FMA, HMGP, BRIC)	critical infrastructure				
2022-City of Brownsville-015	Rotary Park Resaca Dredging	Problem: Rotary Park Resaca is in need of sediment removal and dredging to increase capacity. Solution: Dredge Rotary Park Resacas to expand and improve storage of storm water.	Existing	Erosion, Flood, Hurricane/ Tropical Storm	1, 2	Ongoing	Engineering and Public Works, BPUB: Resaca Maintenance	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	NSP, SIP	NR
2022-City of Brownsville-016	Conduct Critical Facility Study and Elevate Structures	Problem: Need to identify facilities vulnerable to flooding in the event of a dam failure. Solution: Conduct analysis of critical facility locations relative to SFHAs and elevate critical structure(s) to prevent flooding in the event of upstream dam failure.	Existing	Flood, Dam and Levee Failure	1, 2	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP	PP
2022-City of Brownsville-017	Resaca Silt Removal Program (Coordinates with 2022-BPUB-017)	Problem: Erosion and silt buildup in area Resacas contribute to flooding. Solution: Develop a program to annually remove buildup of silt in area Resacas that become cutoff from the river.	Both	Erosion, Flood, Drought	1, 2	Ongoing	Engineering and Public Works, BPUB: Resaca Maintenance	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	SIP, NSP	NR
2022-City of Brownsville-018	MOU with Lower Rio Grande Flood Control Agency	Problem: Need structural measures to mitigate dam and levee failure. Solution: Secure Memorandum of Understanding (MOU) with Lower Rio Grande Flood Control	Both	Dam and Levee Failure, Flood	1, 3	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (FMA,	Life safety and protection of structures and critical infrastructure	Medium	High	LPR	SP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		agency to implement structural drainage measures to mitigate potential dam and levee failure of upstream flood control system.						HMGP, BRIC)					
2022-City of Brownsville-019	Evacuation Outreach Program for Dam and Levee Failure	Problem: Need evacuation education for dam and levee failure. Solution: Conduct a public education program for evacuating residents downstream of the Lower Rio Grande Flood Control system in the event of dam or levee failure.	Both	Dam and Levee Failure, Flood	1, 5	Ongoing	Office of Emergency Management	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Life safety and protection	Medium	High	EAP	PI, ES
2022-City of Brownsville-020	Firewise Program Implementation	Problem: Need a program to help mitigate fire hazards. Solution: Implement the Firewise Program to minimize dangers of wildfire in extreme heat and drought conditions.	Both	Wildfire	1, 2	1-5 Years	Fire Department	General Funds, FEMA Grant Funding (HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	LPR	NR
2022-City of Brownsville-021	Weather Station Installation	Problem: Slow notifications of impending severe weather events. Solution: Install system of weather stations.	Both	Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Winter Storm	1, 2	1-5 Years	Office of Emergency Management	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	SIP	
2022-City of Brownsville-022	Emergency Alert System	Problem: Coordinated emergency alerts are needed.	Both	Dam and Levee Failure, Extreme Heat,	1, 5	1-5 Years	Office of Emergency Management	General Funds, FEMA Grant	Life safety and protection	Medium	High	EAP	PI, ES

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: Install emergency alert system such as I-Info that includes notification in real time alerts.		Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm				Funding (FMA, HMGP, BRIC)					
2022-City of Brownsville-023	Emergency Alert System Education and Outreach	Problem: Public does not know what the alerts mean and how to react to them. Solution: Conduct public education on tones and signals associated with area-wide emergency alert system.	Both	Dam and Levee Failure, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 5	Ongoing	Office of Emergency Management	General Funds, FEMA Grant Funding (FMA, HMGP)	Life safety and protection	Medium	High	EAP	PI
2022-City of Brownsville-024	Become a CRS Community	Problem: History of flooding and properties damaged during flood events. Solution: The City will begin the process of joining the Community Rating System program to reduce risk and flood insurance premiums to residents.	Both	Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Engineering and Public Works	General Funds, FEMA Grant Funding (FMA, HMGP)	Life safety and protection of structures and critical infrastructure	Medium	High	LPR	PR, PP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-City of Brownsville-025	Integration With the Comprehensive Plan and other City plans and programs	Problem: Better integration is needed between the HMP and other City plans. Solution: As the Comprehensive Plan and other City plans are updated, integration portions of the HMP to include hazard areas, etc.	Both	Dam and Levee Failure, Disease Outbreak, Drought, Erosion, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 2, 3	Ongoing	Planning and Redevelopment Services	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Life safety and protection of structures and critical infrastructure	Medium	High	LPR	PR
2022-City of Brownsville-026	NFIP Education and Outreach	Problem: The number of NFIP insurance policies in the City could be increased. Solution: Implement an NFIP public education program to increase the number of flood insurance policies by promoting availability of flood insurance including the Preferred Risk Policy for non-SFHA's.	Both	Flood, Hurricane/ Tropical Storm	1, 5	1-5 Years	Office of Emergency Management	General Funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Protection of structures and critical infrastructure	Medium	High	EAP	PI
2022-City of Brownsville-027	Implement Drainage Improvements in the 2012 Flood Protection Plan	Problem: Flood-prone areas throughout the City. Solution: Provide drainage improvements based on our	Both	Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Engineering and Public Works	CIP funds, TDOT, TWDB, GLO, FEMA Grant Funding	Reduce flood risk in flood-prone areas; protection of structures and critical infrastructure	$150 million	High	SIP	SP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
	and Drainage Study Findings	flood studies or flood protection plans.						(FMA, HMGP, BRIC)					
2022-City of Brownsville-028	Asset Management Software Updates	Problem: Software needs continual updates to track and manage infrastructure. Solution: Continue to update Asset Management software (GIS, VUEWorks) to include pipe size, slopes, and depths. Currently only have X,Y coordinates of infrastructure is visible from the ground.	Existing	Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Engineering and Public Works	CIP funds, TDOT, TWDB, GLO, FEMA Grant Funding (FMA, HMGP, BRIC)	Better preparation for storm events and better control of our water flows; protection of structures and critical infrastructure	$2-5 million	High	SIP	PI
2022-City of Brownsville-029	Public Information and Outreach (Coordinates with 2022-BPUB-018)	Problem: Lack of hazard mitigation information and education for citizen preparedness. Solution: Add or increase website content and use other outreach methods such as mailers and flyers for suggested homeowner mitigation strategies and hazard preparedness information.	Both	Dam and Levee Failure, Disease Outbreak, Drought, Earthquake, Erosion, Extreme Heat, Flood, Hail, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Wildfire, Winter Storm	1, 5	Ongoing	Office of Emergency Management, BPUB	FEMA Grant Funding (FMA, HMGP), Staff Time	Greater understanding of mitigation suggestions and awareness of hazards will enable citizens to prepare for hazard events. Critical information received at the right time will help protect lives and property.	Medium	High	EAP	PI

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
2022-City of Brownsville-030	Generators and Quick Connects for Emergency Service Buildings	Problem: Emergency service buildings and other facilities require mobile generators and quick connects to preserve continuity of services during power outages Solution: Purchase mobile generators and install quick connects at the following sites: 1) West 5th and Saint Charles 2) Cottonwood and Old Alice 3) El Tapiz Building 4) City Hall 5) City Plaza.	Existing	Extreme Heat, Hurricane/ Tropical Storm, Lightning, Thunderstorm Wind, Tornado, Winter Storm	1, 2	1-5 years	Public Works, Emergency Management, Fire, Internal Services	General Funds, FEMA Grant Funding (HMGP, BRIC)	Continuity of operations during power outages	Medium	High	SIP	ES
2022-City of Brownsville-031	North Brownsville Weir Construction	Problem: Flood risk from canal overflows Solution: Construct a weir to prevent flood risk from the overflow of canals located on the North side of Brownsville	Both	Flood, Hurricane/ Tropical Storm	1, 2	1-5 Years	Engineering and Public Works	CIP funds, FEMA Grant Funding (FMA, HMGP, BRIC)	Flood risk reduction; protection of structures and critical infrastructure	Medium	High	SIP	SP
2022-City of Brownsville-032	Weir Restoration & Seawall Construction	Problem: Erosion has deteriorated the water overflow structure and the gate valve has deteriorated for emergence water release from the 300 acre-feet storm water retention system as a critical part of the Cameron County Drainage District No 1, Main No 1 Drain (and Paseo de la Resaca Park System City of Brownsville) water level control to the point of risking complete failure of the system. Shoreline is eroding into the reservoir	Both	Dam and Levee Failure, Erosion, Flood	1, 2, 3, 4	1-5 Years	Weir: Cameron County Drainage District No 1 Seawall: City of Brownsville and Paseo de la Resaca Lighting and Landscape Maintenance District, and Paseo de la Resaca Municipal Utility District No.3	Entity funds, MUD, Loans, USACE, FEMA, HMGP, FMA, CDBG-DR	Storm water management is crucial to public safety and protection of public and private property. Dollar amounts are outside the scope of this writer's skill set, but imagine flooding a 700 acre area with 3,000 homes, and you can begin to	The weir construction project was just under $200,000. There is a concurrent $5.1 ,million seawall construction project underwa	High	LPR, SIP, EAP	SP

Project Number	Mitigation Initiative Name	Description of Problem and Solution	New or Existing Assets?	Hazard(s) to be Mitigated	Goals Met	Estimated Timeline	Lead and Support Agencies	Potential Funding Sources	Estimated Benefits	Estimated Costs	Priority	Mitigation Category	CRS Category
		Solution: Restore the storm water detention weir and build a seawall to prevent further shoreline erosion into the reservoir							embrace the scope of potential damage.	y to prevent further shoreline erosion into the reservoir (City & Public Improvement District).			

Notes:
Not all acronyms and abbreviations defined below are included in the table.

Acronyms and Abbreviations:

CAV	*Community Assistance Visit*
CIP	*Capital Improvement Plan*
CRS	*Community Rating System*
DPW	*Department of Public Works*
EHP	*Environmental Planning and Historic Preservation*
FEMA	*Federal Emergency Management Agency*
FPA	*Floodplain Administrator*
GLO	*Texas General Land Office*
HMA	*Hazard Mitigation Assistance*
MUD	*Municipal Utility District*
N/A	*Not applicable*
NFIP	*National Flood Insurance Program*
OEM	*Office of Emergency Management*
TDOT	*Texas Department of Transportation*
TWDB	*Texas Water Development Board*

Potential FEMA HMA Funding Sources:

FMA	*Flood Mitigation Assistance Grant Program*
HMGP	*Hazard Mitigation Grant Program*
BRIC	*Building Resilient Infrastructure and Communities Program*

Timeline:
The time required for completion of the project upon implementation

Cost:
The estimated cost for implementation.

Benefits:
A description of the estimated benefits, either quantitative and/or qualitative.

Mitigation Category:

- *Local Plans and Regulations (LPR) – These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.*

- *Structure and Infrastructure Project (SIP) - These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.*
- *Natural Systems Protection (NSP) – These are actions that minimize damage and losses, and also preserve or restore the functions of natural systems.*
- *Education and Awareness Programs (EAP) – These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as StormReady and Firewise Communities.*

CRS Category:

- *Preventative Measures (PR) - Government, administrative or regulatory actions, or processes that influence the way land and buildings are developed and built. Examples include planning and zoning, floodplain local laws, capital improvement programs, open space preservation, and storm water management regulations.*
- *Property Protection (PP) - These actions include public activities to reduce hazard losses or actions that involve (1) modification of existing buildings or structures to protect them from a hazard or (2) removal of the structures from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.*
- *Public Information (PI) - Actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and educational programs for school-age children and adults.*
- *Natural Resource Protection (NR) - Actions that minimize hazard loss and also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.*
- *Structural Flood Control Projects (SP) - Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, setback levees, floodwalls, retaining walls, and safe rooms.*
- *Emergency Services (ES) - Actions that protect people and property during and immediately following a disaster or hazard event. Services include warning systems, emergency response services, and the protection of essential facilities.*

Table 9.2-16. Summary Evaluation and Action Priority

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-City of Brownsville-001	Culvert Upgrades and Detention Ponds	1	1	0	1	1	0	0	1	1	0	1	1	1	1	10	High
2022-City of Brownsville-002	RL Property Identification	0	1	1	1	0	1	0	1	-1	1	1	1	1	1	9	High
2022-City of Brownsville-003	Hail Guard Installation	-1	1	1	1	0	1	0	0	1	1	-1	1	1	1	7	Medium
2022-City of Brownsville-004	Water Conservation Campaign	-1	-1	1	1	0	1	0	1	1	1	-1	1	1	1	6	Medium
2022-City of Brownsville-005	Cooling Stations	1	1	1	1	0	1	0	0	1	1	1	1	1	1	11	High

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-City of Brownsville-006	Develop a Drought Protection Plan	-1	-1	1	1	0	1	0	1	1	0	-1	1	1	1	5	Medium
2022-City of Brownsville-007	Develop a Tree Management Master Plan	1	1	1	1	0	1	0	1	1	0	1	1	1	1	11	High
2022-City of Brownsville-008	Backup Pumps	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-009	Alternate EOC	1	1	1	1	0	1	0	1	1	0	1	1	1	1	11	High
2022-City of Brownsville-010	City Plaza Drainage Upgrades	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-011	City Fuel Station Backup Power	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-012	Golf Course Retaining Walls	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-013	Storm Shutter Installation	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-014	Levee Gate Valve Construction	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-015	Rotary Park Resaca Dredging	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-016	Conduct Critical Facility Study and Elevate Structures	0	1	1	1	0	1	0	1	1	0	1	1	1	1	10	High
2022-City of Brownsville-017	Resaca Silt Removal Program	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-018	MOU with Lower Rio Grande Flood Control Agency	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-019	Evacuation Outreach Program for Dam and Levee Failure	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-City of Brownsville-020	Firewise Program Implementation	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-021	Weather Station Installation	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-022	Emergency Alert System	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-023	Emergency Alert System Education and Outreach	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-024	Become a CRS Community	1	1	1	1	0	1	0	1	1	0	1	1	1	1	11	High
2022-City of Brownsville-025	Integration With the Comprehensive Plan and other City plans and programs	1	1	1	1	0	1	0	1	1	1	1	1	1	1	12	High
2022-City of Brownsville-026	NFIP Education and Outreach	0	1	1	1	0	1	0	1	1	1	1	1	1	1	11	High
2022-City of Brownsville-027	Implement Drainage Improvements in the 2012 Flood Protection plan and Drainage Study Findings	1	1	1	1	1	0	1	0	0	1	1	1	1	1	11	High
2022-City of Brownsville-028	Asset Management Software Updates	1	1	1	1	1	0	1	0	0	1	1	1	1	1	11	High
2022-City of Brownsville-029	Public Information and Outreach	1	1	0	1	1	0	0	1	1	0	1	1	1	0	9	High
2022-City of Brownsville-030	Generators and Quick Connects for Emergency Service Buildings	1	1	0	1	1	0	0	1	1	0	1	1	1	0	9	High
2022-City of Brownsville-031	North Brownsville Weir Construction	1	1	0	1	1	0	0	1	1	0	1	1	1	0	9	High

Project Number	Project Name	Life Safety	Property Protection	Cost-Effectiveness	Technical	Political	Legal	Fiscal	Environmental	Social	Administrative	Multi-Hazard	Timeline	Agency Champion	Other Community Objectives	Total	High / Medium / Low
2022-City of Brownsville-032	Weir Restoration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	14	High

Note: Section 6 (Mitigation Strategy), which conveys guidance on prioritizing mitigation actions. Low (0-4), Medium (5-8), High (9-14).